



Lacey City Council Worksession Agenda

Refer to the bottom of the agenda for meeting information.

Tuesday, June 24, 2025

6:00 PM

Council Chambers and Online

1. Call to Order

2. Roll Call

3. Land Acknowledgement

We, the City of Lacey, are on the ancestral land of the Tribal People of the Treaty of Medicine Creek, including the Nisqually Indian Tribe and Squaxin Island Tribe. We acknowledge and remember those Tribal People not recognized today who were absorbed or relocated into other tribes for survival. We recognize the ancestors and their descendants who are still here. We recognize and respect the Tribal People of the Treaty of Medicine Creek as the traditional stewards of this land since time immemorial and their role today in taking care of these lands in perpetuity. We recognize and have the responsibility to call attention to the histories of dispossession, forced removal, and abridged treaty rights that allowed our nation, state, and city to develop as they have today. We recommend that community members read the Medicine Creek Treaty of 1854.

4. Approval of the Agenda

5. Public Comment

Refer to the bottom of the agenda for instructions on how to provide public comment.

6. Agenda Items

A. LOTT State of the Utility

Matthew Kennelly, LOTT Executive Director

B. Reclaimed Water Plan (RWP)

Gagan Brar, P.E., Civil Engineer

Matt Huang, P.E., Principal Planning Engineer, Carollo Engineers

C. Equity Map Introduction

Shannon Kelley-Fong, Assistant City Manager

7. Adjourn

Meeting Information:

Attendance (Remote or In-Person)

The public may attend the meeting in-person, or you may view or listen to the meeting using one of the following platforms:

In-Person: Council Chambers at Lacey City Hall
420 College Street SE, Lacey, WA 98503

Zoom: https://us02web.zoom.us/webinar/register/WN_je-tpNCXTuKz5Z9GyrbYA

Website: <https://cityoflacey.org/government/public-meetings/>

Facebook: <https://www.facebook.com/cityoflacey>

YouTube: <https://www.youtube.com/watch?v=ikg5KJ0NdII>

Phone: (888) 788-0099 or (877) 853-5247 (Webinar ID 836 2754 5420)

Verbal Public Comment

Each speaker is limited to three minutes. Comments are welcome on matters connected to City business or specific agenda items. **Ballot measure endorsements (in support or opposition) are not allowed during Public Comment. This includes comments on candidates or the Lacey Metropolitan Park District (RCW 42.17A.555).**

Prior to starting your comments, please provide your:

- a. Name
- b. City of residence or connection to the City
- c. Topic or subject matter of your comments

Those wishing to provide verbal public comment may do so in-person or by Zoom:

In-Person: Use the sign-up sheet located in the Council Chambers.

Zoom: Preregister using the following Zoom link no later than two hours prior to the meeting:
https://us02web.zoom.us/webinar/register/WN_je-tpNCXTuKz5Z9GyrbYA

Instructions and access details will be provided once registration is complete.

Written Public Comment

Public comments may also be submitted by email to PublicComment@cityoflacey.org. The commenting period will close two hours before the meeting time. Written comments will be provided to the City Council electronically prior to the meeting. Comments will not be addressed during the Council meeting; however, comments received will be added to the official record.



LACEY CITY COUNCIL WORKSESSION

June 24, 2025

SUBJECT: RECLAIMED WATER PLAN

BRIEFING: Briefing only. No formal action from the Council is requested as the Plan will supplement an update to the Wastewater Comprehensive Plan that will be presented for formal adoption in the future.

STAFF CONTACT: Rick Walk, City Manager *RW*
Scott Egger, P.E., PW Director *SE*
Vince McGowan, P.E., Water Resources Manager *VMc*
Teri O'Neal, P.E., Sr Utility Engineer *T20*
Gagan Brar, P.E., Utility Engineer *GSB*

ORIGINATED BY: Public Works – Water Resources

ATTACHMENTS: 1. [Reclaimed Water Plan](#)

FISCAL NOTE: Council approved the Water Capital Fund as part of the 2025 Budget. The Reclaimed Water Plan is listed as a 2025 Water Capital Fund project

WORK PLAN GOAL AND STRATEGY: A Safe and Secure Community - (H)(12)

DOC. ALIGNMENT: Utilities portion of the City of Lacey's Comprehensive Plan

PRIOR REVIEW: None

BACKGROUND:

The City of Lacey's Public Works/Water Resources division (City) has created a draft Reclaimed Water Plan (RWP) with the help of Carollo Engineers (Consultant). The plan has been developed to ensure the efficient and sustainable use of reclaimed water in our community. As part of our ongoing efforts to address water conservation, reduce reliance on potable water, and improve environmental sustainability, this plan outlines strategies for the expansion, implementation, and utilization of reclaimed water throughout the city.

The RWP encompasses the current state of the reclaimed water utility, detailing available reclaimed water, its current usage, and planning parameters for infrastructure needed to

meet the City's forecasted reclaimed water demand. It also defines the best use of Class 'A' reclaimed water as growth continues.

Wastewater from the City is treated by the LOTT Clean Water Alliance (LOTT) at two of their wastewater treatment plants (Budd Inlet Treatment Plant and The Martin Way Reclaimed Water Plant). The Martin Way Reclaimed Water Plant produces Class A reclaimed water. Reclaimed water is defined in WAC 173-219, 2018 as a water source that meets the requirement of the WAC, including at a minimum, is at all times an oxidized, coagulated, filtered, disinfected. The Washington State Department of Ecology (Ecology) and Department of Health regulate reclaimed water based on Chapter 173-219 WAC, which was promulgated in 2018.

The City of Lacey currently receives a portion of the reclaimed water produced at LOTT's Martin Way Reclaimed Water Treatment Plant, which is located within Lacey city limits. This plan identifies potential customers, and the system infrastructure needed to use its reclaimed water supply. Under current conditions, all the City's allocation of reclaimed water is used for the mitigation of water rights at the Woodland Creek Groundwater Recharge Facility; thus, the plan has no recommended infrastructure. The plan does anticipate that additional reclaimed water will be available for expanded uses in the future based on the forecasted increase in population.

The initial draft of the RWP has been reviewed and commented on by both internal stakeholders (City Staff) and external stakeholders, including the City of Olympia, the City of Tumwater, LOTT, and the Nisqually Indian Tribe. The plan has been updated based on their comments. The Plan has also been presented to the City Planning Commission.

The Reclaimed Water Plan will be included as an appendix to the City's Wastewater Comprehensive Plan (WWCP), which is currently under development and will be presented for formal adoption in the future.

NEXT STEPS:

No formal action from the Council is requested as the Plan will supplement an update to the Wastewater Comprehensive Plan that will be presented for formal adoption in the future.



Reclaimed Water Plan

May 2025 / FINAL





Reclaimed Water Plan

May 2025 / FINAL

Digitally signed by Matthew M. Huang
Contact Info: Carollo Engineers, Inc.
Date: 2025.05.13 15:18:40-07'00'



Contents

CHAPTER 1 - EXISTING SYSTEM

1.1	Purpose	1-1
1.2	City of Lacey Land Acknowledgement	1-1
1.3	Service Area	1-2
1.4	Relationship to other Utilities	1-2
1.5	Agreements and Permits	1-2
1.5.1	Martin Way Plant Reclaimed Water Allotment	1-2
1.6	Related Studies and Plans	1-3
1.7	Existing Infrastructure	1-3
1.7.1	Martin Way Reclaimed Water Treatment Plant	1-8
1.7.2	Hawks Prairie Reclaimed Water Ponds	1-8
1.7.3	Woodland Creek Groundwater Recharge Facility	1-9
1.7.4	Reclaimed Distribution System	1-9

CHAPTER 2 - REGULATIONS AND CRITERIA

2.1	Review of Regulations	2-1
2.1.1	Reclaimed Water Regulations	2-1
2.1.2	Aquifer Storage and Recovery Regulations	2-2
2.1.3	Groundwater Recharge Regulations	2-2
2.1.4	Direct Potable Reuse Regulations	2-2
2.2	Beneficial Uses for Reclaimed Water	2-4
2.3	Service Policies	2-4
2.4	Planning Criteria	2-8
2.4.1	Reliability	2-10
2.4.2	Storage and Booster Pumping	2-10

CHAPTER 3 - SUPPLY AND DEMAND FORECAST

3.1	Introduction	3-1
3.1.1	Definitions	3-1
3.1.2	Reference Documents	3-1
3.2	Historical Flows to MWRWP	3-2
3.2.1	Annual Flows and Monthly Seasonal Variation	3-3
3.2.2	Daily Flows and Fluctuation	3-3
3.3	Supply Forecast	3-8
3.3.1	Summary of Reclaimed Water Documents and Agreements	3-8
3.3.2	Supply Forecast Assumptions	3-9
3.3.3	MWRWP and MWPS Flow Projections	3-9
3.3.4	Flow Summary	3-9
3.4	Environmental Mitigation	3-14
3.4.1	Reclaimed Water Needed for Environmental Mitigation	3-14

3.4.2	Methodology for Determining Infiltration Rates	3-16
3.4.3	Summary of Available Reclaimed Water	3-16
3.5	Water Available for Other Uses	3-20
3.5.1	Equalization Basin at MWRWP	3-20
3.5.2	Options for Use of Remaining Reclaimed Water	3-21

CHAPTER 4 - INFRASTRUCTURE EVALUATION

4.1	Methodology	4-1
4.2	Existing Reclaimed Water System	4-2
4.3	Potential Reclaimed Water Customers	4-2
4.3.1	Top Existing Irrigation Customers	4-2
4.3.2	Pipeline Routes	4-4
4.3.3	Additional Existing Irrigation Customers	4-4
4.3.4	Potential Future Reclaimed Water Customers	4-7
4.3.5	Maximum Month and Peak Hour Demands	4-9
4.4	Potential Reclaimed Water Customers Use	4-10
4.4.1	Hydraulic Model	4-11
4.4.2	Potential Pipeline	4-11
4.5	Storage and Pumping Configuration	4-13
4.5.1	Storage Analysis	4-13
4.5.2	Pump Station Analysis	4-15
4.5.3	Redundancy Analysis	4-15
4.6	Chlorine Residual	4-15
4.7	Infrastructure Alternatives	4-15
4.7.1	Alternative 1 - Ground Storage and Retrofit PS	4-16
4.7.2	Alternative 2 - Ground Storage and New PS	4-17
4.7.3	Alternative 3 - Elevated Storage and Retrofit PS	4-17
4.7.4	Alternative 4 - Elevated Storage and New PS	4-18
4.8	Cost Estimates	4-19
4.8.1	Cost Estimate Assumptions	4-19
4.8.2	Life Cycle Cost Evaluation	4-21
4.9	Seasonal Storage	4-21
4.10	Conclusion	4-22

CHAPTER 5 - POTABLE REUSE EVALUATION

5.1	Available Flow for Potable Reuse	5-1
5.2	Overview of Potable Reuse Options	5-1
5.2.1	<i>De Facto</i> Potable Reuse	5-1
5.2.2	Surface Water Augmentation	5-2
5.2.3	Groundwater Augmentation	5-3
5.2.4	Direct Potable Reuse	5-4
5.2.5	Advanced Treatment Options	5-5

5.3	Water Quality Targets for Potable Reuse	5-8
5.3.1	Chemicals Regulated in Drinking Water and Potable Reuse	5-8
5.3.2	Pathogens	5-9
5.3.3	Constituents of Emerging Concern	5-11
5.4	High-Level Alternatives	5-12
5.4.1	Alternative 1 - Use of Percolation Facilities with Potable Water Recovery	5-12
5.4.2	Alternative 2 - Direct Recharge to Non-Potable Groundwater with Treatment Post-Extraction	5-14
5.4.3	Alternative 3 - Direct Recharge to Potable Groundwater	5-17
5.4.4	Comparison of Alternatives	5-20
5.5	References	5-20

CHAPTER 6 - CONCLUSIONS AND RECOMMENDATIONS

6.1	Introduction	6-1
6.2	Summary of Recommendations	6-1
6.2.1	Reclaimed Water Supply Recommendations	6-1
6.2.2	Potable Reuse Recommendations	6-1
6.2.3	Reclaimed Water Distribution System Recommendations	6-2
6.3	Conclusion	6-2

Appendices

APPENDIX A	RECLAIMED WATER AGREEMENTS AND PERMITS
APPENDIX B	REFERENCE LIST
APPENDIX C	RECLAIMED WATER ASR PRE-FEASIBILITY EVALUATION

Tables

Table 1.1	City of Lacey Reclaimed Water Agreements and Permits	1-5
Table 1.2	Martin Way Reclaimed Water	1-6
Table 1.3	Studies and Plans related to Reclaimed Water	1-6
Table 1.4	LOTT Martin Way Plant Reclaimed Water Piping Summary (feet)	1-9
Table 1.5	Lacey Reclaimed Water Piping Summary (feet)	1-10
Table 2.1	Class A Performance Standards	2-2
Table 2.2	Aquifer Storage and Recovery Regulations	2-3
Table 2.3	Beneficial Uses of Class A Reclaimed Water	2-5
Table 2.4	Service Policies	2-7
Table 2.5	System Configuration Criteria	2-9
Table 2.6	Operational Criteria	2-10
Table 3.1	Documents and Agreements Reviewed for Supply Forecast	3-2
Table 3.2	Reclaimed Water Supply Forecast Assumptions	3-10
Table 3.3	Reclaimed Water Available to City for Other Uses ("Wet" Water)	3-20
Table 4.1	Potential Conversion from Potable Water - Top Irrigation Customers	4-2
Table 4.2	Potential Pipeline System	4-4

Table 4.3	Potential Conversion from Potable Water - Additional Customers	4-4
Table 4.4	Average Irrigation Consumption per Acre by Land Use and Parcel Size	4-7
Table 4.5	Potential Conversion from Potable Water - Future Customers	4-9
Table 4.6	Summary of Potential Reclaimed Water Customers Annual Demand	4-10
Table 4.7	Summary of Potential Reclaimed Water Customers Maximum Month Demand	4-10
Table 4.8	Potential Pipeline	4-11
Table 4.9	Construction Unit Cost Assumptions	4-20
Table 4.10	Contingencies and Indirect Costs	4-20
Table 4.11	Summary of Energy Costs	4-21
Table 4.12	Alternatives Analysis Cost Comparison	4-21
Table 5.1	Historical MWRWP Effluent Flows and Concentrations	5-6
Table 5.2	Class A Reclaimed Water and Groundwater Enforcement Limits	5-6
Table 5.3	Comparison of Potable Reuse Options	5-8
Table 5.4	PFAS SALs and Maximum Concentration in LOTT Water	5-9
Table 5.5	Pathogen Goal Concentrations for Potable Reuse	5-10
Table 5.6	Pathogen Gap Analysis	5-11
Table 5.7	Concentrations of Indicator Trace Organic Chemicals in Secondary Effluent	5-12
Table 5.8	Pathogen LRV Analysis for Alternative 1	5-14
Table 5.9	Pathogen LRV Analysis for Alternative 2a RO Based Treatment	5-16
Table 5.10	Pathogen LRV Analysis for Alternative 2b Ozone/BAF Based Treatment	5-16
Table 5.11	Pathogen LRV Analysis for Alternative 3	5-18
Table 5.12	Comparison of Potable Reuse Alternatives Evaluated	5-20

Figures

Figure 1.1	City of Lacey Reclaimed Water Service Area	1-4
Figure 1.2	Existing Distribution System	1-7
Figure 1.3	Status of Reclaimed Water Piping	1-11
Figure 3.1	Reclaimed Water System Schematic	3-3
Figure 3.2	Historical Inflows to MWPS, MWRWP, and BITP (2018 and 2019)	3-5
Figure 3.3	Seasonal Variation in Inlet Flows at MWPS in 2019 (Average Monthly Flows)	3-6
Figure 3.4	MWPS Diurnal Curve for Average Annual Flow from 2019	3-7
Figure 3.5	Projected Inflows to MWPS and Projected MWRWP Production (2020-2040)	3-11
Figure 3.6	2020 Lacey Wet and Paper Water Supply Scenarios	3-12
Figure 3.7	2040 Lacey Wet and Paper Water Supply Scenarios	3-13
Figure 3.8	Historical and Estimated Future Reclaimed Water Needed for Environmental Mitigation	3-15
Figure 3.9	Design Infiltration Rates at Woodland Creek	3-16
Figure 3.10	Increasing Environmental Mitigation Requirements for Lacey	3-17
Figure 3.11	2020 Reclaimed Water Available After Environmental Mitigation	3-18
Figure 3.12	2040 Reclaimed Water Available After Environmental Mitigation	3-19
Figure 3.13	Annual Volume of Reclaimed Water Available to City for Other Uses	3-22
Figure 3.14	Daily Flow of Reclaimed Water Available to City for Other Uses	3-23
Figure 4.1	Potential Conversion from Potable Water - Top Irrigation Customers	4-3
Figure 4.2	Potential Reclaimed Water Pipeline	4-5

Figure 4.3	Potential Conversion from Potable Water - Additional Customers	4-6
Figure 4.4	Vacant Parcels Identified As Future Potential Reclaimed Water Customers	4-8
Figure 4.5	Typical Irrigation Diurnal Curve	4-9
Figure 4.6	Conversion from Potable Water - All Customers Identified in Analysis	4-12
Figure 4.7	Daily Demand and Supply Curves for Conversion from Potable Water Scenario	4-14
Figure 4.8	Daily Demand and Supply Curves for Conversion from Potable Water Plus Future Customers Scenario	4-14
Figure 4.9	Alternative 1 Schematic: Ground Storage and Retrofit PS	4-16
Figure 4.10	Alternative 2 Schematic: Ground Storage and New PS	4-17
Figure 4.11	Alternative 3 Schematic: Elevated Storage and Retrofit PS	4-18
Figure 4.12	Alternative 4 Schematic: Elevated Storage and New PS	4-18
Figure 4.13	Cost Estimate Classification Matrix for Process Industries	4-19
Figure 5.1	De Facto Reuse Schematic	5-2
Figure 5.2	Martin Way Reclaimed Water Plant Process Flow Diagram	5-7
Figure 5.3	Alternative 1 - Use of Percolation Facilities with Potable Water Recovery	5-13
Figure 5.4	Alternative 2 - Non-Potable ASR with Treatment Post-Extraction	5-15
Figure 5.5	Alternative 3 - Direct Recharge to Potable Groundwater	5-18
Figure 5.6	Alternative 3b - Potable ASR	5-19

Abbreviations

AA BOD	average annual biochemical oxygen demand
AA TN	average annual total nitrogen
AACE	American Association of Cost Estimators
AAF	average annual flow
AFY	acre-feet per year
AOP	advanced oxidation process
ASR	aquifer storage and recovery
BAF	biological aerated filter
BIRWP	Budd Inlet Reclaimed Water Plant
BITP	Budd Inlet Treatment Plant
BOD	biochemical oxygen demand
BOD ₅	5-day biochemical oxygen demand test
C	contact
Carollo	Carollo Engineers, Inc.
CDPH	California Department of Public Health
CEC	constituent of emerging concern
cfy	cubic feet per year
City	City of Lacey
Ct	contact time
DOH	Washington State Department of Health
DPR	direct potable reuse
Ecology	Washington State Department of Ecology
fps	feet per second
ft	feet
GAC	granular activated carbon
gpm	gallons per minute
GWA	groundwater augmentation
HAA5	haloacetic acids
HDPE	high-density polyethylene
HGL	Hydraulic Grade Line
hr	hour
hp	horsepower
ILA	Interlocal Agreement
kWh	kilowatt-hour
L	liter
LF	linear foot (feet)

LOTT	LOTT Clean Water Alliance
LRV	log removal value
LT2	USEPA Long Term Rule 2
µg/L	micrograms per liter
MBR	membrane bioreactors
MCL	maximum contaminant level
MG	million gallons
mg/L	milligrams per liter
mgd	million gallons per day
MGY	million gallons per year
mJ/cm ²	millijoules per square centimeter
mL	milliliter
MMF	maximum monthly flow
MPN	most probable number
MPN/L	most probable number per liter
MWPS	Martin Way Pump Station
MWRWP	Martin Way Reclaimed Water Plant
NDMA	N-Nitrosodimethylamine
NF	nanofiltration
ng/L	nanogram per liter
NO ₂ -N	nitrite as nitrogen
NO ₃ -N	nitrate as nitrogen
NRC	net reuse capacity
NTU	nephelometric turbidity unit
PFAS	per- and polyfluoroalkyl substance
PGE	Puget Sound Energy
PGG	Pacific Groundwater Group
PHD	peak hour demand
POLY	polypropylene
PPCP	pharmaceuticals and personal care products
PS	pump station
psi	pounds per square inch
PVC	poly-vinyl chloride
RCW	Revised Code of Washington
RO	reverse osmosis
RWP	Reclaimed Water Plan
SAT	soil aquifer treatment
SCVWD	Santa Clara Valley Water District
SWA	surface water augmentation

TCEP	tris(2-chloroethyl) phosphate
TCEQ	Texas Commission on Environmental Quality
TDH	total dynamic head
TM	technical memorandum
TOC	total organic carbon
TSS	total suspended solids
TTHM	trihalomethane
UF	ultrafilter
USEPA	United States Environmental Protection Agency
UV	ultraviolet
UVAOP	ultraviolet advanced oxidation process
VFD	variable frequency drives
WAC	Washington Administrative Code
WAS	waste activated sludge
WRRF	WateReuse Research Foundation
WTP	water treatment plant

CHAPTER 1 EXISTING SYSTEM

1.1 Purpose

Wastewater from the City of Lacey (City) is currently treated by the LOTT Clean Water Alliance (LOTT), where Class 'A' reclaimed water is produced. A portion of the reclaimed water is allocated back to the City; under current conditions, all of the City's allocation of the reclaimed water is used for mitigation of water rights. Based on growth projections, the City believes there may be more reclaimed water available in the future.

The purpose of the Reclaimed Water Plan (Plan) is to define the best use of Class 'A' reclaimed water as growth continues. The City of Lacey currently receives reclaimed water supply from LOTT's Martin Way Reclaimed Water Treatment Plant (Martin Way Plant), which is located within Lacey city limits. This Plan will identify potential customers and system infrastructure needed to use its reclaimed water supply.

1.2 City of Lacey Land Acknowledgement

We acknowledge the ancestral land we are on today as the traditional territory of the Tribal People of the Treaty of Medicine Creek, signed in 1854, including the Nisqually Indian Tribe and Squaxin Island Tribe.

We acknowledge, remember, and must not forget those Tribal People that are named but not recognized today, and who were absorbed or relocated into other tribes for survival. We recognize the ancestors and their descendants who are still here.

We acknowledge, Indigenous People who called the land home before the arrival of settlers and have been here Since Time Immemorial.

We recognize the relationship that exists between Indigenous People and their traditional territories, which include the religious significance, self-determination, identity, and economic factors. The relationship helps all people heal from the past and learn how not to inflict new wounds today.

We recognize and respect Indigenous People as traditional stewards of this land, and acknowledge the Tribal Governments and their role today in taking care of these lands.

We recognize that this land acknowledgement, and the Nisqually-Lacey Accord of 2011, are small steps toward true allyship. We commit to partnering with the Tribal People of the Treaty of Medicine Creek to continue to uplift the voices, experience, and histories of indigenous people of this land and beyond.

We recognize and have the responsibility to call attention to the histories of dispossession, forced removal, and abridged treaty rights that allowed our nation, state, and city to develop as it has today. We recommend that community members read the Medicine Creek Treaty of 1854.

1.3 Service Area

The Martin Way Plant is authorized to distribute reclaimed water for direct non-potable beneficial use in Thurston County or other nearby counties, as defined in the Martin Way Plant permit (DOE 2013). For purpose of this Plan, Lacey's reclaimed water service area is limited to its Urban Growth Area (UGA), which is shown in Figure 1.1. However, Lacey is open to serving customers outside its UGA given conditions are met from the Martin Way Plant permit, and applicable City agreements and regulations.

1.4 Relationship to other Utilities

LOTT provides wastewater management services for the urban area of northern Thurston County, Washington. This includes wastewater treatment and production of Class A Reclaimed Water. LOTT is a non-profit corporation, formed by four government partners: Lacey, City of Olympia (Olympia), City of Tumwater (Tumwater), and Thurston County. The reclaimed water produced at the Martin Way Plant is shared between Lacey, Olympia, and LOTT, per interlocal agreements summarized below.

Lacey and other governmental partners coordinate regarding reclaimed water, as well as regional treatment. LOTT owns, operates, and maintains the Martin Way Plant and all associated facilities up to the reclaimed water delivery point(s). Lacey owns, operates, and maintains all infrastructure downstream of the delivery point(s) to the end user's water meter. Lacey and other Partners may resell or otherwise supply reclaimed water provided by LOTT to any of its End Users for the purposes authorized in the Reclaimed Water Permit or other uses approved by Ecology.

LOTT owns and operates the Hawks Prairie facility that is designed to infiltrate up to 5 million gallons per day (mgd) of reclaimed water from the Martin Way Plant. Actual infiltration at the site typically averages 0.65 mgd. The facility is designed to accept excess flows from the Martin Way Plant when the other partners are not able to use the reclaimed water. Currently, Lacey's delivery point is at the Martin Way Plant; however, additional delivery points in LOTT's transmission system may be used. Additionally, Lacey is the lead agency on joint-use Woodland Creek Infiltration Groundwater Recharge (Woodland Creek) Facility that provides water right mitigation with the City of Olympia. It is anticipated that Lacey will continue to operate this and other joint facilities in its UGA. Existing agreements between the partners are summarized in the next section.

1.5 Agreements and Permits

Existing agreements pertaining to Lacey's reclaimed water system are summarized in Table 1.1. The table provides the agreement or permit name, utility or agency involved, and a summary of contents. Important conclusions from these documents are discussed in the following sections. The summarized agreements are available in Appendix A.

1.5.1 Martin Way Plant Reclaimed Water Allotment

The allotment of produced Reclaimed Water from the Martin Way Plant is defined by two agreements:

- Reclaimed Water Distribution Agreement No. 2 Between the LOTT Clean Water Alliance, Thurston County and the Cities of Lacey, Olympia, and Tumwater (2020).
- General Interlocal Agreement Between the LOTT Clean Water Alliance, Thurston County and the Cities of Lacey, Olympia and Tumwater for the Distribution and Use of Reclaimed Water (2020).

The Martin Way Plant reclaimed water has been allocated between LOTT, Lacey, and Olympia, as shown in Table 1.2. LOTT reserves water for plant use and the Hawks Prairie Facility. Olympia uses its share for water rights mitigation at the Woodland Creek Facility. Lacey uses a portion of their share at the Woodland Creek Facility. This Plan will identify how to serve potential customers with the remaining reclaimed water allotment.

1.6 Related Studies and Plans

Existing studies and plans related to Lacey's reclaimed water system are summarized in Table 1.3. The table provides the study or plan name, author, date, and a summary of the studies and plans. Appendix B provides a link to each study or the study/plan when not available online.

1.7 Existing Infrastructure

Substantial existing reclaimed water infrastructure has been constructed in Lacey, as shown in Figure 1.2. Reclaimed water from the Martin Way Plant is distributed to two infiltration facilities: LOTT's Hawks Prairie facility and Lacey's and Olympia's joint Woodland Creek Groundwater Recharge Facility. Transmission and distribution piping are owned and operated by LOTT or Lacey, as depicted in the figure.

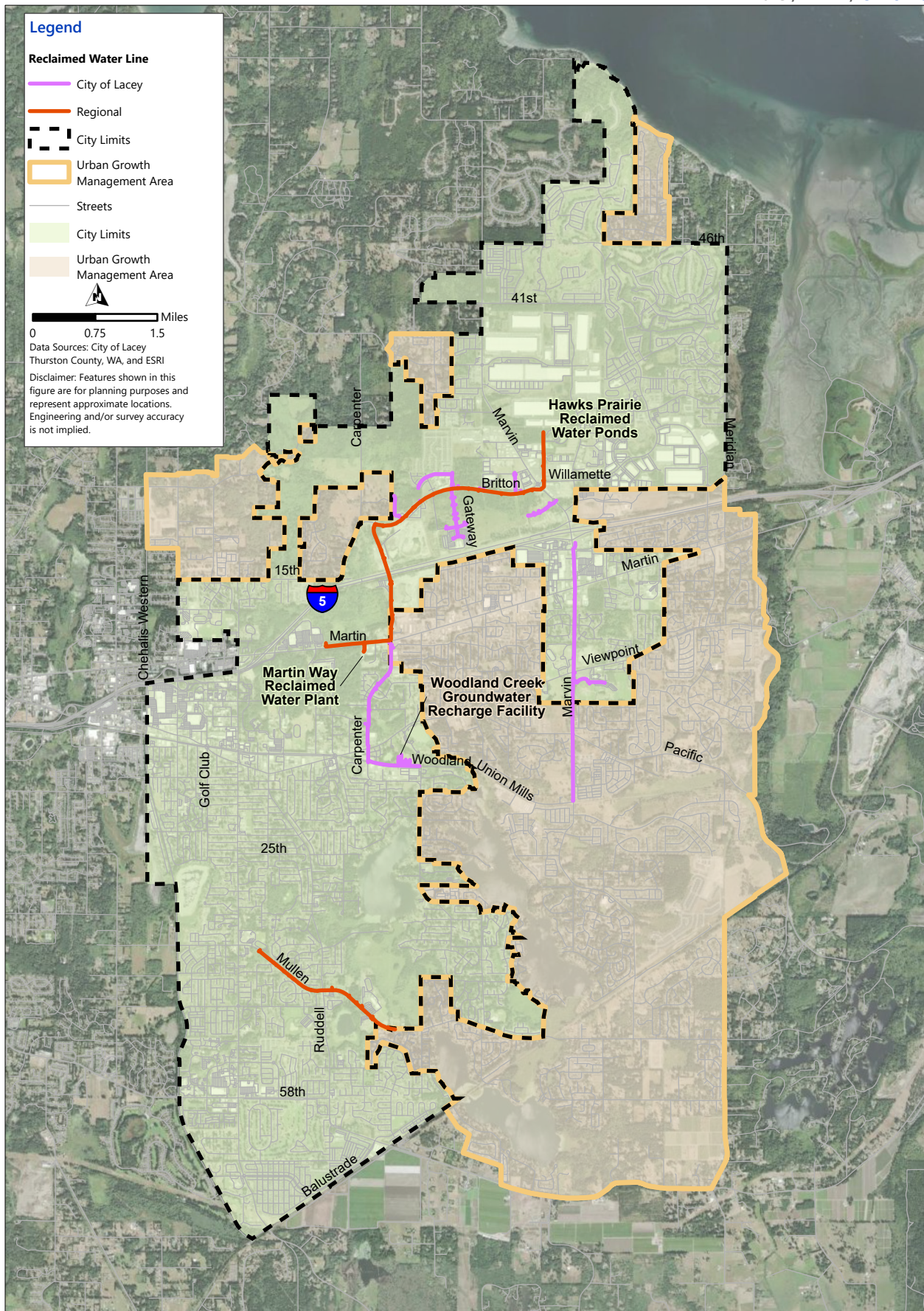


Figure 1.1 City of Lacey Reclaimed Water Service Area
CITY OF LACEY
RECLAIMED WATER PLAN

Table 1.1 City of Lacey Reclaimed Water Agreements and Permits

Name	Utility / Agency	Date	Summary of Contents	Highlighted Content
Interlocal Cooperation Act Agreement for Wastewater Management by the LOTT Wastewater Alliance	Lacey, Olympia, Tumwater, and Thurston County	1999	Defines the governance structure for LOTT to implement the reclaimed water treatment infrastructure.	Establishes legal means to implement the LOTT Reclaimed Water system.
General Interlocal Agreement Between LOTT Wastewater Alliance, Thurston County and the Cities of Lacey, Olympia and Tumwater for the Distribution and use of Reclaimed Water	LOTT, Lacey, Olympia, Tumwater, and Thurston County	2004	Regional reclaimed water policies, supply of reclaimed water, resale to end users, sharing of information, policy coordination, dispute resolution, indemnification, and terms of agreement and withdrawal.	Agreement on how the Partners will interact with the LOTT Reclaimed Water system. Please refer to Section 1.3 for a narrative of the interaction.
Reclaimed Water Distribution Agreement No. 1 Between LOTT Wastewater Alliance, Thurston County, and the Cities of Lacey, Olympia, and Tumwater	Lacey, Olympia, Tumwater, and Thurston County	2005	Allocates the first and second 1.0 mgd of production to participating cities. Document to be amended as expansion continues.	Distribution Table #1 establishes Lacey's reclaimed water supply as 60% of the first 1.0 mgd of production, and 100% of the second 1.0 mgd of production (estimated to be 1,450 gpm). Lacey's understanding is that additional future expansion will be allocated 100% to Lacey.
Gateway Development Memorandum of Understanding	Lacey and Hawks Prairie LLC	2006	Defines the conditions for the Gateway Development, including use of reclaimed water.	Legal agreement for the construction of planned future reclaimed infrastructure in the development.
Reclaimed Water Supply Agreement between the LOTT Alliance and the City of Lacey Regarding the Martin Way Reclaimed Water Plant	LOTT and Lacey	2008	Describes the supply and sale of reclaimed water, conditions of supply, responsibilities for the production, distribution, and use of reclaimed water, resale to end use customer, and agreement administration.	Sets the responsibilities for distribution of reclaimed water and resale to end use customers.
Interlocal Agreement between the City of Lacey and the City of Olympia for Water Rights Mitigation (ILA for Water Rights Mitigation)	Lacey, Olympia	2008	Defines the collaboration between the City of Lacey and Olympia to mitigate predicted impacts to water resources in the development of new water rights and resultant groundwater withdrawals, impacts to Woodland Creek Basin, and address the impacts to Olympia's senior water rights at McAllister Springs.	Establishes the City of Lacey and Olympia's water right applications, plan to accommodate future population growth within an Urban Growth Area and development of mitigations.
Woodland Creek Basin, City of Lacey Comprehensive Water Rights Mitigation Plan	Lacey, Olympia	2010	Defines the predicted impacts to Woodland Creek basin and proposed mitigation actions.	Establishes Lacey to have larger predicted impacts on the basin and defining upper Woodland Creek as the focal point of the mitigation plan.
Martin Way Treatment Plant Permit (State Reclaimed Water Permit Number ST 6206 – Issued 6/26/2020)	Department of Ecology (Ecology) and LOTT	2011 (modified in 2013)	The Martin Way Reclaimed Water Treatment Plant permit defines reclaimed water flow and water quality, limitation, monitoring requirements, reporting and record keeping requirements, allowable distribution and use, operations and maintenance, and general permit conditions.	Defines the minimum water quality of Reclaimed Water Users of the reclaimed water as listed in the approved Water Reuse Summary Plan New users must meet permit conditions and be reported in the next annual update of the Water Reuse Summary Plan.
Master LOTT Interlocal Agreement between Clean Water Alliance and City of Lacey	LOTT, Lacey	2014	Defines request for services, payment, care, and maintenance of equipment, right of entry, relationship of parties, indemnification, insurance, and termination.	Agreement on how Lacey and LOTT will interact with the LOTT Reclaimed Water system.
Exhibit A (Revised) to 2020 General Interlocal Agreement: Reclaimed Water Distribution Methodology(1)	LOTT, Lacey, Olympia, Tumwater, Thurston County	2019	Defines original reclaimed water plans/negotiations, capacity planning, volumes available for reuse, supply/side agreements, discrepancies in distribution volumes, updates to reclaimed water allocations, future updates to the distribution methodology, fall back distribution proportions, agreements/approvals, interim uses, and renegotiation opportunities	Defines the underestimation of LOTT's reuse needs. Defines MWRWP actual production volumes, 1.45 mgd of water volume.
Reclaimed Water Supply Agreement between the LOTT Clean Water Alliance and the City of Lacey Regarding the Martin Way Reclaimed Water Plant	LOTT, Lacey	2020	Relationship to general agreement, supply of reclaimed water, conditions of reclaimed water supply, description of facilities, responsibility for production/distribution/use of reclaimed water, sale to end use customer, designated representatives / notices, term of agreement, termination, sharing of information and legal relations / interpretation of agreement.	Defines the update to the general ILA dated 2004 and the terms/conditions between LOTT's supply and the City of Lacey's use/distribution of reclaimed water
Reclaimed Water Distribution Agreement No. 2 between the LOTT Clean Water Alliance, Thurston County, and the Cities of Lacey, Olympia, and Tumwater	LOTT, Lacey, Olympia, Tumwater, Thurston County	2020	Defines the negotiated distribution of reclaimed water to participating cities, allocating a maximum volume of 1.75 mgd from MWRWP. Document has been amended to show updates current to 2020.	Table 1. Reclaimed Water Allocation establishes the distribution to be as follows: Lacey – 1.45 mgd, Olympia – 0.30 mgd.
Exhibit B to Supply Agreements: Class A Reclaimed Water Service Agreement	Olympia	2020	Terms and conditions of service, use of reclaimed water, quantity of reclaimed water, prices of reclaimed water, general use / use area requirements, restrictions on use, temporary interruption of supply, disclaimer, indemnity and hold harmless, termination, and compliance with laws governing reclaimed water.	Establishes the end user having access to Class A Reclaimed Water through the City of Olympia
General Interlocal Agreement between the LOTT Clean Water Alliance, Thurston County and the Cities of Lacey, Olympia, and Tumwater for Distribution and Use of Reclaimed Water	LOTT, Lacey, Olympia, Tumwater, Thurston County	2020	Regional reclaimed water policies, supply of reclaimed water, resale to end users, sharing of information, policy coordination, dispute resolution, indemnification, and terms of agreement and withdrawal.	Defines agreement on how the Partners will interact with the LOTT Reclaimed Water system and terms to the agreement

Table 1.2 Martin Way Reclaimed Water

Increment	Volume Produced	LOTT Reserve	Volume Reserve	Lacey		Olympia		Tumwater	
	mgd	mgd	mgd	Percent	mgd	Percent	mgd	Percent	mgd
First (Existing) ⁽¹⁾	1	0.25	0.75	60	0.45	40	0.30	0	0
Second (Existing) ⁽¹⁾	1	0	1	100	1	0	0	0	0
Third (Future) ⁽²⁾	1	0	1	40.4	0.404	44.3	0.443	15.3	0.153
Fourth (2017) ⁽³⁾	2	0.25	1.75	82.9	1.45	17.1	0.30	0	0

Notes:

- (1) Reclaimed Water Distribution Agreement No. 1 between LOTT Wastewater Alliance, Thurston County, and the Cities of Lacey, Olympia, and Tumwater (2004).
(2) General Interlocal Agreement between LOTT Wastewater Alliance, Thurston County and the Cities of Lacey, Olympia and Tumwater for the Distribution and use of Reclaimed Water (2005).
(3) Exhibit A (Revised) to 2020 General Interlocal Agreement: Reclaimed Water Distribution Methodology.

Table 1.3 Studies and Plans related to Reclaimed Water

Name	Author	Date	Summary of Contents	Highlighted Content
Reclaimed Water Study – Lacey Gateway and Surrounding Areas	Huitt-Zollars, Inc.	2008	Identifies planned reclaimed water improvements for the Gateway Development and surrounding areas.	Documents planned future reclaimed infrastructure that is further evaluated in Chapters 4 and 5.
Woodland Creek Water Infiltration Facility Analysis	Pacific Groundwater Group	2010	Defines prior studies of Woodland Creek, hydrogeology, infiltration simulations, and annual volume of infiltration.	Assess the feasibility of large-scale reclaimed water infiltration at Woodland Creek Community Park
Comprehensive Water Rights Mitigation Plan	Lacey	2010	Provides a detailed description of mitigation actions to clearly show that Lacey will mitigate predicted impacts to water resources. It defines the reclaimed water needed for mitigation at the Woodland Creek Infiltration Facility.	Lacey is anticipating recharging 0.53 mgd of reclaimed water in the summer and 0.14 mgd in the winter as part of regional mitigation efforts for Woodland Creek.
LOTT Flows and Loading Report	LOTT	2015	Provides projected growth for the Lacey service area. Analyzes residential and employment population projections within the Urban Growth Boundary and estimates the impact on wastewater flows and loading within the LOTT wastewater system.	Projected reclaimed water demands are discussed in Chapter 3.
City of Lacey Comprehensive Plan	Lacey	2016	Presents a clear vision for Lacey's future over a twenty year period. Provides a consistent policy direction relating to growth and development, housing, parks, open space, environmentally sensitive areas, historic preservation, public services, and other issues. These policies establish the foundation for the development of this Plan.	Overarching goals that direct the City's Reclaimed Water System and Level of Service. Future zoning/land use will be used to develop potential RW customers.
LOTT Capacity Assessment Report	LOTT	2018	Provides projected reclaimed water supply from the Martin Way Plant. Uses flows and loadings data and inflow and infiltration evaluation results to analyze system components (i.e., conveyance, treatment, and discharge/use), determine when limitations will occur, and provide a timeline for new system components and upgrades.	Projected LOTT flows are discussed in Chapter 3.
Reclaimed Water Supply Agreement Revisions Technical Memorandum (TM)	Reclaimed Water Policy Task Force, Technical Sub-Committee	2019	Memorializes the rationale used in determining volumes of reclaimed water listed in the revised Supply Agreements between LOTT and partner jurisdictions. Defines supply agreements for MWRWP and BIRWP.	Establishes the volumes of reclaimed water available to LOTT and the partner jurisdiction (cities) by assuming a Net Reuse Capacity (Table 2). Outlined in subsection 3.3 of each supply agreement.
LOTT Reclaimed Water Infiltration Study	LOTT (with various consultants)	2022	Provides local scientific data and community perspectives to help policymakers make decisions about future reclaimed water treatment and uses. Summarizes LOTTs concern with residual chemicals and effects of the infiltration of reclaimed water into the ground.	Testing, tracking, and risk assessment of chemicals used to treat reclaimed water and analyzing the risk to people and wildlife.

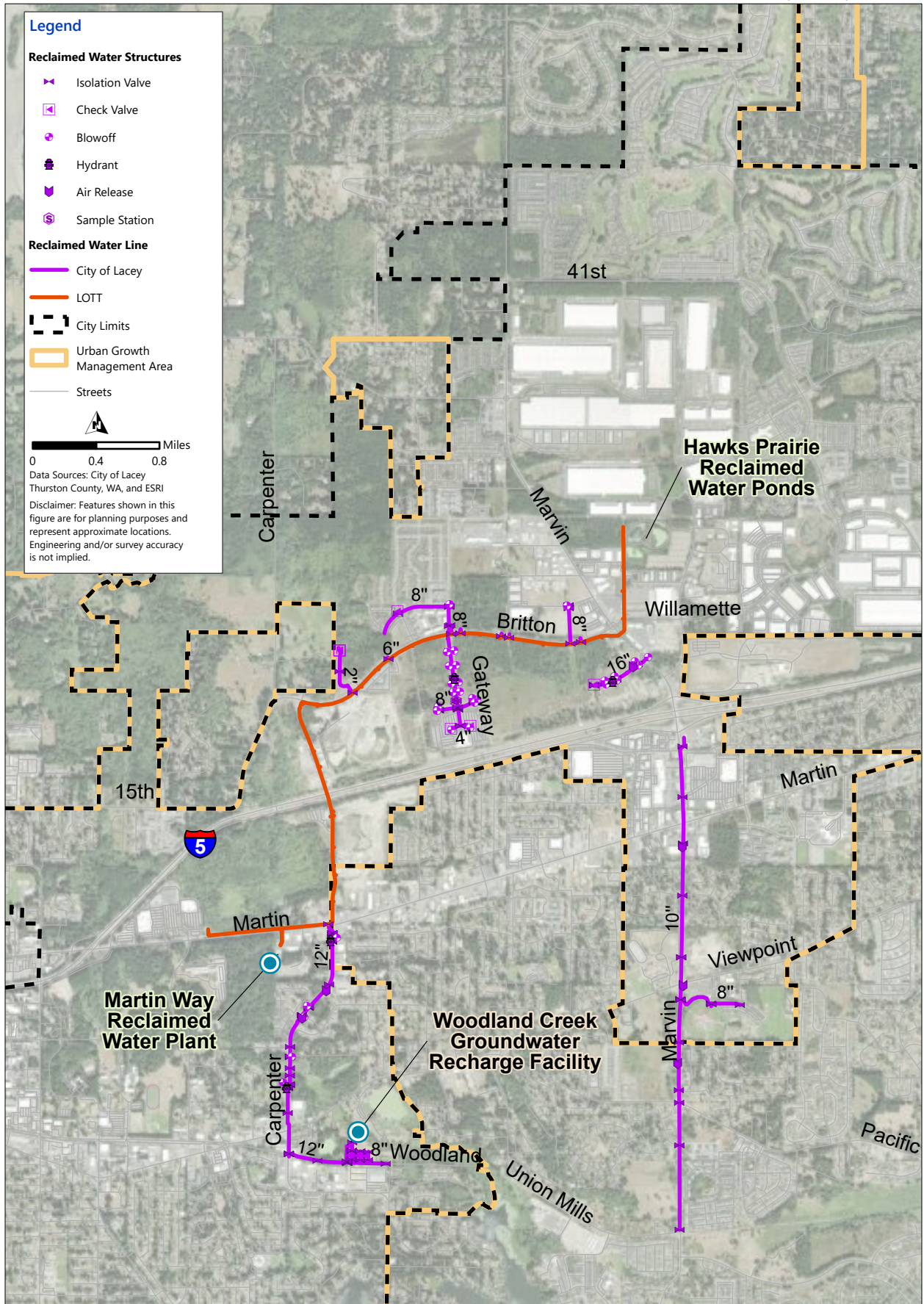


Figure 1.2 Existing Distribution System
CITY OF LACEY
RECLAIMED WATER PLAN

1.7.1 Martin Way Reclaimed Water Treatment Plant

The Martin Way Plant treats a large portion of the base wastewater flows from Lacey and its UGA year-round. The plant receives flows from the Martin Way Pump Station (MWPS). Wet-weather flows and dry-weather flows not treated at the plant are pumped to the LOTT Budd Inlet Treatment Plant (BITP) in Olympia for treatment via the Martin Way Pump Station. There are currently three pumps (4-mgd capacity each) for a total capacity of 12 mgd (8 mgd firm capacity) that pump to the BITP. Plans are underway to upgrade/replace the MWPS to increase the firm pumping capacity to Budd Inlet to 16 mgd. The project will increase redundancy and pumping capacity to the Martin Way Plant. The production of reclaimed water at the Martin Way Plant is preferential as it makes beneficial use of the wastewater and aids LOTT in meeting permit conditions at the BITP.

The Martin Way Plant uses a membrane bioreactor process that is designed to treat up to 2 mgd of Class A reclaimed water. The LOTT Capacity Report states "the plant is expandable up to 8 mgd of treatment capacity with additional construction on the existing site. Expansion at the plant will occur incrementally and depends on increased raw wastewater flow." Current wastewater flow projections, described in Chapter 3, indicate that major expansions at the plant are largely dependent on the septic conversion schedule for Lacey (2015 Capacity Report) and/or routing of out-of-basin wastewater flows to the Martin Way Plant. Wastewater process tanks needed to expand treatment to 3 mgd were constructed during the original construction; therefore, the plant will only require adequate source flow and the installation of the membrane filtering equipment to expand to 3.0 mgd.

The Martin Way Plant does not currently include equalizing storage for raw wastewater or treated reclaimed water; therefore, production of reclaimed water varies depending on time of day and year. LOTT is currently studying options for providing raw wastewater equalizing storage to improve the efficiency of the plant, which if implemented will likely reduce the current diurnal fluctuations in reclaimed water production.

When the Martin Way Plant is offline due to maintenance or other failures, all wastewater flows is pumped to the Budd Inlet Treatment plant. The reliability of reclaimed water production at this facility will need to be considered for potential reclaimed water customers.

1.7.2 Hawks Prairie Reclaimed Water Ponds

Reclaimed water not used by the LOTT partners is infiltrated at the Hawks Prairie Recharge Facility. The Hawks Prairie facility is designed to infiltrate up to 5 mgd of reclaimed water from the Martin Way Plant. The 41-acre site circulates reclaimed water flows through five wetland ponds before entering eight one-acre recharge cells (shallow basins) where it is infiltrated into the ground. The facility's ponds and recharge basin serve as the primary means of using reclaimed water from the plant. The facility serves as the default disposition for reclaimed water not otherwise used. Additionally, the ponds provide:

- Public visibility and education on reclaimed water, groundwater recharge, and natural features on the site.
- Community benefits due to its park-like setting.

1.7.3 Woodland Creek Groundwater Recharge Facility

Lacey and Olympia are partners in the Woodland Creek Groundwater Recharge Facility (Woodland Creek Facility), an approximately 5-acre facility that infiltrates reclaimed water from the Martin Way Plant to replenish groundwater and stream flows in nearby Woodland Creek Community Park. The facility consists of 4.7 miles of underground infiltration chambers that are approximately 3 feet under the ground, where the surface is maintained as a grass field in Lacey's Woodland Creek Park. Operating since 2014, the facility provides an average infiltration capacity between 0.3 and 0.9 mgd depending on ground water levels. The facility mitigates predicted impacts to Hicks Lake, Pattison Lake, and Long Lake as required by Lacey's water right mitigation agreements with Washington State Department of Ecology. Cost and ownership of the facility are shared with Olympia; Lacey's share is 78.3 percent.

Olympia has utilized all of their reclaimed water allotment (0.3 mgd) from the Martin Way Plant to the Woodland Creek facility. Lacey contributes the remaining reclaimed water production capacity, which varies by season (up to 0.6 mgd).

1.7.4 Reclaimed Distribution System

1.7.4.1 LOTT Reclaimed Transmission System

LOTT's reclaimed water has a transmission main within the study area. A summary of the size and material of piping is provided in Table 1.4. Water is conveyed to the Hawks Prairie facility via approximately 3 miles of 14-inch transmission main along Carpenter Road NE and Britton Parkway NE (see Figure 1.1). The transmission main is owned and operated by LOTT. The transmission main has regular isolation valves and air releases, but not hydrants or blow-off assemblies.

A second inactive transmission main has been constructed in Mullen Road SE, which was intended to serve a previously planned Mullen Road Reclaimed Water Plant. Recent planning indicates that the Mullen Road Reclaimed Water Plant will not be needed and the property has been declared surplus to the needs of LOTT; however, LOTT intends to retain the property for the foreseeable future in case plans change. The City has an interest in purchasing the portion of LOTT's reclaimed water line on Mullen Road from Ruddell Road to Timberline High School.

Table 1.4 LOTT Martin Way Plant Reclaimed Water Piping Summary (feet)

Material/Diameter	Unknown	PVC	DI	STEEL
Unknown	1,990	0	0	10
2	210	730	0	0
4	0	0	2,210	0
6	0	80	0	0
8	310	110	0	0
12	0	5,070	0	0
14	0	15,640	1,350	0

Notes:

DI - ductile iron; PVC - poly-vinyl chloride; STEEL - wire-wrapped steel.

1.7.4.2 Lacey Reclaimed Distribution System

Lacey's existing reclaimed distribution system provides water to the Woodland Creek Facility and lays the groundwork for future customers. A summary of the size and material of piping is provided in Table 1.5. Table 1.5 includes distribution piping, as well as piping associated with laterals, structures, and the Woodland Creek Facility. Reclaimed water is conveyed to the Woodland Creek Facility by approximately 1.3 miles of 12-inch distribution piping along Carpenter Road SE and Lacey Woodland Trail (south of Pacific Ave SE). The distribution main has regular isolation valves and blow-off assemblies. The line also has air releases as needed, and two reclaimed water hydrants (not to be used for fire). Approximately 2,300 feet of 8-inch piping in Table 1.5 is associated with the distribution system within the Woodland Creek Facility.

Lacey has installed reclaimed distribution piping as part of recent projects, as shown in Figures 1.2 and 1.3, most notable along Marvin Road NE from I-5 to Union Mills Rd SE. This pipeline is currently inactive but can be used in the future to supply reclaimed water customers. Lacey has also recently installed reclaimed water pipelines, most notable in the Gateway Development, along Main Street NE to Marvin Road NE, and along Western Parkway to Britton Parkway NE. These reclaimed water pipelines are currently active and charged with potable water. The pipe along Main Street NE maybe extended to the east and south in the future to supply more reclaimed water customers. The Gateway Development distribution piping is generally between 8 inches and 16 inches in diameter. It has regular isolation valves, blow-off assemblies, and reclaimed water hydrants, as well as air release valves as needed. The Marvin Road piping is generally 10-inch diameter and has regular isolation valves and air release valves, as needed. The pipelines are connected to transmission water lines with a reduced pressure backflow assembly. Table 1.5 also includes smaller piping associated with laterals and structures.

Table 1.5 Lacey Reclaimed Water Piping Summary (feet)

Material/Diameter	Unknown	PVC	POLY	DI	HDPE
2	120	600	1,327	0	0
3	0	17	0	0	0
4	1,028	1,968	0	20	0
6	1,311	307	0	185	0
8	1,163	11,150	0	2,102	0
10	0	9,599	0	0	0
12	0	15,347	0	0	0
16	0	1,481	0	915	0

Notes:

HDPE - high-density polyethylene; POLY - polypropylene.

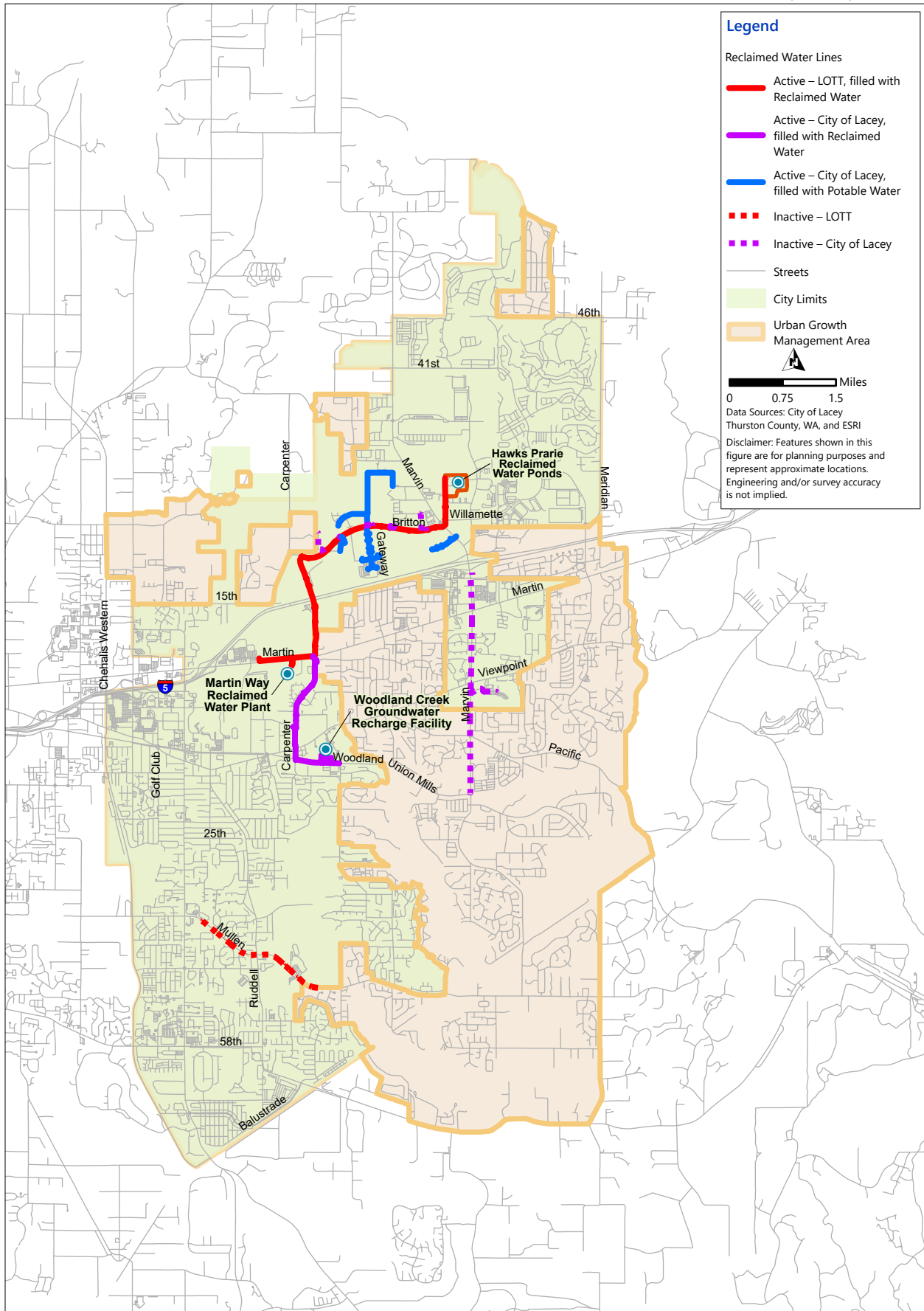


Figure 1.3 Status of Reclaimed Water Piping
CITY OF LACEY
RECLAIMED WATER PLAN

CHAPTER 2 REGULATIONS AND CRITERIA

This Chapter provides a review of regulations and criteria that impact the long-term planning of the City's reclaimed water system, including the Washington Administrative Code (WAC), Lacey Municipal Code (LMC), and other sources. Additionally, the City has set level of service goals that will be used for planning and operating the system and submitted for approval by the City Council as part of this Plan.

2.1 Review of Regulations

Current reclaimed water regulations are summarized below. Additionally, aquifer storage and recovery (ASR) regulations are included as they pertain to storing and recovering reclaimed water. Both options are potentially viable uses of reclaimed water for the City; ASR may help maximize the year-round beneficial use of the available resource.

2.1.1 Reclaimed Water Regulations

2.1.1.1 Current Regulations

The Washington State Department of Ecology (Ecology) and Department of Health regulates Reclaimed water based on Chapter 173-219 WAC, which was promulgated in 2018. Key aspects of this regulation are summarized throughout this chapter.

LOTT's Martin Way Reclaimed Treatment Plant produces Class A Reclaimed Water, which is the highest class of reclaimed water in Washington. Ecology defines Class A reclaimed water as "at a minimum, is at all times an oxidized, coagulated, filtered, disinfected wastewater" (WAC 173-219, 2018) " Additional requirements for a Class A reclaimed water are described below in Table 2.1.

While a Class A Reclaimed Water is the highest level designation for water quality, Department of Health may designate a Class A+ to waters which may be eligible for direct potable reuse. Class B requires lower water quality; therefore, Class A Reclaimed Water can be applied for any Class B-designated use. All classes lower than B were eliminated in the 2018 rule.

In addition to state standards, the City has adopted its own regulations in LMC Chapter 13.64, providing service policies that guide the delivery of reclaimed water to its customers. Key aspects of these regulations are summarized in Section 2.3.

2.1.1.2 Class A Requirements and Definition

Ecology and the Department of Health have recently expanded upon requirements for a Class A Reclaimed water designation. The definition of Class A includes water which is oxidized, coagulated, filtered, and disinfected; however, other allowable methods include water which is has been treated "at all times with oxidation, membrane filtration, and disinfection" (WAC 173-219, 2019) or alternative methods approved by the lead agency.

Further, depending on the use of Class A water, additional requirements may apply. WAC 173-219-390 defines a series of use-based requirements for reclaimed water. For example, Class A reclaimed water that is planned for use in surface water augmentation, direct groundwater recharge, or indirect groundwater recharge, must not exceed drinking water maximum contaminant levels (MCL) in finished reclaimed water or at an alternative point of compliance. (WAC 173-219-390, 2019). These MCLs are described in WAC 246-290.

Notable, recent changes to WAC 246-290 include the addition of State Action Levels (SAL) and State MCLs related to per- and polyfluoroalkyl substances (PFAS). Additionally, WAC 246-290-320 "Follow-up Action" has been amended to include required actions following an SAL exceedance.

Performance standards for Class A are described in Table 2.1.

Table 2.1 Class A Performance Standards

Parameter	Monthly Average	Additional Requirements
Turbidity (Coagulation/Filtration)	2 NTU	Sample Maximum: 5 NTU
Total Coliform	7-Day Median: 2.2 MPN/100 mL	Sample Maximum: 23 MPN/mL
Virus Removal	–	4-log virus removal or inactivation
Total Nitrogen	10 mg/L	Weekly Average: 15 mg/L
Residual Chlorine	–	≥0.2 mg/L free chlorine or ≥0.5 mg/L total chlorine

Additional oxidation performance standards are detailed in WAC 173-219-330 for both Class A and Class B.

2.1.2 Aquifer Storage and Recovery Regulations

ASR is a technique to store water in an underground aquifer for use at a later time. For example, excess reclaimed water during the winter could be stored for use during the summer. Ecology regulates ASR using reclaimed water (in WAC 173-219) in accordance with RCW 90.46, a rule which gives Ecology the authority to permit the beneficial use, storage, and recovery from storage of reclaimed water. ASR regulations provide a process and minimum requirement to be worked through to obtain a permit, where Table 2.2 summarizes key aspects. The feasibility of ASR in Lacey from a hydrogeological and water quality standpoint is discussed in Chapter 3.

2.1.3 Groundwater Recharge Regulations

De facto reuse occurs when water discharged to groundwater or streamflow is later reused for potable uses. As discussed elsewhere in this chapter, streamflow augmentation is determined to be infeasible, but groundwater recharge with later potable or non-potable reuse may be a potential use of the reclaimed water. Groundwater recharge will need to meet the requirements in Table 2.2.

2.1.4 Direct Potable Reuse Regulations

Direct potable reuse (DPR) is a process in which reclaimed water is used directly for potable uses. DPR requires Class A+ reclaimed water (which Martin Way WRP does not currently meet) and requires a waiver from the Department of Health (DOH). LOTT and its jurisdiction partners, include the City, are currently working with Ecology and DOH to advance the first-ever Class A+ demonstration project in the state of Washington.

Table 2.2 Aquifer Storage and Recovery Regulations

Criteria	Reference	Summary
ASR Application Process	WAC 173-219	- Applying for an ASR project is governed within WAC 173-219, which establishes requirements for “production, distribution, and use of reclaimed water as authorized by Ecology and Health”, including: » Permitting, planning, design, construction, and management of reclaimed water facilities. » “Technology-based treatment, operational storage and distribution, treatment reliability, and use-based requirements”, which is where applications for ASR projects fall under this rule.
Minimum ASR Application Requirements	Ecology website and WAC 173-219	- Submit an application for an ASR project that contains at a minimum: » Water rights for the source waters for the proposed ASR project. » A feasibility analysis. » Timing and signature requirements. » An engineering report, which includes the technical basis for the design of the proposed reclaimed water facility or facility component. In addition, if the proposed use of the reclaimed water is for aquifer recharge, the engineering report must include the following: ◦ Information to assess the specific treatment and use of reclaimed water for application to recharge groundwater. ◦ A project operation plan. ◦ A conceptual model of the hydrogeologic system. ◦ A description of the legal framework. ◦ An environmental assessment and analysis of any potential adverse conditions or potential impacts to the surrounding ecosystem that might result from the project. ◦ A project monitoring plan. ◦ A pilot demonstration of project performance. - WAC 173-219-210 also discusses the criteria by which ASR project applications will be evaluated.
Regulatory Requirements	Ecology website and WAC 173-219	- Water to be stored in an aquifer as part of an ASR project must meet water quality standards for groundwaters of the state of Washington (Chapter 173-200 WAC). Additionally, injection wells for an ASR project must be registered with Ecology in accordance with Chapter 90.48 RCW (Water Pollution Control Act) and Chapter 173-218 WAC (Underground Injection Control Program). - If reclaimed water is used for ASR, it is also subject to WAC 173-219-390 Specific Use-Based Requirements. Among other requirements, this code states Class A water being used for aquifer recharge or aquifer recovery must meet WAC 246-290-310 (drinking water maximum contaminant levels) in finished reclaimed water product or at alternative point of compliance.
Water Quality Standards for Ground Waters	WAC 173-200	The goal of this policy is to ensure the purity of the state’s ground waters and to protect the natural environment.

2.2 Beneficial Uses for Reclaimed Water

The state allows Class A Water to be used in a wide range of beneficial uses that are summarized in Table 2.3. Table 2.3 indicates if the City would like to pursue these uses as part of this Plan and notes if there are existing potential customers of the use category. In general, reclaimed water can be applied for most uses that do not lead to ingestion of the reclaimed water. However, a case-by-case designation of Class A+ can be established for direct potable reuse. Any beneficial use must also be consistent with other applicable regulations, such as meeting surface water discharge requirements, having water quality parameters which meet maximum contaminant levels allowable for Class A, and not harming surrounding ecology.

The City has chosen not to pursue the following three state approved uses for Class A Reclaimed Water: fire flows, toilet and urinal flushing, and streamflow augmentation. Given the City's available water supplies, the City does not wish to ask developers to incur the additional costs of dual pipe structures for reclaimed water to allow for indoor uses, including toilet and urinal flushing. However, the City is open to working with developers that want to use reclaimed water due to its lower rate (currently set at 70 percent of potable water) or environmentally friendly attributes.

Similarly, the City does not wish to size and operate the reclaimed water system for fire flows. There is already sufficient supply and infrastructure in the potable water system for fire protection, and the current level of reliability of the reclaimed water system would pose concerns for this use.

The City has previously determined using reclaimed water for streamflow augmentation is infeasible due to water quality considerations. The City, in consultation with Ecology, has previously determined that using reclaimed water for direct streamflow augmentation is infeasible due to Woodland Creek's temperature and sensitive water chemistry concerns. Additionally, LOTT's RW permit only allows for groundwater infiltration and may not meet the State's surface water quality standards for Woodland Creek. If direct surface augmentation is desired, LOTT's RW permit will need to be reopened for further review and public comment. Additionally, uses that could potentially lead to discharge of reclaimed water to surface waters should be avoided due to these water quality considerations. However, the City would like to consider future applications of reclaimed water to constructed, beneficial use wetlands which involves meeting specified water quality criteria in WAC 173-219 and RCW 90.46.090(2).

2.3 Service Policies

The City has established service area policies in the LMC to guide the development of the reclaimed water system. A summary of key regulations is provided in Table 2.4. As discussed in Chapter 1, the City has defined the Reclaimed Water Service Area to be the urban growth boundary (UGB), which includes the City and unincorporated surrounding areas. The study area was therefore defined as the UGB; however, the City is willing to consider supplying reclaimed water outside the UGB on a case-by-case basis. Similar to other utilities, the City will own the reclaimed water mains, service connections, and appurtenances of the reclaimed water system. As a condition of service, all connections will be metered and cross-connections with the potable water system are prohibited. Similar to the potable water system, customers will own and maintain cross connection control devices and reclaimed water piping beyond the meter.

Table 2.3 Beneficial Uses of Class A Reclaimed Water

Use	Description	Consider Further	Comment
Direct Potable Reuse	Class A+ criteria are established case-by-case. A waiver must be received from the state board of health under WAC 246-290-060(4).	Yes	
Irrigation			
Nonfood Crops	- Irrigation of trees or fodder, fiber, and seed crops and irrigation of sod, ornamental plants for commercial use, or pasture to which milking cows or goats have access. - A minimum 50-foot setback from public access must be in place at all times.	Yes	- Large sod farm is located close to, but outside of City limits. - Marijuana grow facilities are located in industrial parks and may have their own treatment facilities. Most grow facilities are on 2-inch meters and are not thought to be significant water users.
Food Crops	Spray Irrigation of food crops and surface irrigation of root crops shall be at all times Class A reclaimed water or better unless otherwise noted. Exceptions which Class B water may be applied include before 15 days of harvesting orchard or vineyards or anytime with process food crops.	Yes	
Land Irrigation	- Irrigation of open access areas (e.g., golf courses, parks, playgrounds, schoolyards, residential landscapes, or other areas where the public has similar access or exposure to the reclaimed water) and restricted access areas (e.g., freeway landscapes, or other areas where the public has similar access or exposure to the reclaimed water). - Irrigation applications with public exposure must be Class A.	Yes	
Institutional Uses			
Institutional Uses with Environmental Contact	- Body of reclaimed water which is used for aesthetic enjoyment or which otherwise serves a function not intended to include public contact. Examples may include but are not limited to: golf course water ponds/hazards, landscape ponds and vegetative landscape ponds, e.g., "lily ponds". - Must have minimal impact upon environmental health.	Yes	
Institutional Uses with Public Contact	- Body of reclaimed water for recreation, including recreational lakes, public water features (ponds), fish ponds, and those restricted recreational impoundments that are limited to fishing, boating, and other non-body-contact water recreation activities. - Reclaimed water shall not be used as a source of supply for swimming pools unless specifically authorized by Health and Ecology under a reclaimed water permit. - Nutrient removal to reduce levels of phosphorus and/or nitrogen is recommended. - Reclaimed Water with environmental contact must maintain minimal impact to environmental health.	Yes	Water may need to be dechlorinated to serve impoundments.
Release to Wetlands			
Category III and IV Wetlands	- Category III and IV wetlands are defined as wetlands with only moderate function. - Overall net environmental benefit through the application of reclaimed waters must be demonstrated while maintaining a specified BOD₅, TSS, TKN, phosphorous, and hydraulic load.	No	
Constructed Beneficial Use and Constructed Treatment Wetlands	- Wetlands intentionally constructed on non-wetland sites to produce or replace natural wetland functions and values (Beneficial Use Wetlands) or managed for the primary purpose of wastewater treatment or stormwater treatment (Constructed Treatment Wetlands). - Additionally, Class A Reclaimed Water can be used for wetlands created to replace natural habitat are intended to mitigate the conversion or loss of natural wetlands and are regulated as such require appropriate review agencies and done according to an approved wetland mitigation plan.	Yes	No existing wetland facilities; however, the City is open to serving future facilities.
Groundwater Recharge			
Direct and Indirect Groundwater Recharge	- Reclaimed water used for groundwater recharge shall be "less than or equal to maximum contaminant levels in finished reclaimed water products or an alternative point of compliance" (WAC 173-219). - Other governing rules include: Chapter 173-200 WAC, Chapter 173-218 WAC, WAC 246-290-310, and a minimum physical setback of 200 feet and sanitary control area requirements, whichever is greater, as outlined in WAC 246-290-135.	Yes	
Recovery of reclaimed water in an aquifer	"No negative impacts should be demonstrated to water rights stakeholders, ecology, or groundwater quality" (WAC 173-219).	Yes	

Use	Description	Consider Further	Comment
Commercial and Industrial Uses			
Fish Hatchery Basins		Yes	Nisqually Indian Tribe maintains a trout farm near the City; however, the relatively high temperature of the reclaimed water is thought to be an issue.
Decorative Fountains		Yes	
Flushing of Sanitary Sewers		Yes	
Street Cleaning	Reclaimed water used for spray washing of streets, as well as dampening brushes and street surfaces during street sweeping.	Yes	NPDES and TMDL requirements may limit use of reclaimed water in areas where storm sewers could discharge to surface water.
Washing of Yards, Lots, and Sidewalks on Corporation Grounds		Yes	
Dust Control	Dampening unpaved roads and other surfaces for dust control.	Yes	Similar to street sweeping, discharge to surface water needs to be considered. In general, relatively low application rates for dust control are unlikely to cause runoff.
Dampening of Soil for Compaction	Dampening soil for compaction at construction sites, landfills, and elsewhere.	Yes	
Water Jetting for Consolidation of Backfill around Pipelines	- Water jetting for consolidation of backfill material around pipelines for reclaimed water, sewage, storm drainage, and gas, and conduits for electricity. - Reclaimed water shall not be used for water jetting for consolidation of backfill material around pipelines for potable water.	Yes	
Fire Protection	- Reclaimed water used for fire protection in hydrants or in sprinkler systems located in commercial or industrial facilities or buildings, hotels, or motels. - Reclaimed water may be used for fire protection in sprinkler systems located in apartment buildings and condominiums where the residents do not have access to the plumbing system for repairs or modifications.	No	- Existing reclaimed hydrants are intended for flushing the reclaimed water system. The Fire department has been informed not to use the hydrants. - The hydrants have a small diameter lateral connection, so they produce a lower flow rate than a typical fire hydrant.
Toilet and Urinal Flushing	- Reclaimed water used to flush toilets and urinals in commercial or industrial facilities or buildings, hotels, and motels. - Reclaimed water used to flush toilets in apartment buildings and condominiums where the residents do not have access to the plumbing system for repairs or modifications. - Reclaimed water shall not be used to flush toilets in any residential property or dwelling unit where the residents have access to the plumbing system for repairs or modifications.	No	The toilet and urinal flushing provisions were removed from the latest Gateway Agreement.
Washing Aggregate and Making Concrete		Yes	- Two existing facilities in City limits: Miles Sand & Gravel has its own wells. - Lakeside Industries takes City water.
Industrial Boiler Feed		Yes	- International Paper on Union Mills Rd. is currently using potable water. - Ecos Products may also be interested as a green source of water.
Industrial Cooling	Industrial cooling purposes where aerosols or other mist are created is allowable.	Yes	
Industrial Process Water	Industrial process water with exposure of workers is allowable.	Yes	
Surface Water Augmentation	Reclaimed water intended for beneficial reuse may be discharged for streamflow augmentation provided the reclaimed water meets the requirements of the federal water pollution control act, chapter 90.48 RCW, Chapter 173-201A WAC, WAC 246-390-310 (Drinking Water MCLs), and is incorporated within a sewer or water comprehensive plan as applicable, adopted by the applicable local government and approved by the departments of Health and Ecology as applicable. This criterion is determined on a case-by-case basis.	No	Previously determined to be generally infeasible as part of Woodland Creek evaluations.

Table 2.4 Service Policies

Criteria	Reference	Summary
Service Area	LMC 13.64.060 (D)	The lawful use area shall be specified by the Reclaimed Water Service Agreement and shall be consistent with LOTT Permits.
Metering	LMC 13.64.040	All use of reclaimed water shall be metered. All meters shall remain property of the City.
Continued Service	LMC 13.64.070.	Continued service will be conditioned on the end user's use of reclaimed water in full and continuous compliance with the Standards, other applicable law and regulations, this chapter, the Permits, and the Reclaimed Water Service Agreement.
Temporary Disruptions	LMC 13.64.070.	Temporary interruptions in service to the end user may occur.
Discontinuation of Service	LMC 13.64.080	The City reserves the right to permanently discontinue service at any time with 30 days prior written notice to the end user.
Cross-connection Prohibited	LMC 13.64.090 (A)	All cross-connections between any reclaimed water system, on the one hand, and any private water supply or the municipal potable water supply of the city (as that term is defined in WAC 246-290-010), on the other, are prohibited, regardless of whether or not such cross-connections are controlled by automatic devices, such as check valves, or by hand-operated mechanisms, such as gate valves or stopcocks.
Potential Uses	LMC 13.64.100	It is unlawful for any person supplied with reclaimed water from the city's reclaimed water supply system to use the reclaimed water for purposes other than those named in the Reclaimed Water Service Agreement, or to use it in violation of any provision of (Chapter LMC 13.64).
Waste of Water	LMC 13.64.110	No person shall waste reclaimed water or allow it to be wasted.
Ownership	LMC 13.64.180	The ownership of all reclaimed water mains, service connections, and appurtenances in public streets or utility rights-of-way shall be vested solely in the city of Lacey. (Note, the City has entered into agreements with LOTT and other Utility providers to operate in the City public streets and utility rights-of-way.)
Temporary Connections	LMC 13.64.200	Reclaimed water service may be supplied to a premises on a temporary basis during the construction of a building on the premises or during the construction of a standard main to serve the premises as long as it meets requirements for adequate backflow prevention
Water Service outside City limits	LMC 13.64.220	- Reclaimed Water service may be provided outside the city limits only to those properties which are within the urban growth boundary and either: - The property for which Reclaimed Water service is sought shall annex to the city as a condition of water connection; or - In the alternative, in its sole discretion, the city may elect to defer annexation and require the owners of the property for which Reclaimed Water service is sought to execute an agreement with the city containing a waiver of protest to annexation and grant to the city manager power of attorney authorizing annexation at such time as the city determines the property should be annexed to the city.

2.4 Planning Criteria

Planning criteria have been established to aid in the planning of the reclaimed water system. General criteria used to configure the reclaimed water distribution system and connections are summarized in Table 2.5, drawn from a combination of state and local requirements. The City will continue to develop the system to meet its level of service goals and applicable regulations. The City generally intends to initially implement a branched reclaimed water system, rather than looped, due to costs; however, the intent is to establish a transmission loop over time to aid in water quality and redundancy.

All reclaimed water infrastructure will continue to comply with regulations concerning the location of the piping in relation to other utilities (setbacks, separation, etc.) as described in Table 2.5. An additional cross-connection control program effective February 23, 2018 (WAC 246-290-496) required a series of additional steps including the following:

- Develop schedules and procedures to eliminate cross-connections, apply backflow prevention assemblies when necessary, and design and approve new assemblies.
- Have certified Cross Connection Specialists implement the program.
- Design a backflow prevention assembly testing program.
- Create a response plan for backflow incidents.
- Develop records which include locations, approved assemblies, annual summary reports, and additional data.

As described in Table 2.5, local code specifies system requirements to prevent backflow. Through these requirements, Class A reclaimed water systems are responsible for the prevention of cross-connections with lower quality reclaimed water, potable, and wastewater supplies. To address these new requirements, the City will need to expand its potable water cross-connection control program to reclaimed water in the future.

To aid in system operation, the City will continue to install valving, blow offs, and reclaimed water flushing hydrants (not intended for firefighting). To comply with surface water discharge permit regulations, the system should be configured to allow flushing of reclaimed water to be discharged into a sanitary sewer.

As part of the study, the City has set operational criteria that are summarized in Table 2.6. These criteria will be used in the system analysis to size future reclaimed water infrastructure. The City has set a minimum pressure (20 psi) based on operating requirements of system infrastructure (PRVs, etc.) during peak hour demands (PHD). However, the City has a higher pressure goal (greater than 50 psi) based on typical irrigation equipment and customer expectations. Additionally, the duration and timing of irrigation have been set based on existing irrigation practices. Note that in contrast to the previous Gateway Study, the City does not plan to constrain the reclaimed system to maintain pressures at least 10 psi below the potable water system.

Additional regulatory updates effective February 18, 2019 (WAC 246-292) include the requirement for certified reclaimed water treatment plant operators and distributors. Cross Connection Control Specialists (CCS) and Backflow Assembly Testers (BAT) are required to acquire certification as well through the Department of Health.

Table 2.5 System Configuration Criteria

Criteria	Reference	Description														
Geometry	WaterReuse, How to Develop a Water Reuse Program: MOP, 2009	A branched distribution system is acceptable. Looping may be required for large irrigation users.														
Hydrants	DOE E1-5.1.16	Reclaimed Water hydrants shall be identified with a tag in addition to being color coded.														
Separation from Sanitary Sewer and Potable Water Facilities	LMC 13.64.70	In accordance with the Standards, the Permits, and other applicable law, all mains, service lines and other waterwork appurtenances which carry reclaimed water shall be located a sufficient distance, both horizontally and vertically, from any sanitary sewer and potable water mains to prevent contamination, infiltration and/or inflow.														
Cross-Connection Control	LMC 13.64.090 (B)	Where both reclaimed water and potable water are supplied to a reclaimed water use area, a reduced pressure principle backflow prevention device or an approved air gap separation shall be installed at the potable water service connection to the use area. (Ord. 1294 §1, 2007).														
Set-Back Requirements	WAC 173-219	- The minimum horizontal distance between Class A reclaimed water storage and distribution and potable water supply intakes must be 200 feet. - Where reclaimed water is used for an impoundment, storage pond, or wetland to prevent measurable seepage, there shall be a minimum of 200 feet, and sanitary control area requirements, whichever is greater, between the perimeter of the impoundment or wetland and any potable water supply well.														
Pipe Depth	DOE E1-5.1.2 (B)	Top of pipe should be a minimum of 36 inches below the finished street grade														
Pipe Identification	DOE E1-5.1.2 (A)	<table><tr><th colspan="2">Table E1-11. Identification Standards for Reclaimed Water Systems</th></tr><tr><th>Item</th><th>Suggested Standard (Must be Acceptable to the Review Agencies)</th></tr><tr><td>Color</td><td>Pantone 512 or 522, or other shades of purple acceptable to review agencies.</td></tr><tr><td>Warning</td><td>Should be either one of the following phrases: - WARNING: RECLAIMED WATER—DO NOT DRINK - WARNING: NONPOTABLE WATER—DO NOT DRINK </td></tr><tr><td>Identification (Warning) Tape</td><td>The tape (color-coded, as listed above) should include the warning (listed above) in high-contrast lettering. The overall width of the tape should be at least 3 inches.</td></tr><tr><td>Equipment Tags and Surface Identification</td><td>The words RECLAIMED WATER should be clearly inscribed on equipment tags and the top surface of below-grade appurtenances, such as valve boxes.</td></tr><tr><td>Facility Signs</td><td>Signs (color-coded, as listed above) should include the warning (listed above) in high-contrast lettering and must have the universal symbol for “do not drink.” An adequate number of signs in English and other primary languages spoken in the area should also be posted on the surrounding fence and at the entrance of each facility.</td></tr></table>	Table E1-11. Identification Standards for Reclaimed Water Systems		Item	Suggested Standard (Must be Acceptable to the Review Agencies)	Color	Pantone 512 or 522, or other shades of purple acceptable to review agencies.	Warning	Should be either one of the following phrases: - WARNING: RECLAIMED WATER—DO NOT DRINK - WARNING: NONPOTABLE WATER—DO NOT DRINK	Identification (Warning) Tape	The tape (color-coded, as listed above) should include the warning (listed above) in high-contrast lettering. The overall width of the tape should be at least 3 inches.	Equipment Tags and Surface Identification	The words RECLAIMED WATER should be clearly inscribed on equipment tags and the top surface of below-grade appurtenances, such as valve boxes.	Facility Signs	Signs (color-coded, as listed above) should include the warning (listed above) in high-contrast lettering and must have the universal symbol for “do not drink.” An adequate number of signs in English and other primary languages spoken in the area should also be posted on the surrounding fence and at the entrance of each facility.
Table E1-11. Identification Standards for Reclaimed Water Systems																
Item	Suggested Standard (Must be Acceptable to the Review Agencies)															
Color	Pantone 512 or 522, or other shades of purple acceptable to review agencies.															
Warning	Should be either one of the following phrases: - WARNING: RECLAIMED WATER—DO NOT DRINK - WARNING: NONPOTABLE WATER—DO NOT DRINK															
Identification (Warning) Tape	The tape (color-coded, as listed above) should include the warning (listed above) in high-contrast lettering. The overall width of the tape should be at least 3 inches.															
Equipment Tags and Surface Identification	The words RECLAIMED WATER should be clearly inscribed on equipment tags and the top surface of below-grade appurtenances, such as valve boxes.															
Facility Signs	Signs (color-coded, as listed above) should include the warning (listed above) in high-contrast lettering and must have the universal symbol for “do not drink.” An adequate number of signs in English and other primary languages spoken in the area should also be posted on the surrounding fence and at the entrance of each facility.															
Pumping	City Goal	On-site irrigation pumps (whole site or zoned) are encouraged to provide site-specific pressure requirements.														
Discharge to Sewers	New Policy	Discharging of reclaimed water into storm sewers should be avoided. Flushing of reclaimed water from blow offs and flushing hydrants should be discharged into a sanitary sewer.														

Table 2.6 Operational Criteria

Criteria	Reference	Value
Irrigation Duration	City Goal	Irrigation to occur over an 8 to 10 hour period
Irrigation Time of Day	Water Master Plan, Carollo, 2012	Night for golf courses, day for others
Low Pressure Requirement	City Goal	Minimum of 20 psi at PHD at meter
Service Pressure Goal	City Goal	Provide greater than 50 psi at PHD at meter
Velocity	DOH 8.1.6	Maximum of 8 ft/s at PHD
Fire flow	Gateway Study	Not Applicable

2.4.1 Reliability

The City goal is to provide a reliable system in the future to encourage customer acceptance and usage. Similar to the potable water system, the ultimate goal of the reclaimed water system is to limit temporary disruptions due to maintenance or other issues to a short period; long-term disruptions would be avoided to the extent possible. The extent of system reliability is anticipated to grow over time based on customer expectations and improved reliability at the Martin Way Reclaimed Treatment Plant (the source of reclaimed water). It is anticipated that reliability will likely vary by customer type, where customers requiring a high level of reliability may require potable water backup or onsite or system storage of reclaimed water, where feasible.

The City goal is that any facilities constructed be sized to accept additional infrastructure that will improve reliability in the future. This may include backup power, empty pedestals for redundant pumps, and reserving site areas for future expansion.

2.4.2 Storage and Booster Pumping

Storage and booster pump requirements are defined on an as-needed basis. The need for such facilities is defined in Chapters 4 and 5 as appropriate.

CHAPTER 3 SUPPLY AND DEMAND FORECAST

3.1 Introduction

The supply for the City of Lacey's (City) reclaimed water system is driven by reclaimed water production at the Martin Way Reclaimed Water Plant (MWRWP) and agreements with LOTT Clean Water Alliance (LOTT). This chapter presents the reclaimed water supply available to the City, its requirements for environmental mitigation, and remaining reclaimed water available for other uses.

3.1.1 Definitions

The terms related to the supply and demand forecast in this chapter are defined as follows:

- **Primary Equalization:** Process of controlling the flow rate through a treatment facility. Equalization basins are used to provide consistent influent flows to the treatment facility by retaining high flow fluctuations. Referred to as "equalization" in this chapter.
- **Equalized Flow:** effluent flow at MWRWP assuming an equalization basin is built.
- **Unequalized Flow:** Effluent flow at MWRWP without an equalization basin (i.e., the current conditions).
- **MWRWP Influent:** Flows to MWRWP from the Martin Way Pump Station (MWPS).
- **LOTT Use:** the quantity of water LOTT needs to reserve for its own uses at MWRWP, MWPS, to convey solids to the Budd Inlet Treatment Plan (BITP), and the Hawks Prairie Ponds and Recharge Basins.
- **Net Reuse Capacity:** Amount of reclaimed water from each increment available for reuse by the Partner jurisdictions, generally determined by the estimated production value, minus LOTT use. Net reuse capacity is intended to reflect the actual available volume, rather than the future planned volume.
- **Nominal Capacity:** Amount of reclaimed water the MWRWP can produce based on the Supply Agreements.
- **Actual Production Capacity:** Amount of reclaimed water MWRWP produces based on variations due to source flow volumes and quality, process upsets, and maintenance activities.
- **Paper Water:** Reclaimed water available to the City based on Supply Agreements.
- **Wet water:** actual reclaimed water available to the City based on MWRWP influent, actual production at MWRWP, and LOTT use.
- **Infiltration Rate:** Flow of reclaimed water that can be discharged into the Woodland Creek Basin based on the capacity of the site, which was evaluated from both field tests and groundwater modeling.
- **Original Supply Agreements (or Distribution Methodology):** Refers to the documents and agreements developed between 2004 and 2008 (first three agreements shown in Table 3.1).

3.1.2 Reference Documents

Multiple documents and agreements were reviewed to develop the supply forecast for the projected volume of reclaimed water available to the City. Table 3.1 summarizes the documents and agreements that are referenced in the supply forecast.

Table 3.1 Documents and Agreements Reviewed for Supply Forecast

Document Name	Date	Document Type
General Interlocal Agreement Between LOTT Wastewater Alliance, Thurston County and the Cities of Lacey, Olympia and Tumwater for the Distribution and use of Reclaimed Water (2004 General ILA)	2004	General Interlocal Agreement
Reclaimed Water Distribution Agreement No. 1 Between LOTT Wastewater Alliance, Thurston County and the Cities of Lacey, Olympia, and Tumwater	2005	Distribution Agreement
Reclaimed Water Supply Agreement between the LOTT Alliance and the City of Lacey Regarding the Martin Way Reclaimed Water Plant	2008	Distribution Agreement
General Interlocal Agreement between the LOTT Clean Water Alliance, Thurston County and the Cities of Lacey, Olympia, and Tumwater for Distribution and Use of Reclaimed Water (2020 General ILA)	Signed in 2020	General Interlocal Agreement
Exhibit A (Revised) to 2020 General Interlocal Agreement: Reclaimed Water Distribution Methodology ⁽¹⁾ (Exhibit A to 2020 General ILA)	December 2019	Distribution Methodology
Reclaimed Water Supply Agreement between the LOTT Clean Water Alliance and the City of Lacey Regarding the Martin Way Reclaimed Water Plan (2020 Lacey Supply Agreement)	Signed in 2020	Distribution Agreement
Reclaimed Water Distribution Agreement No. 2 between the LOTT Clean Water Alliance, Thurston County, and the Cities of Lacey, Olympia, and Tumwater ⁽²⁾ (2020 LOTT Partners Agreement)	Signed in 2020	Distribution Agreement
Reclaimed Water Supply Agreement Revisions Technical Memorandum (TM) ⁽³⁾	December 2019	Technical Memorandum
LOTT Capacity Assessment Report	2018	Reference Document
Interlocal Agreement between the City of Lacey and the City of Olympia for Water Rights Mitigation (ILA for Water Rights Mitigation)	2008	Interlocal Agreement
Woodland Creek Water Infiltration Facility Analysis ⁽⁴⁾	2010	Reference Document

Notes:

- (1) This document is an exhibit for the 2020 General Interlocal Agreement (ILA).
- (2) This document is an exhibit for the 2020 Lacey Supply Agreement.
- (3) This document was written by the Reclaimed Water Policy Task Force. The document memorialized the rationale used in determining the volumes of reclaimed water listed in the revised Supply Agreements between LOTT and the partner jurisdictions (Exhibit A to 2020 General ILA).
- (4) Prepared by the Cities of Lacey and Olympia, and the Pacific Groundwater Group.

3.2 Historical Flows to MWRWP

Wastewater flows drive the amount of reclaimed water that can be produced at MWRWP; therefore, it is important to gain an understanding of these flows.

A portion of raw wastewater flows are conveyed to the MWPS where flows are pumped to either the MWRWP or BITP, as shown in Figure 3.1. The nominal capacity of the existing MWRWP based on the original Supply Agreements was 2.0 million gallons per day (mgd), however, the current capacity of the MWRWP is only 1.63 mgd due to daily flow fluctuations, process upsets, and maintenance activities as outlined in *Exhibit A to 2020 General ILA*. Note, the capacity is also reduced due to the longer retention time needed to meet the reduced nitrogen limit requested by the City (from the permitted 10 mg/L to

5 mg/L). Additionally, Wastewater flows entering MWRWP fluctuate diurnally based on water use patterns, dipping below the two mgd rate at low use times of the day., MWRWP does not have an equalization basin so all flows above the peak capacity of MWRWP are diverted to BITP. These factors together contribute to daily production volumes less than the 2.0 mgd nominal capacity stated in the original Supply Agreements.

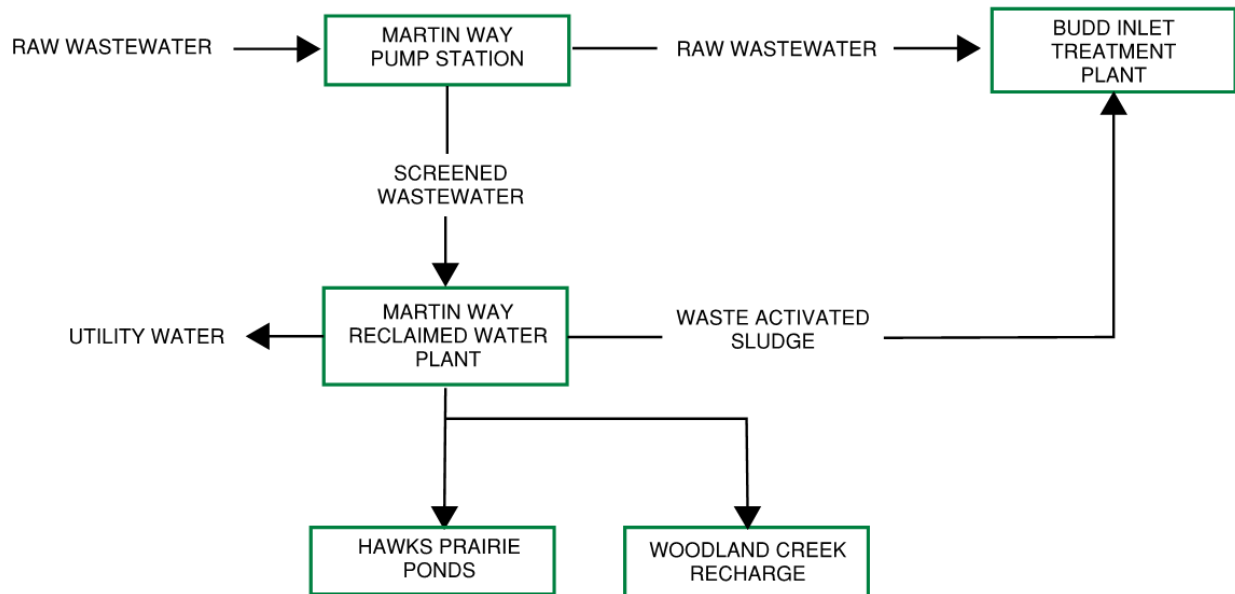


Figure 3.1 Reclaimed Water System Schematic

3.2.1 Annual Flows and Monthly Seasonal Variation

LOTT provided historical flow data from 2018 and 2019 including inflows to MWPS, MWRWP, and BITP as shown on Figure 3.2. The average annual flow to MWRWP based on this historical data is 1.39 mgd. Historical 2019 monthly flow to the MWPS shows limited seasonal fluctuations as shown in Figure 3.3 (i.e., less than 14 percent fluctuation). All flows above the actual production capacity of MWRWP (i.e., 1.63 mgd) are diverted to BITP.

3.2.2 Daily Flows and Fluctuation

Wastewater flows entering the MWRWP fluctuate daily based on water use patterns, dipping below the MWRWP actual production capacity of 1.63 mgd at low use times of day (i.e., 2:00 AM through 8:00 AM). The facility was not designed to equalize fluctuating flows. Any flows above 1.63 mgd to the MWRWP are currently diverted to the BITP. Figure 3.4 shows the diurnal curve for flows entering MWPS (dark blue line) and the maximum amount of flow that can be treated at MWRWP (green shading). Figure 3.4 was developed based on the maximum flow to the facility and the percentage of daily average flows throughout the day, as shown in the *LOTT 2018 Capacity Reports* (Figure 3-27 in *LOTT 2018 Capacity Reports*).

Without equalization, only the volume shown in green in Figure 3.4 will be treated. In 2020, this equates to approximately 87 percent of flow to MWRWP being treated. With no equalization, during the low flow times of day, MWRWP treats less than the 1.63 mgd actual production capacity of the plant, which causes a lower average annual flow (approximately 1.39 mgd as previously noted). The lower average annual flow is also a result of MWRWP not being in service every day.

Additionally, waste activated solids (WAS) from MWRWP are conveyed to the BITP using flows from MWRWP. A minimum flow of 0.5 mgd is required to convey WAS from MWRWP to BITP.

Note, peak daily flows shown in Figure 3.4 may exceed the average monthly flows shown in Figure 3.3.

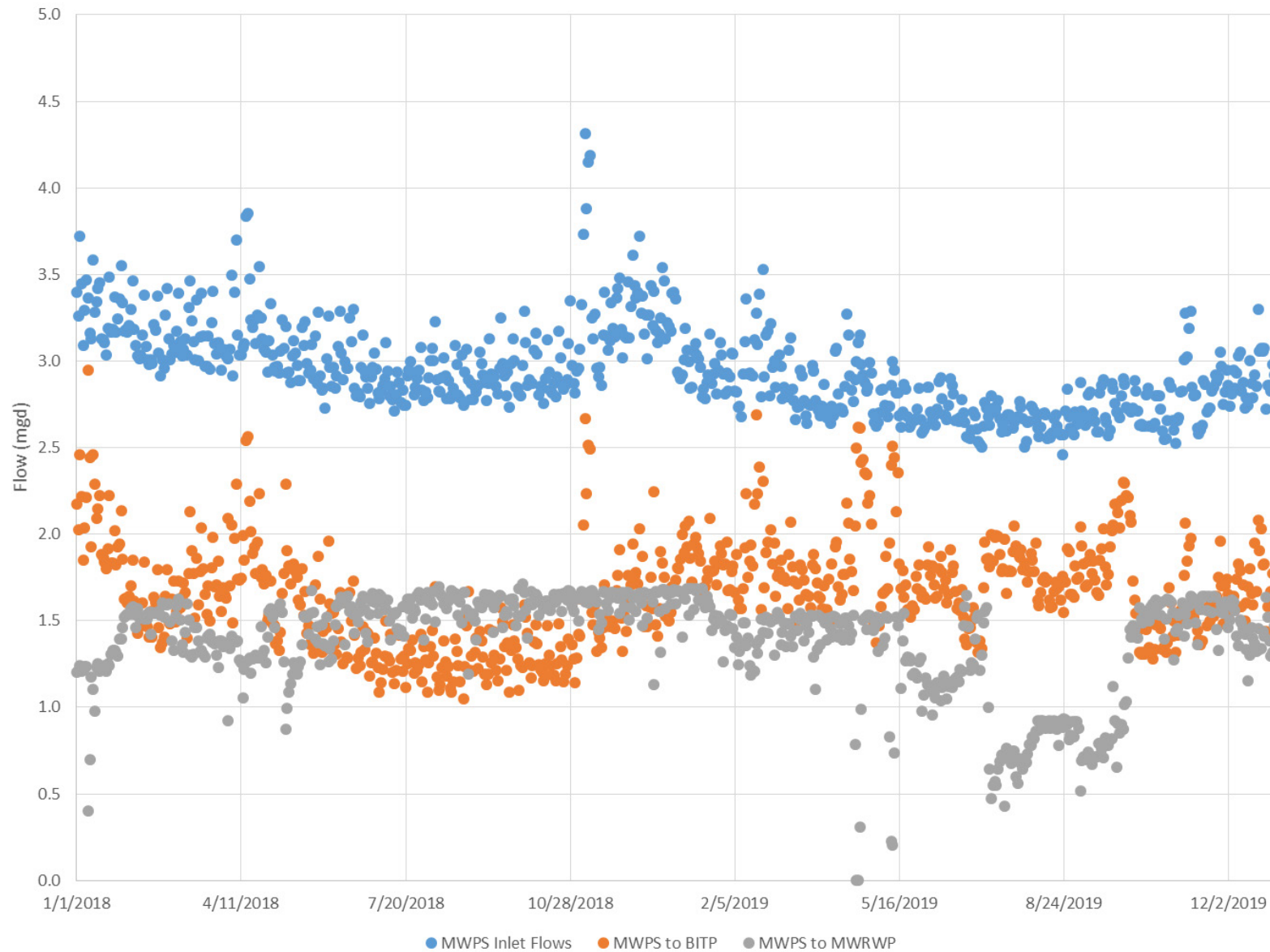


Figure 3.2 Historical Inflows to MWPS, MWRWP, and BITP (2018 and 2019)

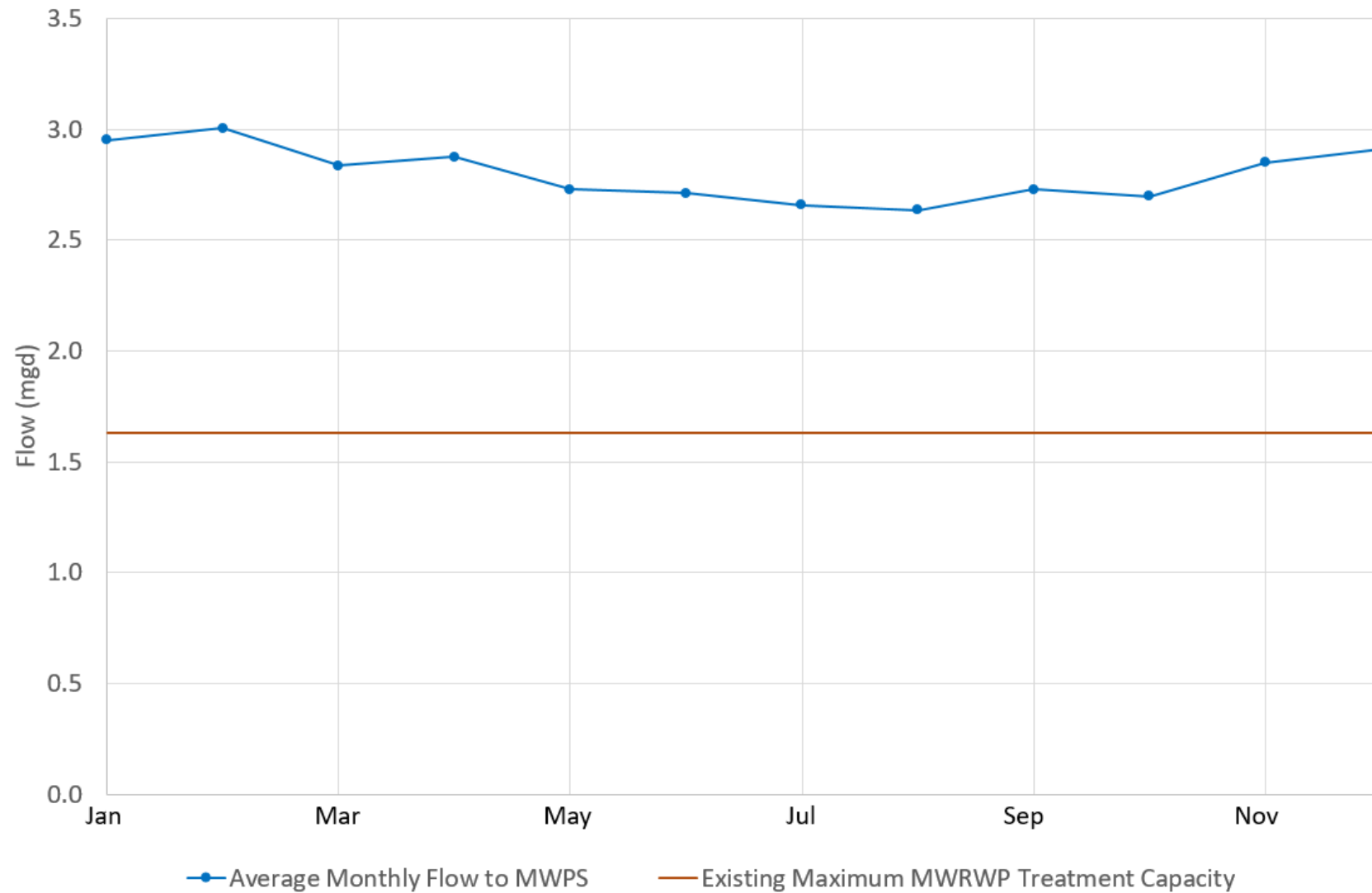


Figure 3.3 Seasonal Variation in Inlet Flows at MWPS in 2019 (Average Monthly Flows)

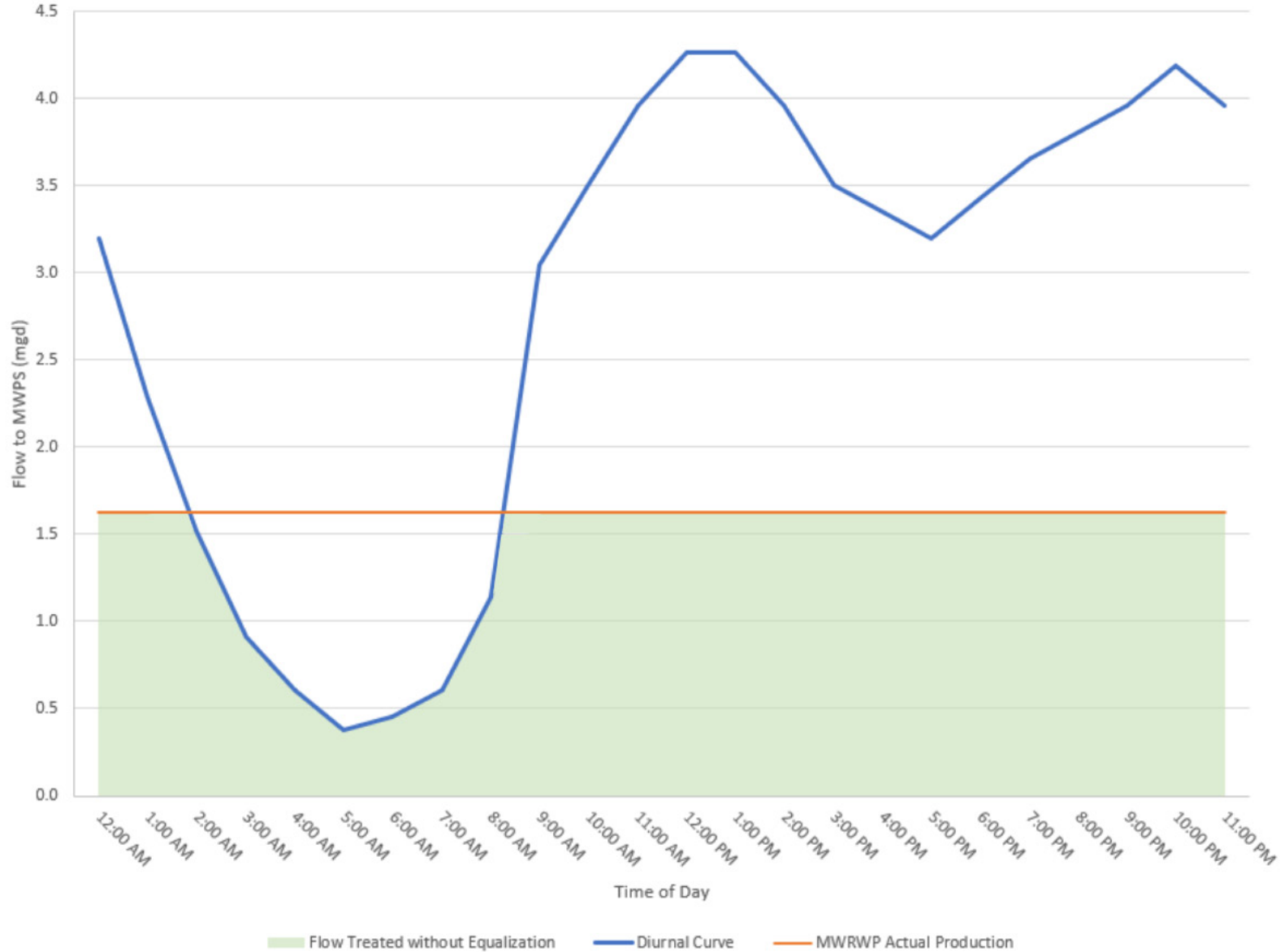


Figure 3.4 MWPS Diurnal Curve for Average Annual Flow from 2019

3.3 Supply Forecast

This section summarizes the Reclaimed Water Distribution Agreement between LOTT, Thurston County, and the Cities of Lacey, Olympia, and Tumwater. It also describes the City's reclaimed water supply forecast including projected daily, seasonal, and annual flows.

3.3.1 Summary of Reclaimed Water Documents and Agreements

The *2020 General ILA* is a March 2020 update to the *2004 General ILA* between LOTT, Thurston County, and the Cities of Lacey, Olympia, and Tumwater, which provides a regional framework for distribution and use of reclaimed water and for conserving potable water supplies. *Exhibit A to 2020 General ILA* is the reclaimed water distribution methodology, which describes the mechanism by which each of the Partner jurisdictions can be assured of a share of the reclaimed water resource.

The original Distribution Methodology was finalized in 2005, memorializing reclaimed water allocations to each of the Partner jurisdictions. The amount of reclaimed water available to each Partner jurisdiction in the original Distribution Methodology was based on simplified assumptions for operations of LOTT's reclaimed water facilities. *Exhibit A to 2020 General ILA* is intended to document what has changed since the original Distribution Methodology was completed and provide a revised set of assumptions regarding current and future available reclaimed water supply.

The *2020 Lacey Supply Agreement* is the agreement between LOTT and the City of Lacey regarding the MWRWP. The document outlines the supply of reclaimed water available to the City from MWRWP. The *2020 LOTT Partners Agreement*, which summarizes the agreement between the partners regarding the reclaimed water allocations, is included as an exhibit for the *2020 Lacey Supply Agreement*. The *2020 Lacey Supply Agreement* notes that the Parties agree that the intent is to expand reclaimed water production capacity in the future to adequately provide for Lacey and Olympia's Phase 2 mitigation requirements (a total of 1,300,000 gallons per day [gpd]).

The *2020 Lacey Supply Agreement* states that LOTT will make up to 0.88 mgd available to Lacey, subject to temporary service interruptions. The *2020 Lacey Supply Agreement* also states that at which time that the NRC reaches 1.75 mgd, the City may receive up to 1.45 mgd, its allocation identified in the *2020 LOTT Partner Agreement*.

The *Reclaimed Water Supply Agreement Revisions TM* was developed in December 2019 by the Reclaimed Water Policy Task Force. The document is intended to memorialize the rationale used in determining the volumes of reclaimed water listed in the revised Supply Agreements between LOTT and the partner jurisdictions.

3.3.2 Supply Forecast Assumptions

Historically, the City has received less water than the water which is available to the City based upon the 2020 Supply Agreement, as shown on Figure 3.2. Average annual flows historically equate to 1.39 mgd; 0.24 mgd less than the existing maximum MWRWP treatment capacity.

Due to fluctuations in the amount of reclaimed water produced, the net reuse capacity (i.e., reclaimed water available to the Cities of Lacey and Olympia) is defined as:

$$\text{Net Reuse Capacity (NRC)} = \text{MWRWP Influent} - \text{LOTT Use}$$

LOTT use includes the following:

- Flow to the Hawks Prairie Ponds and Recharge Basins.
- Internal plant use for membrane cleaning cycles, pump seal water (constant flow), foam suppression in the aeration basins (constant flow), and irrigation at the plant site.
- Reuse at the MWPS for screen cleaning.
- Water to convey solids to the BITP for treatment.

An expansion of MWRWP to a capacity of three mgd is currently planned for 2038. It is assumed that this expansion would include equalization and would increase the maximum amount of reclaimed water produced at the plant by one mgd from 1.63 mgd to approximately 2.63 mgd.

Table 3.2 summarizes the assumptions used for the reclaimed water supply forecast. Table 3.2 differentiates between paper water, the water that is available to the City based on the Supply Agreements, and the wet water, the actual water available to the City based on flows to MWRWP.

3.3.3 MWRWP and MWPS Flow Projections

LOTT provided flow projections, which were published in the *LOTT 2018 Capacity Reports*. Using the historical flow data and the annual flow projection increases, annual average flow projections to MWPS and MWRWP were developed through 2040 as shown in Figure 3.5. The difference between the projected flows for MWPS (in blue) and MWRWP (in orange) gets diverted to BITP.

3.3.4 Flow Summary

Figure 3.6 shows the “2020 Available Paper Water” and “Wet Water Supply” for the City in planning year 2020. As shown in Figure 3.6, the “Wet Water Supply” fluctuates seasonally, with peak flows in the winter when more wastewater is available for treatment and the lowest flows in the summer when less wastewater is available for treatment.

Figure 3.7 shows the “Future Paper Water” and “Wet Water Supply” for the City in planning year 2040. Since the supply forecast for planning year 2040 assumes the MWRWP expansion includes equalization (which is a recommendation from this Plan), there is no seasonal fluctuation in the “Wet Water Supply”.

Table 3.2 Reclaimed Water Supply Forecast Assumptions

	Paper Water Based on 2005 Distribution Methodology ⁽²⁾ (mgd)	2020 Available Paper Water based on 2020 Agreements (mgd)	2020 Wet Water (mgd)	Future Paper Water based on 2020 Agreements ⁽⁹⁾ (mgd)	2040 Wet Water ⁽¹⁰⁾ (mgd)
MWRWP Nominal Capacity	2	2	1.63	n/a	3
MWRWP Actual Production ⁽¹⁾	n/a	1.63 ⁽³⁾	1.39 ⁽⁷⁾	n/a	2.63 ⁽¹¹⁾
LOTT Use	0.25	0.57 ⁽⁴⁾	0.57	n/a	0.87 ⁽¹¹⁾
Net Reuse Capacity	1.75	1.06 ⁽⁵⁾	0.82 ⁽⁵⁾	1.75	1.76 ⁽¹¹⁾
Available to Lacey	1.45	0.88 ⁽⁶⁾	0.68 ⁽⁶⁾	1.45	1.46 ⁽⁸⁾

Notes:

- (1) At the MWRWP, actual production volumes vary due to source flow volumes and quality, process upsets, and maintenance activities (Source: Exhibit A to 2020 General ILA).
- (2) Source: Table 3 "Supply Agreements as of 2017" from Exhibit A to 2020 General ILA.
- (3) Table 2 "Reclaimed Water Net Reuse Capacity" from Exhibit A to 2020 General ILA states the range of actual production at MWRWP is 1.10 to 1.63 mgd.
- (4) Table 2 "Reclaimed Water Net Reuse Capacity" from Exhibit A to 2020 General ILA states the range of LOTT use at MWRWP is 0.41 to 0.57 mgd.
- (5) This value is the LOTT Use (0.57 mgd) subtracted from the MWRWP actual production (1.63 mgd). The value is within the range of NRC of 0.53 to 1.22 mgd from Table 2 "Reclaimed Water Net Reuse Capacity" from Exhibit A to 2020 General ILA. The NRC value of 1.06 mgd is also referenced in the Reclaimed Water Supply Agreement Revisions TM as the assumed value for NRC from MWRWP for the purposes of the revised Supply Agreements.
- (6) "Subject to available remaining supply or reclaimed water, the LOTT Alliance shall make up to 880,000 gallons per day, of reclaimed water to the City at the Delivery Point(s), except when temporary interruptions in service occur due to circumstances described in section 4.5 of this agreement." (Source: Supply Agreement Lacey MWRWP).
- (7) This value is the MWRWP actual production without equalization implemented at MWRWP. This value is lower than the 2020 Available Paper Water based on seasonal and daily fluctuations in flows to MWRWP.
- (8) Lacey is entitled to 83 percent of the NRC. "The 880,000 gpd value is related to an understanding between Lacey and Olympia regarding how they determine their relative credit for water rights mitigation at their Woodland Creek Groundwater Recharge Facility. They have agreed to a split of 83% to Lacey, and 17% to Olympia. The two cities requested that the values for the Supply Agreements apply that same proportion. Thus, Lacey has access to 83% of the 1.06 mgd Net Available Supply." (Source: Reclaimed Water Supply Agreement Revisions TM).
- (9) "Subject to an increase in production of reclaimed water at the Reclaimed Water Plant and at such time as the Net Reuse Capacity (net available supply) reached 1,750,000 gallons per day, the volume of reclaimed water available to the City may reach a maximum of 1,450,000 gallons of reclaimed water each day." (Source: Supply Agreement Lacey MWRWP).
- (10) The 2040 Wet Water values assume that the MWRWP Expansion includes equalization and is online by planning year 2040.
- (11) The expansion of MWRWP is currently planned to be online by 2038. Per LOTT, the expansion will include 1 mgd of production for a total of 2.63 mgd actual production at MWRWP. With the MWRWP expansion, the increase in process loss/LOTT use is anticipated to be approximately 0.3 mgd for a total assumed LOTT use of 0.87 mgd by planning year 2040. The LOTT use is a rough estimate that may be lowered as LOTT continues to refine the treatment process. (Source: emails from Tyle Zuchowski at LOTT from April 1, 2021, and December 8, 2021.) The estimated future amount for NRC is 1.76 mgd by planning year 2040. The actual amount will be designated in future agreements.

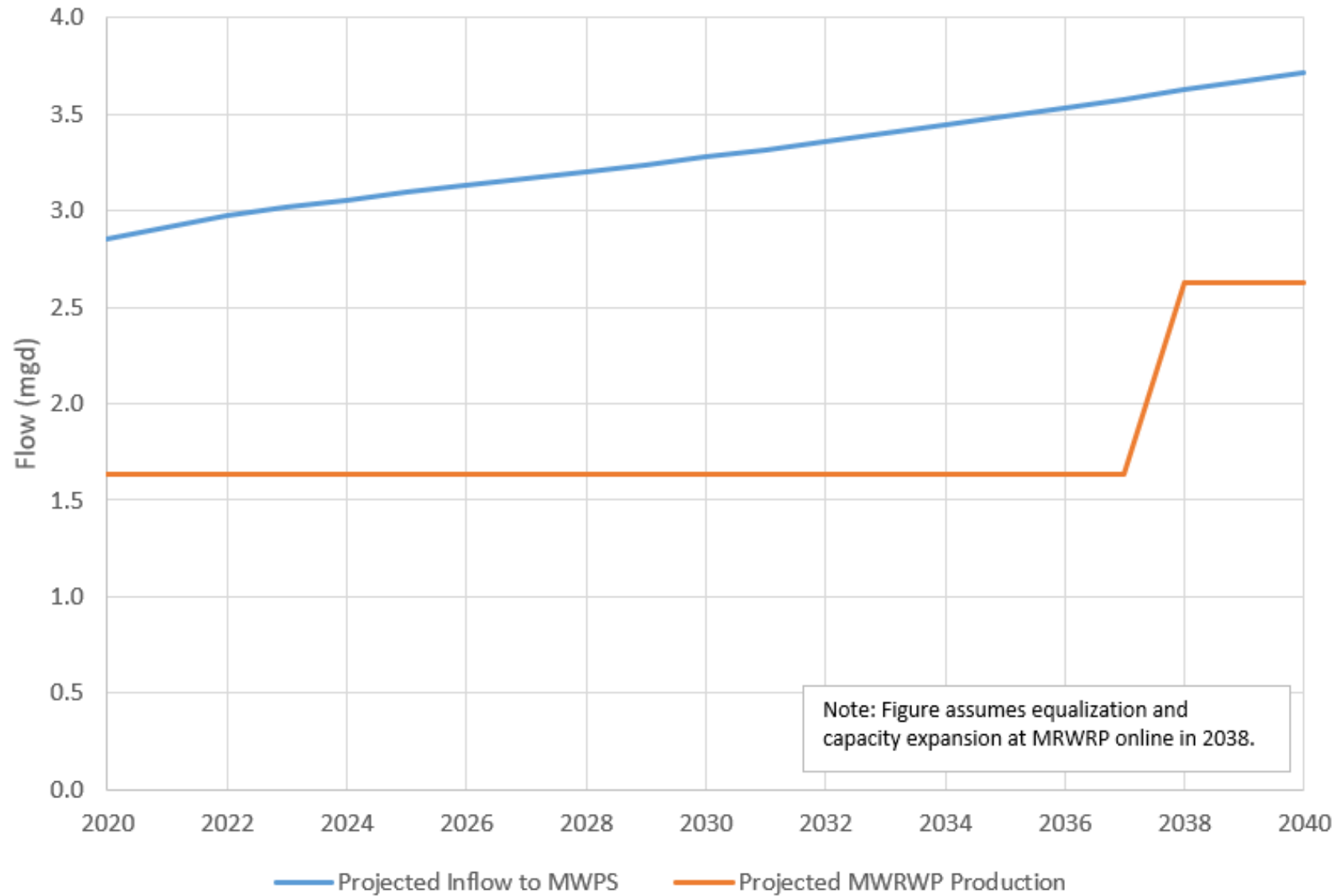


Figure 3.5 Projected Inflows to MWPS and Projected MWRWP Production (2020-2040)

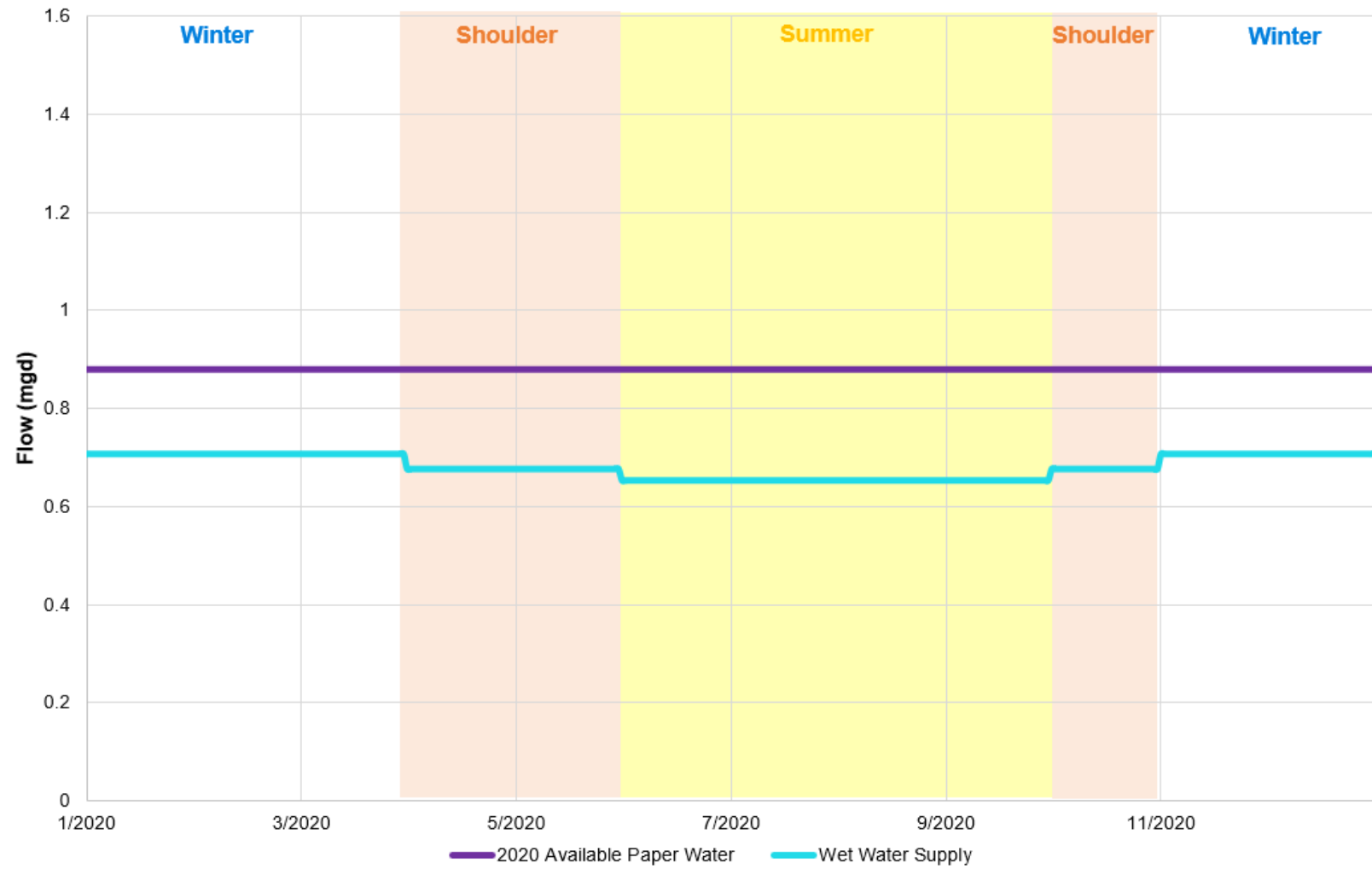


Figure 3.6 2020 Lacey Wet and Paper Water Supply Scenarios

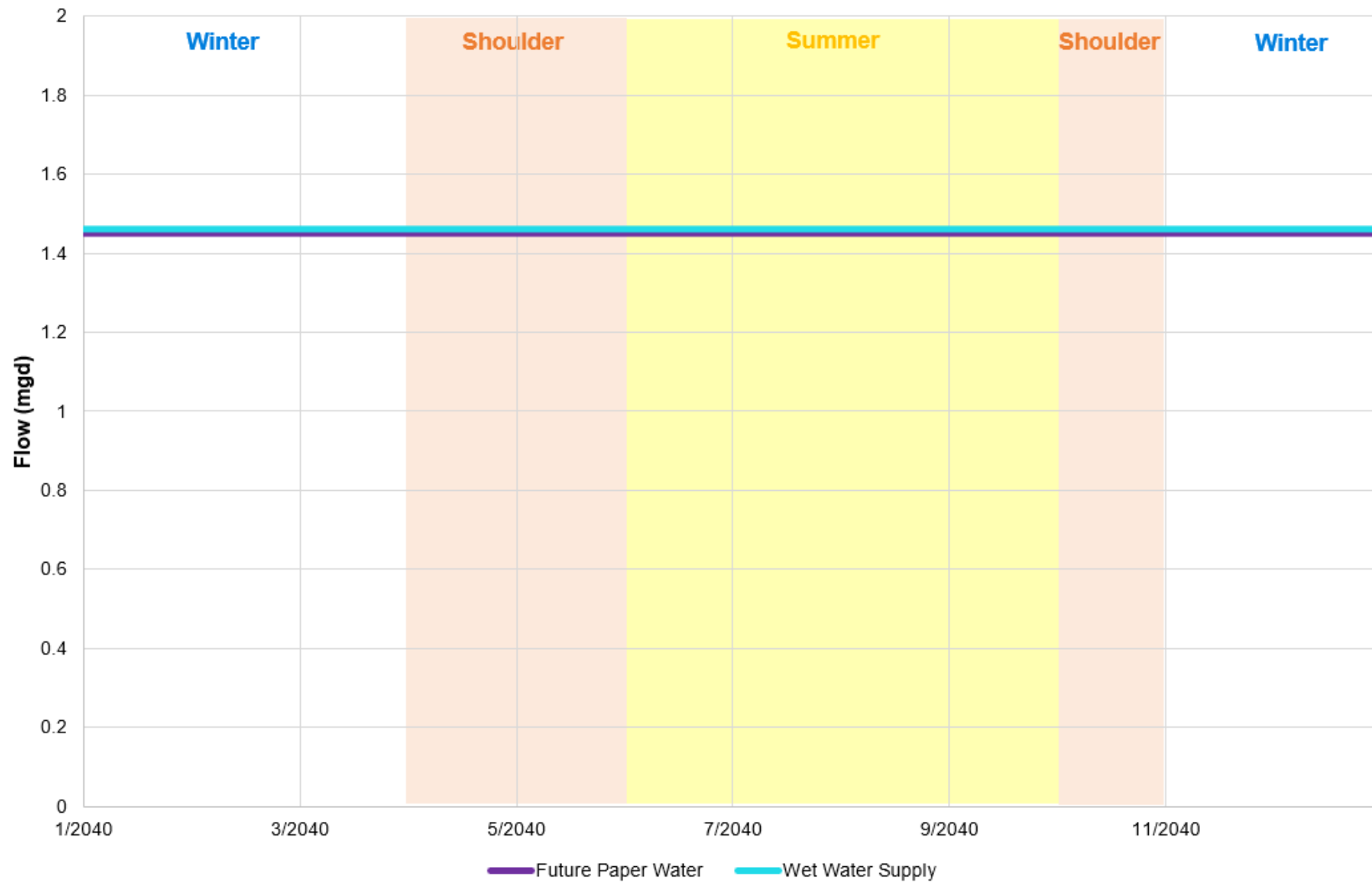


Figure 3.7 2040 Lacey Wet and Paper Water Supply Scenarios

3.4 Environmental Mitigation

The Department of Ecology included a number of environmental mitigation requirements in six water permits issued to the City in 2011-2012. One element of the mitigation requires infiltrating reclaimed water to provide indirect groundwater recharge, and the recharge must keep pace with the city's development of the water rights. This section summarizes the water right development phases, and quantity of reclaimed water needed for environmental mitigation. It also identifies the reclaimed water available after environmental mitigation has been met.

3.4.1 Reclaimed Water Needed for Environmental Mitigation

The City's water rights development is occurring in three phases. When the full use of the water rights is achieved, 227.75 million gallons per year (MGY) of reclaimed water will be needed for environmental mitigation. The three phases of water right development and the reclaimed water needed at full use of water rights are as follows:

- Phase 1: Water rights for Betti (29.85 MGY) and Hawks Prairie 2 (22.64 MGY).
- Phase 2: Water rights for Evergreen Estates (46.13 MGY) and Marvin Rd (21.53 MGY).
- Phase 3: Water rights for Madrona wellfield (95.3 MGY) and Meridian Campus (12.3 MGY).

In 2008, Lacey and Olympia signed the *ILA for Water Rights Mitigation*, under which the Cities have agree to share ownership and costs for a reclaimed water infiltration facility that will be operated by Lacey and will provide water rights mitigations for both Cities. Consequently, the environmental mitigation requirements for the City of Olympia are also considered as part of the analysis of the infiltration rates and are as follows:

- Phase 1: Olympia pumping up to 11.576 acre-feet per year (AFY) (74.07 MGY).
- Phase 2: Olympia pumping up to 13.713 AFY (6.15 MGY).
- Phase 3: Olympia pumping up to 17.809 AFY (15.4 MGY).

Figure 3.8 shows the calculated reclaimed water need based on historical use (for 2017-2019) and estimated reclaimed water needed for future years (2025-2040) for Lacey and Olympia. Figure 3.8 assumes a constant increase in estimated reclaimed water need between planning years (2025, 2030, 2035, and 2040). A detailed table outlining the reclaimed water needed for water rights for long-term planning is provided in Appendix C.

Note, neither City is planning to reach full use of its mitigated water rights by the planning year 2040 so the Cities' need for mitigation shown in Figure 3.8 will continue to increase until full use of mitigated water rights. Future mitigated water rights will need to be considered in future planning efforts.

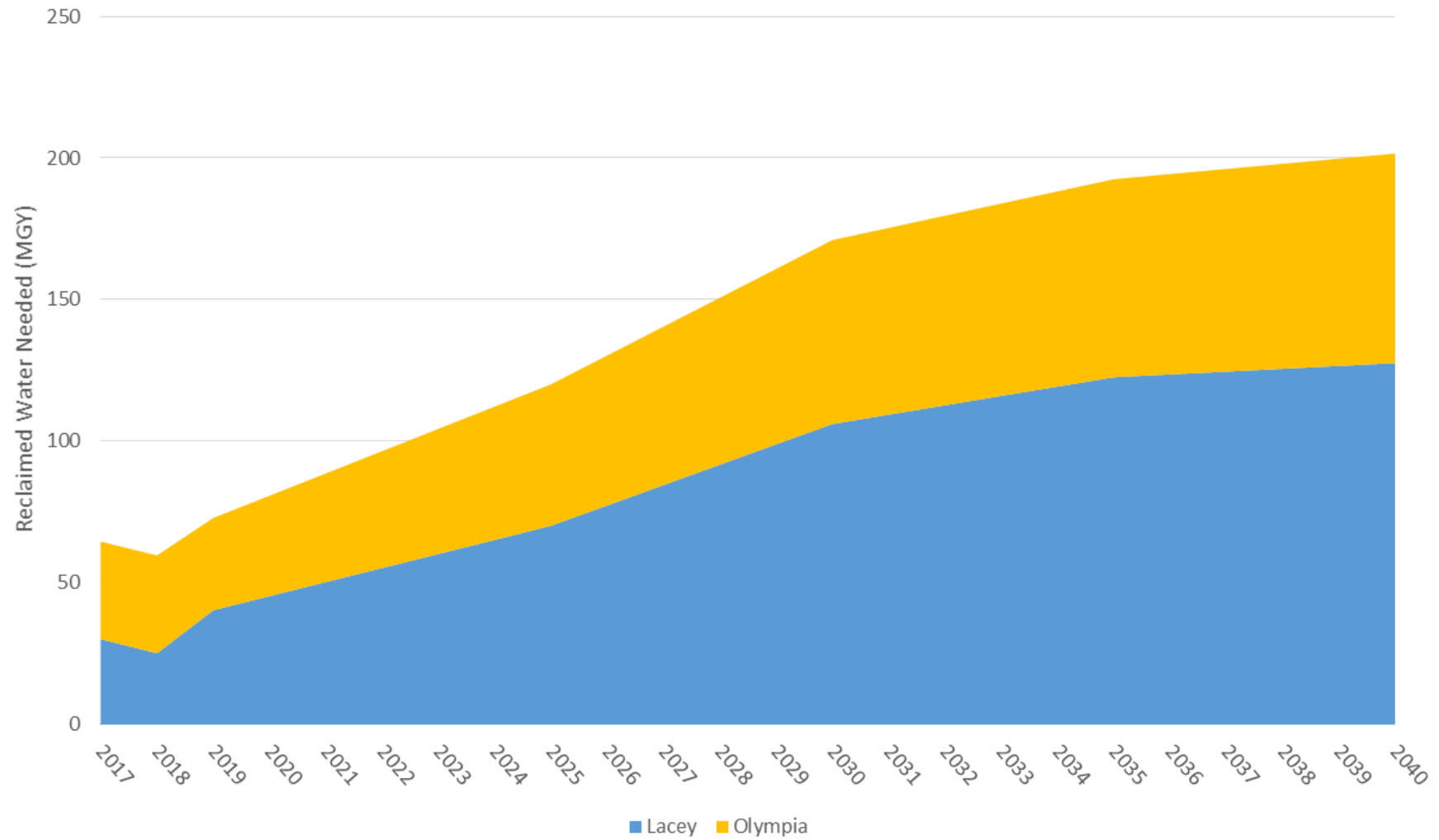


Figure 3.8 Historical and Estimated Future Reclaimed Water Needed for Environmental Mitigation

3.4.2 Methodology for Determining Infiltration Rates

The modeled infiltration rate for the Woodland Creek Facility was used to predict the capacity of the infiltration facility that can be used for environmental mitigation. Pacific Groundwater Group (PGG) performed a study of the infiltration rate for the Woodland Creek Facility (*Woodland Creek Water Infiltration Facility Analysis*) and developed the preferred infiltration rate as a function of daily ambient groundwater elevation as seen in Figure 3.9. The infiltration rates are based on the “I Rate with Constant” from the PGG Study (shown as the purple line in Figure 3.9). The average infiltration rates for summers were interpolated from the data. It was assumed that the increase is proportionate to the summer ratio for the winter and shoulder infiltration rates. The following equation was used to develop the infiltration rates as a ratio of 2018 data:

$$Inf. Rate_{day, year(n)} = \frac{Inf. Rate_{Summer, year(n)}}{Inf. Rate_{Summer, 2018}} \times Daily Inf. Rate_{day, 2018}$$

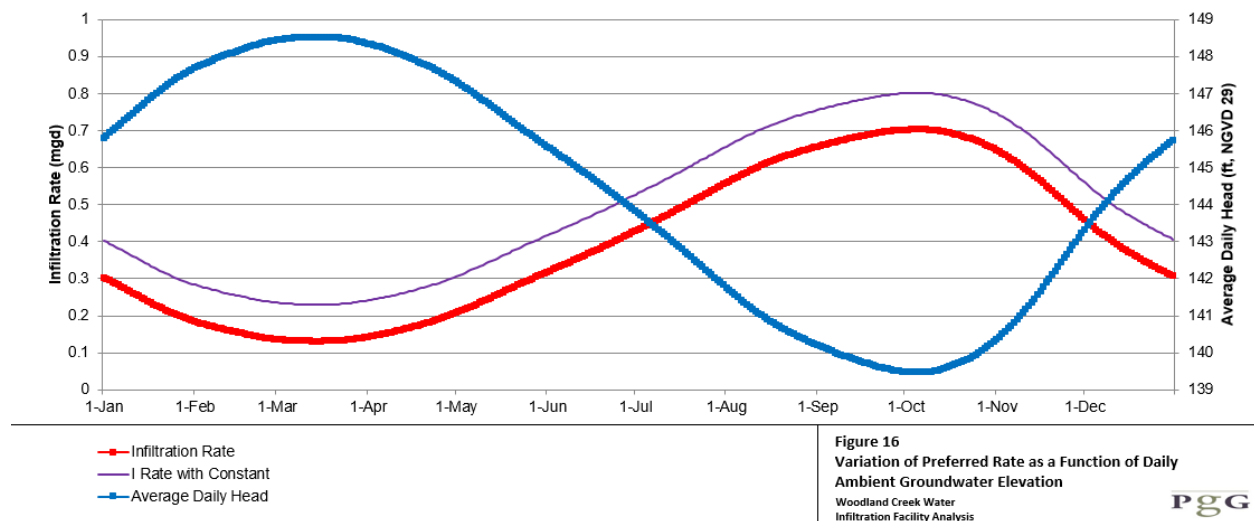


Figure 3.9 Design Infiltration Rates at Woodland Creek

The infiltration rates were then scaled based on the ratio of estimated reclaimed water needed (from Figure 3.9) to the quantity developed for the infiltration study. Figure 3.10 shows the assumed infiltration rates from 2020 through 2040 with the seasonal variation shown in Figure 3.9.

3.4.3 Summary of Available Reclaimed Water

Figures 3.11 and 3.12 summarize the reclaimed water available to the City after environmental mitigation for 2020 and 2040, respectively, based on the “wet” water flows in Table 3.2 and Figures 3.6 and 3.7.

As shown in Figures 3.11 and 3.12, the “Wet Water Supply After Env. Mitigation” fluctuates throughout the year based on the variation in daily infiltration rate. The “Wet Water Supply After Env. Mitigation” for 2020 shown in Figure 3.11 reaches a low at the end of the summer month at a flow of approximately 0.45 mgd. The “Wet Water Supply After Env. Mitigation” for 2040 shown in Figure 3.12 reaches a low at the end of the summer month at a flow of approximately 0.9 mgd.

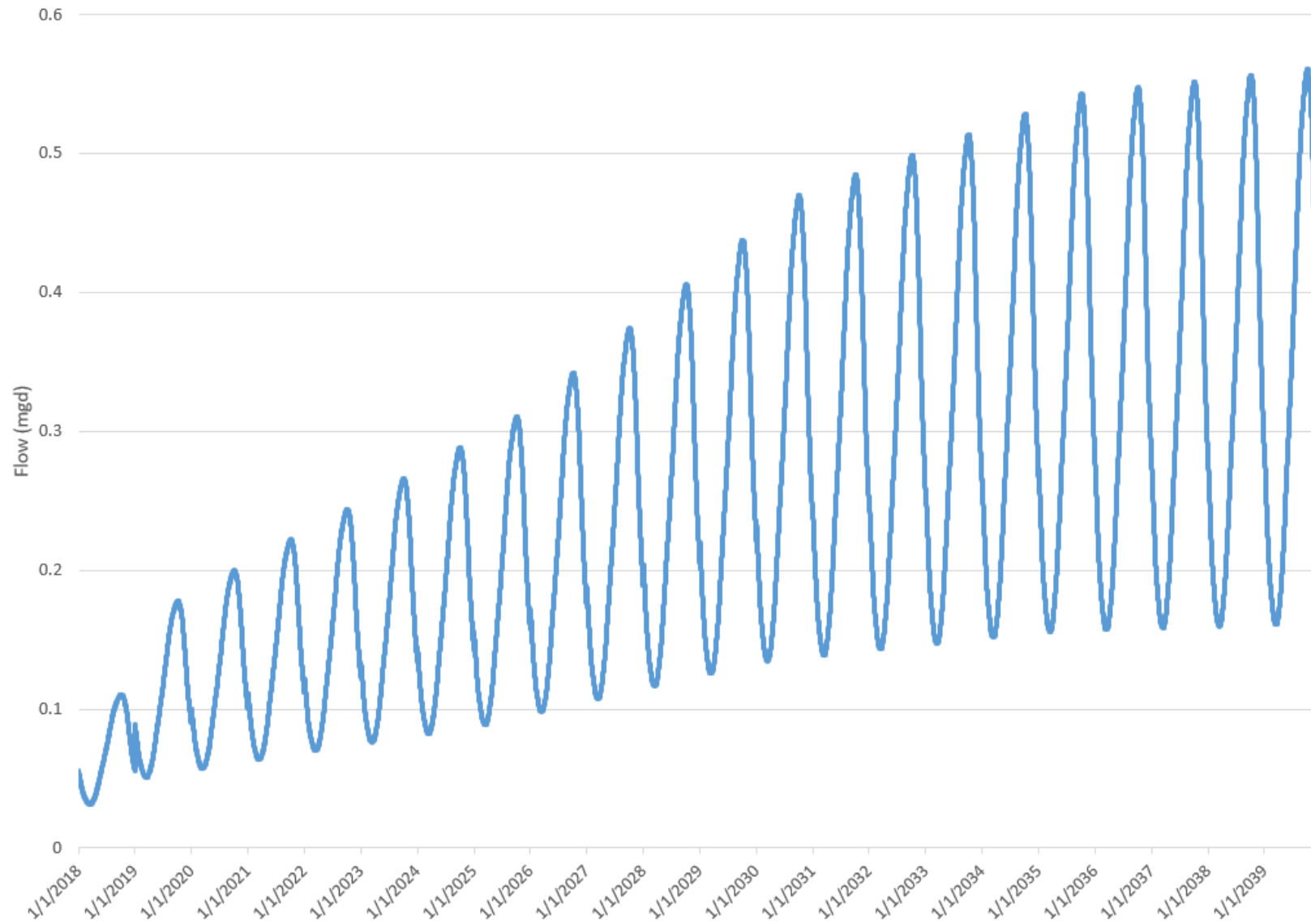


Figure 3.10 Increasing Environmental Mitigation Requirements for Lacey

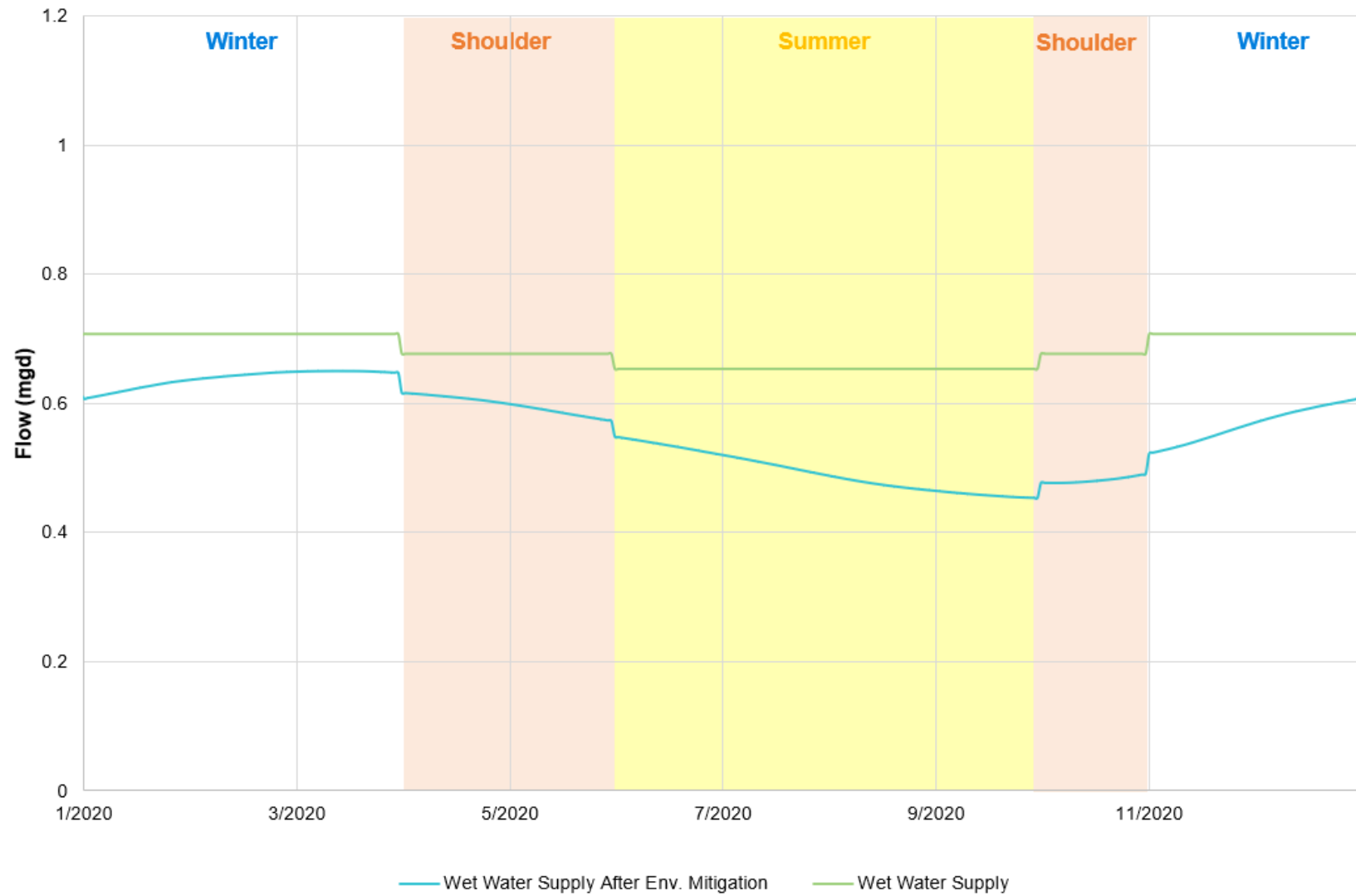


Figure 3.11 2020 Reclaimed Water Available After Environmental Mitigation

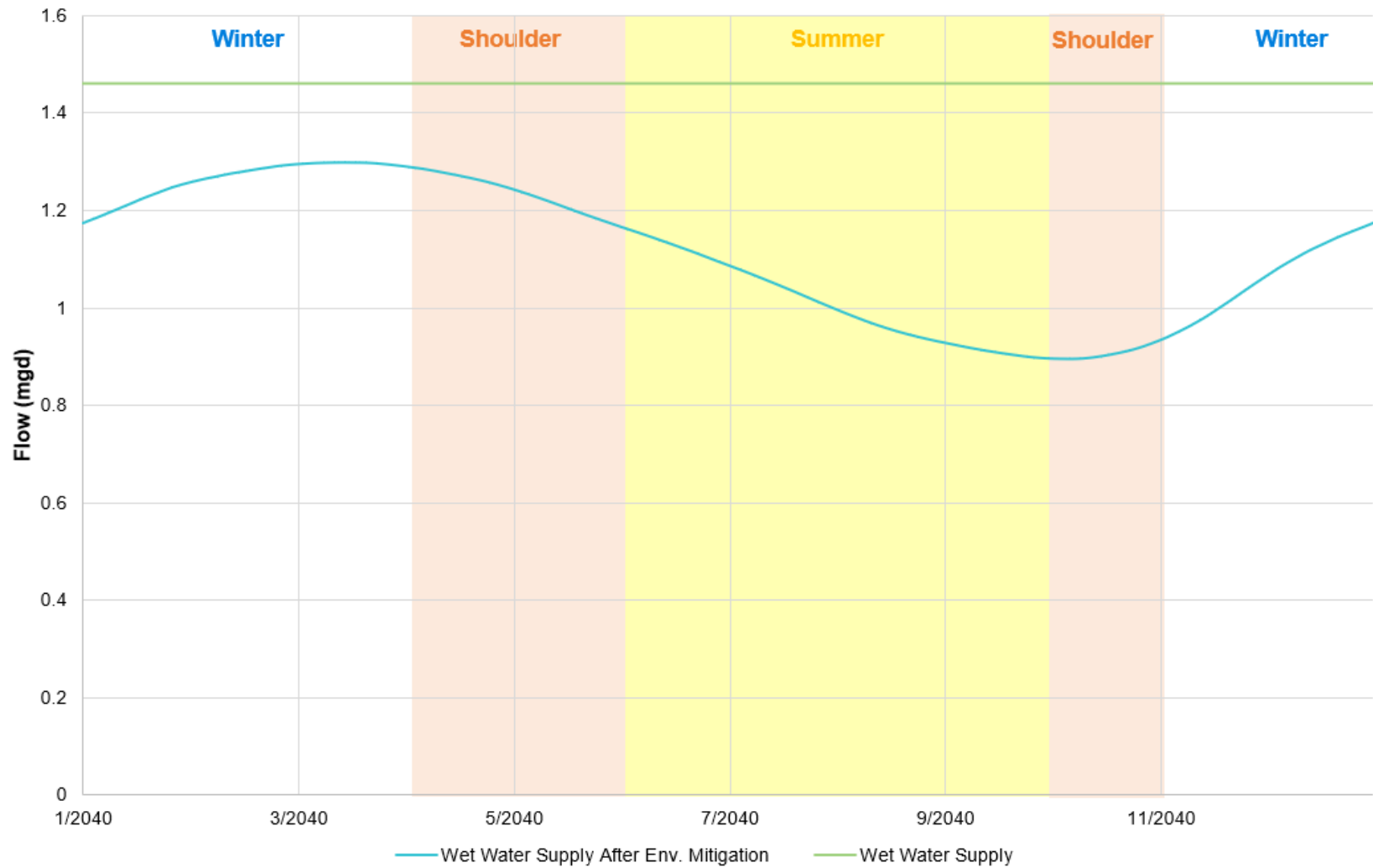


Figure 3.12 2040 Reclaimed Water Available After Environmental Mitigation

3.5 Water Available for Other Uses

Based on the available water from LOTT and required environmental mitigation, Table 3.3 summarizes the reclaimed water available to the City for other uses.

Figure 3.13 shows the volume of reclaimed water available to the City for other uses on an annual basis from 2020 through 2040. Figure 3.14 shows the daily flow of reclaimed water available to the City for other uses from 2020 through 2040. Figures 3.13 and 3.14 assume that MWRWP capacity expansion is online in 2038.

As shown in Figure 3.13, by planning year 2037, the annual volume of reclaimed water available for other uses drops to approximately 140 MGY. As shown in Figure 3.14, by planning year 2037, the available daily flow of reclaimed water available for other uses drops to approximately 0.15 mgd during the summer months with unequalized flow at MWRWP.

Table 3.3 Reclaimed Water Available to City for Other Uses ("Wet" Water)

Year	Equalized Flow at MWRWP		Unequalized Flow at MWRWP	
	Annual (MGY)	Maximum Day (mgd)	Annual (MGY)	Maximum Day (mgd)
2020	n/a ⁽¹⁾	n/a ⁽¹⁾	204	0.5
2025	277	0.6	184	0.4
2030	215	0.4	152	0.2
2035	199	0.3	140	0.1
2040	407 ⁽²⁾	0.9 ⁽²⁾	268 ⁽²⁾	0.5 ⁽²⁾

Notes:

(1) There is not currently equalized flow at MWRWP.

(2) Increases from 2035 value due to MWRWP expansion in 2038.

As shown in Table 3.3, without equalized flow from at MWRWP, the City has a minimal amount of reclaimed water available for other uses in the mid-2030s and a minimal margin of error for meeting its estimated environmental mitigation requirements. The data shows that there is available water in the winter and shoulder months for reclaimed water use, but there is minimal reclaimed water supply during the summer months.

3.5.1 Equalization Basin at MWRWP

It is recommended that LOTT construct an equalization basin at MWRWP so the City can meet its estimated environmental mitigation requirements with a smaller degree of uncertainty in the future. Additionally, if LOTT constructs an equalization basin, the City may have reclaimed water available for other beneficial uses.

3.5.2 Options for Use of Remaining Reclaimed Water

Two alternative uses of the remaining reclaimed water have been developed and are presented in Chapter 4 - Infrastructure Evaluation and Chapter 5 - Potable Reuse Evaluation.

In Chapter 4, a reclaimed water system to serve existing and future irrigation users is presented. The chapter includes an analysis identifying potential existing irrigation customers and developing demand for future irrigation customers, and developing a layout for the reclaimed water system, including pipeline, pumps, and storage. Due to the small amount of reclaimed water available in the summer months, the use of aquifer storage and recovery (ASR) is examined in relation to the reclaimed water system for irrigation.

In Chapter 5, potable reuse is examined. The chapter identifies several potable reuse options and examines three alternatives available to the City.

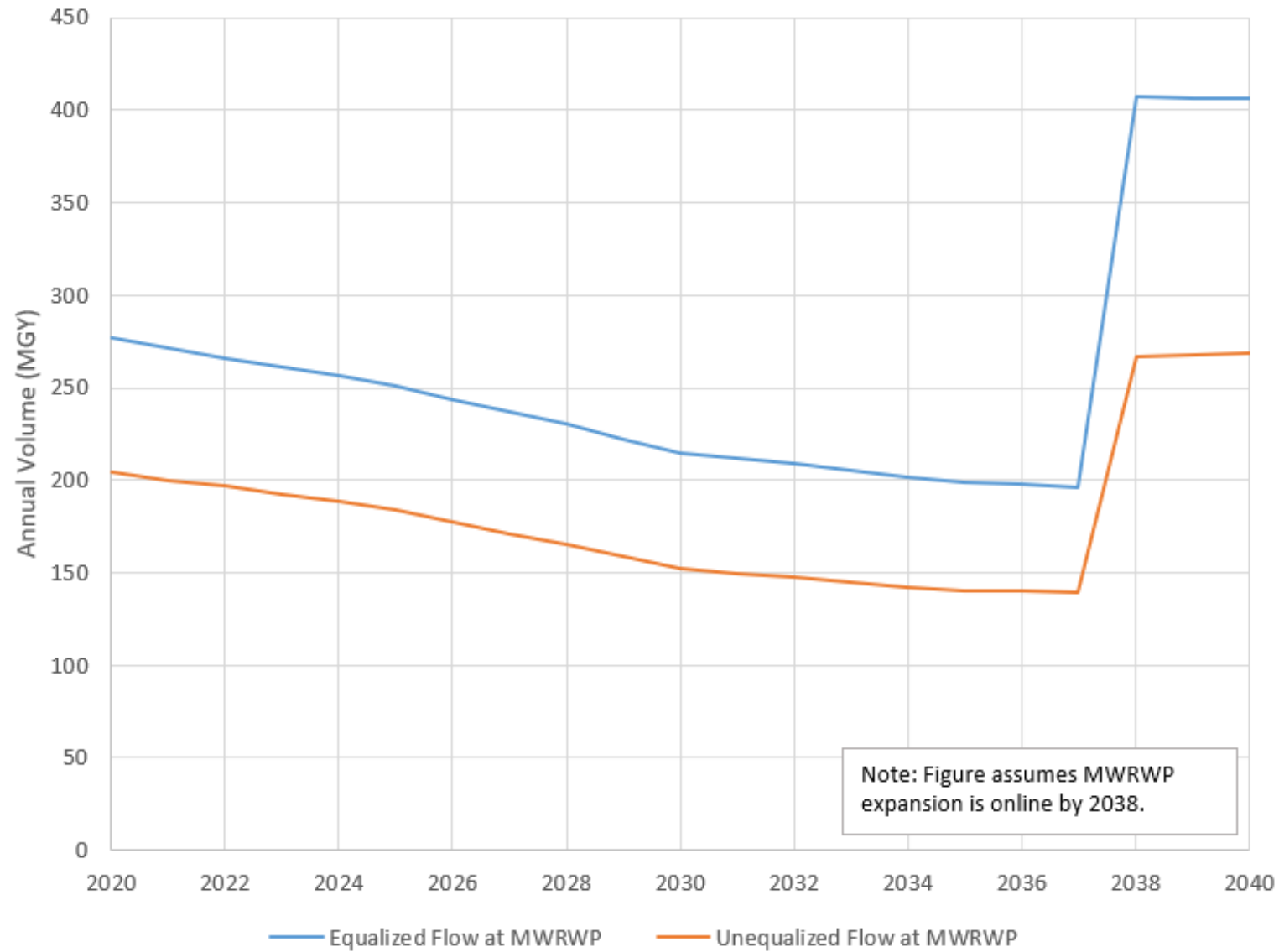


Figure 3.13 Annual Volume of Reclaimed Water Available to City for Other Uses

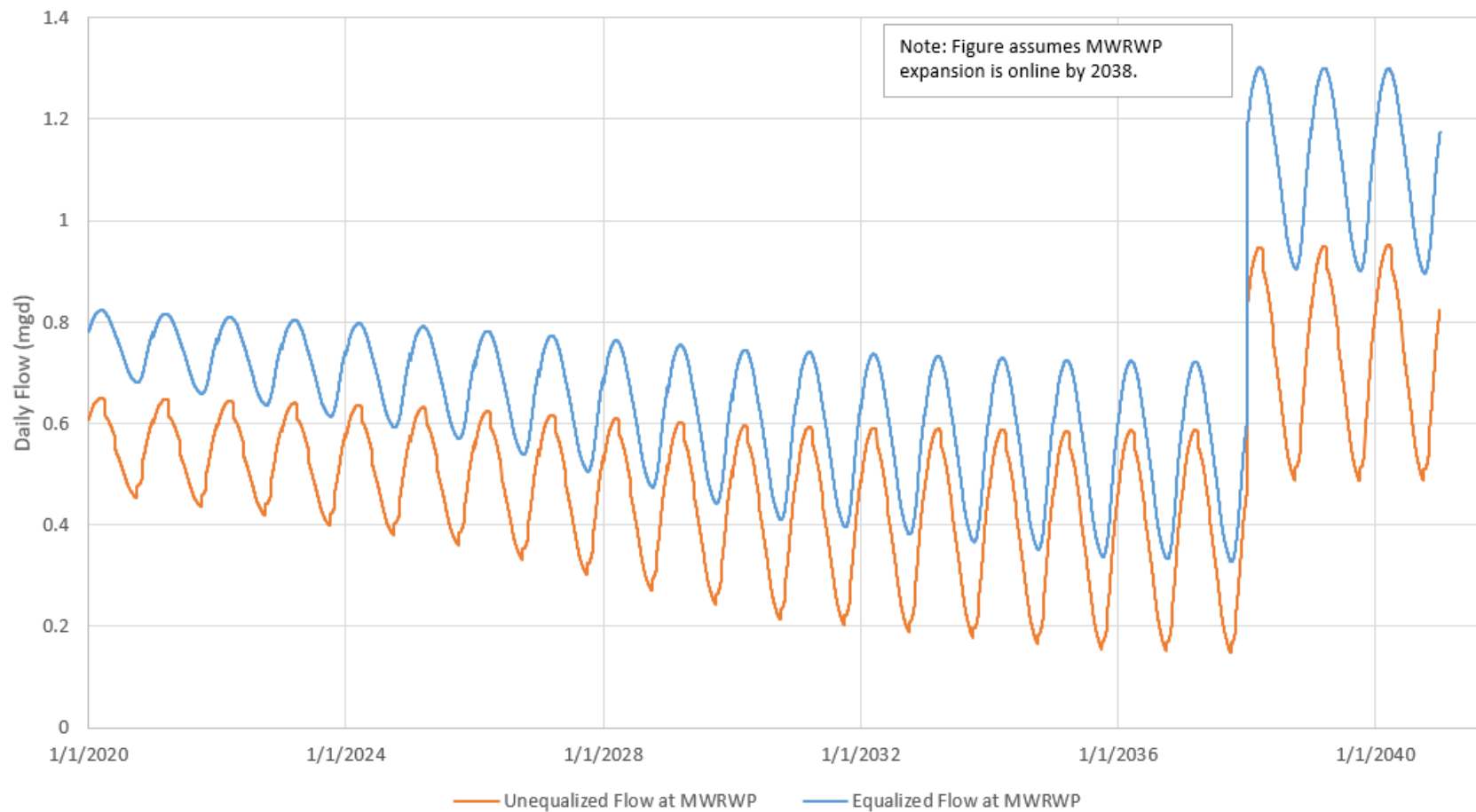


Figure 3.14 Daily Flow of Reclaimed Water Available to City for Other Uses

CHAPTER 4 INFRASTRUCTURE EVALUATION

The purpose of this chapter is to identify potential retail reclaimed water customers and their demands for the City of Lacey (City) reclaimed water system if the City chooses to build a reclaimed water system to serve irrigation customers. This chapter describes the methodology used to identify these potential customers and identifies future potential customers in addition to existing irrigation customers. The chapter also identifies the potential infrastructure necessary to deliver reclaimed water to these potential customers. Industrial customers were also considered, however no potentially feasible customers were identified. This analysis assumes that sufficient water will be available to meet the new customers' demands, though there is also a discussion regarding the availability of such water in the future.

The chapter also summarizes the potential for aquifer storage and recovery (ASR) to supplement available reclaimed water from the Martin Way Reclaimed Water Plant (MWRWP) during the irrigation season.

4.1 Methodology

To identify the potential customers for the reclaimed water system, the existing reclaimed water system was reviewed to show any existing irrigation customers who could be served from the existing system. The existing reclaimed water system includes both City and LOTT Clean Water Alliance (LOTT) infrastructure as presented in Chapter 1. This review also identified new pipelines needed to connect currently inactive reclaimed water pipelines to the reclaimed water system.

The City's records of monthly and annual irrigation consumption were then reviewed to identify the top 10 irrigation customers on an annual basis. The locations of these 10 top irrigation customers were used to develop the expansion of the reclaimed water system infrastructure because these customers could be converted from potable water service to reclaimed water. After a draft pipeline system was developed based on the top irrigation customers, additional existing irrigation customers within 200 feet of the draft pipeline and with an annual irrigation use greater than 200,000 cubic feet per year (cfy) were identified for conversion from potable water. They were added to the analysis as potential reclaimed water customers.

Finally, potential future irrigation customers for conversion from potable water were identified from vacant parcels based on land use designation and vacant parcel locations (provided in September 2020). The irrigation use for these future customers was calculated based on average use from existing customers with the same land use designation and similar parcel acreage.

After potential existing and future customers were established and the proposed reclaimed water pipeline was developed, the system was analyzed to determine the required pressure zones, storage, and pump stations, as necessary.

4.2 Existing Reclaimed Water System

Substantial existing reclaimed water infrastructure has been constructed in the City, as shown in Figure 4.1. Transmission and distribution piping are owned and operated by either LOTT or the City, as depicted in Figure 4.1. Both LOTT and the City have installed reclaimed water pipes that are currently inactive but can be used in the future to supply reclaimed water customers. These are shown in red (LOTT) and purple (City) on Figure 4.1.

4.3 Potential Reclaimed Water Customers

This section outlines the potential reclaimed water customers and their corresponding demands. It also introduces the potential pipeline routes for the reclaimed water system.

4.3.1 Top Existing Irrigation Customers

The City's historical irrigation use from 2018 was reviewed to determine the top 10 existing irrigation customers on an annual basis for conversion from potable water. These customers were targeted for development of the reclaimed water infrastructure due to the large potential for reclaimed water use. Figure 4.1 shows the location of these top 10 irrigation customers for conversion from potable water. It should be noted that due to the freeway crossing and lack of additional large irrigation customers in the area, The Chinook Middle School and North Thurston High School campus was removed from consideration as a potential reclaimed water customer.

Table 4.1 summarizes the historical irrigation use from 2018 for the City's top irrigation customers that are considered for conversion from potable water.

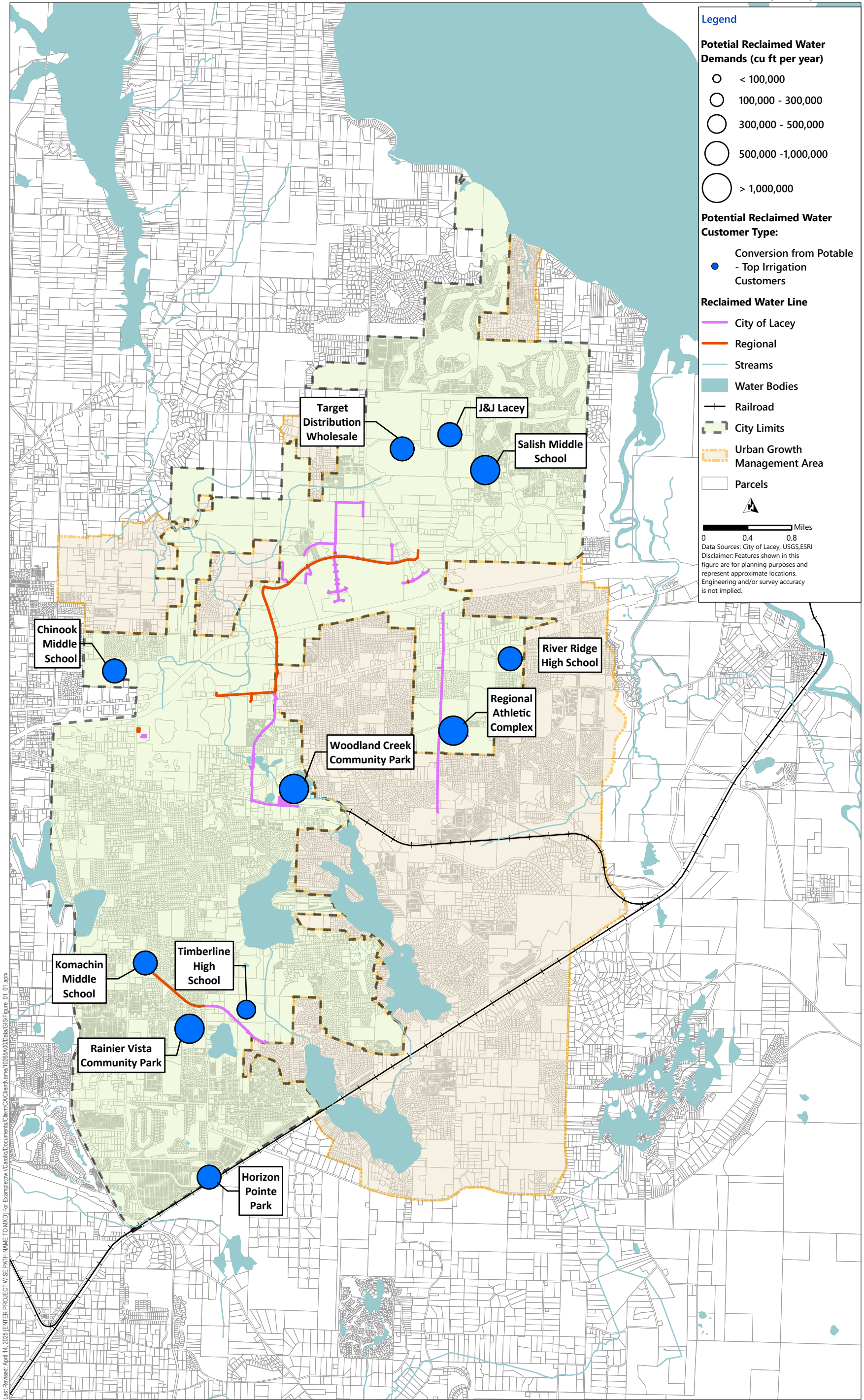
Table 4.1 Potential Conversion from Potable Water - Top Irrigation Customers

Customer	2018 Annual Irrigation Water Use	
	cfy	MGY
City of Lacey (Rainier Vista Community Park)	1,633,970	12.22
North Thurston Public Schools (River Ridge High School)	1,534,500	11.48
City of Lacey (Regional Athletic Complex)	1,345,560	10.06
North Thurston Public Schools (Salish Middle School)	1,066,700	7.98
North Thurston Public Schools (Timberline High School)	1,031,069	7.71
City of Lacey (Woodland Creek Community Park) ⁽¹⁾	1,030,146	7.71
Target Corporation	969,479	7.25
City of Lacey (Horizon Pointe Park)	650,230	4.86
North Thurston Public Schools (Komachin Middle School)	622,830	4.66
J&J Lacey	596,960	4.47
Total	10,481,444	78.40

Notes:

(1) Annual irrigation water use for the Woodland Creek Community Park includes two meters.

MGY - million gallons per year.



4.3.2 Pipeline Routes

Potential pipeline routes were developed to serve customers identified for conversion from potable water identified in Table 4.1. The pipeline system was split into North and South Sections based on the locations of the top irrigation customers and the existing reclaimed water pipelines. Figure 4.2 shows the potential reclaimed water pipeline routes. Table 4.2 summarizes the approximate pipe lengths for each section of the potential system.

Table 4.2 Potential Pipeline System

Section	Location	Length
North Section	Interstate-5 Crossing on Marvin Road	3,500 feet
	North of I-5 on Willamette Drive., 31st Avenue NE, Hogum Bay Road NE, and Hawks Prairie Road NE	14,750 feet
	Martin Way East of Marvin Road	7,400 feet
South Section	Lacey Boulevard, College Street., and Ruddell Road SE	20,600 feet

4.3.3 Additional Existing Irrigation Customers

Beyond the top irrigation customers, additional existing irrigation customers for potential conversion from potable water were identified based on the following criteria:

- Customers are within 200 feet of the proposed or existing reclaimed water pipeline.
- Customers having existing irrigation demands greater than 200,000 cubic feet (1.5 MG) per year.

Figure 4.3 shows the location of the uses for potential conversion from potable water based on the two criteria above. Table 4.3 summarizes the additional irrigation demands that could be converted from potable water.

Table 4.3 Potential Conversion from Potable Water - Additional Customers

Section	2018 Annual Irrigation Water Use	
	cfy	MGY
North Section	5,282,946	39.5
South Section	739,210	5.5
Total	6,022,156	45.0

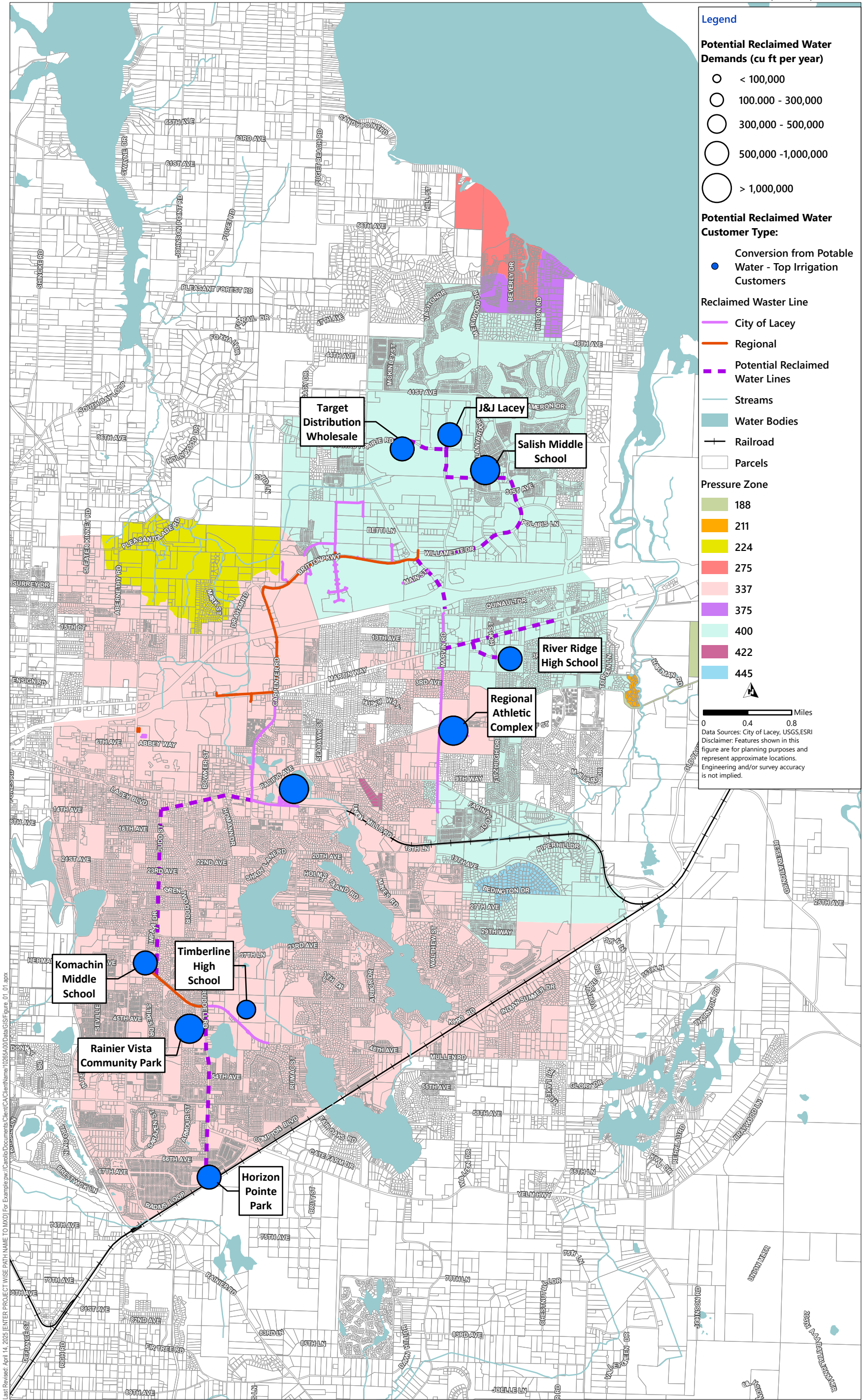


Figure 4.2 Potential Reclaimed Water Pipeline
CITY OF LACEY
RECLAIMED WATER PLAN

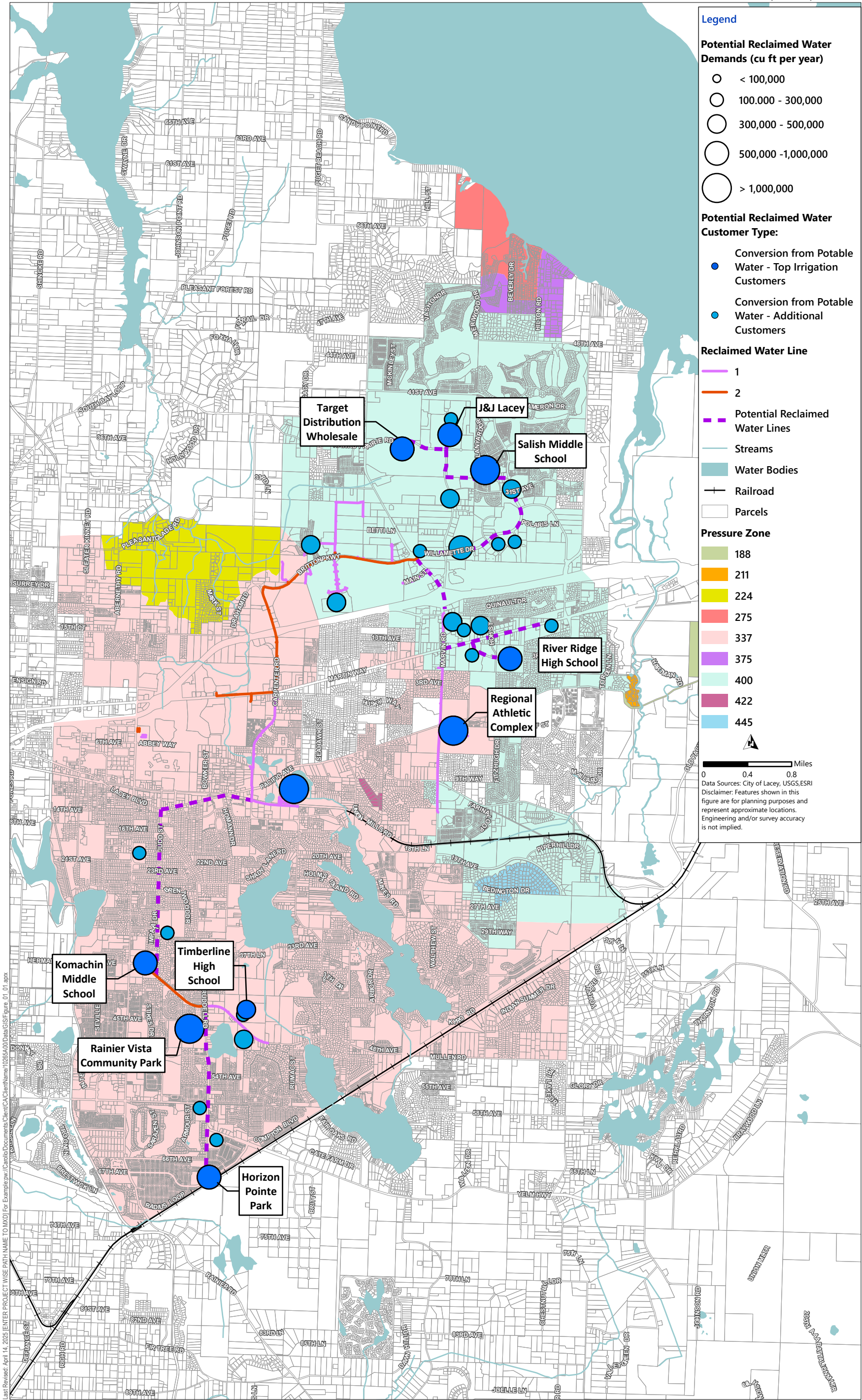


Figure 4.3 Potential Conversion from Potable Water - Additional Customers
CITY OF LACEY
RECLAIMED WATER PLAN

4.3.4 Potential Future Reclaimed Water Customers

In addition to converting existing irrigation customers to reclaimed water customers, potential future reclaimed water customers were identified through analysis of vacant parcels data. Vacant parcels were selected for analysis based on the following criteria:

- Vacant parcels are zoned as commercial, industrial, institutional, or mixed-use land use designations.
- Parcels are within 500 feet of existing or proposed reclaimed water pipeline for any size parcel.
- Parcels are within 1,000 feet from existing or proposed reclaimed water pipeline for parcels greater than or equal to 3 acres.

Figure 4.4 shows the vacant parcels that meet the criteria previously outlined.

To determine the potential reclaimed water use for these future customers, the average reclaimed water use per acre was calculated from the existing customers' irrigation consumption data for the corresponding land uses. The irrigation rates from the existing irrigation data were calculated by land use and parcel size to determine an average consumption per acre, as shown in Table 4.4.

Table 4.4 Average Irrigation Consumption per Acre by Land Use and Parcel Size

Component	Value			
Commercial Land Use ⁽²⁾				
Parcel Size	<2 acres	2-10 acres	>10 acres	
Average Annual Irrigation Demand ⁽¹⁾	1.36	0.24	0.03	
Industrial Land Use ⁽³⁾				
Parcel Size	< 5 acres	5-15 acres	15-60 acres	> 60 acres
Average Annual Irrigation Demand ⁽¹⁾	0.43	0.15	0.02	0.002
Institutional Land Use ⁽⁴⁾				
Parcel Size	< 5 acres	5-20 acres	20-40 acres	> 40 acres
Average Annual Irrigation Demand ⁽¹⁾	1.10	0.12	0.003	0.01
Mixed Use Land Use ⁽⁵⁾				
Parcel Size	< 3 acres	3-10 acres	10-40 acres	> 40 acres
Average Annual Irrigation Demand ⁽¹⁾	0.82	0.17	0.03	0.001

Notes:

- (1) Average annual irrigation demand units are annual MG/acre.
- (2) Commercial land use designations include the following categories: Neighborhood commercial, community office, Hawks Prairie Business District-commercial, community commercial, Hawks Prairie Business District-business/commercial, general commercial.
- (3) Industrial land use designations include the following categories: Light industrial commercial, light industrial.
- (4) Institutional land use designations include the following categories: Open space school, open space institutional.
- (5) Mixed use land use designations include the following categories: Central Business District 4, 5, 6, 7, mixed use high density, mixed use moderate density, Saint Martin's University, Woodland District, Village (urban) center.

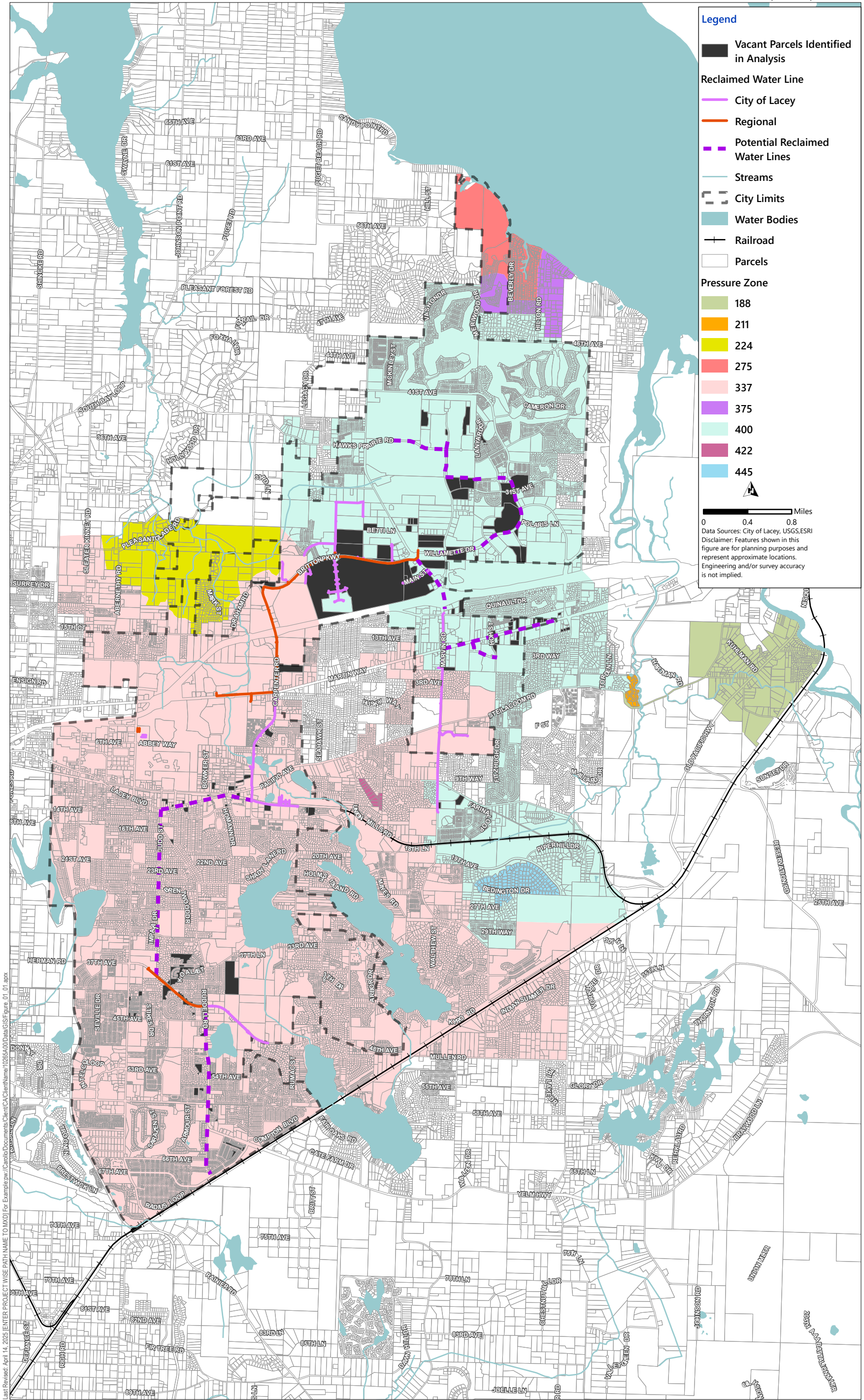


Figure 4.4 Vacant Parcels Identified as Future Potential Reclaimed Water Customers
CITY OF LACEY
RECLAIMED WATER PLAN

Based on the land use designation and size of the vacant parcel, the irrigation consumption by parcel was estimated. Table 4.5 summarizes the acreage of the parcels and potential future customer irrigation use by land use and section.

Table 4.5 Potential Conversion from Potable Water - Future Customers

Land Use	Acreage of Vacant Parcels Identified in Analysis		Potential Future Customer Irrigation Use	
	North Section (acres)	South Section (acres)	North Section (MGY)	South Section (MGY)
Commercial	366.0	0	32.6	0
Industrial	44.6	0	9.4	0
Institutional	70.0	53.6	19.3	38.4
Mixed Use	30.9	9.5	17.0	5.3
Total	511.5	63.1	78.3	43.7

4.3.5 Maximum Month and Peak Hour Demands

The existing irrigation customer data consists of monthly irrigation demands by customer. This data was used to determine the maximum month reclaimed water demands. The trends from this data were applied to estimate the maximum month demands for the potential future additional irrigation customers.

To determine the peak hour demands (PHD), a PHD to maximum month demand peaking factor of 3.0 was used, which is based on a typical irrigation diurnal curve as shown in Figure 4.5.

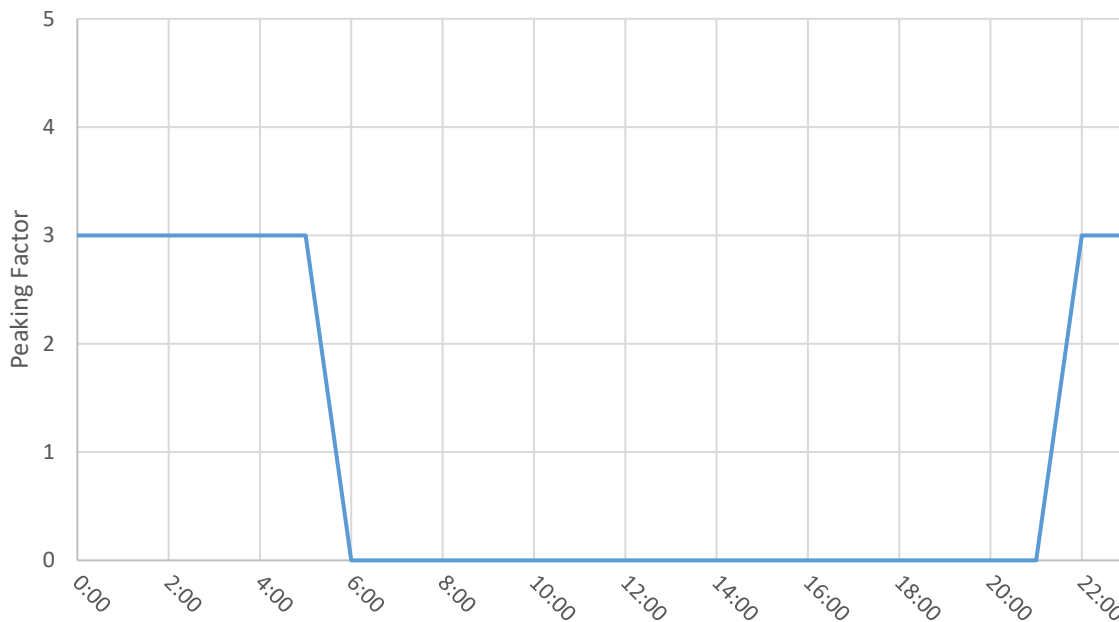


Figure 4.5 Typical Irrigation Diurnal Curve

4.4 Potential Reclaimed Water Customers Use

The total water use for potential conversion from potable water includes the demands calculated in the previous sections as outlined below:

- Potential Conversion from Potable Water - Top Irrigation Customers (Table 4.1).
- Potential Conversion from Potable Water - Additional Customers (Table 4.3).
- Potential Future Customers (Table 4.5).

Table 4.6 summarizes the annual existing irrigation demand for conversion from potable water defined as Conversion from Potable Water, and the annual future irrigation demand for conversion from potable water plus the potential future customers, defined as Conversion from Potable Water Plus Future Customers. Figure 4.6 shows the locations and magnitude of demands of all potential reclaimed water customers.

Table 4.6 Summary of Potential Reclaimed Water Customers Annual Demand

Section	Total Annual Reclaimed Water Demand				
	Top Irrigation Customers (Table 4.1)	Additional Customers (Table 4.3)	Conversion from Potable Water	Potential Future Customers (Table 4.5)	Conversion from Potable Water Plus Future Customers
North Section (MGY)	41.2	39.5	80.8	78.3	159.0
South Section (MGY)	37.2	5.5	42.7	43.7	86.4
Total	78.4	45.0	123.5	122.0	245.4

Table 4.7 summarizes the estimated maximum month demands for the north section and the source section for the Conversion from Potable Water scenario and the Conversion from Potable Water Plus Future Customers scenario.

Table 4.7 Summary of Potential Reclaimed Water Customers Maximum Month Demand

Section	Maximum Month Demand	
	Conversion from Potable Water	Conversion from Potable Water Plus Future Customers
North Section	0.9 mgd	1.6 mgd
South Section	0.5 mgd	0.9 mgd
Total	1.4 mgd (1,000 gpm)	2.5 mgd (1,700 gpm)

mgd - million gallons per day; gpm - gallons per minute.

4.4.1 Hydraulic Model

A hydraulic model of the proposed reclaimed water system was developed using Innovyze InfoWater Pro to determine pipeline diameters, pump station and storage capacities. The model was used to simulate the potential reclaimed water system under 24-hour extended-period simulation conditions with the 3.0 peaking factor from the typical irrigation diurnal curve (Figure 4.5). The model was run using the Conversion from Potable Water maximum month demands and the Conversion from Potable Water Plus Future Customers maximum month demands to identify the potential extent of the reclaimed water system. The Conversion from Potable Water scenario maximum month demand is 1,000 gpm with a PHD of approximately 3,000 gpm. The Conversion from Potable Water Plus Future Customers scenario maximum month demand is 1,700 gpm with a PHD of approximately 5,000 gpm. The pipelines were sized to limit velocity to eight feet per second (fps) and minimize excessive headloss through the pipes.

The hydraulic model includes demands for all proposed reclaimed water customers as well as demands to simulate the environmental mitigation for Woodland Creek as described in Chapter 3. For the purposes of modeling, it was assumed that this demand is 620 gpm. A minimum pressure of 20 pounds per square inch (psi) was reached at all potential reclaimed customer locations.

4.4.2 Potential Pipeline

To determine the recommended diameter for the proposed pipeline, the maximum month demands and an assumed maximum velocity of 8 fps in the pipe were considered.

Assuming a maximum velocity of 8 fps in the pipe, Table 4.8 summarizes the recommended pipe diameter for potential pipes shown in Figure 4.2.

Table 4.8 Potential Pipeline

	Pipe Diameter/Length
North Section	12-inch diameter pipe at following locations: » Marvin Road NE from Britton Parkway NE to Quinault Drive NE (3,500 feet). » Willamette Drive NE from Marvin Road NE to 31st Avenue NE, 31st Avenue NE from Willamette Drive NE to Hogum Bay Road NE, Hogum Bay Road NE from 31st Avenue NE to Hawks Prairie Road NE, Hawks Prairie Road NE from Hogum Bay Road NE to Target Distribution Center (14,750 feet). » Martin Way E from Marvin Road NE to Meridian Road NE (5,800 feet). » Litt Drive SE from Martin Way E to River Ridge High School (1,600 feet).
South Section	12-inch diameter pipe on Pacific Avenue SE from Carpenter Road SE to Lacey Street SE, Lacey Boulevard SE from Lacey Street SE to Ruddell Road SE, Ruddell Road SE from Lacey Boulevard SE to 15th Avenue SE, Judd Street SE from 15th Avenue SE to 32nd Avenue SE, and South to Mullen Road SE (12,400 feet). 8-inch diameter pipe on Ruddell Road SE from Mullen Road SE to Balustrade Boulevard SE (8,200 feet).
Existing Pipe	12-inch diameter pipe parallel to existing 14-inch diameter pipe on Martin Way from MWRWP to Carpenter Road SE (1,500 feet).

Notes:

(1) Assumes a maximum velocity of 8 fps in the pipe.

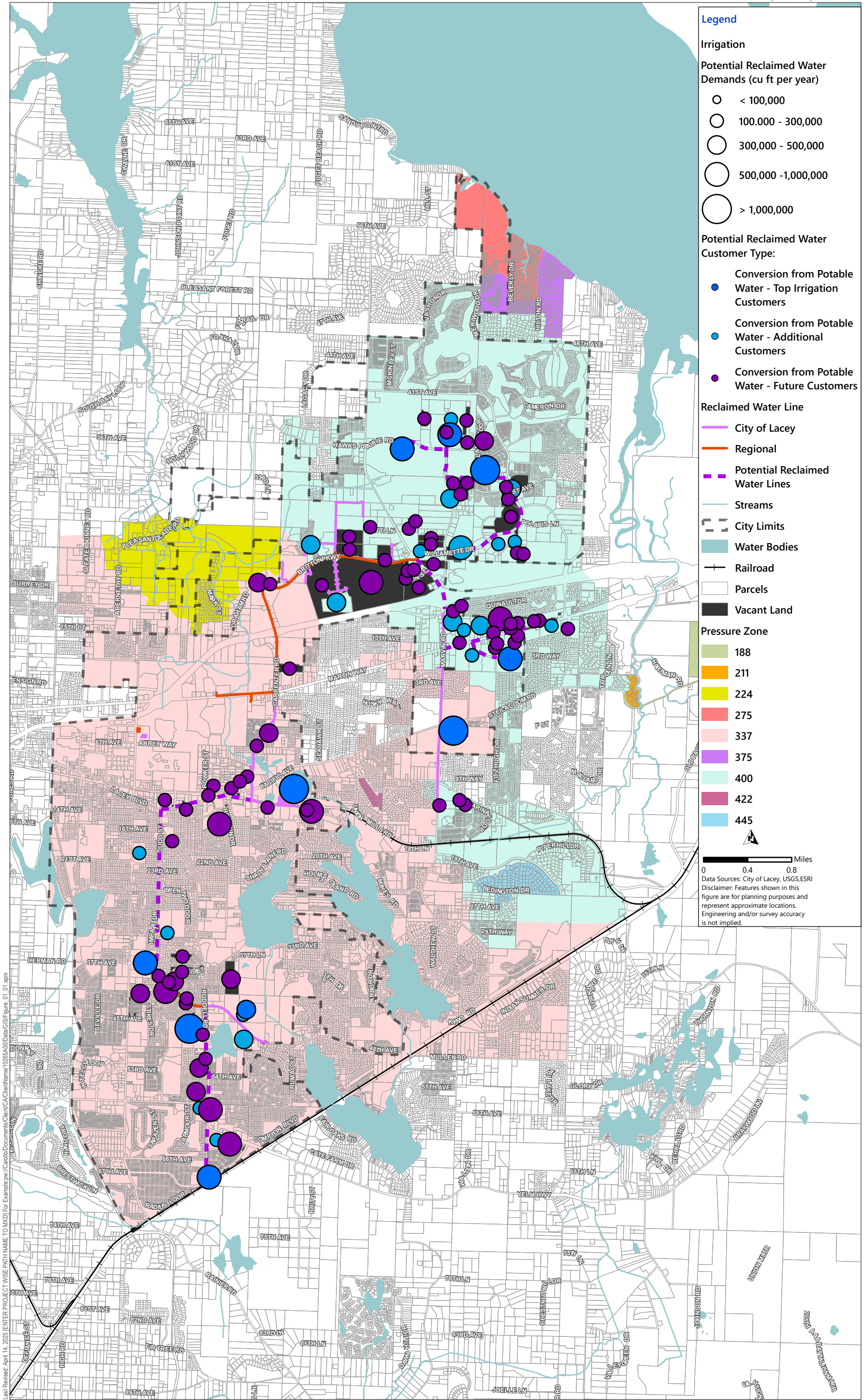


Figure 4.6 Conversion from Potable Water - All Customers Identified in Analysis
CITY OF LACEY
RECLAIMED WATER PLAN

4.5 Storage and Pumping Configuration

This section outlines a potential pressure zone configuration and summarizes the storage and pump station analyses. For this analysis, it was assumed that all reclaimed water customers will be served from the existing MWRWP.

The recommended pressure zone configuration is to serve both the North Section and the South Section from one pressure zone at a hydraulic grade level (HGL) of 385 feet. This HGL has been selected so that the irrigation customer at the highest elevation can receive water at 20 psi.

4.5.1 Storage Analysis

It is recommended that one storage tank be constructed either at the MWRWP or in the distribution system for equalization of the treated reclaimed water. The storage tank is sized based on equalizing storage volumes from a typical irrigation diurnal curve (as shown in Figure 4.5) and the Conversion from Potable Water scenario and Conversion from Potable Water Plus Future Customers scenario maximum month demands.

As shown in Table 4.7, the total maximum month demand for the North and South Sections is 1.4 mgd for the Conversion from Potable Water scenario and 2.5 mgd for the Conversion from Potable Water Plus Future Customers scenario. Based on the maximum month demand and the typical irrigation curve, the required operational storage volume for daily equalization is approximately 0.9 MG for the Conversion from Potable Water scenario and 1.6 MG for the Conversion from Potable Water Plus Future Customers scenario. Figure 4.7 shows the daily irrigation supply curve and demand curve where the required storage is the area between the curves, as shown in orange, for the Conversion from Potable Water scenario. Figure 4.8 shows the same information for the Conversion from Potable Water Plus Future Customers Total scenario. Thus, for the irrigation system to work properly, a 1 MG storage tank will be needed for the Conversion from Potable Water scenario and a 2 MG storage tank will be needed for the Conversion from Potable Water Plus Future customers scenario, assuming a continuous flow rate throughout the day from the MWRWP.

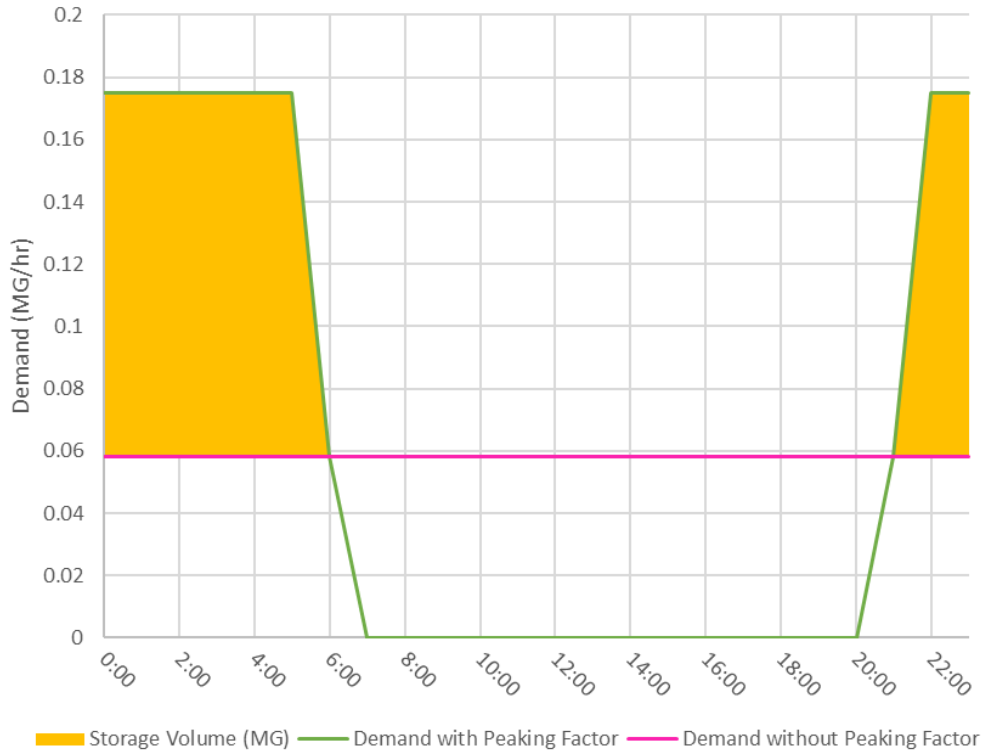


Figure 4.7 Daily Demand and Supply Curves for Conversion from Potable Water Scenario

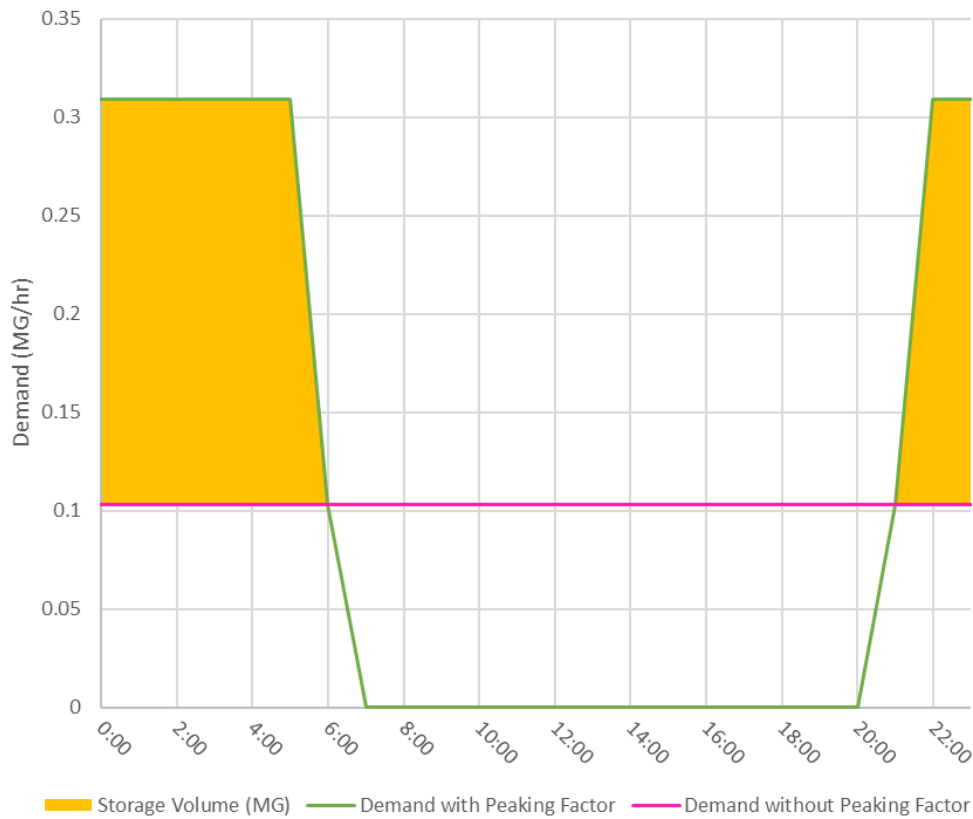


Figure 4.8 Daily Demand and Supply Curves for Conversion from Potable Water Plus Future Customers Scenario

4.5.2 Pump Station Analysis

In order to pump water into the reclaimed water system, it is assumed that the existing effluent pump station (PS) at the MWRWP would be retrofitted and/or expanded to serve the proposed reclaimed water system. The existing MWRWP PS has three vertical pumps where each pump has a design flow of 743 gpm and a total dynamic head (TDH) of 180 feet. The existing MWRWP PS does not have the flow capacity or TDH to serve the proposed reclaimed water system, so the following improvements are recommended:

- The three existing pumps be retrofitted to provide approximately 320 feet TDH by adding additional stages to each pump.
- New pumps be added to the existing PS with the same design flow and TDH as the retrofitted existing pumps.

The total recommended flow for the expanded PS is approximately 3,700 gpm for the Conversion from Potable Water scenario and 5,700 gpm for the Conversion from Potable Water Plus Future Customers scenario, based on the maximum month demands and daily peaking factor of 3.0 plus an additional flow of approximately 700 gpm required for the Woodland Creek Infiltration Facility. Variable frequency drives (VFD) are recommended on all retrofitted or new pumps.

An alternative pump station configuration could be implemented to maintain the current effluent pump station operations to serve the Hawks Prairie Ponds and Recharge Basin and the Woodland Creek Infiltration Facility. A separate set of pumps within the effluent PS could be dedicated to the reclaimed water distribution system.

4.5.3 Redundancy Analysis

To provide customers with continuation of service when reclaimed water is not available, it is recommended that a fill line to the proposed reclaimed water tank at MWRWP be constructed. This fill line would provide supplemental potable water to the reclaimed water system when reclaimed water from MWRWP is not available.

4.6 Chlorine Residual

A chlorine residual of at least 0.2 mg/L measured as free chlorine or 0.5 mg/L total chlorine must be maintained in the reclaimed water during conveyance to the location of use or to the storage pond if reclaimed water is not directly piped to the location of use (source: WAC 173-219-370). The potential reclaimed water system would require chlorine monitoring equipment and chlorine injection. Note, the Woodland Creek reclaimed water recharge facility has a total chlorine analyzer.

4.7 Infrastructure Alternatives

This section outlines four infrastructure alternatives developed to serve reclaimed water for the Conversion from Potable Water scenario, serving customers (primarily irrigation) currently using potable water with reclaimed water. A brief description and schematic have been developed for each alternative.

The main differences between the alternatives are the storage type and location and pump station operations, as follows:

- Storage:
 - » Option 1: Ground storage at the MWRWP.
 - » Option 2: Elevated storage within the reclaimed water distribution system.
- Pump Station:
 - » Option 1: Retrofit and expand the existing Effluent PS at the MWRWP to serve the reclaimed water distribution system and Hawks Prairie Ponds and Recharge Basins and the Woodland Creek Infiltration Facility. This option would require control valves at Hawks Prairie and the Woodland Creek facility to break the additional head from the retrofitted Effluent PS.
 - » Option 2: Continue to use the existing pumps at the Effluent PS to serve Hawks Prairie and the Woodland Creek facility. Install new pumps at the Effluent PS dedicated to the reclaimed water distribution system. This option would require installing approximately 28,000 feet of 12-inch diameter pipe parallel to the existing reclaimed water pipelines to have a separate system dedicated to the reclaimed water distribution system.

4.7.1 Alternative 1 - Ground Storage and Retrofit PS

This option includes a 1 MG ground tank at or near the MWRWP to provide equalizing storage for the reclaimed water distribution system. The option also includes a retrofit and expansion of the existing Effluent PS, with new VFDs, at the MWRWP to serve both Hawks Prairie and the Woodland Creek facility as well as the reclaimed water distribution system. The TDH for the retrofit/expanded PS would be approximately 320 feet. The required pump station capacity to serve the Conversion from Potable Water scenario plus environmental mitigation at the Woodland Creek facility is approximately 3,700 gpm. Two control valves, one at Hawks Prairie and one at the Woodland Creek facility, would be required to reduce the increased pressure from the retrofitted pumps to match the existing operations. Figure 4.9 is a simple schematic of Alternative 1.

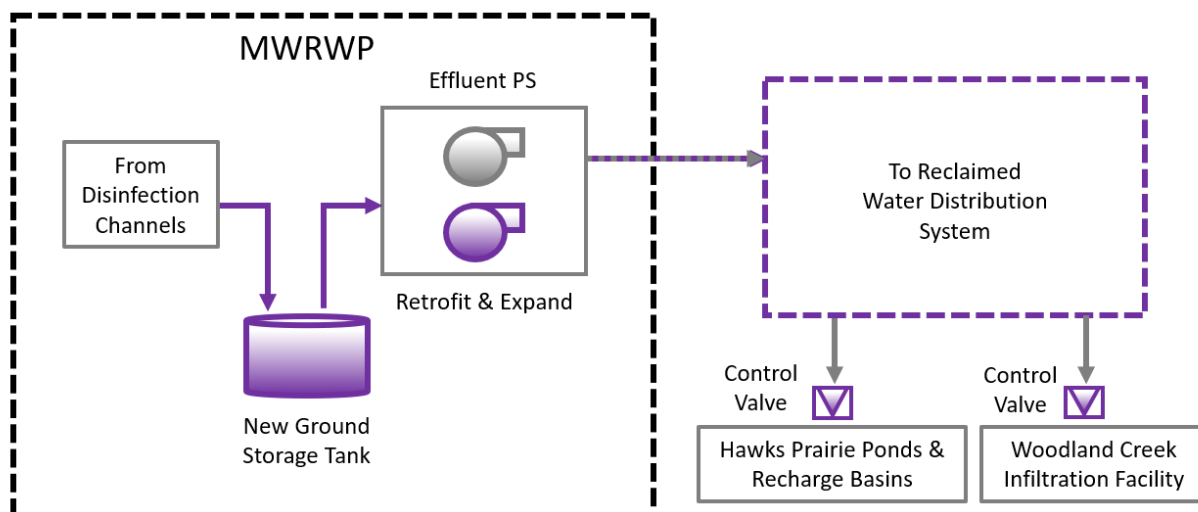


Figure 4.9 Alternative 1 Schematic: Ground Storage and Retrofit PS

4.7.2 Alternative 2 - Ground Storage and New PS

This option includes a 1 MG ground tank at the MWRWP to provide equalizing storage for the reclaimed water distribution system. For this option, the existing pumps at the Effluent PS would continue to serve Hawks Prairie and the Woodland Creek facility. New pumps at the Effluent PS, with VFDs, a capacity of 3,000 gpm, and TDH of 320 feet would be installed and be dedicated to the reclaimed water distribution system. This option would require installing approximately 28,000 feet of 12-inch diameter pipe parallel to the existing reclaimed water pipelines to have a separate system dedicated to the reclaimed water distribution system. Figure 4.10 is a simple schematic of Alternative 2.

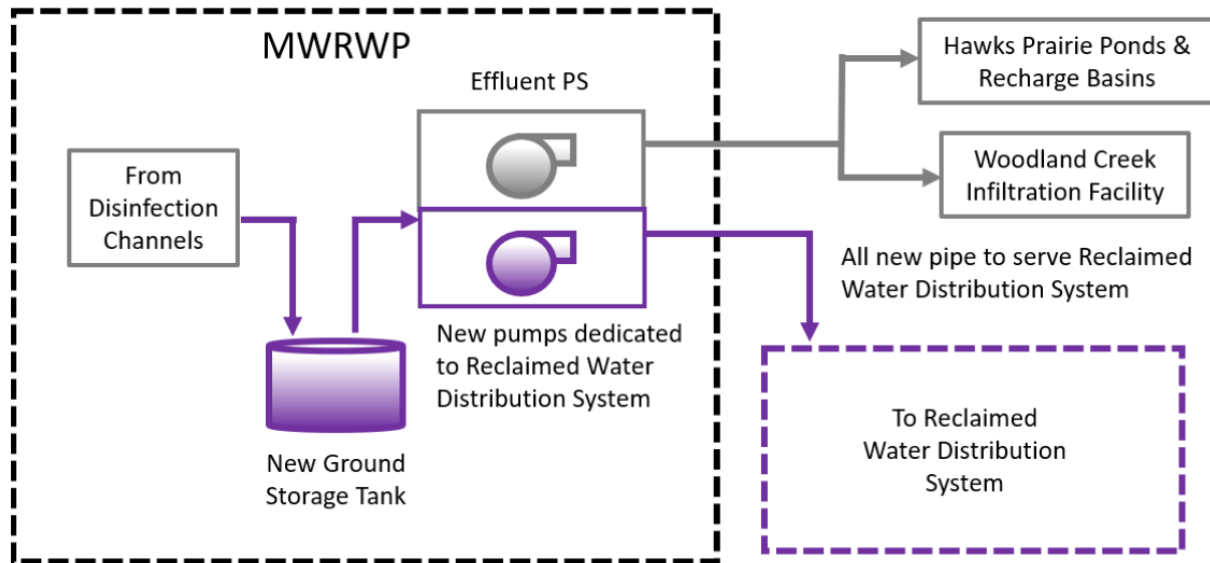


Figure 4.10 Alternative 2 Schematic: Ground Storage and New PS

4.7.3 Alternative 3 - Elevated Storage and Retrofit PS

This option includes a 1 MG elevated tank within the reclaimed water system (the location has not been determined). The option also includes a retrofit and expansion of the existing Effluent PS, with new VFDs, at the MWRWP to serve both Hawks Prairie and the Woodland Creek facility as well as filling the elevated tank and serving the reclaimed water distribution system. The TDH for the retrofit/expanded PS is recommended to be 320 feet, or higher, depending on the location and elevation of the elevated tank. The required pump station capacity to serve the Conversion from Potable Water scenario plus environmental mitigation at the Woodland Creek facility is approximately 3,700 gpm. Two control valves, one at Hawks Prairie and one at the Woodland Creek facility, would be required to reduce the increased pressure from the retrofitted pumps to match the existing operations. Figure 4.11 is a simple schematic of Alternative 3.

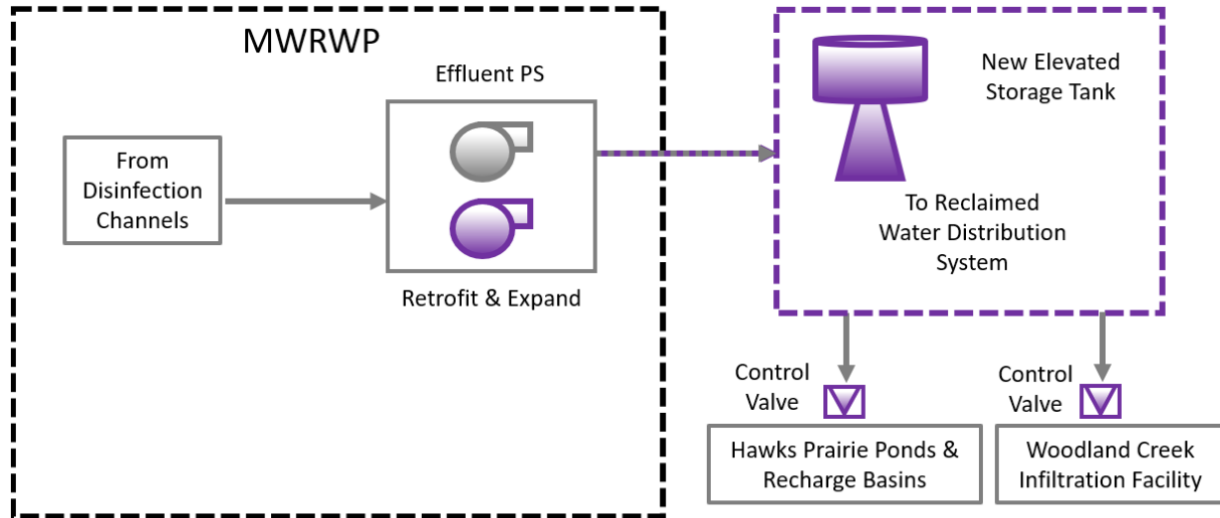


Figure 4.11 Alternative 3 Schematic: Elevated Storage and Retrofit PS

4.7.4 Alternative 4 - Elevated Storage and New PS

This option includes a 1 MG elevated tank within the reclaimed water system (the location has not been determined). For this option, the existing pumps at the Effluent PS would continue to serve Hawks Prairie and the Woodland Creek facility. New pumps at the Effluent PS with VFDs, a capacity of 3,000 gpm, and TDH of at least 320 feet (or higher, depending on the location and elevation of the elevated tank) would be installed and be dedicated to fill the elevated tank and serve the reclaimed water distribution system. This option would require installing approximately 28,000 feet of 12-inch diameter pipe parallel to the existing reclaimed water pipelines to have a separate system dedicated to the reclaimed water distribution system. Figure 4.12 is a simple schematic of Alternative 4.

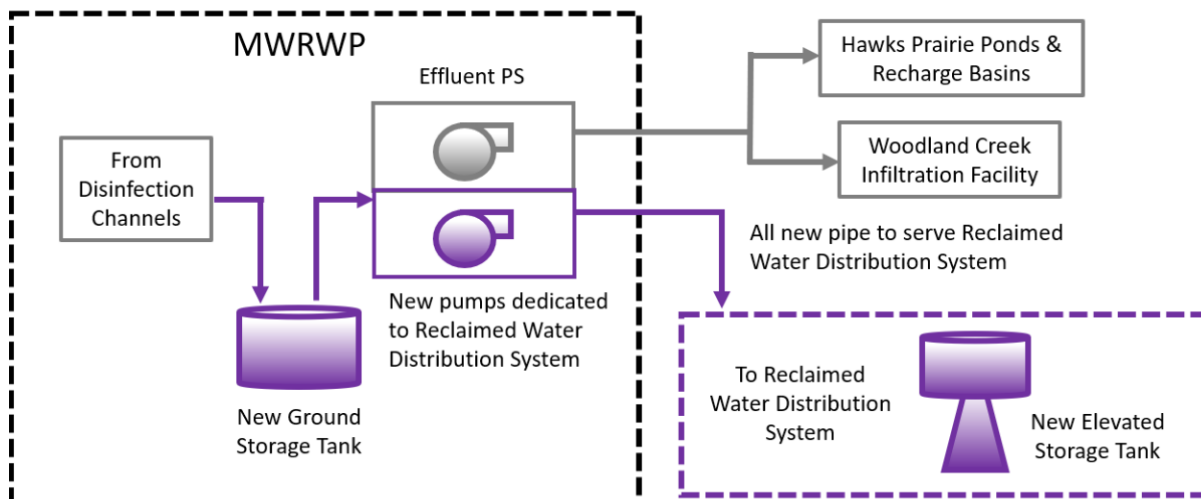


Figure 4.12 Alternative 4 Schematic: Elevated Storage and New PS

4.8 Cost Estimates

This section presents cost and non-cost considerations for each of the proposed infrastructure alternatives. Costs were estimated using unit costs with assumptions that were made for each alternative.

4.8.1 Cost Estimate Assumptions

Planning-level estimates were developed to evaluate the alternatives. The cost estimates were developed using Class 5 Planning Cost estimate, as established by the Association for the Advancement of Cost Engineering (AACE). Figure 4.13 shows the AACE cost estimate classifications for the process industry.

ESTIMATE CLASS	Primary Characteristic	Secondary Characteristic		
	MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES Expressed as % of complete definition	END USAGE Typical purpose of estimate	METHODOLOGY Typical estimating method	EXPECTED ACCURACY RANGE Typical variation in low and high ranges
Class 5	0% to 2%	Concept screening	Capacity factored, parametric models, judgment, or analogy	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study or feasibility	Equipment factored or parametric models	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	L: -10% to -20% H: +10% to +30%
Class 2	30% to 75%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: -5% to -15% H: +5% to +20%
Class 1	65% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	L: -3% to -10% H: +3% to +15%

Source: Association for the Advancement of Cost Engineering (AACE) International RP No. 18R-97, "Cost Estimate Classification System – As applied in Engineering, Procurement, and Construction for the Process Industries", Rev. March 1, 2026.

Figure 4.13 Cost Estimate Classification Matrix for Process Industries

The Class 5 estimate is used for long-range planning, evaluation of alternatives, or concept screening. The expected accuracy range is -50 percent to +100 percent, which means meaning the actual cost should fall in the range of 50 percent below the estimate to 100 percent above the estimate. Note that costs have not been adjusted for the -50 percent to +100 percent range.

The costs were determined using both Carollo Engineers, Inc., (Carollo) understanding of project locations and current conditions and the City's costs for similar and recently constructed capital projects. The cost estimates have been prepared for the general master planning purposes.

All costs are in 2023 dollars. The Handy-Whitman Index of Public Utility Construction Costs for the Pacific region for July 2023 reflects cost index numbers for different materials and equipment. For costs in this project, the following cost index numbers were used for 2023, pipes: 1,297, storage tanks: 1,237, and pumps: 1,841. Note, all cost assumptions and estimates are construction costs, not capital costs.

These costs do not include project contingencies, indirect capital costs, maintenance costs, or operational costs, except as noted. Table 4.9 summarizes the construction unit cost assumptions used to develop the construction costs. Table 4.10 summarizes the contingencies and indirect costs that are factored into the total project cost for each of the proposed alternatives.

Table 4.9 Construction Unit Cost Assumptions

Component	Cost
Pipe	
8-inch Diameter ⁽¹⁾	\$213/LF
12-inch Diameter ⁽¹⁾	\$244/LF
I-5 Freeway Crossing	\$1,500,000 each
Pump Station⁽²⁾	
< 200 hp	\$18,739/hp
> 200 hp	\$13,548/hp
Retrofit of Existing Pumps	\$100,000/pump
VFDs	\$300/hp
Reservoir⁽¹⁾	
Ground Reservoir	\$2.96/gallon
Elevated Reservoir	\$5.18/gallon
Other⁽²⁾	
Control Valves	\$200,000/each
Chlorine Analyzers	\$20,000/each
Customer Conversion	\$20,000/customer

Notes:

- (1) 8-inch diameter and 12-inch diameter pipe and reservoir costs are escalated from 337 PZ Study Unit Costs (from May 2018, using Handy-Whitman Index to 2023 dollars.
 - (2) Pump station and other costs were developed based on typical costs from past projects.
 - (3) Contingencies and indirect costs are not included in these assumptions.
- hp - horsepower; LF - linear foot.

Table 4.10 Contingencies and Indirect Costs

Project Cost Markup ⁽¹⁾⁽²⁾	Pipe/Other	Storage	PS
Construction Contingency (percent)	25	30	30
Sales Tax (percent)	9.40	9.40	9.40
Study (percent)	0	0	5
Engineering Design (percent)	15	25	25
Legal/Admin/City Coordination (percent)	27	27	27
Construction Support (percent)	5	10	10

Notes:

- (1) Project cost markups for pipelines and other infrastructure match the project cost markups for pipelines from the Draft Lacey Water System Plan (April 2022).
- (2) Project costs do not include land acquisition costs.

Table 4.11 summarizes the electricity costs for both the existing and retrofit pump station scenarios. These costs were calculated to estimate the total annual cost to operate the pump stations based on its power demand (kWh). Based on the assumption the pump station has a lifetime of 50 years, a lifetime cost was also estimated. The prices per kWh of energy were determined using Puget Sound Energy (PGE) electric summary for commercial and industrial customers with demand greater than 350 kW. These costs are based on PGE rates as of January 1, 2024.

Table 4.11 Summary of Energy Costs

Component	Cost
Existing PS Annual Cost	\$24,000
Existing PS Lifetime Cost (50 years)	\$1,200,000
Retrofit PS Annual Cost	\$42,700
Retrofit PS Lifetime Cost (50 years)	\$2,135,000
Difference in Lifetime Cost	\$935,000

4.8.2 Life Cycle Cost Evaluation

Table 4.12 summarizes the costs for the components of each proposed alternative. The total cost for each of the four alternatives includes the contingencies for capital improvement and construction costs as well as the unit cost assumptions made in Table 4.9. This evaluation shows that Alternative 1, followed by Alternative 3 are the lowest cost alternatives. Retrofitting LOTT's existing discharge pump station to provide higher discharge pressures and constructing a ground storage tank at or near MWRWP have the lowest life cycle costs.

Table 4.12 Alternatives Analysis Cost Comparison

Component	Alternative 1 - Ground Storage and Retrofit PS	Alternative 2 - Ground Storage and New PS	Alternative 3 - Elevated Storage and Retrofit PS	Alternative 4 - Elevated Storage and New PS
Storage	\$3,000,000	\$3,000,000	\$5,200,000	\$5,200,000
Pump Station	\$6,200,000	\$5,600,000	\$6,200,000	\$5,600,000
Pipeline	\$14,200,000	\$23,400,000	\$14,200,000	\$23,400,000
Other	\$1,100,000	\$700,000	\$1,100,000	\$700,000
Baseline Construction Costs	\$24,500,000	\$32,700,000	\$26,700,000	\$34,900,000
Total Construction Costs	\$31,100,000	\$41,300,000	\$33,900,000	\$44,100,000
Total Project Cost	\$50,800,000	\$66,600,000	\$55,700,000	\$71,500,000

4.9 Seasonal Storage

As discussed in Chapter 3, some years will not have reclaimed water available for other purposes beyond environmental mitigation during peak demand months. If reclaimed water is available, portions of the reclaimed water system can be constructed to serve irrigation customers. As shown in Chapter 3, water may be available during winter and other low demand months for irrigation purposes. If there is some kind of seasonal storage of reclaimed water, then reclaimed water could be made available for irrigation during high irrigation months. The method of seasonal storage that could offer the greatest feasibility is ASR.

GSI Water Solutions, Inc. completed a Reclaimed Water ASR Pre-Feasibility Evaluation (Appendix D) as a preliminary assessment of the potential for the City to use ASR as a means to inject and store excess reclaimed water available during the winter and spring months for non-potable uses during the summer.

The ASR concept for the City would include direct groundwater recharge of Class A reclaimed water available from the MWRWP. Direct recharge of the water would be accomplished via a series of injection wells capable of a combined recharge rate of 1-2 mgd (700-1,400 gpm). Recharge would likely take place during periods when surplus reclaimed water is available from the facility (i.e., winter and spring). Injecting 1-2 mgd over a 6-month period equates to an estimated storage volume of between 180 MG and 360 MG.

Due to the limited availability of reclaimed water in the summer months when irrigation water is in highest demand, the potential storage provided by ASR could provide the City with a means of accessing reclaimed water during peak irrigation season.

However, due to limited storage capacity in the groundwater basin, expected low yield of wells, and the inability to effectively isolate portions of the groundwater basin to create a non-potable groundwater basin, developing an ASR project to store reclaimed water may have significant hindrances to implementation. Additional hydrogeology studies will be necessary to evaluate the feasibility of implementing reclaimed water ASR. Due to the expense of such a project and the sufficiency of the City's existing water rights for the next few decades, it is not recommended that the City pursue a reclaimed water ASR project at this time. If there is a time where water supplies are insufficient to meet potable demands, development of a reclaimed water ASR project can be reviewed at that time.

4.10 Conclusion

The reclaimed water system presented in this chapter was developed to serve potential customers identified as an option for use of reclaimed water available to the City after environmental mitigation. The potential customers include existing irrigation customers that could be converted to reclaimed water customers, and potential future customers based on vacant parcels. The analysis presented in this chapter assumes that sufficient reclaimed water will be available to meet these demands.

The potential pipeline routes were developed to serve the top irrigation customers and sized based on velocity requirements and headloss through the pipeline. The potential reclaimed water system would be served in one pressure zone with a retrofit and/or expansion of the existing effluent pump station at the MWRWP, and construction of a new storage tank for equalization. Four alternatives for pump and storage infrastructure were developed to serve potential reclaimed water customers.

Development of a reclaimed water ASR system is not recommended at this time.

Costs and options for the potential reclaimed water system are presented in Chapter 6, which outlines the City's Reclaimed Water Capital Improvement Program.

CHAPTER 5 POTABLE REUSE EVALUATION

The City of Lacey (City) infiltrates reclaimed water at its Woodland Creek Recharge Facility to provide environmental mitigation for water rights for the City and City of Olympia. Any reclaimed water not used for environmental mitigation is infiltrated for beneficial use at the LOTT Clean Water Alliance (LOTT) Hawks Prairie Ponds and Recharge Basins. In addition to irrigation (discussed in Chapter 4), potable reuse is another potential opportunity for reclaimed water.

In recent years, supplementing drinking water supplies with reclaimed water, also known as potable reuse, has been shown a safe and economically viable practice in a number of communities in the United States and around the world. Potable reuse is an established practice in a number of historically water-stressed states such as California, Arizona, and Texas, in all of which intentional potable reuse projects date back to the 1960s or earlier.

As populations grow, water resources become scarcer and the impacts of discharging effluents become more significant. This alternative beneficial use of reclaimed water is also garnering support from communities that are not located in semi-arid regions. Examples include the Hampton Roads Sanitation District in Virginia and the Gwinnett County Department of Water Resources in Georgia. Both communities have or are implementing large-scale potable reuse projects driven by a combination of challenges related to both water supply and discharge water quality.

This Chapter identifies a number of potable reuse options, establishes three alternatives available to the City and evaluates them based on feasibility, cost, and non-monetary factors.

5.1 Available Flow for Potable Reuse

The potable reuse analysis is based on the 2040 planning period. A number of assumptions were made to determine the available water for potable reuse at that point. For details on the assumptions, please reference Chapter 3. However, due to the seasonal requirements of the environmental mitigation, reclaimed water is largely available in the wet season for both wet and paper water scenarios. If not beneficially used (potable reuse irrigation, etc.), the reclaimed water not used for environmental mitigation is anticipated to be infiltrated at the LOTT Hawks Prairie Ponds and Recharge Basins.

5.2 Overview of Potable Reuse Options

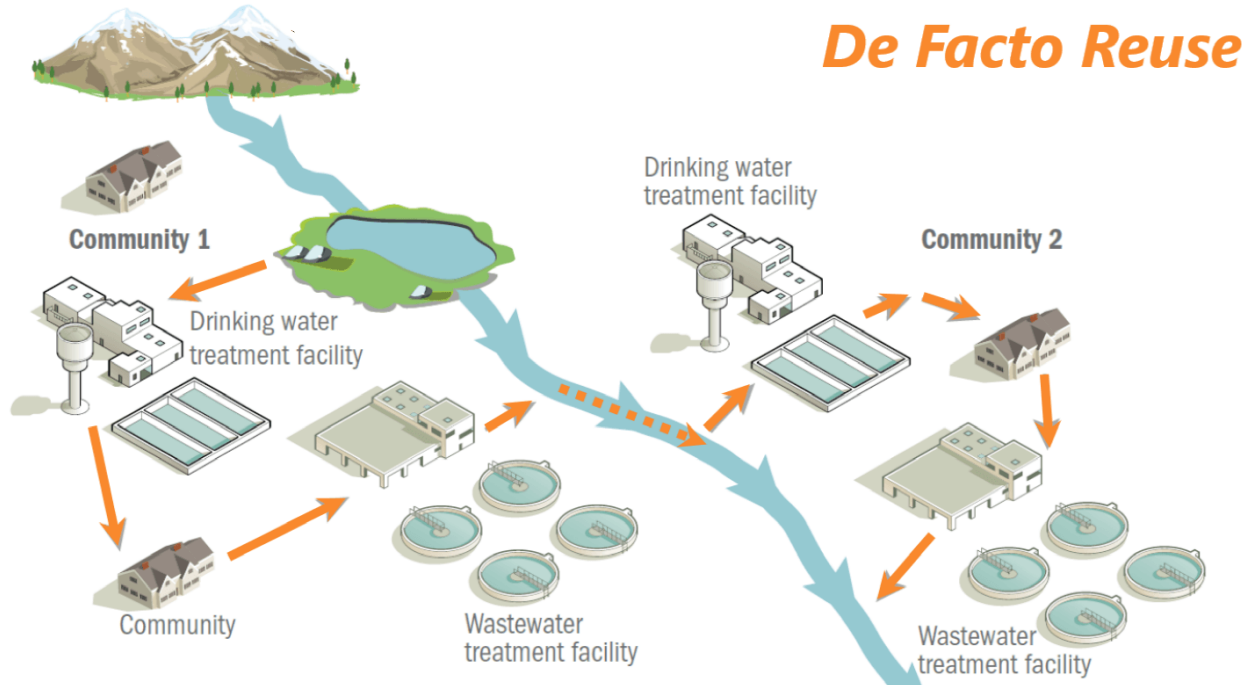
Like any other water supply alternatives, there are multiple ways in which potable reuse projects can be implemented. It is helpful for the purpose of evaluation and regulation, however, to categorize them into a small handful of types. Each one is then evaluated for high-level feasibility at the City.

5.2.1 *De Facto* Potable Reuse

No introduction to potable reuse is complete without a brief discussion of what has become known as *de facto* reuse. *De facto* reuse occurs when a community draws water from a river or reservoir that includes treated effluent discharged by upstream communities, as shown in Figure 5.1. All major US river basins provide examples of *de facto* reuse. The distinction between this practice and Surface Water Augmentation described in the next section is mainly intent: *De facto* reuse, as the name implies, is an

incidental form of reuse, and not always acknowledged. Surface water augmentation, on the other hand, implies an intentionally implemented project for the purpose of supplementing surface water supplies with reclaimed water.

Given the lack of receiving water bodies near the City, this option is not being considered.



Modified from AWWA Potable Reuse 101

Figure 5.1 *De Facto Reuse Schematic*

5.2.2 Surface Water Augmentation

As noted above, surface water augmentation (SWA) involves intentionally supplementing surface water supplies with reclaimed water. It is a form of *de facto* potable reuse, which means that the reclaimed water is returned to the drinking water supply via some residence time in a natural system, also called an "environmental buffer."

In some states, SWA is defined more narrowly to pertain to surface water reservoirs with stringent advanced treatment and significant monitoring oversight required by recent regulation (California State Water Resources Control Board, 2018). In other states, SWA is practiced under a number of regulatory paradigms that range from evaluation only under existing discharge and drinking water treatment regulations (many projects in Texas, for example) to project-specific oversight and regulatory approval (such Gwinnett County in Georgia, or the Upper Occoquan Services Authority in Virginia, for example).

In Washington State, reclaimed water intended for beneficial reuse may be discharged for streamflow augmentation provided the reclaimed water meets the requirements of the federal water pollution control act, Chapter 90.48 Revised Code of Washington (RCW), Chapter 173-201A Washington Administrative Code (WAC), WAC 246-390-310, and is incorporated within a sewer or water comprehensive plan as applicable, adopted by the applicable local government and approved by the Washington State Departments of Health (DOH) and Ecology (Ecology) as applicable. These criteria are determined on a case-by-case basis.

Surface water augmentation in the City has been previously determined to be generally infeasible as part of Woodland Creek evaluations due to temperature and sensitive water quality concerns and will not be considered further in this evaluation.

5.2.3 Groundwater Augmentation

Groundwater augmentation (GWA) is the intentional supplementation of groundwater supplies with reclaimed water. Like SWA, GWA is a form of *de facto* potable reuse, with the groundwater basin acting as the environmental buffer in which the reclaimed water resides for a period of time.

In Washington State, similar to most other jurisdictions, a distinction is made between two forms of groundwater augmentation, termed *indirect* groundwater recharge (through surface percolation, subsurface percolation or vadose wells) and *direct* groundwater recharge (injected directly into the aquifer). The distinction is important because of the vadose zone, which acts like a large biologically active filter for the reclaimed water percolating from the surface until it reaches the water table and has been shown to confer significant treatment benefits by removing both pathogens and chemicals of concern.

GWA is yet again separate from aquifer storage and recovery (ASR), as described below.

5.2.3.1 Aquifer Storage and Recovery

ASR is the process of storing water underground and retrieving it for later use. It is often also discussed in the context of potable reuse (or confused with potable reuse), but ASR does not *necessarily* include any form of reuse. Chapter 2 discusses regulations related to ASR in Washington State.

The *subsurface residence time* (also referred to as the “response retention time”) of typical groundwater augmentation potable reuse projects defines an important functional distinction between a typical storage-only ASR system. This “guaranteed minimum residence time” allows for additional contaminant attenuation and pathogen die-off to occur in the subsurface. Subsurface residence time can be achieved either through establishing a minimum waiting period between injection and withdrawal at one location or by providing separate injection and extraction well sites with sufficient travel time demonstrated in between the two locations.

The feasibility of *non-potable* reclaimed water (“storage-only”) ASR in the study area from a regulatory, hydrogeological and water quality standpoint is discussed in Chapter 4; this prior evaluation will be helpful in evaluating the feasibility of potable reuse via groundwater augmentation in this chapter.

5.2.3.2 Indirect Groundwater Recharge

Indirect groundwater recharge is defined in Washington State as the application of reclaimed water to groundwater “through surface percolation, subsurface percolation or vadose wells” (WAC 173-219-390

Table 3: Use-Based Performance Standards, Item (21)). Similar to requirements in other states, indirect groundwater recharge can be performed with Class A or B reclaimed water, with criteria for projects established on a case-by-case basis. In any case, the water infiltrated must meet groundwater standards, which include numerical limits and an anti-degradation policy.

Reclaimed water is already being used for indirect groundwater recharge at the LOTT's Hawks Prairie Infiltration Basins and the Woodland Creek Groundwater Recharge Facility, as described in Chapter 1. Potable reuse could build on these existing practices. While the water infiltrated at Woodland Creek is allocated for mitigation under six of the City's water right permits (see Chapter 1), the water infiltrated at Hawks Prairie, or a similar facility *may* be available for extraction.

The treatment requirements for indirectly infiltrated reclaimed water that is later extracted for potable purposes are not clearly described in Washington State regulations or guidance. At minimum, the water would need to meet all drinking water standards; an evaluation of additional treatment needs would also include attenuation of pathogens and unregulated chemicals and be based on industry best practices.

Potable reuse building on these existing indirect groundwater recharge practices is retained for further consideration as Alternative 1.

5.2.3.3 Direct Groundwater Recharge

Direct groundwater recharge, also referred to as "aquifer recharge" (WAC 173-219-390 Table 3: Use-Based Performance Standards, Item [22]) describes the practice of injecting reclaimed water directly into an aquifer. Once again, two separate regulatory paradigms exist: direct recharge into *potable* groundwater versus direct recharge into *non-potable* groundwater.

Direct recharge to non-potable groundwater is allowed with Class A reclaimed water. The other requirements are similar to those listed for indirect groundwater recharge. The feasibility of "non-potable ASR" via direct injection of Class A reclaimed water into a non-potable aquifer is the scenario more fully explored in Chapter 4, which discusses the feasibility of using ASR for seasonal storage of non-potable reclaimed water. Chapter 4 estimates that injection wells would have a capacity of approximately 1.1 million gallons per day (mgd). A potable reuse scenario could build upon this proposal by treating extracted non-potable water to drinking water standards. This is retained for further consideration as Alternative 2.

Direct recharge to potable groundwater requires all of the above and carries additional water quality requirements, the most limiting of which is the need to meet a total organic carbon (TOC) of less than 1 milligram per liter (mg/L), which the current Class A reclaimed water produced at the Martin Way plant does not meet. Significant advanced treatment would be needed to meet this requirement, most likely including the use of reverse osmosis (RO) or nanofiltration (NF) membranes. This approach will be further evaluated as Alternative 3.

5.2.4 Direct Potable Reuse

Direct potable reuse (DPR) is the *direct* augmentation of drinking water supplies with advanced-treated reclaimed water without passing through an environmental buffer such as a river, lake, or aquifer. With one operating municipal-scale facility in the United States (in Big Spring, Texas), several more in the planning and design stages, and regulations still under development in California, Arizona, Colorado, Florida and several other states, this form of potable reuse is still emerging.

As noted in Chapter 2, DPR in Washington State requires Class A+ reclaimed water, the standards for which would have to be established by the Department of Health on a case-by-case basis but are assumed to include at minimum the requirements established for direct groundwater recharge. Similar to the direct recharge scenario therefore, an advanced purification facility for DPR would have to produce water with a TOC of less than 1 mg/L.

In addition to the regulatory uncertainty surrounding a DPR scenario in the City, one additional factor makes this an unfavorable alternative compared to the others: the lack of seasonal storage. During times of high reclaimed water demand, there is no excess water available to feed an advanced purification facility. It is cost-inefficient to build the expensive treatment facilities needed for DPR sized to handle a peak reclaimed water flow but have them produce on average much less total water. Advanced treatment processes also do not shut down and ramp up readily. Therefore, it would be much more logical in the City's situation to take advantage of the natural flow equalization (and potential for contaminant attenuation) provided by its local aquifers and to build additional treatment, if needed, post-extraction, where treatment can occur at a consistent flow.

Thus, DPR is not further considered in this evaluation.

5.2.5 Advanced Treatment Options

Beyond the methods of potable reuse, various advanced treatment options are available to meet chemical and pathogen regulations for non-potable and potable reclaimed water. Due to generally lower costs, modifications to existing treatment facilities and infrastructure are considered more favorable.

5.2.5.1 Martin Way Reclaimed Water Plant

The process at the Martin Way Reclaimed Water Plant (MWRWP) consists of grit removal, secondary screening, activated sludge aeration basins, membrane bioreactors (MBR), and ultraviolet (UV) disinfection, as shown in Figure 5.2. All waste activated sludge (WAS) are then conveyed to Budd Inlet Treatment Plant approximately six miles away. For 2018, MWRWP had an average annual influent flow of 1.49 mgd. This Class A Reclaimed Water is then conveyed to the Hawk's Prairie Infiltration Ponds or Woodland Creek Recharge Basins depending upon seasonal environmental mitigation demands and recommended infiltration rates. Table 5.1 summarizes the historical MWRWP effluent flows and concentrations.

The MWRWP must meet both groundwater quality limits and Class A Reclaimed Water limits. The most stringent of the Class A Reclaimed Water limits includes an effluent total nitrogen of less than 10 mg/L monthly and 15 mg/L sample maximum. The City requested that LOTT meet an additional voluntary target of total nitrogen levels less than 5 mg/L for any finished water sent to the Woodland Creek Groundwater Recharge Facility. Additionally, groundwater limits require a maximum concentration for various pollutants including copper, lead, and species of total nitrogen, i.e., nitrate as nitrogen ($\text{NO}_3\text{-N}$) and nitrite as nitrogen ($\text{NO}_2\text{-N}$). The groundwater limits and Class A Reclaimed Water limits are shown in Table 5.2.

While effluent data for the MWRWP is limited, violation of the plant's State Reclaimed Water Permit, ST#6206, provides an indication of historical performance related to pollutants listed above. During the five years through 2019, the MWRWP had violated limits on trihalomethane, mercury, iron, manganese, chlorine, and turbidity. Iron accounted for approximately 63 percent of all violations, but iron was removed from the Permit in June 2020. Average influent biochemical oxygen demand (BOD_5)

concentration for 2019 is approximately 302 mg/L with an effluent load of 2.07 mg/L. This remains well below the average weekly and average monthly limits described below in Table 5.2. Average annual total suspended solids (TSS) concentrations remain very low at approximately 0.1 mg/L as well.

Table 5.1 Historical MWRWP Effluent Flows and Concentrations

Year	AAF (mgd)	MMF (mgd)	AA TN Influent (mg/L)	AA TN Effluent (mg/L)	AA BOD Influent (mg/L)	AA BOD Effluent (mg/L)
2017	1.0	1.5	33.5	3.3	226.8	2.0
2018	1.5	1.6	55.7	3.9	265.1	2.2
2019	1.3	1.6	60.6	3.5	302.7	2.1

Notes:

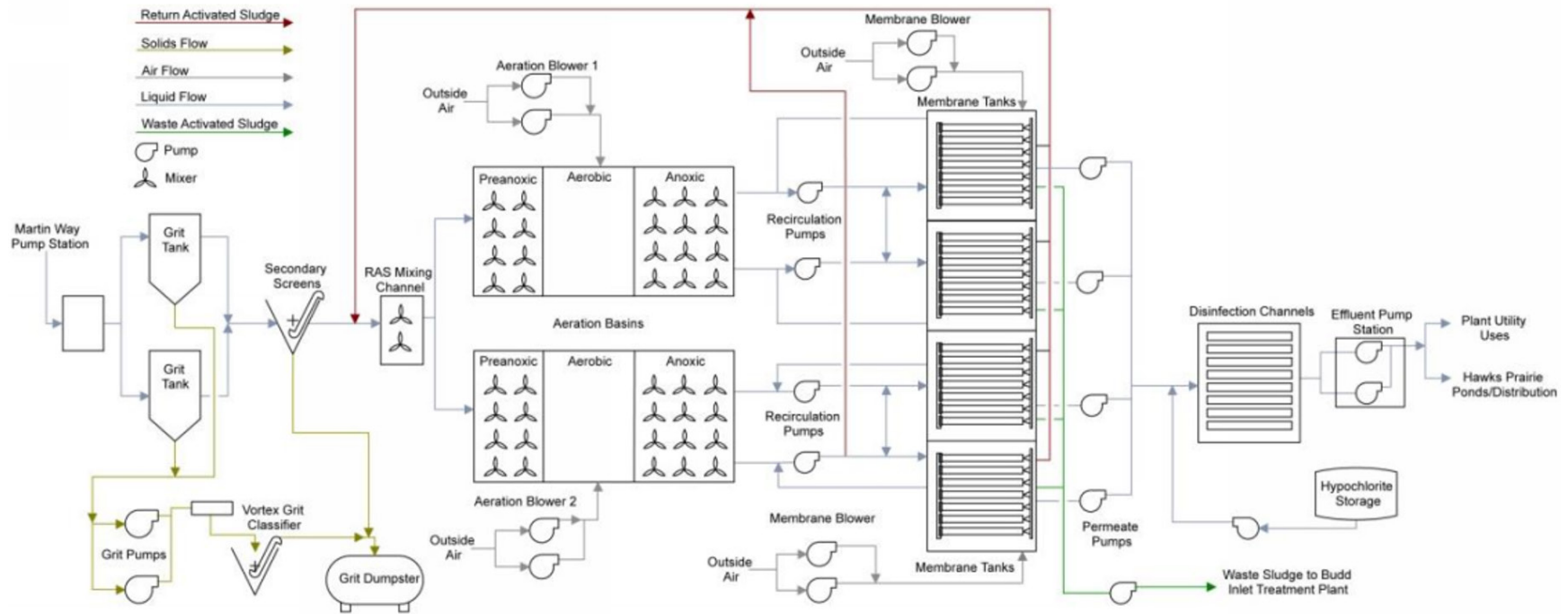
AA BOD - average annual biochemical oxygen demand; AA TN - average annual total nitrogen; AAF - average annual flow; MMF - maximum monthly flow.

Table 5.2 Class A Reclaimed Water and Groundwater Enforcement Limits

Parameter	Average Monthly Limit	Average Weekly Limit
BOD ₅	20 mg/L	30 mg/L
Parameter	7-day Median	Sample Maximum
Total Coliform	≤2.2 MPN/100 mL	≤23 MPN/100 mL
Parameter	Average Monthly Limit	Average Weekly Limit
Total Nitrogen as N	10 mg/L	15 mg/L
Parameter	Units	Groundwater Enforcement Limits
Nitrate as N	mg/L	10
Arsenic	µg/L	10
Cadmium	µg/L	5
Chromium	µg/L	50
Fluoride	mg/L	2
Mercury	µg/L	2
Nickel	µg/L	100
Total Trihalomethane	µg/L	80
Total Dissolved Solids	mg/L	500
Chloride	mg/L	250
Sulfate	mg/L	250
Copper	mg/L	1
Lead	µg/L	15
Manganese	µg/L	50
Silver	µg/L	50
Zinc	mg/L	5

Notes:

µg/L - micrograms per liter; mL - milliliter; MPN - most probable number.



Source: Capacity Report, 2018

Figure 5.2 Martin Way Reclaimed Water Plant Process Flow Diagram

Table 5.3 provides a summary of the comparison of potable reuse options.

Table 5.3 Comparison of Potable Reuse Options

Reuse Options	Feasibility	Pros	Cons	Recommendation
<i>De Facto</i> Reuse	Not Feasible	--	--	Not applicable
Surface Water Augmentation	Not Feasible	--	--	Not applicable
Indirect Groundwater Recharge	Feasible	Provides seasonal storage capacity.	Larger surface area typically required for infiltration.	Alternative 1
Direct Recharge to Potable Groundwater	Feasible	- Provides seasonal storage capacity. - Small surface area required typically.	- More expensive than other groundwater augmentation methods. - Requires pretreatment.	Alternative 2
Direct Recharge to Non-potable Groundwater				Alternative 3
Direct Potable Reuse	Feasible	Does not require consideration of groundwater interactions and regulations.	- Most extensive and expensive treatment requirements. - Inefficient use of available water resources due to lack of seasonal storage. Regulatory uncertainty.	Not recommended

5.3 Water Quality Targets for Potable Reuse

Each project will be evaluated for its ability to meet water quality targets in three broad categories of parameters: 1) chemicals regulated in drinking water; 2) pathogens; and 3) unregulated chemicals or constituents of emerging concern (CEC).

5.3.1 Chemicals Regulated in Drinking Water and Potable Reuse

A full list of chemicals that are regulated in drinking water is not provided herein. Typically, concentrations of chemicals regulated in drinking water (i.e., parameters with Maximum Contaminant Levels [MCL]) are not of concern in reclaimed water. This would need to be confirmed through sampling if any of the proposed alternatives were to proceed.

A few chemical parameters warrant close consideration: nitrate (MCL = 10 mg/L as N), nitrite (MCL = 1 mg/L as N), trihalomethanes (MCL = 80 µg/L as TTHM), and haloacetic acids (MCL= 50 µg/L as HAA5). Additionally, as of January 1, 2022, WAC 246-290 established State Action Levels (SAL) for per- and polyfluoroalkyl substances (PFAS) which will need to be met. A groundwater quality standard has been established in WAC 173-200-050 for N-Nitrosodimethylamine (NDMA) at two nanograms per liter (ng/L). Table 5.4 summarizes the PFAS SALs and their occurrence in LOTT-produced reclaimed water (Intertox, 2020).

In addition, the Washington State’s “Water Reclamation and Reuse Standards” (Publication #97-23) imposes additional water quality requirements on certain potable reuse projects:

- Groundwater recharge by *surface percolation*, must be with Class A reclaimed water from oxidized wastewater with an “additional step to reduce nitrogen.”
- For direct aquifer recharge into *potable* aquifers, the standards require compliance with MCLs and MCL Goals, and State MCLs, as well as a turbidity of less than 0.1 nephelometric turbidity unit (NTU) (average) and 0.5 NTU (maximum), TOC of less than 1 mg/L, and “any other constituent limits deemed appropriate by the Departments of Ecology or Health”. PFAS SALs will also need to be met for direct aquifer recharge into potable aquifers.
- For direct aquifer recharge into *non-potable* aquifers, the standards require Class A reclaimed water with biochemical oxygen demand (BOD) and TSS of 5 mg/L or less, respectively, and “any other constituent limits deemed appropriate by the Departments of Ecology or Health”.

Table 5.4 PFAS SALs and Maximum Concentration in LOTT Water

PFAS	Maximum Concentration in LOTT Water (ng/L) ⁽¹⁾	SAL (ng/L)
Perfluoro octanoic acid (PFOA)	22	10
Perfluoro octanesulfonate or Perfluoro octanesulfonic acid (PFOS)	Not Detected	15
Perfluoro-1-hexanesulfonic acid (PFHxS)	Not Detected	65
Perfluoro-n-nonanoic acid (PFNA)	<5	9
Perfluoro-1-butanefulfonic acid (PFBS)	13	345

Notes:

(1) Data reported by (Intertox, 2020).

5.3.2 Pathogens

Unlike other “conventional” drinking water treatment scenarios, the exact approach to pathogen removal in potable reuse is not defined by existing federal regulation. Therefore, an industry standard approach is applied in this evaluation, which establishes log removal value (LRV) requirements for the three pathogen types regulated in drinking water: *Giardia*, *Cryptosporidium*, and enteric virus. The approach, sometimes referred to as a “gap analysis”, bases treatment requirements on an understanding of the pathogen concentrations in the source water (here: MBR effluent) and pathogen concentration goals for drinking water, which are shown in Table 5.5. The “gap” between those two values establishes the minimum treatment requirements.

The goal concentrations listed in this table were established on the basis of achieving a less than 1 in 10,000 annual risk of infection. For reference, this level of risk is lower, and thus more conservative with respect to pathogen inactivation than existing federal drinking water regulations.

Table 5.5 Pathogen Goal Concentrations for Potable Reuse

Pathogen	Drinking Water Goal ⁽¹⁾	Reference
<i>Giardia</i>	< 6.8 x 10 ⁻⁶ cysts/L	(Regli et al., 1991)
<i>Cryptosporidium</i>	< 3.0 x 10 ⁻⁵ oocysts/L ⁽²⁾	(Haas, Rose, & Gerba, 1999)
Enteric virus	< 2.2 x 10 ⁻⁷ MPN/L ⁽³⁾	(Regli et al., 1991)

Notes:

- (1) Drinking water goals are identified for national DPR research and as implied by California regulations and cited by Trussell et al. (2013). These are consistent with values used in Texas based on personal communications with staff at the Texas Commission on Environmental Quality (TCEQ).
- (2) The *Cryptosporidium* goal as inferred from the treatment requirements under the U.S. Environmental Protection Agency (USEPA) Long Term 2 (LT2) Rule for Bin 3, which is the most conservative defined-boundary bin (only a lower boundary is defined for Bin 4). Bin 3 has an upper limit of 3 oocysts/L and requires 5-log treatment. The original quantitative microbial risk assessment defining this limit based on a 1 in 10,000 annual risk of infection was performed by Haas et al (1999).
- (3) The 10⁻⁴ risk level concentration of a number of enteric viruses is provided by Regli et al. (1991). The most conservative value listed in Table 2 of this reference is for rotavirus (at 2.22 x 10⁻⁷ MPN/L).

L - liter; MPN/L - most probable number per liter.

In order to determine treatment requirements for pathogens in terms of target LRVs, an estimate of the “starting point” of treatment must be made. The proposed source water has the advantage of being high quality MBR permeate. The MBR wastewater treatment process provides superior solids removal as it provides a physical membrane barrier with an average pore size of 0.02 microns. This barrier also provides superior removal of pathogenic protozoa, bacteria, and viruses that are associated with particles. There are a number of recently completed or ongoing efforts focusing on the value and performance of MBR for these types of applications, including:

- Pathogen removal research in Australia (Le-Clech [2015], WaterVal Validation Protocol Membrane Bioreactor [2016]).
- Pathogen removal research in the United States (Santa Clara Valley Water District [SCVWD] MBR Final Report, 2017).
- Developing projects to refine MBR pathogen removal for potable reuse:
 - » Metropolitan Water District of Southern California MBR demonstration (completion 2020).
 - » City of Los Angeles California MBR demonstration (completion 2020).
 - » Water Research Foundation Project 4997.

These and other projects all document the robust removal of indigenous pathogens by hollow fiber MBR systems. As one example, SCVWD (2017) demonstrated more than 3- log removal of a broad range of pathogens, finding them at below detectable values in all but one case, at four full-scale MBR systems with operational run time of up to 8 years. The estimated pathogen concentrations in MBR effluent are greater than 0.1 MPN/L *Giardia* and *Cryptosporidium*, respectively, and greater than one MPN/L for enteric virus. Table 5.6 shows these values, along with the minimum LRV targets that can be calculated from those values and the goals listed in Table 5.5. These are also compared to the “baseline” LRV targets established for Texas DPR projects, which are widely seen as minimum standards for DPR in Texas (see Appendix E).

Table 5.6 Pathogen Gap Analysis

	<i>Giardia</i>	<i>Cryptosporidium</i>	Enteric virus
Drinking Water Goal (#/L)	$< 6.8 \times 10^{-6}$	$< 3.0 \times 10^{-5}$	$< 2.2 \times 10^{-7}$
Estimated MBR Effluent ⁽¹⁾ (#/L)	< 0.1	< 0.1	<1.0
Calculated LRV Gap ⁽²⁾	4.2-log	3.5-log	6.7-log
Texas "Baseline" LRVs ⁽³⁾	6-log	5.5-log	8-log
California LRV Requirements ⁽⁴⁾	10-log ⁽⁴⁾	10-log ⁽⁴⁾	12-log ⁽⁴⁾

Notes:

- (1) Salveson A. and Fontaine. N. (2017).
- (2) The gap is calculated by taking the base 10 logarithm of the ratio of the effluent concentration to the drinking water goal concentration.
- (3) Personal communication with staff at the Texas Commission on Environmental Quality.
- (4) California pathogen LRV goals for potable reuse via groundwater augmentation (California Department of Public Health [CDPH] 2014). California goals are based on LRV from raw wastewater to finished drinking water. Based on ongoing validation efforts, some significant LRV credit would be given to MBRs under this paradigm, reducing the total LRV targets that would need to be met downstream in advanced treatment and/or the subsurface.

The LRVs provided in Table 5.5 thus provide a potential guide for the minimum level of disinfection that any potable reuse scenario would need to provide.

5.3.3 Constituents of Emerging Concern

Besides the chemical (and radiological) constituents explicitly regulated through MCLs, a wealth of research has been conducted on the concentrations of other CECs in wastewater, their attenuation through conventional wastewater treatment plants, and their further breakdown during advanced treatment (Baronti, et al., 2000) (Taylor, Lovins, & Chen, 2002) (Lovins, III, Taylor, & Hong, 2002) (Schafer, Fane, & Waite, 2005) (Sedlak & Kavanaugh, 2006) (Steinle-Darling, Litwiller, & Reinhard, 2010) (Linden, Salveson, & Thurston J., 2012) (Salveson, Brown, Zhou, & Lopez, 2010) (Snyder, von Gunten, Amy, Debroux, & Gerrity, 2012). While the state of Washington has enacted a SAL for PFAS and regulations regarding NDMA in groundwater recharge, other CoCs continue to exist which may or may not be addressed by treatment for PFAS and NDMA. These constituents include pharmaceuticals and personal care products (PPCP), consumer chemicals, flame retardants, and others, some of which have endocrine disrupting, carcinogenic, and/or other potentially harmful properties at sufficiently high concentrations. Due to this fact, this group of constituents has been the cause of more public concern than the pathogens discussed above.

Table 5.7 provides a list of indicator CECs along with typical concentrations in secondary effluent and their maximum recommended value in drinking water (WateReuse Research Foundation [WRRF] November 02, 2013) and their occurrence in LOTT-produced reclaimed water (Intertox, 2020). The comparison of the two data columns clearly indicates that CECs are well-addressed even in conventional water reclamation processes. The advanced treatment that is necessary mainly for pathogen attenuation also results in an aesthetically pleasing water and provides additional conservative margins of safety for unregulated constituents.

Since the alternatives being evaluated in this study are planned for implementation no sooner than an approximately 20-year horizon, it is important to note that additional chemicals currently classified as CECs may become regulated in the future.

Table 5.7 Concentrations of Indicator Trace Organic Chemicals in Secondary Effluent

Target Compound	Use of Target Compound	Maximum Concentration in LOTT Water (ng/L) ⁽¹⁾	Typical Concentrations in Secondary Wastewater Treatment ⁽²⁾ (ng/L)	Maximum Recommended Value ⁽²⁾ (ng/L)
Atenolol	Pharmaceutical, beta blocker	230	710	70,000
Atrazine	Herbicide	Not Detected	28	1,000
Bisphenol A	Plastics additive	<100	<50	200,000
Carbamazepine	Pharmaceutical, anti-convulsant	730	140	1,000
DEET	Insect repellent	140	54	2,500,000
Diclofenac	Pharmaceutical, nonsteroidal anti-inflammatory drug	260	62	1,800
Gemfibrozil	Pharmaceutical, lipid regulating agent	710	31	45,000
Ibuprofen	Pharmaceutical, pain reliever	320	<25	400,000
Meprobamate	Pharmaceutical, anti-anxiety medication	390	41	260,000
Musk Ketone	Fragrance additive	Untested	<100	350,000
Naproxen	Pharmaceutical, pain reliever	32	<25	220,000
Phenytoin ⁽³⁾	Pharmaceutical, anti-convulsant	130	110	6,800
Primidone	Pharmaceutical, anti-convulsant	930	67	10,000
Sulfamethoxazole	Pharmaceutical, antibiotic	520	570	35,000
Triclosan	Biocide	130	26	350
Trimethoprim	Pharmaceutical, antibiotic	97	280	70,000
TCEP	Fire retardant	240	540	1,000

Notes:

(1) Data reported by (Intertox, 2020).

(2) Data reported by (WRRF 11-02, 2013).

(3) Phenytoin is also known as dilantin.

TCEP - tris(2-chloroethyl) phosphate.

5.4 High-Level Alternatives

Three high level alternatives for groundwater recharge are discussed below:

- Alternative 1 - Expanding Percolation Facilities with Potable Water Recovery.
- Alternative 2 - Direct Recharge to Non-Potable Groundwater with Treatment Post-Extraction.
- Alternative 3 - Direct Recharge to Potable Groundwater.

5.4.1 Alternative 1 - Use of Percolation Facilities with Potable Water Recovery

In Alternative 1, LOTT would complete reclaimed water treatment to meet Class A reclaimed water permit requirements. The reclaimed water would be recharged into the Hawks Prairie Infiltration Ponds, which have a recharge capacity of 8 mgd. Class A Reclaimed Water that is infiltrated from the ponds may then percolate through the vadose zone which provides soil aquifer treatment. Recovery of the percolated

water would occur following travel and mixing via a potable well. At this point, the recovered water would be considered potable and would require standard groundwater treatment such as disinfection and removal of any constituents that do not meet the potable water MCL. This process is shown below in Figure 5.3.

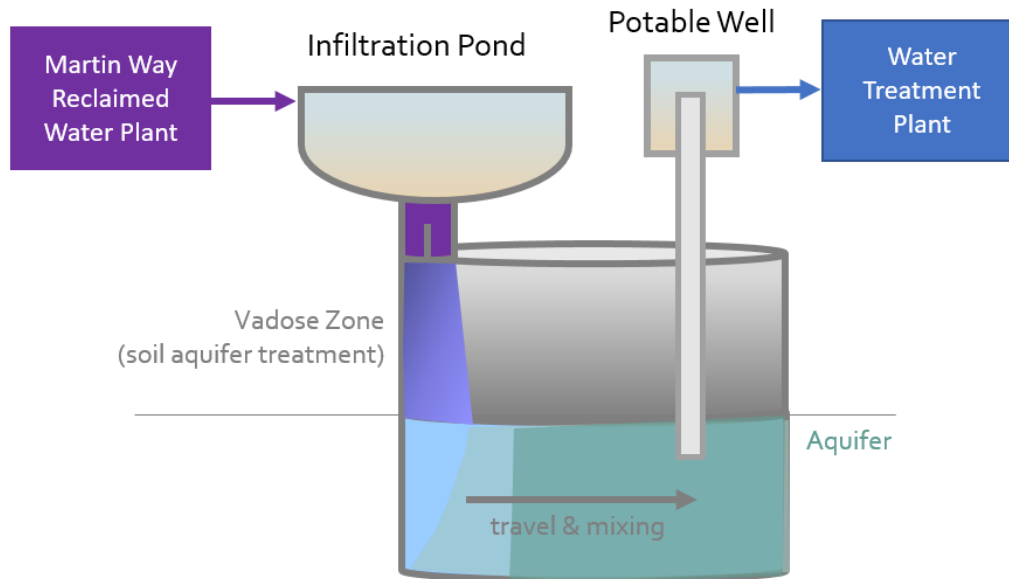


Figure 5.3 Alternative 1 - Use of Percolation Facilities with Potable Water Recovery

5.4.1.1 Treatment Evaluation for Alternative 1

Pathogen Evaluation

A pathogen evaluation for Alternative 1, summarized in Table 5.8, provides two alternative perspectives on pathogen removal in the subsurface. The first two lines document attenuations for soil aquifer treatment (SAT) and subsequent subsurface travel time observed in the literature as separate phenomena. The third line lists the LRV credit that the State of California will provide for percolation based potable reuse projects for SAT and subsurface travel time combined. In either case, the evaluation indicates that the attenuation expected in the subsurface (provided the travel time is greater than 6-months) should be sufficient to meet pathogen goals for *Giardia* and *Cryptosporidium*. Some additional chlorination at the wellhead would be needed to achieve sufficient virus inactivation. The chlorine would need to be dosed such that the residual (C) at the determined contact time (t) provides at least 2-log virus inactivation based on USEPA contact time (Ct) Tables.

This analysis assumes that at least six months of travel time (with some safety factor added) are achieved in the subsurface between reclaimed water application and groundwater extraction. Additional investigation of SAT for pathogen inactivation and CECs attenuation is warranted, but for the purposes of this evaluation, no additional treatment needs are assumed.

Table 5.8 Pathogen LRV Analysis for Alternative 1

	<i>Giardia</i>	<i>Cryptosporidium</i>	Enteric virus	Reference
SAT	4-log	4-log	4-log	Hogg et al, 2012
Subsurface Travel (minimum 6 months)	6-log	6-log	6-log	Hogg et al, 2012
Combination SAT and Travel Time	10-log	10-log	6-log	CDPH, 2014
Wellhead Chlorination	-	-	2-log	Based on USEPA Ct Tables
Total LRVs	≥10-log	≥10-log	≥ 8-log	

Chemicals Regulated and Constituents of Emerging Concern

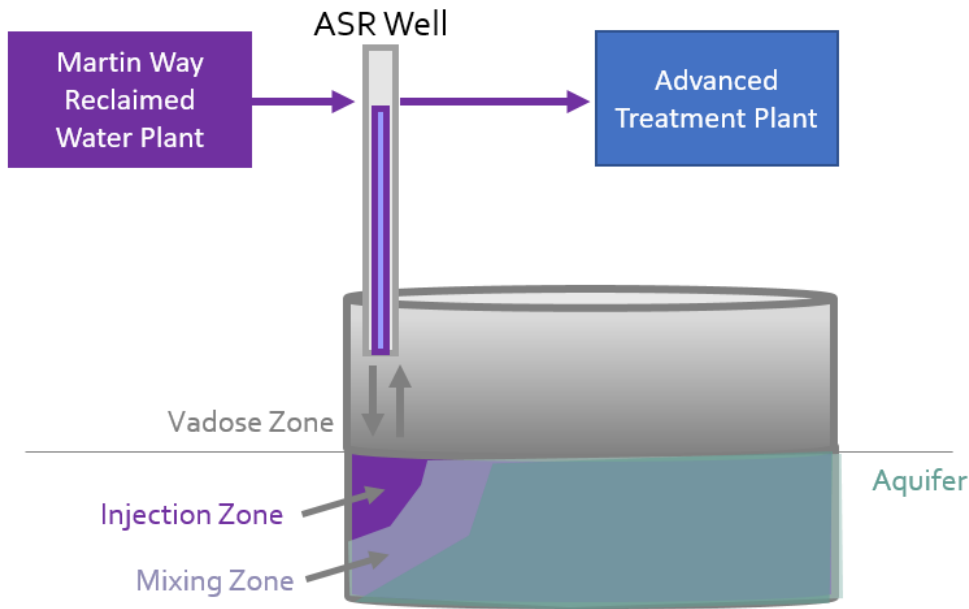
With respect to chemicals, the SAT component of the subsurface treatment is expected to result in significant attenuation of any remaining CECs. Further evaluation is recommended if this alternative is selected for further investigation.

5.4.1.2 Water Rights Considerations for Alternative 1

In Alternative 1, the water is recharged at an infiltration basin and then pumped through downstream groundwater wells. As a quantity of water is already recharged at the Hawks Prairie Infiltration Ponds, the Department of Ecology may require a new water right to pump this water, as it has been mixed with existing groundwater. As reclaimed water production and recharge are expanded, the “new” quantity of water may be accessible for extraction. Further discussions will be needed with the Department of Ecology to identify whether this is a feasible alternative.

5.4.2 Alternative 2 - Direct Recharge to Non-Potable Groundwater with Treatment Post-Extraction

For the second groundwater augmentation method, non-potable Class A Reclaimed Water would be treated as required by permit per the current method of operation at the MWRWP then injected into the vadose zone, as shown in Figure 5.4. For this alternative, the same ASR well may be utilized for injection and extraction. This could be the same well as used for an irrigation system as discussed in Chapter 4. Following extraction, the non-potable reclaimed water would require advanced treatment to meet potable water standards. Notably, a vadose zone injection well may be prone to clogging or lose capacity over time (Metcalf & Eddy, 2007; Gastélum et al., 2009). Currently, no recovery methods exist for vadose zone wells which become clogged. This alternative would also require designation of a portion of the aquifer as non-potable, requiring a location where potable wells would not be impacted.



Note: Injection well can be reversed for extraction with ASR.

Figure 5.4 Alternative 2 - Non-Potable ASR with Treatment Post-Extraction

5.4.2.1 Treatment Evaluations for Alternative 2

Alternative 2 assumes that the (non-potable) reclaimed water is pulled from an ASR well with no guaranteed minimum subsurface residence time. This means the alternative essentially requires treatment equivalent to what would be provided in a DPR scenario. Because this particular form of potable reuse is not addressed by existing regulations or guidance in Washington State, two alternative treatment approaches are proposed:

- Traditional potable reuse treatment using a RO based approach, and;
- Alternative potable reuse treatment centered on ozone, biofiltration, and granular activated carbon (GAC).

Both treatment approaches have significant challenges: The major drawback of Alternative 2a is approximately 15 percent of the flow is wasted in the form of RO concentrate. Not only does this mean 15 percent of the reclaimed water is unavailable for beneficial use, but it also poses a potentially significant disposal challenge. The major potential drawback of Alternative 2b is that it could be difficult to achieve a 1 mg/L TOC limit, if that were to be enforced with respect to this alternative. Further evaluation of TOC attenuation potential in the subsurface during ASR and pilot work to assess the subsequent removal of TOC within the treatment processes would be needed to be confident in this treatment solution. Both treatment trains should be capable of meeting all other chemical removal targets.

Pathogen Evaluation

A pathogen evaluation for the treatment options under Alternative 2 are summarized in Tables 5.9 and 5.10. Both indicate that no attenuation is expected in the subsurface because we assume no guaranteed minimum subsurface residence time.

Table 5.9 Pathogen LRV Analysis for Alternative 2a RO Based Treatment

	<i>Giardia</i>	<i>Cryptosporidium</i>	Enteric virus	Basis for LRV Credit
ASR	+(1)	+	+	No guaranteed minimum subsurface residence time
RO	2-log	2-log	2-log	TOC monitoring
UVAOP	6-log	6-log	6-log	UV Dose Monitoring
Chlorine Ct	-	-	4-log	Ct
Total LRVs	8-log	8-log	12-log	

Notes:

(1) The plus symbol (“+”) indicates that some amount of attenuation takes place, but it is unquantified or not verifiable and thus acts as an additional safety factor.

UVAOP - ultraviolet advanced oxidation process

For Alternative 2a, pathogen removal of significantly higher than 2-log through RO has been demonstrated consistently through sampling; however, credit is limited by the ability to demonstrate membrane integrity through online TOC monitoring. The bulk of the inactivation credit is achieved through high-dose UV disinfection. An advanced oxidation process (AOP) is achieved through addition of an oxidant (typically hydrogen peroxide) to the UV process and polishes for CECs removal. Chlorine contact provides additional virus inactivation, resulting in a treatment approach that exceeds the target LRV goals.

Table 5.10 Pathogen LRV Analysis for Alternative 2b Ozone/BAF Based Treatment

	<i>Giardia</i>	<i>Cryptosporidium</i>	Enteric virus	Basis of LRV Credit
ASR	+(1)	+	+	No guaranteed minimum subsurface residence time
Ozone	+	+	5-log	Ozone dose monitoring or Ct
BAF	+	+	+	TOC removal but no pathogen credit
UF	4-log	4-log	+	Pressure decay testing
GAC	-	-	-	TOC removal but no pathogen credit
UV (800 mJ/cm ²)	6-log	6-log	6-log	UV Dose Monitoring
Chlorine Ct	-	-	1-log	Ct
Total LRVs	10-log	10-log	12-log	

Notes:

(1) The plus symbol (“+”) indicates that some amount of attenuation takes place, but it is unquantified or not verifiable and thus acts as an additional safety factor.

BAF - biological aerated filter; mJ/cm² - millijoules per square centimeter; UF - ultrafilter.

For Alternative 2b, significant virus inactivation is expected through ozonation, this also provides an AOP which provides additional CECs removal. A potentially optional UF obtains significant protozoa LRV credit. Again, the bulk of the inactivation credit is achieved through high-dose UV disinfection and chlorine contact provides additional virus inactivation. A smaller Ct is assumed here compared to Alternative 2a to avoid formation of disinfection byproducts with remaining TOC. Thus, the Alternative 2b treatment approach also exceeds the target LRV goals.

Chemicals Regulated and Constituents of Emerging Concern

As far as chemical removals, the RO process removes nearly all organic and inorganic constituents to a high degree, and typically results in a permeate TOC of less than 0.1 mg/L. The subsequent AOP step serves as a final polishing step. This treatment process should result in water that meets all water quality goals with respect to chemical constituents.

Regarding chemical removals, the combination of ozone and BAF provides significant removal of organic constituents, with the ozone serving to break down previously recalcitrant organics into assimilable organic carbon that is then consumed within the BAF step. The downstream GAC step serves as a polishing process, further removing CECs as well as reducing the bulk organic content. The expectation is that a 1 mg/L TOC limit would dictate the carbon change-out frequency. Even if the 1 mg/L TOC limit were found not to apply in this scenario, a limit of 2-3 mg/L TOC would need to be maintained to avoid downstream formation of disinfection byproducts due to chlorination. No additional chemical removals are expected through the UV and chlorination steps.

5.4.2.2 Water Rights Considerations for Alternative 2

In Alternative 2, tertiary treated wastewater would be injected into the ground through groundwater wells and treated after extraction. In this case, the water must be injected into a nonpotable aquifer based on WAC requirements. Upon review of the hydrogeology of this area, there does not appear to be a confined nonpotable aquifer that could be used for such a purpose. There is likely no opportunity to inject this water into the ground at a location that would not impact a potable water aquifer; therefore, Alternative 2 is not likely to be approved by the Department of Ecology under current regulations.

5.4.3 Alternative 3 - Direct Recharge to Potable Groundwater

For Alternative 3, non-potable Class A Reclaimed Water will need to meet potable Class A+ Reclaimed Water standards. This will require an advanced treatment plant or advanced treatment technology following MWRWP, as shown in Figure 5.5. The Class A+ Reclaimed Water could then be injected into a potable aquifer. Following a given residence time in which travel and mixing occurs within the aquifer, the water may be extracted as potable water and treated with typical groundwater treatment such as disinfection and removal of any constituents that do not meet the potable water MCL. In this alternative, treatment to meet minimum drinking water and groundwater standards would need to be provided prior to recharge to groundwater.

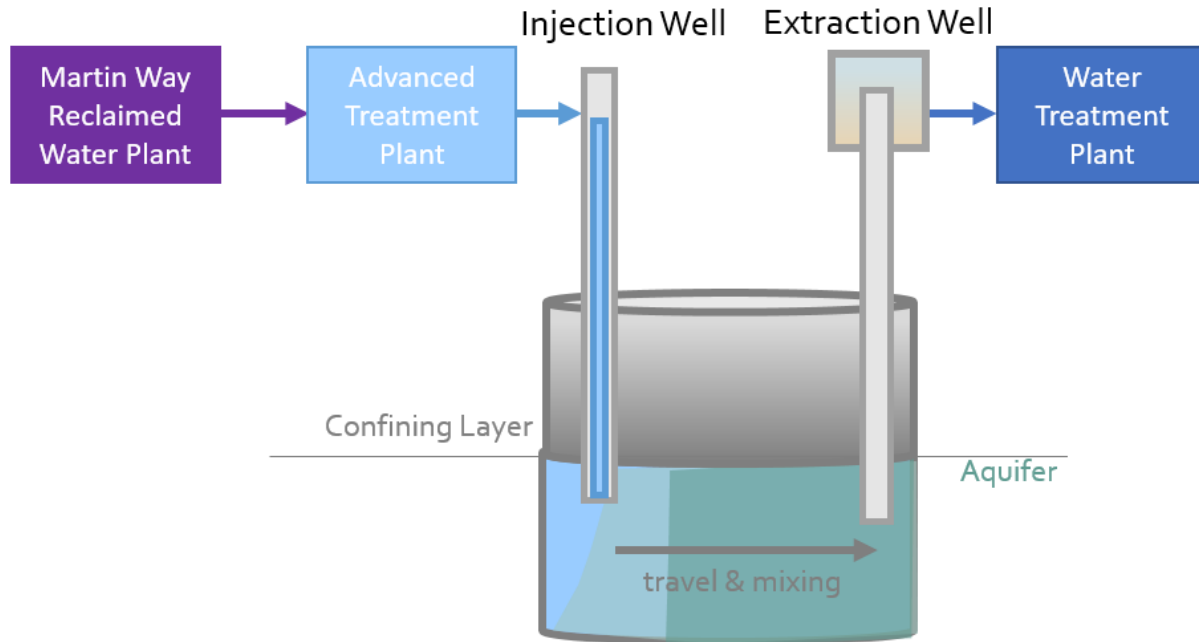


Figure 5.5 Alternative 3 - Direct Recharge to Potable Groundwater

5.4.3.1 Treatment Evaluation for Alternative 3

Alternative 3 assumes that the reclaimed water is treated prior to direct injection into a potable aquifer. This alternative requires treatment that produces water for injection that complies with MCLs and State MCLs, has a turbidity of less than 0.1 NTU (average) and 0.5 NTU (maximum), TOC of less than 1 mg/L, and “any other constituent limits deemed appropriate by the Departments of Ecology or Health” (Publication 97-23). While it is difficult to evaluate the last requirement at the planning level, the 1 mg/L TOC limit for water being injected into the ground dictates the treatment approach: either RO or possibly NF, two very similar membrane-based technologies, are the only treatment solution that will provide this level of treatment.

As with Alternative 2a, the major drawback of this alternative is the production of concentrate, which constitutes approximately 15 percent of the flow.

A pathogen evaluation for the treatment option under Alternative 3 is summarized in Table 5.11.

Table 5.11 Pathogen LRV Analysis for Alternative 3

	<i>Giardia</i>	<i>Cryptosporidium</i>	Enteric virus	Basis for LRV Credit
RO	2-log	2-log	2-log	TOC monitoring
UVAOP	6-log	6-log	6-log	UV Dose Monitoring
Subsurface Travel (assume 2 months)	2-log	2-log-	2-log	Hogg et al, 2012; 1-log per month
Wellhead Chlorine Ct	-	-	2-log	Ct, can be adjusted
Total LRVs	10-log	10-log	12-log	

Notes:

(1) The plus symbol (“+”) indicates that some amount of attenuation takes place, but it is unquantified or not verifiable and thus acts as an additional safety factor.

Similar to Alternative 2a, RO LRV credit in Alternative 3 is limited by the ability to demonstrate membrane integrity through online TOC monitoring. The bulk of the inactivation credit is achieved through high-dose UV disinfection. An AOP is achieved through addition of an oxidant (typically hydrogen peroxide) to the UV process and polishes for CECs removal. Chlorine contact at the wellhead provides additional virus inactivation, resulting in a treatment approach that exceeds the target LRV goals.

As far as chemical removals, the RO process removes nearly all organic and inorganic constituents to a high degree, and typically results in a permeate TOC of less than 0.1 mg/L. The subsequent AOP step serves as a final polishing step. This treatment process should result in water that meets all water quality goals with respect to chemical constituents. RO, however, demineralizes the water, which can have unintended consequences when it is infiltrated, so local geology and soil characteristics should be evaluated prior to selection of a treatment approach.

5.4.3.2 Water Rights Considerations for Alternative 3

In Alternative 3, the water is recharged at an injection well and then pumped through downstream groundwater wells. As this injected water would mix with native groundwater, the Department of Ecology may require a new water right to pump this water, as it has been mixed with existing groundwater. Further discussions will be needed with the Department of Ecology to identify whether this is a feasible alternative.

An alternate configuration, Alternative 3b, in which the reclaimed water is treated, injected, and then extracted from the same well as it is injected is shown in Figure 5.6. Alternative 3b would address the water rights considerations raised in Alternatives 1, 2, and 3. This case, however, is essentially the same as direct potable reuse since it would not receive any treatment benefit from being in the ground. Therefore, this alternate configuration does not provide an advantage and therefore is not included for further consideration.

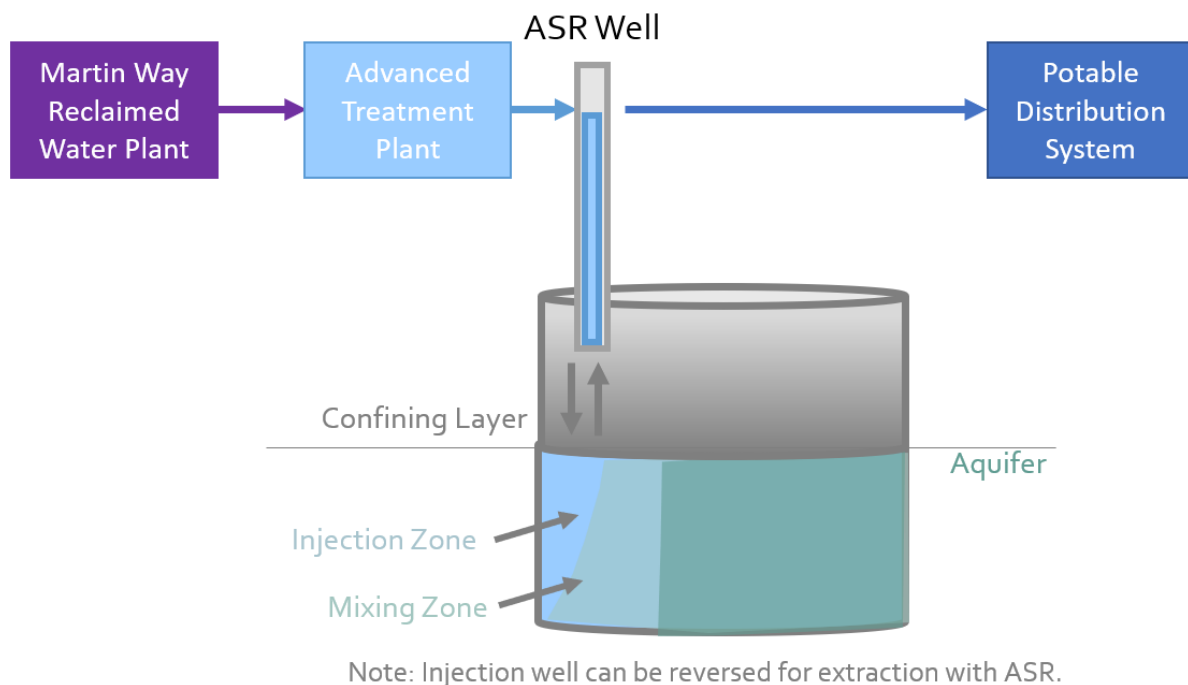


Figure 5.6 Alternative 3b - Potable ASR

5.4.4 Comparison of Alternatives

When comparing the three alternatives described, key features and concerns of each potable reuse approach should be considered. These alternatives are further described below and in Table 5.12. While each of the alternatives have been eliminated due to some sort of fatal flaw associated with water rights, the technical comparison of the alternatives is presented.

Table 5.12 Comparison of Potable Reuse Alternatives Evaluated

Alternative	Treatment Process	Pros	Cons
Alternative 1	Traditional WTP	More affordable	Larger surface area required typically
Alternative 2	a) RO	Smaller surface area; high removal of chemical constituents	More expensive than Alternatives 1 and 2b; brine disposal
	b) Ozone, biofiltration, and GAC	Smaller surface area	More expensive than Alternative 1; possible TOC removal challenges
Alternative 3	RO	Smaller surface area; high removal of chemical constituents	Most expensive; brine disposal

Notes:

WTP - water treatment plant.

For Alternative 1, the utilization of the vadose zone with additional travel time could provide treatment to non-potable water without the need for an advanced treatment plant. However, Alternative 1 provides the least pathogen log reduction available for all alternatives. Alternative 1 will most likely provide the most cost-effective treatment option when comparing the cost per gallon.

For Alternative 2, two different treatment options posed different challenges. Alternative 2a applies RO which creates a high concentration brine equivalent to 15 percent of influent flow requiring disposal. Alternative 2b applies ozone, biofiltration, and GAC yet would require additional feasibility analysis to verify the target TOC concentration (1 mg/L) may be met. Alternative 2a and 2b provide 12-log pathogen removal which is higher than Alternative 1 and equivalent to Alternative 3.

For Alternative 3, an advanced treatment plant would be required prior to direct recharge into potable groundwater as well as a water treatment plant after extraction; therefore, this may be the most expensive option available. An RO or possibly nanofiltration system would reach desired treatment level. Similar to Alternative 2a, RO brine disposal may pose challenges.

Overall, Alternative 1 provides the most cost-effective treatment scenario, if feasible. Additionally, Alternative 2b provides greater pathogen removal without the challenge of RO brine disposal.

If any of these alternatives are desired, then further discussions with Department of Ecology and LOTT will be required. Due to the limited amount of reclaimed water available on a year-round basis as discussed in Chapter 3, no recommendations are included for the further development of potable reuse at this time. It is recommended that the City review this information once sufficient reclaimed water supplies are available to the City to consider implementation of such a project.

5.5 References

- Baronti et al., 2000. Baronti, C., Curini, R., D'Ascenzo, G., Di Corcia, A., Gentili, A., & Samperi, R. (2000). Monitoring natural and synthetic estrogens at activated sludge sewage treatment plants and in a receiving water. *Environmental Science & Technology*, 5059-5066.

- CDPH, 2014. California Department of Public Health (CDPH), 2014. Groundwater Replenishment Reuse Regulations, June 2014.
- Gastélum et al, 2009. Gastélum, Jesús, Mario Lluria, and Gary G. Small. "Vadose zone recharge wells: Ten years later at the City of Scottsdale's water campus facility." Arizona Hydrological Society 2009 Annual Water Symposium Proceedings. 2009.
- Hogg et al, 2012. Hogg, S. Lau-Staggs, R. Uota, D., Salveson, A., Fontaine, N. Swanback, S., Macket, E. Danielson, R. and Cooper, R., 2020. Demonstration of Filtration and Disinfection Compliance through Soil-Aquifer Treatment. WaterReuse Research Foundation Project 10-10, Final Report.
- Intertox, 2020. *Screening-Level Evaluation for the Human Health Risk Assessment – LOTT Clean Water Alliance Reclaimed Water Infiltration Study*. Prepared for LOTT.
- Lindne, Salveson & Thurston, 2012. Linden, K., Salveson, A., & Thurston J. (2012). *Study of Innovative Treatments for Reclaimed Water*. Washington, D.C.: WaterReuse Research Foundation Project No. 02-009.
- Lovins, Taylor, & Hong, 2002. Lovins, III, W., Taylor, J., & Hong, S. (2002). Microorganism Rejection by Membrane Systems. *Environmental Engineering Science*, 19(2), 453-465.
- Metcalf and Eddy, Inc, et al., 2007. *Water reuse*. McGraw-Hill Professional Publishing.
- Orlowski et al, 2020. D. Orlowski, K. Janssen, M. Kohlbecker, 2020. City of Lacey Reclaimed Water Master Plan – Reclaimed Water ASR Pre-Feasibility Evaluation (updated 9/2020), Final Report.
- Salveston et al., 2010. Salveson, A., Brown, J., Zhou, Z., & Lopez, J. (2010). *Monitoring for microconstituents in an advanced wastewater treatment facility and modeling discharge of reclaimed water to surface canals for Indirect Potable Reuse*. Washington, D.C.: WaterReuse Research Foundation Project No. 06-019.
- Schafer, A., Fane, A., & Waite, T. (2005). *Nanofiltration, Principles and Applications*. Elsevier.
- Sedlak, D., & Kavanaugh, M. (2006). *Removal and destruction of NDMA and NDMA precursors during wastewater treatment*. Alexandria, VA: WaterReuse Research Foundation Project 01-002.
- Snyder et al, 2012. Snyder, S., von Gunten, U., Amy, G., Debroux, J., & Gerrity, D. (2012). *Identifying hormonally active compounds, pharmaceuticals, and personal care product ingredients of health concern from potential presence in water intended for Indirect Potable Reuse*. Alexandria, VA: WaterReuse Research Foundation Project No. 08-05.
- Steinle-Darling, E., Litwiller, E., & Reinhard, M. (2010). Effects of sorption on the rejection of trace organic contaminants during nanofiltration. *Environmental Science & Technology*, 44(7): 2,592-2,598.
- Taylor, J., Lovins, W., & Chen, S. (2002). Emerging Contaminants and Membrane Technology. *Florida Water Resources Journal*.
- SWB, 2017. SWB—State Water Resources Control Board Surface water augmentation using recycled water (SBDDW-16-02) 2017.
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/SurfaceWater_Augmentation_Regulations.shtml
- WSDH, 1997. Washington State Department of Health and Washington State Department of Ecology "Water Reclamation and Reuse Standards" September 1997. Publication #97-23.

CHAPTER 6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter presents a summary of conclusions and recommendations outlined in the previous chapters. The planning and development of the capital improvement plan are focused on the City's goals to identify the best future applications for reclaimed water. Plans listed in this chapter consider ground and elevated storage, retrofit pump stations, and implementation of new pump stations.

6.2 Summary of Recommendations

This section summarizes the conclusions and recommendations for the City. Highlighted in the summary are the recommendations for the City's reclaimed water supply, potable reuse, and reclaimed water distribution system.

6.2.1 Reclaimed Water Supply Recommendations

The City of Lacey expects to see an increase in the availability of reclaimed water for uses other than environmental mitigation, summarized in Chapter 3. Based on these projections, the City should strongly consider improving their reclaimed water supply by working with LOTT to explore options for adding an equalization basin at Martin Way Reclaimed Water Plant (MWRWP) and expanding MWRWP to increase the production capacity of reclaimed water.

Because LOTT owns and operates the facilities that would be expanded and upgraded, it is recommended that the City and LOTT explore how to accelerate the implementation of these projects, and how to incorporate any additional treatment requirements.

For the foreseeable future, the available water at MWRWP will be used for environmental mitigation with recharge at the Woodland Creek Basin. Once there is sufficient reclaimed water available, then the City could consider other potential projects, such as potable reuse or a reclaimed water distribution system.

6.2.2 Potable Reuse Recommendations

With the limited amount of reclaimed water currently available on a year-round basis, summarized in Chapter 3, the development of potable reuse is not recommended at this time. Once there is sufficient water available, the City can consider implementation of a potable reuse project. The City will need to review the information summarized in Chapter 5 and the regulations in place at that time to determine the feasibility of such a project.

6.2.3 Reclaimed Water Distribution System Recommendations

Constructing and expanding a reclaimed water distribution system is another option for the City once there are sufficient reclaimed water supplies available. If the City is to proceed with upgrading the reclaimed water distribution system, it is recommended to implement either Alternative 1 or Alternative 3 as described in Chapter 4. Completing the project in two phases would be the most effective way to deliver the project. Phase 1 will focus on the northern section of the system, where a large portion of the upgrades will take place. The Phase 1 project will include the installation of the north section of pipeline, construction of a new storage tank (standpipe or elevated), construction of a new pump station or the retrofit of an existing pump station, and the installation of chlorine analyzers and control valves. Phase 1 recommendations will also connect customers to the upgraded system. Phase 2 of the project will focus on the southern section of the system. This phase will include the installation of the south section of pipeline.

The implementation of these recommendations to the reclaimed water system will be costly. The cost of reclaimed water systems is much higher per gpm of flow than the new sources of recommended supply from the WSP. The cost per gpm for new sources like wells and treatment facilities ranged from \$5,000 to \$15,250. The cost per gpm for reclaimed water distribution system upgrades ranged from approximately \$29,000 to \$56,000 depending on the capacity and alternative selected.

6.3 Conclusion

The primary focus of the recommendations of this RWP is centered around the equalization of reclaimed water supply based on the margin for environmental mitigation and the expansion of Martin Way Reclaimed Water Plant. Once the expansion of MWRWP is completed and additional reclaimed water is available, the City should review the current water supply and regulatory situation. Based on any new findings, the City can decide on whether development of non-potable reuse or potable reuse options are economically viable.

APPENDIX A

RECLAIMED WATER AGREEMENTS AND PERMITS

- Cities of Lacey and Olympia, 2008, Interlocal Agreement between the City of Lacey and the City of Olympia for Water Rights Mitigation, October.
- City of Olympia, 2020, Exhibit B – Class A Reclaimed Water Service Agreement. End User Agreement Template.
- LOTT Clean Water Alliance and City of Lacey, 2008, Reclaimed Water Supply Agreement between the LOTT Clean Water Alliance and the City of Lacey Regarding the Martin Way Reclaimed Water Plant.
- LOTT Clean Water Alliance and the City of Lacey, 2014, Master Interlocal Agreement Between LOTT Clean Water Alliance and City of Lacey, May.
- LOTT Clean Water Alliance, City of Lacey, and City of Olympia, 2019, Reclaimed Water Coordination, Shared Objectives and Communication Procedures, July.
- LOTT Clean Water Alliance, Thurston County, and the Cities of Lacey, Olympia, and Tumwater, 2019, Exhibit A (Revised) to the General Interlocal Agreement Between the LOTT Clean Water Alliance, Thurston County and the Cities of Lacey, Olympia and Tumwater for Distribution and Use of Reclaimed Water – Reclaimed Water Distribution Methodology, December.
- LOTT Clean Water Alliance, Thurston County, and the Cities of Lacey, Olympia, and Tumwater, 2020, General Interlocal Agreement Between the LOTT Clean Water Alliance, Thurston County and the Cities of Lacey, Olympia and Tumwater for Distribution and Use of Reclaimed Water, August 13.
- LOTT Clean Water Alliance, Thurston County, and the Cities of Lacey, Olympia, and Tumwater, 2020, Reclaimed Water Distribution Agreement No. 2 Between the LOTT Clean Water Alliance, Thurston County and the Cities of Lacey, Olympia and Tumwater, August 13.
- LOTT Clean Water Alliance and the City of Lacey, 2020, Reclaimed Water Supply Agreement Between the LOTT Clean Water Alliance and the City of Lacey Regarding the Martin Way Reclaimed Water Plant, August 13.
- LOTT Wastewater Alliance, 1999, Interlocal Cooperation Act Agreement for Wastewater Management by the LOTT Wastewater Alliance, November 5.
- LOTT Wastewater Alliance, Thurston County, and the Cities of Lacey, Olympia, and Tumwater, 2005, Reclaimed Water Distribution Agreement No. 1 Between the LOTT Wastewater Alliance, Thurston County and the Cities of Lacey, Olympia and Tumwater, January 13.
- State of Washington Department of Ecology, 2011, Reclaimed Water Permit Number ST 6206 for Martin Way Reclaimed Water Plant (Modified in July 2013), August.

Interlocal Agreement between the City of Lacey and the City of Olympia for Water Rights Mitigation

THIS AGREEMENT is made and entered into this 10th day of October, 2008, by and between, the City of Olympia, a Washington municipal corporation ("Olympia"), and the City of Lacey, a Washington municipal corporation ("Lacey"), collectively referred to herein as "the Parties."

WHEREAS Olympia and Lacey are expanding Group A water purveyors in the State of Washington, and

WHEREAS Olympia and Lacey have planned under the Growth Management Act to accommodate future population growth within a defined boundary known as the Urban Growth Area, and

WHEREAS Lacey has submitted water right applications G2-29165, 2226 acre-feet per year (afy) (12/16/94); G2-29304, 1000 afy (9/20/95); G2-30249, 600 afy (04/28/05); G2-30248, 1066 afy (05/03/05); G2-30250, 1000 afy (05/06/05); and G2-30251, 1500 afy (05/06/05) to meet, in part, its Growth Management responsibilities to accommodate this future population, and

WHEREAS Olympia has applied to transfer its McAllister Springs water rights certificates 8030, 25 cubic feet per second (cfs) (09/15/95) and S2- 01105, 5.33 cfs, (09/15/95), and Abbott Springs water right permit 10191, 10 cfs (09/15/95) to a new well field known as McAllister Wellfield in order to secure a more protected source of water supply and accommodate future population growth, and

WHEREAS Olympia and Lacey's water right applications listed above are for withdrawing groundwater from a common hydrogeographic area, and

WHEREAS Olympia and Lacey have used the best available science to quantify predicted impacts from these water right applications to surface water, and

WHEREAS Olympia and Lacey must develop mitigation plans to submit to the Department of Ecology to mitigate these predicted impacts, and

WHEREAS Olympia and Lacey have agreed that it is mutually beneficial to jointly mitigate some of said predicted impacts to existing water resources and senior water right holders,

NOW, THEREFORE, it is hereby agreed between the parties as follows:

- 1) Lacey and Olympia will work together in a cooperative manner for the purpose of mitigating predicted impacts to water resources in the development of new water rights and resulting groundwater withdrawals. This generally means that the two cities will develop mitigation plans which complement one another, share drafts of these plans, and jointly work on mitigation projects where feasible and practical.
- 2) Lacey and Olympia will work together in a cooperative manner for the purpose of mitigating predicted impacts in the Woodland Creek basin resulting from exercising the water rights covered under Lacey and Olympia's water right applications identified above and shown in Attachments D and E. In general, after discussions with the Washington State Department of Ecology (DOE), the Washington State Department of Fish and Wildlife (WFW), the Nisqually Indian Tribe and the Squaxin Island Indian Tribe, the Parties will mitigate predicted impacts to Hicks Lake, Pattison Lake, Long Lake (collectively referred to as the "Tri-Lakes") and Woodland Creek by infiltrating Class A reclaimed water at a location or locations downstream from the outlet of Long Lake. If possible and practical, these location(s) would be upstream of the point where Woodland Creek passes beneath Martin Way. The total amount of mitigation for both Olympia and Lacey would be based on maximum annual predicted impacts as listed in Attachment "B".
 - a) Lacey agrees to design, obtain the necessary permits and construct all necessary facilities to infiltrate Class A reclaimed water to mitigate the predicted impacts of both Olympia's and Lacey's water right applications on Woodland Creek and the Tri-Lakes as defined in Attachment B.. Lacey shall submit the proposed pre-design and design, including any associated cost estimates, to Olympia for its review and approval before proceeding to the design and construction phases, respectively. Olympia will use best efforts to review and provide comments on the proposed pre-design and design within sixty (60) days of receipt. Final approval from Olympia will be provided in writing to Lacey after completion of any necessary amendments to the pre-design or design.
 - b) The Cities will jointly pay for the pre-design, design and construction of said reclaimed water infiltration facilit(ies) and all infrastructure needed to convey reclaimed water to the facilit(ies), and property acquisition, if needed, for siting the facility(ies). The Parties will pay a pro-rata share of costs based on predicted depletions as defined in Attachment B. The proceeds of any grants or other donations for the project obtained by either Lacey or Olympia will be deducted from the project costs before the cost

shares are calculated. Olympia will reimburse Lacey based on invoices setting forth in detail actual costs incurred. Olympia will pay undisputed items within thirty (30) days of receipt of invoices from Lacey.

- c) The source of reclaimed water will be the Martin Way Reclaimed Water Plant owned by the LOTT Alliance. The parties will use their respective shares of reclaimed water from the Martin Way Reclaimed Water Plant to mitigate their respective predicted impacts to the Tri-Lakes and Woodland Creek.
- d) Lacey and Olympia will share the cost of operation and maintenance of mitigation facility(ies) based on the same pro-rata basis outlined in paragraph 2(b). Lacey will be responsible for operating and maintaining the facilities in order to ensure on-going compliance with all related water right conditions. The details of the operation and maintenance responsibilities and oversight, as well as cost tracking, payment and other administrative issues will be addressed in a separate agreement to be negotiated by the Cities before the reclaimed water infiltration facilities are made operational.
- e) The ownership of the reclaimed water infiltration facilities will be held jointly by the Parties. Any property purchased by both Parties for the facility as provided under paragraph 2(b) will be jointly owned by both Parties. Property used for the reclaimed water infiltration facility(ies) that is not jointly purchased will not be considered jointly owned by the Parties as a result of this agreement.
- f) The Parties intend to create the ability for the reclaimed water infiltration facility to be expanded in the future to provide additional mitigation as needed. When requested by either party, the Parties agree to enter into good faith negotiations to reach agreement on the conditions of any facility expansion.
- g) As additional mitigation for Lacey and Olympia's respective water right applications, Lacey and Olympia agree to purchase or obtain easements for certain land along Woodland Creek as defined in Attachment "A" that will increase the riparian boundary protection for the Creek. Lacey and Olympia will both maintain an ownership interest in the lands and/or easements to be acquired. Lacey will perform necessary activities to acquire such land or easements defined in Attachment "A". If the Parties determine that condemnation action is necessary to acquire the identified properties, the Parties agree to enter into good faith negotiations to

outline the terms of a joint condemnation action. Olympia and Lacey agree to share the costs of such land or easement acquisition including administrative and legal costs based on the same pro-rata basis outlined in paragraph 2(b).

- h) The Cities will jointly develop consistent language on the proposed joint mitigation for Woodland Creek and Tri-Lakes (including reclaimed water infiltration and land/conservation easement acquisition) in their respective Mitigation Plans submitted to the Washington State Department of Ecology (Ecology).
 - i) All actions necessary to implement the Woodland Creek and Tri-Lakes mitigation as defined in paragraph 2 must be completed by Lacey no later than the date upon which Olympia has reduced its withdrawals from McAllister Springs by at least 5 cfs.
 - j) Olympia's mitigation requirement for Woodland Creek is not expected to require Olympia's full allocation of reclaimed water from the Martin Way Reclaimed Water Plant. At its discretion, Olympia may allow Lacey to utilize the unused portion of Olympia's allocation for water rights mitigation in Woodland Creek, until capacity at the Martin Way Reclaimed Water Plant is expanded beyond its current capacity of 2 million gallons per day. The terms of Lacey's temporary use of Olympia's allocation of reclaimed water will be addressed in a separate agreement.
- 3) The Olympia McAllister Wellfield Numerical Groundwater model predicts that Lacey's six water right applications found in Attachment D will have impacts to Olympia's senior water rights at McAllister Springs, as outlined in Attachment C. It is therefore agreed as follows:
- a) Olympia agrees not to protest or appeal Lacey's groundwater right permit G2-29304 for an additional 1000 AFY and 400 gallons per minute (gpm) for Lacey's Evergreen Estates well or Lacey's groundwater right permit G2-30249 for an additional 600 AFY for Lacey's Betti Well if the mitigation conditions outlined in this subsection 3(a) are included in the final water right permit conditions imposed by Ecology. Lacey agrees that its mitigation plan for permits G2-29304 and G2-30249 will provide that Lacey will eliminate its maximum summer (June through September) impacts to McAllister Creek and Olympia's senior water rights at McAllister Springs by restricting monthly pumping of the Evergreen Estates well to current levels, defined as the volumes used in the model baseline for the Evergreen Estates well for the months of June through September as outlined in Attachment 'F'. This mitigation requirement for the predicted impacts to McAllister

Springs will be in place until Olympia reduces its withdrawals from McAllister Springs by at least 5 cfs as a result of Olympia transferring its water withdrawals to the McAllister Wellfield. Lacey shall provide pumping records documenting this mitigation to Olympia on a monthly basis during this mitigation timeframe. If Olympia's application to transfer its McAllister Springs water rights to a new wellfield known as McAllister Wellfield is denied or not finally approved substantially in the form requested by Olympia, Lacey shall, in lieu of restricting the monthly pumping of the Evergreen Estates well, deed to Olympia within six (6) months sufficient water rights to fully mitigate the effect on McAllister Springs of the exercise by Lacey of the rights granted under permits G2-29304 and G2-30249. The total water rights to be deeded for such purpose will be 106.18 afy (Betti Well mitigation 14.48 afy plus Evergreen Estates mitigation 90.70 afy equals 106.18 afy). The Parties agree to negotiate in good faith the selection of the water rights to be deeded to Olympia. The main factors the Parties will consider in the selection of the water rights will be: 1) avoiding the need to change or transfer a water right through the Department of Ecology process; 2) the relative ease and viability of a water right change or transfer if such application is needed; 3) avoiding or minimizing any requirement for providing mitigation in the change or transfer application; and 4) minimizing cost and expense by the Parties.

- b) Olympia agrees not to protest or appeal Lacey's groundwater right permit G2-30248 for an additional 1066 AFY from Lacey's Hawks Prairie Well #2, if the mitigation conditions outlined in this subsection 3(b) are included in the final water right permit conditions imposed by Ecology. Lacey agrees that its mitigation plan for permit G2-30248 will provide that Lacey will compensate Olympia for impacts to Olympia's senior water rights at McAllister Springs by paying Olympia for an additional 30,240 gallons per day of peak capacity (July through October) through an amendment of the Intergovernmental Agreement for Sale of Water between City of Olympia and City of Lacey dated May 1, 2007. This mitigation requirement for the predicted impacts to McAllister Springs will be in place when the Hawks Prairie Well #2 is in operation, and until Olympia reduces its withdrawals from McAllister Springs by at least 5 cfs as a result of Olympia transferring its water withdrawals from McAllister Springs to the McAllister Wellfield. If Olympia's application to transfer its McAllister Springs water rights to a new wellfield known as McAllister Wellfield is denied or not finally approved substantially in the form requested by Olympia, Lacey shall, in lieu of the purchase of water, deed to Olympia within six (6) months sufficient water rights to fully mitigate the effect on McAllister Springs of the

exercise by Lacey of the rights granted under permit G2-32048. The total water rights to be deeded for such purpose will be 24.14 afy. The Parties agree to negotiate in good faith the selection of the water rights to be deeded to Olympia. The main factors the Parties will consider in the selection of the water rights will be: 1) avoiding the need to change or transfer a water right through the Department of Ecology process; 2) the relative ease and viability of a water right change or transfer if such application is needed; 3) avoiding or minimizing any requirement for providing mitigation in the change or transfer application; and 4) minimizing cost and expense by the Parties.

- c) Olympia agrees not to protest or appeal Lacey's groundwater right permit G2-30251 for an additional 1500 AFY from Lacey's Marvin Road Well, if the mitigation conditions outlined in this subsection 3(c) are included in the final water right permit conditions imposed by Ecology. Lacey agrees that its mitigation plan for permit G2-30251 will provide that Lacey will compensate Olympia for impacts to Olympia's senior water rights at McAllister Springs by paying Olympia for an additional 38,880 gallons per day of peak capacity (July through October) through an amendment of the Intergovernmental Agreement for Sale of Water between City of Olympia and City of Lacey dated May 1, 2007. This mitigation requirement for the predicted impacts to McAllister Springs will be implemented by Lacey when the Marvin Road Well is in operation, and until Olympia reduces its withdrawals from McAllister Springs by at least 5 cfs as a result of Olympia transferring its water withdrawals from McAllister Springs to the McAllister Wellfield. If Olympia's application to transfer its McAllister Springs water rights to a new wellfield known as McAllister Wellfield is denied or not finally approved substantially in the form requested by Olympia, Lacey shall, in lieu of the purchase of water, deed to Olympia within six (6) months sufficient water rights to fully mitigate the effect on McAllister Springs of the exercise by Lacey of the rights granted under permit G2-32051. The total water rights to be deeded for such purpose will be 28.96 afy. The Parties agree to negotiate in good faith the selection of the water rights to be deeded to Olympia. The main factors the Parties will consider in the selection of the water rights will be: 1) avoiding the need to change or transfer a water right through the Department of Ecology process; 2) the relative ease and viability of a water right change or transfer if such application is needed; 3) avoiding or minimizing any requirement for providing mitigation in the change or transfer application; and 4) minimizing cost and expense by the Parties.
- d) After Ecology's final approval and the completion of any appeals of Olympia's water right transfer applications for McAllister Springs

and Abbott Springs, Olympia agrees not to protest or appeal Lacey's water right applications G2-29165, 2226 afy (12/16/94) Madrona; and G2-30250, 1000 afy (05/03/05) Meridian Campus, or permits issued under these application numbers.

- 4) Lacey agrees not to protest or appeal Olympia's transfer of water rights from McAllister Springs 8030 (25 cfs) and S2- 01105 (5.33 cfs) and Abbott Springs 10191 (10 cfs) to the new McAllister well field.
- 5) This agreement is effective upon execution, and shall remain in effect as long as any mitigation requirements covered in this agreement are applicable, unless terminated or modified by mutual agreement of the Parties.
- 6) Olympia may terminate this agreement in the event that the applications to transfer water right certificates 8030 and S2- 01105 and water right permit 10191 have not been finally approved (i.e., all appeals successfully resolved and beyond the time for any further appeal) substantially in the form and content as requested by Olympia by September 15, 2009.
- 7) Lacey may terminate this agreement in the event that the applications to transfer water right applications G2-29165, G2-29304, G2-30249, G2-30250, G2-30251 and G2-30248 have not been approved (i.e., all appeals successfully resolved and beyond the time for any further appeal) substantially in the form and content as requested by Lacey by September 15, 2009.
- 8) Before either party terminates the agreement pursuant to paragraph 6 or 7 above, the Parties agree to meet and confer in good faith to modify or amend this agreement.
- 9) The Parties agree to the following Dispute Resolution Process:
 - a) Step One – Negotiation. In the event of a dispute concerning any matter pertaining to this Agreement, the Parties involved shall attempt to adjust their differences by informal negotiation. The Party perceiving a dispute or disagreement persisting after informal attempts at resolution shall notify the other Parties in writing of the general nature of the issues. The letter shall be identified as a formal request for negotiation and shall propose a date for representatives of the Parties to meet. The other Parties shall respond in writing within ten (10) business days. The response shall succinctly and directly set out that Party's view of the issues or state that there is no disagreement. The Parties shall accept the date to meet or shall propose an alternate meeting date not more than ten (10) business days later than the date

proposed by the Party initiating dispute resolution. The representatives of the Parties shall meet in an effort to resolve the dispute. If a resolution is reached the resolution shall be memorialized in a memorandum signed by all Parties which shall become an addendum to this Agreement. Each Party will bear the cost of its own attorneys, consultants, and other Step One expenses. Negotiation under this provision shall not exceed 90 days. If a resolution is not reached within 90 days, the Parties shall proceed to mediation.

- b) Step Two – Mediation. If the dispute has not been resolved by negotiation within ninety (90) days of the initial letter proposing negotiation, any Party may demand mediation. The mediator shall be chosen by agreement. Each Party will bear the cost of its own attorneys, consultants, and other Step Two expenses. The parties to the mediation will share the cost of the mediator. A successful mediation shall result in a memorandum agreement which shall become an addendum to this Agreement. Mediation under this provision shall not exceed 90 days. If the mediation is not successful within 90 days, the Parties may proceed to litigation.
- c) Step Three – Litigation. Unless otherwise agreed by the Parties in writing, Step One and Step Two must be exhausted as a condition precedent to filing of any legal action. A Party may initiate an action without exhausting Steps One or Two if the statute of limitations is about to expire and the Parties cannot reach a tolling agreement, or if either Party determines the public health, safety, or welfare is threatened.

10) General Conditions

- a) No separate legal entity is created by this agreement.
- b) No joint organization whatsoever is created.
- c) No common budget is to be established.
- d) This agreement shall be recorded with the Thurston County Auditor's Office prior to being effective.
- e) Each party shall be responsible for its own finances and for its own personal or real property.
- f) All lawsuits whatsoever in regards to this agreement shall be brought in Thurston County Superior Court. The governing law shall be the laws of Washington State.

- g) The Contract Administrator for Olympia shall be the Director of Water Resources of the City of Olympia, Department of Public Works. The Contract Administrator for Lacey shall be Water Resources Manager of the City of Lacey, Department of Public Works.
- h) All notices with regard to this agreement shall be sent in addition to any other legal requirement to:

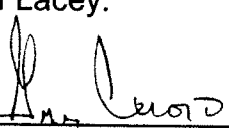
City of Olympia:

Department of Public Works
Attn: Director of Water Resources
Re: Mitigation Agreement with City of Lacey
P. O. Box 1967
Olympia WA, 98507

City of Lacey:

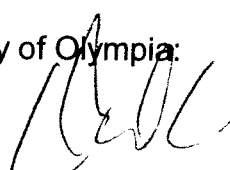
Water Resources Manager
City of Lacey, Department of Public Works
P.O. Box 3400
Lacey, WA 98509

City of Lacey:



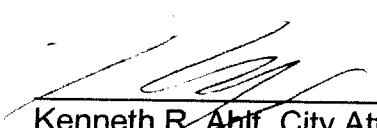
By: Greg J. Cuoio
Its: City Manager

City of Olympia:



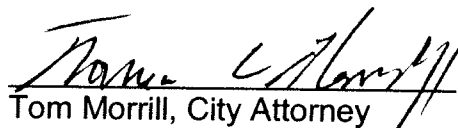
By: Doug Mah
Its: Mayor

Approved as to form:



Kenneth R. Ahlf, City Attorney

Approved as to form:

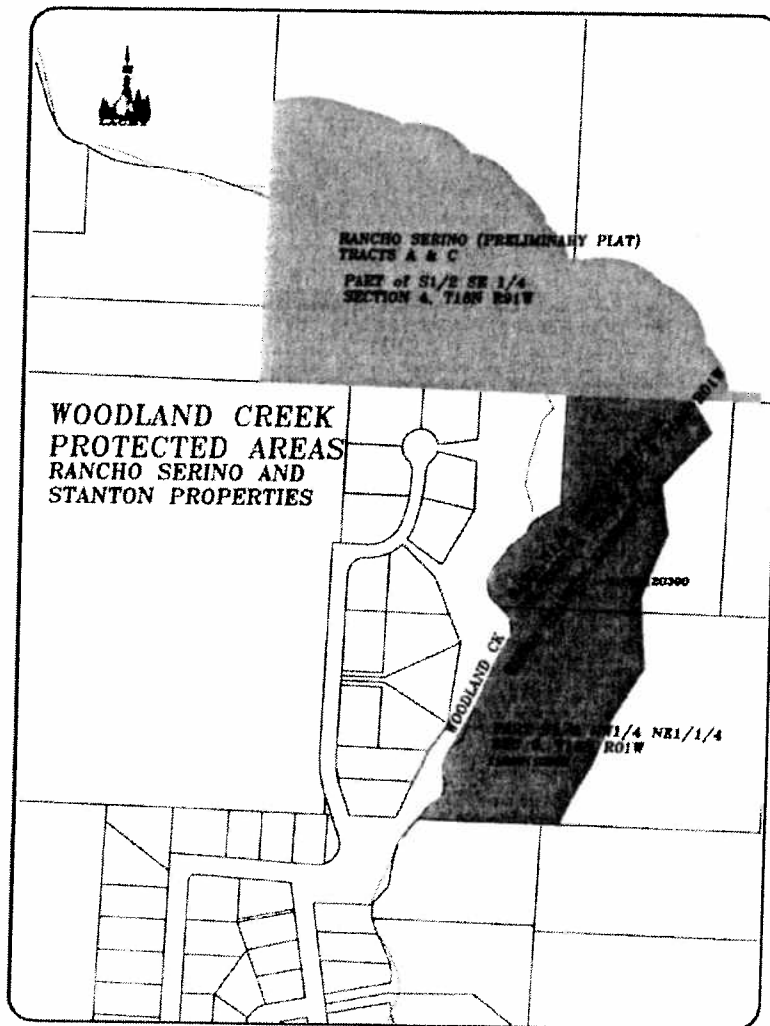


Tom Morrill, City Attorney

Attachment 'A'

Woodland Creek Buffer Property Acquisition List

<u>Property Name</u>	<u>Acreage</u>
1. Rancho Serino Wetland and Buffer	19.6 acres
2. Eldon Stanton Easement	12.65 acres



Attachment 'B'
Calculation of Mitigation Quantities for Woodland Creek/Tri-Lakes and Pro-Rata Share of Costs

PARTY	WATER BODY	MAXIMUM ANNUAL IMPACTS (CFS)	MITIGATION QUANTITY (CFS)	PRO RATA SHARE OF COSTS
City of Lacey ¹	Woodland Creek	0.22	1.245	78.3%
	Tri-Lakes/Wetlands	0.61		
	Total Combined	0.83		
City of Olympia ²	Woodland Creek	0.03	0.345	21.7%
	Tri-Lakes/Wetlands	0.20		
	Total Combined	0.23		

¹ Reflects City of Lacey water right applications G2-29304 (Evergreen Estates Well); G2-30249 (Betti Well); G2-29165 (Madrona Wellfield); G2-30248 (Hawks Prairie Well #2); G2-30250 (Meridian Campus); G2-30251 (Marvin Road)

² Reflects City of Olympia water right change applications 8030 and S2- 01105 (McAllister Springs) and 10191 (Abbott Springs)

Attachment 'C'

Impacts to McAllister Springs from Lacey's Water Right Applications As predicted by the McAllister Numerical Model

Application	Max Summer Impact (cfs)	% of groundwater inflow
G2-29165	0.29	1.1
G2-29304	0.19	0.7
G2-30249	0.03	0.1
G2-30248	0.05	0.2
G2-30250	0.05	0.2
G2-30251	0.06	0.2

Attachment 'D'

Water Right Applications for City of Lacey

Application G2-29165 was amended by letter in 2005; current quantities and point of withdrawal are shown in this Affidavit of Publication.

Legal # 1947

Affidavit of Publication

STATE OF WASHINGTON

County of Thurston County

ss.

The undersigned being first duly sworn on oath depose and says:
That she is the Principal Clerk of The Olympian which is a legal newspaper printed and published in the city of Olympia, Thurston County, Washington: of general circulation in said City, County and State;

that the

Notice of Application to Appropriate Public Waters

In the case of

Application No. G2-29165 -- City of Lacey

of which the attached is a printed copy, was published in said newspaper:

On the	30th	day of	August	2005
the	6th	day of	September	2005
the		day of		2005
the		day of		2005
the		day of		2005
the		day of		2005

that the said newspaper was generally circulated during all of said time, and has been published for more than six months prior to the dates of the publication of this legal document, and that said notice was published in the newspaper proper and not in supplement form.

The amount of fee charged for this publication **\$174.00**

Legal #1947
STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
AMENDED
NOTICE OF APPLICATION
TO APPROPRIATE
PUBLIC WATERS

TAKE NOTICE:

That City of Lacey, on December 16, 1994, under Application No. G2-29165 filed for a permit to appropriate public waters, subject to existing rights, from a well (Madrona Well) in the amount of 2000 gallons per minute, 2226 acre feet per year as needed year round each year for municipal supply. The source of the proposed appropriation is located within the NW1/4NW1/4 of Section 24, T. 18 N., R. 1 W.W.M., of Thurston Co., WA.

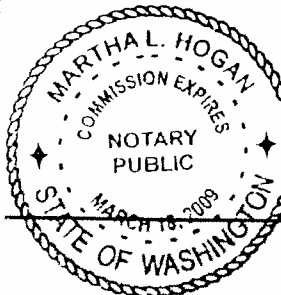
Protests of objections to approval of this application must include a detailed statement of the basis for objections; protests must be accompanied by a fifty dollar (\$50.00) recording fee and filed with the Department of Ecology, at the address shown below, within thirty (30) days from: September 2, 2005
Department of Ecology, SWRO
P.O. Box 47775
Olympia, WA 98504-7775

Publish: August 30,
September 6, 2005

Lou Nelson
Principal Clerk

Subscribed and sworn to me this 6th day of

September 2005



Martha L. Hogan
Notary Public in and for the State of Washington
Residing at Olympia, Thurston County, Washington

The Olympian has been appointed as a legal newspaper by order of the Superior Court of the State of Washington for Thurston County, dated July 10, 1941, in the county in which said newspaper is published in accordance with RCW 65.16.020 and RCW 63.16.040.

Note - The above affidavit and fee is in compliance with RCW 63.16.030 and Sec. 3, Chapter 34, Laws of 1977.

APPLICATION FOR PERMIT

TO APPROPRIATE PUBLIC WATERS OF THE STATE OF WASHINGTON

☐ SURFACE WATER ☒ GROUND WATER

\$10.00 MINIMUM STATUTORY EXAMINATION FEE REQUIRED WITH APPLICATION

(GRAY BOXES FOR OFFICE USE ONLY)



APPLICATION NO. G-2-29165	W.R.I.A. 13	COUNTY Thurston	PRIORITY DATE 12-16-94	TIME 5:58	ACCEPTED 8
APPLICANT'S NAME - PLEASE PRINT City of Lacey					Bus. Tel. (206) 438-2648
					Home Tel.
					Other Tel.

ADDRESS (STREET) P.O. Box 'B'	(CITY) Lacey	(STATE) WA	(ZIP CODE) 98503-0507
DATE & PLACE OF INCORPORATION IF APPLICANT IS A CORPORATION			

SOURCE OF SUPPLY	
IF SURFACE WATER SOURCE (NAME OF STREAM, LAKE, SPRING, ETC.) (IF UNNAMED, SO STATE) as required by SEPA and find that IT IS: ☐ not an "action". ☒ categorically exempt.	IF GROUND WATER SOURCE (WELL, TUNNEL, INFILTRATION TRENCH, ETC.) Well(s) (2 wells TW 2) SIZE AND DEPTH See 7. Remarks
1/3/95 DATE AS SIGNATURE	USE

USE TO WHICH WATER IS TO BE APPLIED (DOMESTIC SUPPLY, IRRIGATION, MINING, MANUFACTURING, ETC.)

Municipal supply	QUANTITY OF WATER STATED USING UNITS OF:	CUBIC FEET PER SECOND (CFS)	OR	GALLONS PER MINUTE (GPM)	ACRE FEET PER YEAR
				2000 to 10,000 (Max for this application)	2226 6,600 (Primary) and 5000 (Supplemental) to all existing as well as any new water rights
TIMES DURING YEAR WATER WILL BE REQUIRED Year round					

IF IRRIGATION, NUMBER OF ACRES	IF DOMESTIC USE, NUMBER OF UNITS BY TYPE, E.G. 1-HOME, 1-MOBILE HOME, 2-CAMPSITES, ETC.	IF MUNICIPAL USE, ESTIMATED POPULATION 20 YEARS FROM TODAY
DATE PROJECT WAS OR WILL BE STARTED 1995	DATE PROJECT WAS OR WILL BE COMPLETED approximately 2015	52,900 - 20 year projection

I. LOCATION OF POINT OF DIVERSION/WITHDRAWAL					
A. IF IN PLATTED PROPERTY					
LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)	SECTION	TOWN	RANGE
ALSO, PLEASE ENCLOSE A COPY OF THE PLAT AND MARK THE POINT(S) OF WITHDRAWAL OR DIVERSION					

B. IF NOT IN PLATTED PROPERTY

ON ACCOMPANYING SECTION MAPS, ACCURATELY MARK AND IDENTIFY EACH POINT OF DIVERSION, SHOW NORTH-SOUTH AND EAST-WEST DISTANCES FROM NEAREST SECTION CORNER OR PROPERTY CORNER

See Appendix A (maps) attach hereto for locations

ALSO, ENTER BELOW THE DISTANCES FROM THE NEAREST SECTION OR PROPERTY CORNER TO THE DIVERSION OR WITHDRAWAL.

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION) NE 1/4 Sec 24 (100)	SECTION 24	TOWNSHIP N. 18	RANGE (E. OR W.) W.M. 1 W	COUNTY Thurston
---	----------------------	--------------------------	-------------------------------------	---------------------------

OWN THE LAND ON WHICH THIS SOURCE IS LOCATED. IF NOT, INSERT NAME & ADDRESS OF OWNER

Lands or easements will be acquired by applicant necessary to site wells.

5. LEGAL DESCRIPTION OF PROPERTY ON WHICH WATER IS TO BE USED

ATTACH A COPY OF THE LEGAL DESCRIPTION OF THE PROPERTY (ON WHICH THE WATER WILL BE USED) TAKEN FROM A REAL ESTATE CONTRACT, PROPERTY DEED OR TITLE INSURANCE POLICY. OR, COPY CAREFULLY IN THE SPACE BELOW.

Area served by the City of Lacey water utility (present and future service area) and area

served by other water purveyors in north Thurston County with which wholesale or exchange

1.60' west

WHAT IS YOUR INTEREST IN THE PROPERTY ON WHICH THE WATER IS TO BE USED (PROPERTY OWNER, LESSOR, CONTRACT PURCHASER, ETC.)
 Municipality

ARE THERE ANY EXISTING WATER RIGHTS RELATED TO THE LAND ON WHICH THE WATER IS TO BE USED (INCLUDING WATER PROVIDED BY IRRIGATION DISTRICTS OR DITCH COMPANIES.)

☒ YES ☐ NO

5. FROM WHAT SOURCE (i.e. SURFACE OR GROUND WATER) AND UNDER WHAT AUTHORITY

Exempt wells, expanding and non-expanding water purveyors holding water rights, irrigators

holding water rights (all groundwater)

DESCRIPTION OF SYSTEM PROPOSED OR INSTALLED

FOR EXAMPLE: SIZE OF PUMP, CAPACITY OF PUMP, PUMP MOTOR HORSE POWER, PIPE DIAMETER, NUMBER OF SPRINKLERS, ETC.

Typical well will be about 300 feet deep (sea level aquifer) and will normally be capable of producing 800 GPM or more.

REMARKS

Intent is to integrate all new wells with water right sufficient to meet demands through year 2015 consistent with DOH requirements. Desirable to have integrated water system withdrawal capacity for all wells for system flexibility. (See accompanying letter for amplification)

COMPLETE THIS SECTION ONLY IF THIS APPLICATION INCLUDES IRRIGATION AS A USE

IN ORDER TO IMPLEMENT THE PROVISIONS OF INITIATIVE MEASURE NUMBER 59, THE FAMILY FARM WATER ACT WHICH WAS PASSED BY THE VOTERS ON MARCH 3, 1977, WE MUST ASK THE FOLLOWING QUESTIONS:

DOES THE TOTAL NUMBER OF ACRES IN WHICH YOU HAVE CONTROLLING INTEREST IN THE STATE OF WASHINGTON EXCEED 2000 ACRES FOR THE FOLLOWING THREE CATEGORIES:

1. LANDS THAT ARE BEING IRRIGATED UNDER WATER RIGHTS ACQUIRED AFTER DECEMBER 8, 1977.
2. LANDS THAT MAY BE IRRIGATED UNDER APPLICATIONS NOW ON FILE WITH THE DEPARTMENT OF ECOLOGY.
3. LANDS THAT MAY BE IRRIGATED UNDER THIS APPLICATION.

YES ☐ NO ☐
 YES ☐ NO ☐
 YES ☐ NO ☐

IF 10 ACRE-FEET OR MORE OF WATER IS TO BE STORED AND/OR IF THE WATER DEPTH WILL BE 10 FEET OR MORE AT THE DEEPEST POINT, A STORAGE PERMIT MUST BE FILED IN ADDITION TO THIS PERMIT. THESE FORMS CAN BE SECURED TOGETHER WITH INSTRUCTIONS, FROM THE DEPARTMENT OF ECOLOGY.

SIGNATURES

Cory A. Cull
 APPLICANT'S SIGNATURE
 WATER RESOURCE MGR, CITY OF LACEY

LEGAL LANDOWNERS NAME
 (PLEASE PRINT)

LEGAL LANDOWNER'S SIGNATURE (OWNER OF PROPERTY DESCRIBED IN ITEM NUMBER 5)

LEGAL LANDOWNER'S ADDRESS

FOR OFFICE USE ONLY

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

SS.

This is to certify that I have examined this application together with the accompanying maps and data, and am returning it for correction or completion as follows:

Application G2-29304 was amended by letter in 2005; current quantities and point of withdrawal are shown in this Affidavit of Publication.

Legal # 1946

Affidavit of Publication

STATE OF WASHINGTON

County of Thurston County

SS.

Legal #1946
STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
AMENDED
NOTICE OF APPLICATION
TO APPROPRIATE
PUBLIC WATERS

TAKE NOTICE:

That City of Lacey, on September 20, 1995, under Application No. G2-29304 filed for a permit to appropriate public waters, subject to existing rights, from a well (Evergreen Estates Well) in the amount of 400 gallons per minute, 1000 acre feet per year as needed year round each year for municipal supply. The source of the proposed appropriation is located within the NE1/4NW1/4 of Section 25, T. 18 N., R. 1 W.W.M., of Thurston Co., WA.

Protests of objections to approval of this application must include a detailed statement of the basis for objections; protests must be accompanied by a fifty dollar (\$50.00) recording fee and filed with the Department of Ecology, at the address shown below, within thirty (30) days from: September 2, 2005.
Department of Ecology, SWRO
P.O. Box 47775
Olympia, WA 98504-7775

Publish: August 30,
September 6, 2005

The undersigned being first duly sworn on oath deposed and says: That she is the Principal Clerk of The Olympian which is a legal newspaper printed and published in the city of Olympia, Thurston County, Washington: of general circulation in said City, County and State;

that the

Notice of Application to Appropriate Public Waters

In the case of

Application No. G2-29304 -- City of Lacey

of which the attached is a printed copy, was published in said newspaper:

On the	30th	day of	August	2005
the	6th	day of	September	2005
the		day of		2005
the		day of		2005
the		day of		2005
the		day of		2005

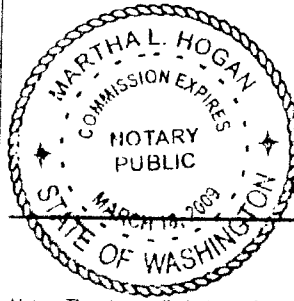
that the said newspaper was generally circulated during all of said time, and has been published for more than six months prior to the dates of the publication of this legal document, and that said notice was published in the newspaper proper and not in supplement form.

The amount of fee charged for this publication \$178.10

Larry Nelson
Principal Clerk

Subscribed and sworn to me this 6th day of

September 2005



Martha L. Hogan
Notary Public in and for the State of Washington
Residing at Olympia, Thurston County, Washington

The Olympian has been appointed as a legal newspaper by order of the Superior Court of the State of Washington for Thurston County, dated July 10, 1941, in the county in which said newspaper is published in accordance with RCW 65.16.020 and RCW 63.16.040.

Note - The above affidavit and fee is in compliance with RCW 63.16.030 and Sec. 3, Chapter 34, Laws of 1977.



For Ecology Use

Fee Paid 10Date 9/21/95

State of Washington

Application for a Water Right

RECEIVED

Please follow the attached instructions to avoid unnecessary delays.

Section 1. APPLICANT - PERSON, ORGANIZATION, OR WATER SYSTEM

Name CITY OF LACEY Home Tel: () -
 Mailing Address P.O. BOX 3400 Work Tel: (360) 438 - 2648
 City LACEY State WA Zip+4 98509 + 3400 FAX: (360) 456 - 7799

Section 2. CONTACT - PERSON TO CALL ABOUT THE APPLICATION

☒ Same as above

Name CORY CREBBIN Home Tel: () -
 Mailing Address _____ Work Tel: () -
 City _____ State _____ Zip+4 _____ + _____ FAX: () -
 Relationship to applicant WATER RESOURCES MANAGER

Section 3. STATEMENT OF INTENT

The applicant requests a permit to use not more than 1,000 (☒ gallons per minute or
☐ cubic feet per second) from a ☐ surface water source or ☒ ground water source (check only one) for the
 purpose(s) of MUNICIPAL WATER SUPPLY. Attach a "legal"
 description of the place of use. (See instructions.) NOTE: A tax parcel number or a plat number is not sufficient.

CITY OF LACEY

Estimate a maximum annual quantity to be used in acre-feet per year: 1,000 AC-FT

☐ Check if the water use is proposed for a short-term project. Indicate the period of time that the water will be needed:

From ___/___/___ to ___/___/___

Section 4. WATER SOURCE

If SURFACE WATER		If GROUNDWATER	
Name the water source and indicate if stream, spring, lake, etc. If unnamed, write "unnamed spring," "unnamed stream," etc.:		A permit is desired for <u>1</u> well(s).	
Number of diversions: _____		TUDY	
Source flows into (name of body of water):		Size & depth of well(s): 16-INCH X 240 FEET	
LOCATION			
Enter the north-south and east-west distances in feet from the point of diversion or withdrawal to the nearest section corner: APPROX 650' N and 400' E of the South Quarter corner			
1/4 of	1/4 of	Section	Township
			Range(E/W)
			County
If location of source is platted, complete below:			
Lot	Block	Subdivision	

Section 5. GENERAL WATER SYSTEM INFORMATION

- A. Name of system, if named: CITY OF LACEY
- B. Briefly describe your proposed water system. (See instructions.)
 SERVICE AREA INCLUDES THE BULK OF THE UGMA FOR THE CITY OF LACEY. THE SERVICE SYSTEM CURRENTLY SERVES A POPULATION OF 34,000. IT IS PROJECTED THAT THE SERVICE POPULATION WILL BE APPROXIMATELY 40,000 BY THE YEAR 2000.
- C. Do you already have any water rights or claims associated with this property or system? ☒ YES ☐ NO
 PROVIDE DOCUMENTATION.

Section 6. DOMESTIC / PUBLIC WATER SUPPLY SYSTEM INFORMATION (Completed for all domestic/public supply uses.)

- A. Number of "connections" requested: 13,000 Type of connection VARIOUS
 (Homes, Apartment, Recreational, etc.)
- B. Are you within the area of an approved water system? ☒ YES ☐ NO
 If yes, explain why you are unable to connect to the system. *Note: Regional water systems are identified by your County Health Department.* WE ARE THE APPROVED SYSTEM.

Complete C. and D. only if the proposed water system will have fifteen or more connections.

- C. Do you have a current water system plan approved by the APPROVAL PENDING
 Washington State Department of Health? ☐ YES ☒ NO
 If yes, when was it approved? _____ Please attach the current approved version of your plan.
- D. Do you have an approved conservation plan? APPROVAL PENDING -DOH HAS REVIEWED ☐ YES ☒ NO
 If yes, when was it approved? _____ Please attach the current approved version of your plan.

Section 7. IRRIGATION/AGRICULTURAL/FARM INFORMATION (Complete for all irrigation and agriculture uses.)

- A. Total number of acres to be irrigated: _____
- B. List total number of acres for other specified agricultural uses:
- | | |
|-----------|-------------|
| Use _____ | Acres _____ |
| Use _____ | Acres _____ |
| Use _____ | Acres _____ |
- C. Total number of acres to be covered by this application: _____
- D. Family Farm Act (Initiative Measure Number 59, November 3, 1977)
 Add up the acreage in which you have a controlling interest, including only:
 ‡ Acreage irrigated under water rights acquired after December 8, 1977;
 ‡ Acreage proposed to be irrigated under this application;
 ‡ Acreage proposed to be irrigated under other pending application(s)
- E. Is the combined acreage greater than 2000 acres? ☐ YES ☐ NO

Section 8. WATER STORAGE

Will you be using a dam, dike, or other structure to retain or store water?

☐ YES ☐ NO

NOTE: If you will be storing 10 acre-feet or more of water and/or if the water depth will be 10 feet or more at the deepest point, and some portion of the storage will be above grade, you must also apply for a reservoir permit. You can get a reservoir permit application from the Department of Ecology.

Section 9. DRIVING DIRECTIONS

Provide detailed driving instructions to the project site.

SOUTH ON MERIDIAN RD
WEST ON 58TH

Section 10. REQUIRED MAP

A. Attach a map of the project. (See instructions.)

Section 11. PROPERTY OWNERSHIP

A. Does the applicant own the land on which the water will be used? ☐ YES ☒ NO
If no, explain the applicant's interest in the place of use and provide the name(s) and address(es) of the owner(s):

MUNICIPAL WATER SYSTEM

MR. & MRS. ROMANO

9220 58TH AVE. SE

OLYMPIA, WA 98503

B. Does the applicant own the land on which the water source is located? ☐ YES ☒ NO
If no, submit a copy of agreement: CURRENTLY WORKING WITH LANDOWNER TO FORGE AGREEMENT.
COPY WILL BE PROVIDED WHEN EXECUTED.

I certify that the information above is true and accurate to the best of my knowledge. I understand that in order to process my application, I grant staff from the Department of Ecology access to the site for inspection and monitoring purposes. Even though I may have been assisted in the preparation of the above application by the employees of the Department of Ecology, all responsibility for the accuracy of the information rests with me.

C.J. GREBBIN

Applicant (or authorized representative)

Date

15 SEP 95

SAME

Landowner for place of use (if same as applicant, write "same")

Date

62-30048

For Ecology Use

Fee Paid _____

Date _____

State of Washington

Application for a Water Right

Please follow the attached instructions to avoid unnecessary delays.

Section 1. APPLICANT - PERSON, ORGANIZATION, OR WATER SYSTEM

Name City of LaceyMailing Address P.O. Box 3400City LaceyState WAZip+4 98504

Home Tel: () _____

Work Tel: (360) 438-2649FAX: (360) 456-7799

Section 2. CONTACT - PERSON TO CALL ABOUT THE APPLICATION

☐ Same as above
Name Dennis RitterMailing Address P.O. Box 3400City LaceyState WAZip+4 98504

Home Tel: () _____

Work Tel: (360) 438-2649FAX: (360) 456-7799Relationship to applicant Public Works Director

and

Name Charles B. Roe, Jr., Perkins Coie LLPMailing Address 111 Market Street NE, Suite 200City OlympiaState WAZip+4 98501

Home Tel: () _____

Work Tel: (360) 956-3300FAX: (360) 956-1208

Section 3. STATEMENT OF INTENT

The applicant requests a permit to use not more than 800 (☒ gallons per minute or ☐ cubic feet per second) from a ☐ surface water source or ☒ ground water source (check only one) for the purpose(s) of Municipal Supply. A "LEGAL" DESCRIPTION OF THE PLACE OF USE IS SET FORTH ON APPENDIX A ATTACHED. (See instructions.) NOTE: A tax parcel number or a plat number is not sufficient. Estimate a maximum annual quantity to be used in acre-feet per year: 1,066

☐ Check if the water use is proposed for a short-term project. Indicate the period of time that the water will be needed:

From ____/____/____ to ____/____/____

Section 4. WATER SOURCE Related to reservation of groundwater set forth in WAC 173-191-070 (Hawks Prairie source area).

If SURFACE WATER	If GROUNDWATER
Name the water source and indicate if stream, spring, lake, etc. If unnamed, write "unnamed spring," "unnamed stream," etc.:	A permit is desired for <u>1</u> well, sometimes known as Lacey Well No. 31 (or Hawks Prairie Well No. 2).
Number of diversions: _____	
Source flows into (name of body of water):	Size & depth of well(s): Proposed well will be 16" diameter and approximately 600 feet below ground surface.

DIVERSION LOCATION

Enter the north-south and east-west distances in feet from the point of diversion or withdrawal to the nearest section corner: Approximately 200 feet east, and 2,200 north, of the southwest corner of Section 35 (not surveyed).

1/4 of	1/4 of	Section	Township	Range(E/W)	County	If location of source is platted, complete below:

Section 5. GENERAL WATER SYSTEM INFORMATION

- A. Name of system, if named: City of Lacey Municipal Water Supply System
- B. Briefly describe your proposed water system. **(See instructions.)**
 The Lacey Water Department is now in the process of expanding its municipal water system which currently serves approximately 60,000 residents, and is anticipated to serve 135,000 residents plus commercial at full build out of Lacey's urban growth area. The system consists of water withdrawal, conveyance, and treatment elements.
- C. Do you already have any water rights or claims associated with this property or system? ☒ YES ☐ NO
 PROVIDE DOCUMENTATION. SEE APPENDIX B – all listed therein are valid municipal use water rights owned by the applicant.

Section 6. DOMESTIC / PUBLIC WATER SUPPLY SYSTEM INFORMATION (Completed for all domestic/public supply uses.)

- A. Number of "connections" requested: approximately 2,041 Type of connection: Municipal water customers, e.g., homes, apartment, recreational, etc.
- B. Are you within the area of an approved water system? N/A ☐ YES ☐ NO
 If yes, explain why you are unable to connect to the system. *Note: Regional water systems are identified by your County Health Department.* Comment: Applicant operates the system.

Complete C. and D. only if the proposed water system will have fifteen or more connections.

- C. Do you have a current water system plan approved by the Washington State Department of Health? ☒ YES ☐ NO
 If yes, when was it approved? 09/03/03 Please attach the current approved version of your plan.
 See comment on last page hereof.
- D. Do you have an approved conservation plan? ☒ YES ☐ NO
 If yes, when was it approved? 09/03/03 Please attach the current approved version of your plan.
 See comment on last page hereof.

Section 7. IRRIGATION/AGRICULTURAL/FARM INFORMATION (Complete for all irrigation and agriculture uses.)

- A. Total number of acres to be irrigated: _____
- B. List total number of acres for other specified agricultural uses:

Use _____ Acres _____
 Use _____ Acres _____
 Use _____ Acres _____

Total number of acres to be covered by this application: _____

- D. Family Farm Act (Initiative Measure Number 59, November 3, 1977, as amended by Chapter 237, Laws of 2001)
 Add up the acreage in which you have a controlling interest, including only:
 † Acreage irrigated under water rights acquired after December 8, 1977;
 † Acreage proposed to be irrigated under this application;
 † Acreage proposed to be irrigated under other pending application(s).
1. Is the combined acreage greater than 6000 acres?
 2. Do you have a controlling interest in a Family Farm? ☐ YES ☐ NO

Section 8. WATER STORAGE

Will you be using a dam, dike, or other structure to retain or store water? ☒ YES ☐ NO Other structures, i.e., seven above-ground storage tanks.

NOTE: If you will be storing 10 acre-feet or more of water and/or if the water depth will be 10 feet or more at the deepest point, and some portion of the storage will be above grade, you must also apply for a reservoir permit. You can get a reservoir permit application from the Department of Ecology.

Section 9. DRIVING DIRECTIONS

Provide detailed driving instructions to the point of withdrawal project site.

From Ecology Headquarters on Desmond Drive, drive east on Martin Way. Turn left onto Marvin Road. Follow Marvin Road over highway, through roundabouts. There is a gated gravel drive on the east side of Marvin Road just north of 40th Ct NE. After passing through the gate, there is a fenced area on the left that encloses a large standpipe reservoir and a wellhouse.

Section 10. REQUIRED MAP

- A. A map of the project, i.e., place of withdrawal and associated documents, is attached and marked Appendix C. (See instructions.)

Section 11. PROPERTY OWNERSHIP

- A. Does the applicant own the land on which the water will be used? ☐ YES ☒ NO
If no, explain the applicant's interest in the place of use and provide the name(s) and address(es) of the owner(s):

The City of Lacey operates a municipal water system related to a water service area that has been approved by the WA Department of Health. That service area is consistent with the North Thurston County Coordinated Water System Plan.

- B. Does the applicant own the property interest on which the water source is located? ☒ YES ☐ NO
If no, submit a copy of agreement:

See Appendix D.

I certify that the information above is true and accurate to the best of my knowledge. I understand that in order to process my application, I grant staff from the Department of Ecology access to the site for inspection and monitoring purposes. Even though I may have been assisted in the preparation of the above application by the employees of the Department of Ecology, all responsibility for the accuracy of the information rests with me.

Virgil G. Clarkson
Virgil Clarkson, Mayor
Applicant (or authorized representative)

May 2, 2005
Date

N/A
Landowner for place of use (if same as applicant, write "same")

Date

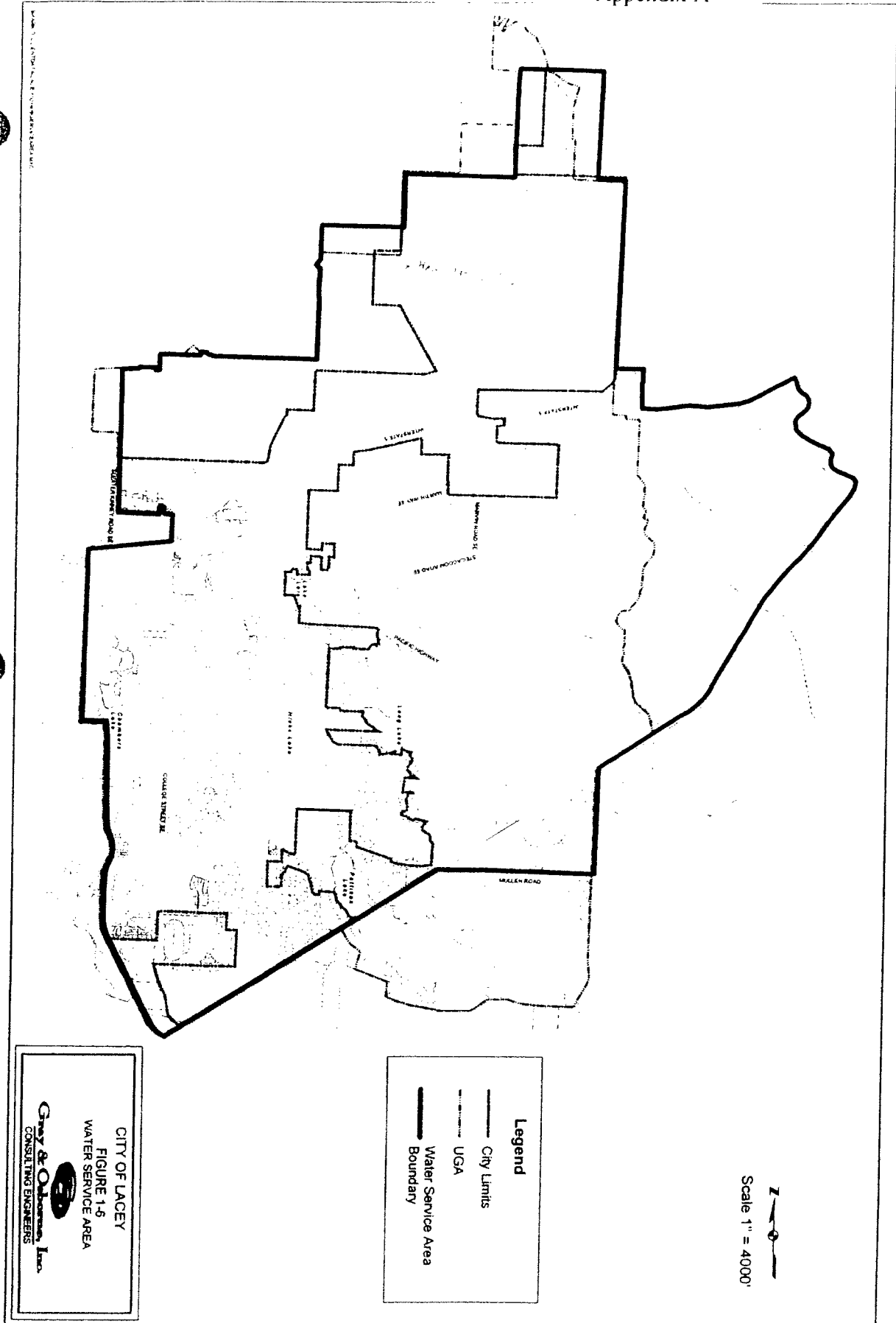
Use this page to continue your answers to any questions on the application. Please indicate section number before answer.

Comment relating to Sections C and D: The current water system plan, including approved conservation plan, is presently on file with the Department. See Application of City of Lacey filed with the Department of Ecology on April 28, 2005. Please refer to that plan which is set forth in "disc" form.

We are returning your application for the following reason(s):	
_____ Examination fee was not enclosed	APPLICANT PLEASE RETURN TO CASHIER, PO BOX 5128, LACEY, WA 98509-5128
_____ Section number(s) _____ is/are incomplete	
APPLICANT PLEASE RETURN TO THE APPROPRIATE REGIONAL OFFICE	
Explanation:	
Please provide the additional information requested above and return your application by _____ (date).	

Ecology staff _____ Date _____

Appendix A



Scale 1" = 4000'

Legend

- City Limits
- UGA
- Water Service Area Boundary

CITY OF LACEY
FIGURE 1-6
WATER SERVICE AREA

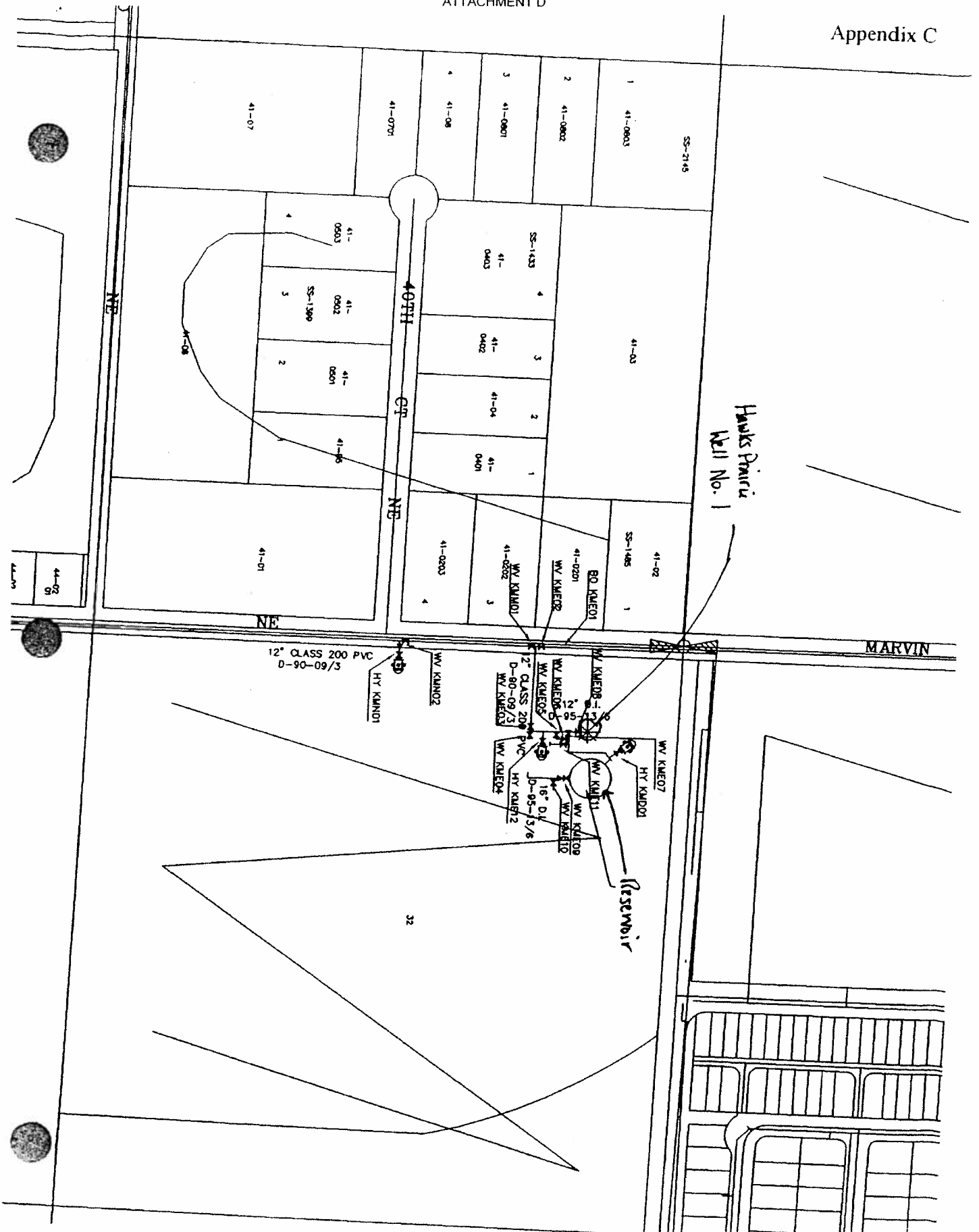
Gray & Osborne, Inc.
CONSULTING ENGINEERS

Lacey Service Area Description

Service area served by the City of Lacey is within all or part of: (1) sections 25, 34, 35, and 36, T. 19 N., R. 01 W.; (2) sections 7, 16, 17, 18, 19, 20, and 30, T. 18 N., R. 01 E.; (3) sections 1, 2, 3, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 32, 33, 34, 35, 36, T. 18 N., R. 01 W., and (4) sections 3, 4, 5, T. 17 N., R. 01 W.

**City of Lacey
Water Right Numbers**

C-4578-A
G2-20880C
C-5655-A
C-7450-A
C-55-A
G2-23191C
G2-27373P
G2-24351C
G2-25779C
G2-25778C
G2-20883C
G2-23743C
G2-26685P
C-1288-A
C-1777-A
C-3718-A
C-3654-A
C-3823-A
C-6320-A
G2-20879
G2-25778B
G2-20878C
G2-26623B
G2-27372P
G2-25802C
G2-27371P
G2-23963C
G2-24547C
G2-20104C
G2-20882C
G2-27007P



WELL SITE AND WATER STORAGE RESERVOIR EASEMENT

THIS INDENTURE, made this 21 day of June, 1990, between Founders Group, Inc., hereinafter called the Grantor, and the City of Lacey, a Municipal Corporation, hereinafter called the Grantee,

WITNESSETH:

That in consideration of \$1.00 and other good and valuable consideration, receipt of which is hereby acknowledged, the Grantor hereby grants and conveys to the Grantee, its successors and assigns, a perpetual easement for a well site and water reservoir over, under, upon and through a portion of that certain real property situate and being in the County of Thurston, State of Washington, more particularly described as follows, to-wit:

Parcel:

The northwest 1/4 of the southwest 1/4 of Section 35, T. 19.N., R. 1 W., W.M.

Permanent Easement:

A portion of the above described parcel being described as follows:

Commencing at the 1/4 corner common to Sections 34 and 35, T. 19 N., R. 1 W., W.M. and running thence S 1°40'08" W along the line common to said sections, said line being the Basis of Bearings for this description, 91.29 feet; thence S 87°55'43" E 105.09 feet to the True Point of Beginning for this description; thence continuing S 87°55'43" E 308.71 feet; thence S 2°04'17" W 208.71 feet; thence N 87°55'43" W 308.71 feet; thence N 2°04'17" E 208.71 feet to the True Point of Beginning.

Together with the right to enter upon, over and along said real property herinbefore described, from time to time, to construct, inspect, repair, alter, modify, replace, remove, and update to present and future technological standards, said well site and water storage reservoir. The Grantor shall not place or construct a building or other structure on the easement right of way.

The permanent rights herein granted to the Grantee shall continue in force until such time as the Grantee, its successors or assigns, shall permanently abandon the same and upon such removal or abandonment, all rights hereby granted shall terminate.

THURSTON COUNTY

OLYMPIA, WA

07/20/90 2:51 PM

REQUEST OF: CITY OF L

Sam S. Reed, AUDITOR

BY: TONI, DEPUTY

\$9.00 EAS

Vol: 1743 Page: 15
File No: 900720015505/25/1990
HPWELL.DOC

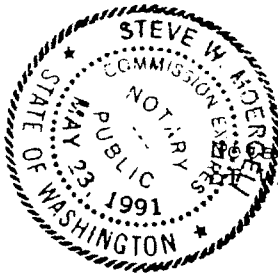
IN WITNESS WHEREOF, this instrument has been executed the day and year first above written.

Sylvia F. McMurry
Secretary

STATE OF WASHINGTON)
County of ~~Thurston~~ ^{King})

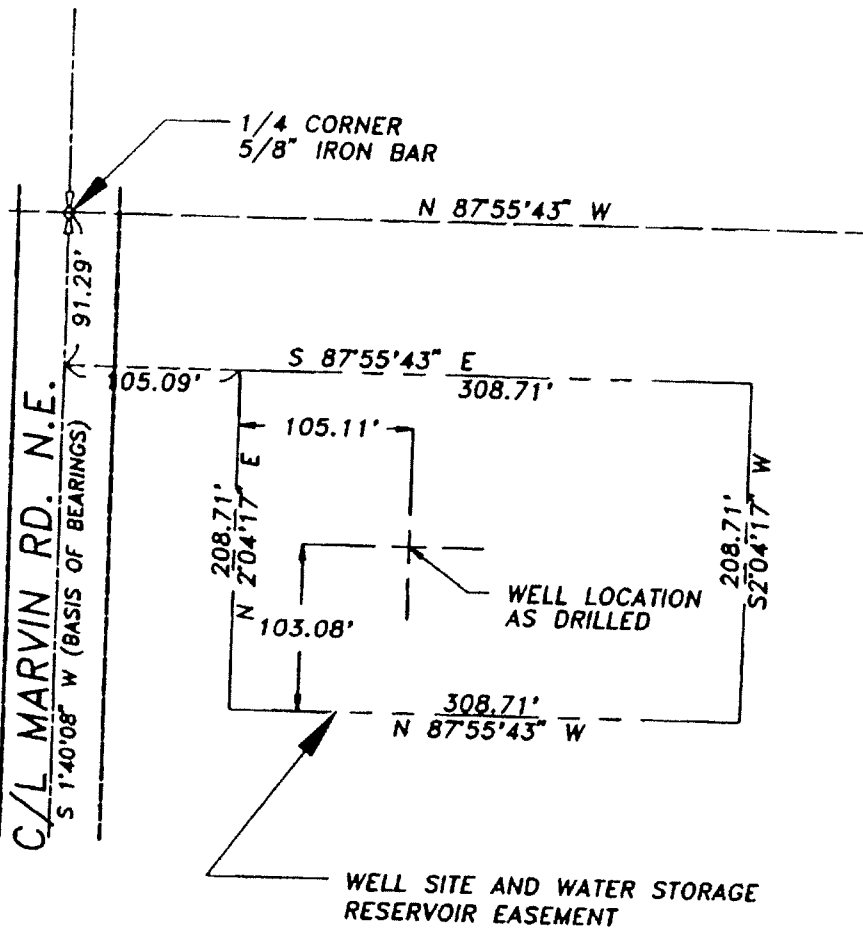
On this day personally appeared before me Sylvia J. McMurry to be known to be the individual(s) described in and who executed the within and foregoing instrument, and acknowledged that she (he) signed the same as her (his) free and voluntary act and deed, for the uses and purposes therein mentioned.

GIVEN under my hand and official seal this 21st day of June, 1990.



Steve W. Anderson
Notary Public in and for the State of Washington, residing at Camacho

Vol: 1749 Page: 16
File No: 9007200155



SCALE
1" = 100'
T.19N., R.1W., W.M.
NW1/4 SW1/4
SECTION
35

BASIS OF BEARINGS:
BRACY & THOMAS,
LAND SURVEYORS,
BOUNDARY SURVEY
#6518 DATED 1/27/87
FOR THE FOUNDERS GROUP

Vol: 1749 Page: 17
File No: 9007200155

EASEMENT NUMBER: 11935320000 . C			
CITY OF LACEY, WASHINGTON DEPT. OF PUBLIC WORKS			
GRANTOR: FOUNDERS GROUP, INC. PURPOSE: WELL SITE AND WATER STORAGE RESERVOIR			
APPROVED <i>Brian F. Barnett</i> 5/25/90 DIRECTOR OF PUBLIC WORKS DATE			DWG. NO. A-90-14
DES. B.B.	DWN. P.D.M.	CKD. M.H.	DATE 4/8/90

MARVINQC.DWG

62-30249

For Ecology

Fee Paid _____

Date _____

State of Washington

Application for a Water Right

Please follow the attached instructions to avoid unnecessary delays. ¹⁰⁶ 28-24-47

Section 1. APPLICANT - PERSON, ORGANIZATION, OR WATER SYSTEM

Name City of Lacey Home Tel: () _____
 Mailing Address P.O. Box 3400 Work Tel: (360) 438-2649
 City Lacey State WA Zip+4 98504 FAX: (360) 456-7799

Section 2. CONTACT - PERSON TO CALL ABOUT THE APPLICATION

☐ Same as above

Name Dennis Ritter Home Tel: () _____
 Mailing Address P.O. Box 3400 Work Tel: (360) 438-2649
 City Lacey State WA Zip+4 98504 FAX: (360) 456-7799
 Relationship to applicant Public Works Director

and

Name Charles B. Roe, Jr., Perkins Coie LLP Home Tel: () _____
 Mailing Address 111 Market Street NE, Suite 200 Work Tel: (360) 956-3300
 City Olympia State WA Zip+4 98501 FAX: (360) 956-1208

Section 3. STATEMENT OF INTENT

☒ applicant requests a permit to use not more than 1,000 (See last page hereof, infra.) (☒ gallons per minute or cubic feet per second) from a ☐ surface water source or ☐ ground water source (check only one) for the purpose(s) of Municipal Supply. A "LEGAL" DESCRIPTION OF THE PLACE OF USE IS SET FORTH ON APPENDIX A ATTACHED. (See instructions.) NOTE: A tax parcel number or a plat number is not sufficient. Estimate a maximum annual quantity to be used in acre-feet per year: 600

☐ Check if the water use is proposed for a short-term project. Indicate the period of time that the water will be needed:

From ____/____/____ to ____/____/____

Section 4. WATER SOURCE Related to reservation of groundwater set forth in WAC 173-191-070 (Hawks Prairie ^{Source Code 5/4/02} service area).

If SURFACE WATER		If GROUNDWATER	
Name the water source and indicate if stream, spring, lake, etc. If unnamed, write "unnamed spring," "unnamed stream," etc.:		A permit is desired for <u>1 existing</u> well, sometimes known as <u>Lacey Well No. 29 (or Betti Well)</u> .	
Number of diversions: _____			
Source flows into (name of body of water): _____		Size & depth of well(s): <u>20" diameter existing well, 393 feet deep.</u>	

LOCATION

Enter the north-south and east-west distances in feet from the point of diversion or withdrawal to the nearest section corner: Approximately 2,200 feet east, and 3,400 feet north, of the southwest corner of section 2 (not surveyed) within the:

1/4 of	1/4 of	Section	Township	Range(E/W)	County	If location of source is platted, complete below:		
						Lot	Block	Subdivision

Section 5. GENERAL WATER SYSTEM INFORMATION

A. Name of system, if named: City of Lacey Municipal Water Supply System

B. Briefly describe your proposed water system. (See instructions.)

The Lacey Water Department is now in the process of expanding its municipal water system which currently serves approximately 60,000 residents, and is anticipated to serve 135,000 residents plus commercial at full build out of Lacey's urban growth area. The system consists of water withdrawal, conveyance, and treatment elements.

C. Do you already have any water rights or claims associated with this property or system? ☒ YES ☐ NO
 PROVIDE DOCUMENTATION. SEE APPENDIX B – all listed therein are valid municipal use water rights owned by the applicant.

Section 6. DOMESTIC / PUBLIC WATER SUPPLY SYSTEM INFORMATION (Completed for all domestic/public supply uses.)

A. Number of "connections" requested: approximately 1,224 Type of connection: Municipal water customers, e.g., homes, apartment, recreational, etc.

B. Are you within the area of an approved water system? N/A ☐ YES ☐ NO
 If yes, explain why you are unable to connect to the system. Note: Regional water systems are identified by your County Health Department. Comment: Applicant operates the system.

Complete C. and D. only if the proposed water system will have fifteen or more connections.

C. Do you have a current water system plan approved by the Washington State Department of Health? ☒ YES ☐ NO
 If yes, when was it approved? 09/03/03 Please attach the current approved version of your plan.
 See Appendix C, attached.

D. Do you have an approved conservation plan? ☒ YES ☐ NO
 If yes, when was it approved? 09/03/03 Please attach the current approved version of your plan.
 See Appendix C, Chapter 7.

Section 7. IRRIGATION/AGRICULTURAL/FARM INFORMATION (Complete for all irrigation and agriculture uses.)

A. Total number of acres to be irrigated: _____

B. List total number of acres for other specified agricultural uses:

Use _____ Acres _____
 Use _____ Acres _____
 Use _____ Acres _____

Total number of acres to be covered by this application: _____

D. Family Farm Act (Initiative Measure Number 59, November 3, 1977, as amended by Chapter 237, Laws of 2001)
 Add up the acreage in which you have a controlling interest, including only:
 ‡ Acreage irrigated under water rights acquired after December 8, 1977;
 ‡ Acreage proposed to be irrigated under this application;
 ‡ Acreage proposed to be irrigated under other pending application(s).

I. Is the combined acreage greater than 6000 acres?

☐ YES ☐ NO

Section 8. WATER STORAGE

Will you be using a dam, dike, or other structure to retain or store water? ☒ YES ☐ NO Other structures, i.e., seven above-ground storage tanks.

NOTE: If you will be storing 10 acre-feet or more of water and/or if the water depth will be 10 feet or more at the deepest point, and some portion of the storage will be above grade, you must also apply for a reservoir permit. You can get a reservoir permit application from the Department of Ecology.

Section 9. DRIVING DIRECTIONS

Provide detailed driving instructions to the point of withdrawal project site.

From Ecology's Headquarters on Desmond Drive, drive east on Martin Way and turn left onto Marvin Road. Cross over I-5, and continue north on Marvin Road through both roundabouts. Just past 29th Ave NE there is a gate drive on the east side of Marvin Road that is the access road into the site (see attached project site map marked Appendix E).

Section 10. REQUIRED MAP

A. Attach a map of the project. (See instructions.)

A map of the applicant's service area, which includes the City of Lacey and portions of Thurston County is attached, marked Appendix A. *6/28/05, See also Appendix F.*

Section 11. PROPERTY OWNERSHIP

A. Does the applicant own the land on which the water will be used? ☐ YES ☒ NO
If no, explain the applicant's interest in the place of use and provide the name(s) and address(es) of the owner(s):

The City of Lacey operates a municipal water system related to a water service area that has been approved by the WA Department of Health. That service area is consistent with the North Thurston County Coordinated Water System Plan.

B. Does the applicant own the land on which the water source is located? ☒ YES ☐ NO
If no, submit a copy of agreement:

I certify that the information above is true and accurate to the best of my knowledge. I understand that in order to process my application, I grant staff from the Department of Ecology access to the site for inspection and storing purposes. Even though I may have been assisted in the preparation of the above application by the employees of the Department of Ecology, all responsibility for the accuracy of the information rests with me.

Virgil Clarkson
Virgil Clarkson, Mayor
Applicant (or authorized representative)

4/28/05
Date

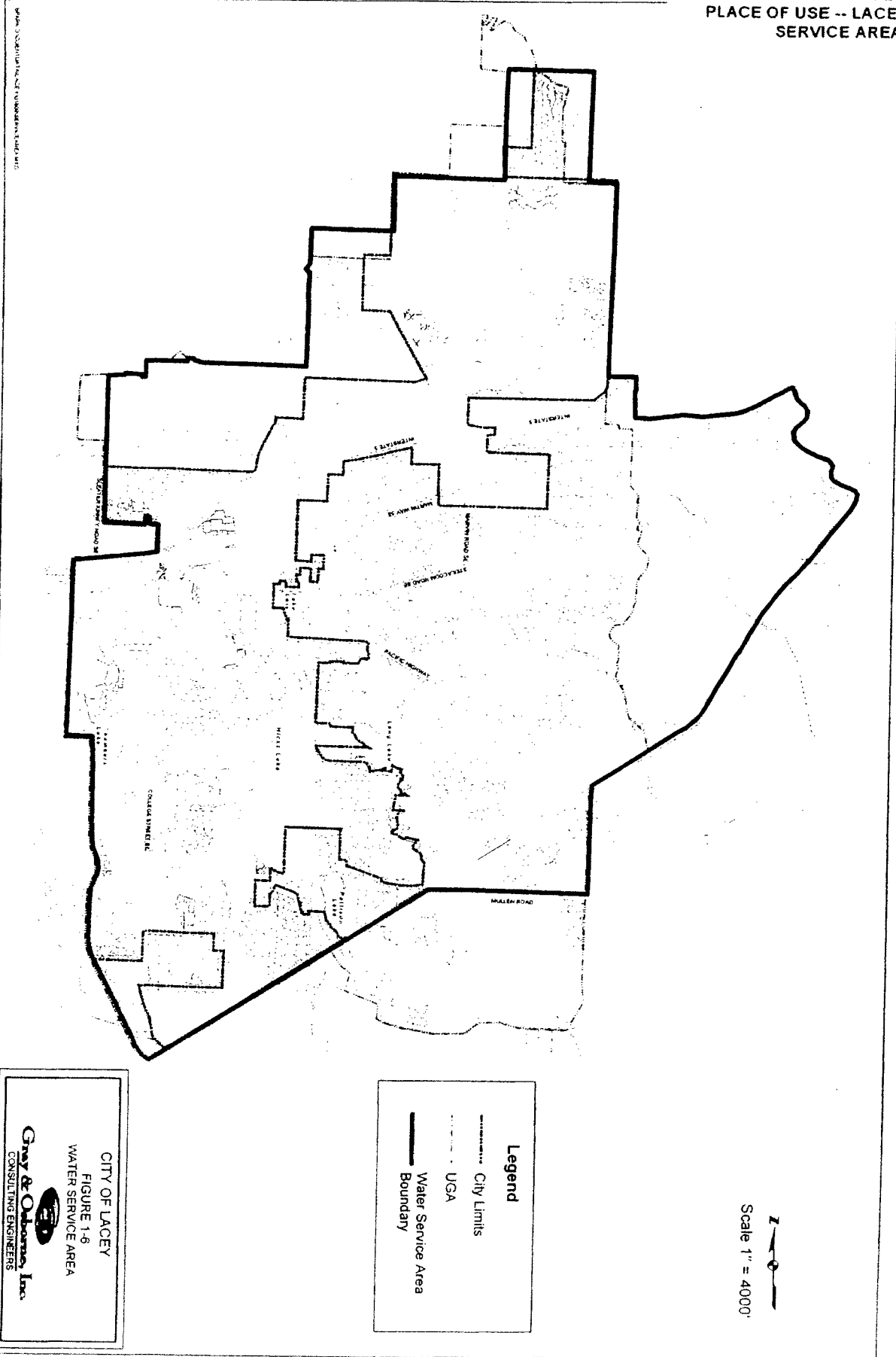
Use this page to continue your answers to any questions on the application. Please indicate section number before answer.

Comment related to Section 3, supra. The water right applied for requests authority to withdraw 1,000 gallons per minute ("gpm"). Please note that the water right evidenced by Permit No. G2-27007P, also owned by applicant, also authorizes the withdrawal of 1,000 gpm at the same point of withdrawal ("pow"). When the two rights are exercised simultaneously, the applicant intends to withdraw no more than 1,000 gpm even though each of the water rights authorizes 1,000 gpm withdrawals. In other words, while the applicant ability to withdraw in total acre-feet the amount of the two water rights when added together is 1,068.3 afy, the instantaneous withdrawal right shall not exceed 1,000 gpm when both water rights are exercised.

We are returning your application for the following reason(s):	
☐ Examination fee was not enclosed	APPLICANT PLEASE RETURN TO CASHIER, PO BOX 5128, LACEY, WA 98509-5128
☐ Section number(s) _____ is/are incomplete	APPLICANT PLEASE RETURN TO THE APPROPRIATE REGIONAL OFFICE
Explanation: 	
Please provide the additional information requested above and return your application by _____ (date).	

Logy staff _____

Date _____



Lacey Service Area Description

Service area served by the City of Lacey is within all or part of: (1) sections 25, 34, 35, and 36, T. 19 N., R. 01 W.; (2) sections 7, 16, 17, 18, 19, 20, and 30, T. 18 N., R. 01 E.; (3) sections 1, 2, 3, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 32, 33, 34, 35, 36, T. 18 N., R. 01 W., and (4) sections 3, 4, 5, T. 17 N., R. 01 W.

**City of Lacey
Water Right Numbers**

C-4578-A
G2-20880C
C-5655-A
C-7450-A
C-55-A
G2-23191C
G2-27373P
G2-24351C
G2-25779C
G2-25778C
G2-20883C
G2-23743C
G2-26685P
C-1288-A
C-1777-A
C-3718-A
C-3654-A
C-3823-A
C-6320-A
G2-20879
G2-25778B
G2-20878C
G2-26623B
G2-27372P
G2-25802C
G2-27371P
G2-23963C
G2-24547C
G2-20104C
G2-20882C
G2-27007P

DR:
ITY MAYOR:
COUNCIL:

VIRGIL CLARKSON
NANCY PETERSON
ANN BURGMAN
JOHN DARBY
MARY DEAN
TOM NELSON
GRAEME SACKRISON
GREG J. CUOIO
KENNETH R. AHLF
DENNIS E. RITTER P.E.
ROGER SCHOESSEL P.E.

MANAGER:
ATTORNEY:
OTOR OF PUBLIC WORKS
ENGINEER:

INGRESS, EGRESS & UTILITY EASEMENT:

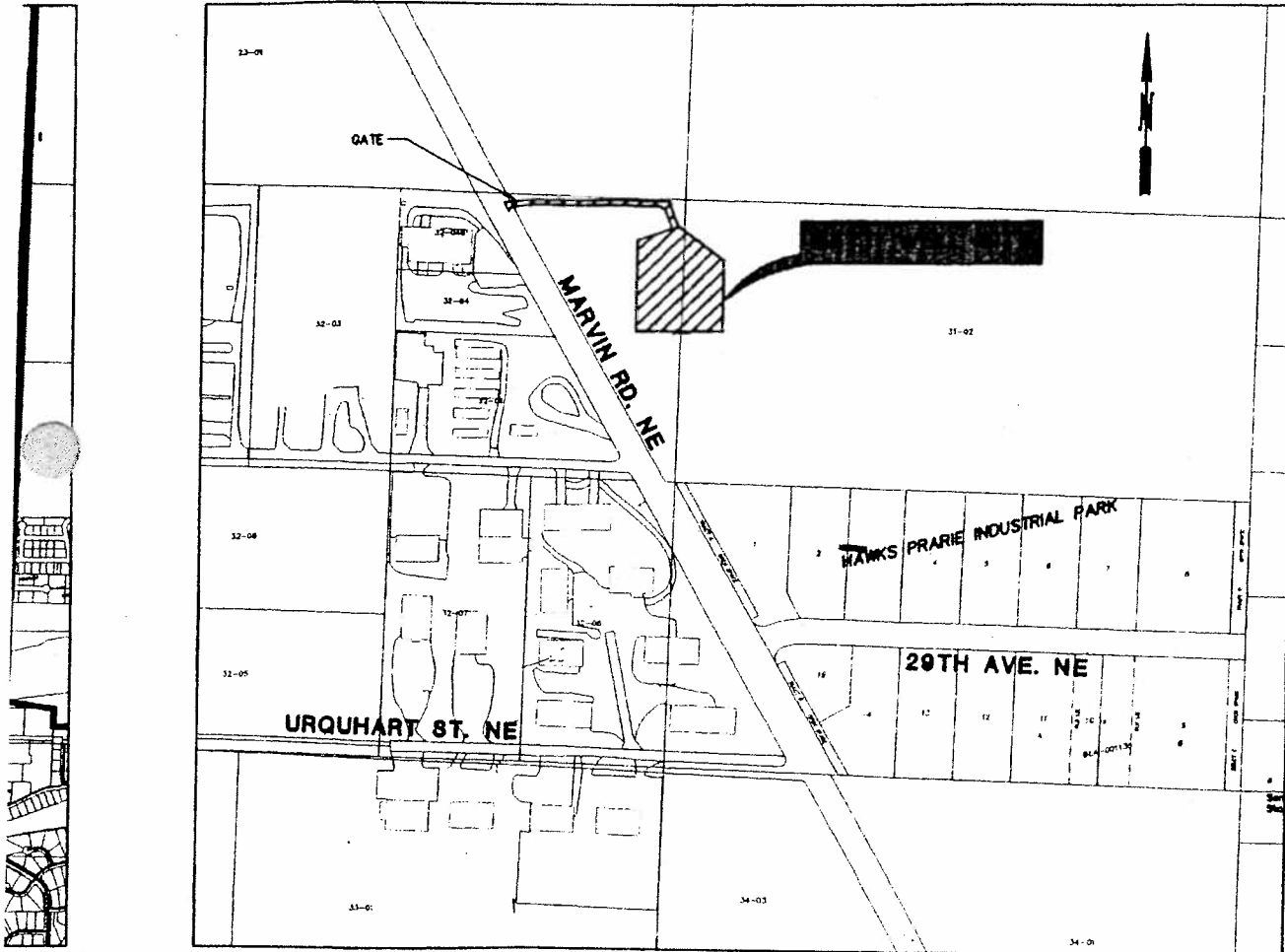
A STRIP OF LAND 20 FEET WIDE, THE CENTER LINE OF WHICH IS DESCRIBED AS FOLLOWS:

COMMENCING AT THE NORTHEAST CORNER OF THE NORTHWEST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 2, TOWNSHIP 18 NORTH, RANGE 1 WEST, W.M.; THENCE, ALONG THE NORTH LINE OF SAID NORTHWEST QUARTER, N88°18'19" W FOR A DISTANCE OF 413.84 FEET TO THE EASTERLY MARGIN OF MARVIN ROAD NORTHEAST; THENCE, ALONG SAID MARVIN S 29°23'40" E FOR A DISTANCE OF 32.18 FEET TO THE POINT OF BEGINNING; THENCE N79°19'08" E FOR A DISTANCE OF 44.84 FEET; THENCE S 89°55'39" E FOR A DISTANCE OF 200.15 FEET; THENCE S88°45'05" E FOR A DISTANCE OF 107.13 FEET; THENCE S21°17'38" E FOR A DISTANCE OF 89.04 FEET AND TERMINUS OF THIS CENTER LINE.

THE SIDELINES OF SAID 20 FOOT EASEMENT TO BE EXTENDED OR SHORTENED TO MEET AT ANGLE POINTS AND TO TERMINATE AT THE SAID EASTERLY MARGIN OF MARVIN ROAD NORTHEAST.

CONTAINING 8224 SQ. FT. OR 0.19 ACRES

(DESCRIPTION PREPARED UNDER THE DIRECTION OF LAWRENCE J. HOLT PLS 11958 C 08/02/2004).



PROJECT SITE MAP
SCALE=1"=200'

SOURCE NO. 29

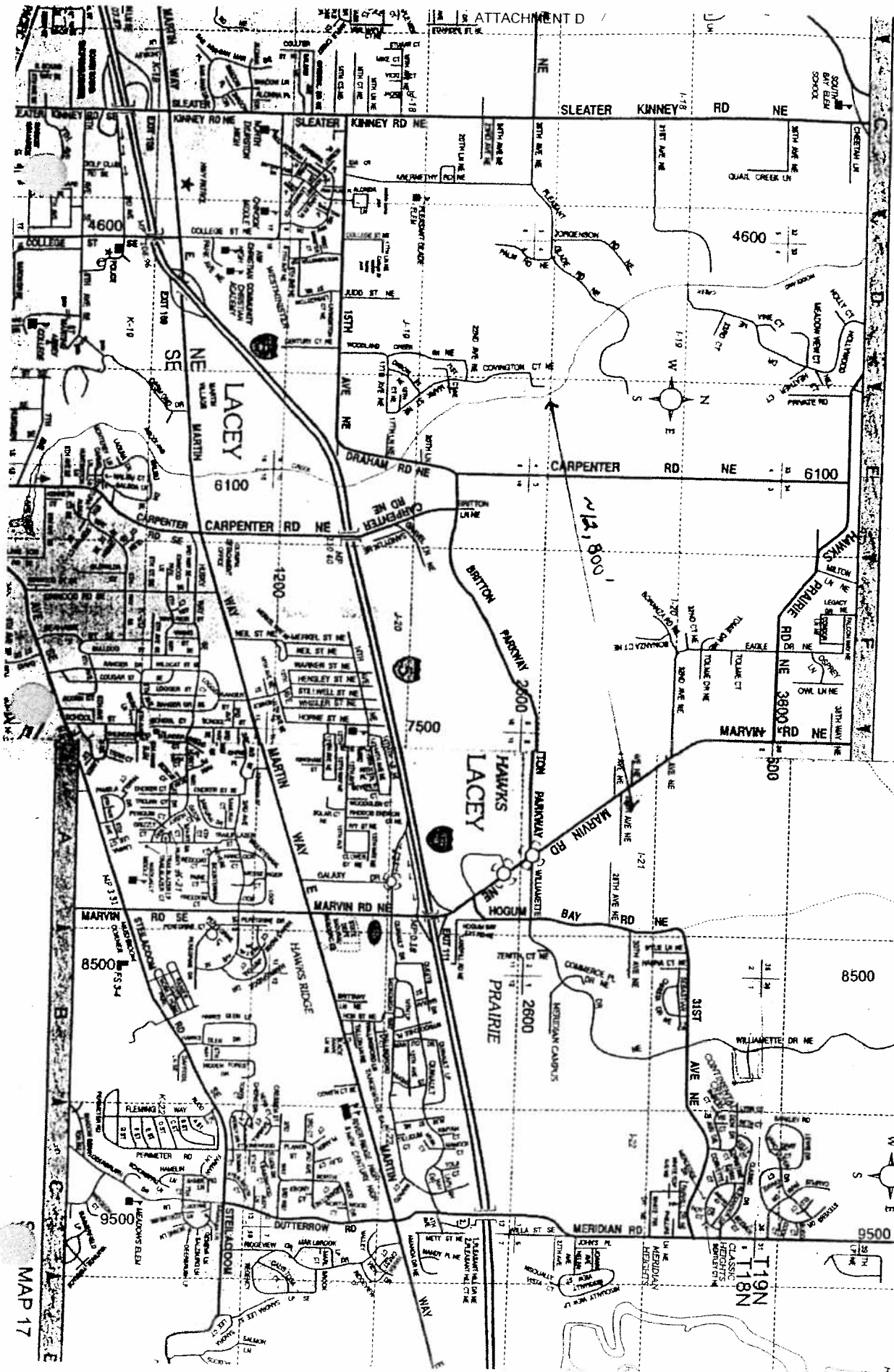
APPRO
BY: DR

APPENDIX F

SEE MAP 07

15

SEE MAP 08



MAP 17

Application G2-30250 was amended by letter in 2005; current quantities and point of withdrawal are shown in this Affidavit of Publication.

Legal # 1945

Affidavit of Publication

STATE OF WASHINGTON
County of Thurston County

ss.

The undersigned being first duly sworn on oath depose and says:
That she is the Principal Clerk of The Olympian which is a legal newspaper printed and published in the city of Olympia, Thurston County, Washington: of general circulation in said City, County and State;

that the

Notice of Application to Appropriate Public Waters

In the case of

Application No. G2-30250 -- City of Lacey

of which the attached is a printed copy, was published in said newspaper:

On the	30th	day of	August	2005
the	6th	day of	September	2005
the		day of		2005
the		day of		2005
the		day of		2005
the		day of		2005

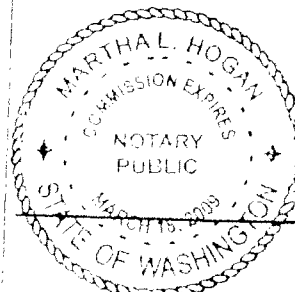
that the said newspaper was generally circulated during all of said time, and has been published for more than six months prior to the dates of the publication of this legal document, and that said notice was published in the newspaper proper and not in supplement form.

The amount of fee charged for this publication **\$174.00**

Lenny Nelson
Principal Clerk

Subscribed and sworn to me this 6th day of

September 2005



Martha L. Hogan
Notary Public in and for the State of Washington
Residing at Olympia, Thurston County, Washington

The Olympian has been appointed as a legal newspaper by order of the Superior Court of the State of Washington for Thurston County, dated July 11, 1996, in the county in which said newspaper is published in accordance with RCW 4A.16.021 and RCW 4A.16.022.

I hereby declare this affidavit to be a true and correct copy with RCW 4A.16.021 and Sec. 3 Chapter 14, Laws of 1977.

Legal #1945
STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
AMENDED
NOTICE OF APPLICATION
TO APPROPRIATE
PUBLIC WATERS
TAKE NOTICE:

That City of Lacey, on May 3, 2005, under Application No. G2-30250 filed for a permit to appropriate public waters, subject to existing rights, from a well (Lacey Well 30) in the amount of 800 gallons per minute, 1000 acre feet per year as needed year round each year for municipal supply. The source of the proposed appropriation is located within the NE1/4NW1/4 of Section 1, T. 18 N., R. 1 W.W.M., of Thurston Co., WA.

Protests of objections to approval of this application must include a detailed statement of the basis for objections; protests must be accompanied by a fifty dollar (\$50.00) recording fee and filed with the Department of Ecology, at the address shown below, within thirty (30) days from:

September 2, 2005
Department of Ecology, SWRO
P.O. Box 47775
Olympia, WA 98504-7775

Publish: August 30,
September 6, 2005

For Ecology Use

Fee Paid _____

Date _____

State of Washington

Application for a Water Right

Please follow the attached instructions to avoid unnecessary delays.

Section 1. APPLICANT - PERSON, ORGANIZATION, OR WATER SYSTEM

Name City of LaceyMailing Address P.O. Box 3400City LaceyState WAZip+4 98504

Home Tel: () _____

Work Tel: (360) 438-2649FAX: (360) 456-7799

Section 2. CONTACT - PERSON TO CALL ABOUT THE APPLICATION

☐ Same as above
Name Dennis RitterMailing Address P.O. Box 3400City LaceyState WAZip+4 98504

Home Tel: () _____

Work Tel: (360) 438-2649FAX: (360) 456-7799Relationship to applicant Public Works DirectorName Charles B. Roe, Jr., Perkins Coie LLP andMailing Address 111 Market Street NE, Suite 200City OlympiaState WAZip+4 98501

Home Tel: () _____

Work Tel: (360) 956-3300FAX: (360) 956-1208

Section 3. STATEMENT OF INTENT

The applicant requests a permit to use not more than 800 (☒ gallons per minute or ☐ cubic feet per second) from a ☐ surface water source or ☒ ground water source (check only one) for the purpose(s) Municipal Supply. A "LEGAL" DESCRIPTION OF THE PLACE OF USE IS SET FORTH ON

APPENDIX A ATTACHED. (See instructions.) NOTE: A tax parcel number or a plat number is not sufficient

Estimate a maximum annual quantity to be used in acre-feet per year: 1,066 1,000 (see letter dated 3/17/04 to Tim Wenger)

☐ Check if the water use is proposed for a short-term project. Indicate the period of time that the water will be needed:

From ____/____/____ to ____/____/____

Section 4. WATER SOURCE Related to reservation of groundwater set forth in WAC 173-191-070 (Hawks Prairie source area).

If SURFACE WATER	If GROUNDWATER
Name the water source and indicate if stream, spring, lake, etc. If unnamed, write "unnamed spring," "unnamed stream," etc.:	A permit is desired for <u>1</u> well, sometimes known as Lacey Well No. 30 (or Meridian Campus Well).
Number of diversions: _____	Size & depth of well(s): Proposed well will be 16" diameter and approximately 550 feet below ground surface.
Source flows into (name of body of water):	

LOCATION

Enter the north-south and east-west distances in feet from the point of diversion or withdrawal to the nearest section corner. Approximately 1,050 - 1,150 feet south, and 1,500 feet - 1,900 feet east of the NW corner of section 1 (not surveyed)

1/4 of	1/4 of	Section	Township	Range/E/W	County	If location of source is plotted, complete below:

Section 5. GENERAL WATER SYSTEM INFORMATION

A. Name of system, if named: City of Lacey Municipal Water Supply System

B. Briefly describe your proposed water system. (See instructions.)

The Lacey Water Department is now in the process of expanding its municipal water system which currently serves approximately 60,000 residents, and is anticipated to serve 135,000 residents plus commercial at full build out of Lacey's urban growth area. The system consists of water withdrawal, conveyance, and treatment elements.

C. Do you already have any water rights or claims associated with this property or system? ☒ YES ☐ NO
 PROVIDE DOCUMENTATION. SEE APPENDIX B – all listed therein are valid municipal use water rights owned by the applicant.

Section 6. DOMESTIC / PUBLIC WATER SUPPLY SYSTEM INFORMATION (Completed for all domestic/public supply uses.)

A. Number of "connections" requested: approximately 2,041 Type of connection: Municipal water customers, e.g., homes, apartment, recreational, etc.

B. Are you within the area of an approved water system? N/A ☐ YES ☐ NO
 If yes, explain why you are unable to connect to the system. *Note: Regional water systems are identified by your County Health Department.* Comment: Applicant operates the system.

Complete C. and D. only if the proposed water system will have fifteen or more connections.

C. Do you have a current water system plan approved by the Washington State Department of Health? ☒ YES ☐ NO
 If yes, when was it approved? 09/03/03 Please attach the current approved version of your plan.
 See comment on last page hereof.

D. Do you have an approved conservation plan? ☒ YES ☐ NO
 If yes, when was it approved? 09/03/03 Please attach the current approved version of your plan.
 See comment on last page hereof.

Section 7. IRRIGATION/AGRICULTURAL/FARM INFORMATION (Complete for all irrigation and agriculture uses.)

A. Total number of acres to be irrigated: _____

B. List total number of acres for other specified agricultural uses:

Use _____ Acres _____
 Use _____ Acres _____
 Use _____ Acres _____

Total number of acres to be covered by this application: _____

D. Family Farm Act (Initiative Measure Number 59, November 3, 1977, as amended by Chapter 237, Laws of 2001)
 Add up the acreage in which you have a controlling interest, including only
 † Acreage irrigated under water rights acquired after December 8, 1977
 † Acreage proposed to be irrigated under this application.
 † Acreage proposed to be irrigated under other pending application(s)

1. Is the combined acreage greater than 6000 acres?
 2. Do you have _____

☐ YES ☐ NO

Section 8. WATER STORAGE

Will you be using a dam, dike, or other structure to retain or store water? ☒ YES ☐ NO Other structures, i.e., seven above-ground storage tanks.

NOTE: If you will be storing 10 acre-feet or more of water and/or if the water depth will be 10 feet or more at the deepest point, and some portion of the storage will be above grade, you must also apply for a reservoir permit. You can get a reservoir permit application from the Department of Ecology.

Section 9. DRIVING DIRECTIONS

Provide detailed driving instructions to the point of withdrawal project site.

From Ecology Headquarters on Desmond Drive, drive east on Martin Way. Turn left onto Meridian Road. Turn left on 31st Ave NE, and turn right onto Willamette Drive. The future park location is north of 31st Ave NE on the east side of the road.

Section 10. REQUIRED MAP

A map of the project, i.e., place of withdrawal and associated documents, is attached and marked Appendix C.
(See instructions.)

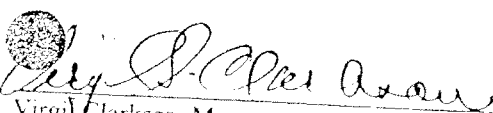
Section 11. PROPERTY OWNERSHIP

- A. Does the applicant own the land on which the water will be used? ☐ YES ☒ NO
If no, explain the applicant's interest in the place of use and provide the name(s) and address(es) of the owner(s):

The City of Lacey operates a municipal water system related to a water service area that has been approved by the WA Department of Health. That service area is consistent with the North Thurston County Coordinated Water System Plan.

- B. Does the applicant own the land on which the water source is located? ☒ YES ☐ NO
If no, submit a copy of agreement:

I certify that the information above is true and accurate to the best of my knowledge. I understand that in order to process my application, I grant staff from the Department of Ecology access to the site for inspection and monitoring purposes. Even though I may have been assisted in the preparation of the above application by the employees of the Department of Ecology, all responsibility for the accuracy of the information rests with me.


Virgil Clarkson, Mayor
Applicant (or authorized representative)

May 2, 2005
Date

N/A
Landowner for place of use (if same as applicant, write "same")

Date

Use this page to continue your answers to any questions on the application. Please indicate section number before answer.

Comment relating to Sections C and D: The current water system plan, including approved conservation plan, is presently on file with the Department. See Application of City of Lacey filed with the Department of Ecology on April 28, 2005. Please refer to that plan which is set forth in "disc" form.

We are returning your application for the following reason(s):	
_____ Examination fee was not enclosed	APPLICANT PLEASE RETURN TO CASHIER, PO BOX 5128, LACEY, WA 98509-5128
_____ Section number(s) _____ is/are incomplete	APPLICANT PLEASE RETURN TO THE APPROPRIATE REGIONAL OFFICE
Explanation:	
Please provide the additional information requested above and return your application by _____ (date).	

Ecology staff _____ Date _____



Water Service Area
Boundary

CITY OF LACEY
FIGURE 1-6
WATER SERVICE AREA



Gray & Osborne, Inc.
CONSULTING ENGINEERS

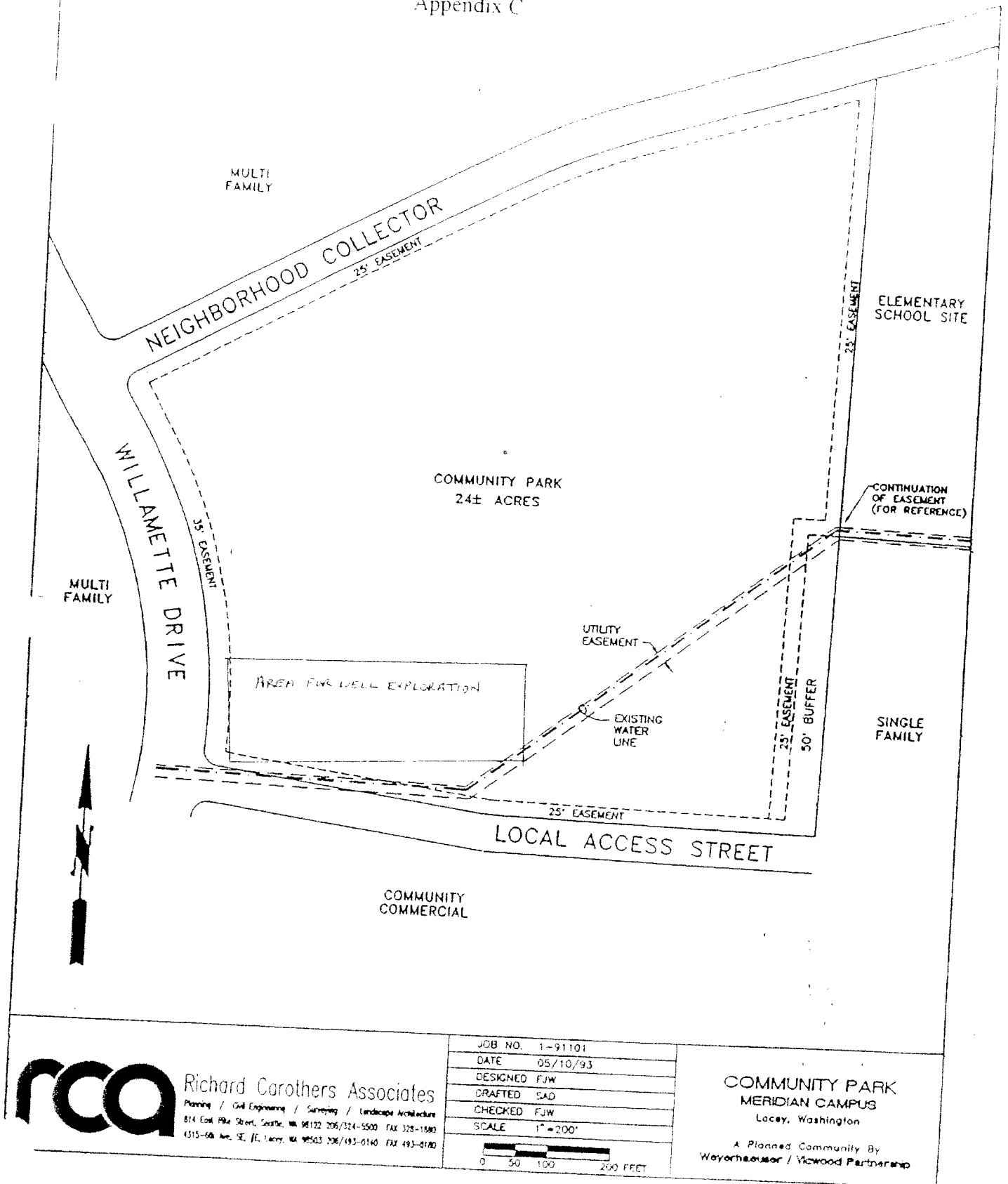
Lacey Service Area Description

Service area served by the City of Lacey is within all or part of: (1) sections 25, 34, 35, and 36, T. 19 N., R. 01 W.; (2) sections 7, 16, 17, 18, 19, 20, and 30, T. 18 N., R. 01 E.; (3) sections 1, 2, 3, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 32, 33, 34, 35, 36, T. 18 N., R. 01 W., and (4) sections 3, 4, 5, T. 17 N., R. 01 W.

**City of Lacey
Water Right Numbers**

C-4578-A
G2-20880C
C-5655-A
C-7450-A
C-55-A
G2-23191C
G2-27373P
G2-24351C
G2-25779C
G2-25778C
G2-20883C
G2-23743C
G2-26685P
C-1288-A
C-1777-A
C-3718-A
C-3654-A
C-3823-A
C-6320-A
G2-20879
G2-25778B
G2-20878C
G2-26623B
G2-27372P
G2-25802C
G2-27371P
G2-23963C
G2-24547C
G2-20104C
G2-20882C
G2-27007P

Appendix C



Application G2-30251 was amended by letter in 2005: current quantities and point of withdrawal are shown in this Affidavit of Publication.

Legal # 4100

Affidavit of Publication

STATE OF WASHINGTON
County of Thurston County

ss.

Legal #4100

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
AMENDED NOTICE OF APPLICATION TO
APPROPRIATE PUBLIC WATERS

TAKE NOTICE:

That City of Lacey, Washington on May 6, 2005, under Application No. G2-30251 filed for a permit to appropriate public waters, subject to existing rights, from Well #32 (Marvin Road Well) in the amount of 1000 gallons per minute as needed year round each year for municipal supply. The source of the proposed appropriation is located within the SE1/4 NE1/4, Section 34, T. 19 N., R. 1 W.M., of Thurston County, Washington.

Protests or objections to approval of this application must include a detailed statement of the basis for objections and are subject to public disclosure. Protests must be accompanied by a fifty dollar (\$50.00) recording fee and filed with the Department of Ecology, at the address shown below, within thirty (30) days from February 22, 2007.

Department of Ecology, SWRO
PO Box 47775
Olympia, Washington 98504-7775

Publish: February 22, March 1, 2007

The undersigned being first duly sworn on oath deposed and says: That she is the Principal Clerk of The Olympian which is a legal newspaper printed and published in the city of Olympia, Thurston County, Washington: of general circulation in said City, County and State;

that the

Notice of Application to Appropriate Public Waters

In the case of

Application No. G2-30251 -- City of Lacey

of which the attached is a printed copy, was published in said newspaper:

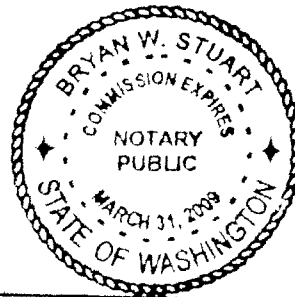
On the	22nd	day of	February	2007
the	1st	day of	March	2007
the		day of		2007
the		day of		2007
the		day of		2007
the		day of		2007

that the said newspaper was generally circulated during all of said time, and has been published for more than six months prior to the dates of the publication of this legal document, and that said notice was published in the newspaper proper and not in supplement form.

The amount of fee charged for this publication **\$233.60**

Lenny Nelson
Principal Clerk

Subscribed and sworn to me this 1st day of March 2007



Bryan W. Stuart

Notary Public in and for the State of Washington
Residing at Olympia, Thurston County, Washington

The Olympian has been appointed as a legal newspaper by order of the Superior Court of the State of Washington for Thurston County, dated July 10, 1911, in the county in which said newspaper is published in accordance with RCW 65.16.020 and RCW 65.16.040.

Note: This above affidavit and fee is in compliance with RCW 65.16.030 and Section 34, Chapter 64, Laws of 1977

For Ecology Use

Fee Paid _____

Date _____

State of Washington

Application for a Water Right

Please follow the attached instructions to avoid unnecessary delays: 12-19

Section 1. APPLICANT - PERSON, ORGANIZATION, OR WATER SYSTEM

Name City of Lacey Home Tel: () -
 Mailing Address P.O. Box 3400 Work Tel: (360) 438-2649
 City Lacey State WA Zip+4 98509 FAX: (360) 456-7799

Section 2. CONTACT - PERSON TO CALL ABOUT THE APPLICATION

☐ Same as above

Name Dennis Ritter Home Tel: () -
 Mailing Address P.O. Box 3400 Work Tel: (360) 438-2649
 City Lacey State WA Zip+4 98509 FAX: (360) 456-7799
 Relationship to applicant Public Works Director

and
 Name Charles B. Roe, Jr., Perkins Coie LLP Home Tel: () -
 Mailing Address 111 Market Street NE, Suite 200 Work Tel: (360) 956-3300
 City Olympia State WA Zip+4 98501 FAX: (360) 956-1208

Section 3. STATEMENT OF INTENT

The applicant requests a permit to use not more than 1,000 (☒ gallons per minute or
 cubic feet per second) from a ☐ surface water source or ☒ ground water source (check only one) for the purpose(s)
 of Municipal Supply. A "LEGAL" DESCRIPTION OF THE PLACE OF USE IS SET FORTH ON
 APPENDIX A ATTACHED. (See instructions.) NOTE: A tax parcel number or a plat number is not sufficient.
 Estimate a maximum annual quantity to be used in acre-feet per year: 1,500

☐ Check if the water use is proposed for a short-term project. Indicate the period of time that the water will be needed:

From ____/____/____ to ____/____/____

Section 4. WATER SOURCE

If SURFACE WATER	If GROUNDWATER
Name the water source and indicate if stream, spring, lake, etc. If unnamed, write "unnamed spring," "unnamed stream," etc.:	A permit is desired for <u>one</u> well, to be known as Lacey Well No. 32 (also known as Marvin Road Well).
Number of diversions: _____	
Source flows into (name of body of water):	Size & depth of well(s): Proposed well will be 16" diameter and approximately 500 feet below ground surface.

LOCATION

Enter the north-south and east-west distances in feet from the point of diversion or withdrawal to the nearest section corner. Approximately 0 - 500 feet west, and 1,300 - 2,600 feet south, of the southeast corner of section 34 (not surveyed).

Map	Map	Section	Township	Range(E/W)	County	Location of nearest plat or corner below		
						Lot	Block	Subdivision
NE	SE	34						

Section 5. GENERAL WATER SYSTEM INFORMATION

- A. Name of system, if named: City of Lacey Municipal Water Supply System
- B. Briefly describe your proposed water system. (See instructions.)
- The Lacey Water Department is now in the process of expanding its municipal water system which currently serves approximately 60,000 residents, and is anticipated to serve 135,000 residents plus commercial at full build out of Lacey's urban growth area. The system consists of water withdrawal, conveyance, and treatment elements.
- C. Do you already have any water rights or claims associated with this property or system? ☒ YES ☐ NO
 PROVIDE DOCUMENTATION. SEE APPENDIX B – all listed therein are valid municipal use water rights owned by the applicant.

Section 6. DOMESTIC / PUBLIC WATER SUPPLY SYSTEM INFORMATION (Completed for all domestic/public supply uses.)

- A. Number of "connections" requested: approximately 2,041 Type of connection: Municipal water customers, e.g., homes, apartment, recreational, etc.
- B. Are you within the area of an approved water system? N/A ☐ YES ☐ NO
 If yes, explain why you are unable to connect to the system. *Note: Regional water systems are identified by your County Health Department.*

Complete C. and D. only if the proposed water system will have fifteen or more connections.

- C. Do you have a current water system plan approved by the Washington State Department of Health? ☒ YES ☐ NO
 If yes, when was it approved? 09/03/03 Please attach the current approved version of your plan.
See comment on last page hereof.
- D. Do you have an approved conservation plan? ☒ YES ☐ NO
 If yes, when was it approved? 09/03/03 Please attach the current approved version of your plan.
See comment on last page hereof.

Section 7. IRRIGATION/AGRICULTURAL/FARM INFORMATION (Complete for all irrigation and agriculture uses.)

- A. Total number of acres to be irrigated: _____
- B. List total number of acres for other specified agricultural uses:

Use _____ Acres _____
 Use _____ Acres _____
 Use _____ Acres _____

Total number of acres to be covered by this application: _____

- D. Family Farm Act (Initiative Measure Number 59, November 3, 1977, as amended by Chapter 237, Laws of 2001)
 Add up the acreage in which you have a controlling interest, including only:
 ‡ Acreage irrigated under water rights acquired after December 8, 1977.
 ‡ Acreage proposed to be irrigated under this application.
 ‡ Acreage proposed to be irrigated under other pending application(s)
- 1 Is the combined acreage greater than 6000 acres? ☐ YES ☐ NO

Section 8. WATER STORAGE

Will you be using a dam, dike, or other structure to retain or store water? ☒ YES ☐ NO Other structures, i.e., seven above-ground storage tanks.

NOTE: If you will be storing 10 acre-feet or more of water and/or if the water depth will be 10 feet or more at the deepest point, and some portion of the storage will be above grade, you must also apply for a reservoir permit. You can get a reservoir permit application from the Department of Ecology.

Section 9. DRIVING DIRECTIONS

Provide detailed driving instructions to the point of withdrawal project site.

From Ecology Headquarters on Desmond Drive, drive east on Martin Way. Turn left onto Marvin Road. Follow Marvin Road over highway, through roundabouts. The parcel is located between 40th Ct NE and 44th Ave NE on the west side of Marvin Road.

Section 10. REQUIRED MAP

Attach a map of the project. (See instructions.)

A map of the project, i.e., place of withdrawal and associated documents, is attached and marked Appendix C

Section 11. PROPERTY OWNERSHIP

- A. Does the applicant own the land on which the water will be used? ☐ YES ☒ NO
If no, explain the applicant's interest in the place of use and provide the name(s) and address(es) of the owner(s):

The City of Lacey operates a municipal water system related to a water service area that has been approved by the WA Department of Health. That service area is consistent with the North Thurston County Coordinated Water System Plan.

- B. Does the applicant own the property interest on which the water source is located? ☐ YES ☒ NO
If no, submit a copy of agreement:

See signature of landowner, infra.

I certify that the information above is true and accurate to the best of my knowledge. I understand that in order to process my application, I grant staff from the Department of Ecology access to the site for inspection and monitoring purposes. Even though I may have been assisted in the preparation of the above application by the employees of the Department of Ecology, all responsibility for the accuracy of the information rests with me.



Virgil Clarkson, Mayor
Applicant (or authorized representative)

5-6-05
Date

Landowner of point of withdrawal (if same as applicant, write "same")

Use this page to continue your answers to any questions on the application. Please indicate section number before answer.

Comment relating to Sections C. and D.: The current water system plan, including approved conservation plan, is presently on file with the Department. See Application of City of Lacey filed with the Department of Ecology on April 28, 2005. Please refer to that plan which is set forth in "disc" form.

We are returning your application for the following reason(s):	
____ Examination fee was not enclosed	APPLICANT PLEASE RETURN TO CASHIER, PO BOX 5128, LACEY, WA 98509-5128
____ Section number(s) _____ is/are incomplete	APPLICANT PLEASE RETURN TO THE APPROPRIATE REGIONAL OFFICE
Explanation:	
Please provide the additional information requested above and return your application by _____ (date).	

Ecology staff _____

Date _____

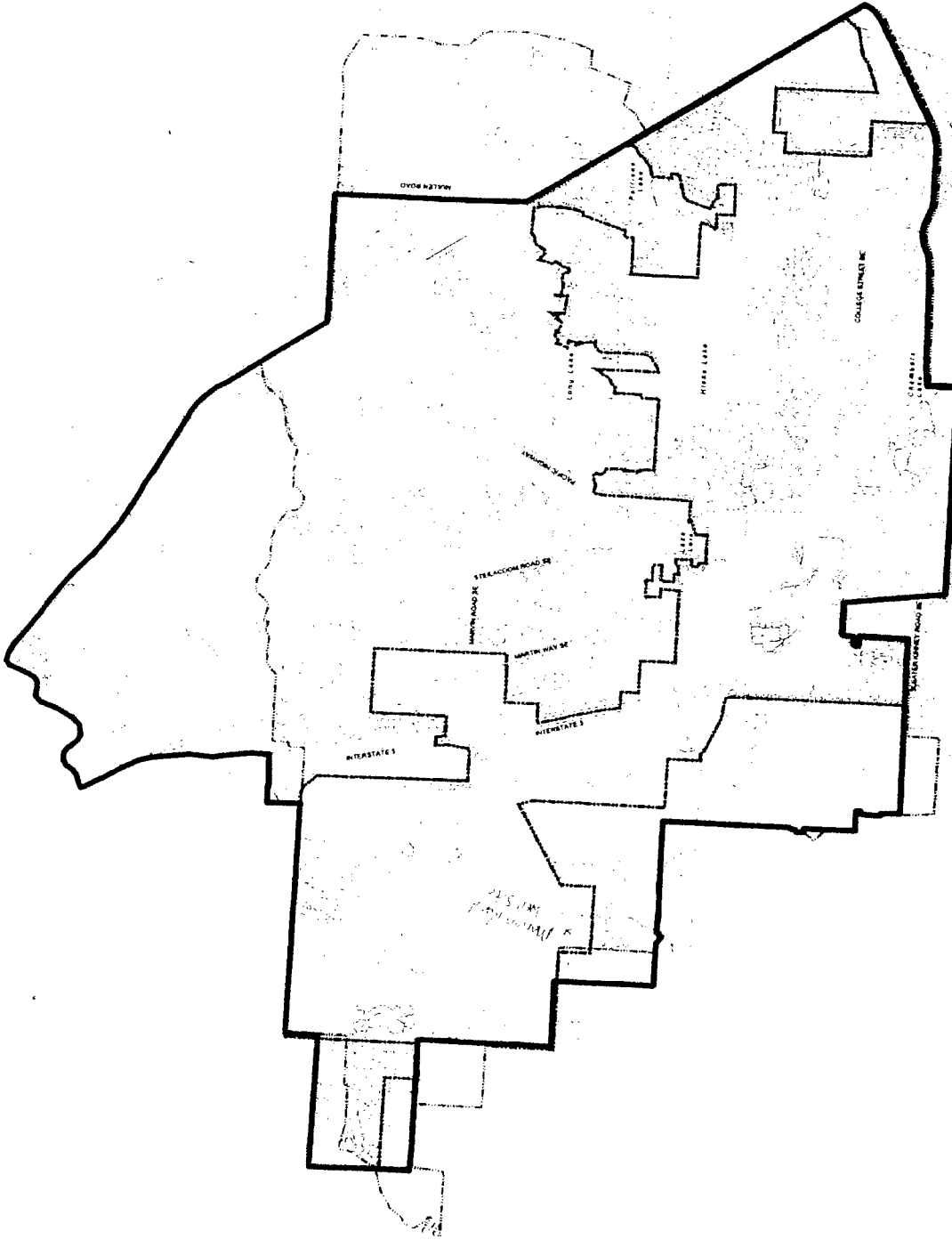
Scale 1" = 4000'

Legend

- City Limits
- UGA
- Water Service Area
- Boundary

CITY OF LACEY
FIGURE 1-6
WATER SERVICE AREA

Gray & Osborne, Inc.
CONSULTING ENGINEERS



MAP OF LACEY, CALIFORNIA, 1996, BY LACEY, CALIFORNIA

Lacey Service Area Description

Service area served by the City of Lacey is within all or part of: (1) sections 25, 34, 35, and 36, T. 19 N., R. 01 W.; (2) sections 7, 16, 17, 18, 19, 20, and 30, T. 18 N., R. 01 E.; (3) sections 1, 2, 3, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 32, 33, 34, 35, 36, T. 18 N., R. 01 W., and (4) sections 3, 4, 5, T. 17 N., R. 01 W.

**City of Lacey
Water Right Numbers**

C-4578-A
G2-20880C
C-5655-A
C-7450-A
C-55-A
G2-23191C
G2-27373P
G2-24351C
G2-25779C
G2-25778C
G2-20883C
G2-23743C
G2-26685P
C-1288-A
C-1777-A
C-3718-A
C-3654-A
C-3823-A
C-6320-A
G2-20879
G2-25778B
G2-20878C
G2-26623B
G2-27372P
G2-25802C
G2-27371P
G2-23963C
G2-24547C
G2-20104C
G2-20882C
G2-27007P

Attachment 'E'

Water Right Applications for City of Olympia

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

RECEIVED

Accepted By	<i>[Signature]</i>
Date	10/16/95
Is Field Exam. Required?	☐ YES ☒ NO
Determined By	

APPLICATION FOR CHANGE OF WATER RIGHT

☐ PURPOSE ☐ DIVERSION OR WITHDRAWAL
☐ PLACE ☒ ADDITIONAL POINT OF POINTS

NAME City of Olympia (Contact Person: Michael Kardas)		Bus. Tel. (360) 753-8740
ADDRESS (CITY) Olympia (STATE) WA		Home Tel. N/A
P.O. Box 1967		Other Tel. N/A
APPLICATION NUMBER	PERMIT NUMBER 4473	CERTIFICATE NUMBER 8030

DECREED RIGHT (TITLE OF CASE)
N/A

APPROPRIATIONS MADE (GIVE DATE IF PRIOR TO JUNE 7, 1917 IF SURFACE WATER, OR JUNE 7, 1945 IF GROUND WATER)
N/A

IS THE WATER RIGHT RECORDED IN YOUR NAME? ☒ YES ☐ NO IF NO, GIVE NAME RECORDED UNDER

1. RIGHT CONSISTS OF

WATERS USED FROM (STREAM, LAKE, WELL, OR TRENCH, ETC.) McAllister Springs	GALLONS PER MINUTE OR CUBIC FEET PER SECOND 25.0 cfs
WATER CURRENTLY USED FOR Municipal Supply and Manufacturing	TIME OF USE Continuously

2. LOCATION OF PRESENT POINT OF DIVERSION OR WITHDRAWAL

ENTER BELOW THE DISTANCES FROM THE NEAREST SECTION OR PROPERTY CORNER TO THE DIVERSION OR WITHDRAWAL.
North 67°20' east 3480 feet from the southwest corner of Section 19

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION) NW 1/4 SE 1/4	SECTION 19	TOWNSHIP N. 18	RANGE (E. OR W.) W.M. 1E	COUNTY Thurston
--	---------------	-------------------	-----------------------------	--------------------

IF THIS IS WITHIN THE LIMITS OF A RECORDED PLATTED PROPERTY, COMPLETE THIS SECTION

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)
-----	-------	------------------------------------

3. LEGAL DESCRIPTION OF LANDS WATER IS USED ON

City of Olympia and vicinity, Thurston County, WA

SECTION 19	TOWNSHIP N. 18	RANGE (E. OR W.) W.M. 1E	COUNTY Thurston
---------------	-------------------	-----------------------------	--------------------

(ATTACH SEPARATE SHEET IF NECESSARY)

ARE YOU THE LEGAL OWNER OF THE ABOVE DESCRIBED LANDS? ☐ YES ☒ NO IF NO, EXPLAIN YOUR INTEREST
 The City of Olympia is a major purveyor of municipal water supply in the above-described area.

REASONS FOR THE PROPOSED CHANGE

To protect municipal supply from possible hazardous spill on the highway or railroad.
 The Springs are downgradient from both facilities; relocation will place supply upgradient from railroad and highway.

A MINIMUM FEE OF \$10.00 MUST ACCOMPANY THIS APPLICATION

CONTINUE ON REVERSE SIDE

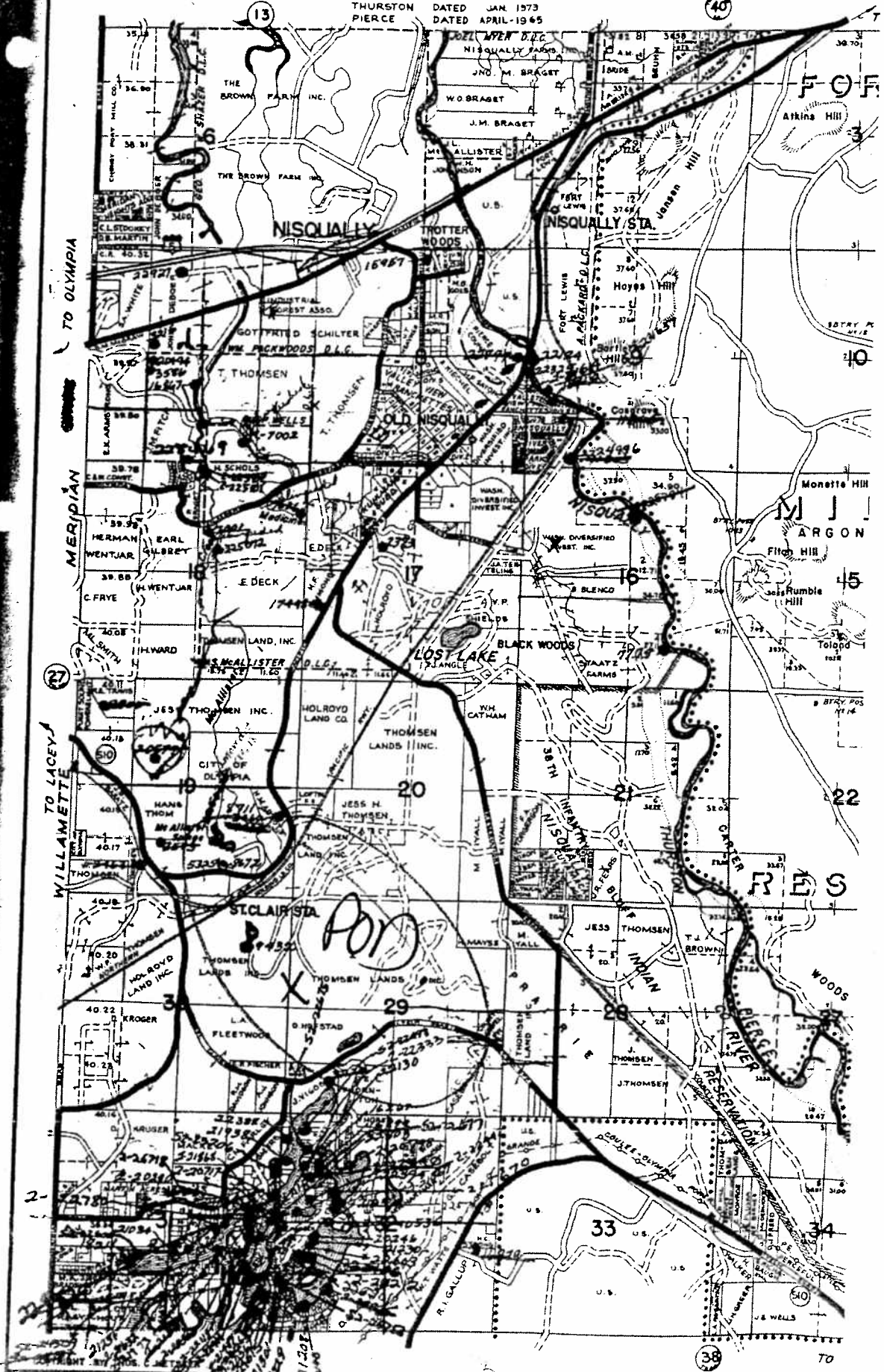
CHANGE

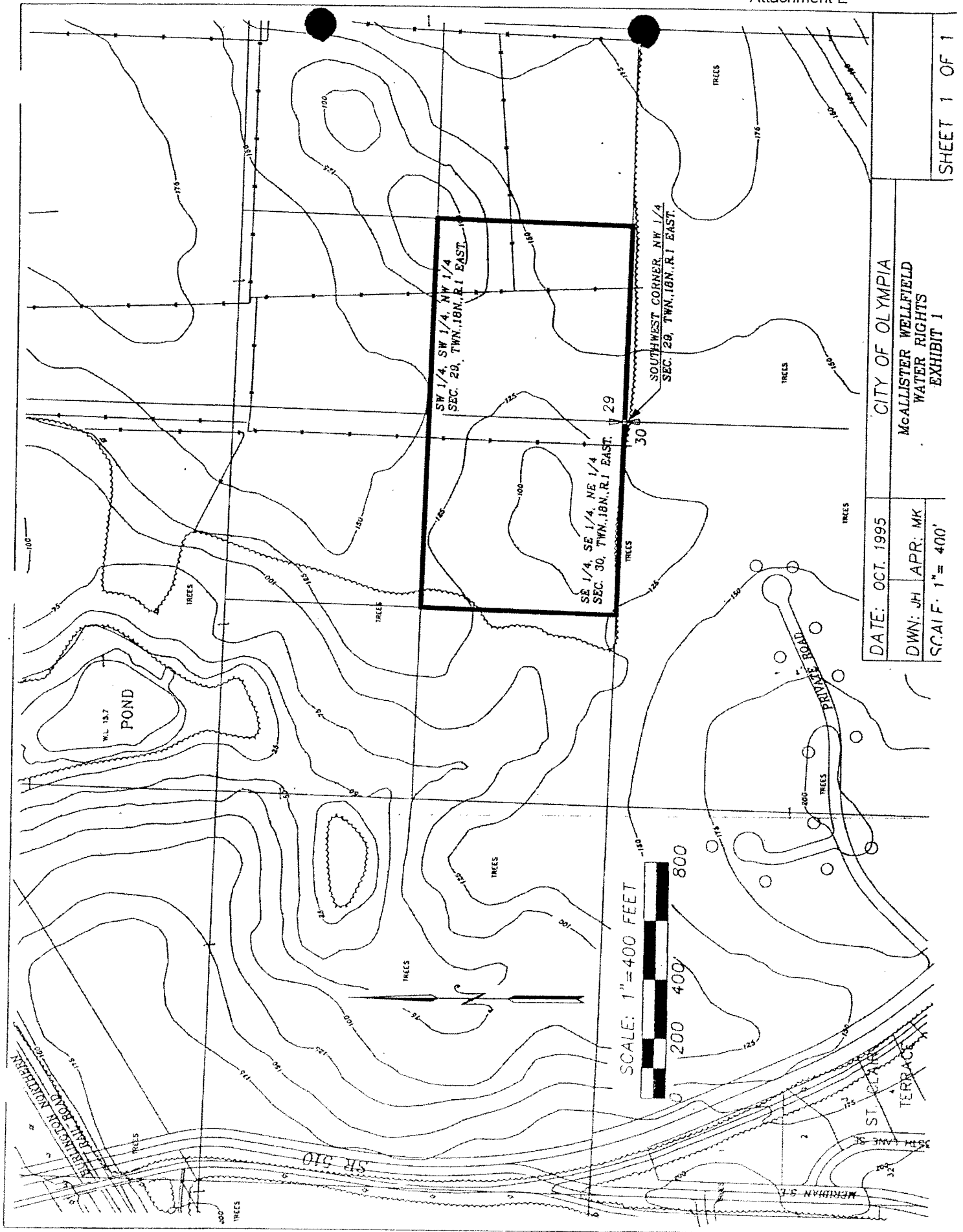
Wria //

111 SOUTH 10TH ST. TACOMA, WASHINGTON
1222 THIRD AVE. SEATTLE, WASHINGTON

Attachment
PIERCE 8

THURSTON
PIERCE
DATED JAN. 1973
DATED APRIL 1965





DATE: OCT. 1995

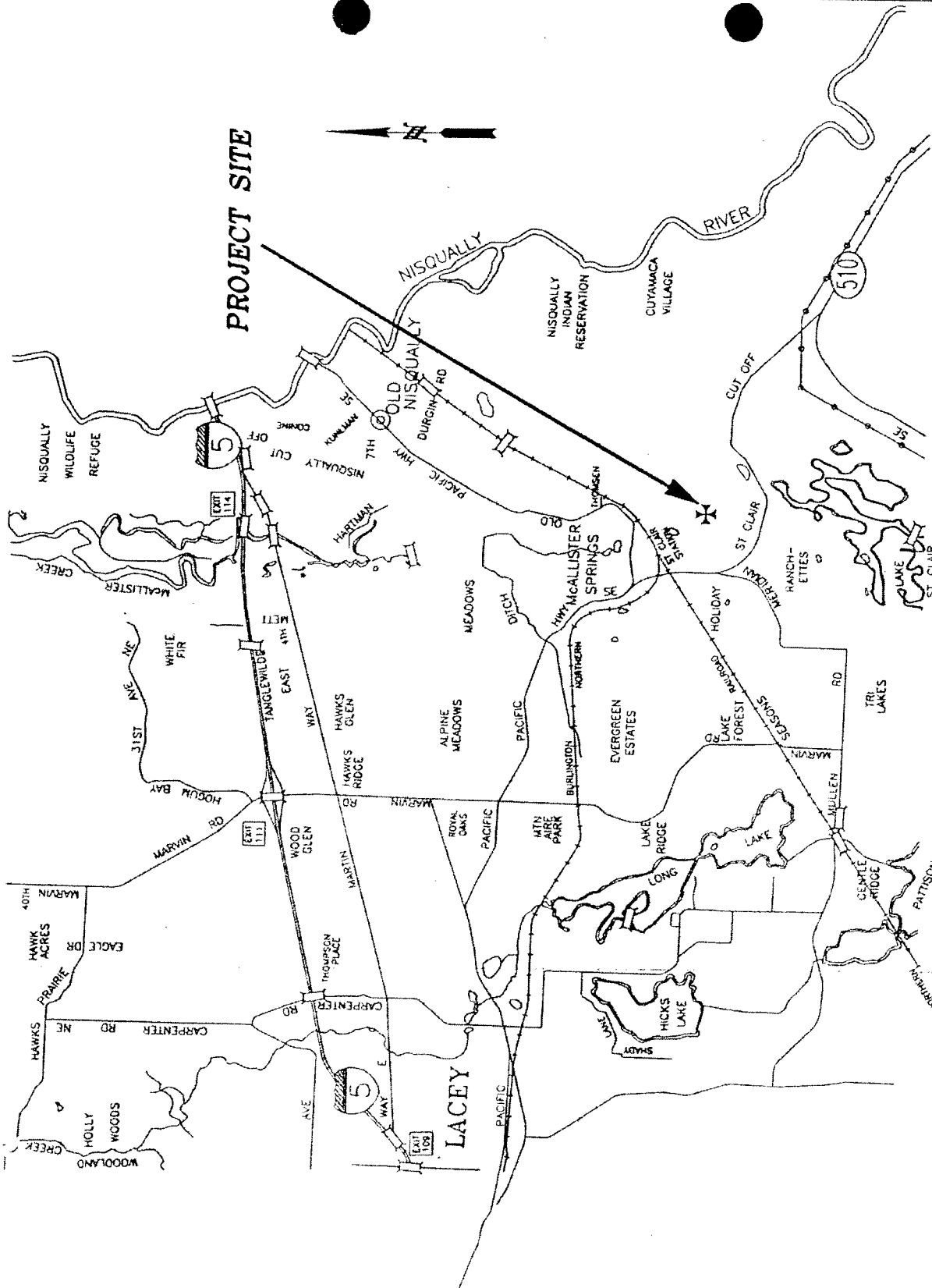
DWN: JH APR: MK

SCALE: 1" = 400'

CITY OF OLYMPIA
McALLISTER WELLFIELD
WATER RIGHTS
EXHIBIT 1

SHEET 1 OF 1

VICINITY MAP



DATE: OCT. 1995		CITY OF OLYMPIA	
DWN: JH APR: MK		McALLISTER WELLFIELD	
SCALE: NTS		VICINITY MAP	
		SHEET 1 OF 1	

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

RECEIVED
WATER RIGHT

RECEIVED
APPLICATION FOR CHANGE OF WATER RIGHT

☐ PURPOSE ☐ DIVERSION OR WITHHELD ☐ A9:32
☐ PLACE ☒ ADDITIONAL POINT OR POINTS

Accepted By g
Date 10/10/95
Is Field Exam. Required?
☐ YES ☐ NO
Determined By _____

NAME		S.W. REGIONAL		(360) 753-8740	
City of Olympia (Contact Person: Michael Kardas)				Buss. Tel.	N/A
				Home Tel.	N/A
				Other Tel.	N/A
ADDRESS P.O. Box 1967		(CITY) Olympia	(STATE) WA	(ZIP CODE) 98507	
APPLICATION NUMBER 8672		PERMIT NUMBER 6337		CERTIFICATE NUMBER S 2-01105 C	
DECREED RIGHT (TITLE OF CASE) N/A					
APPROPRIATIONS MADE (GIVE DATE IF PRIOR TO JUNE 7, 1917 IF SURFACE WATER, OR JUNE 7, 1945 IF GROUND WATER) N/A					
IS THE WATER RIGHT RECORDED IN YOUR NAME? IF NO, GIVE NAME RECORDED UNDER ☒ YES ☐ NO					
1. RIGHT CONSISTS OF WATERS USED FROM (STREAM, LAKE, WELL, OR TRENCH, ETC.) McAllister Springs GALLONS PER MINUTE OR CUBIC FEET PER SECOND 5.33 cubic feet per second WATER CURRENTLY USED FOR municipal supply TIME OF USE continuously					
2. LOCATION OF PRESENT POINT OF DIVERSION OR WITHDRAWAL ENTER BELOW THE DISTANCES FROM THE NEAREST SECTION OR PROPERTY CORNER TO THE DIVERSION OR WITHDRAWAL. North 67°20' east 3480 feet from the southwest corner of Section 19 LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION) NW¼ SE¼ SECTION 19 TOWNSHIP N. 18 RANGE (E. OR W.) W.M. 1E COUNTY Thurston IF THIS IS WITHIN THE LIMITS OF A RECORDED PLATTED PROPERTY, COMPLETE THIS SECTION LOT BLOCK OF (GIVE NAME OF PLAT OR ADDITION)					
3. LEGAL DESCRIPTION OF LANDS WATER IS USED ON Area served by the City of Olympia					
SECTION TOWNSHIP N. RANGE, (E. OR W.) W.M. COUNTY (ATTACH SEPARATE SHEET IF NECESSARY) ARE YOU THE LEGAL OWNER OF THE ABOVE DESCRIBED LANDS IF NO, EXPLAIN YOUR INTEREST ☐ YES ☒ NO The City of Olympia is a major purveyor of municipal water supply in the above-described area.					

A MINIMUM FEE OF \$10.00 MUST ACCOMPANY THIS APPLICATION

CONTINUE ON REVERSE SIDE

CHANGE

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

Attachment E

APPLICATION FOR CHANGE OF WATER RIGHT

☐ PURPOSE ☐ DIVERSION OR WITHDRAWAL
☐ PLACE ☒ ADDITIONAL POINT OR POINTS

RECEIVED

Accepted By	SC
Date	Oct 16 95
Is Field Exam. Required?	☐ YES ☐ NO
Determined By	

NAME City of Olympia (Contact Person: Michael Kardas)		Bus. Tel. (360) 753-8740
ADDRESS (CITY) Olympia (STATE) WA (ZIP CODE) 98507		Home Tel. N/A
P.O. Box 1967		Other Tel. N/A
APPLICATION NUMBER 13460	PERMIT NUMBER 10191	CERTIFICATE NUMBER
DECREED RIGHT (TITLE OF CASE) N/A		
APPROPRIATIONS MADE (GIVE DATE IF PRIOR TO JUNE 7, 1917 IF SURFACE WATER, OR JUNE 7, 1945 IF GROUND WATER) N/A		

IS THE WATER RIGHT RECORDED IN YOUR NAME? ☒ YES ☐ NO IF NO, GIVE NAME RECORDED UNDER

1. RIGHT CONSISTS OF

WATERS USED FROM (STREAM, LAKE, WELL, OR TRENCH, ETC.) Unnamed Springs (Abbot)	GALLONS PER MINUTE OR CUBIC FEET PER SECOND 10 cubic feet per second
WATER CURRENTLY USED FOR to be Municipal supply	TIME OF USE Continuously

2. LOCATION OF PRESENT POINT OF DIVERSION OR WITHDRAWAL

ENTER BELOW THE DISTANCES FROM THE NEAREST SECTION OR PROPERTY CORNER TO THE DIVERSION OR WITHDRAWAL.

North 69°35' east 5218 feet from Southwest corner Sec. 19 T18N R1 E WM

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION) NE 1/4 SE 1/4	SECTION 19	TOWNSHIP N. 18	RANGE (E. OR W.) W.M. 1E	COUNTY Thurston
--	---------------	-------------------	-----------------------------	--------------------

IF THIS IS WITHIN THE LIMITS OF A RECORDED PLATTED PROPERTY, COMPLETE THIS SECTION

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)
-----	-------	------------------------------------

3. LEGAL DESCRIPTION OF LANDS WATER IS USED ON PROPOSED TO BE USED ON

City of Olympia water service area.

SECTION	TOWNSHIP N.	RANGE (E. OR W.) W.M.	COUNTY Thurston
---------	-------------	-----------------------	--------------------

(ATTACH SEPARATE SHEET IF NECESSARY)

ARE YOU THE LEGAL OWNER OF THE ABOVE DESCRIBED LANDS ☐ YES ☒ NO IF NO, EXPLAIN YOUR INTEREST

The City of Olympia is a major purveyor of municipal water supply in the above-described area.

REASONS FOR THE PROPOSED CHANGE

To protect municipal supply from possible hazardous spills on the highway or railroad. The springs are downgradient from both facilities, relocation will place supply upgradient from railroad and highway.

A MINIMUM FEE OF \$10.00 MUST ACCOMPANY THIS APPLICATION

CONTINUE ON REVERSE SIDE

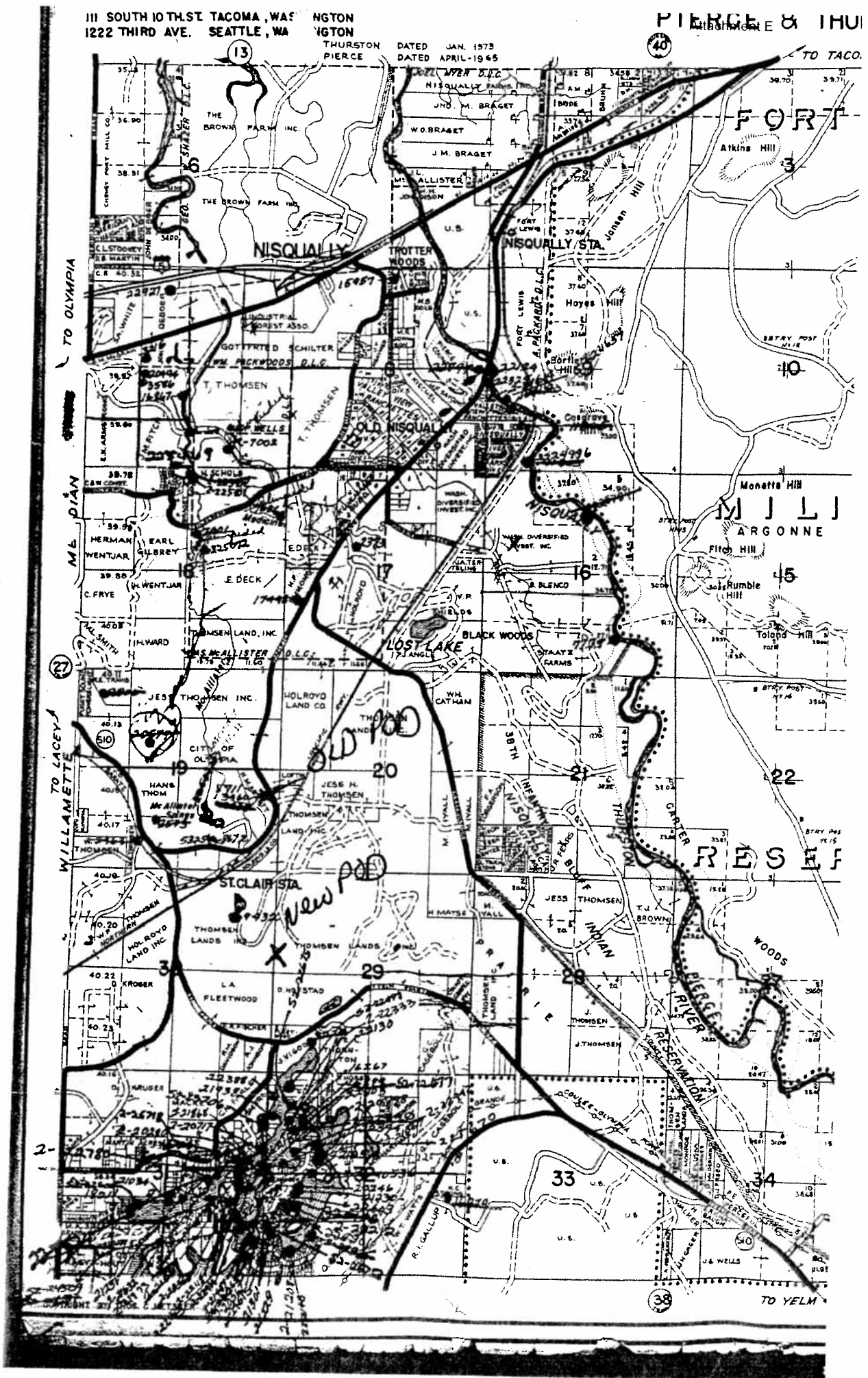
CHANGE

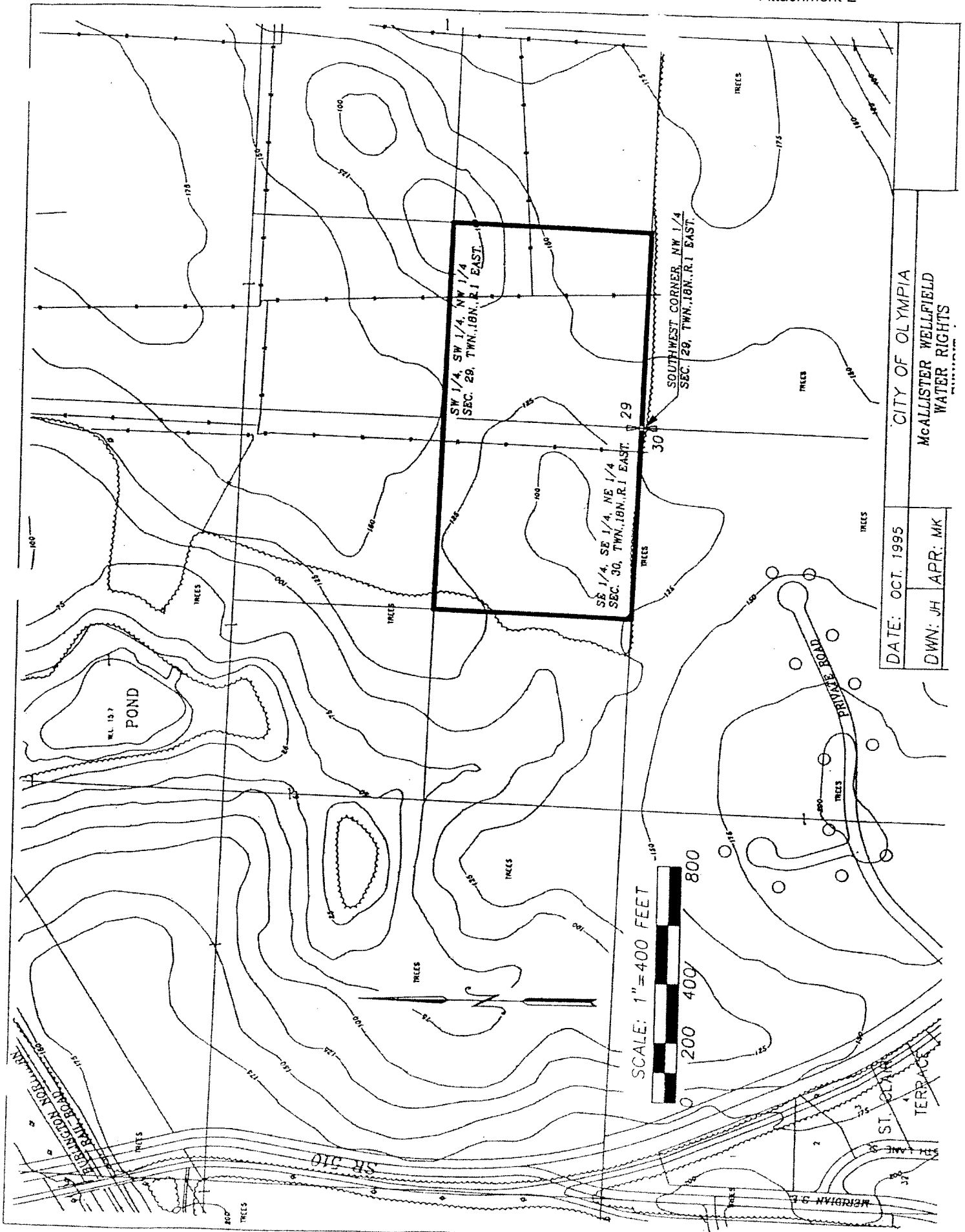
[illegible]

City Engineer
City of Olympia

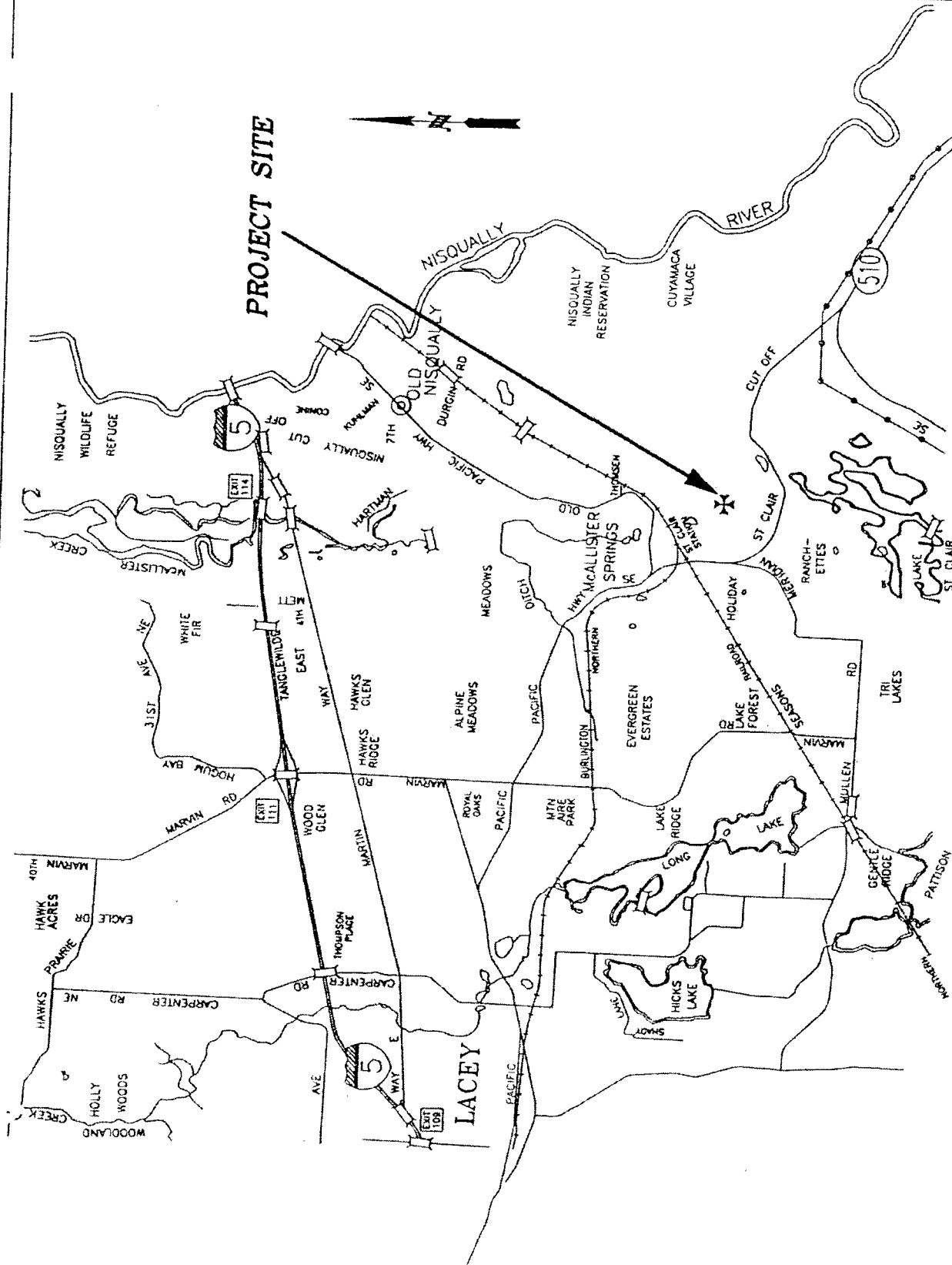
APPLICANT'S SIGNATURE

TO TACO.





VICINITY MAP



PROJECT SITE

DATE: OCT. 1995

DWN: JH APR: MK

CITY OF OLYMPIA

McALLISTER WELLFIELD

VICINITY MAP

CHANGE REQUESTED	
CHANGE WATER USE TO No change	TIME OF USE No change
GALLONS PER MINUTE OR CUBIC FEET PER SECOND 5.33 cubic feet per second	

LOCATION OF PROPOSED POINT OF DIVERSION OR WITHDRAWAL

ON ACCOMPANYING SECTION MAPS, ACCURATELY MARK AND IDENTIFY EACH POINT OF DIVERSION. SHOW NORTH-SOUTH AND EAST-WEST DISTANCES FROM NEAREST SECTION CORNER OR PROPERTY CORNER.

ALSO, ENTER BELOW THE DISTANCES FROM THE NEAREST SECTION OR PROPERTY CORNER TO THE DIVERSION OR WITHDRAWAL.
Approximately 400 feet north of the Southwest corner, NW $\frac{1}{4}$ Sec. 29 T18N R1 East

LOCATED WITHIN (SMALLEST LEGAL SUBDIVISION)	SECTION	TOWNSHIP N.	RANGE (E. OR W.) W.M.	COUNTY
SW $\frac{1}{4}$ NW $\frac{1}{4}$	29	13	1E	Thurston

IF THIS IS WITHIN THE LIMITS OF A RECORDED PLATTED PROPERTY, COMPLETE THIS SECTION

LOT	BLOCK	OF (GIVE NAME OF PLAT OR ADDITION)

ARE YOU THE OWNER OF THE LAND ON WHICH THE PROPOSED POINT OF DIVERSION OR WITHDRAWAL IS TO BE LOCATED
☐ YES ☐ NO

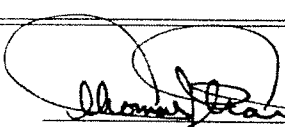
LEGAL DESCRIPTION OF LANDS WATER IS TO BE USED ON

The water service area of the City of Olympia as described in the approved
City of Olympia Water Comprehensive Plan.

SECTION	TOWNSHIP N.	RANGE, (E. OR W.) W.M.	COUNTY

(ATTACH SEPARATE SHEET IF NECESSARY)

ARE YOU THE LEGAL OWNER OF THE ABOVE DESCRIBED LANDS	IF NO, EXPLAIN YOUR INTEREST
☐ YES ☒ NO	The City of Olympia is a major purveyor of municipal water supply in the above-described area.



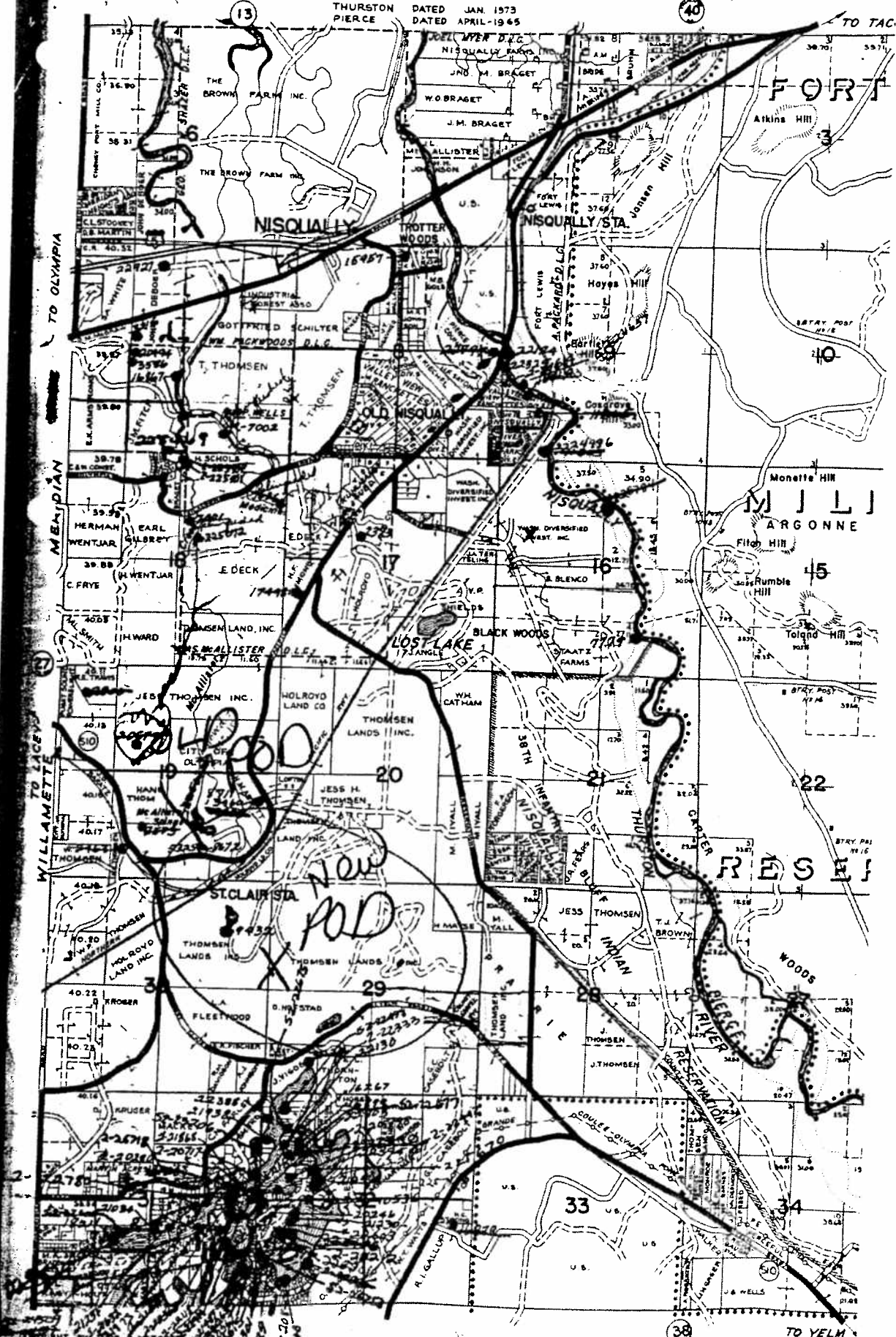
 City Engineer
 City of Olympia

APPLICANT'S SIGNATURE

111 SOUTH 10TH ST TACOMA, WASHINGTON
1222 THIRD AVE. SEATTLE, WASHINGTON

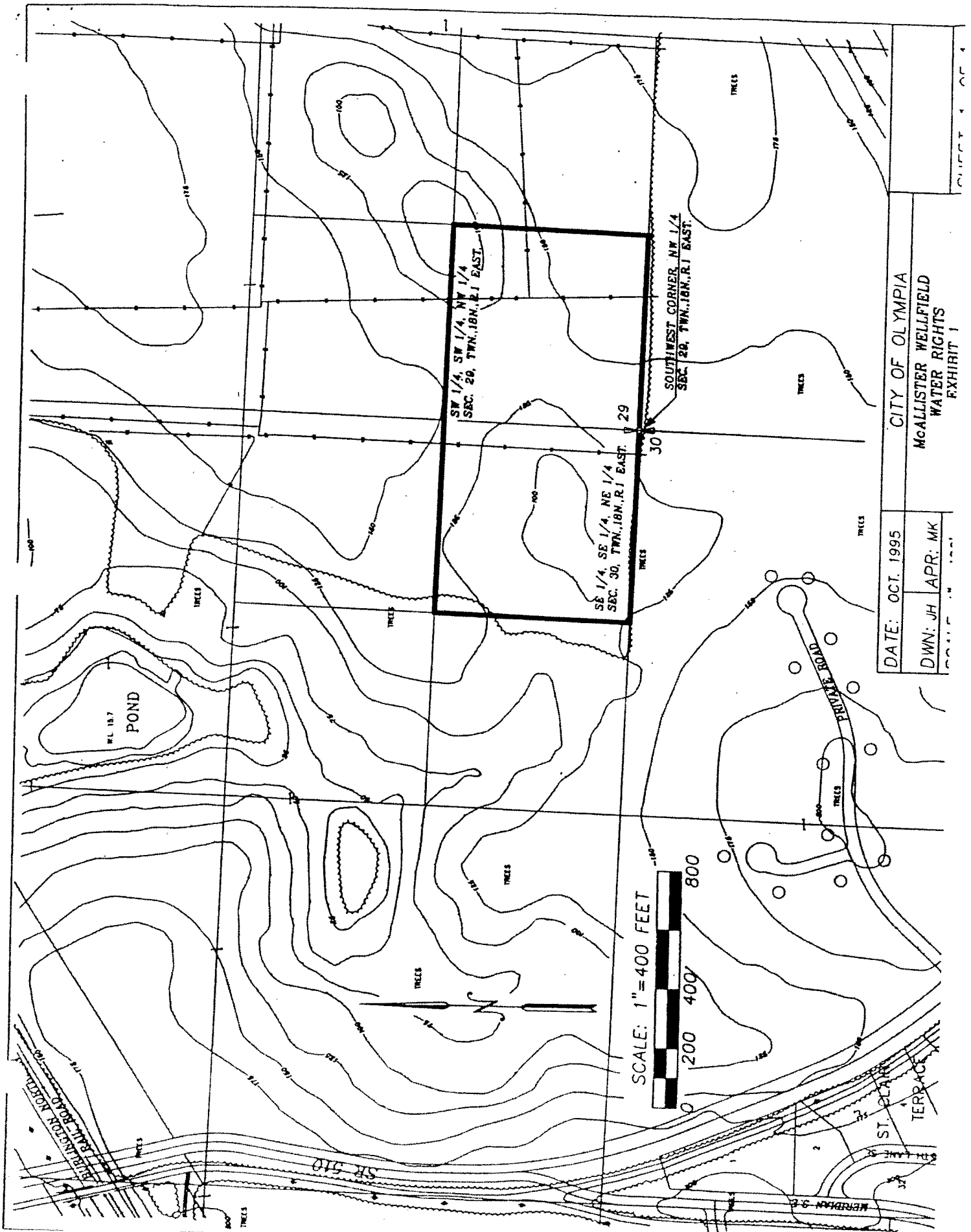
PIERCE & TH

THURSTON
PIERCE
DATED JAN. 1973
DATED APRIL-1965

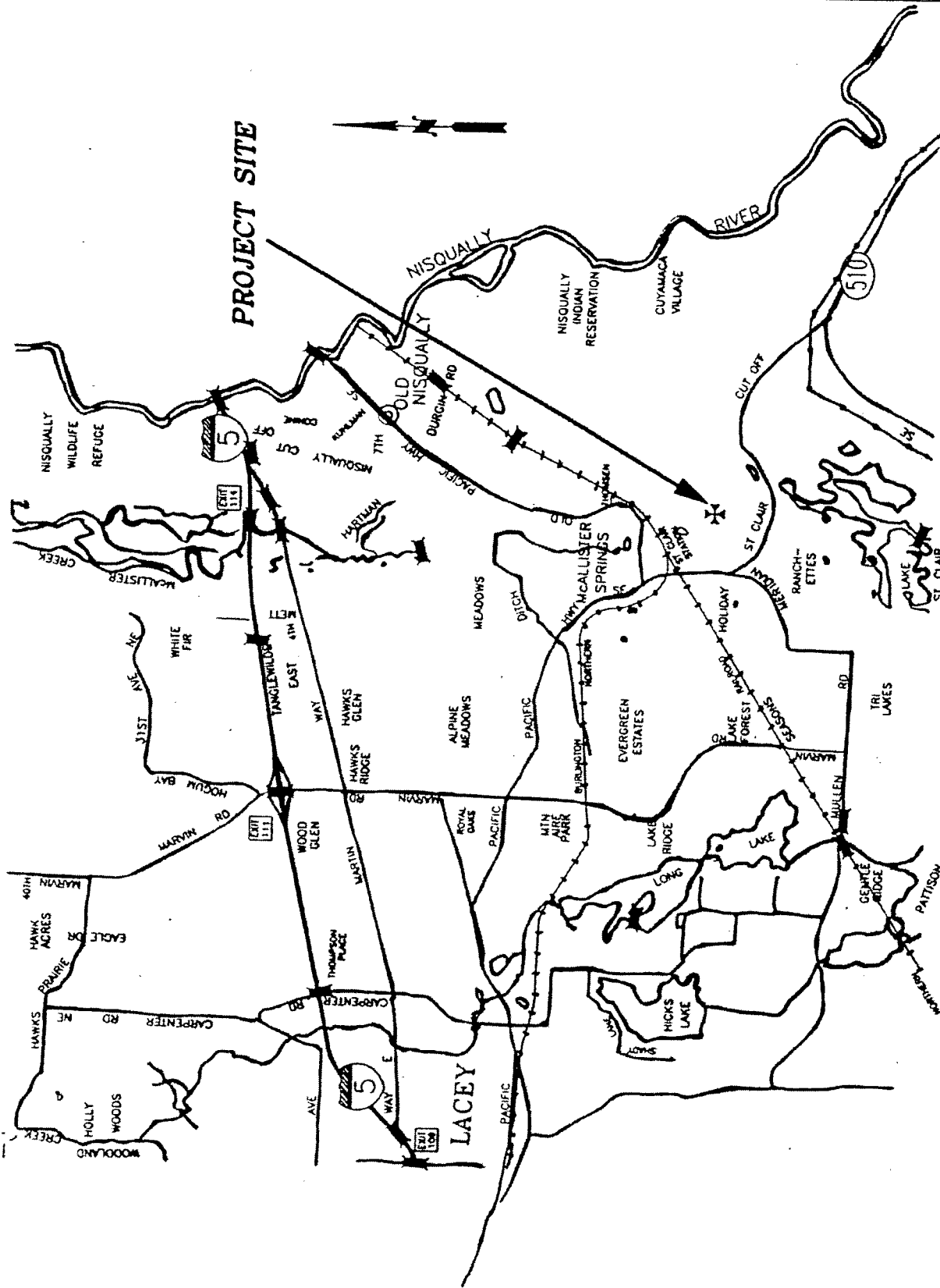


TO OLYMPIA
TO LACV
WILLAMETTE

TO TAC.
TO YELM



DATE: OCT. 1995		CITY OF OLYMPIA	
DWN: JH APR: MK		McALLISTER WELLFIELD	
		WATER RIGHTS	
		EXHIBIT 1	



VICINITY MAP

DATE: OCT. 1995

V: JH APR: MK

SCALE: NTS

CITY OF OLYMPIA

McALLISTER WELLFIELD

VICINITY MAP

SHEET 1 OF 1

Attachment 'F'

Lacey's Evergreen Estates Well Monthly Production Used in Model Baseline

Month	Gallons/Baseline
June	11,318,400
July	18,114,912
August	20,704,032
September	13,422,240

CLASS A RECLAIMED WATER SERVICE AGREEMENT

END USER: _____
CONTACT PERSON: _____
TITLE: _____
PHONE NO.: (____) _____ EMAIL: _____
ADDRESS: _____

TERMS AND CONDITIONS OF SERVICE

The End User identified in this Service Agreement, in receiving Class A Reclaimed Water from the City of Olympia (City) under this Service Agreement, does hereby agree to the following Terms and Conditions for the use of Class A Reclaimed Water:

DEFINITION

“Class A Reclaimed Water” means reclaimed water that meets Washington State Class A Reclaimed Water criteria established in Washington State reclaimed water regulations found at RCW 90.46 and WAC 173-219, as currently defined, or as Class A Reclaimed Water may be defined in the future.

1. Use of Reclaimed Water

End User is authorized to use Class A Reclaimed Water upon signing this Service Agreement under the terms and conditions described in this Agreement:

- a. **Use Area(s)** or location(s) of use as described here and shown on **Exhibit A:** _____
- b. **Intended Use(s):** _____
- c. **Period of Use:**
 - ☐ Year-round
 - ☐ Temporary: From (date) _____ to (date) _____
 - ☐ Other: _____

2. Quantity of Reclaimed Water

When available from LOTT Clean Water Alliance (LOTT), the City will provide Class A Reclaimed Water to the End User as follows:

- a. Minimum Quantity (gallons per day): _____
- b. Maximum Quantity (gallons per day): _____

Continued provision of reclaimed water depends on supply provided by LOTT Clean Water Alliance to the City and may be subject to change. When reclaimed water is available from LOTT sufficient to serve the minimum quantity established in this Section and the City cannot provide that water, potable water may be used to make up at least the minimum quantity at the price established in Section 3, providing the potable water system is adequately protected against cross-connections with the reclaimed water system as determined by the City, and the

reclaimed water system is adequately protected against cross-connections with lower quality or waste waters as determined by the City or LOTT.

3. **Price of Reclaimed Water**

Class A Reclaimed Water rates are set forth in Chapter 4 of the Olympia Municipal Code (OMC).

4. **General Use and Use Area Requirements**

- a. Standard notification signs required by the City must be posted in all Class A Reclaimed Water Use Areas.
- b. Backflow prevention assemblies must be installed, maintained, and tested in accordance with the City's current cross-connection control plan.
- c. All reclaimed water piping and appurtenances shall be color-coded purple, taped purple, or otherwise marked to identify the source of the water as being reclaimed water, consistent with Washington State reclaimed water regulations and the Uniform Plumbing Code.
- d. Reclaimed water use, including runoff and spray, shall be confined to the Use Area(s) designated in this Service Agreement.
- e. All End User personnel using reclaimed water must complete appropriate training in the requirements for the Intended Use(s) of the reclaimed water. This training requirement may be met by: 1) familiarizing personnel with the Terms and Conditions of this Service Agreement; and 2) discussing written materials provided by the City with personnel or attending orientation provided by LOTT or City staff. All training activities shall be documented and available to the City upon request. Training logs shall be maintained to show the most recent 5 years of training.
- f. Users of reclaimed water for irrigation must ensure the irrigation system(s) is in good working order, maintained regularly, and kept free of leaks. Sprinkler heads must be set to apply reclaimed water to the irrigated area at no more than the appropriate agronomic rate(s), and to avoid runoff or standing reclaimed water. Sprinkler heads must be adjusted to avoid application of reclaimed water to impervious surfaces.
- g. The reclaimed water distribution system(s) and Use Area(s) shall be maintained to ensure that all equipment associated with the reclaimed water system operates correctly and reliably at all times.
- h. End User must restrict access to reclaimed water facilities to authorized personnel.

5. **Restrictions on Use**

- a. Class A Reclaimed Water provided under this Service Agreement shall not be sold, leased, gifted, transferred, or conveyed to any other premise or Use Area(s), except to a direct tenant located in the Use Area(s) identified in this Service Agreement, without prior written approval by the City, which shall not be unreasonably denied.
- b. Class A Reclaimed Water may be used only as specified in this Service Agreement. Any change in the use or quantity of reclaimed water specified in Sections 1 or 2 of this Service Agreement must be specifically approved by an Amendment to the Agreement.
- c. Class A Reclaimed Water shall not be used for human consumption or in the preparation of foodstuffs or other products intended for human consumption.
- d. Class A Reclaimed Water shall not be discharged or released to any surface water body or stormwater collection or conveyance facility.
- e. All locations served with both potable water and reclaimed water shall be provided with appropriate cross-connection control on the potable water service as determined by the City.

- f. All locations served with reclaimed water where there exists a potential cross connection to lower quality or waste water shall provide appropriate cross-connection control to protect the reclaimed water system as determined by the City or LOTT.

6. Temporary Interruption of Supply

In case of emergency repairs or other necessary work, or whenever public health or safety so demands, the City may temporarily discontinue the supply of Class A Reclaimed Water for reasons outlined in OMC 13.24. The City shall insofar as practicable, notify all reclaimed water customers affected when temporary service interruptions occur. The City shall not be responsible for any damage resulting from interruption or change of the reclaimed water supply, or for any damages incurred by the End User arising out of the use or transport of the reclaimed water.

7. Disclaimer, Indemnity, and Hold Harmless

- a. To the extent permitted by law, the End User shall hold harmless, indemnify, and defend the City whether acting as a separate municipal entity or as a member of LOTT, and LOTT separately, from any claims, suits, actions, losses, penalties, judgments, or awards for damages of any kind arising out of or in connection with the use of Class A Reclaimed Water provided under this Service Agreement, except to the extent arising out of the negligence or other fault of the City or LOTT.
- b. User will not take any action that would interfere with the City's agreement to comply with LOTT's permit and all applicable federal, state, and local laws, regulations, and standards that govern the generation and delivery of Class A Reclaimed Water.

8. Termination

- a. Class A Reclaimed Water service may be terminated without cause upon thirty (30) days written notice by the City; provided, however, that if the City terminates Class A Reclaimed Water service without cause prior to the expiration of five (5) years from the date of this Service Agreement, the City will provide potable water to the End User in the same quantities and prices set forth in Section 3 above until five (5) years from the date of this Service Agreement.
- b. Termination for violation of the requirements described in Section 9b below voids the City's obligations under this Section 8a.

9. Compliance with Laws Governing Reclaimed Water

- a. The End User's use of Class A Reclaimed Water will meet all applicable requirements contained in Washington State reclaimed water regulations and Ordinance No. 6874, Chapter 13.24 of the OMC, as amended from time to time, or contained in any successor standards or ordinances.
- b. Failure to correct deficiencies or improper use in a timely manner could lead to violation(s) which may result in the termination of Class A Reclaimed Water service under this Service Agreement. The City shall notify the End User in writing and provide a reasonable opportunity and time frame for the End User to correct the noncompliance before terminating service.

10. References

- a. LOTT's Permit – National Pollutant Discharge Elimination System Waste Discharge and Reclaimed Water Permit No. _____ issued by State of Washington Departments of

Ecology and Health to LOTT Clean Water Alliance, effective _____ (date), and future amendments and renewals as issued.

END USER:

I, the undersigned, do hereby affirm that I have the legal authority to enter into this Service Agreement for Class A Reclaimed Water service on behalf of the End User identified above, that I have read the Terms and Conditions specified in this Service Agreement and references herein, and that the End User identified above agrees to and shall be bound by said Terms and Conditions for the use of reclaimed water as specified in this Service Agreement and the references herein:

By: _____
Printed Name and Title Signature Date

CITY OF OLYMPIA:

By: _____
Printed Name and Title Signature Date

Approved As To Form:

By: _____
Printed Name and Title Signature Date

RESOLUTION NO. 917

CITY OF LACEY

A RESOLUTION RELATING TO THE PROVIDING OF SERVICES BY THE CITY'S WATER UTILITY SYSTEM.

WHEREAS, the City of Lacey has, and intends to continue to manage its water resources in a manner which will protect environmental quality, provide for the public health, protect fish and other aquatic habitat, provide for a vibrant local economy and account for anticipated growth mandated by the State Growth Management Act, and

WHEREAS, the City has set goals for reducing per capita water usage by adopting a tiered water rate schedule, mandating limitations on summer watering schedules, providing for the use of reclaimed water, providing water conservation services and water audits to its customers and establishing a leak detection program and a pipe replacement program, and

WHEREAS, the City has promoted water quality by acquiring land along the Woodland Creek corridor, consistently expending funds for habitat enhancement along Woodland Creek, entering into a lengthy process to eliminate untreated discharges of stormwater into service water bodies within the City's jurisdiction, adopting a low impact development ordinance and engaging in other activities designed to enhance water quality and salmon restoration, and

WHEREAS, the City has been an active participant in the preparation and implementation of the WRIA 11 Nisqually River Watershed Management Plan and the planning efforts of the WRIA 13 Deschutes River Watershed Management Plan, and has entered into partnerships with the LOTT Alliance and the partner jurisdictions of such Alliance for a Water Conservation Coordination Plan, supported the efforts of the inter-jurisdictional Stream Team and Project Green and cooperated with the City of Olympia for joint mitigation of potential impacts of water supply production, and

WHEREAS, the City has filed applications with the Washington State Department of Ecology for additional water rights and water right transfers and is engaged jointly with the Cities of Olympia and Tumwater in an attempt to acquire and transfer for municipal use existing water rights formerly held by the Brewery located in the City of Tumwater, and

Whereas, the City has secured over one-half of its existing water rights by purchase from private parties within and adjacent to the City's water service area, however, the availability of additional rights to purchase is nearly exhausted, and

WHEREAS, despite the efforts described in the previous recitals, the City has been unable to

secure water rights and water to provide for the health and safety of an expanding population mandated by the Washington State Growth Management Act and therefore the City staff, with the approval of the City Council, has instituted policies limiting the availability of water for future water customers and the City Council desires to officially adopt such policies,

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF LACEY, WASHINGTON, as follows:

Section 1. Subject to the provisions of Section 2, hereof, the following policies shall govern the decisions of the City regarding the availability of services from the City's Water Utility System:

A. The City shall only commit to providing future water services pursuant to the provisions of Subsection B of this Section. Provided, however, that water services to properties located within the City shall be provided if both water rights and water production is available at the time that buildings located upon such properties are connected to the City's System.

B. Commitments for future water services shall be made by the City only if one of the following conditions applies:

(1) Sufficient water production is available and the owner or developer of the property provides water rights to the City sufficient to serve such property and the transfer of such water rights for municipal use is approved by the State Department of Ecology.

(2) The owner or developer of the property provides water rights to the City and facilitates an acceptable water supply agreement with another qualified water purveyor for furnishing to the City sufficient water to serve the subject property.

(3) The owner or developer of the property enters into an agreement acceptable to the City which commits such owner or developer to use reclaimed water for all irrigation and toilet flushing within the development and, in addition, where feasible and allowed by state law and regulation, use for other purposes within the development. The City shall not approve such an agreement unless a sufficient supply of reclaimed water beyond that needed for water right mitigation is available in the area in question and the agreement makes provision for the installation or advanced payment for the infrastructure necessary to store, distribute and convey such reclaimed water from LOTT reclaimed water facilities to the development.

C. The City Manager is authorized to enter into such agreements as may be necessary pursuant to the Coordinated Water System Plan for Thurston County for the providing of temporary water service by other public water purveyors or water purveyors meeting the requirements of the Washington State Department of Health and regulated by the Washington State Utilities and Transportation Commission to properties which are located within the City's service area but cannot currently be served by the City under the policies adopted herein.

Section 2. The policies set forth in Section 1, hereof, shall be reviewed by the City Council on an annual, or, if necessary, a more frequent basis to determine whether such policies can or should be modified.

ADOPTED BY THE CITY COUNCIL OF THE CITY OF LACEY, WASHINGTON, this ____ day of _____, _____.

CITY COUNCIL

By _____
Mayor

Attest:

Approved as to form:

City Clerk

City Attorney

MASTER INTERLOCAL AGREEMENT
BETWEEN LOTT CLEAN WATER ALLIANCE AND CITY OF LACEY

This Agreement is entered into in duplicate originals this 8TH day of May, 2014 between the LOTT CLEAN WATER ALLIANCE, a 501(c)(3) corporation acting as a public agency to provide wastewater resource management services (hereinafter "LOTT") and the CITY OF LACEY, a municipal corporation (hereinafter "City"), pursuant to RCW 39.34.080.

WHEREAS, it is to the mutual advantage of LOTT and the City to cooperate as described herein in order to make the most efficient use of their resources to provide services and facilities needed by the citizens residing within their respective jurisdictions; and

WHEREAS, RCW 39.34.080 authorizes a public agency to contract with another public agency to perform any governmental service, activity, or undertaking that each public agency is authorized by law to perform;

NOW THEREFORE, by virtue of RCW 39.34.080 and in consideration of the terms, conditions, covenants, and performances contained herein, or attached and incorporated and made a part hereof, IT IS MUTUALLY AGREED AS FOLLOWS:

I

GENERAL

- 1.0 It is the purpose of the Agreement to permit the parties to make the most efficient use of their resources by enabling them to cooperate by providing staff support, equipment, and materials when available on a reimbursable basis for roadway, utility, and utility appurtenance maintenance activities or cooperate on joint roadway, utility, and utility appurtenance maintenance and repair projects. This will be done with the understanding that the work of the owner of the requested resources takes first priority.
- 1.1 This Agreement sets forth all terms and conditions agreed upon by LOTT and the City and supersedes any and all prior agreements oral or otherwise with respect to the subject matter addressed herein.

II

DURATION

- 2.0 This Agreement shall become effective on the date written above and shall remain in effect for five (5) years unless terminated sooner as provided for herein. At the end of the five-year term, this Agreement may be renewed under those terms and conditions mutually agreed to by the parties herein. Prior to becoming enforceable, this Agreement shall be executed by both Parties and recorded with the Thurston County Auditor's Office or posted upon the websites or other electronically retrievable public source as required by RCW 39.34.040.

III
REQUEST FOR SERVICES

- 3.0 Each request for service shall be submitted by the authorized official or designee on behalf of each entity. Each request for service shall be in writing and shall specify the particular service required, the amounts and types of labor, equipment, and material required, the location of the work, the estimated cost of the work, when the work is to be performed, and other information pertinent to the request. Upon receipt of the request, the party which has been requested to supply the service shall indicate their acceptance or rejection of the request, have the request reduced to a writing that complies with RCW 39.34 et.seq, and signed by their authorized official, and return one (1) copy to the requesting party. The authorized official for LOTT is the Executive Director and for the City of Lacey is the City Administrator or designee. In cases of emergency, as declared in writing by the official at the requesting agency authorized to do so, the request and approval may be verbal, but must be documented in writing within 48 hours of the verbal request, and following up by an Agreement that complies with RCW 39.34 et.seq. . In some instances, it may be necessary for one or both Parties to obtain the authorization of their respective governing body as a pre-requisite to provide services under this Agreement or, in the case of an emergency, for the governing body to review the services provided.
- 3.1 The party that accepts the request for service agrees to perform, or cause to be performed, all work and furnish, or cause to be furnished, all materials and equipment required to procure and perform the work described in the Request for Services. The work shall be procured and performed in accordance with this Agreement and all applicable city, state, and federal laws, policies, and regulations applicable to each Party.

IV
PAYMENT

- 4.0 The parties to this Agreement agree that the party receiving services under this Agreement shall reimburse the party providing the services for their actual direct and related indirect costs. Upon request of the providing party, the party receiving services shall make partial payments to cover out of pocket costs incurred. These payments are not to be more frequent than once per month. It is agreed that any such partial payment will not constitute agreements as to the appropriateness of any item or to the reasonableness of the cost incurred. Neither party may incur costs on behalf of the other beyond that expressed in their written agreement to perform services without first obtaining the requesting party's written consent.
- 4.1 The maximum amount payable for work to be performed under this Agreement is \$100,000 per calendar year.

V

RECORDS RETENTION AND AUDIT

- 5.0 During the progress of the work and for a period not less than six (6) years from the final date of payment, the records and accounts pertaining to the work and accounting therefore are to be kept available for inspection and audit by either party and/or the Federal Government. Copies of all records, accounts, documents, or other data pertaining to the work will be furnished upon request. If any litigation, claim, or audit is commenced, the records and accounts along with supporting documentation shall be retained until all litigation, claim, or audit finding has been resolved even though such litigation, claim, or audit continues past the 6-year retention period. The Parties agree that any requirements under the Washington Public Records Act and RCW 40.14 that exceed the six (6) year requirement described herein shall be complied with.

VI

CARE AND MAINTENANCE OF EQUIPMENT

- 6.0 The parties agree that any time a request is made for the use of equipment, the requesting party shall be responsible for the proper care, maintenance, and security of the equipment until the equipment is returned to the owner. Any damage other than normal wear and tear will be the responsibility of the party in possession of the equipment at the time the equipment is damaged.

VII

RIGHT OF ENTRY

- 7.0 The parties to this Agreement hereby grant and convey to each other the right of entry upon all land in which the parties have interest, within or adjacent to the right of way of the highway, road, or street for the purpose of accomplishing all work or services requested as part of this Agreement.

VIII

RELATIONSHIP OF PARTIES

- 8.0 The employees or agents of each party who are engaged in the performance of this Agreement shall continue to be employees or agents of that party and shall not be considered for any purpose to be employees or agents of the other party. This Agreement is for the benefit of the parties, and no third party beneficiary relationship is intended. No separate legal entity and no joint organization are created by this Agreement. No common budget is to be established. No personal or real property is to be jointly acquired or held.

IX

HOLD HARMLESS AND INDEMNIFICATION

- 9.0 The City shall hold harmless, indemnify, and defend LOTT, its officers, officials, employees and agents, solely for third party claims relating to bodily injury, sickness or death, or real or personal property damage or destruction and loss of use thereof, including costs and attorney's

fees in defense thereof, caused by or arising out of the City's negligence in the performance of its obligations under this Agreement.

- 9.1 LOTT shall hold harmless, indemnify, and defend the City, its officers, officials, employees and agents, solely for third party claims relating to bodily injury, sickness or death, or real or personal property damage or destruction and loss of use thereof, including costs and attorney's fees in defense thereof, caused by or arising out of the LOTT's negligence in the performance of its obligations under this Agreement.
- 9.2 The City's obligations hereunder shall not extend to bodily injury, sickness or death caused by or arising out of the sole negligence of LOTT, its officers, officials, employees or agents.
- 9.3 LOTT's obligations hereunder shall not extend to bodily injury, sickness or death caused by or arising out of the sole negligence of the City, its officers, officials, employees or agents.
- 9.4 In the event of the concurrent negligence of the parties, the City's obligations hereunder shall apply only to the percentage of fault attributable to the City, its officers, officials, employees or agents.
- 9.5 In the event of the concurrent negligence of the parties, the LOTT's obligations hereunder shall apply only to the percentage of fault attributable to LOTT, its officers, officials, employees or agents.
- 9.6 The provisions of this Section IX shall survive the expiration or termination of this Agreement and completion of the request for services.

X

INSURANCE

- 10.0 Both parties shall maintain Commercial General Liability or equivalent for bodily injury, personal injury and property damage, subject to limits of not less than \$1,000,000 per loss. The general aggregate limit shall apply separately to this Agreement and be no less than \$2,000,000. Participation in a governmental self-insured risk pool shall fulfill the above stated coverage requirements. An Evidence of Coverage acknowledgement letter from the jurisdictions' risk pools will be provided to each party. Other insurance coverage that may be unique to the work performed will be included in the written agreement following the acceptance of a request to perform work, as more particularly referred to in Section III herein.
- 10.1 Both parties shall maintain workers' compensation insurance as required by Title 51 RCW, and shall provide evidence of coverage to the other party.

- 10.2 Both parties shall maintain all required policies in force from the time services commence until services are completed. Certificates, policies, and endorsements expiring before completion of services shall be promptly replaced with written notice mailed to each party.

XI

TERMINATION

- 11.0 Either party may terminate this Agreement upon 30 calendar days' prior written notice to the other party. If this Agreement is so terminated, the parties shall be liable only for performance rendered or costs incurred in accordance with the terms of this Agreement prior to the effective date of termination. The hold harmless and indemnification provision shall survive the termination of this Agreement and completion of the request for services. In exercising its right to Termination, the Parties agree to act reasonable to minimize any costs associated with the overall project and the work specifically being undertaken pursuant to this Agreement.

XII

LEGAL RELATIONS

- 12.0 No liability shall attach to the parties by reason of entering into this Agreement except as expressly provided herein.

XIII

ADMINISTRATION AND NOTICE

- 13.0 The following individuals are designated as representatives of the respective parties. The representatives shall be responsible for administration of this Agreement and for coordinating and monitoring performance under this Agreement. Wherever written notice is required under this Agreement, such notice shall be provided to the representatives designated below. In the event such representatives are changed, the party making the change shall notify the other party.

The City's representative shall be the Wastewater Supervisor or their Designee

LOTT's representative shall be the Contract Administrator, 500 Adams Street NE, Olympia, WA 98501, 360-528-5718.

- 13.1 Any notice required under this Agreement shall become effective three (3) calendar days following the date of deposit in the United States Postal Service.

XIV

CHANGES, MODIFICATIONS, AND AMENDMENTS

- 14.0 This Agreement may be changed, modified, amended or waived only by written agreement executed by the authorized officials of both parties hereto.

XV
GOVERNING LAW AND VENUE

- 15.0 This Agreement has been and shall be construed as having been made and delivered within the State of Washington and it is agreed by each party hereto that this Agreement shall be governed by the laws of the State of Washington both as to its interpretation and performance. Any action at law, suit in equity, or judicial proceeding arising out of this Agreement shall be instituted and maintained only in a court of competent jurisdiction in Thurston County, Washington.

XVI
WAIVER

- 16.0 A failure by either party to exercise its rights under this Agreement shall not preclude that party from subsequent exercise of such rights and shall not constitute a waiver of any other rights under this Agreement unless stated to be such in a writing signed by an authorized representative of the party and attached to the original Agreement.

XVII
SEVERABILITY

- 17.0 If any provision of this Agreement or any provision of any document incorporated by reference shall be held invalid, such invalidity shall not affect the other provisions of this Agreement which can be given effect without the invalid provision, if such remainder conforms to the requirements of applicable law and the fundamental purpose of this Agreement, and to this end the provisions of this Agreement are declared to be severable.

XVIII
EQUAL OPPORTUNITY TO DRAFT

- 18.0 The parties have participated and had an equal opportunity to participate in the drafting of this Agreement, and the Exhibits, if any, attached. No ambiguity shall be construed against any party upon a claim that such party drafted the ambiguous language.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the day and year first above written.

City of Lacey

A blue ink signature of Scott Spence, consisting of a stylized 'S' and 'S'.

By: Scott Spence

Its: City Manager

LOTT Clean Water Alliance

A blue ink signature of Michael D. Strub, consisting of a stylized 'M' and 'S'.

By: Michael D. Strub

Its: Executive Director

ATTEST: Carol Litten

Carol Litten, City Clerk

ATTEST: Farah Derosier

Farah Derosier, Corporate Secretary

Approved as to form

By: David Schneider

David Schneider, City Attorney

Approved as to form

By: Rick Hughes

Rick Hughes, General Counsel

REQUEST FOR SERVICES
EXHIBIT _____
TO
MASTER INTERLOCAL AGREEMENT
BETWEEN LOTT CLEAN WATER ALLIANCE AND CITY OF LACEY

TITLE

SCOPE OF PROJECT

COST ESTIMATE (Itemization to be attached)

Labor	\$ _____
Materials	\$ _____
Equipment	\$ _____
Other	\$ _____
TOTAL	\$ _____

LOCATION OF WORK

START DATE

COMPLETION DATE

PROJECT CONTACTS

LOTT Clean Water Alliance

City of Lacey

CONCURRENCE

LOTT Clean Water Alliance

City of Lacey

Reclaimed Water Coordination:

Shared Objectives and Communication Procedures

LOTT Clean Water Alliance
City of Lacey
City of Olympia

LOTT supplies Class A reclaimed water to LOTT's partner jurisdictions for a variety of uses, including supply to the Cities of Lacey and Olympia for groundwater recharge at the Woodland Creek Groundwater Recharge Facility (WCGRF). A series of reclaimed water agreements between LOTT and the Partners governs the distribution and use of reclaimed water, and includes provisions that LOTT will provide reclaimed water to the cities without interruption to the best of its ability, but that all parties recognize there may be interruptions or limitations in service for a variety of reasons. The Cities' uses of reclaimed water changed substantially when the WCGRF came on line in 2014. Recognizing a need for improved coordination, staff from LOTT, Lacey, and Olympia were tasked with establishing operational objectives for the supply of reclaimed water from LOTT's Martin Way Reclaimed Water Plant to the Cities' Woodland Creek Groundwater Recharge Facility. This document outlines objectives developed over the course of several meetings in late 2016 and early 2017.

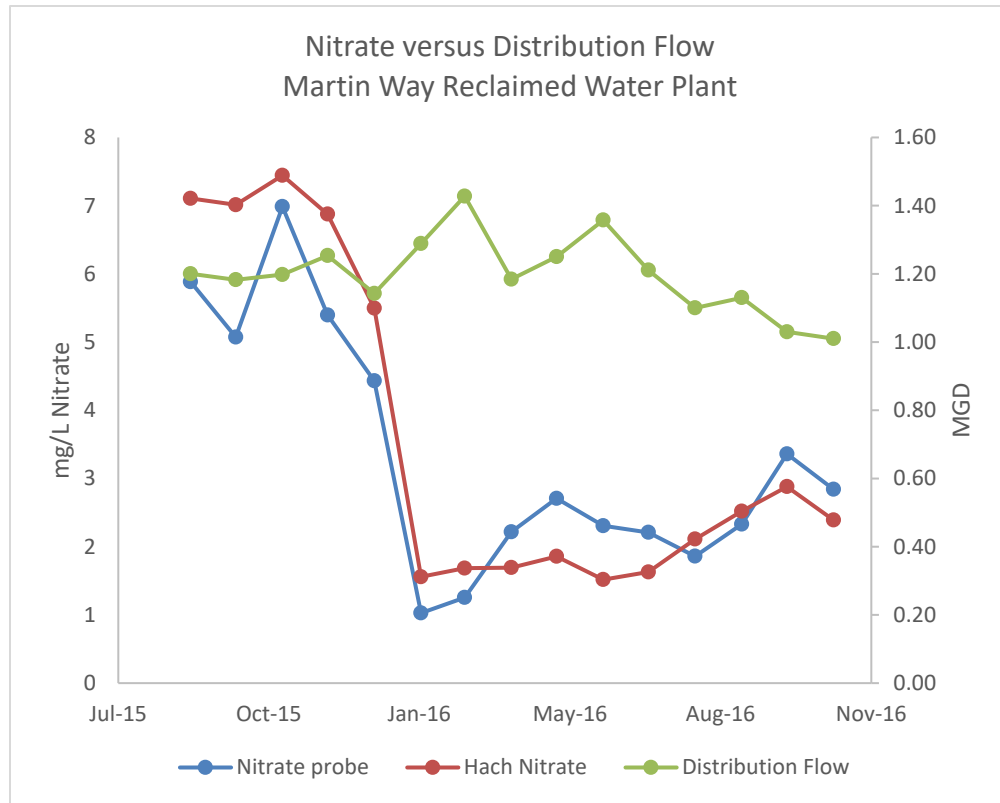
The document also describes standard communication procedures. Clear communication between LOTT and the Cities is essential to support a successful reclaimed water program. The Cities need to communicate in advance plans to operate reclaimed water systems and LOTT needs to communicate any planned or unanticipated service interruptions. Actions by either LOTT or the Cities are likely to impact the other, and clear, effective communications are the best method for preventing misunderstandings or problems.

Performance at Martin Way Reclaimed Water Plant

- In 2014 and 2015, total nitrogen levels in reclaimed water from the plant were between 5-10 mg/L.
- In early 2016, LOTT made changes to the treatment process to substantially lower nitrogen.
- The Martin Way plant is currently producing reclaimed water with nitrate levels < 5 mg/L under normal operating conditions.
- Operational conditions can affect plant performance and result in higher nitrate levels.

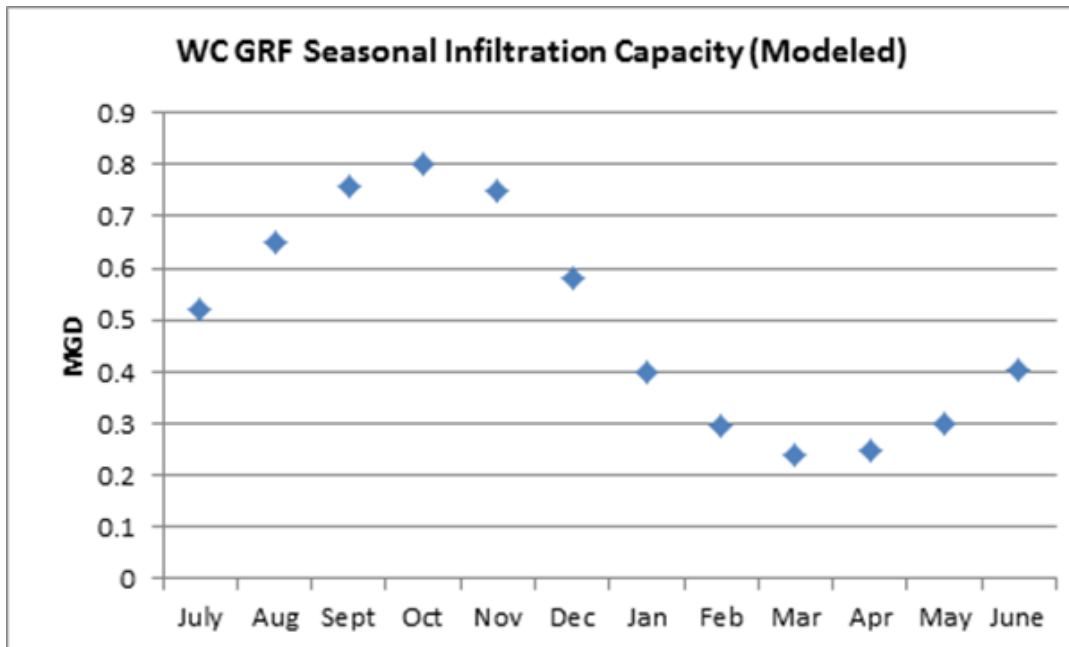
Constraints and circumstances that may cause increased nitrogen levels include:

- Maintenance and operational issues that require plant shut-downs
- High ammonia loads from STEP system septage that disrupt the biological process
- Lower temperatures
- Demands that require processing more than 1.5 mgd of flow at the plant (reduced retention time)



Needs at the Woodland Creek Groundwater Recharge Facility

- LOTT currently produces > 0.9 MGD at the Martin Way Reclaimed Water Plant. This meets the Cities' current needs for water rights mitigation at the Woodland Creek Groundwater Recharge Facility for the next 6-8 years. The Cities' needs will increase in the future as water rights are developed.
- The recharge facility was designed to infiltrate up to 300,000 gallons of reclaimed water per day in winter and 800,000 gallons per day in summer (see figure below), although actual quantities fluctuate each season based on groundwater levels and the Cities' mitigation needs. There will be times the Cities wish to infiltrate more than 800,000 gpd in summer to achieve their 5-year rolling average compliance measure.
- Reclaimed water with nitrate levels < 5 mg/L is consistent with the Cities' needs for the recharge facility.
- The Cities have not been infiltrating on a regular basis at the recharge facility since August 2015 due to concerns raised at neighboring Goose Pond. The Cities are working to better understand how to operate the facility to minimize impacts at the pond.



Shared Objectives

- LOTT will continue to operate the Martin Way Reclaimed Water Plant with the goal of nitrate levels < 5 mg/L.
- Under normal circumstances, LOTT and the Cities will operate the two recharge facilities – Woodland Creek Groundwater Recharge Facility (WCGRF) and the Hawks Prairie Ponds and Recharge Basins – following these general parameters:
 - Reclaimed water to be infiltrated at either location will have nitrate levels < 5 mg/L.
 - Reclaimed water with nitrate > 5 mg/L will not be distributed to the WCGRF.
 - Reclaimed water with nitrate > 5 mg/L will not be infiltrated at the Hawks Prairie site.
- LOTT and City staff will continue to work together to improve communications and coordination regarding reclaimed water.

Woodland Creek Groundwater Recharge Facility

- LOTT will shut off distribution of reclaimed water to the Woodland Creek Groundwater Recharge Facility when the following condition(s) exist:
 - The 5-day rolling average of nitrate (daily average from Hach data) is > 5 mg/L; and/or
 - Process control probe data shows a trend of nitrate climbing and staying above 6 mg/L for more than 4 hours.
- Under either of these conditions, LOTT will shut off distribution to the Woodland Creek facility and then notify the Cities.
- LOTT's process for evaluating and shutting off distribution to the WCGRF in general includes:

- Data is reviewed daily with automated alerts when nitrate values for 5-day rolling average are greater than 5 mg/L.
- When probe data shows greater than 6 mg/L for more than 4 hours, a sample will be taken and analyzed to verify nitrate levels.
- The Process Control and Environmental Compliance Supervisor will verify nitrate levels and make the decision, with backup from Operations Supervisors.
- Once the decision is made, LOTT staff will close the valve to WCGRF.
- When nitrate levels are once again < 5 mg/L, LOTT will notify the Cities and then turn on distribution to the Woodland Creek facility.

Hawks Prairie Reclaimed Water Ponds and Recharge Basins

- Reclaimed water from the Martin Way Reclaimed Water Plant is also sent to LOTT's Hawks Prairie Ponds and Recharge Basins site. Under most circumstances, water infiltrated at that site will have nitrate levels < 5 mg/L.
 - LOTT will collect data on nitrate levels of water leaving the ponds, prior to entering the infiltration basins.
 - Water with nitrate levels < 5 mg/L will be allowed to infiltrate at the site as needed.
 - Water with nitrate levels > 5 mg/L will be retained in the ponds and may be discharged to the Lacey wastewater collection system if necessary. If flow is discharged to the Lacey wastewater collection system, LOTT staff will notify Lacey staff.
- If conditions arise that require LOTT to deviate from these operational parameters, LOTT will notify the City of Lacey to discuss the situation.

These operational objectives are subject to change based on new and emerging information. LOTT will continue to collect data on nitrate levels in association with routine sampling and LOTT's Reclaimed Water Infiltration Study, and the Cities will continue monitoring associated with operation of the Woodland Creek Groundwater Recharge Facility. LOTT, Lacey, and Olympia staff will share data and work together to assess new information and adjust these objectives as warranted. It is anticipated that the objectives will be re-evaluated at the conclusion of the Reclaimed Water Infiltration Study, which is expected to be complete in early 2019.

Communication Procedures

The intent of this section is to establish standard communications procedures for a variety of scenarios to ensure that information is being shared in a timely and effective manner between LOTT, Lacey, and Olympia. In most cases, communications will occur between the staff members designated in the following table as Main Contacts for LOTT and each of the Cities. Typically, the Main Contacts will phone or email each other, cc'ing the staff members listed as 1st and 2nd Back-up Contacts to ensure timely response. Information will be shared with additional staff within each organization as needed.

Points of Contact

	NAME	EMAIL	WORK	CELL
LOTT				
Main Contact	Terri Prather	terriprather@lottcleanwater.org	528-5724	584-5989
1 st Back-Up	George Peterson	georgepeterson@lottcleanwater.org	528-5720	918-1210
2 nd Back-Up	Mark Petrie	markpetrie@lottcleanwater.org	528-5749	584-8375
LACEY				
Main Contact	Julie Rector	JRector@ci.lacey.wa.us	493-2410	
1 st Back-Up	Emergency Dispatch		704-2740	
2 nd Back-Up	Lance Sponberg	LSponber@ci.lacey.wa.us	456-7794	239-1148
OLYMPIA				
Main Contact	Erin Conine	econine@ci.olympia.wa.us	570-3793	
1 st Back-Up (24/7)	Emergency Dispatch		753-8333	

Seasonal Operations

The Woodland Creek Groundwater Recharge Facility was designed to operate year-round, however, high groundwater levels and other considerations have resulted in a seasonal operational pattern to date.

The following protocols will ensure that both LOTT and the Cities are aware and adequately prepared for start-up and shut-down of the WCGRF.

1. Start-Up – In advance of start-up of the WCGRF, Lacey staff will gather information about planned start up, including:
 - a. Anticipated start-up date
 - b. Anticipated plan for recharge – target recharge quantities for the season
 - c. Expected duration of infiltration – seasonal or continual
2. Notice of Start-Up Intent – The designated Lacey Main Contact will contact the LOTT Main Contact preferably one month prior to the planned start-up date to share start-up plans. Once Lacey has provided the Notice of Intent, Lacey and LOTT staff will stay in close communication until actual start up to ensure that changes in plans regarding start date are known as far in advance as possible. Recognizing that conditions affecting start-up may change unexpectedly and notice well in advance may not be possible, LOTT will strive to accommodate the Cities' start-up needs.
3. LOTT Preparations for Start-Up – Following Notice of Intent, LOTT operational staff will meet to discuss and schedule any necessary actions to prepare to distribute reclaimed water to accommodate the Cities' start up. Any issues related to LOTT's ability to accommodate the Cities' start up plan will be communicated to the Cities as soon as possible. In that case, LOTT and the Cities will work together to adjust start up plans as necessary.

4. Changes in Planned Use – The Lacey Main Contact will communicate with LOTT as far in advance as possible any changes in plans for taking/receiving reclaimed water at the facility. This includes any changes in the timing and/or quantity of reclaimed water expected to be used at the WCGRF.
5. Shut-Down – If the Cities plan to shut down the WCGRF for any period of time, the Lacey Main Contact will communicate with LOTT as far in advance as possible the expected date by which the WCGRF will be shut down and reclaimed water will temporarily not be needed at the facility.

Short-Term/Minor Service Interruptions

This scenario refers to short-term minor service interruptions that are not anticipated to significantly affect the quantity of water expected by the Cities.

1. Water Quality Interruptions – When nitrogen levels from the Martin Way Plant exceed established thresholds described above, LOTT will shut off distribution to the WCGRF and the LOTT Main Contact will notify the Cities Main Contacts. Once reclaimed water quality again falls within acceptable thresholds, LOTT will notify the Cities and then restore distribution to the WCGRF.
2. Data Gathering and Sharing – If LOTT must interrupt service, LOTT operational staff will gather information concerning the interruption, including:
 - a. Type of interruption
 - b. Time it began or will begin
 - c. Expected duration
 - d. Possible impacts to quantity and quality and timing of delivery
 - e. Cause of interruption
 - f. Actions being taken to minimize/prevent in future if applicable

This information will immediately be shared with the designated LOTT Main Contact, who is charged with communicating minor operational issues with the Cities. The LOTT Main Contact will notify the two Cities Main Contacts, and cc any Cities Primary Back-Ups.

Longer-term Service Interruptions

This scenario refers to circumstances that have longer term or more significant impacts on LOTT's ability to provide reclaimed water in the quantity, quality, or timeline anticipated by the Cities. Examples include planned or unanticipated longer-term shutdowns or reclaimed water diversions such as plant improvement projects, repairs on failed equipment, maintenance activities, flow needs for the Reclaimed Water Infiltration Study, or other urgent purposes.

1. Information Gathering and Decision-Making – LOTT staff will gather information and meet in a team setting to discuss the situation and potential impacts on the Cities' needs, and develop a recommended course of action. Information to be gathered includes:
 - a. What is the issue?
 - b. Why is it happening? Why is it a problem?

- c. What is LOTT proposing to do about it?
 - d. How will this impact delivery of reclaimed water to the Partner(s)?
 - e. How long is this change anticipated?
 - f. What steps are being taken to resolve the issue?
2. Notice of Interruption – The information above will be shared with City staff by the designated LOTT Main Contact as early as possible PRIOR to initiating a change in service. City staff can help to determine the severity of potential impacts and provide input/feedback on the proposed action.
 3. Agreement on Course of Action for Planned Events – In situations where LOTT and the Partners identify a significant impact on the quantity, quality, or timing of reclaimed water anticipated by the Partners; LOTT and the Partners will work together to evaluate options and determine a course of action for addressing the situation. If time allows, the recommended course of action will be vetted through LOTT’s Senior Leadership Team. For reclaimed water stoppages or diversions from LOTT to the Partners, a Letter of Agreement, which may be signed at the Technical Sub-Committee level as needed, will be developed that outlines anticipated impacts and the course of action.
 4. Debrief – If applicable, LOTT staff will meet internally to debrief the situation and determine how to avoid/prevent similar situations in the future. Debrief will include a report back to City staff and LOTT’s Senior Leadership Team to review what happened, actions taken, communications with the Cities, and lessons learned.

Data Sharing

1. Reclaimed Water Quality – On a monthly basis, LOTT will share the Monthly Data Sheet related to reclaimed water quality with Lacey staff. Quarterly, Lacey will share with LOTT staff data related to monitoring wells (well levels and water quality).
2. Reclaimed Water Quantity – Data on the quantity of water used at the WCGRF is available to LOTT via SCADA. Using that data, LOTT will include a summary of quantity used on the Monthly Data Sheet. Lacey will provide quantity data to LOTT in their quarterly report. In this way, LOTT and Lacey can compare information and identify any inconsistencies in their respective data.
3. Operational Issues – The Cities are working to better understand how to operate the WCGRF. The Cities will communicate with LOTT changes in operation and general information related to unusual issues or circumstances at the facility.
4. Permit Compliance – Operation of the WCGRF is included under the Martin Way Reclaimed Water Plant Permit ST 6206 issued to LOTT by the Department of Ecology. The Cities and LOTT will share relevant information and data as needed to meet conditions of this permit. Examples include any changes in operational practices or equipment.

Exhibit A (Revised)
General Interlocal Agreement
Between the LOTT Clean Water Alliance,
Thurston County and the Cities of Lacey, Olympia, and Tumwater
For Distribution and Use of Reclaimed Water

Reclaimed Water Distribution Methodology

Introduction

LOTT treats a portion of the regional wastewater flow to Class A reclaimed water standards as part of an overall strategy for meeting the wastewater management needs of LOTT's Partner jurisdictions. LOTT operates under the Wastewater Resource Management Plan, which outlines a strategy for building new reclaimed water capacity in increments over time, "just in time" as that capacity is needed. The Class A Reclaimed Water is a resource that is made available to LOTT's Partner jurisdictions (Partners) for reuse.

This Distribution Methodology describes the mechanism by which each of the Partners can be assured a share of the reclaimed water resource. Each of the three Partner cities operates a water utility for supply and distribution of potable water and each has developed utility procedures to allow for the distribution and use of reclaimed water. Although Thurston County currently does not operate a wastewater utility providing water that reaches the LOTT system, this distribution process recognizes that such a relationship could exist in the future. This Methodology is designed to provide the Partners with some assurance of access to current and future increments of reclaimed water to facilitate the planning and investments necessary for distribution and reuse of the resource.

The original Distribution Methodology was finalized in 2005, memorializing reclaimed water allocations to each of the Partner cities that were negotiated in 2004. Those negotiations were based on simplified assumptions concerning the amount of reclaimed water that would be available to the Partners. Much has been learned since then about the operation of LOTT's reclaimed water facilities, reclaimed water demand, and projections of future wastewater capacity needs. This, in turn, resulted in adjustments to LOTT's plans for future reclaimed water facilities.

This update to the Distribution Methodology is intended to document what has changed since the original Methodology was completed and provide a revised set of assumptions regarding current and future available reclaimed water supply. This update also acknowledges that conditions are continually changing, and as such, this Methodology will require review and revision in the future.

Original Reclaimed Water Plans and Negotiations

Four reclaimed water facilities were originally envisioned as part of the Wastewater Resource Management Plan. Increments of treatment capacity were planned over time at 1.0 million gallons per day (MGD) increments. Based on capacity projections at the time, multiple increments of reclaimed water capacity totaling 5.0 MGD were expected to be on-line within the span of just over a decade. Based on those assumptions, negotiations were completed in

2004 to allocate the reclaimed water between the Partners. The following table, which reflects the results of those negotiations, was included in the original 2005 Distribution Methodology. These negotiations were based primarily on the proximity of each facility to the Partners and the objective that allocations to each Partner would ultimately be proportional to the amount of flow each contributed to the wastewater system (by 2050 or full build-out).

Table 1. Negotiated Reclaimed Water Distributions, 2005

Facility	Year On-Line	Volume Produced	LOTT Reserve	Volume Available	Lacey Percent	Lacey MGD	Olympia Percent	Olympia MGD	Tumwater Percent	Tumwater MGD
<i>First Increments:</i>										
Budd Inlet	2004	1.00	0.54	0.46	0.0%	0.00	100.0%	0.46	0.0%	0.00
Martin Way	2007	1.00	0.25	0.75	60.0%	0.45	40.0%	0.30	0.0%	0.00
Tumwater	2014	1.00	0.25	0.75	0.0%	0.00	0.0%	0.00	100.0%	0.75
Chambers Prairie	2016	1.00	0.25	0.75	60.0%	0.45	40.0%	0.30	0.0%	0.00
Increment 1 Subtotals		4.00	1.29	2.71	33.2%	0.90	39.1%	1.06	27.7%	0.75
<i>Second Increments:</i>										
Martin Way	2007	1.00	0.00	1.00	100.0%	1.00	0.0%	0.00	0.0%	0.00
Increment 2 Subtotals		1.00	0.00	1.00	100.0%	1.00	0.0%	0.00	0.0%	0.00
Totals		5.00	1.29	3.71	51.2%	1.90	28.6%	1.06	20.2%	0.75

All volumes are listed in million gallons per day (MGD)

Capacity Planning

LOTT conducts continual planning to assess capacity needs and completes biennial planning cycles to develop both a near-term and long-term Capital Improvements Plan (CIP). Additional reclaimed water production is incorporated into LOTT's CIP to meet future capacity needs. The schedule for design and construction of new increments of reclaimed water production capacity is subject to change based on overall wastewater capacity needs that are influenced by population growth projections, rate of conversions of area septic systems to the sewer system, and regulatory changes, such as changes to LOTT's NPDES discharge permit for the Budd Inlet Treatment Plant. Results of the Reclaimed Water Infiltration Study and the recent update to the state-level Reclaimed Water Rule may also influence future reclaimed water plans, including the level of treatment provided.

Opportunities for multiple community benefits also influence planning for future reclaimed water increments. Wastewater management needs remain the primary driver for the timing, location, and treatment level for future increments. However, benefits to LOTT Partners and the broader community are also taken into account. As stated in the General Interlocal Agreement for Distribution and Use of Reclaimed Water between LOTT and the Partners, the availability of "committed or clearly identified users" in a given area may be considered in decisions about the timing and location of reclaimed water increments. Thus, it is incumbent upon the Partners to provide such information to LOTT in conjunction with LOTT's capacity assessment planning efforts.

Since the original negotiations in 2004, projections of LOTT's future capacity needs have changed dramatically in response to several factors, including updated projections of population growth, more accurate data on per capita wastewater generation rates, revised rates of septic system conversion, and improved treatment performance. By 2016, LOTT had incorporated this new information into its annual capacity assessment. This analysis indicated that LOTT would not need to expand reclaimed water capacity for many years, and then, only in small increments at each of the two existing reclaimed water plants, rather than at the four locations originally envisioned. The 2016 analysis assumed a total of 6 MGD of reclaimed water treatment capacity would be needed by 2050; with 3 MGD of existing capacity and 3 MGD of new capacity. This represents the current understanding of future capacity needs, however, LOTT and the Partners recognize that conditions are continually changing and this projection is also subject to change.

Volumes Available for Reuse

Since 2004, much has also been learned regarding wastewater treatment capacity, reclaimed water production capacity, LOTT's reuse needs, and reuse needs of various end users, all of which differ substantially from original expectations. Negotiations for reclaimed water allocations were based on a simplistic view of treatment capacity increments. These were generalized round numbers that served as the basis of design for the treatment facilities – 1 MGD at the Budd Inlet Reclaimed Water Plant (BIRWP) and 2 MGD at the Martin Way Reclaimed Water Plant (MWRWP).

Once the facilities were in operation, it became apparent that these volumes did not reflect actual production. At the MWRWP, wastewater flows entering the facility fluctuate diurnally based on water use patterns, dipping below the 2 MGD rate at low use times of day. The facility was not designed to equalize fluctuating flows. Together, these factors contribute to daily production volumes less than the 2 MGD originally anticipated. Maintenance activities, such as scheduled clean-in-place cycles, repairs, and upgrades, and operational issues, like process upsets, further reduce the volume of water produced. These types of issues also affect reclaimed water production capacity at the BIRWP, though source flow is not an issue.

The volume of reclaimed water available for reuse by the Partners is also affected by LOTT's reuse needs. The General Interlocal Agreement for Distribution and Use of Reclaimed Water between LOTT and the Partners and Supply Agreements between each of the Partners and LOTT acknowledge that LOTT's uses of reclaimed water take priority over supply of reclaimed water to the Partners. LOTT's uses were estimated at the time of the original negotiations, and LOTT reserve volumes were established for each facility. Operational realities again differ from what was envisioned at the time of negotiations. Once the BIRWP, MWRWP, and the Hawks Prairie Ponds and Recharge Basins were operational, it became apparent that LOTT's reuse needs had been underestimated.

LOTT uses reclaimed water from the BIRWP for decorative and recreational water features at its Regional Services Center and East Bay Public Plaza, along with landscaping irrigation and toilet flushing at both locations and cleaning and process water within the Budd Inlet Treatment Plant. Reclaimed water from the MWRWP is used at the plant and the Martin Way Pump Station for cleaning, process water, and irrigation. It also supports the wetland ponds and

irrigation at the Hawks Prairie site and is used for groundwater recharge at that location. Evaporative losses from the wetland ponds at the Hawks Prairie site are significant and lead to a number of issues when pond levels are low, including loss of wetland plants, accelerated warming of pond water, and associated blooms and die-off of algae and other aquatic vegetation, which in turn causes odor issues and complaints from members of the public who recreate at the site. Excessive plant growth and die-off also contributes to gradual loss of hydraulic capacity as the ponds fill with organic material, which exacerbates the issues. To minimize these issues, LOTT uses reclaimed water to replace evaporative losses and maintain adequate water levels in the wetland ponds.

Actual reclaimed water production volumes and LOTT's reuse needs were not adequately understood until recent years, when the Partner cities' demand for reclaimed water grew and supply limitations became apparent. The term Net Reuse Capacity (NRC) is now used to refer to the volume of reclaimed water from each increment that is actually available for reuse by the Partners. To determine the NRC, LOTT must first identify how much water it expects to produce, operational considerations that may limit production, and the amount LOTT needs to reserve for its own uses. The remaining volume, or NRC, is available for distribution.

Table 2 summarizes the actual production volumes, LOTT's reserve needs, and the resulting NRC for each reclaimed water production facility. The values are provided in ranges because there are many factors that affect each volume. At the MWRWP, actual production volumes vary due to source flow volumes and quality, process upsets, and maintenance activities. LOTT's reuse needs from that facility fluctuate based on process issues like foaming at the MWRWP (reclaimed water is used to counteract, or wash down, the foam) and weather, which drives rates of evaporation from the wetland ponds at the Hawks Prairie site. At the BIRWP, source flow is always available, but the facility is operated based on demand, with production ramping up in the irrigation season when reuse is at its highest. This system includes a one million gallon storage tank, which can supplement peak demands. For this reason, available supply from this facility at times exceeds the NRC. The NRC values listed in this table represent the Parties' best understanding of the volumes of reclaimed water available for reuse by the Partners, however, LOTT and the Partners recognize that conditions are continually changing and NRC values are also subject to change.

Table 2. Reclaimed Water Net Reuse Capacity

	Budd Inlet Reclaimed Water Plant	Martin Way Reclaimed Water Plant
Actual Production and Use		
Production	0.55-1.26	1.10-1.63
LOTT Use	0.55-0.77	0.41-0.57
Net Reuse Capacity (NRC)	0.00-0.71	0.53-1.22
Storage Volume	0.00-1.00	None

All volumes are listed in million gallons per day (MGD)

Supply Agreements and Side Agreements

Supply Agreements have been established between LOTT and each Partner, and these agreements serve multiple purposes. First, they memorialize the allocation of reclaimed water to the Partner from the specific production facility – either the BIRWP or MWRWP. Second, the agreements establish responsibilities of LOTT and the Partners to ensure compliance with LOTT’s permit requirements throughout the chain of reclaimed water treatment, distribution, reuse, and/or recharge. Table 3 summarizes the reclaimed water volumes memorialized in Supply Agreements, and in side agreements between the Partners.

Table 3. Supply Agreements as of 2017

	Budd Inlet Reclaimed Water Plant	Martin Way Reclaimed Water Plant
Original Expectations and Negotiations		
LOTT Reserve	0.54	0.25
Supply Agreement between LOTT and Lacey	-	1.45
Supply Agreement between LOTT and Olympia	0.46	0.30
Production Volume	1.0	2.0
Adjustment to Address Tumwater Access to Resource		
<i>Side Agreement between Olympia and Tumwater</i>	<i>0.40</i>	
Supply Agreement between LOTT and Tumwater	0.50	
Reserved by Olympia from Olympia Supply Agreement	0.06	
Total Committed through Supply Agreements	0.56	1.75

All volumes are listed in million gallons per day (MGD)

The reclaimed water volumes listed in the Supply Agreements do not, in all cases, reflect accurately the volumes of water currently available to the Partners for reuse. For example, the Supply Agreement between LOTT and Lacey for the MWRWP indicates that LOTT “shall make available up to 1,450,000 gallons per day” to the City, but that full volume of water, while allocated to Lacey through past negotiations, is more than the NRC and will not likely be available to Lacey until the MWRWP is expanded to treat an additional increment of water. In that sense, the volumes memorialized in the Supply Agreements recognize allocations that may not be fully realized until some point in the future.

Original negotiations were based on assumptions that access to reclaimed water would be dependent on the Partners’ proximity to each production facility. Lacey and Olympia were assumed to have access to reclaimed water from the MWRWP and Olympia was assumed to have sole access to reclaimed water from the BIRWP. It was assumed that Tumwater would not have access to reclaimed water until a future satellite facility was constructed in the Tumwater area. For that reason, Olympia was allocated the full 0.46 MGD expected to be available from

the BIRWP. In 2012, however, a reclaimed water conveyance line was constructed from the BIRWP to Tumwater, opening up the possibility of irrigating the Tumwater Municipal Golf Course with reclaimed water. Because Olympia did not have uses established for their full allocation, a side agreement was negotiated between Olympia and Tumwater to allow Tumwater to access up to 400,000 gallons per day of Olympia's allocation from the Budd Inlet Reclaimed Water Plant. This side agreement then formed the basis for a Supply Agreement between LOTT and Tumwater, stating that Tumwater could receive up to 0.50 MGD (0.40 MGD of Olympia's allocation and 0.10 MGD of uncommitted, yet available, reclaimed water supply). This arrangement has been sufficient to meet Tumwater's current reuse need, but due to the temporary nature of the side agreement, it does not afford Tumwater the same level of assurance as exists for the other Partners.

Discrepancies in Distribution Volumes

Table 4 provides an overview of existing reuse by each of the Partners. These values were derived from 2016 reuse data. They were then refined to account for potential recharge rates at the cities' Woodland Creek Groundwater Recharge Facility. Actual reuse volumes vary year to year due to weather, groundwater levels, and other factors.

Table 4. Reclaimed Water Use as of 2017

	Budd Inlet Reclaimed Water Plant	Martin Way Reclaimed Water Plant
Existing Partner Uses		
Lacey – Woodland Creek Recharge Facility		0.25-0.75
Olympia – Woodland Creek Recharge Facility		0.05-0.15
Olympia – Department Enterprise Services	0.03	
Olympia – Port of Olympia	0.03	
Olympia – City of Olympia	0.01	
Tumwater – Golf Course	0.40-0.60	
Total of Partner Uses	0.47-0.67	0.30-0.90

All volumes are listed in million gallons per day (MGD)

In comparing negotiated allocations, volumes memorialized in Supply Agreements, existing Partner reuse, and NRC, it becomes clear there are discrepancies in some of these values. Those discrepancies are summarized in Table 5.

For the MWRWP, the resource appears to be over-allocated by 0.53 MGD when comparing both the negotiated allocations and Supply Agreement volumes to the maximum NRC. This discrepancy was due to a combination of factors, most notably that production volume was originally overestimated, and LOTT's reserve volume was underestimated. When compared to existing reuse data, however, the available supply, or NRC, is sufficient to meet the current reuse needs of the Partners.

For the BIRWP, NRC exceeds the current reuse needs of the Partners. It also exceeds both the negotiated allocations and the Supply Agreement volumes. The end result is that there is an uncommitted volume of 0.25 MGD from the BIRWP available to allocate through negotiation.

Table 5. Discrepancies Based on Actual Supply and Demand

	Budd Inlet Reclaimed Water Plant	Martin Way Reclaimed Water Plant
Discrepancies		
Maximum Net Reuse Capacity vs. Supply Agreements	+0.15	-0.53
Maximum Net Reuse Capacity vs. Negotiated Allocations	+0.25	-0.53
Maximum Net Reuse Capacity vs. Actual Use	+0.04	0.32

All volumes are listed in million gallons per day (MGD)

Long-Term Reclaimed Water Planning

In 2010, the City of Lacey identified in the “City of Lacey Comprehensive Water Right Mitigation Plan” and the City of Olympia identified in the “City of Olympia and Nisqually Indian Tribe, McAllister Wellfield Mitigation Plan” the reclaimed water quantities needed for all phases of water rights mitigation. Although the quantity of reclaimed water currently (2018) available to Lacey and Olympia from the MWRWP is adequate to meet each of the Cities’ current mitigation requirement, it will not be adequate for the third phase of water rights mitigation. Thus, Lacey and Olympia have an interest in gaining access within the next decade to their maximum allocation as listed in the Supply Agreement (up to 1.75 MGD from the MWRWP). Similarly, the City of Tumwater is developing a water right mitigation plan that will be dependent in part on access to more reclaimed water. The Cities’ mitigation need is one example of a clearly identified use that may be considered in decisions about the timing and means of developing additional reclaimed water supply. However, it may be a situation in which a Partner’s need for reclaimed water as a resource is more urgent than LOTT’s overall system capacity needs. In that case, creative approaches may need to be considered, including the possibility that the Partner might fund, in whole or in part, expansion of reclaimed water production capacity or optimization of an existing facility.

LOTT is conducting a master planning effort beginning in 2018. It involves two phases, the second of which will be an update of the long-range plan for overall wastewater system capacity, focusing on expansion of reclaimed water production, conveyance, and disposition. This work will provide opportunity to consider the Cities of Lacey and Olympia’s need for additional reclaimed water, as well as needs of the other Partners, within the context of an overall system strategy. Some of the options to be evaluated as part of this effort include construction of flow equalization at the MWRWP, construction of the 3rd increment at the MWRWP, conveyance of source flow from the Budd Inlet Plant to the MWRWP, and more. The planning effort is expected to be complete in 2020.

Updates to Reclaimed Water Allocations

This update to the Distribution Methodology does not involve a re-negotiation of previously allocated reclaimed water volumes from the BIRWP or the MWRWP. However, it does adjust assumptions regarding future reclaimed water production facilities, acknowledging that there

are likely to be only the two existing reclaimed water production facilities for the foreseeable future, rather than the four facilities originally envisioned.

This update also includes the results of negotiation for the uncommitted volume of reclaimed water from the BIRWP (0.25 MGD). Tumwater has committed, clearly identified, established uses for reclaimed water, but lacks a formal allocation. During 2018 negotiations, Lacey and Olympia acknowledged that they did not have need of the uncommitted volume and all agreed that Tumwater will receive that allocation. This provides Tumwater with more permanent access to a portion of their existing reuse needs, though continuation of the side agreement with Olympia is necessary to fulfill the remainder of their existing reuse need.

Table 6 summarizes the updated allocations and replaces the distribution table completed in 2005 (Table 1). Table 6 reflects the original reclaimed water allocations for both Lacey and Olympia from both reclaimed water production facilities and the new allocation from the BIRWP for Tumwater.

Table 6. Negotiated Reclaimed Water Allocations, 2018

Facility	Year On-Line	Lacey MGD	Olympia MGD	Tumwater MGD
Budd Inlet Reclaimed Water Plant	2004	0.00	0.46	0.25
Martin Way Reclaimed Water Plant	2006	1.45	0.30	0.00
Totals		1.45	0.76	0.25

All volumes are listed in million gallons per day (MGD)

Future Updates to the Distribution Methodology

The Distribution Methodology must be updated in the future to reflect changes in reclaimed water facility planning and other factors. LOTT and the Partners are responsible for updating the document, which may include negotiating distributions of future reclaimed water increments. The Partners recognize that this initial update was overdue, and that future updates should be completed in a timely manner to ensure the document remains relevant and reflective of actual conditions. The Partners agree to begin the next update of the Distribution Methodology when one or more of the following conditions apply:

- LOTT determines a course of action for responses to completion of the Budd Inlet/Capitol Lake Total Maximum Daily Load (TMDL) study that involves additional reclaimed water production capacity;
- LOTT moves the next increment of reclaimed water production capacity into the project design phase or additional reclaimed water becomes available through other means, such as operational adjustments;
- Partner or LOTT demand for reclaimed water changes substantially in response to some specific condition;
- Any one Partner demonstrates to the LOTT Board of Directors a need for an update.

If none of these conditions apply by 2025, the Partners agree to consider completing an update to the Distribution Methodology document at that time. The Partners may choose, however, to

further postpone the update if at that time, there is still much uncertainty in plans for future reclaimed water increments.

The Partners also agree to negotiate future allocations in good faith, and to consider multiple objectives in their negotiations. Those objectives, and their relative priority, may change over time in step with changing conditions. They include:

- Reconcile the discrepancies between current Supply Agreement volumes and available supply.
 - For the Martin Way Reclaimed Water Plant, this may involve allocating the next available increments to resolve shortfalls for Lacey and Olympia.
 - For the Budd Inlet Reclaimed Water Plant, this may involve allocating the next available increment to Tumwater to eliminate the need for the side agreement between Olympia and Tumwater.
- Address anticipated demand for reclaimed water, allocating resource to the Partners based on definitive or highly likely end uses.
- Consider the issue of equitable access to the resource, using the fallback distribution proportions described below as a gauge for assessing proportional distribution.

It is possible that one or more of these objectives may conflict with the others, or with LOTT's wastewater management needs. For example, a new large-scale irrigation end use could play a role in meeting regulatory requirements to reduce discharge to Budd Inlet. However, that new end use may not be located within the service area of the Partner that is "due" an allocation to meet the objective of equitable access to the resource. LOTT's capacity needs must be factored into future negotiations and may ultimately supersede other negotiation objectives.

Fallback Distribution Proportions

The LOTT Partners recognize that equitable access to the reclaimed water resource is of interest to each jurisdiction. For that reason, this methodology establishes distribution proportions based on each Partner's long-term projected contribution to the LOTT system. These percentages can be used to help inform future negotiations and, if necessary, as a "fallback" proportion for distribution of added increments of capacity in the event that distribution negotiations between the Partners are not successful.

TRPC population and employment projections are used to estimate each Partner's long-term projected contribution to the LOTT system. The percentage allotments are based on TRPC's 2050 population and employment forecasts converted into equivalent residential units (ERUs) for LOTT planning purposes. This approach is consistent with other long-range water and sewer planning data used by LOTT and the LOTT Partners.

Based on the 2050 planning forecasts available in 2017, the corresponding reclaimed water distribution for each of the LOTT Partners is:

Lacey	39.6%
Olympia	42.7%
Tumwater	17.7%
Thurston County	0.0%

The Parties recognize that the TRPC population and employment forecasts and related wastewater flow projections are planning estimates only and will change over time. For that reason, the fallback percentages may be revisited and, if necessary, readjusted prior to future negotiations and other updates to the Distribution Methodology. Such adjustments will not affect distribution agreements already in effect.

Agreements and Approvals

The negotiated (or fallback) distribution volumes will serve as the basis for future Supply Agreements between LOTT and each of the Partners as additional reclaimed water capacity is developed and reclaimed water not addressed through existing Supply Agreements becomes available for use.

Interim Uses

Because planning, funding limitations, and/or infrastructure requirements may delay a Partner's ability to put some or all of its allocated reclaimed water to use, the Partners reserve the right to allow some or all of their share of water to be temporarily used by another Partner(s) until it is actually needed. Such interim use may be negotiated among the affected Partners. Such an agreement is currently in place between Olympia and Tumwater.

Renegotiation Opportunities

The Parties recognize that needs and circumstances may change as they gain continued experience with distribution and use of reclaimed water. Accordingly, flexibility to adjust distributions is needed. Renegotiations of the reclaimed water distributions for any increment can occur at any time if all of the participating Partners agree.

The Partners also recognize that LOTT's long-range capacity needs are subject to change. It is possible that LOTT may need to produce substantially more reclaimed water than the increments currently planned or that LOTT may produce a higher quality of water than Class A. Negotiations for new or different increments can occur at any time if all of the participating Partners agree.

Flexibility in adjusting to realities of reclaimed water distribution may also result in desires to exchange other benefits as substitutes for reclaimed water. Accordingly, the Parties agree that they may exchange alternative benefits, including but not limited to financial benefits or substitute water supplies, in place of reclaimed water distributions. Alternative benefits may be considered as distributions are negotiated or renegotiated.

**GENERAL INTERLOCAL AGREEMENT
BETWEEN THE LOTT CLEAN WATER ALLIANCE,
THURSTON COUNTY AND THE CITIES OF
LACEY, OLYMPIA AND TUMWATER
FOR DISTRIBUTION AND USE OF RECLAIMED WATER**

This agreement ("General Agreement") is entered into as of the date set forth in Section 10 below by and between the LOTT Clean Water Alliance ("LOTT"), Thurston County, and the Cities of Lacey, Olympia, and Tumwater, each a "Party" and together referred to as the "Parties."

1. RECITALS

WHEREAS:

- 1.1 The Cities of Lacey, Olympia, Tumwater, and Thurston County (the "LOTT Partners") have for over 40 years cooperated successfully in planning, financing, constructing, and operating joint wastewater treatment and discharge facilities and services; and
- 1.2 In 2000, the LOTT Partners entered the Interlocal Cooperation Act Agreement for Wastewater Management by the LOTT Wastewater Alliance ("Interlocal Cooperation Act Agreement") to enable further cooperative actions to develop additional capacity by and through LOTT, a nonprofit corporation created, funded, and controlled by the LOTT Partners; and
- 1.3 Pursuant to the Interlocal Cooperation Act Agreement, LOTT is implementing the LOTT Wastewater Resource Management Plan ("WRMP") including development of reclaimed water and groundwater recharge facilities located throughout the LOTT service area; and
- 1.4 LOTT manages the regional wastewater treatment system for the benefit of the LOTT Partners and the ratepayers; and
- 1.5 LOTT is the owner and operator of reclaimed water facilities that produce Class A reclaimed water and plans to build additional reclaimed water capacity in the future; and
- 1.6 In RCW 90.46.005, the Washington State Legislature encourages the use of reclaimed water "to replace potable water in nonpotable applications, to supplement existing surface and ground water supplies, and to assist in meeting the future water requirements of the state"; and

- 1.7 The Legislature further finds, in RCW 90.46.005, that “use of reclaimed water constitutes the development of new basic water supplies needed for future generations”; and
- 1.8 LOTT has been issued a National Pollution Discharge Elimination System (NPDES) Permit for the Budd Inlet Wastewater and Reclaimed Water Plant and a State Reclaimed Water Permit for the Martin Way Reclaimed Water Plant by the State of Washington. Pursuant to RCW 90.46 and WAC 173-219, these permits authorize LOTT to produce Class A reclaimed water; and
- 1.9 The LOTT Partners, with the exception of Thurston County, operate municipal water utilities that supply water that is ultimately discharged to the LOTT system and that will be reclaimed and made available for beneficial use in the public interest; Thurston County may operate a water utility in the future; and
- 1.10 This General Agreement will effectuate the purposes of the Reclaimed Water Act, Ch. 90.46 RCW, implement the Reclaimed Water Rule (WAC 173-219) developed by the Washington State Departments of Health and Ecology pursuant to the Reclaimed Water Act, and implement the NPDES and State Reclaimed Water Permits issued to LOTT by enabling the LOTT Partners to replace the use of potable water for non-potable applications; and
- 1.11 LOTT and the LOTT Partners will coordinate on water supply planning as required by the Reclaimed Water Act (RCW 90.46.120); and
- 1.12 LOTT has conducted extensive environmental review under the State Environmental Policy Act of the reclaimed water project including issuance of a Wastewater Resource Management Plan Final Programmatic Environmental Impact Statement dated December 1996, a Final Supplemental Environmental Impact Statement dated November 1998, and environmental evaluations for individual facilities; and
- 1.13 The LOTT Partners recognize LOTT, as the permittee, has responsibilities for ensuring that reclaimed water treatment, water quality, monitoring, reporting, recordkeeping, uses, and use locations meet the terms and conditions of the NPDES and State Reclaimed Water Permits; and
- 1.14 LOTT and the LOTT Partners have determined that it is in the public interest to enter into a general agreement to establish policies and provide a framework for implementing distribution and use of reclaimed water and conserving the LOTT Partners’ potable water supplies; and
- 1.15 Pursuant to Chapter 39.34 RCW, the Parties are authorized to jointly exercise the powers, privileges, and authority described herein. The Parties agree that they intend to act jointly to accomplish the purposes of this General Agreement. No

separate legal entity is created by this General Agreement. LOTT will serve as administrative lead.

2. DEFINITIONS

- 2.1 “Class A Reclaimed Water” means reclaimed water that meets State Class A criteria established in the Reclaimed Water Rule (WAC 173-219), as it may be amended from time to time.
- 2.2 “Delivery Point” means the physical location(s) where LOTT transfers reclaimed water to a LOTT Partner for distribution or use. The term includes any points of withdrawal or diversion identified in the future by the Parties to recover reclaimed water stored underground and/or conveyed along a surface water body.
- 2.3 “End User” means a person or entity that puts reclaimed water to one or more End Uses. End Users may include LOTT, a LOTT Partner that uses reclaimed water, or a person or entity that receives reclaimed water from a LOTT Partner.
- 2.4 “End User Agreement” means an agreement between a LOTT Partner and an End User concerning terms and conditions of reclaimed water supply and use. If the End User is the LOTT Partner, the terms and conditions of reclaimed water supply and use are set forth in the Supply Agreement between LOTT and the LOTT Partner and a separate End User agreement for that LOTT Partner’s use is not required.
- 2.5 “End Uses” means the beneficial uses for which reclaimed water may be used consistent with LOTT’s NPDES and State Reclaimed Water Permits and the Reclaimed Water Rule including, but not limited to, commercial and industrial uses, irrigation, groundwater recharge, stream flow augmentation, and other environmental enhancement or restoration.
- 2.6 “Increment” means any substantive new volume of reclaimed water added to the system, through design and construction of new treatment capacity or through other means, such as operational adjustments, and includes initial development of each new Class A Reclaimed Water facility or each addition of new reclaimed water capacity to a previously built facility.
- 2.7 “In-Ground Stored Water” means reclaimed water stored underground by recharge, surface percolation, or otherwise that is intended for recovery and beneficial use. This is also referred to as Aquifer Storage and Recovery.
- 2.8 “National Pollution Discharge Elimination System Permit or NPDES Permit” means the wastewater permit use authority issued by the state, under federal guidelines. The reclaimed water use permit authority of the state is included in the

same permit for LOTT's NPDES Permit No. WA0037061, which governs the Budd Inlet Treatment Plant and the Budd Inlet Reclaimed Water Plant.

- 2.9 "Net Reuse Capacity" means the amount of reclaimed water from each increment available for reuse by the Partners, generally determined by the estimated production value, minus LOTT reuse needs. Net Reuse Capacity is intended to reflect the actual available volume, rather than the future planned volume.
- 2.10 "Reclaimed Water Distribution Agreement" means an agreement among the Parties that distributes available reclaimed water among the LOTT Partners consistent with the Reclaimed Water Distribution Methodology attached hereto as Exhibit A.
- 2.11 "Reclaimed Water Rule" means the rule given in WAC 173-219, and which governs the permitting, production, use, and distribution of reclaimed water in Washington State.
- 2.12 "State Reclaimed Water Permit" means the reclaimed water use permit authority issued by the State. The State Reclaimed Water Permit No. ST 6206 governs the Martin Way Reclaimed Water Plant. Additional State Reclaimed Water Permits may be issued to LOTT for future reclaimed water facilities.
- 2.13 "Supply Agreement" means an agreement between LOTT and a LOTT Partner that provides for LOTT to supply the Partner with reclaimed water from a LOTT reclaimed water production facility under terms and conditions consistent with this General Agreement.

3. REGIONAL RECLAIMED WATER POLICIES

- 3.1 LOTT's Permits, Responsibility, and Rights. The Parties agree that LOTT's primary responsibility is to provide adequate and reliable wastewater treatment and discharge services and system capacity, consistent with the terms of the NPDES and State Reclaimed Water Permits. In implementing this General Agreement, the Parties agree that compliance with LOTT's NPDES and State Reclaimed Water Permits takes precedence over supply and beneficial use. To the extent feasible, LOTT will specify in Supply Agreements the nature of the rights it reserves to itself for the purpose of compliance with its NPDES and State Reclaimed Water Permits.
- 3.2 Beneficial Use Goal. Subject to LOTT's NPDES and State Reclaimed Water Permits, the Reclaimed Water Rule, and regulatory compliance, the Parties agree that the overriding policy goal of this General Agreement is beneficial use of reclaimed water, including conservation and mitigation of potable water supplies, recharge of aquifers, and other environmental enhancements. Accordingly, use of reclaimed water takes precedence over generation of revenue. The LOTT

Partners receiving reclaimed water will demonstrate a good faith commitment to use the water and facilitate distribution of the water in the best interests of their communities.

- 3.3 **Region-Wide Accessibility Goal.** Consistent with the Wastewater Resource Management Plan and subsequent LOTT Capital Improvement Programs, the Parties reaffirm their intent to make reclaimed water available and accessible to all of the LOTT Partners for beneficial use. Prior to authorizing the construction of each Increment, the LOTT Board of Directors shall consider treatment capacity needs, conveyance capacity needs, timing considerations, cost-benefit, availability of committed or clearly identified needs for the water, impact on future facility requirements, alternative methods for achieving region-wide access, and other policy considerations.
- 3.4 **Intent to Preserve Exclusive Rights.** For any reclaimed water that is not immediately taken at a Delivery Point by a LOTT Partner, the Parties intend to preserve and maintain LOTT's exclusive rights to that reclaimed water as a future water resource and for the benefit of the LOTT Partners. Among other steps, the Parties intend to pursue programs or projects that result in groundwater replenishment for the purpose of water rights mitigation and/or wetland/streamflow augmentation for the purpose of water rights mitigation or watershed enhancement. The Parties intend for LOTT and/or LOTT Partner(s) to obtain mitigation or other credits for such efforts where appropriate. The Parties may also pursue projects for In-Ground Stored Water/Aquifer Storage and Recovery.
- 3.5 **Supply Roles and Responsibilities.** Except for use of reclaimed water by LOTT, as described in this section, the Parties intend for the LOTT Partners to serve as the suppliers and to regulate the delivery and use of reclaimed water to and by End Users. LOTT will reserve water needed for its own uses at LOTT facilities, uses intended to mitigate permit provisions and water quality requirements, demonstration projects, uses that are not feasible for the LOTT Partners to serve, and special projects approved by the LOTT Board of Directors. LOTT will not serve as a retail supplier of reclaimed water to any End Users unless requested by a LOTT Partner or unless such supply is needed for permit or water quality mitigation purposes. The Parties intend for the LOTT Partners to adopt reclaimed water ordinances, as described in section 5a of this General Agreement, to govern the supply of reclaimed water to End Users.
- 3.6 **Distribution Responsibility and Flexibility.** The Parties intend for the LOTT Partners receiving reclaimed water supply to take the lead roles in developing distribution programs and facilities and, in doing so, to assume responsibility for meeting the terms and conditions of LOTT's State Reclaimed Water Permits as they apply to distribution and End Use of the water. The Parties recognize that specific End Uses or patterns of End Uses may vary among the LOTT Partners,

and that two or more Parties may join together for distribution programs and facilities that provide mutual benefit.

- 3.7 LOTT Partners as End Users. The Parties further intend that the LOTT Partners may also use reclaimed water for their own purposes, consistent with the End Uses and End User requirements of the Reclaimed Water Rule and LOTT's NPDES and State Reclaimed Water Permits.
- 3.8 Involvement with End Users. The Parties intend for LOTT to become involved with the LOTT Partners' End User customers only to provide technical or other assistance at the request of a LOTT Partner or as a last resort to ensure permit compliance.

4. SUPPLY OF RECLAIMED WATER

- 4.1 Supply Agreements. For each reclaimed water production facility built by LOTT, the Parties intend for LOTT to enter a Supply Agreement with each participating LOTT Partner regarding reclaimed water produced at that facility. Supply Agreements will contain provisions that further common policy and regional accessibility goals (set forth in sections 3.2 and 3.3 of this General Agreement), and enable provision of reclaimed water service to customers across jurisdictional boundaries on generally consistent terms and conditions.
- 4.2 Reclaimed Water Distribution Methodology. The Parties agree that the primary responsibility for water supply planning and distributing available reclaimed water to End Users rests with the LOTT Partners. Accordingly, the LOTT Partners will jointly negotiate the distribution of reclaimed water available from each LOTT facility, as prescribed in the Reclaimed Water Distribution Methodology attached hereto as Exhibit A and incorporated herein by reference. The Parties shall execute binding Reclaimed Water Distribution Agreements documenting negotiated distributions or be bound by the fallback distribution percentages as prescribed in Exhibit A.
- 4.3 LOTT Uses. With respect to beneficial use and supply of reclaimed water, the Parties agree that use by LOTT has priority over supply of reclaimed water to the LOTT Partners in event of limited supply, subject to the specific provisions of a Supply Agreement concerning quantities of water for LOTT's use and for distribution or use by LOTT Partners.
- 4.4 LOTT Partner Supplies. LOTT agrees that it will provide Class A Reclaimed Water to one or more LOTT Partner(s) under terms and conditions specified in Supply Agreements, subject to terms and conditions that ensure full and continuous compliance with LOTT's NPDES permit and State Reclaimed Water Permits, the Reclaimed Water Rule, and other applicable law.

- 4.5 **Supply Responsibilities.** A Supply Agreement shall specify responsibilities for the reclaimed water production and distribution according to the following general principles.
- (a) **LOTT Responsibilities.** LOTT shall maintain control over, and be responsible for, all facilities and activities relating to the production of reclaimed water and distribution to Delivery Points or LOTT-owned use sites including groundwater recharge basins to ensure that reclaimed water facilities operate as approved by the Washington Departments of Health and Ecology. LOTT's responsibility for distribution of the reclaimed water, as to its quality (except as noted in subsection 4.5(b) below), disposition, or otherwise, ends at the Delivery Point(s).
 - (b) **LOTT Partner Responsibilities.** Each LOTT Partner's responsibility for distribution of the reclaimed water, as to its quality (to the extent altered while under direct control of the LOTT Partner), disposition, or otherwise, begins at the Delivery Point(s). The LOTT Partners shall maintain control over, and be responsible for, all facilities and activities relating to the distribution of the reclaimed water to their End Users or Partner-owned use sites including groundwater recharge basins.
- 4.6 **Terms of Distribution.** A Supply Agreement will provide for the terms of use and distribution of the reclaimed water by the LOTT Partners. A Supply Agreement will also provide for LOTT to supply and a LOTT Partner to obtain reclaimed water from a LOTT facility.
- 4.7 **Construction and Funding Responsibilities.** For a particular reclaimed water facility or project, LOTT will construct and fund LOTT facilities and the LOTT Partners will construct and fund their respective facilities. This General Agreement shall not preclude future negotiations or considerations among the Parties with regard to funding or construction responsibilities for development of reclaimed water supply or distribution of reclaimed water.

5. SALE TO END USERS

Pursuant to a Supply Agreement, the Parties agree that a LOTT Partner utility may sell reclaimed water received from LOTT to any of its End User customers under the following additional conditions.

- (a) **Reclaimed Water Ordinance.** The City Council or Board of Commissioners of the LOTT Partner has adopted a reclaimed water ordinance providing for reclaimed water service to End Users, the lawful use of reclaimed water, and enforcement authority through service termination, penalties, and other appropriate means. This ordinance shall

not include any provision in conflict with requirements in the LOTT NPDES or State Reclaimed Water Permits, or Reclaimed Water Rule.

- (b) End User Agreement. The End User has signed a binding reclaimed water End User Agreement with the LOTT Partner utility. The Parties intend for the LOTT Partners' End User Agreements to be materially consistent with this General Agreement and the Supply Agreements and as to permit and regulatory compliance, and the form of the End User Agreement will be attached to the reclaimed water Supply Agreement between LOTT and the LOTT Partner. The binding reclaimed water service agreement shall set forth terms and conditions including legal rights and responsibilities; regulatory compliance provisions required by the Washington State Departments of Health or Ecology; provisions enabling enforcement action as necessary to ensure regulatory compliance; and other necessary or appropriate terms and conditions.

6. SHARING OF INFORMATION

The Parties agree, to the fullest extent permitted by law, to exchange information about all aspects of reclaimed water programs and projects including but not limited to operations, maintenance, customer comments, metering data, water quality analyses, and regulatory compliance.

7. POLICY COORDINATION

The Parties recognize an ongoing need to cooperatively address reclaimed water policy, and distribution and use issues on a regional basis. The LOTT Technical Sub-Committee (TSC) will be responsible for assuring that issues are addressed on a timely and coordinated basis. To accomplish that goal, the TSC may choose to appoint a subcommittee to address reclaimed water matters and make recommendations for TSC consideration. As needed, the TSC will propose policies, agreements and/or other actions for referral to the LOTT Board of Directors. For policy recommendations that affect all the Parties, the LOTT Board of Directors may make recommendations to the LOTT Partner jurisdictions. LOTT shall have the responsibility of coordinating the Committee's activities.

8. DISPUTE RESOLUTION

Each Party shall negotiate in good faith and use its best efforts to resolve any dispute which may arise. If a dispute cannot be resolved initially by designated representatives for each Party, the designated representatives shall prepare a joint statement describing the dispute and refer the dispute to the TSC. If the dispute is not resolved after consultation with the TSC, then the designated representatives shall refer the dispute to

the LOTT Executive Director, the City Managers, and the County Chief Administrative Officer. These officials shall meet and confer regarding the issue. If they are unable to resolve the dispute, then the designated representatives shall bring the matter before the LOTT Board. At a Board meeting, the LOTT Board shall consider the issues and attempt to resolve the dispute. Only upon failure to resolve the dispute through such negotiations may a Party institute legal action.

9. INDEMNIFICATION

To the maximum extent permitted by law, each Party shall protect, defend, indemnify, and hold harmless each other Party and their officials and employees from and against all claims, demands, suits, actions, costs, damages, liability, or loss of any kind whatsoever arising from the acts or omissions of the indemnifying Party and its officials, employees, agents, and contractors. The indemnifying Party specifically assumes the defense of actions brought by its own employees against the other Parties and for that purpose the indemnifying Party specifically waives, insofar as it defends another party, any immunity under the Worker's Compensation Act, RCW Title 51. The indemnifying Party recognizes that this waiver was the subject of mutual negotiation and is expressly entered into pursuant to the provisions of RCW 4.24.115, if applicable. In the case of joint negligence, any damages allowed shall be levied in proportion to the percentage of negligence attributed to each Party. This indemnification shall survive the termination of this General Agreement.

10. TERM OF AGREEMENT & WITHDRAWAL

This General Agreement shall become effective on the first date when all of the following events have occurred: i) it has been duly executed by all of the Parties; ii) it has been filed with the Thurston County Auditor pursuant to RCW 39.34.040; and iii) it has been approved by the State Departments of Health and Ecology pursuant to RCW 39.34.050. The term of this General Agreement shall commence on the effective date and remain in effect until terminated by action of the Parties. LOTT may not withdraw from this General Agreement. A LOTT Partner may withdraw from this General Agreement after giving 180 days written notice to the other Parties. A LOTT Partner may not withdraw from this General Agreement without also withdrawing from (or other termination of) any Supply Agreements then in effect to which that Partner is a party. When a LOTT Partner withdraws from this General Agreement, the remaining Parties will promptly meet and negotiate the disposition of the withdrawing LOTT Partner's share under the reclaimed water distribution methodology (Exhibit A).

11. MISCELLANEOUS

11.1 This General Agreement shall be governed by the laws of the State of Washington. The exclusive jurisdiction and venue for any lawsuit between the

Partners arising out of this General Agreement shall be in Thurston County Superior Court.

- 11.2 The Parties expressly do not intend to create any right, obligation, or liability, or promise any performance, to any third party. The Parties have not created any right for any third party to enforce this General Agreement.
- 11.3 It is the belief of the Parties that all provisions of this General Agreement are lawful. If any covenant or provision of this General Agreement shall be finally adjudicated by a court of competent jurisdiction to be invalid or unenforceable, such adjudication shall not affect the validity, obligation or performance of any other covenant or provision, or part thereof, which in itself is valid if such remainder conforms to the terms and requirements of applicable law and the intent of this General Agreement. In such event, the Parties shall enter into immediate negotiations for the purpose of arriving at a mutually satisfactory replacement of such covenant or provision, or renegotiation of the terms of the General Agreement.
- 11.4 Waiver of any breach of any provision of this General Agreement shall not be deemed to be a waiver of any prior or subsequent breach, and shall not be construed to be a modification of this General Agreement.
- 11.5 This General Agreement shall be binding on a Party's assigns and successors. A Party may not assign its rights or delegate its duties under this General Agreement in any respect without the written consent of the other Parties.
- 11.6 This General Agreement embodies the Parties' entire agreement on the issues covered by it, except as supplemented or modified by subsequent written agreements signed by all of the Parties. All prior negotiations and draft written agreements are merged into and superseded by this General Agreement.

IN WITNESS WHEREOF, each Party has caused this General Agreement to be signed by its duly authorized officer or representative as of the date set forth below its signature.

LOTT Clean Water Alliance:

By  _____

Its EXECUTIVE DIRECTOR

Date: 8/13/2020

Approved as to form:

By  _____
WSB 16320

City of Lacey:

By Long Wood for _____

Its: CITY MANAGER

Date: 7/12/2020

Approved as to form:

By  for David Schneider _____

City of Olympia:

By SE J M _____

Its: Interim City Manager

Date: 3/24/20

Approved as to form:

By  _____

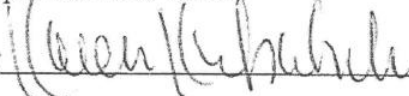
City of Tumwater:

By Pete Krost _____

Its: Mayor

Date: 5/13/2020

Approved as to form:

By  _____

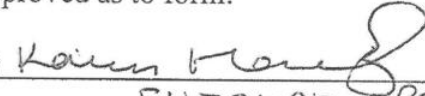
Thurston County:

By Kevin A. Carr _____

Its: COUNTY MANAGER

Date: 5/7/2020

Approved as to form:

By  for
Elizabeth Perrich

RECLAIMED WATER DISTRIBUTION AGREEMENT NO. 2
BETWEEN THE LOTT CLEAN WATER ALLIANCE,
THURSTON COUNTY AND THE CITIES OF
LACEY, OLYMPIA AND TUMWATER

This Agreement ("Distribution Agreement") is entered into as of the date of the latest signature below by and between the LOTT Clean Water Alliance ("LOTT"), Thurston County, and the Cities of Lacey, Olympia, and Tumwater, each a "Party" and together referred to as the "Parties."

1. RECITALS

WHEREAS:

- 1.1 The Parties entered into the General Interlocal Agreement Between LOTT, Thurston County and the Cities of Lacey, Olympia and Tumwater For Distribution and Use of Reclaimed Water ("General Agreement"), originally dated January 16, 2004, and updated March 24, 2020, to provide a regional framework for distribution and use of reclaimed water and for conserving potable water supplies; and
- 1.2 Exhibit A of the General Agreement is a "Reclaimed Water Distribution Methodology," which defines a process for distribution of reclaimed water among the four LOTT Partner jurisdictions; and
- 1.3 The LOTT Partner representatives originally completed negotiations for distribution of the first 1.0 million gallon per day increments of reclaimed water from four planned LOTT reclaimed water facilities, consistent with the 2004 Reclaimed Water Distribution Methodology; and
- 1.4 LOTT's long range strategy for reclaimed water has since been revised to include expansion of capacity at LOTT's two existing reclaimed water production facilities (Budd Inlet Reclaimed Water Plant and Martin Way Reclaimed Water Plant), with no plans in the foreseeable future to construct the two additional satellite facilities previously planned (Chambers Prairie Reclaimed Water Satellite and Tumwater Reclaimed Water Satellite); and
- 1.5 LOTT and the LOTT Partner representatives updated the Reclaimed Water Distribution Methodology in 2019 based on the revised long range strategy and more accurate assumptions for existing reclaimed water production capacity, demand, and availability; and
- 1.6 The LOTT Partner representatives completed negotiations in 2019 for distribution of the remaining, unallocated reclaimed water available from existing facilities; and

- 1.7 Table 1 attached hereto and incorporated by reference documents the negotiated distributions for reclaimed water produced at LOTT's existing reclaimed water facilities.

NOW, THEREFORE, in consideration of the recitals and the mutual promises and covenants contained herein the Parties commit to the negotiated distributions as follows.

2. AGREEMENT

- 2.1 The Parties agree to the reclaimed water allocations documented in Table 1 attached hereto.
- 2.2 The allocations documented in Table 1 shall be in effect until superseded by any future Reclaimed Water Distribution Agreement negotiated and approved consistent with the Reclaimed Water Distribution Methodology, or until the General Agreement is terminated, or until some other action is taken by the Parties that supersedes Table 1.

Table 1. Reclaimed Water Allocations

Facility	Lacey MGD	Olympia MGD	Tumwater MGD
Budd Inlet Reclaimed Water Plant	0.00	0.46	0.25
Martin Way Reclaimed Water Plant	1.45	0.30	0.00
Totals	1.45	0.76	0.25

All volumes are listed in million gallons per day (MGD)

- 2.3 The values listed in Table 1 represent the maximum volume of water allocated to each of the Parties listed, however, these values are not necessarily reflective of current available supply. Full realization of these allocations may not occur until some point in the future, as explained in the Distribution Methodology.
- 2.4 Each Party reserves the right to allow some or all of their share of water to be temporarily used by another Party if they do not have existing demand for the resource. Such interim use may be negotiated among the affected Parties through side agreements to the respective Parties' Supply Agreement(s).
- 2.5 This Reclaimed Water Distribution Agreement No. 2, or successor agreement(s), will be appended to the Supply Agreements for the Budd Inlet Reclaimed Water Plant and the Martin Way Reclaimed Water Plant.

(Continued on next page)

IN WITNESS WHEREOF, each Party has caused this Reclaimed Water Distribution Agreement No. 2 to be signed by its duly authorized officer or representative as of the date set forth below its signature.

LOTT Clean Water Alliance:

By: 
Its: EXECUTIVE DIRECTOR
Date: 8/13/2020

Approved as to form:

By: 
WSBA 16390

City of Lacey:

By: Tom Wood for
Its: CITY MANAGER
Date: 7/12/2020

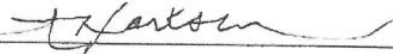
Approved as to form:

By:  for David Shaefer

City of Olympia:

By: Richard T. Kelly
Its: Public Works Director
Date: 4/27/2020

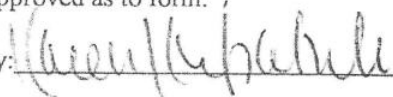
Approved as to form:

By: 

City of Tumwater:

By: Pat Kmet
Its: Mayor
Date: 5/13/2020

Approved as to form:

By: 

Thurston County:

By: 
Its: COUNTY MANAGER
Date: 5/1/2020

Approved as to form:

By: Karen Khabuli for
Elizabeth Penick

RECLAIMED WATER SUPPLY AGREEMENT
BETWEEN THE LOTT CLEAN WATER ALLIANCE
AND THE CITY OF LACEY
REGARDING THE MARTIN WAY RECLAIMED WATER PLANT

This agreement ("Supply Agreement") supersedes the Supply Agreement of January 2008 and is entered into as of the date of the latest signature below by and between the LOTT Clean Water Alliance ("LOTT") and the City of Lacey ("City") each a "Party" and together referred to as the "Parties".

1. RECITALS

WHEREAS:

- 1.1 LOTT owns and operates the Martin Way Reclaimed Water Plant, a municipal reclaimed water plant that generates Class A Reclaimed Water. LOTT operates the facility and generates reclaimed water under the requirements of chapter 173-219 of the Washington Administrative Code ("Reclaimed Water Rule") and Reclaimed Water Permit No. ST 6206 issued to LOTT by the Washington State Department of Ecology ("State Reclaimed Water Permit"); and
- 1.2 LOTT and the LOTT Partners (the Cities of Lacey, Olympia, and Tumwater, and Thurston County) entered into the General Interlocal Agreement for Distribution and Use of Reclaimed Water, dated January 16, 2004, and updated on March 24, 2020 [date], ("General Agreement") to provide a regional framework for distribution and use of reclaimed water; and
- 1.3 Exhibit A of the General Agreement is the Reclaimed Water Distribution Methodology which defines a process for distribution of reclaimed water among the four LOTT Partner jurisdictions; and
- 1.4 The LOTT Partner representatives completed negotiations for distribution of planned Increments of reclaimed water from LOTT reclaimed water facilities in 2004 and 2018, consistent with the Reclaimed Water Distribution Methodology; and
- 1.5 LOTT and the Cities of Lacey and Olympia jointly developed the document Reclaimed Water Coordination: Shared Objectives and Communication Procedures ("Shared Objectives Document"), dated June 22, 2017, for reclaimed water distributed from the Martin Way Reclaimed Water Plant, and this document may be revised over time through mutual agreement of the Parties;
- 1.6 The Cities of Lacey and Olympia own and operate the Woodland Creek Groundwater Recharge Facility to recharge reclaimed water to groundwater and

thereby meet their state requirements for in-kind mitigation of potable water rights. The City utilizes reclaimed water supplied by LOTT from the Martin Way Reclaimed Water Plant for that mitigation purpose; and

- 1.7 The City adopted Ordinance No. 1294 that governs the supply of reclaimed water to End Use customers.

NOW, THEREFORE, in consideration of the recitals and the mutual promises and covenants contained herein, LOTT agrees to supply and the City agrees to use and distribute reclaimed water on the terms and conditions set forth herein.

2. RELATIONSHIP TO GENERAL AGREEMENT

- 2.1 LOTT and the City enter into this Supply Agreement to implement the General Agreement, and they intend for this Supply Agreement to be performed and interpreted consistent with the provisions of the General Agreement, which is incorporated herein by reference.
- 2.2 Definitions. Capitalized terms in this Supply Agreement have the same meanings as set forth in the General Agreement. In addition, the term "Reclaimed Water Plant" means the Martin Way Reclaimed Water Plant, a municipal wastewater treatment and reclaimed water plant that generates Class A Reclaimed Water.

3. SUPPLY OF RECLAIMED WATER

- 3.1 LOTT agrees to deliver Class A Reclaimed Water to the City on the condition that all uses are in full and continuous compliance with the Reclaimed Water Rule, other applicable state, federal and local regulations, and the conditions in LOTT's State Reclaimed Water Permit.
- 3.2 LOTT warrants it shall deliver Class A Reclaimed Water, as defined in the Reclaimed Water Rule and in compliance with LOTT's State Reclaimed Water Permit. LOTT also shall make a good faith effort to meet the water quality objectives outlined in the Shared Objectives Document, developed jointly by LOTT, Olympia, and Lacey. LOTT makes no further express or implied warranties whatsoever as to the reclaimed water supplied under this Supply Agreement.
- 3.3 Consistent with the Reclaimed Water Distribution Methodology established in the General Agreement and Reclaimed Water Distribution Agreement No. 2 included as Exhibit A hereto, the reclaimed water produced at the Reclaimed Water Plant will be made available as follows:

- (a) LOTT reserves up to 570,000 gallons per day of the reclaimed water produced at the Reclaimed Water Plant for its own use.
 - (b) Subject to available remaining supply of reclaimed water, the LOTT Alliance shall make available up to 880,000 gallons per day, of reclaimed water to the City at the Delivery Point(s), except when temporary interruptions in service occur due to circumstances described in section 4.5 of this agreement. At its option, the City may take some, all or none of the above quantity of reclaimed water.
 - (c) Subject to an increase in production of reclaimed water at the Reclaimed Water Plant and at such time as the Net Reuse Capacity (net available supply) reaches 1,750,000 gallons per day, the volume of reclaimed water available to the City may reach a maximum of 1,450,000 gallons of reclaimed water each day,
 - (d) Quantities are subject to adjustment as new Increments of reclaimed water treatment capacity are added to the LOTT system or the distribution among LOTT Partners is renegotiated as set forth in the General Agreement.
- 3.4 The volume of reclaimed water produced at the Reclaimed Water Plant may be adjusted to correspond to actual demand up to the amounts specified in Sections 3.3(a), (b), and (c) herein. Reclaimed water not otherwise used or distributed by the City may be sent to LOTT's Hawks Prairie Ponds and Recharge Basins Site and/or returned to the treatment system, or used by LOTT in addition to the volume provided in paragraph 3.3(a) herein. However, such temporary disposition does not constitute a permanent relinquishment by the City.

4. CONDITIONS OF RECLAIMED WATER SUPPLY

- 4.1 The Parties agree that LOTT's primary responsibility is to provide wastewater treatment and discharge services and capacity consistent with the terms of LOTT's State Reclaimed Water Permit No. ST 6206 and National Pollution Discharge Elimination System ("NPDES") Permit No. WA0037061. In carrying out this Supply Agreement, the Parties agree that compliance with LOTT's State Reclaimed Water Permit and NPDES Permit is the primary interest and that supply and beneficial use are a secondary interest.
- 4.2 LOTT shall in good faith, to the best of its ability, provide reclaimed water with nitrate levels less than 5 mg/L for City use at the Woodland Creek Groundwater Recharge Facility, as stipulated in the Shared Objectives Document.
- 4.3 The Parties agree that use by LOTT stipulated in this Supply Agreement has priority over supply of reclaimed water to the City under this Agreement but that

LOTT shall in good faith to the best of its ability provide reclaimed water to the City as stipulated in section 3.3 of this Agreement.

- (a) In the event of a limited supply of reclaimed water, the Parties will work together to evaluate options and determine a course of action for managing the shortage. The course of action will be formalized in a Letter of Agreement, and signed by the Technical Sub-Committee.
 - i. In this situation, LOTT agrees to temporarily reduce its reserve uses by up to 300,000 gallons per day and make that water available to Lacey and Olympia for water rights mitigation obligations as necessary.
 - ii. In the unlikely event that the City's ability to meet its mitigation obligation is compromised, the TSC will present options to the LOTT Board for their decision regarding additional curtailment or other actions.
- (b) Based on the obligations set forth in section 3.3 of this agreement, there is sufficient reclaimed water supply to meet the equivalent volume of Lacey and Olympia's Phase 1 & 2 requirements (900,000 gallons per day) of their potable water rights mitigation plans.
- (c) The Parties agree that the intent is to expand reclaimed water production capacity in the future to adequately provide for Lacey and Olympia's Phase 3 mitigation requirements (a total of 1,300,000 gallons per day).

4.4 The Parties shall in good faith, to the best of their ability, abide by the coordination, communication, and data sharing procedures outlined in the Shared Objectives Document.

4.5 LOTT shall in good faith provide reclaimed water to the City without interruption to the best of its ability, and the City shall in good faith maintain and operate its system to the best of its ability. Temporary interruptions and limitations may occur and will be communicated to the City as soon as is practicable, per the Shared Objectives Document. Additionally, the Parties understand and agree that, with no liability or penalty to any Party, there may be temporary interruptions or limitations in supply, service, or acceptance of reclaimed water due to the following events:

- (a) Unavailability or limited quantities of reclaimed water;
- (b) Emergencies and otherwise unforeseen situations requiring repair or replacement of Reclaimed Water Plant or conveyance system equipment;
- (c) Routine repair, maintenance, or replacement of Reclaimed Water Plant, Hawks Prairie Ponds and Recharge Basins, or conveyance system equipment;

- (d) The need for LOTT, in its professional judgement, to take action to comply with its State Reclaimed Water Permit (for example and without limitation, to address treatment upsets or in response to violations of permit conditions by the City and/or End Users);
- (e) As a result of regulatory or judicial orders; or
- (f) Other circumstances beyond the control of a Party.

If the performance by any Party is prevented or delayed by any of the foregoing events, the Party shall have a reasonable period of time after each such event to resume performance under this Agreement. When possible, planned service interruptions will be scheduled by LOTT to avoid occurrences during the irrigation season or other time periods critical to users. In the event of a planned interruption of flow, LOTT will provide notice of the interruption, including its cause and expected duration, as far in advance as possible under the circumstances, per the procedures established in the Shared Objectives Document.

5. DESCRIPTION OF FACILITIES

- 5.1 LOTT's Facilities. LOTT owns, operates and maintains the Reclaimed Water Plant, Hawks Prairie Ponds and Recharge Basins, and all associated facilities up to the Delivery Point(s).
- 5.2 City's Facilities. The City owns, operates, and maintains all facilities on the downstream side of the Delivery Point(s), up to and including the End Users' water meters. Additionally, the City jointly owns the Woodland Creek Groundwater Recharge Facility with the City of Olympia, which is operated by the City of Lacey.

6. RESPONSIBILITY FOR PRODUCTION, DISTRIBUTION AND USE OF RECLAIMED WATER

Consistent with Washington State requirements, the Parties shall have the following responsibilities for the reclaimed water produced, distributed, and used pursuant to this Agreement.

- 6.1 Production. LOTT shall maintain control over, and be responsible for, all facilities and activities relating to the production of reclaimed water and conveyance of reclaimed water to the Delivery Point(s) to ensure that the Reclaimed Water Plant operates as approved by the Washington Departments of Health and Ecology. LOTT's responsibility for the reclaimed water made

available to the City, as to production reliability requirements, reclaimed water quality, disposition, or otherwise, shall end at the Delivery Point(s).

- 6.2 Distribution. The City shall maintain control over, and be responsible for, all of its facilities and activities relating to the distribution of the reclaimed water once it passes the Delivery Point(s). The City shall ensure that its distribution system and End Uses are constructed, operated and maintained in compliance with the Reclaimed Water Rule, other applicable state, federal and local regulations, and the conditions of LOTT's State Reclaimed Water Permit. The City's responsibility for the reclaimed water as to its quality, disposition, or otherwise, shall begin at the Delivery Point(s).
- 6.3 Connection to LOTT Facilities. All facilities to be connected directly to LOTT reclaimed water transmission lines or other LOTT reclaimed water facilities by the City are subject to LOTT's review and approval prior to installation.
- 6.4 Disconnection from LOTT Facilities. If service is discontinued from any Delivery Point or this Agreement is terminated for any reason, the City will ensure proper abandonment or disconnection of its facilities from LOTT facilities. The City shall notify LOTT of such abandonment or disconnection.
- 6.5 Inspection. Consistent with LOTT's obligations under its State Reclaimed Water Permit, the City shall allow an authorized representative of LOTT or of the Washington State Departments of Health or Ecology, upon the presentation of credentials:
 - (a) To enter upon the premises where reclaimed water is distributed or used under this agreement; or
 - (b) To inspect at reasonable times any facilities, equipment, meters, records, or premises involved in the distribution and use of the reclaimed water under this agreement, and to take samples of the water or soil, and make copies of records.
- 6.6 Enforcement. In the event that the City as distributor or End User, or other End Users do not comply with conditions of LOTT's State Reclaimed Water Permit, the Reclaimed Water Rule, or other applicable local, state, or federal regulations, LOTT may take enforcement actions including:
 - (a) Temporarily discontinuing the supply of reclaimed water;
 - (b) Issuing specific remedial actions necessary to ensure compliance;
 - (c) In cases where it is not possible to resolve the issue and ensure compliance, requiring permanent disconnection of the use from the distribution system.

7. SALE TO END USE CUSTOMER

- 7.1 The City may sell or otherwise distribute reclaimed water supplied from LOTT to any of its End Users for those purposes authorized in the State Reclaimed Water Permit or other uses as additionally approved by the Washington State Departments of Health and Ecology.
- 7.2 The City has adopted Ordinance No.1294 that governs the supply of reclaimed water by the City to End Users. The Parties intend for the City to serve as the supplier and to regulate the delivery and use of reclaimed water to and by its End Users. The Parties intend for LOTT to become involved with End Users only as necessary to provide technical or other assistance at the request of a LOTT Partner, or as a last resort to ensure permit compliance.
- 7.3 The City may sell or otherwise distribute reclaimed water supplied from LOTT to an End User only where a binding End User Agreement exists between the City and the End User. The End User Agreement shall be substantially and materially in the form set out in Exhibit B to this Agreement, as approved by the Washington State Departments of Ecology and Health. Any changes in the End User Agreement must be approved in advance by LOTT. If the End User is the LOTT Partner, the terms and conditions of reclaimed water supply and use are set forth in this Supply Agreement and a separate End User Agreement for the LOTT Partner's use is not required.
- 7.4 The City shall maintain all End User Agreements for the duration of LOTT's State Reclaimed Water Permit, and shall provide copies of all new or revised End User Agreements to LOTT to meet annual reporting requirements of the Departments of Health and Ecology.

8. DESIGNATED REPRESENTATIVES AND NOTICES

- 8.1 To facilitate communication between the Parties and cooperative implementation of this Agreement, each Party shall name a designated representative to receive all notices under this Agreement. The initial designated representatives are as follows:

LOTT Clean Water Alliance:

Lisa Dennis-Perez, Director of Environmental Planning & Communication
LOTT Clean Water Alliance
500 Adams St NE
Olympia, WA 98501
Phone: (360)528-5719
Email: lisadennis-perez@lottcleanwater.org

City of Lacey:

Scott Egger, P.E., Public Works Director

City of Lacey

PO Box 3400

Lacey, WA 98509-3400

Phone: (360) 4941-5600

E-mail: segger@ci.lacey.wa.us

A Party's designated representative or place of business may be changed with advance notice to the other Party.

- 8.2 LOTT will maintain 24-hour emergency response personnel, who can be reached by calling (360) 528-5700.
- 8.3 The City will maintain 24-hour emergency response personnel for the project, who can be reached by calling:
- | | |
|-------------------------|----------------|
| Lacey Public Works Shop | (360) 491-5644 |
| After Hours Pager | (360) 413-2870 |
| After Hours Cell Phone | (360) 789-1187 |

9. TERM OF AGREEMENT

- 9.1 The term of this Agreement shall commence on the date of the later signature below and continue until terminated as specified in section 10 of this Agreement.

10. TERMINATION

- 10.1 The City may terminate this Supply Agreement for any reason at any time. The City shall give LOTT notice of such a change in status as far in advance as possible, per the Shared Objectives Document.
- 10.2 LOTT may terminate this agreement if the City violates terms of this Agreement, LOTT's State Reclaimed Water Permit, the Reclaimed Water Rule, or other requirements of the Washington State Departments of Health and Ecology; or if the termination is necessary due to regulatory mandate or termination of LOTT's State Reclaimed Water Permit; or if LOTT's Board of Directors (Board) determines termination is in LOTT's best interest.
- 10.3 This Supply Agreement will terminate if the City withdraws from the General Agreement, or if the General Agreement is terminated.

11. SHARING OF INFORMATION

- 11.1 The Parties agree, to the fullest extent permitted by law, to exchange information about all aspects of reclaimed water programs and projects including but not limited to operation, maintenance, customer comments, metering data, water quality analyses, and regulatory compliance.

12. LEGAL RELATIONS AND INTERPRETATION OF AGREEMENT

- 12.1 Each Party shall negotiate in good faith and use its best efforts to resolve any dispute which may arise. If a dispute cannot be resolved initially by the designated representatives, the designated representatives shall prepare a joint statement describing the dispute and refer the dispute to the Technical Sub-Committee that advises the LOTT Board. If the dispute is not resolved after consultation with the Technical Sub-Committee, then the designated representatives shall refer the dispute to the LOTT Executive Director, the three City Managers, and the County Chief Administrative Officer. These officials shall meet and confer regarding the issue. If they are unable to resolve the dispute, then the designated representatives shall bring the matter before the LOTT Board. At a Board meeting, the LOTT Board shall consider the issues and attempt to resolve the dispute. Only upon failure to resolve the dispute at the LOTT Board Meeting may a Party institute legal action.
- 12.2 This Supply Agreement shall be governed by the laws of the State of Washington. The exclusive jurisdiction and venue for any lawsuit between the Parties arising out of this Supply Agreement shall be in Thurston County Superior Court.
- 12.3 The Parties expressly do not intend to create any right, obligation or liability, or promise any performance, to any third party. The Parties have not created any right for any third party to enforce this Supply Agreement.
- 12.4 It is the belief of the Parties that all provisions of this Supply Agreement are lawful. If any covenant or provision of this Supply Agreement shall be finally adjudicated by a court of competent jurisdiction to be invalid or unenforceable, such adjudication shall not affect the validity, obligation or performance of any other covenant or provision, or part thereof, which in itself is valid if such remainder conforms to the terms and requirements of applicable law and the intent of this Supply Agreement. In such event, the Parties shall enter into immediate negotiations for the purpose of arriving at mutually satisfactory replacement of such covenant or provision, or renegotiation of the terms of the Supply Agreement.

- 12.5 Waiver of any breach of any provision of this Supply Agreement shall not be deemed to be a waiver of any prior or subsequent breach, and shall not be construed to be a modification of this Supply Agreement.
- 12.6 This Supply Agreement shall be binding on a Party's assigns and successors. A Party may not assign its rights or delegate its duties under this Supply Agreement in any respect without the written consent of the other Party.
- 12.7 To the maximum extent permitted by law, each Party shall protect, defend, indemnify and hold harmless the other Party and its officials and employees from and against all claims, demands, suits, actions, costs, damages, liability or loss of any kind whatsoever arising from the acts or omissions of the indemnifying Party and its officials, employees, agents and contractors. The indemnifying Party specifically assumes liability for actions brought by its own employees against the other Party arising out of this Agreement and for that purpose the indemnifying Party specifically waives, as respects the other Party only, any immunity under the Worker's Compensation Act, RCW Title 51. The indemnifying Party recognizes that this waiver was the subject of mutual negotiation and is expressly entered into pursuant to the provisions of RCW 4.24.115 if applicable. In the case of joint negligence, any damages allowed shall be levied in proportion to the percentage of negligence attributed to each Party. This indemnification shall survive the termination of this Supply Agreement.
- 12.8 LOTT shall defend the City at LOTT's sole cost from and against any cause of action in which LOTT's and the City's right to use reclaimed water pursuant to state statute and LOTT's State Reclaimed Water Permit is challenged in said cause of action. Where multiple causes of action are brought against the City in the same suit, LOTT's obligation to defend shall extend only to the cause or causes of action that expressly apply to LOTT and the City as described in the preceding sentence of this section. LOTT is not obligated to indemnify the City under any circumstances involving a cause or causes of action as described in this section. LOTT is not obligated to provide a defense to the City where LOTT's Articles of Incorporation would be violated, or where said defense would be contrary to any applicable law. LOTT's obligation to defend shall take effect only after the City has first tendered defense to any and all insurers that may defend the City and said tender is denied in writing. LOTT will not be obligated to defend the City where any insurer agrees to defend the City, notwithstanding a defense provided under reservation of rights by any covering insurer. LOTT shall have no duty to defend where the City, by and through its agents and employees, intentionally or recklessly fails to act in good faith, or contrary to law, and such is a substantial factor in bringing about the cause or causes of action against which LOTT would otherwise be obligated to defend.

13. ATTACHMENTS

13.1 The following documents are attached hereto and incorporated by reference herein:

Exhibit A: Reclaimed Water Distribution Agreement No. 2

Exhibit B: End User Agreement Template

IN WITNESS WHEREOF, each Party has caused this Supply Agreement to be signed by its duly authorized officer or representative as of the date set forth below its signature.

LOTT:

City of Lacey:

By



By



Its

EXECUTIVE DIRECTOR

Its

CITY MANAGER

Date:

8/13/2020

Date:

7/12/2020

Approved as to form:

Approved as to form:

By


LOTT Legal Counsel

By

 for David Schneider
City Attorney



**LOTT Alliance
Intergovernmental
Agreement**

**INTERLOCAL COOPERATION ACT AGREEMENT FOR
WASTEWATER MANAGEMENT
BY THE LOTT WASTEWATER ALLIANCE**

by and among

**City of Lacey, City of Olympia, City of Tumwater, and Thurston County
("Partners")**

November 5, 1999

(This page intentionally left blank)

Table of Contents

Recitals	1
Article I. Purpose and Scope.....	3
Article II. LOTT Alliance: Nonprofit Corporation Governance	9
Article III. LOTT Alliance: Finance.....	13
Article IV. LOTT Alliance: Wastewater Conveyance and Treatment.....	19
Article V. LOTT Alliance: Cooperation in Management & Development of Wastewater Facilities	21
Article VI. State Environmental Policy Act.....	23
Article VII. Pretreatment	25
Article VIII. Flow Reduction & Prevention of Capacity Degradation	29
Article IX. Reserved	31
Article X. Legal Relations	33
Article XI. Cooperation Through Consolidation Period	37
Exhibit A 1976 Intergovernmental Agreement, As Amended.....	43
Exhibit B Existing Joint Facilities	45
Exhibit C Articles of Incorporation of LOTT Wastewater Alliance	47
Exhibit D Bylaws of LOTT Wastewater Alliance.....	55
Exhibit E LOTT System Service Area (Urban Growth Area Boundary, Ch. 36.70 RCW)	67
Exhibit F Allocation of Costs to New Connections and Monthly Rates.....	69
Exhibit G LOTT Discharge and Industrial Pretreatment Regulations	71
Exhibit H O&M Contract between City of Olympia and LOTT Alliance	123
Exhibit I Agreement Regarding Additional LOTT Joint Facilities	133
Exhibit J Intergovernmental Contract for I / I Management of March, 1995.....	137
Exhibit K Agreement Concerning Cooperation on Flow Reduction.....	153
Exhibit L Administrative and Treasury Services Contract.....	157

(This page intentionally left blank)

INTERLOCAL COOPERATION ACT AGREEMENT FOR WASTEWATER MANAGEMENT BY THE LOTT WASTEWATER ALLIANCE

THIS AGREEMENT ("Agreement"), dated _____, 1999, is entered into by and between the City of Lacey, Washington ("Lacey"); the City of Olympia, Washington ("Olympia"); the City of Tumwater, Washington ("Tumwater"); and Thurston County, Washington (the "County") pursuant to Chapter 39.34 RCW. The parties are herein individually referred to as "Partner" and collectively as the "Partners."

R E C I T A L S

WHEREAS, pursuant to the Intergovernmental Contract for Wastewater Facilities Management dated November 1976, as amended ("1976 Intergovernmental Contract") the LOTT Partners have for more than two decades cooperated successfully in financing, constructing, maintaining and operating joint facilities to provide wastewater treatment and discharge services for the citizens of the urban area of northeast Thurston County; and

WHEREAS, said 1976 Intergovernmental Contract has been modified from time to time to provide for changing environmental and technical requirements, increased service demands and revised public health and environmental protection policies initiated by Partner governments, the Washington State Department of Ecology ("Ecology") and the federal government; and

WHEREAS, since 1976, the Partners have managed the construction and expansion of wastewater treatment and discharge facilities for the region through The Advisory Committee ("TAC") and have relied on Olympia as the lead agency for LOTT contracting and financing; and

WHEREAS, Olympia issued certain water and sewer revenue bonds (the "Bonds" as defined in Section 1.5) to provide funds to finance or refinance the Existing Facilities and local facilities, and, so long as the Bonds are outstanding, Olympia is obligated to comply with its covenants to owners of such Bonds, including covenants not to dispose of the Existing Facilities, as hereinafter defined, without repaying the Bonds or to take any action that would impact the tax-exempt status of the Bonds; and

WHEREAS, in March 1995, TAC authorized the development of a new comprehensive plan known as the LOTT Wastewater Resource Management Plan ("Plan") to provide for the region's future wastewater needs and initiated an environmental review process to assess all reasonable and feasible alternatives for wastewater management; and

WHEREAS, the Plan, as developed by LOTT with the assistance of community, Partner, and Ecology input, provides for the development of future treatment capacity on an incremental basis utilizing new joint use reclamation and groundwater recharge facilities located throughout

the LOTT service area but connected to the main LOTT treatment and marine discharge facilities; and

WHEREAS, the development of such new joint reclamation facilities must be planned and implemented on a cooperative basis so that increments of capacity are added no sooner than necessary but in sufficient time to meet NPDES permit limits and public health requirements; and

WHEREAS, to this point financing and contracting obligations for LOTT have been assumed by Olympia on behalf of the LOTT Partners; and

WHEREAS, the Partners have agreed that an independent, nonprofit corporate entity should be established pursuant to Chapters 36.34 and 24.03 RCW to enable LOTT to directly contract for the services and construction necessary to develop and manage new joint use facilities in response to the Plan; and

WHEREAS, the Partners will exercise control of the new non-profit corporate entity, called the "LOTT Wastewater Alliance" (or "LOTT Alliance"), through appointment of board members by and from their legislative bodies, who will represent their respective local governments; and

WHEREAS, by December 31, 1999, the Partners intend to transfer all joint use facilities developed or identified under the 1976 Intergovernmental Contract to the LOTT Wastewater Alliance and to terminate the 1976 Intergovernmental Contract, so that the LOTT System is exclusively managed by the LOTT Wastewater Alliance Board of Directors pursuant to this Agreement (a series of events termed "Consolidation");

NOW, THEREFORE, in consideration of the mutual promises and covenants contained herein, the Partners hereby agree as follows:

ARTICLE I PURPOSE AND SCOPE

Section 1.1 PURPOSE OF AGREEMENT

The purpose of this Agreement is to provide for a new governance structure to carry out the Plan, which anticipates development of additional treatment capacity for the LOTT Partners through innovative wastewater reclamation and management facilities. The new facilities implemented pursuant to this Agreement, together with the facilities and improvements identified or developed as Existing Joint Facilities pursuant to the 1976 Intergovernmental Contract, shall be operated as a combined system for the benefit of all the Partners in the manner set forth herein.

The Partners intend to form a new nonprofit corporate entity, to be known as the LOTT Wastewater Alliance, pursuant to Chapter 39.34 and Chapter 24.03 RCW. The LOTT Wastewater Alliance shall be solely controlled by Partner representatives and its primary function shall be to carry out the public purposes expressed in the Plan and this Agreement, as both may be amended or supplemented from time to time. The Partners intend for the LOTT Wastewater Alliance to function as a regional agency that provides wholesale wastewater resource treatment and management services in the public interest.

The Partners intend to consolidate the ownership and management of all Existing Joint Facilities and related properties and interests in the LOTT Wastewater Alliance so that the entire LOTT System is under its sole management and control. This "Consolidation" can occur only after the Bonds have been paid or defeased and when it is otherwise legally feasible. The Partners herein commit to work together in good faith, to use their best efforts, and to take all necessary actions to accomplish Consolidation as provided herein. The Partners recognize that a transition period will be necessary to identify and accomplish all required and appropriate Consolidation steps and to coordinate the assumption by the LOTT Board of TAC responsibilities and legal obligations related to the LOTT System. The 1976 Intergovernmental Contract, as amended, will continue in effect until the Consolidation is completed as determined by the LOTT Board, and then the 1976 Intergovernmental Contract will terminate.

Section 1.2 COMMITMENT & ACCESS TO JOINT FACILITIES

Consistent with their covenants in the 1976 Intergovernmental Contract, in this Agreement the Partners commit to deliver all sewage flows in their Local Systems within the LOTT Plan area (see Exhibit E) to the Joint Facilities for treatment and disposal or reuse. Each Partner foregoes the opportunity to treat and dispose or reuse its sewage flows individually and decides to share control of access to and capacity in sewerage facilities within its community. Because this Agreement and the 1976 Intergovernmental Contract contemplate that all Partners will be using Joint Facilities and because most, if not all, Partners will be transporting sewage flows collected in their Local Systems through the political jurisdictions of one or more other Partners, the Partners declare and confirm i) that this Agreement is not intended as an instrument to permit one Partner to control the sewer collection services furnished by another Partner, and ii) that each Partner will cooperate to provide the others with access for sewage flow to the Joint

Facilities either by sharing Local System capacity, if reasonably available, or by facilitating the acquisition of necessary rights-of-way, franchises, and permits through and under public streets, rights-of-way, and property under reasonable conditions for such access.

Section 1.3 PARTNER CONTRIBUTIONS

The Partners recognize that they have jointly developed and maintained the LOTT System to serve all the Partner governments. Although precise legal and equitable interests of the Partners in specific Existing Joint Facilities cannot be defined, the Partners hereby reconfirm that they each have an unquantified interest in the Existing Joint Facilities based on the rights and obligations of all Partners under the 1976 Intergovernmental Contract and past financial contributions to the development, operation and maintenance of the facilities. In this Agreement, the Partners commit to transfer all right, title and interest in and to Existing Joint Facilities to the LOTT Wastewater Alliance. In consideration for the mutual promises and covenants and establishment of a new LOTT governance structure, each Partner waives all potential claims against the other Partners as to ownership of Existing Joint Facilities and as to monetary reimbursement or compensation arising from the ownership of Existing Joint Facilities or its transfer to the LOTT Wastewater Alliance, except for the purchase of City of Lacey facilities as provided in the Agreement Regarding Additional LOTT Joint Facilities of June 21, 1999 (see Exhibit I).

Section 1.4 CONTRACT DOCUMENTS

The following exhibits are incorporated by reference into this Agreement as though fully set forth herein:

- Exhibit A — List of all agreements comprising the 1976 Intergovernmental Contract
- Exhibit B — List of Existing Joint Facilities
- Exhibit C — Articles of Incorporation of LOTT Wastewater Alliance
- Exhibit D — Bylaws of LOTT Wastewater Alliance
- Exhibit E — LOTT System Service Area (Urban Growth Area Boundary, Ch. 36.70 RCW)
- Exhibit F — Allocation of Costs to New Connections and Monthly Rates
- Exhibit G — LOTT Discharge and Industrial Pretreatment Regulations
- Exhibit H — O & M Contract
- Exhibit I — Agreement Regarding Additional LOTT Joint Facilities of June 21, 1999

- Exhibit J — Intergovernmental Contract for Inflow and Infiltration Management and New Capacity Planning of March 27, 1995
- Exhibit K — Interlocal Cooperation Agreement Between Thurston County and the Cities of Lacey, Olympia, and Tumwater Regarding Joint Wastewater Flow Reduction and Water Conservation Projects of May 28, 1997 (with attachments)
- Exhibit L — Administrative and Treasury Services Contract

Section 1.5 DEFINITIONS

For purposes of this Agreement, the following terms shall have the meanings set out below.

“Bonds” means City of Olympia Water and Sewer Revenue Refunding Bonds, 1993 (LOTT Series), Water and Sewer Revenue Bonds, 1997A and Water and Sewer Revenue Refunding Bonds, 1997 (Series B).

“Capacity Development Charge” means the one-time connection charge collected at issuance of building permit for each new connection to a Local System or directly to the LOTT System.

“Consolidation” means the point at which the LOTT Wastewater Alliance has been formed and is capable of functioning as an independent wastewater treatment and management entity and all significant steps necessary to concentrate ownership or control of Existing Joint Facilities and the LOTT System in the LOTT Wastewater Alliance, including defeasance of the Bonds, have been accomplished.

“Debt Service” means the principal of, interest on, sinking fund requirements, reserve account requirements and any coverage requirement required by a resolution authorizing the issuance of LOTT Debt.

“Equivalent Residential Unit” or “ERU” means:

- 1) One separate single family residence;
- 2) With respect to residential duplexes, one per single family unit;
- 3) With respect to each residential structure having more than two single family residential units, each single family unit shall equal 0.70 ERU (or, for these structures, one ERU equals 1.43 single family units);
- 4) With respect to mobile home and trailer parks, one per each mobile home or trailer unit; or
- 5) With respect to the Wastewater Service Charge for uses other than residential uses, the monthly discharge of sewage in units of 900 cubic feet measured at the source either by water consumption or sewage discharge, and with respect to determining the ERU number used to calculate the Capacity Development charge for other than

residential uses, the monthly discharge of sewage in units of 900 cubic feet estimated pursuant to guidelines established by the Advisory Committee and based on the then current or most recent experience of the type and character of the proposed service requested.

“Existing Joint Facilities” means any “Joint Facilities” as defined in or developed pursuant to the 1976 Intergovernmental Contract that are in existence and operation or are designated as LOTT Joint Facilities as of the effective date of this Agreement. The Existing Joint Facilities are identified in Exhibit B.

“General Pretreatment Regulations” shall mean the United States Environmental Protection Administration General Pretreatment Regulations for existing and new sources as set forth in 40 CFR part 403.

“I/I Study” means the LOTT Infiltration and Inflow Removal Study (Gibbs & Olson 1994).

“Joint Facilities” means Existing Joint Facilities and LOTT Wastewater Alliance Joint Facilities.

“Joint Facilities Maintenance and Operation Expenses” means all costs and expenses relating to labor, fringe benefits, power, light, water, heat, chemicals, equipment including repair and replacement thereof, tools, materials, supplies, insurance premiums, contract services, inspections and taxes and “in lieu of taxes” directly and properly chargeable to the operation and maintenance of the Joint Facilities plus administrative overhead expenses, and any other similar costs chargeable to the Joint Facilities.

“LOTT Wastewater Alliance Joint Facilities” means all sewerage or wastewater treatment or reclaimed water facilities or conveyance acquired or developed after the effective date of this Agreement by the LOTT Wastewater Alliance including but not limited to trunk sewer lines, sewage pumping stations, sewage force mains, sewage treatment facilities and outfall lines, resource management basins, reclamation and groundwater recharge facilities, flow reduction improvements, and other improvements, properties, rights, or interests used or useful in the conveyance, treatment, disposal, storage, or management of sewage or wastewater flows or reclaimed wastewater or water products, including any appurtenances thereto, and any improvements or replacements of Existing Joint Facilities.

“Local System” means sewer or wastewater facilities other than Joint Facilities that are owned or operated by a Partner for the local collection, pretreatment, transmission, and delivery of sewage or wastewater flows to Joint Facilities.

“LOTT” means the LOTT Partnership created by the 1976 Intergovernmental Contract and the LOTT Wastewater Alliance created pursuant to this Agreement, and the “LOTT System” means all Joint Facilities that are owned, operated, or controlled by one or more of the Partners or by LOTT or that are used or useful in the performance of LOTT’s

functions, including all contracts, permits, rights, and interests that are necessary or useful for operation of said facilities.

“LOTT Board” or “Board of Directors” means the board of directors created pursuant to Chapter 24.03 RCW to manage and oversee the LOTT Wastewater Alliance non-profit corporation.

“LOTT Debt” means any notes, bonds or other obligation of the LOTT Wastewater Alliance issued to finance or refinance improvements, betterments, or extensions to Joint Facilities or any other costs related to the LOTT System and the State of Washington loan to LOTT, evidenced by the Olympia Water and Sewer Revenue Bonds (1992) ultimately issued in a principal amount of \$36,579,836.19.

“LOTT Discharge and Industrial Pretreatment Regulations” shall mean the regulations attached as Exhibit G to this Agreement, which may be amended from time to time by a unanimous vote of the LOTT Board.

“LOTT System” (see “LOTT”)

“LOTT Wastewater Alliance” or “LOTT Alliance” means the non-profit corporation to be created by the Partners pursuant to Chapter 24.03 RCW and this Agreement.

“1976 Intergovernmental Contract” means the Intergovernmental Contract for Wastewater Facilities Management, dated November 30, 1976, together with all later amendments, all of which are listed in Exhibit A.

“O & M Contract” means the agreement for operation and maintenance of the wastewater treatment plant and other Joint Facilities to be entered by the LOTT Wastewater Alliance and Olympia pursuant to Section 10.3.

“Plan” means the LOTT Wastewater Resource Management Plan dated November, 1999 and approved by the Partners, as may be amended from time to time.

“TAC” means The Advisory Committee formed pursuant to the 1976 Intergovernmental Contract that operates to advise the development and operation of Existing Joint Facilities.

“TSC” means the Technical Subcommittee formed by TAC in response to the requirements of the 1976 Intergovernmental Contract and also made part of the LOTT Wastewater Alliance. The TSC is composed of one public works executive manager from each Partner; the person responsible for management of LOTT treatment plant and facility operations; the LOTT staff engineer; and the LOTT administrator appointed by TAC or the LOTT Board. The LOTT administrator shall chair the TSC.

“Wastewater Service Charge” means the LOTT monthly rate charged for each Equivalent Residential Unit (ERU) connected to Local Systems or directly to the LOTT System.

(This page intentionally left blank)

ARTICLE II

LOTT WASTEWATER ALLIANCE: NONPROFIT CORPORATION GOVERNANCE

Section 2.1 LOTT WASTEWATER ALLIANCE

As soon as practical after this Agreement takes effect, the Partners shall act to form a nonprofit corporation under Chapter 24.03 RCW to be formally called the "LOTT Wastewater Alliance." A form of articles of incorporation and bylaws are attached as Exhibits C and D respectively, and the Partners shall use articles of incorporation and bylaws substantially in the form set out in Exhibits C and D to create the nonprofit corporation.

Section 2.2 POWERS.

The LOTT Wastewater Alliance, an independent legal entity, acting through its Board of Directors and duly authorized employees and agents, shall have all the powers of a nonprofit corporation organized under Chapter 24.03 RCW. Among its powers, the LOTT Wastewater Alliance shall have the full power and authority to:

- a) Acquire, construct, receive, own, manage, lease, sell, and otherwise dispose of real property, personal property, intangible property, and Joint Facilities;
- b) Plan, develop, replace, operate and maintain Joint Facilities;
- c) Enter into contracts for goods, services, work, or other benefits to the LOTT Wastewater Alliance;
- d) Borrow money and issue debt instruments or provide for the borrowing of money and issuance of debt instruments;
- e) Receive gifts or grants for the planning, design, development, construction, or operation of Joint Facilities, or assets or programs to further LOTT's purposes, or for other purposes necessary to carry out LOTT's purposes;
- f) Lend money or provide services or facilities to any Partner or other governmental utility or governmental service provider in furtherance of LOTT's purposes;
- g) Invest its funds;
- h) Sue and be sued;
- i) Hire and fire employees of the LOTT Wastewater Alliance;
- j) Fix salaries, wages and other compensation of officers and employees;

- k) Employ or retain engineering, legal, financial or other specialized personnel and consultants as may be necessary to carry out the purposes of the LOTT Wastewater Alliance;
- l) Impose, alter, regulate, control, and collect rates, charges, and assessments;
- m) Purchase insurance and participate in pooled insurance and self-insurance programs;
- n) Indemnify the Partners and their officers and employees in accordance with law;
- o) Establish policies, guidelines, or rules to carry out its powers and responsibilities;
- p) Exercise all other powers within the authority of and that may be exercised individually by all of the Partners with respect to sewage or wastewater conveyance, treatment, disposal, reclamation, reuse, conservation, or other LOTT purposes or functions as set forth herein; and
- q) Take any other actions as the LOTT Board deems necessary to implement the Plan, to protect and advance the interests of the LOTT System, its Partners, and its ratepayers that are consistent with this Agreement, Chapter 39.34 RCW, and other applicable law.

Section 2.3 PUBLIC ACCOUNTABILITY.

The Partners intend for the LOTT Wastewater Alliance to operate and function as a public agency. The LOTT Board shall conduct its deliberations and take action openly. Therefore, the LOTT Wastewater Alliance shall operate and conduct its business subject to the Open Public Meetings Act (Ch. 42.30 RCW, as may be amended), the Public Disclosure Act (Ch. 42.17 RCW, as may be amended), local government accountancy statutes (RCW 43.09.200 et seq., as may be amended), and other applicable laws, regulations, and self-imposed policies.

Section 2.4 NO EFFECT ON PARTNER POLICE POWERS.

Nothing in this Agreement shall be deemed to limit the exercise of a Partner's police or regulatory powers as may be required or allowed by law. The Partners herein confirm that the LOTT Board has no local land use authority to direct growth or development within the LOTT service area as shown on Exhibit E. Instead, the LOTT Board shall manage the LOTT System in a way that is responsive to local land use planning and sewerage plans adopted by the Partners within LOTT's service area and consistent with applicable state and federal laws. However, the LOTT Board may comment on proposed changes by Partners to their land use plans and zoning codes where such changes could affect the amount, timing or characteristics of sewage or wastewater flows to be treated by the LOTT System.

Section 2.5 LOTT BOARD

a) **Composition.** The Board of Directors for the LOTT Wastewater Alliance shall consist of four (4) Directors and four (4) alternate Directors. One Director and one alternate Director shall be appointed by and from the legislative bodies of Lacey, Olympia, Tumwater and

Thurston County. The Director and alternate Director of each Partner appointed to the LOTT Board shall serve at the will and discretion of the legislative body of that Partner. Any Partner may remove its Director or Alternate Director from the LOTT Board at any time. In the event that a Partner's Director or alternate Director is so removed, is no longer qualified to serve on, or otherwise departs from the LOTT Board, that Partner's legislative body shall promptly appoint a new Director or alternate Director to the LOTT Board. It is the Partners' intent that a representative on the LOTT Board will represent his or her Partner local government in voting and acting as a LOTT Board member.

b) Local government representation. The Partners hereby agree that legislative oversight by their respective local governments shall not be required for any LOTT Board decisions in the management and operation of the LOTT System, except as expressly provided herein. LOTT Board members shall represent the interests of their respective local governments in carrying out their responsibilities to act in the best interests of the LOTT Wastewater Alliance.

c) Procedures and voting. Each Director shall have one vote. A Partner's alternate Director shall vote in place of that Partner's Director when the Director is absent or unavailable or when the Director position is vacant. Alternate Directors may also vote to resolve tie votes as provided below. The LOTT Board shall establish procedures for conducting its meetings consistent with Roberts Rules of Order and its decisions shall be by a majority vote except when a unanimous vote is required, as provided below.

d) Tie votes. In the event of a tie vote by the LOTT Board, the LOTT Board shall 1) randomly choose one alternate Director, and 2) table the matter to the following LOTT Board meeting which shall be scheduled as a special or regularly scheduled meeting within the next twenty-one (21) days or as soon thereafter as all LOTT Directors can be present together with the alternate Director randomly chosen to assist in resolving tie votes. At this meeting, all LOTT Directors, including the alternate Director chosen, shall participate in the discussion and voting on the matter or related matters until such time as the issue previously resulting in a tie vote has been resolved by a majority affirmative vote, defeated by a majority, or otherwise resolved. The LOTT Board shall select the alternate Director to resolve a tie vote by a random drawing of the Partners' names from a hat or other container; however, no Partner's alternate Director shall serve as a tie breaker in two consecutive tie vote matters.

e) Unanimous votes. For the actions that require unanimous votes identified below, proposed LOTT Board resolutions or motions must be distributed to the Clerk of each Partners' legislative body at least eighteen (18) calendar days in advance of final action by the LOTT Board. The following actions shall require unanimous votes by the LOTT Board:

i) Approval or amendment of the Plan;

ii) Revisions in the Articles of Incorporation or Bylaws or dissolution of the LOTT Wastewater Alliance non-profit corporation;

iii) Revision of the allocation of costs as to new connection charges and monthly rates; the allocation of costs in effect as of the effective date of this Agreement is set forth in Exhibit F;

iv) Modification or amendment of the LOTT Discharge and Industrial Pretreatment Regulations pursuant to Section 7.1 of this Agreement; and

v) Establishment or modification of pretreatment permit fees, charges, and actions pursuant to Section 7.2 of this Agreement.

f) **Local government review and comment.** The LOTT Board shall, in a timely manner, solicit the review and comment by its Partner local governments of proposed changes in LOTT comprehensive plans, annual budgets and annual capital programs. The LOTT Board shall consult with a Partner local government on any specific Joint Facility capital project proposed within the Partner jurisdiction prior to approving the final design for such project.

Section 2.6 COMMITTEES

The LOTT Board may form and convene committees and advisory bodies as it deems appropriate for Partner review and comment, public input, efficient staff and Board work, and other purposes. Initially, until the LOTT Board directs otherwise, the following standing committees shall exist to advise the LOTT Board: i) the Technical Subcommittee ("TSC"), and ii) the Legal Committee composed of an attorney chosen by each Partner and the LOTT Wastewater Alliance legal counsel to review legal matters as from time-to-time directed by the LOTT Board.

Section 2.7 BOOKS AND RECORDS.

Any member of the LOTT Board or a representative of such member may examine the books and records of any Partner or of the LOTT Wastewater Alliance that relate to the Joint Facilities, the administration thereof, this Agreement, or the 1976 Intergovernmental Contract. After provision of reasonable notice, such books and records may be examined at any reasonable time during business hours of that Partner. The LOTT Board may appoint an auditor or accountant to review any such books and records and the costs of such review shall be charged to LOTT which in turn may include such costs as a Joint Facilities Maintenance and Operations Expense.

ARTICLE III

LOTT WASTEWATER ALLIANCE: FINANCE

Section 3.1 LOTT RATES & CHARGES

The LOTT Wastewater Alliance shall establish rates and collect fees for wastewater service that will be at least sufficient to pay the expenses of maintenance and operation of the LOTT System and will meet the principal, interest and coverage requirements and other bond covenants of all obligations issued by the LOTT Wastewater Alliance or by a Partner on behalf of the LOTT Wastewater Alliance that are related to improvements and extensions to the LOTT System or refunding bonds issued for the LOTT System and that constitute a charge upon the revenue of such system.

Section 3.2 PARTNER COVENANTS TO MAKE PAYMENTS

a) **Covenants to make payments.** In consideration for the LOTT Wastewater Alliance maintaining and operating the Joint Facilities and as a condition for use thereof and service therefrom, each Partner irrevocably covenants, obligates and binds itself to timely bill, collect and pay the Wastewater Service Charge and the Capacity Development Charge provided for in this Article III. All such payments shall be made at the times and in the manner provided in this Article III. All such payments shall be made out of the gross revenues of each Partner's Local System or combined water/sewer system. Each Partner shall pay its share of costs attributable to Debt Service on and other costs associated with LOTT Debt throughout the term of this Agreement whether or not the Joint Facilities or the LOTT System is operating or operable and notwithstanding the performance or nonperformance of this Agreement by any Partner. Nothing in this Agreement shall be interpreted to cause the LOTT Wastewater Alliance not to charge the Partners for Debt Service or to relieve a Partner from paying its share of Debt Service.

b) **Wastewater Service Charge.** Commencing with the first complete month in which sewage flows are collected and delivered by the Partners to LOTT, each Partner shall pay to the LOTT Wastewater Alliance the Wastewater Service Charge established by the LOTT Board. Initially this uniform charge is \$25.50 per month per ERU as approved by the LOTT Partners and made effective January 1, 1993. At least annually and more frequently as necessary, the LOTT Board shall consider the Wastewater Service Charge and confirm or adjust the amount of the Wastewater Service Charge as needed to cover costs. The Wastewater Service Charge paid by each Partner is based on the number of ERUs connected to its Local System, determined as follows.

i) **Reporting and Payment of ERU count.** By the 25th day of each month each Partner shall deliver to LOTT a statement specifying the amount of Wastewater Service Charge revenue collected and remitted to LOTT and the number of ERUs served or billed by it as of the last day of the immediate preceding month. An ERU shall be counted if it is either connected to or billed for availability of use by Local Facilities. If any Partner fails to furnish such count in a timely manner, LOTT may estimate such ERU count and bill that Partner according to that estimate. Any Partner by giving reasonable notice may examine the books and records of any

other Partner to determine the basis for the computation of any ERU figure used by that examined Partner. No dispute over any such charges shall relieve a Partner from its duty to pay a monthly bill. In the event an adjustment or correction must be made, it shall be effective for a credit or additional charges in the next succeeding month. In order to keep count of ERUs each Partner shall cause all nonresidential users to install meters measuring either all water usage or sewage discharge. Any Significant Industrial User (see Exhibit G Section 2 (JJ)) not covered by an Industrial Pretreatment Permit and covered by a separate discharge contract with any Partner or with the LOTT Wastewater Alliance shall have charges paid and reported consistent with its discharge contract and shall be exempt from the ERU requirements of this section.

ii) ERU payment reduction. A Partner may reduce the Wastewater Service Charge for each ERU qualifying under the Partner's sewer rate reduction program for elderly and handicapped low income persons, provided the program is consistent with applicable State law and regulations. The reduction in ERU payment will be equal to the percentage reduction allowed of the Partner's sewer collection system rate per ERU, but in no event may the reduction in ERU payment exceed 50% per qualifying ERU.

c) Capacity Development Charge. Each Partner shall collect a LOTT Wastewater Alliance Capacity Development Charge equal to the amount established by the LOTT Board for every additional structure connected to its Local System beginning with the effective date established by the LOTT Board. Upon change in the character in use of any structure connected to a Local System resulting in significantly increased sewage discharge, an additional LOTT Wastewater Alliance Capacity Development Charge shall be collected so as to account for actual use, giving appropriate credit for connection charges already paid. All Capacity Development Charges shall be paid to LOTT with the Partner's next monthly payment following the month in which the charges are collected. Initially the Capacity Development Charge is \$3,000.00 per ERU as approved by the LOTT Partners and made effective July 1, 1999. At least annually and more frequently as necessary, the LOTT Board shall consider the Capacity Development Charge and confirm or adjust the amount of the Capacity Development Charge as needed to cover costs of additional conveyance, treatment and management capacity.

d) Local System Expenses. The Wastewater Service Charge shall be deemed a maintenance and operation expense to the maximum extent possible under existing bond resolutions and ordinances and shall expressly be made a part of the maintenance and operation expenses of the Local Systems of each Partner in any future bond issue or other financing payable in whole or in part from the revenues of such systems and shall be payable and constitute a charge prior and superior to any charge or lien of any revenue bonds, or any obligation, issued by the Partners payable from the net revenues (gross revenues less operations and maintenance expenses) of their respective systems.

Section 3.3 PARTNER COVENANTS TO MAINTAIN CHARGES

Each Partner irrevocably covenants and agrees to establish rates and collect fees for sewer service or sewer and water service, in the case of a combined utility, that will be at least sufficient to pay the charges to the LOTT Wastewater Alliance and to pay the other maintenance and operation expenses of their respective Local Systems.

Section 3.4 PARTNER BONDS

a) **Future water and sewer bonds.** On and after the effective date of this Agreement, no Partner shall issue any debt secured by existing or future LOTT sewerage charges or connection revenue, Joint Facilities, or any other LOTT revenues or assets; however, with the approval of the LOTT Board a Partner may issue such debt on behalf of or for the benefit of the LOTT Wastewater Alliance.

b) **Outstanding local bonds.** It is recognized that Olympia, Tumwater and Lacey presently have outstanding revenue bonds payable in whole or in part from the net sewer revenue of their Local Systems. Nothing in this Agreement is intended or shall be construed to violate any covenant of these outstanding bonds, and such covenants, to the extent there is a conflict between them and this Agreement, shall control with respect to such outstanding bonds and any debt issued on a parity with such bonds and required to have the same covenants as the outstanding bonds.

Section 3.5 BILLINGS AND PAYMENTS

For all charges prescribed in this Article III, the LOTT Wastewater Alliance shall bill each Partner on the first day of each calendar month for charges accrued to the first day of the immediately preceding month, unless already paid as provided in Section 3.2. Each Partner shall pay such charges so billed by the twentieth day of the month such bill is received, after which time such billing shall be delinquent. Charges omitted in one month may be billed in the following months. Delinquent charges shall accrue interest on the unpaid balance at a rate equal to the current one year Treasury Bill rate plus 1% from date of delinquency until paid.

Section 3.6 ADMINISTRATIVE AND TREASURY SERVICES

As provided in Section 11.4, the LOTT Wastewater Alliance and Olympia shall enter into an Administrative and Treasury Services Contract to provide for Olympia to continue to provide such services for an initial period of time. Prior to giving notice of termination of all or part of the Administrative and Treasury Services Contract, the LOTT Board shall consider and document Olympia's and alternative administrative and treasury service costs and practices. After this consideration, the LOTT Board shall determine whether to continue under the Administrative and Treasury Services Contract, to terminate all or part of the Administrative and Treasury Services Contract and make other arrangements for such services, or take such other action as the Board finds necessary and appropriate. After the Administrative and Treasury Services Contract terminates, the LOTT Wastewater Alliance may, in its sole discretion, decide to operate and maintain the administrative and treasury services through its own staff or through a contract or contracts with others, including any of the Partners.

The LOTT Board shall control and direct the disposition of all LOTT funds and monies. The contractor shall establish a separate fund to hold LOTT funds, establish special accounts within the LOTT Fund, and keep separate and adequate books and records of the same, all as required by law and regulations of the State Auditor and as the LOTT Board may direct. The

contractor shall also be responsible for investment of LOTT funds consistent with the investment policy adopted by the LOTT Board.

Section 3.7 LOTT BUDGETING

a) Annual LOTT budget

i) By each June 1, the LOTT Board shall notify each Partner of its proposed budget and capital improvement program for the Joint Facilities showing its estimate of the debt service and reserve requirements for debt obligations incurred to finance the LOTT Existing Joint Facilities, LOTT Wastewater Alliance Joint Facilities, Joint Facilities Maintenance and Operation Expenses, and the coverage requirements of such obligations per ERU for the ensuing calendar year and shall furnish forthwith to those Partners upon request for inspection the data and records supporting such estimate. Each Partner shall furnish LOTT with its recommendations and comments by July 31. Thereafter LOTT shall adopt its final annual budget and capital improvement program for the forthcoming calendar year on or before August 31. Subject to adjustment as provided in this subparagraph, the ERU charges for the Partners under this subparagraph shall be based on the final budget.

ii) By March 1 of each year, LOTT shall determine and notify the other Partners of the actual debt service and reserve requirements of the LOTT Debt, the actual Joint Facilities Maintenance and Operation Expenses, the actual requirements for LOTT Wastewater Alliance obligations and any other payment requirements for the immediately preceding calendar year, or part thereof, covered by this Agreement.

iii) The annual schedule of budget events is summarized as follows:

March 1 st	Notice of previous year's reconciliation
March 15 th	Preliminary flow estimate for next calendar year provided by LOTT
April 15 th	Partners respond to preliminary flow estimates for next calendar year
May 1 st	LOTT provides final flow estimate for next calendar year
June 1 st	LOTT provides proposed budget and capital improvement program for next calendar year
July 31 st	Partners and public comment on proposed LOTT budget and capital improvement program for next calendar year
August 31 st	LOTT adopts budget and capital improvement program for next calendar and advises Partners of LOTT rates to take effect January 1st

iv) To respond to special circumstances, the LOTT Board shall have the authority to alter the annual budget schedule in a given year.

b) LOTT Joint Facilities budget adjustments. The LOTT Wastewater Alliance shall operate within its annual budget. Should debt service and reserve requirements for the LOTT Debt, or Joint Facilities Maintenance and Operation Expenses, or coverage requirements increase above budget estimates, or should the money in the Operations Account of the LOTT Joint Facilities Fund or the LOTT Wastewater Alliance Joint Facilities Fund be insufficient to meet and pay those requirements and expenses in that calendar year, the LOTT Wastewater Alliance may amend its budget and increase the Wastewater Service Charge after first submitting the proposed budget amendment and Wastewater Service Charge increase to the Partners for comments.

Section 3.8 SHORT-TERM FINANCIAL ASSISTANCE FOR EMERGENCY SEWER REPAIRS

a) Upon request from a Partner, the LOTT Wastewater Alliance shall consider providing short-term financial assistance to any Partner facing an emergent need to repair or replace failed sewer facilities when that emergency involves a threat to public health or public safety, poses a significant threat to the natural environment, or presents a threat to or operational difficulty for the LOTT System. In dealing with such emergencies, time is of the essence. The temporary financing is intended to provide financial assistance between the time of the emergency and the time when the requesting Partner has opportunity to secure other financing. It is understood the requesting Partner will make all reasonable efforts to effectively use its own financial resources and any other available funding to assure minimum use of assistance from LOTT.

b) LOTT resources available for use in providing emergency repair assistance to a requesting Partner shall be limited to LOTT funds in excess of that required by bond covenants and other debt and that which is not otherwise committed or programmed according to the adopted current LOTT budget and Capital Improvement Program during the term of the requested temporary financing. The amount of the requested temporary financing may not exceed the total cost of the engineering and construction of repairs necessary to restore sewer service, end the public health or safety emergency, end the threat to the natural environment, or end the threat to or operational difficulty for Joint Facilities plus the cost of liquidation losses and interest as provided herein.

c) Temporary financing for emergency repairs may be extended for a term of up to eighteen months from the time of first withdrawal at which time it will be due and payable in full including the principal amount, the added cost of losses due to liquidation, and all interest. Any Partner using LOTT funds under this Section 3.8 is subject to the same obligations for payment as for the charges set forth in this Article III.

d) The Partners hereby recognize that, due to the emergency nature of the financial assistance covered by this agreement, invested LOTT money may be subject to losses due to liquidation of investments as a result of providing for temporary financing assistance. Every reasonable effort will be made to avoid such losses; however, the amount of these losses will be added to the principal amount of the temporary financing and will be subject to interest charges as described herein.

e) Interest will be charged on temporary financing for emergency repairs at a rate equal to the net earnings rate of the State of Washington Local Government Investment Pool. The interest period will begin with the effective date of the issuance of funds to the requesting Partner.

f) Because time is of the essence when dealing with temporary financing for emergency sewer repairs, the following procedure will guide processing of a request. First, the requesting Partner will, by letter addressed to the LOTT Board, describe the emergency for which a temporary financing is being requested, state the amount requested, and propose a date to meet with LOTT and its treasurer to negotiate a schedule of dates and amounts of withdrawals and repayment. If time permits, the LOTT Board may refer the request to a committee for review and recommendation. In any event, the LOTT Board shall attempt to act on the request in a timely fashion.

Section 3.9 TAXES

In recognition of the LOTT Wastewater Alliance as a public entity, the Partners shall not impose any tax on the gross receipts of the LOTT Wastewater Alliance. Each Partner may levy a gross receipts tax on its utility, including receipts representing the Wastewater Service Charge.

ARTICLE IV

LOTT WASTEWATER ALLIANCE: WASTEWATER CONVEYANCE AND TREATMENT

Section 4.1 LOTT SERVICE OBLIGATION IN SERVICE AREA

LOTT shall accept all Partner sewage flows delivered to Joint Facilities within the LOTT System service area (shown on Exhibit E), subject to the conditions and limitations stated herein. The service area shall be the Lacey-Olympia-Tumwater Urban Growth Area in effect when this Agreement takes effect. The LOTT Wastewater Alliance shall not directly accept sewage or wastes from any person, firm or corporation that is located within the boundaries of or is delivering its sewage flows to the Local System of a Partner without the written consent of that Partner.

If the Lacey-Olympia-Tumwater Urban Growth Area is expanded beyond that shown on Exhibit E, the LOTT System service area shall be expanded only if the Partner requesting the expansion remits a connection charge that includes all capacity development costs including those otherwise allocated to monthly rates (Wastewater Service Charge). The foregoing sentence shall not apply to service expansions outside the Lacey-Olympia-Tumwater Urban Growth Area that correct identified health hazards or water quality problems in high density developments consistent with the Thurston County Sewerage General Plan of 1990, and the cost of such expansions shall be allocated pursuant to Exhibit F.

Section 4.2 PARTNER OBLIGATION TO DELIVER FLOWS

Each Partner shall deliver all sewage and wastewater flows collected by its Local System to the LOTT System. Each Partner shall deliver its Local System flows at such locations in the LOTT System and pursuant to such connection procedures and other terms and conditions as may be established by the LOTT Board. Except as provided in Section 4.4 of this Agreement, a Partner shall not deliver sewage or wastewater flows generated in the LOTT System service area to an agency other than LOTT for treatment and disposal or treat such flows at its own sewage treatment facilities without the consent of the LOTT Board.

Section 4.3 LOTT SYSTEM CAPACITY

a) **Acceptance of Partner flows.** The LOTT System shall be available to receive and treat sewage flows delivered to Joint Facilities by the Partners so long as the LOTT System has capacity to accept, treat, and manage such flows. The LOTT Wastewater Alliance shall use its best efforts to provide for increased capacity pursuant to the Plan, in a manner designed to allow the LOTT System to accept, treat, and manage all flows proposed to be delivered to the Joint Facilities by the Partners. Flows from the Partners' Local Systems shall be accepted on a "first-come, first-served" basis. The LOTT Board shall have the authority to limit flows from the Partners only to ensure preservation of public health and compliance with applicable laws, regulations, permits and provisions of the LOTT Plan. However, in the event that flows are proposed from a single non-residential user which will impair, for a significant period of time,

any Partner's capacity to accommodate growth projected by the Thurston Regional Planning Council in its service area, the LOTT Board shall have the authority to delay the delivery of flows or portions thereof from the single non-residential user until, through the best efforts of the LOTT Board, a plan is in place which will be implemented in time to avoid such projected impairment. Any such flow limitation shall not in any way excuse or reduce any Partner's obligation to make payments to the LOTT Wastewater Alliance under this Agreement.

b) Annual flow predictions. The LOTT Board shall annually provide to the Partners by March 15th a preliminary estimate of flows to be produced within each Partner local government during the following calendar year based on data from the Thurston County Regional Planning Council forecasting population and employment. Each Partner, within thirty (30) days of receipt of the estimate, shall a) estimate and provide to LOTT the expected building activity within its jurisdiction for the following calendar year based on plats and/or building permits approved or pending immediate approval and b) provide to LOTT any other information that it would like LOTT to consider in establishing a final estimate of the capacity available during the following calendar year. After receiving such comments and information from the Partners, the LOTT Board shall publish a final estimate no later than each May 1st identifying the total estimated capacity available for the following year in the LOTT System and the percentage of such capacity expected to be utilized during such year.

c) No default. The LOTT Wastewater Alliance shall not be in default of its obligations under this Agreement or any other intergovernmental contract in the event that the LOTT Board determines that insufficient capacity exists to accept, treat, and manage sewerage flows, despite using best efforts to develop sufficient capacity. The existence of a capacity constraint or the unavailability of additional capacity shall not excuse or reduce any Partner's obligation to make payments to the LOTT Wastewater Alliance under this Agreement.

Section 4.4 PARTNER OPTIONS IN THE EVENT OF CAPACITY CONSTRAINT

In the event that the LOTT Board limits additional Partner flows to the LOTT System pursuant to Section 4.3, the following exclusive remedies are available to the Partners, but only for the duration of such limitation.

i) A Partner may deliver additional sewage flows to an agency other than LOTT for treatment and disposal; and

ii) A Partner may develop its own sewage treatment facilities to serve new demand; provided that such facilities are sized no larger than reasonably necessary to serve customers connecting during the expected duration of the capacity constraint.

The foregoing remedies are the exclusive remedies available to a Partner as to the LOTT Wastewater Alliance and the other Partners in the event of a LOTT System capacity constraint, except that the Partners shall not be limited to such exclusive remedies in the event the LOTT Wastewater Alliance is in default of its obligations under this Agreement.

ARTICLE V

LOTT WASTEWATER ALLIANCE: COOPERATION IN MANAGEMENT & DEVELOPMENT OF WASTEWATER FACILITIES

Section 5.1 RESPONSIBILITY FOR JOINT FACILITIES AND LOCAL SYSTEMS

a) **Joint Facilities.** The LOTT Wastewater Alliance shall plan, construct, acquire, replace, operate, and maintain all Joint Facilities such that the entire LOTT System and the Joint Facilities are built, operated and maintained as an integrated sewerage system in accordance with high engineering standards and in conformity with the sewer standards of American Public Works Association, the Water Environment Federation and requirements of the state, federal and local agencies having jurisdiction over the same. The LOTT Wastewater Alliance shall in its sole discretion determine the name, location, and time of construction of LOTT Wastewater Alliance Joint Facilities. The LOTT Wastewater Alliance shall maintain through responsible insurers including insurance pools public liability insurance for Joint Facilities operations and responsibilities in accordance with industry standards.

b) **Local Systems.** The Partners shall maintain and operate their respective Local Systems in accordance with high engineering standards and in conformity with the standards established by the state and federal agencies having jurisdiction over the same. Modifications and additions to Local Systems shall be constructed and operated in accordance with the sewer standards of American Public Works Association, the Water Environment Federation and requirements of the state and federal agencies having jurisdiction over the same. The Partners shall secure and maintain with responsible insurers including insurance pools all such insurance as is customarily maintained with respect to sewage systems of like character against loss of or damage to the Local Systems against public and other liability to the extent that such insurance can be secured and maintained at reasonable cost.

c) **Liability.** Any liability incurred by the LOTT Wastewater Alliance as a result of the operation of the LOTT System shall be the sole liability of the LOTT Wastewater Alliance and any liability incurred by a Partner as a result of the operation of its Local System shall be the sole liability of that Partner.

Section 5.2 JOINT FACILITIES OPERATIONS

As provided in Section 11.3, LOTT and Olympia shall enter into an O&M Contract to provide for Olympia to continue to operate the Joint Facilities for an initial period of time. Prior to giving notice of termination of the O&M Contract, the LOTT Board shall prepare a study of Olympia's and alternative operating costs and practices. After completion of the study, the LOTT Board shall determine whether to continue under the O&M Contract, to terminate the O&M Contract and make other arrangements for facilities operations, or take such other action as the Board finds necessary and appropriate. If termination of the O&M Contract with Olympia occurs, the LOTT Board will provide for an orderly, smooth transition which fairly takes into account the effect on Olympia employees. The Partners shall work together in good faith and cooperate with the LOTT Wastewater Alliance in preparation of the study and in developing new

arrangements, if any, for facilities operations to succeed the O&M Contract. After the O&M Contract terminates, the LOTT Wastewater Alliance may, in its sole discretion, decide to operate and maintain the Joint Facilities through its own staff or through a contract or contracts with others, including any of the Partners.

Section 5.3 RELATIONSHIP TO LOCAL PLANNING

a) **Land use.** The development of LOTT Wastewater Alliance Joint Facilities shall be consistent with the Plan, with applicable laws, regulations and permits, and with the Partners' zoning and land use requirements. The LOTT Wastewater Alliance does not have any land use or police powers as a non-profit corporation even though it exists for the benefit of its governmental Partners and their citizens. LOTT shall follow applicable Partner zoning and land use requirements to secure conditional use and other permits and approvals necessary for the development of new LOTT Wastewater Alliance Joint Facilities or modification of Existing Joint Facilities.

b) **Partner and GMA sewerage plans.** The Plan shall be consistent with and responsive to land use plans adopted both individually and collectively by the Partners at the time this Agreement is adopted and whenever the Plan is amended. Future land use plans or modifications proposed individually or collectively by the Partners that affect wastewater treatment shall be offered to the LOTT Board for review and comment regarding their relationship to current LOTT plans prior to their adoption. Further, the Plan shall be consistent with the general sewer plans of the Cities of Lacey, Olympia and Tumwater and the sewerage general plan of Thurston County in force at the time this Agreement is adopted. Before adopting any new or modified general sewer plan or sewerage general plan, each Partner shall forward any such plan proposal to the LOTT Board for review and comment.

Section 5.4 PARTNER COMMITMENTS TO ASSIST LOTT

To the extent legally feasible, each Partner agrees to give good faith consideration to LOTT requests for necessary zoning, land use, eminent domain proceedings and other permits and approvals to implement the Plan. In the event that a Partner completes an eminent domain proceeding for the benefit of the LOTT Wastewater Alliance to secure property or property rights for Joint Facilities, the LOTT Wastewater Alliance shall compensate the Partner for its expenses and for just compensation paid for such property and property rights.

ARTICLE VI STATE ENVIRONMENTAL POLICY ACT

Section 6.1 COORDINATION OF ENVIRONMENTAL REVIEW & SEPA REQUIREMENTS

The Partners and the LOTT Wastewater Alliance are obligated to identify and consider environmental impacts, alternatives and mitigation measures in the development of plans, programs and facilities relating to wastewater management. The State Environmental Policy Act, Ch. 43.21C RCW, and the regulations and ordinances promulgated under it ("SEPA"), establishes procedures for preparing environmental documents and obtaining input from citizens and agencies, and requires identification of a lead agency to prepare the environmental documents and administer the environmental review process. SEPA also requires agencies to integrate environmental review at the earliest time in the decision making process to ensure that planning and decisions reflect environmental values. The Partners agree that it is generally in the public interest for the LOTT Wastewater Alliance to directly manage environmental review of LOTT proposals and actions to assure the early consideration of environmental factors.

For purposes of this Article VI, "action" has the meaning given it in WAC 197-11-704, and "proposal" has the meaning provided in WAC 197-11-784.

Section 6.2 SEPA COMPLIANCE

a) **LOTT as an Agency under SEPA.** The LOTT Wastewater Alliance shall fulfill the responsibilities of an agency pursuant to SEPA in connection with all proposals and actions which it undertakes. By carrying out the responsibilities of an agency under SEPA, the LOTT Wastewater Alliance shall satisfy any SEPA obligations that apply directly to the LOTT Wastewater Alliance as well as any that may apply to indirectly due to the Alliance's acting on the Partners' behalf.

b) **Procedural Responsibilities as Lead Agency.** With respect to LOTT proposals and actions, the LOTT Wastewater Alliance shall carry out the Partners' lead agency procedural responsibilities under SEPA, including the procedural functions of a "lead agency" under SEPA, WAC 197-11-758; however, the Partners retain their legal authority to assert lead agency status for projects located within their respective jurisdictions as permitted under SEPA, including, for example, by WAC 197-11-340(2)(e) and 197-11-948. This includes, without limitation, authority to adopt agency SEPA rules, to establish an administrative appeals process, to enter into lead agency agreements pursuant to WAC 197-11-944, and to appoint a "responsible official."

Section 6.3 RETENTION OF SUBSTANTIVE AUTHORITY

The LOTT Wastewater Alliance's authority under this Article VI is to implement the procedural requirements of SEPA for LOTT proposals and actions. The Partners retain their respective substantive authorities to condition or deny such proposals and actions in their respective jurisdictions as part of their zoning, land use, SEPA, or other permitting processes.

(This page intentionally left blank)

ARTICLE VII PRETREATMENT

Section 7.1 Pretreatment Program

Pursuant to this Agreement, the LOTT Wastewater Alliance will own and operate the LOTT System, and will hold permits required to operate the LOTT System, including the NPDES waste discharge permit for the LOTT Treatment Plant.

Various facilities located within the Partners' respective jurisdictions currently contribute wastewater which includes commercial and industrial waste to the LOTT System. Such facilities are referred to in this Article as "Industrial Users."

The LOTT Wastewater Alliance must implement and enforce a pretreatment program to control discharges from all Industrial Users of the LOTT System pursuant to requirements set out in 40 CFR Part 403, Ch. 173-208 WAC, and the NPDES Permit. In this Article, the Partners agree to adopt and maintain sewer use ordinances that subject Industrial Users within their respective boundaries to the necessary pretreatment controls, and to implement and enforce such sewer use ordinances.

The Partners stipulate their willingness and ability to assume enforcement powers of the Washington State Department of Ecology, and shall adopt, maintain, and actually enforce the LOTT Discharge and Industrial Pretreatment Regulations (the "LOTT Regulations") as contained in Exhibit "G" of this Agreement, and as the LOTT Regulations may be amended from time to time by the LOTT Board. No Partner shall retain or adopt any ordinance provisions conflicting with or superseding the LOTT Regulations.

The LOTT Wastewater Alliance shall conduct an annual review of the LOTT Regulations and prepare any revisions necessary to provide adequate protection of the LOTT System and maintain compliance with Federal General Pretreatment Regulations and applicable state regulations. Any proposed revisions shall be submitted to the LOTT Board for approval. The LOTT Regulations shall not be modified or amended except by unanimous agreement of the LOTT Board. The Partners agree to immediately consider for adoption any revisions to the LOTT Regulations approved by the LOTT Board. The Partners agree to consider and act upon such revisions within ninety (90) days of approval by the LOTT Board.

Section 7.2 Pretreatment Charges and Permits

Where the LOTT Regulations call for the development of permits, permit fees, charges for discharge violations, and/or enforcement actions, the Partners agree to establish these permits, fees, charges and actions through their annual review of the LOTT operating budget based on predicted costs developed using information provided by the LOTT Wastewater Alliance. Such permit fees, charges and actions shall become effective upon unanimous approval by the LOTT Board. Permits for Industrial Users shall be issued by the Partners. Partners shall provide the LOTT Wastewater Alliance with fourteen (14) days' written notice

before issuing permits so that LOTT Wastewater Alliance personnel can review and comment on the proposed terms and conditions of such permits.

Section 7.3 Inspections; Imminent Danger

The Partners agree that LOTT Wastewater Alliance personnel, or the LOTT Wastewater Alliance's agents, shall coordinate with the appropriate Partner jurisdiction personnel to conduct activities within each Partner's jurisdiction to collect information on compliance with the LOTT Regulation, Federal General Pretreatment Regulation, and state requirements. These activities shall include, among others, coordination with the Department of Ecology Pretreatment Program, updating the industrial waste survey, developing industrial discharge permits and compliance schedules, conducting compliance monitoring and inspections, reviewing industrial self monitoring reports, and notifying the Partners of instances of non-compliance. In order to accomplish these requirements the Partners agree that:

- a) Agents of the LOTT Wastewater Alliance may, following reasonable notice to the Partner, enter and inspect at any reasonable time any part of the Local System of any Partner, and any records pertaining to the Partner's pretreatment program.
- b) To the extent allowed by law, duly authorized agents of the LOTT Wastewater Alliance, in coordination with Partner personnel, shall be permitted to enter onto private property to inspect Industrial Users. Upon the request of the LOTT Wastewater Alliance, the Partners shall promptly make all necessary legal and administrative arrangements for these inspections.
- c) Where a discharge to the wastewater treatment system reasonably appears to present an imminent danger to the health and welfare of persons, or an imminent danger to the environment, or threatens to interfere with the operation of the wastewater treatment system, the LOTT Wastewater Alliance may, in cooperation with a Partner, immediately initiate steps to identify the source of the discharge and to halt or prevent the discharge.

Section 7.4 Enforcement

Whenever provided notice that a discharger has failed or has refused to fulfill any requirements of either the LOTT Regulations, an Industrial Discharge Permit, or a Compliance Schedule, the Partner with jurisdiction over the discharger shall use its legal authority to enforce the applicable regulations. Such enforcement may include collection of permit fees and industrial surcharges, application of fines and/or civil penalties, seeking injunctive relief, and /or interruption of sewer services.

Should a dispute arise between any Partner and personnel or agents of the LOTT Wastewater Alliance regarding any application of the LOTT Regulations, the issue shall be submitted to the LOTT Board. The determination of a majority of the LOTT Board shall be given in writing and the recommended action shall be followed by all Partners.

Section 7.5 Accountability

A majority of the LOTT Board may penalize any single Partner for failure to apply and enforce the LOTT Regulations. This penalty may include requiring that the total of all fines, fees and other charges which are due and payable be paid by the offending Partner to LOTT for each day the Partner fails to apply and enforce the regulations. The offending Partner shall indemnify and hold harmless the LOTT Wastewater Alliance against any damages, penalties or other losses incurred as a result of the Partner's failure to enforce the LOTT Regulations. Without limitation, the LOTT Wastewater Alliance may obtain the remedy of specific performance from a court of competent jurisdiction to require the offending Partner to enforce the LOTT Regulations.

(This page intentionally left blank)

ARTICLE VIII

FLOW REDUCTION & PREVENTION OF CAPACITY DEGRADATION

Section 8.1 PRIOR AGREEMENTS RELATING TO INFLOW AND INFILTRATION AND JOINT FLOW REDUCTION PROJECTS.

The Intergovernmental Contract for Inflow and Infiltration Management and New Capacity Planning, dated March 27, 1995 (see Exhibit J) and the Interlocal Cooperation Agreement Between Thurston County and the Cities of Lacey, Olympia, and Tumwater Regarding Joint Wastewater Flow Reduction and Water Conservation Projects (with attachments), dated May 28, 1997 (see Exhibit K) shall continue in force according to their terms, subject to amendment, modification, or termination by the Partners. With approval of this Agreement the "December 31, 1999" dates in the second paragraph of Section 4 (c) of the Intergovernmental Contract for Inflow and Infiltration Management and New Capacity Planning, dated March 27, 1995 (Exhibit J) are amended to "December 31, 2001." This amendment is reflected in Exhibit J.

Section 8.2 Commitment to Support Volume Based Billing by the Partners

As early as practical, but in no event later than one year after Consolidation, the LOTT Board will develop economic incentives that assist individual Partners choosing to implement residential sewer rates based in some degree on wastewater discharge volumes and designed to encourage lower residential wastewater discharge.

(This page intentionally left blank)

ARTICLE IX
[RESERVED]

[Reserved for additional subject]

(This page intentionally left blank)

ARTICLE X LEGAL RELATIONS

Section 10.1 EFFECTIVE DATE & TERM OF AGREEMENT

a) **Effective date.** This Agreement shall become effective on the first date when all of the following events have occurred: i) the Agreement has been duly executed by all of the Partners; ii) the Agreement has been filed with the Thurston County Auditor pursuant to RCW 39.34.040; and iii) the Agreement has been approved pursuant to RCW 39.34.050.

b) **Duration.** Commencing on the effective date specified above, this Agreement shall be for a term of 35 years or such longer period as any LOTT Debt is outstanding or the payment thereof is not fully provided for, secured and funded.

Section 10.2 WITHDRAWAL BY A PARTNER

Any Partner may individually withdraw from the obligations of this Agreement with the consent of all of the other Partners, which consent shall not be unreasonably withheld, after all LOTT Debt is retired or payment thereof is fully provided for, secured and funded, and the remaining Partners shall continue to be bound by this Agreement as it may be amended.

Section 10.3 AMENDMENT OF AGREEMENT AND ORGANIZATION

This Agreement may be amended with the approval of the legislative bodies of the Partners. The LOTT Wastewater Alliance may be converted into a separate municipal corporation if and as permitted by law. Upon the creation of such a separate municipal corporation, all LOTT Wastewater Alliance rights and obligations under this Agreement shall transfer to that new municipal corporation.

Section 10.4 NOTICE

Notices required to be given to Partners shall be deemed given when served on the respective City Clerks and the Clerk of the Board of County Commissioners of the County. When members of the LOTT Board must be notified, notice to one member thereof from each Partner shall be sufficient compliance, but reasonable efforts shall be made to give notice to every member.

Section 10.5 RELATIONSHIP TO 1976 INTERGOVERNMENTAL CONTRACT

As detailed in Article XI, the 1976 Intergovernmental Contract remains in force until Consolidation. Upon Consolidation, the 1976 Intergovernmental Contract as described in Exhibit A terminates in its entirety.

Section 10.6 RESOLUTION OF LEGAL DISPUTES

a) To effect a quick and efficient resolution of legal disputes that may arise under this Agreement, the Partners establish the following procedure. All claims or disputes concerning the interpretation or application of this Agreement or breach thereof ("Dispute") shall be decided exclusively by the following dispute resolution procedure unless all Partners agree in writing otherwise. This dispute resolution procedure applies only to disputes of a legal nature, and shall not be construed to apply to legislative or policy matters that are within the discretion or authority of the LOTT Board or the Partners.

b) Each Partner shall use its best efforts to resolve issues prior to giving Notice of Dispute and invoking the procedures set forth in this Section. In the event that any Partner is not satisfied with the results of the resolution, that Partner, acting through its representative on the LOTT Board, shall give prompt written notice of any Dispute to the other Partners' representatives on the LOTT Board, with a copy to the LOTT administrator or executive director. This notice, herein referred to as a "Notice of Dispute," shall clearly state the subject matter of the unresolved issues and the relief requested.

c) **Level I.** Within ten (10) working days of receipt of a Notice of Dispute, each Partner's representative on the LOTT Board shall designate a representative and the designated representatives shall meet and confer and attempt to resolve the Dispute for a period not to exceed five (5) working days. If the Dispute is not resolved at the close of the Level I meeting, the designated representatives shall prepare before adjournment of the meeting a written memorandum summarizing the matters that remain at issue.

d) **Level II.** If the Dispute is not resolved within 48 hours of the close of the Level I meeting, each designated representative shall meet with that Partner's representative on the LOTT Board to discuss the Dispute and the memorandum. Within ten (10) working days of the close of the Level I meeting, the designated representatives of the Partners shall meet and confer and attempt to resolve the Dispute for an additional period not to exceed five (5) working days. Attendance by LOTT Board members at the Level II meeting is optional. If the Partners are not able to resolve the Dispute in the Level II meeting, the designated representatives shall discuss the use of mediation, arbitration, or other alternative dispute resolution process before concluding the Level II meeting.

e) The terms of the resolution of all Disputes concluded in Level I or II meetings shall be memorialized in writing and signed by each Partner's representative on the LOTT Board.

f) If the Dispute is not resolved within 48 hours of the close of the Level II meeting, then a) the Partners may mediate the issue; b) the Partners may submit the dispute to the Superior Court of Thurston County for arbitration proceedings provided by Chapter 7.04 RCW; or c) any Partner may commence a civil action to resolve the Dispute, unless the Parties agree otherwise in writing. The Superior Court of Thurston County shall be the exclusive venue for the filing of any action, and this Agreement shall be governed by Washington law. Any mediation or arbitration shall be limited to the interpretation and application of this Agreement and may not

impair the contract and debt obligations of LOTT or the powers of LOTT to fix the budget for and determine the methods used in the management of the Joint Facilities.

Section 10.7 PARTNER OBLIGATION PENDING RESOLUTION OF DISPUTES

The initiation or existence of a dispute between the Partners or between one or more Partners and the LOTT Wastewater Alliance arising out of or relating to this Agreement shall not relieve or authorize the deferral of the Partners' duty to make payments to the LOTT Wastewater Alliance as provided herein.

Section 10.8 SURVIVAL OF OBLIGATIONS

The Partners' obligations under Section 11.2(b) of this Agreement shall survive the expiration or earlier termination of this Agreement.

Section 10.9 INTERPRETATION OF AGREEMENT

a) **Governing law.** This Agreement shall be governed by the laws of the State of Washington. The exclusive jurisdiction and venue for any lawsuit between the Partners arising out of this Agreement shall be in Thurston County Superior Court.

b) **Assignment.** This Agreement shall be binding on each Partner and the successors to them and may not be assigned in any respect without the consent of all Partners.

c) **Third party beneficiaries.** The Partners expressly do not intend to create any right, obligation or liability, or promise any performance, to any third party. The Partners have not created any right for any third party to enforce this Agreement.

d) **Severability.** It is the belief of the Partners that all provisions of this Agreement are lawful. If any covenant or provision of this Agreement shall be finally adjudicated by a court of competent jurisdiction to be invalid or unenforceable, such adjudication shall not affect the validity, obligation or performance of any other covenant or provision, or part thereof, which in itself is valid if such remainder conforms to the terms and requirements of applicable law and the intent of this Agreement. In such event, the Partners shall enter into immediate negotiations for the purpose of arriving at a mutually satisfactory replacement of such covenant or provision.

e) **Entire Agreement.** This Agreement embodies the Partners' entire agreement on the issues covered by it, except as supplemented by subsequent written agreements that the Parties make. All prior negotiations and draft written agreements are merged into and superseded by this Agreement.

f) **Counterparts.** This Agreement may be executed in counterparts, each of which shall be considered for all purposes as an original.

Section 10.10 WAIVER

No waiver by any party of any term or condition of this Agreement shall be deemed or construed as a waiver of any other term or condition, nor shall a waiver of any breach be deemed to constitute a waiver of any subsequent breach whether of the same or a different provision of this Agreement.

Section 10.11 REMEDIES

In addition to the remedies provided by law, this Agreement shall be specifically enforceable by any party.

ARTICLE XI

COOPERATION THROUGH CONSOLIDATION PERIOD

Section 11.1 COORDINATION: LOTT BOARD & TAC

a) Parallel oversight. This Agreement is intended to facilitate the operation of the LOTT System, including the integration of the Existing Joint Facilities and new LOTT Wastewater Alliance Joint Facilities, under the management of the LOTT Wastewater Alliance Board of Directors. During the period from the effective date of the Agreement until the date of Consolidation, the LOTT System shall be administered by two parallel organizations composed of members appointed by the Partners who will concurrently serve as TAC members under the 1976 Intergovernmental Contract and as the Board of Directors of the LOTT Wastewater Alliance. The same Partner representatives will serve as TAC members and as LOTT Board members. Therefore, the Partner representatives may be called upon to act as TAC, in their role under the 1976 Intergovernmental Contract, or as the LOTT Board, in their role under this Agreement, or in a joint capacity, as circumstances may determine.

b) Extraordinary cooperative efforts. The Partners recognize that, during at least the initial twelve months after the effective date of this Agreement, extraordinary cooperative efforts will be required to coordinate the legal and service obligations of the LOTT System and to complete all of the legal and administrative steps necessary to consolidate the TAC and LOTT Wastewater Alliance operations.

i) The TAC and the LOTT Board shall coordinate the LOTT functions under the two legal instruments so that the ratepayers are not disadvantaged by the use of concurrent agreements.

ii) The Partners shall cooperate as may be necessary to enable the LOTT Board to operate as a legal and independent entity.

iii) During the initial twelve month period under this Agreement, the LOTT Board shall make quarterly reports to the Partners' legislative bodies on the progress made on implementing an independent LOTT entity and any steps taken to assume legal obligations and achieve Consolidation.

Section 11.2 TRANSFER AND RELEASE

a) Transfer of Existing Joint Facilities. Each Partner agrees to transfer all right, title, and interest in and to the Existing Joint Facilities to the LOTT Wastewater Alliance. Each Partner further agrees to execute or approve any and all deeds, leases, instruments, documents and resolutions or ordinances necessary to give effect to the terms of this Agreement.

b) Release of Claims. Each Partner hereby releases and agrees to hold each other Partner harmless from any and all claims, demands, and causes of action arising from or relating to the legal or equitable ownership of Existing Joint Facilities prior to effective date of this

Agreement, including the extent or nature of such ownership and related claims to reimbursement or compensation, except as provided in the Agreement Regarding Additional LOTT Joint Facilities of June 21, 1999 (see Exhibit I) concerning City of Lacey facilities.

Section 11.3 O & M CONTRACT WITH OLYMPIA.

To provide for an orderly transition of facilities operations, the LOTT Wastewater Alliance and Olympia shall enter into an O&M Contract generally in the form set out in Exhibit H. This contract does not include administrative staff reporting directly to the LOTT Board. The term of the O&M Contract shall commence on the date of Consolidation and terminate one year after the LOTT Board provides notice of termination to Olympia, which notice shall not be given earlier than December 31, 1999. This Section shall not preclude other contracts with Olympia at the LOTT Board's discretion.

Section 11.4 ADMINISTRATIVE AND TREASURY SERVICES CONTRACT WITH OLYMPIA.

To provide for an orderly transition of administrative and treasury services, the LOTT Wastewater Alliance and Olympia shall enter into an Administrative and Treasury Services Contract generally in the form set out in Exhibit L. The term of the Administrative and Treasury Services Contract shall commence on the date of Consolidation and terminate one year after the LOTT Board provides notice of termination to Olympia, which notice shall not be given earlier than December 31, 1999. This Section shall not preclude other contracts with Olympia at the LOTT Board's discretion.

Section 11.5 CONSOLIDATION PRINCIPLES AND OBJECTIVES

The Partners shall use their best efforts and work together in good faith to achieve Consolidation by meeting the following objectives:

a) LOTT Wastewater Alliance. The LOTT Wastewater Alliance shall have been formed, obtained Section 501(c)(3) status from the Internal Revenue Service, and demonstrated its capability of carrying out its responsibilities under this Agreement.

b) Olympia Bonds. All of the Bonds shall have been paid or defeased under a financing arrangement where LOTT funds pay for all transaction costs, 88 percent of which shall be paid using Capacity Development Charge receipts and 12 percent using Wastewater Service Charge receipts. In addition, the State of Washington loan to LOTT, evidenced by the Olympia Water and Sewer Revenue Bonds (1992) ultimately issued in a principal amount of \$36,579,836.19, shall be assumed, assigned or otherwise transferred from Olympia to the LOTT Wastewater Alliance. The LOTT Wastewater Alliance shall pay the bonds and meet all covenants set forth in Olympia ordinances authorizing the bonds.

c) Rates. The Partners shall have approved and imposed the rates and charges specified in Article III of this Agreement, and the proceeds are under the control of and available for use by the LOTT Wastewater Alliance.

d) Transfer of Existing Joint Facilities. All of the Existing Joint Facilities, as identified in Exhibit B, shall have been transferred to the LOTT Wastewater Alliance by an appropriate instrument or legislative action, or such transfers shall have been substantially provided for to the satisfaction of the LOTT Board.

e) O&M Contract. The LOTT Wastewater Alliance and Olympia shall have entered the O&M Contract to take effect upon Consolidation.

f) Administrative and Treasury Services Contract. The LOTT Wastewater Alliance and Olympia shall have entered the Administrative and Treasury Services Contract to take effect upon Consolidation.

g) Vendor contracts. Olympia shall have assigned to the LOTT Wastewater Alliance all consulting, service, supply, utility and other similar contracts relating to Existing Joint Facilities or the LOTT System, unless such assignment is not legally feasible or would represent any significant additional costs or risk to Olympia or unless the O&M Contract provides for Olympia to continue to administer or to enter such contracts relating to Joint Facilities. If contracts held by Olympia for the benefit of LOTT cannot be so assigned or terminated and then assumed by the LOTT Wastewater Alliance without cost or risk to Olympia, then such contracts shall be allowed to expire at the end of their normal term and the LOTT Wastewater Alliance shall secure such services, supplies, materials or construction in the future under separate agreements.

h) Permits. Olympia and the other Partners have assigned or transferred the LOTT Wastewater Alliance NPDES permits and all other permits, certificates, and licenses necessary or useful in ownership, operation, or control of the LOTT System or Existing Joint Facilities.

i) Other necessary steps. As determined by the LOTT Board, the Partners shall take such other steps and actions as are necessary and appropriate to concentrate ownership and control of Existing Joint Facilities and the LOTT System in the LOTT Wastewater Alliance and to enable the LOTT Wastewater Alliance to function as a comprehensive wastewater treatment and management entity.

Section 11.6 CONSOLIDATION EVENT

a) LOTT Board finding. When it determines that the Consolidation objectives set out in Section 11.5 have been substantially achieved, the LOTT Board shall adopt a resolution that finds and declares that Consolidation has been achieved. The Partners acknowledge that the LOTT Board may make a finding of Consolidation that reflects substantial attainment of the objectives.

b) Effect on 1976 Intergovernmental Contract and TAC. Upon the LOTT Board's adoption of the Consolidation resolution pursuant to paragraph (a) of this section, the following events shall be deemed to occur:

- i) 1976 Intergovernmental Contract shall terminate as provided in Section 10.5;
- ii) TAC shall be dissolved;
- iii) The O & M Contract shall enter into force; and
- iv) The Administrative and Treasury Services Contract shall enter into force.

IN WITNESS WHEREOF, each Party has caused this Agreement to be signed by its duly authorized officer or representative as of the date set forth below its signature.

CITY OF OLYMPIA

By Stan Eder

Its: Mayor

Date: 11/18/00

CITY OF LACEY

By Nancy Peterson

Its: Mayor

Date: 12-16-99

Attest: By James R. Kirkemo

Attest: By Carol Litten, Deputy City Clerk

CITY OF TUMWATER

By Ralph Osgood

Its: Mayor

Date: 12-14-99

Attest: By [Signature]

THURSTON COUNTY

By Maureen Cheyette

Its: Chairman, Commissioners

Date: January 24, 2000

Attest: LeBron S. Boyman

(This page intentionally left blank)

Exhibit A

1976 INTERGOVERNMENTAL AGREEMENT, AS AMENDED TABLE OF CONTENTS

Intergovernmental Contract for Financial Assistance with Emergency Sewer Repairs	April 29, 1996
Intergovernmental Agreement for Purchase and Sale of Animal Shelter Facilities	February 26, 1996
Intergovernmental Contract for LOTT Environmental Review	August 23, 1994
Intergovernmental Agreement for Industrial Waste Pretreatment Program	April 26, 1993
Amendment to Intergovernmental Contract for Wastewater Facilities Management; Reserve Capacity Charge	January 11, 1993
Amendment to Intergovernmental Contract for Wastewater Facilities Management; Low Income Assistance Rates	July 20, 1992
Amendment to Intergovernmental Contract For Wastewater Facilities Management; Multi-Family Units, ERUs	October 15, 1991
Intergovernmental Contract: Uses of the Reserve Capacity Charge, Joint Facilities, Inflow and Infiltration and Equalization Basins	September 16, 1991
Intergovernmental Contract: Amending 1976 Agreement and Initiating Nitrogen Removal Plant Improvements	January 9, 1989
Amendment to Intergovernmental Agreement for Wastewater Facilities Management (LOTT Phase II Study)	September 7, 1982
Intergovernmental Contract for Wastewater Facilities Management	November 30, 1976

(This page intentionally left blank)

Exhibit B

EXISTING JOINT FACILITIES

Existing Joint Facilities are comprised of the following facilities:

- 1) All facilities designated as Joint Facilities in the 1976 Intergovernmental Contract.
- 2) Modifications to the LOTT Wastewater Treatment Plant and outfalls.
- 3) The 1990 and 1998 modifications to Joint Facilities in the vicinity of Henderson Blvd./Plum. Street and Union Avenue
- 4) Modifications to Joint Facilities in Martin Way.
- 5) Planned modifications to the Capitol Lake Pump Station and force main.
- 6) Lacey's interceptor extending north and east from the LOTT joint facilities at Martin Way and Sleater-Kinney Road to the intersection of Martin Way and Marvin Road including Lacey's Martin Village Pump Station.
- 7) Planned Southern Connection south from the Capitol Lake Pump Station to a point on the eastern boundary of Tumwater Falls Park on Capitol Boulevard south of the bridge across the Deschutes River.

All Existing Joint Facilities include any and all easements, rights of way, permits and approvals, licenses, franchises, and other property interests necessary or useful in the ownership or operation of the specific facility.

(This page intentionally left blank)

Exhibit C
ARTICLES OF INCORPORATION
of the
LOTT WASTEWATER ALLIANCE

The undersigned, to form a nonprofit corporation under the provisions of the Washington Nonprofit Corporation Act (Chapter 24.03 of the Revised Code of Washington), as amended, hereby submit the following Articles of Incorporation.

Article 1. NAME

The name of the corporation shall be the LOTT Wastewater Alliance (the "Corporation").

Article 2. DURATION

The Corporation shall have perpetual existence.

Article 3. PURPOSES AND POWERS

Section 3.1. Purposes.

This Corporation is organized exclusively for one or more of the purposes specified in Section 501(c)(3) of the Internal Revenue Code of 1986, as amended. The Corporation shall exist for the primary purpose of lessening the burdens of the various municipal governments that require wastewater or other governmental services in the area to be served by the Corporation. The Corporation was created pursuant to that certain Interlocal Cooperation Act Agreement for Wastewater Facilities Management by LOTT Alliance by and between the City of Olympia, Washington ("Olympia"); the City of Lacey, Washington ("Lacey"); the City of Tumwater, Washington ("Tumwater"); and Thurston County, Washington (the "County"), dated _____, _____ ("Agreement"). By way of illustration, and not by way of limitation, the Corporation intends to lessen the burdens of government by implementing a wastewater resource management plan, which anticipates the development of additional wastewater treatment capacity, and operating and maintaining all or part of the wastewater facilities.

In furtherance of such purposes, this Corporation shall have the following additional purposes and powers:

- (a) implement and otherwise effectuate the Agreement;
- (b) administer property, including without limitation, selling, leasing, exchanging or otherwise distributing real and personal property;
- (c) contract for services and work and enter into other legal instruments binding the Corporation or provide for benefits to be secured by the Corporation;

- (d) aid, support, and assist by contributions or otherwise, other organizations organized and operated exclusively for purposes specified in Section 501(c)(3) of the Internal Revenue Code of 1986, as amended, no part of the net earnings of which inures to the benefit of any private shareholder or individual, and no substantial part of the activities of which is carrying on propaganda, or otherwise attempting to influence legislation; and
- (e) engage in any and all lawful activities which may be necessary, useful or desirable for the furtherance, accomplishment, fostering or attainment of the foregoing purposes, either directly or indirectly and either alone or in conjunction or cooperation with others, whether such others be persons or organizations of any kind or nature, such as corporations, firms, associations, trusts, institutions, foundations, or governmental bureaus, departments, or agencies.

Section 3.2. Powers.

In general, and subject to such limitations and conditions as are or may be prescribed by law, these Articles of Incorporation or the Corporation's Bylaws, the Corporation shall have all powers which now or hereafter are conferred by law upon a corporation organized for the purposes set forth above, are necessary or incidental to the powers so conferred, or are conducive to the attainment of the Corporation's purposes.

Article 4. LIMITATIONS

All of the purposes and powers of the Corporation shall be exercised exclusively for charitable purposes in such manner that the Corporation shall qualify as an exempt organization under Section 501(c)(3) of the Internal Revenue Code of 1986 or the corresponding provision of any future United States Internal Revenue law, and that contributions to the Corporation shall be deductible under Section 170(c)(2) of the Internal Revenue Code of 1986, or the corresponding provision of any future United States Internal Revenue law.

No substantial part of the activities of the Corporation shall be the carrying on of propaganda, or otherwise attempting to influence legislation, except as otherwise permitted by an organization described in Section 501(c)(3) of the Internal Revenue Code of 1986, or the corresponding provision of any future United States Internal Revenue law. The Corporation shall not participate in, nor intervene in any political campaign, including the publishing or distribution of statements, on behalf of or in opposition to any candidate for public office.

Notwithstanding any other provisions of these Articles, the Corporation shall not carry on any activities not permitted to be carried on (a) by a corporation exempt from federal and state income taxes under Section 501(c)(3) of the Internal Revenue Code of 1986 or the corresponding provision of any future United States Internal Revenue law, or (b) by a corporation, contributions to which are deductible under Section 170(c)(2) of the Internal Revenue Code of 1986, or the corresponding provision of any future United States Internal Revenue law.

No part of the net earnings of the Corporation shall inure to the benefit of, or be distributable to, its members (if any), directors, trustees, officers, or other private persons, except

that the Corporation is authorized or empowered to pay reasonable compensation for services rendered and to make payments and distributions in furtherance of its purposes.

Article 5. DISSOLUTION

Upon the winding up and dissolution of the Corporation, the assets of the Corporation remaining after payment, or provision for payment, of all debts and liabilities of the Corporation, shall be distributed in trust to either a governmental entity or municipal corporation in such a manner as to best accomplish the goals of the Corporation as provided in a plan of final liquidation and dissolution as may be approved by the Corporation's Board of Directors. If, however, (i) such distribution would not be in compliance with Section 501(c)(3) of the Internal Revenue Code of 1986; (ii) no such governmental entity or municipal corporation is willing or able to accept the distribution; or (iii) if such distribution is not otherwise possible, then the distribution shall be made to an organization or organizations recognized as exempt from taxation under Section 501(c)(3) of the Internal Revenue Code of 1986, or the corresponding provision of any future United States Internal Revenue law (to be used exclusively to accomplish the purposes for which this Corporation is organized) as may be provided in a plan of final liquidation and dissolution approved by the Corporation's Board of Directors.

Article 6. MEMBERS

The qualifications of members, the property, voting and other rights, privileges, and responsibilities of members shall be set forth in the Bylaws.

Article 7. DIRECTORS

The management of the Corporation shall be vested in a Board of Directors pursuant to the Washington Nonprofit Corporation Act, these Articles of Incorporation and the Corporation's Bylaws. The Board shall consist of directors and alternate directors. The powers, duties, number, qualifications, terms of office, manner of election, time and criteria for removal, and time and place of meetings of the directors and alternate directors shall be as set forth in the Bylaws of the Corporation.

The names and addresses of the persons who are to serve as the initial directors of the Corporation are as follows:

<u>Name</u>	<u>Address</u>
-------------	----------------

The names and addresses of the persons who are to serve as the initial alternate directors of the Corporation are as follows:

<u>Name (Alternate For)</u>	<u>Address</u>
-----------------------------	----------------

For purposes of these Articles of Incorporation, and unless the context otherwise clearly indicates, the term “director” shall include both directors and alternate directors.

Article 8. DIRECTOR LIABILITY LIMITATIONS

A director shall have no liability to the Corporation for monetary damages for conduct as a director, except for acts or omissions that involve intentional misconduct by the director, or for any transaction from which the director will personally receive a benefit in money, property or services to which the director is not legally entitled. If the Washington Nonprofit Corporation Act is hereafter amended to authorize corporate action further eliminating or limiting the personal liability of directors, then the liability of a director shall be eliminated or limited to the full extent permitted by the Washington Nonprofit Corporation Act, as so amended without need for further amendment of these Articles by the Corporation’s Board of Directors. Any repeal or modification of this Article shall not adversely affect any right or protection of a director of the Corporation existing at the time of such repeal or modification for or with respect to an act or omission of such director occurring prior to such repeal or modification.

Directors of the Corporation shall not be personally liable to the Corporation or its members, if any, for monetary damages for conduct as a director, except for acts or omissions that involve intentional misconduct by a director or a knowing violation of law by a director, where the director votes or assents to a distribution which is unlawful or violates the requirements of these Articles of Incorporation, or for any transaction from which the director will personally receive a benefit in money, property, or services to which the director is not legally entitled.

Article 9. INDEMNIFICATION

Section 9.1. Right to Indemnification.

Each person who was, or is threatened to be made a party to or is otherwise involved (including, without limitation, as a witness) in any actual or threatened action, suit or proceeding, whether civil, criminal, administrative or investigative, by reason of the fact that he or she is or was a director or officer of the Corporation or, while a director or officer, he or she is or was serving at the request of the Corporation as a director, director, officer, employee or agent of another corporation or of a partnership, joint venture, trust or other enterprise, including service with respect to employee benefit plans (whether the basis of such proceeding is an alleged action

in an official capacity as a director, trustee, officer, employee or agent or in any other capacity while serving as a director, trustee, officer, employee or agent), shall be indemnified and held harmless by the Corporation, to the full extent permitted by applicable law as then in effect, against all expense, liability and loss (including attorney's fees, judgments, fines, ERISA excise taxes or penalties and amounts to be paid in settlement) actually and reasonably incurred or suffered by such person in connection therewith, and such indemnification shall continue as to a person who has ceased to be a director, trustee, officer, employee or agent and shall inure to the benefit of his or her heirs, executors and administrators; however, except as provided in Section 9.2 with respect to proceedings seeking solely to enforce rights to indemnification, the Corporation shall indemnify any such person seeking indemnification in connection with a proceeding (or part thereof) initiated by such person only if such proceeding (or part thereof) was authorized by the Board of Directors of the Corporation. The right to indemnification conferred in this Section 9.1 shall be a contract right and shall include the right to be paid by the Corporation the expenses incurred in defending any such proceeding in advance of its final disposition; however, the payment of such expenses in advance of the final disposition of a proceeding shall be made only upon delivery to the Corporation of an undertaking, by or on behalf of such director or officer, to repay all amounts so advanced if it shall ultimately be determined that such director or officer is not entitled to be indemnified under this Section 9.1 or otherwise.

Section 9.2. Right of Claimant to Bring Suit.

If a claim for which indemnification is required under Section 9.1 is not paid in full by the Corporation within sixty (60) days after a written claim has been received by the Corporation, except in the case of a claim for expenses incurred in defending a proceeding in advance of its final disposition, in which case the applicable period shall be twenty (20) days, the claimant may at any time thereafter bring suit against the Corporation to recover the unpaid amount of the claim and, to the extent successful in whole or in part, the claimant shall also be entitled to be paid the expense of prosecuting such claim. The claimant shall be presumed to be entitled to indemnification under this Article upon submission of a written claim (and, in an action brought to enforce a claim for expenses incurred in defending any proceeding in advance of its final disposition, where the required undertaking has been tendered to the Corporation), and thereafter the Corporation shall have the burden of proof to overcome the presumption that the claimant is not so entitled. Neither the failure of the Corporation (including its Board of Directors, independent legal counsel or its members, if any) to have made a determination prior to the commencement of such action that indemnification, or the reimbursement or advancement of expenses of the claimant is proper in the circumstances, nor an actual determination by the Corporation (including its Board of Directors, independent legal counsel or its members, if any) that the claimant is not entitled to indemnification or the reimbursement or advancement of expenses, shall be a defense to the action or create a presumption that the claimant is not so entitled.

Section 9.3. Nonexclusivity of Right.

The right to indemnification and the payment of expenses incurred in defending a proceeding in advance of its final disposition conferred in this Article shall not be exclusive of any other right which any person may have or hereafter acquire under any statute, provision of

these Articles of Incorporation, Bylaws, agreement, vote of members, if any, or disinterested directors or otherwise.

Section 9.4. Indemnification of Members.

The Corporation shall hold Corporation members harmless and defend all claims for personal injury or property damage arising out of the Corporation's activities in the same manner as provided for directors and officers under Sections 9.1, 9.2, and 9.3, and only to the extent that such claims, damages, and injuries are not caused by the negligent act or omission of a member to perform required maintenance or other operations or by any member violation of applicable laws or regulations.

Section 9.5. Insurance, Contracts, and Funding.

The Corporation may maintain insurance at its expense to protect itself and any director, trustee, officer, employee, agent or member of the Corporation or another corporation, partnership, joint venture, trust or other enterprise against any expense, liability or loss, whether or not the Corporation would have the power to indemnify such persons against such expense, liability or loss under the Washington Business Corporation Act, as applied to nonprofit corporations. The Corporation may, without further action of the Corporation's members, enter into contracts with any director or officer of the Corporation in furtherance of the provisions of this Article and may create a trust fund, grant a security interest or use other means (including, without limitation, a letter of credit) to ensure the payment of such amounts as may be necessary to effect indemnification as provided in this Article.

Section 9.6. Indemnification of Employees and Agents of the Corporation.

The Corporation may, by action of its Board of Directors, provide indemnification and pay expenses in advance of the final disposition of a proceeding to employees and agents of the Corporation with the same scope and effect as the provisions of this Article with respect to the indemnification and advancement of expenses of directors and officers of the Corporation or pursuant to rights granted pursuant to, or provided by, the Washington Business Corporation Act, as applied to nonprofit corporations, or otherwise.

Article 10. BYLAWS

Bylaws of the Corporation may be adopted by the Board of Directors at any regular meeting or any special meeting called for that purpose, so long as they are not inconsistent with the provisions of these Articles of Incorporation. The authority to make, alter, amend or repeal Bylaws is vested in the Board of Directors and may be exercised at any regular or special meeting of the Board of Directors.

Article 11. INCORPORATORS

The name and address of the incorporators of the Corporation are:

Name	Address

Article 12. REGISTERED OFFICE AND AGENT

The address of the initial registered office of the Corporation shall be _____, Washington 98_____. The name of the initial registered agent of the Corporation at such address shall be _____.

Article 13. AMENDMENTS

These Articles of Incorporation may be amended as allowed by the Washington Non-profit Corporation Act and pursuant to a unanimous vote of the Board of Directors.

IN WITNESS WHEREOF, the undersigned have signed these Articles of Incorporation:

(Signature)

Print name: _____

Date: _____

(Signature)

Print name: _____

Date: _____

(Signature)

Print name: _____

Date: _____

(Signature)

Print name: _____

Date: _____

CONSENT TO SERVE AS REGISTERED AGENT

I, _____, hereby consent to serve as Registered Agent in the State of Washington for the LOTT Alliance. I understand that as agent for the corporation, it will be my responsibility to receive service of process in the name of the corporation; to forward all mail to the corporation; and to immediately notify the Office of the Secretary of State in the event of my resignation or of any changes in the registered office of the corporation for which I am agent.

DATED: _____

(Signature of agent)

Address of Registered Office and Agent:

Exhibit D
BYLAWS
of the
LOTT WASTEWATER ALLIANCE

The Board of Directors of the LOTT Wastewater Alliance (the "Corporation") hereby adopts the following Bylaws:

Article 1. OFFICES

Section 1.1. Principal Office.

The principal office of the Corporation shall be located at its principal place of business or such other place as the Board of Directors may designate. The Corporation may have such other offices, either within or outside of the State of Washington, as the Board of Directors may designate or as the business of the Corporation may require.

Section 1.2. Registered Office and Agent.

The Corporation's initial registered office and registered agent shall be as set forth in the Articles of Incorporation. The registered agent and the address of the registered office may be changed by the Board of Directors.

Article 2. MEMBERSHIP

Section 2.1. Members.

The Corporation shall have one class of members consisting of four Members. The four Members of the Corporation shall be the City of Olympia, Washington ("Olympia"); the City of Lacey, Washington ("Lacey"); the City of Tumwater, Washington ("Tumwater"); and Thurston County, Washington (the "County").

Section 2.2. No Voting Rights.

Except as expressly provided in this Section 2.2, the Members of the Corporation shall not be members within the meaning of RCW 24.03 and shall not have the authority to manage or vote on any matters related to the business and affairs of the Corporation. Each Member shall have the right to appoint one Director and one Alternate Director to represent such Member on the Board of Directors.

Section 2.3. Meetings.

Because Members do not have voting rights and because each Member appoints a representative Director and Alternate Director to the Board of Directors, there shall be no annual or special meetings of the membership.

Article 3. BOARD OF DIRECTORS

Section 3.1. General Powers.

The business and affairs of the Corporation shall be managed by a Board of Directors. The actions of the Board shall be consistent with and shall effectuate the terms of that certain Interlocal Cooperation Act Agreement for Wastewater Facilities Management by LOTT Wastewater Alliance by and between the Members, dated _____, _____ ("Agreement"), including without limitation, adopting the revenue allocation formula set forth in the Agreement. The Board shall have the power to do, but shall not be limited to, the following:

- (a) Acquire, construct, receive, own, manage, lease, sell, and otherwise dispose of real property, personal property, intangible property, and the facilities of the Corporation;
- (b) Plan, develop, operate, replace, and maintain the facilities of the Corporation;
- (c) Enter into contracts for goods, services, work, or other benefits to the Corporation;
- (d) Borrow money and issue debt instruments or provide for the borrowing of money and issuance of debt instruments;
- (e) Receive gifts or grants for the planning, design, development, construction, or operation of the facilities of the Corporation, or for the assets or programs to further the Corporation's purposes, or for other purposes necessary to carry out the purposes of the Corporation;
- (f) Lend money or provide services or facilities to any Member or other governmental utility or governmental service provider in furtherance of the Corporation's purposes;
- (g) Invest Corporate funds;
- (h) Sue and be sued;
- (i) Hire and fire employees of the Corporation;
- (j) Fix salaries, wages and other compensation of officers and employees;
- (k) Employ or retain engineering, legal, financial or other specialized personnel and consultants as may be necessary to carry out the purposes of the Corporation;

- (l) Impose, alter, regulate, control, and collect rates, charges, and assessments;
- (m) Purchase insurance and participate in pooled insurance and self-insurance programs
- (n) Indemnify Members, officers, and employees in accordance with applicable law;
- (o) Establish policies, guidelines, or rules to carry out the Corporation's powers and responsibilities;
- (p) Convene or appoint committees and advisory bodies as the Board deems appropriate for Member or public review and comment on Corporate matters, efficient staff and Board work, or any other purpose in the best interests of the Corporation and consistent with applicable law;
- (q) Exercise all other powers within the authority of, and that may be exercised individually by all of, the Members with respect to sewage or wastewater conveyance, treatment, disposal, reclamation, reuse, conservation, or other Corporate purposes or functions as set forth in the Agreement; and
- (r) Take any other actions as the Board deems necessary to implement a comprehensive plan and to protect and advance the interests of the Corporation, its property and other assets, its Members, and its ratepayers that are consistent with the Agreement, Chapter 39.34 RCW, and other applicable law.

Section 3.2. Number and Types.

The Board of Directors shall consist of four (4) Directors and (4) Alternate Directors. Each Member shall appoint an Alternate Director to represent such Member at meetings of the Board of Directors in which such Member's Director is not present.

Section 3.3. Qualification and Representation.

Each Director and each Alternate Director must be serving as a member of the legislative body of the Member that has appointed that Director or Alternate Director. Each Director and Alternate Director shall serve at the will and discretion of the legislative body of the Member that appointed the respective Director or Alternate Director. Each Director and Alternate Director shall represent his or her Member in carrying out his or her responsibility to act in the best interests of the Corporation. The Alternate Director appointed by each Member shall be entitled to attend meetings of the Board and to receive notice of such meetings as provided in these Bylaws but shall not be entitled to vote unless the Director appointed by such Member is absent or unless selected to break a tie vote.

Section 3.4. Appointment of Directors.

Subsection 3.4.1. Initial Directors.

Each initial Director and Alternate Director named in the Articles of Incorporation shall serve until he or she resigns, becomes disqualified to serve as a Director or Alternate Director, or is removed or replaced by the legislative body of the Member that he or she represents.

Subsection 3.4.2. Successor Directors.

Each Director and Alternate Director shall be appointed by the legislative body of the Member that each respective Director and Alternate Director is to represent.

Section 3.5. Vacancies.

A vacancy in a Director or an Alternate Director position shall be filled promptly by the legislative body of the Member who appointed the predecessor Director or Alternate Director. Vacancies may occur or arise by removal, disqualification, or resignation, as described below, or by other means.

Subsection 3.5.1. Removal.

A Director or Alternate Director may be removed at any time by, and at the sole discretion of, the legislative body of the Member that appointed the respective Director or Alternate Director. The removal of a Director or Alternate Director shall constitute a vacancy of that position.

Subsection 3.5.2. Disqualification.

Whenever a Director or Alternate Director is no longer qualified to serve as a Director or Alternate Director pursuant to these Bylaws, that Director or Alternate Director shall cease to be a Director or Alternate Director and his or her position shall be considered vacant.

Subsection 3.5.3. Resignation.

Any Director or Alternate Director may resign at any time by delivering written notice to the President or the Secretary of the Corporation at the principal office or registered office of the Corporation, or by giving written notice at any meeting of the Board of Directors. Any such resignation shall take effect at the time specified in the notice, or if the time is not specified, upon delivery of the notice. Upon the effective date of the resignation, that position shall be considered vacant. Unless otherwise specified in the notice, the acceptance of such resignation shall not be necessary to make it effective.

Section 3.6. Compensation and Expenses.

Directors and Alternate Directors shall not receive compensation for their service as Directors and Alternate Directors. Consistent with any applicable law, Directors and Alternate Directors may receive reimbursement for expenditures incurred on behalf of the Corporation.

Article 4. ACTIONS OF BOARD OF DIRECTORS

Section 4.1. Regular Meetings.

Regular meetings of the Board of Directors shall be specified as to the date, time and place for the holding of such regular meetings by the adoption of a resolution of the Board of Directors.

Section 4.2. Special Meetings.

Special meetings of the Board of Directors may be called by or at the written request of the President or any two (2) Directors. Notice of special meetings of the Board of Directors shall be made as set forth in Section 4.6.

Section 4.3. Meetings by Telephone.

Members of the Board of Directors may participate in a meeting of such Board of Directors by means of a conference telephone or similar communication equipment if all persons participating in the meeting can hear each other at the same time and the participation complies with the Open Public Meetings Act, Chapter 42.30, as may be amended. Participation by such means shall constitute presence in person at a meeting.

Section 4.4. Place of Meetings.

All meetings shall be held at the principal office of the Corporation or at such other place within the State of Washington designated by the Board of Directors, by any persons entitled to call a meeting, or by a waiver of notice signed by all of the Directors and Alternate Directors.

Section 4.5. Notice of Meetings.

Where notice of a meeting of the Board of Directors is required by the Articles of Incorporation or these Bylaws, such notice shall be given to each Director and Alternate Director in writing or by personal communication with Director or Alternate Director not less than five (5) calendar days before the meeting. Notices in writing may be hand delivered or sent by U.S. mail or facsimile transmission to the Director or Alternate Director at his or her address shown on the records of the Corporation. Neither the business to be transacted at, nor the purpose of, the meeting need be specified in the notice of such meeting, unless specifically required by the Articles of Incorporation or these Bylaws. If a notice is delivered by mail, the notice shall be deemed effected when deposited in the official government mail properly addressed with postage prepaid. If notice is given by facsimile transmission, the notice shall be deemed effective upon receipt of the facsimile transmission confirmation showing the facsimile transmission was received at the Director's or Alternate Director's facsimile number shown on the records of the Corporation. Facsimile transmission of any signed original document, and retransmission of any signed facsimile transmission shall be the same as delivery of an original document. At the request of the Secretary, any person will confirm facsimile transmitted signatures by signing an original document.

Section 4.6. Waiver of Notice.

Subsection 4.6.1. Written Waiver of Notice.

Whenever any notice is required to be given to any Director or Alternate Director under the provisions of these Bylaws, the Articles of Incorporation or applicable Washington law, a waiver thereof in writing, signed by the person or persons entitled to such notice, whether before or after the time stated therein, shall be deemed equivalent to the giving of such notice. Neither the business to be transacted at, nor the purpose of, any regular or special meeting of the Board of Directors need be specified in the waiver of notice of such meeting.

Subsection 4.6.2. Waiver of Notice by Attendance.

The attendance of a Director or Alternate Director at a meeting shall constitute a waiver of notice of such meeting, except where a Director or Alternate Director attends a meeting for the express purpose of objecting to the transaction of any business because the meeting is not lawfully called or convened.

Section 4.7. Quorum.

The attendance of a majority of Directors (or their respective Alternate Directors) in office shall constitute a quorum for the transaction of business at any meeting of the Board of Directors. For purposes of these Bylaws, "majority" shall mean a number more than one-half. If a quorum is not present at a meeting, any one Director present may adjourn the meeting.

Section 4.8. Manner of Acting.

The act of the majority of the Directors (or their respective Alternate Directors) present at a meeting at which there is a quorum shall be the act of the Board of Directors, unless the vote of a greater number is required, or a tie-breaking procedure is provided by these Bylaws, the Articles of Incorporation, a valid Board resolution, or applicable Washington law.

Subsection 4.8.1. Tie-breaking procedure.

In the event of a tie vote on any matter requiring a majority vote of Directors, the Directors shall: (1) randomly choose an Alternate Director to assist in resolving the tie vote pursuant to these Bylaws; and (2) table the matter to the following Board of Directors meeting, which shall be calendared as a special or regularly scheduled meeting within the next twenty-one (21) days or as soon thereafter as all Directors can be present together with the randomly-chosen Alternate Director. At said meeting, all Directors, including the randomly-chosen Alternate Director, shall participate in the discussion and vote on the matter or related matters until such time as the issue has been resolved by a majority affirmative vote, defeated by a majority vote, or withdrawn.

Subsection 4.8.2. Alternate Director randomly chosen to serve in a tie-breaking situation.

The Board shall select the Alternate Director to assist in resolving a tie vote by a random drawing of the current Alternate Directors' names from a hat or other container; , however, no Alternate Director shall serve as a tie-breaker in two consecutive tie vote matters.

Subsection 4.8.3. Actions requiring unanimous votes.

In addition to any action required by the Articles of Incorporation or applicable Washington law to be by unanimous vote of the Board of Directors, the following actions shall be taken only by unanimous vote of the Board of Directors:

- (a) Approval or amendment of the comprehensive plan for the Corporation;
- (b) Revisions of or amendments to the Articles of Incorporation or Bylaws of the Corporation, or dissolution of the Corporation;
- (c) Revision of the allocation of costs as to new connection charges and monthly rates set forth in the Agreement;
- (d) Modification or amendment of the LOTT Discharge and Industrial Pretreatment Regulations pursuant to Section 7.1 of the Agreement; and
- (e) Establishment or modification of pretreatment permit fees, charges, and actions pursuant to Section 7.2 of the Agreement.

At least eighteen (18) calendar days in advance of taking any such action, the Board shall distribute a proposed Board resolution or motion regarding such action to the Clerk of each Members' legislative body, by any reasonable method of distribution, including but not limited to, deposit in the U.S. Mail, facsimile, hand delivery, or electronic mail.

Section 4.9. Presumption of Assent.

A Director (or, where authorized by these Bylaws to cast a vote, an Alternate Director) of the Corporation present at a meeting of the Board of Directors at which action on any corporate matter is taken shall be presumed to have assented to the action taken, unless the Director's or Alternate Director's dissent or abstention is entered in the minutes of the meeting or the Director or Alternate Director files a written dissent or abstention to such action with the person acting as secretary of the meeting before the adjournment of the meeting or forwards such dissent or abstention by registered mail to the Secretary of the Corporation immediately after the adjournment of the meeting. Such right to dissent or abstain shall not apply to a Director or Alternate Director who voted in favor of such action.

Section 4.10. Open Public Meetings.

Meetings of the Board are subject to the Open Public Meetings Act, Chapter 43.20 RCW. Accordingly, the Board shall ensure that its deliberations are conducted openly and that the

actions of the Corporation are taken openly.

Section 4.11. Procedure.

The Board shall conduct its meetings consistent with Robert's Rules of Order on Parliamentary Procedure, so far as applicable and when not inconsistent with these Bylaws, the Articles of Incorporation, the Agreement, or any resolution of the Board. The Board may adopt additional rules of procedure to govern the conduct of its meetings.

Article 5. OFFICERS

Section 5.1. Officers.

The officers of the Corporation shall be a President, one Vice President, a Secretary and a Treasurer, each of whom shall be elected by the Board of Directors. Other officers and assistant officers may be elected or appointed by the Board of Directors, such officers and assistant officers to hold office for such period, have such authority and perform such duties as are provided in these Bylaws or as may be provided by resolution of the Board of Directors. Any officer may be assigned by the Board of Directors any additional title that the Board of Directors deems appropriate. Any two or more offices may be held by the same person, except the offices of President and Secretary.

Section 5.2. Election and Term of Office.

The officers of the Corporation shall be elected annually by the Board of Directors. Unless an officer resigns or is removed or replaced, he or she shall hold office until the next annual election by the Board of Directors or until the officer's successor is elected and assumes the office, whichever is later.

Section 5.3. Vacancies.

A vacancy in any office created by the resignation, removal, replacement, or any other cause may be filled by the Board of Directors for the unexpired portion of the term or for a new term established by the Board of Directors.

Section 5.4. Resignation.

Any officer may resign at any time by delivering written notice to the President, a Vice President, the Secretary or the Board of Directors or by giving oral or written notice at any meeting of the Board of Directors. Any such resignation shall take effect at the time specified in the notice, or if the time is not specified, upon delivery of the notice and, unless otherwise specified in the notice, the acceptance of such resignation shall not be necessary to make it effective.

Section 5.5. Removal.

Any officer or agent elected or appointed by the Board of Directors may be removed from office by the Board of Directors whenever in its judgment the best interests of the

Corporation would be served thereby. Such removal shall be without prejudice to the contract rights, if any, of the person so removed.

Section 5.6. President.

The President shall preside over meetings of the Board of Directors. The President may sign deeds, mortgages, bonds, contracts or other instruments, except when the signing and execution thereof have been expressly delegated by the Board of Directors or by these Bylaws to some other officer or agent of the Corporation or are required by law to be otherwise signed or executed by some other officer or in some other manner. In general, the President shall perform all duties incident to the office of President and such other duties as are assigned to him or her by the Board of Directors.

Section 5.7. Vice President.

In the event of the death of the President or his or her inability to act, the Vice President shall perform the duties of the President, except as may be limited by resolution of the Board of Directors, with all the powers of, and subject to, all of the restrictions upon the President. The Vice President shall have, to the extent authorized by the President or the Board of Directors, the same powers as the President to sign deeds, mortgage, bonds, contracts or other instruments. The Vice President shall perform such other duties as from time to time may be assigned to him or her by the President or the Board of Directors.

Section 5.8. Secretary.

The Secretary shall: (a) keep the minutes of meetings of the members and the Board, and minutes which may be maintained by committees of the Board; (b) see that all notices are duly given in accordance with the provisions of these Bylaws or as required by law; (c) be custodian of the corporate records of the corporation; (d) keep records of the post office address of each member and Director and of the name and post office address of each officer; (e) sign with the President, or other officer authorized by the President or the Board, deeds, mortgages, bonds, contracts, or other instruments; and (f) in general perform all duties incident to the office of Secretary and such other duties as from time to time may be assigned to him or her by the President or the Board.

Section 5.9. Treasurer.

The Treasurer shall have charge and custody of and be responsible for all funds and securities of the corporation; receive and give receipts for moneys due and payable to the corporation from any source whatsoever, and deposit all such moneys in the name of the corporation in banks, trust companies or other depositories selected in accordance with the provisions of these Bylaws, the Agreement, and applicable law; and in general perform all of the duties incident to the office of Treasurer and such other duties as from time to time may be assigned to him or her by the President or the Board.

Section 5.10. Salaries.

The officers shall serve without salary unless they are employees of the Corporation. No officer shall be prevented from receiving a salary by reason of the fact that he or she is a Director or Alternate Director of the Corporation. Consistent with any applicable law, officers may receive reimbursement for expenditures incurred on behalf of the Corporation upon approval of the Board of Directors.

Article 6. EMPLOYEES

Subject to the other provisions of these Bylaws, the Board of Directors may establish such positions of employment as it deems desirable and shall fix the salaries for such positions; provided, there shall be created and maintained the position of Executive Director. This position shall be responsible for implementing Board policy and for general administration of the Alliance functions.

The Executive Director shall have sole authority to appoint persons to fill other positions created by the Board, or to dismiss or discipline such persons. The appointments shall be based on ability and training appropriate for the position. Except for the purpose of inquiry, the Board and its members shall deal with policy implementation or administrative services solely through the Executive Director and neither the Board nor any of its members shall give directions or orders to employees subordinate to the Executive Director. Nothing in this Article shall prevent the Board from freely and fully discussing with the Executive Director anything pertaining to appointments and removals of subordinate employees.

Article 7. ADMINISTRATIVE PROVISIONS

Section 7.1. Books and Records of the Corporation.

The Corporation shall keep at its principal or registered office copies of its current Articles of Incorporation and Bylaws; correct and adequate records of accounts and finances; minutes of its proceedings; records of the name and address of each Member, Director, Alternate Director, and officer; and such other records as may be necessary or advisable. All books and records of the Corporation shall be open at any reasonable time to inspection by any Director or Alternate Director.

Section 7.2. Books and Records of Members.

Any Director or a representative of that Director may examine the books and records of any Member which relate to the Corporation (including, but not limited to, the Corporation's assets, property, facilities, governance, and finance). After provision of reasonable notice, such books and records may be examined at any reasonable time during business hours of that Member. The Board may appoint an auditor or accountant to review any such books and records and the costs of such review shall be charged to the Corporation, which in turn may include such costs as an expense to be shared jointly among all Members.

Section 7.3. Accounting Year.

The accounting year of the Corporation shall be the twelve months ending December 31 of each year.

Article 8. AMENDMENTS

These Bylaws may be altered, amended or repealed and new Bylaws may be adopted by a unanimous vote of the Board of Directors.

THE FOREGOING BYLAWS were adopted by the Board of Directors on

_____, _____.

Secretary

(This page intentionally left blank)

Exhibit E

LOTT System Service Area (Urban Growth Area Boundary, Ch. 36.70 RCW)

(This page intentionally left blank)

Exhibit E

LOTT System Service Area

(Urban Growth Area Boundary,
Ch. 36.70 RCW, as of October, 1999)

-----Olympia, Lacey, Tumwater
Urban Growth Management
Boundary

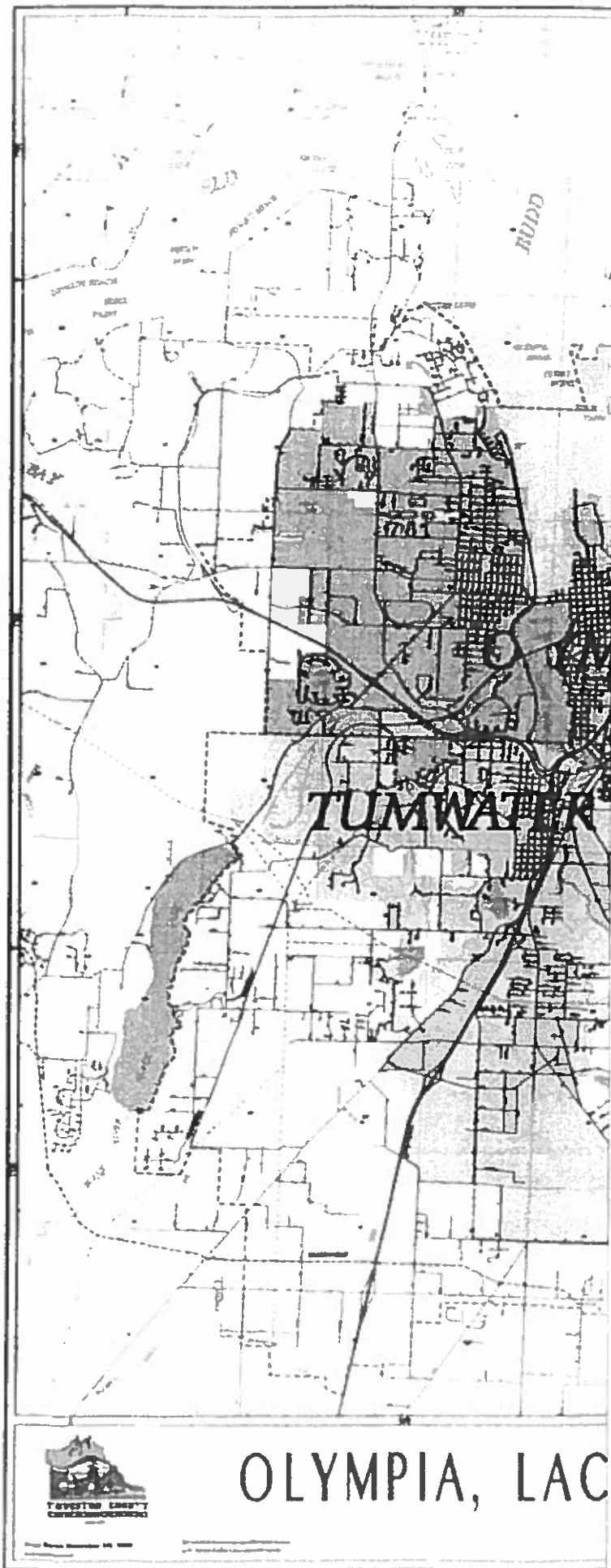


Exhibit F

ALLOCATION OF COSTS TO NEW CONNECTIONS AND MONTHLY RATES

The INTERLOCAL COOPERATION ACT AGREEMENT FOR WASTEWATER MANAGEMENT BY THE LOTT WASTEWATER ALLIANCE recognizes two principal revenue sources for LOTT: 1) revenues from the one-time connection charge (Capacity Development Charge) received at issuance of building permit for each new connection to the LOTT System, and 2) monthly rate revenues (Wastewater Service Charge) received based on each Participant's number of Equivalent Residential Units (ERUs).

There are two types of capital facilities costs: 1) new capacity facilities or those capital expenditures necessary to provide additional wastewater management facilities to serve additional wastewater flows, and 2) system upgrades or capital modifications of existing facilities necessary to improve efficiency or meet higher water quality standards for water treated and discharged by LOTT. Certain capital projects could contain both cost types. In considering future facilities, LOTT chooses to associate new capacity costs primarily with connection charge revenues and system upgrade costs primarily with monthly rates to the extent those costs provide for connections existing at the time the upgrade is constructed. Accordingly, for each facility addition or upgrade project, there is an allocation of the facility cost to the two cost types LOTT is choosing to recognize.

Allocation for New Capacity Projects. Projects to create new capacity facilities are divided into four types. These project costs are to be paid using the allocation of revenue sources described in the following table follows:

<i>Project Type</i>	<i>% Capacity Development Charge</i>	<i>% Wastewater Service Charge</i>
Plants – Satellite wastewater treatment plants and associated downstream conveyance to send treated Class A water to polishing ponds	90%	10%
Ponds – Polishing ponds which further treat Class A water from satellite plants and serve to store Class A water for use, recharge basins which infiltrate unused Class A from polishing ponds, and associated conveyance	80%	20%
Pipes – New sewer interceptors, piping and existing pipe modifications necessary to convey wastewater to satellite wastewater treatment plants	100%	0%

Allocation for System Upgrades. Projects which upgrade or replace existing LOTT facilities are considered System Upgrades. Recognizing that these projects will usually include

provision for extra capacity, and based on a review of the incremental cost associated with this extra capacity for System Upgrade projects in the Plan, these project costs are to be paid using 9% Capacity Development Charge revenues and 91% Wastewater Service Charge revenues.

Exhibit G

LOTT DISCHARGE AND INDUSTRIAL PRETREATMENT REGULATIONS

1. PURPOSE AND POLICY.

This ordinance sets forth uniform requirements for direct and indirect contributors into the wastewater collection systems and the Regional Wastewater Treatment Facility for the Cities of Lacey, Olympia and Tumwater and for Thurston County. This ordinance enables the Cities of Lacey, Olympia, and Tumwater and Thurston County to comply with all applicable State and Federal laws required by the Clean Water Act of 1977, and amendments thereof, and the General Pretreatment Regulations (40 CFR, Part 403). The objectives of this ordinance are:

- A. To prevent the introduction of pollutants into the POTW (Publicly Owned Treatment Works) which will interfere with the operation of the system or contaminate the resulting sludge;
- B. To prevent the introduction of pollutants into the POTW which will pass through the system inadequately treated, into receiving waters or the atmosphere or otherwise be incompatible with the system;
- C. To ensure that the quality of the wastewater treatment plant sludge is maintained at a level which allows its use and disposal in compliance with applicable statutes and regulations;
- D. To provide for equitable distribution of wastewater costs among dischargers and establish a system of fees and charges that recovers the cost of the Industrial Pretreatment Program;
- E. To protect POTW personnel who may be affected by wastewater and sludge in the course of their employment and to protect the general public;

Except as otherwise provided herein, the Plant Manager shall administer and implement the provisions of this ordinance, and shall conduct other activities as set forth in Sections 6,7 and 8 of the Intergovernmental Agreement for Industrial Waste Pretreatment Program of April 23, 1993. Any powers granted to or duties imposed upon the Plant Manager may be delegated by the Plant Manager to personnel under the Plant Manager's direction.

This ordinance shall apply to all users of the POTW. The ordinance authorizes the issuance of wastewater discharge permits; authorizes monitoring,

compliance, and enforcement activities; establishes administrative review procedures; requires user reporting; and provides for the setting of fees for the equitable distribution of costs resulting from the program established herein.

2. DEFINITIONS.

Unless a provision explicitly states otherwise, the following terms and phrases, as used in this ordinance, shall have the following meanings:

A. ACT - The Clean Water Act (33 U.S.C. 1251 et. seq.), as amended.

B. AKART - This is an acronym for All Known, Available, and Reasonable methods of prevention, control, and Treatment. AKART shall represent the most current methodology that can be reasonably required for preventing, controlling, or abating the pollutants associated with a discharge. The concept of AKART applies to both point and nonpoint sources of pollution. The term "best management practices" is considered a subset of the AKART requirement.

C. APPLICABLE PRETREATMENT STANDARD - For any specified pollutant, prohibited discharge standards and discharge limitations as defined herein, State of Washington pretreatment standards, or EPA's Categorical Pretreatment Standards (when effective), whichever standard is appropriate or most stringent.

D. APPROVAL AUTHORITY - The Washington State Department of Ecology.

E. AUTHORIZED REPRESENTATIVE OF THE USER shall mean:

1. If the user is a corporation:

a. The president, secretary, treasurer, or a vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation; or

b. The manager of one or more manufacturing, production, or operation facilities employing more than 250 persons or having gross annual sales or expenditures exceeding \$25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

2. If the user is a partnership or sole proprietorship: a general partner or proprietor, respectively;

3. If the user is a Federal, State, or local governmental facility: a director or highest official appointed or designated to oversee the operation and performance of the activities of the government facility, or his/her designee;

4. The individuals described in paragraphs 1 through 3 above may designate another authorized representative if the authorization is in writing, the authorization specifies the individual or position responsible for the overall operation of the facility from which the discharge originates or having overall responsibility for environmental matters for the company, and the written authorization is submitted to the Plant Manager.

F. BOD (denoting Biochemical Oxygen Demand) shall mean the quantity of oxygen utilized in the biochemical oxidation of organic matter under standard laboratory procedure in five (5) days at 20 degrees C., expressed in parts per million (mg/l) by weight.

G. CATEGORICAL PRETREATMENT STANDARDS shall mean any regulation containing pollutant discharge limits promulgated by the U.S. EPA in accordance with Section 307(b) and (c) of the Act which apply to a specific category of users and which appear in 40 CFR Chapter I, Subchapter N, Parts 405-471.

H. CATEGORICAL USER - a user covered by one of EPA's Categorical Pretreatment Standards.

I. COLOR - The optical density at the visual wave length of maximum absorption, relative to distilled water. One-hundred percent (100%) transmittance is equivalent to zero (0.0) optical density.

J. COOLING WATER/NON-CONTACT COOLING WATER - Water used for cooling which does not come into direct contact with any raw material, intermediate product, waste product, or finished product. Cooling water may be generated from any use, such as air conditioning, heat exchangers, cooling or refrigeration to which the only pollutant added is heat.

K. COMPOSITE SAMPLE - The sample resulting from the combination of individual wastewater samples taken at selected intervals based on an increment of either flow or time.

L. DOMESTIC USER (RESIDENTIAL USER) shall mean any person who contributes, causes, or allows the contribution of wastewater into the POTW that is of a similar volume and/or chemical make-up as that of a residential dwelling unit. Discharges from a residential dwelling unit include up to 900 cu.ft. of flow, with up to 300 mg/l of BOD, and 300 mg/l of TSS, per month.

M. ENVIRONMENTAL PROTECTION AGENCY (EPA) - The U.S. Environmental Protection Agency or, where appropriate, the Regional Water Division Director, or other duly authorized official of said agency.

N. EXISTING SOURCE - Any Categorical Industrial User whose construction or operation commenced prior to the publication by EPA of proposed Categorical Pretreatment Standards, which will be applicable to such source if the standard is thereafter promulgated in accordance with Section 307 of the Act.

O. EXISTING USER shall refer to all Industrial Users except Categorical Users which were discharging wastewater prior to the effective date of this ordinance. Any person that buys an existing facility that is discharging non-domestic wastewater will be considered an "Existing User" if no significant changes are made in the manufacturing operation.

P. GRAB SAMPLE - A sample which is taken from a wastestream on a one-time basis without regard to the flow in the wastestream and without consideration of time.

Q. INTERFERENCE - Any discharge which, alone or in conjunction with a discharge or discharges from other sources, either:

1. Inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; or

2. Is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent State or local regulations); Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including Title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), or 40 CFR part 503, and including State Regulations contained in any State sludge management plan prepared pursuant to Subtitle D of the SWDA), the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act.

R. MAXIMUM ALLOWABLE DISCHARGE LIMIT (DISCHARGE LIMITATION) - The maximum concentration of a pollutant allowed to be discharged at any time, determined from the analysis of any discrete or composite sample collected, independent of the industrial flow rate and the duration of the sampling event.

S. MINOR INDUSTRIAL USER (MIU) - Any Industrial User which does not otherwise qualify as a Significant Industrial User of the POTW, identified by the Plant Manager as having the potential to spill or discharge chemicals or slugs of wastewater to the POTW, or the potential to discharge a waste stream that, when taken into account with the waste streams of other industrial users, may have a significant impact on the POTW.

T. NPDES - National Pollutant Discharge Elimination System permit program as administered by the U.S.EPA or State.

U. NEW SOURCE

1. Any building, structure, facility, or installation from which there is (or may be) a discharge of pollutants, the construction of which commenced after the publication of proposed pretreatment standards under Section 307(c) of the Act which will be applicable to such source if such standards are thereafter promulgated in accordance with that section, provided that:

- a. The building, structure, facility, or installation is constructed at a site at which no other source is located; or
- b. The building, structure, facility, or installation totally replaces the process or production equipment that causes the discharge of pollutants at an existing source; or
- c. The production or wastewater generating process of the building, structure, facility, or installation are substantially independent of an existing source at the same site. In determining whether these are substantially independent, factors such as the extent to which the new facility is integrated with the existing plant, and the extent to which the new facility is engaged in the same general type of activity as the existing source, should be considered.

2. Construction on a site at which an existing source is located results in a modification rather than a new source if the construction does not create a new building, structure, facility, or installation

meeting the criteria of Part 1, b. or c. above but otherwise alters, replaces, or adds to existing process or production equipment.

3. Construction of a new source as defined under this paragraph has commenced if the owner or operator has:

a. Begun, or caused to begin as part of a continuous on-site construction program any placement, assembly, or installation of facilities or equipment; or significant site preparation work including clearing, excavation, or removal of existing buildings, structures, or facilities necessary for the placement, assembly, or installation of new source facilities or equipment; or

b. Entered into a binding contractual obligation for the purchase of facilities or equipment which are intended to be used in its operation within a reasonable time. Options to purchase or contracts which can be terminated or modified without substantial loss, and contracts for feasibility, engineering, and design studies do not constitute a contractual obligation under this paragraph.

V. NEW USER - Any Non-Categorical Industrial User that applies to the Participant for a new building permit or otherwise makes known their intentions to begin operations which will generate non-domestic wastes. This includes any person occupying existing buildings and planning to discharge wastewater to the POTW's collection system after the effective date of this ordinance. Also included are Industrial Users which have been previously overlooked or otherwise not identified by the Plant Manager as a Minor or Significant Industrial User.

W. pH - The logarithm of the reciprocal of the weight of hydrogen ions, in grams per liter of solution.

X. PARTICIPANT - means the City or County of _____ Washington, a municipal corporation or county organized and existing under and by virtue of the laws of the State of Washington. "WITHIN THE PARTICIPANT JURISDICTION" shall mean within the Participant jurisdiction boundaries as now or hereafter constituted.

Y. PASS THROUGH - Discharge which exits the POTW into waters of the United States in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation).

LOTT DISCHARGE AND INDUSTRIAL PRETREATMENT REGULATIONS

SECTION 1 – GENERAL PROVISIONS

1.1 Purpose and Policy

This Ordinance sets forth uniform requirements for Users of the Publicly Owned Treatment Works (POTW) for the LOTT Alliance and the Cities of Lacey, Olympia, and Tumwater, and for Thurston County and enables the LOTT Alliance and the Cities of Lacey, Olympia, and Tumwater, and Thurston County to comply with all applicable State and Federal laws, including the Clean Water Act (33 United States Code, Section 1251 et seq.) and the General Pretreatment Regulations (40 Code of Federal Regulations Part 403). The objectives of this Ordinance are:

- A. To protect the POTW from potential harm by establishing clear standards and requirements for pretreatment of non-domestic waste. Harm to be prevented includes: causing Interference or otherwise harming the collection system; causing Pass Through, or otherwise harming the receiving environment; or causing the POTW to respond to a discharge based on a real or perceived threat;
- B. To protect POTW staff who may be affected by wastewater and sludge in the course of their employment and to protect the general public;
- C. To promote reuse and recycling of industrial wastewater by Industrial Users;
- D. To provide high-quality end products, such as reclaimed water and biosolids from the POTW, for beneficial use;
- E. To provide for fees for the equitable distribution of the cost of operation, maintenance, and improvement of the POTW; and
- F. To enable LOTT to comply with its National Pollutant Discharge Elimination System permit conditions, sludge use and disposal requirements, and any other Federal or State laws to which the POTW is subject.

This Ordinance shall apply to all Users of the POTW. The Ordinance authorizes the issuance of wastewater discharge permits; provides for monitoring, compliance, and enforcement activities; establishes administrative review procedures; requires User reporting; and provides for the setting of fees for the equitable distribution of costs resulting from the program established herein.

1.2 Administration

Except as otherwise provided herein, the LOTT Executive Director shall administer and implement the provisions of this Ordinance, and shall conduct other activities as set forth in Article VII of the "Interlocal Cooperation Act Agreement for Wastewater Management by the LOTT Wastewater Alliance by and among City of Lacey, City of Olympia, City of Tumwater, and Thurston County, dated November 5, 1999." Any powers granted to or duties imposed upon the Executive Director may be delegated by the Executive Director to personnel under the Executive Director's direction.

1.3 Abbreviations

The following abbreviations, when used in this Ordinance, shall have the designated meanings:

BMP	Best Management Practice
CFR	Code of Federal Regulations
CIU	Categorical Industrial User
USEPA	U.S. Environmental Protection Agency
gpd	Gallons per day
MIU	Minor Industrial User
mg/L	Milligrams per liter
NPDES	National Pollutant Discharge Elimination System
POTW	Publicly Owned Treatment Works
RCRA	Resource Conservation and Recovery Act
SIU	Significant Industrial User
U.S.C.	United States Code

1.4 Definitions

Unless a provision explicitly states otherwise, the following terms and phrases, as used in this Ordinance, shall have the meanings hereinafter designated.

- A. Act or "the Act" – The Federal Water Pollution Control Act, also known as the Clean Water Act, as amended, 33 U.S.C. Section 1251 et seq.
- B. Approval Authority – The Washington State Department of Ecology, Water Quality Program Manager.
- C. Authorized or Duly Authorized Representative of the User –
 - 1. If the User is a corporation:
 - a. The president, secretary, treasurer, or a vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for

the corporation; or

- b. The manager of one or more manufacturing, production, or operating facilities, provided the manager is authorized to make management decisions, which govern the operation of the regulated facility, including having the explicit or implicit duty of making major capital investment recommendations, and initiate and direct other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; can ensure that the necessary systems are established or actions taken to gather complete and accurate information for control mechanism requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.
- 2. If the User is a partnership or sole proprietorship: a general partner or proprietor, respectively.
 - 3. If the User is a Federal, State, or local governmental facility: a director or highest official appointed or designated to oversee the operation and performance of the activities of the government facility, or their designee.
 - 4. The individuals described in Section 1.4 (C)(1-3), may designate another authorized representative if the authorization is in writing, the authorization specifies the individual or position responsible for the overall operation of the facility from which the discharge originates, or having overall responsibility for environmental matters for the company, and the written authorization is submitted to the Executive Director.
- D. Biochemical Oxygen Demand or BOD – The quantity of oxygen utilized in the biochemical oxidation of organic matter under standard laboratory procedures for five (5) days at 20 degrees centigrade, usually expressed as a concentration (e.g., mg/L).
 - E. Best Management Practices or BMPs – Schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to implement the prohibitions listed in Section 2.1(A) and (B) and 40 CFR Part 403.5(a)(1) and (b). BMPs also include treatment requirements, operating procedures, and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw materials storage.
 - F. Categorical Pretreatment Standard or Categorical Standard – Any regulation containing pollutant discharge limits promulgated by the USEPA in accordance with Sections 307(b) and (c) of the Act (33 U.S.C. Section 1317), which apply to a specific category of Users and which appear in 40 CFR Chapter I, Subchapter N, Parts 405-471.

- G. Categorical Industrial User or CIU – An Industrial User subject to a Categorical Pretreatment Standard or Categorical Standard.
- H. [City or County] – The City or County of [City or County], Washington, a municipal corporation or county organized and existing under and by virtue of the laws of the State of Washington.
- I. Composite Sample – A composite of several samples taken throughout the period of a day when a regulated discharge is occurring. Several brands of electric samplers, some with a refrigerated sample collection area, may be used. Approvable composite samplers may either use a flow paced or time paced algorithm. For example, collecting a same size aliquot every 1,000 gallons (flow paced), or a variable sized aliquot every hour (time paced). In both cases, they must interface with a device, which senses the effluent flow volume to collect a representative sample unless the Executive Director has determined that a flow proportionate sample is not required.
- J. Daily Limit or Daily Maximum Limit – The maximum allowable discharge of a pollutant over a calendar day or equivalent representative 24-hour period. Where daily maximum limits are expressed in units of mass, and the daily discharge is calculated by multiplying the daily average concentration and total flow volumes in the same 24-hour period by a conversion factor to get the desired units. Where daily limits are expressed in terms of a concentration, the daily discharge is the composite sample value, or flow weighted average if more than one discrete sample was collected. Where flow weighting is infeasible, the daily average is the arithmetic average of all samples if analyzed separately, or the sample value if samples are composited prior to analysis.
- K. Domestic User (Residential User) – Any person who contributes, causes, or allows the contribution of wastewater into the POTW that is of a similar volume and/or chemical make-up as that of a residential dwelling unit. Discharges from a residential dwelling unit include up to 900 cubic feet of flow per month, with a concentration up to 300 mg/L of Biochemical Oxygen Demand, 300 mg/L of Total Suspended Solids, and 60 mg/L Total Ammonia.
- L. Environmental Protection Agency – The U.S. Environmental Protection Agency or, where appropriate, the Regional Water Management Division Director, the Regional Administrator, or other duly authorized official.
- M. Executive Director – The Executive Director of the LOTT Alliance and shall be considered LOTT Alliance personnel or the LOTT Alliance's agent for purposes of Article VII of the "Interlocal Cooperation Act Agreement for Wastewater Management by the LOTT Wastewater Alliance by and among City of Lacey, City of Olympia, City of Tumwater, and Thurston County, dated November 5, 1999." The term also means a duly authorized representative of the Executive Director.

- N. Existing Source – Any source of discharge subject to Categorical Standards that does not meet the definition of a “New Source” per Section 1.4(Y).
- O. Grab Sample – A sample, which is taken from a wastestream without regard to the flow in the wastestream and over a period of time not to exceed fifteen (15) minutes.
- P. Indirect Discharge or Discharge – The introduction of pollutants into the POTW from any non-domestic source regulated under 307(b), (c), or (d) of the Act.
- Q. Instantaneous Maximum Discharge Limit or Instantaneous Limit – The maximum concentration of a pollutant allowed to be discharged at any time, determined from the analysis of a discrete sample. Where a User is required to take a grab sample for purposes of determining compliance with Local Limits, this standard is the same as the Daily Maximum standard. For pollutants for which Users are required to take composite samples, (or for metals if no permit has been issued) the Instantaneous Limit shall be twice the Daily Limit.
- R. Interference – A discharge that causes (either by itself or in combination with other discharges) a violation of LOTT's NPDES permit or prevents the intended sewage sludge use or disposal by inhibiting or disrupting the POTW, including its collection systems, pump stations, and wastewater and sludge treatment processes. For example, a discharge from a User that causes a blockage resulting in a discharge at a point not authorized under LOTT's NPDES permit.
- S. Local Limits – Effluent limitation developed for Users by the Executive Director to specifically protect the POTW from the potential of Pass Through, Interference, vapor toxicity, explosions, sewer corrosion, and intended biosolids uses. Such limits shall be based on the POTW's site-specific flow and loading capacities, receiving water considerations, and reasonable treatment expectations for non-domestic wastewater. See Section 2.4 for a full list of Local Limits.
- T. LOTT Alliance or LOTT – A State of Washington nonprofit corporation created by Interlocal Agreement that operates as a public agency under State of Washington law, providing wastewater management and reclaimed water production services for the urbanized area of north Thurston County, Washington.
- U. Minor Industrial User or MIU – Any Industrial User that does not otherwise qualify as a Significant Industrial User of the POTW, identified by the Executive Director as having the potential to spill or discharge chemicals or slugs of wastewater to the POTW, or the potential to discharge a waste stream that, when taken into account with the waste streams of other Industrial Users, may have a significant impact on the POTW.

- V. Medical Waste – Isolation wastes, infectious agents, human blood and blood products, pathological wastes, sharps, body parts, contaminated bedding, surgical wastes, potentially contaminated laboratory wastes, and dialysis wastes.
- W. Monthly Average – The arithmetic mean of the effluent samples collected during a calendar month or specified 30-day period. Where the Control Authority has taken a sample during the period, it must be included in the monthly average if provided in time. However, where composite samples are required, grab samples taken for process control or by the Control Authority are not to be included in a monthly average.
- X. Monthly Average Limit – The limit to be applied to the Monthly Average to determine compliance with the requirements of this Ordinance (see Section 2.4 for listing).
- Y. New Source –
1. Any building, structure, facility, or installation from which there is (or may be) a discharge of pollutants, the construction of which commenced after the publication of proposed pretreatment standards under Section 307(c) of the Act, which will be applicable to such source if such standards are thereafter promulgated in accordance with that Section, provided that:
 - a. The building, structure, facility, or installation is constructed at a site at which no other source is located;
 - b. The building, structure, facility, or installation totally replaces the process or production equipment that causes the discharge of pollutants at an existing source; or
 - c. The production or wastewater generating processes of the building, structure, facility, or installation are substantially independent of an existing source at the same site. In determining whether these are substantially independent, factors such as the extent to which the new facility is integrated with the existing plant, and the extent to which the new facility is engaged in the same general type of activity as the existing source, should be considered.
 2. Construction on a site at which an existing source is located results in a modification rather than a new source if the construction does not create a new building, structure, facility, or installation meeting the criteria of (b) or (c) above but otherwise alters, replaces, or adds to existing process or production equipment.
 3. Construction of a new source as defined under this paragraph has commenced if the owner or operator has:

- a. Begun, or caused to begin, as part of a continuous onsite construction program,
 - (i) any placement, assembly, or installation of facilities or equipment; or
 - (ii) significant site preparation work including clearing, excavation, or removal of existing buildings, structures, or facilities that is necessary for the placement, assembly, or installation of new source facilities or equipment; or
 - b. Entered into a binding contractual obligation for the purchase of facilities or equipment, which are intended to be used in its operation within a reasonable time. Options to purchase or contracts, which can be terminated or modified without substantial loss, and contracts for feasibility, engineering, and design studies do not constitute a contractual obligation under this paragraph.
- Z. Non-Contact Cooling Water – Water used for cooling that does not come into direct contact with any raw material, intermediate product, waste product, or finished product.
- AA. Pass Through – A discharge, which exits the POTW into waters of the United States in quantities or concentrations, which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of LOTT's NPDES permit, including an increase in the magnitude or duration of a violation.
- BB. Person – Any individual, partnership, co-partnership, firm, company, corporation, association, joint stock company, trust, estate, governmental entity, or any other legal entity; or their legal representatives, agents, or assigns. This definition includes all Federal, State, and local governmental entities.
- CC. pH – A measure of the acidity or alkalinity of a solution, expressed in standard units.
- DD. Pollutant – Dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, medical wastes, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt, municipal, agricultural and industrial wastes, and certain characteristics of wastewater (e.g., pH, temperature, Total Suspended Solids, turbidity, color, Biochemical Oxygen Demand, Carbonaceous Oxygen Demand, toxicity, or odor).
- EE. Pretreatment – The reduction of the amount of pollutants, the elimination of

pollutants, or the alteration of the nature of pollutant properties in wastewater prior to, or in lieu of, introducing such pollutants into the POTW. This reduction or alteration can be obtained by physical, chemical, or biological processes; by process changes; or by other means, except by diluting the concentration of the pollutants unless allowed by an applicable pretreatment standard.

- FF. Pretreatment Requirements – Any substantive or procedural requirement related to pretreatment imposed on a User, other than a pretreatment standard.
- GG. Pretreatment Standards or Standards – Pretreatment standards shall mean discharge prohibitions (Section 2.1), categorical pretreatment standards (Section 2.2), State pretreatment standards (Section 2.3) and local limits (Section 2.4).
- HH. Publicly Owned Treatment Works or POTW – A treatment works, as defined by Section 212 of the Act (33 U.S.C. Section 1292), which is owned by LOTT and/or the [City or County] and more fully described in the "Interlocal Cooperation Act Agreement for Wastewater Management by the LOTT Wastewater Alliance by and among City of Lacey, City of Olympia, City of Tumwater, and Thurston County, dated November 5, 1999." This definition includes any devices or systems used in the collection, storage, treatment, recycling, and reclamation of sewage or industrial wastes of a liquid nature and any conveyances, including sanitary sewer and storm sewer collection systems, which convey wastewater to a treatment plant.
- II. Septic Tank Waste – Sewage and typically associated solids from domestic activities pumped from a septic tank serving one or more private residences. The Executive Director may also consider wastes from other holding tanks such as boat blackwater, bilge water, cesspools, and treatment lagoons to be Septic Tank Waste so long as they are absent chemicals, which might inhibit biological activity.
- JJ. Sewage – Human excrement and gray water (from household showers, toilets, kitchens, clothes and dish washing, and related domestic activities).
- KK. Significant Industrial User or SIU – Except as provided in paragraphs (3) and (4) of this Section, a Significant Industrial User is:
1. A User subject to categorical pretreatment standards; or
 2. A User that:
 - a. Discharges an average of twenty-five thousand (25,000) gpd or more of process wastewater to the POTW (excluding sanitary, noncontact cooling, and boiler blowdown wastewater);
 - b. Contributes a process wastestream that makes up five (5) percent or

more of the average dry weather hydraulic or organic capacity of the POTW treatment plant; or

- c. Is designated as such by [the City] on the basis that it has a reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement.
- (3) The Executive Director may determine that a User subject to categorical pretreatment standards is a Non-Significant Categorical Industrial User rather than a Significant Industrial User on a finding that the User never discharges more than one-hundred (100) gpd of total categorical wastewater (excluding sanitary, non-contact cooling and boiler blowdown wastewater, unless specifically included in the Pretreatment Standard) and the following conditions are met:
- a. the User, prior to Executive Director's finding, has consistently complied with all applicable categorical Pretreatment Standards and Requirements;
 - b. the User annually submits the certification statement required in Section 6.14(B) and 40 CFR Part 403.12(q), together with any additional information necessary to support the certification statement; and
 - c. the User never discharges any untreated concentrated wastewater.
- (4) Upon a finding that a User meeting the criteria in Section 1.4(KK)(2) has no reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement, the Executive Director may at any time, on its own initiative or in response to a petition received from a User, and in accordance with procedures in 40 CFR Part 403.8(f) (6), determine that such User should not be considered a Significant Industrial User.
- LL. Slug Load or Slug Discharge – Any Discharge of a non-routine, episodic nature, including but not limited to an accidental spill or a non-customary batch Discharge, which has a reasonable potential to cause Interference or Pass Through, or in any other way violate the POTW's regulations, local limits, or Permit conditions. This includes discharges at a flow rate or concentration that could cause a violation of the prohibited discharge standards of Section 2.1 of this Ordinance.
- MM. Storm Water – Any flow occurring during or following any form of natural precipitation, and resulting from such precipitation, including snowmelt.
- NN. Total Suspended Solids – The total suspended matter that floats on the surface

of, or is suspended in, water, wastewater, or other liquid, and which is removable by laboratory filtering.

- OO. User or Industrial User – Any Person with a source of discharge that does not qualify that person as a Domestic User who discharges an effluent into the POTW by means of pipes, conduits, pumping stations, force mains, tank trucks, constructed drainage ditches, intercepting ditches, and all constructed devices and appliances appurtenant thereto.
- PP. Wastewater – Liquid and water-carried industrial wastes and sewage from residential dwellings, commercial buildings, industrial and manufacturing facilities, and institutions, whether treated or untreated, which are contributed to the POTW.
- QQ. Wastewater Treatment Plant or Treatment Plant – That portion of the POTW, which is designed to provide treatment of municipal sewage and industrial waste.

SECTION 2 – GENERAL SEWER USE REQUIREMENTS

2.1 Prohibited Discharge Standards

- A. General Prohibitions – No User shall introduce or cause to be introduced into the POTW any pollutant or wastewater, which causes Pass Through or Interference. These general prohibitions apply to all Users of the POTW whether or not they are subject to Categorical Pretreatment Standards or any other National, State, or local pretreatment standards or requirements.
- B. Specific Prohibitions – No User shall introduce or cause to be introduced into the POTW the following pollutants, substances, or wastewater:
 - 1. Pollutants, which either alone or by interaction may create a fire or explosive hazard in the POTW, a public nuisance or hazard to life, or prevent entry into the sewers for their maintenance and repair or are in any way injurious to the operation of the system or operating personnel. This includes waste streams with a closed-cup flashpoint of less than 140 degrees F (60 degrees C) using the test methods specified in 40 CFR Part 261.21.
 - 2. Wastewater having a pH less than 5.0 or more than 11.0, or otherwise having any other corrosive property capable of causing damage or hazard to structures, equipment, or personnel. Discharges outside this pH range may be authorized by the Executive Director through a permit issued by the [City or County] pursuant to a finding that the system is specifically designed to accommodate a discharge of that pH.
 - 3. Solid or viscous substances in amounts that may cause obstruction to the flow in the sewer or other interference with the operation of the system. In no case shall solids greater than 1/4 inch (0.64 cm) in any dimension be discharged.
 - 4. Pollutants, including oxygen-demanding pollutants (Biochemical Oxygen Demand, etc.), released in a discharge at a flow rate and/or pollutant concentration, which, either singly or by interaction with other pollutants, will cause interference with the POTW.
 - 5. Wastewater having a temperature that will interfere with the biological activity in the system, has detrimental effects on the collection system, or prevents entry into the sewer. In no case shall wastewater be discharged, which causes the wastewater temperature at the treatment plant to exceed 104 degrees F (40 degrees C).
 - 6. Petroleum oil, nonbiodegradable cutting oil, or products of mineral oil origin, in amounts that will cause Interference or Pass Through.

7. Pollutants, which result in the presence of toxic gases, vapors, or fumes within the POTW in a quantity that may cause acute worker health and safety problems.
8. Trucked or hauled pollutants, except at discharge points designated by the Executive Director in accordance with Section 3.4 of this Ordinance.
9. The following are prohibited unless approved by the Executive Director under extraordinary circumstances, such as lack of direct discharge alternatives due to combined sewer service or need to augment sewage flows due to septic conditions (as required under WAC 173-216-050).
 - a. Non-contact cooling water in significant volumes.
 - b. Stormwater, or other direct inflow sources.
 - c. Wastewaters significantly affecting system hydraulic loading, which do not require treatment or would not be afforded a significant degree of treatment by the system.
10. Noxious or malodorous liquids, gases, solids, or other wastewater, which, either singly or by interaction with other wastes, are sufficient to create a public nuisance or a hazard to life, or to prevent entry into the sewers for maintenance or repair.
11. Wastewater, which imparts color that cannot be removed by the treatment process, such as, but not limited to, dye wastes and vegetable tanning solutions, which consequently imparts color to the treatment plant's effluent, thereby violating LOTT's NPDES permit.
12. Wastewater containing any radioactive wastes or isotopes except in compliance with applicable State or Federal regulations.
13. Storm water, surface water, ground water, artesian well water, roof runoff, subsurface drainage, swimming pool drainage, condensate, deionized water, noncontact cooling water, and unpolluted wastewater, unless specifically authorized by the Executive Director.
14. Sludges, screenings, or other residues from the pretreatment of industrial wastes;
15. Medical wastes, except as specifically authorized by the Executive Director and the [City or County] in a wastewater discharge permit;
16. Wastewater causing, alone or in conjunction with other sources, the

17. Detergents, surface-active agents, or other substances, which may cause excessive foaming in the POTW;
18. Fats, oils, or greases of animal or vegetable origin in concentrations greater than three hundred (300) mg/L, or Total Petroleum Hydrocarbon concentrations of no more than one hundred (100) mg/L.
19. Wastewater causing two readings on an explosion hazard meter at the point of discharge into the POTW, or at any point in the POTW, of more than ten percent (10%) or any single reading over twenty percent (20%) of the Lower Explosive Limit based on an explosivity meter reading.

Pollutants, substances, or wastewater prohibited by this Section shall not be processed or stored in such a manner that they could be discharged to the POTW.

2.2 National Categorical Pretreatment Standards

The categorical pretreatment standards found at 40 CFR Chapter I, Subchapter N, Parts 405-471 are hereby incorporated.

- A. Where a categorical pretreatment standard is expressed only in terms of either the mass or the concentration of a pollutant in wastewater, the Executive Director may impose equivalent concentration or mass limits in accordance with Section 2.2(E) and 2.2(F) and 40 CFR Part 403.6(c).
- B. When categorical Pretreatment Standards are expressed in terms of a mass of pollutant, which may be discharged per unit of production, the Executive Director may either impose limits based on mass or equivalent effluent concentrations. The User must supply appropriate actual or projected long term production rates for the unit of production specified in order to facilitate this process pursuant to 40 CFR Part 403.6(c)(2)
- C. The Executive Director may allow wastewater subject to a categorical pretreatment standard to be mixed with other wastewaters prior to treatment. In such cases, the User shall identify all categorical wastestreams and provide sufficient information on each non-categorical wastestream to determine whether it should be considered dilute for each pollutant. Absent information showing that non-categorical wastestreams contain the pollutant in question at levels above that of the supply water, such wastestreams shall be considered dilute. In such situations, the Executive Director shall apply the combined wastestream formula as found at 40 CFR Part 403.6(e) to determine appropriate limits.
- D. A CIU may request an adjustment to a categorical standard to reflect the presence of pollutants in the Industrial User's intake water when its water source

is from the same body of water that the POTW discharges into.

1. Any CIU wishing to obtain credit for intake pollutants must include, in their permit application, sample data showing influent water pollutant levels, which form the basis for the credit requested in their permit application.
 2. Unless the categorical standard was written to be applied on a net basis, the information supplied by the CIU must also demonstrate that the treatment system it proposes or uses to meet the categorical standards would, if properly installed and operated, meet the Standards in the absence of pollutants in the intake waters.
 3. In response to an acceptable application, the Executive Director may adjust the categorical standards to the extent necessary to meet the applicable categorical Pretreatment Standard(s), up to a maximum value equal to the influent pollutant concentration.
 4. The Executive Director may waive the requirement for the intake water to be drawn from the same body of water the POTW discharges to if the Executive Director determines that no environmental degradation will result.
- E. When a categorical pretreatment standard is expressed only in terms of pollutant concentrations, an Industrial User may request that the Executive Director convert the limits to equivalent mass limits. The Executive Director may establish equivalent mass limits if the Industrial User meets all of the conditions set forth below.
1. To be eligible for equivalent mass limits, the Industrial User must submit information with its permit application or permit modification request, which:
 - a. Shows it has a pretreatment system, which has consistently met all applicable Pretreatment Standards and maintained compliance without using dilution;
 - b. Describes the water conserving practices and technologies it employs, or will employ, to substantially reduce water use during the term of its permit;
 - c. Includes the facility's actual average daily flow rate for all waste streams from continuous effluent flow metering;
 - d. Determines an appropriate unit of production, and provides the present and long-term average production rates for this unit of production;

- e. Shows that long term average flow and production are representative of current operating conditions;
 - f. Shows that its daily flow rates, production levels, or pollutant levels do not vary so much that equivalent mass limits would be inappropriate; and
 - g. Shows the daily and monthly average pollutant allocations currently provided based on the proposed unit of production.
2. An Industrial User subject to equivalent mass limits must:
- a. Maintain and effectively operate control and treatment technologies adequate to achieve compliance with the equivalent mass limits;
 - b. Continue to record the facility's flow by continuous effluent flow monitoring;
 - c. Continue to record the facility's production rates;
 - d. Notify the Executive Director if production rates are expected to vary by more than twenty (20) percent from the baseline production rates submitted according to Section 2.2(E)(1)(d). The Executive Director may reassess and revise equivalent limits as necessary to reflect changed conditions; and
 - e. Continue to employ the same or comparable water conservation methods and technologies as those implemented pursuant to Section 2.2(E)(1)(b) so long as it discharges under an equivalent mass limit.
3. Equivalent mass limits:
- a. Will not exceed the product of the actual average daily flow from regulated process(es) of the User and the applicable concentration-based daily maximum and monthly average standards (and the appropriate unit conversion factor);
 - b. May be reassessed and the permit revised upon notification of a revised production rate, as necessary to reflect changed conditions at the facility; and
 - c. May be retained in subsequent permits if the User's production basis and other information submitted in 2.2(E)(1) is verified in their reapplication. The User must also be in compliance with Section 13.3 regarding the prohibition of bypass.

- F. The Executive Director may convert the mass limits of the categorical pretreatment standards of 40 CFR Parts 414 (organic chemicals), 419 (petroleum refining), and 455 (pesticide formulating, packaging, and repackaging) to concentration limits in permits for such Users. In such cases, the Executive Director will document the basis and the determination that dilution is not being substituted for treatment in the permit fact sheet.
- G. The Executive Director is obliged under Federal regulations to make the documentation of how any equivalent limits were derived (concentration to mass limits or vice versa) publicly available.
- H. Once incorporated into its permit, the User must comply with the equivalent limits in lieu of the Categorical Standards from which they were derived.
- I. The same production and flow estimates shall be used in calculating equivalent limits for the monthly (or multiple day average) and the maximum day.
- J. Users subject to permits with equivalent mass or concentration limits calculated from a production-based standard shall notify the Executive Director if production will significantly change. This notification is required within two business days after the User has a reasonable basis to know that that production will significantly change in the next calendar month. Users who fail to notify the Executive Director of such anticipated changes must meet the more stringent of the equivalent limits or the User's prior limits.

2.3 State Pretreatment Standards

Washington State pretreatment standards and requirements, located at Chapter 173-216 WAC, were developed under authority of the Water Pollution Control Act, Chapter 90.48 RCW and are hereby incorporated. The version incorporated is the version current as of the date of the latest revision or version of this Ordinance. All waste materials discharged from a commercial or industrial operation into the POTW must satisfy the provisions of Chapter 173-216 WAC. In addition to some slightly more stringent prohibitions, (merged with Section 2.1), the following provisions unique to Washington State are required by this Chapter for discharges to a POTW:

- A. Any person who constructs or modifies or proposes to construct or modify wastewater treatment facilities must first comply with the regulations for submission of plans and reports for construction of wastewater facilities, chapter 173-240 WAC. Until LOTT or the [City or County] is delegated the authority to review and approve such plans under RCW 90.48.110, sources of non-domestic discharges shall request approval for such plans through the Department of Ecology. To ensure conformance with this requirement, proof of the approval of such plans and one copy of each approved plan shall be provided to the Executive Director and the [City or County] before commencing any such construction or modification.

- B. Users shall apply to the Executive Director and the [City or County] for a permit at least 60 days prior to the intended discharge of any pollutants other than domestic wastewater or wastewater, which the Executive Director has determined is similar in character and strength to normal domestic wastewater with no potential to adversely affect the POTW.
- C. All Significant Industrial Users must apply for and obtain a permit prior to discharge.
- D. All Users shall apply all known, available, and reasonable methods to prevent and control waste discharges to the waters of the State.
- E. Discharge restrictions of Chapter 173-303 WAC (Dangerous Waste) shall apply to all Users.
- F. Claims of confidentiality shall be submitted according to WAC 173-216-080. Information, which may not be held confidential includes the: Name and address of applicant, description of proposal, the proposed receiving water, receiving water quality, and effluent data. Claims shall be reviewed based on the standards of WAC 173-216-080, Chapter 42.17 RCW, Chapter 173-03 WAC, and RCW 43.21A.160.
- G. Persons applying for a new permit or a permit renewal or modification, which allows a new or increased pollutant loading shall publish notice for each application in the format provided by the Executive Director. Such notices shall fulfill the requirements of WAC 173-216-090. These requirements include publishing:
 - 1. The name and address of the applicant and facility/activity to be permitted;
 - 2. A brief description of the activities or operations, which result in the discharge;
 - 3. Whether any tentative determination, which has been reached with respect to allowing the discharge;
 - 4. The address and phone number of the office of the Executive Director where persons can obtain additional information;
 - 5. The dates of the comment period (which shall be at least 30 days); and
 - 6. How and where to submit comments or have any other input into the permitting process, including requesting a public hearing.
- H. The Executive Director and the [City or County] may require the applicant to also

mail this notice to persons who have expressed an interest in being notified, to State agencies and local governments with a regulatory interest, and to post the notice on the premises. If the Executive Director or the [City or County] determined there is sufficient public interest the [City or County] shall hold a public meeting following the rules of WAC 173-216-100. The Executive Director or the [City or County] may assume responsibility for public notice requirements for any Person.

- I. Permit terms shall include, wherever applicable, the requirement to apply all known, available, and reasonable methods of prevention, control, and treatment.
- J. All required monitoring data shall be analyzed by a laboratory registered or accredited under the provisions of Chapter 173-50 WAC, except for flow, temperature, settleable solids, conductivity, pH, turbidity, and internal process control parameters. However, if the laboratory analyzing samples for conductivity, pH, and turbidity must otherwise be accredited, it shall be accredited for these parameters as well.

2.4 Local Limits

- A. The Executive Director may establish local limits pursuant to 40 CFR Part 403.5(c).
- B. The following pollutant limits are established to protect against Pass Through and Interference and reflect the application of reasonable treatment technology. No person discharging more than 1,000 gallons per day shall discharge wastewater in excess of the following Daily Maximum Concentration Limits unless authorized by a wastewater discharge permit issued by the [City or County]. In addition, no person discharging 1,000 gallons a day or less shall discharge wastewater in excess of following Daily Maximum Loading Limits unless authorized by a wastewater discharge permit issued by the [City or County].
- C. The below limits apply at the point where the wastewater is discharged to the POTW. All concentrations for metallic substances are for total metal unless indicated otherwise. The Executive Director may impose mass limits in addition to a concentration-based limits.

- D. Users shall be subject to "instantaneous limits" (as determined by a grab sample) of equal to twice the below "daily maximum" concentrations for any pollutant for which a composite sample is required in a permit. This provision is inapplicable to Users without permits, or without the permit requirement to collect a composite sample for the analyte in question.

ANALYTE	DAILY MAXIMUM CONCENTRATION LIMIT	DAILY MAXIMUM LOADING LIMITS (1,000 gallons per day or less)
Arsenic	0.2 mg/L	0.002 lbs. per day
Cadmium	0.2 mg/L	0.002 lbs. per day
Chromium	1.0 mg/L	0.008 lbs. per day
Chromium (hexavalent)	0.25 mg/L	0.002 lbs. per day
Copper	0.5 mg/L	0.004 lbs. per day
Cyanide (total)	0.64 mg/L	0.005 lbs. per day
Cyanide (free)	0.25 mg/L	0.002 lbs. per day
Lead	0.4 mg/L	0.004 lbs. per day
Mercury	0.05 mg/L	0.0004 lbs. per day
Nickel	0.5 mg/L	0.004 lbs. per day
Silver	0.2 mg/L	0.002 lbs. per day
Zinc	1.0 mg/L	0.008 lbs. per day
Fats, oils, & greases of animal or vegetable origin	300 mg/L	Any amount
Hydrocarbon-based oils & greases	50 mg/L	Any amount
Minimum pH	5.0 standard units	N/A
Maximum pH	10.5 standard units	N/A
Reduction in effluent ultra violet transmissivity (per cm at 254 nm wavelength)	10% reduction	N/A
Decrease in maximum effluent no observed effect concentration (NOEC) in any whole effluent toxicity test	10% decrease	N/A

- E. Users discharging Biochemical Oxygen Demand, Total Suspended Solids, or ammonia in excess of the concentration limits by more than the threshold amount listed below must apply for a permit. Such Users may be subject to surcharges as established in and under the authority of Section 14.1 up to any maximum loading limit established by permit.

ANALYTE	EXCESS STRENGTH CHARGES THRESHOLD LIMIT	PERMITTED DISCHARGE THRESHOLD AMOUNT
Biochemical Oxygen Demand (BOD ₅)	300 mg/L	2.5 lbs. per day
Total Suspended Solids	300 mg/L	2.5 lbs. per day
Total Ammonia, as ammonia (NH ₃) and ammonium ion (NH ₄ ⁺)	60 mg/L	0.5 lbs. per day

- F. The [City or County] shall use the individual permit process to establish ceiling limits for compatible pollutants and appropriate discharge limits for all other pollutants not listed under Section 2.4. This includes pollutants subject to regulation under RCRA, volatile or semi-volatile organics, halogenated or brominated compounds, poly-aromatic hydrocarbons, polymers, surfactants, pesticide active ingredients, etc.
- G. The Executive Director may establish and the [City or County] require Best Management Practices for any category of User or type of industrial process, which creates a non-domestic waste stream. Such requirements may be applied either in lieu of or in addition to the local limits of Section 2.4. BMPs may also include alternative limits, which may be applied at the end of a specific process or treatment step instead of at the combined effluent.

2.5 Right of Revision

The Executive Director and the [City or County] reserves the right to establish, by regulation, Ordinance, or in wastewater discharge permits, more stringent standards or requirements on discharges to the POTW.

2.6 Dilution

No User shall ever increase the use of process water, or in any way attempt to dilute a discharge, as a partial or complete substitute for adequate treatment to achieve compliance with a discharge limit unless expressly authorized by an applicable pretreatment standard or requirement. The Executive Director may impose mass limitations on Users where deemed appropriate to safeguard against the use of dilution to meet applicable pretreatment standards or requirements, or in other cases when the imposition of mass limitations is appropriate.

SECTION 3 – PRETREATMENT OF WASTEWATER

3.1 Pretreatment Facilities

Users shall provide wastewater treatment as necessary to comply with this Ordinance and shall achieve compliance with all categorical pretreatment standards, local limits, and the prohibitions set out in Section 2.1 of this Ordinance within the time limitations specified by USEPA, the State, the [City or County], or the Executive Director, whichever is more stringent. Any facilities necessary for compliance shall be provided, operated, and maintained at the User's expense, and satisfy State requirements for review and approval of Plans for Wastewater Facilities as described in Section 2.3. Such plans (Engineering Report, Plans and Specifications, and Operation and Maintenance Manuals) shall be submitted as required by Chapter 173-240 WAC to either the Executive Director, the [City or County], or the Department of Ecology for review, and Users shall obtain approval prior to construction. The review of such plans and operating procedures shall in no way relieve the User from the responsibility of modifying such facilities as necessary to produce a discharge acceptable to the Executive Director and the [City or County] under the provisions of this Ordinance.

3.2 Additional Pretreatment Measures

- A. The Executive Director may immediately and effectively halt or prevent any discharge of pollutants to the POTW, which reasonably appear to present an imminent endangerment to the health or welfare of persons. In such cases, the Executive Director will provide the User advance notice if possible, but shall not delay a response to imminent endangerment.
- B. The Executive Director may halt or prevent any discharge to the POTW, which presents or may present an endangerment to the environment or, which threatens to interfere with the operation of the POTW (including the collection system and pump stations). In such cases, the Executive Director shall attempt to provide not only notice to the affected User(s), but the opportunity to respond.
- C. Any User causing the Executive Director to exercise the emergency authorities provided for under Sections 3.2(A) and (B) shall be responsible for reimbursement of all related costs to the Executive Director and the [City or County].
- D. The Executive Director may require Users to reduce or curtail certain discharges to the sewer, designate that certain wastewater be discharged only into specific sewers, relocate and/or consolidate points of discharge, separate sewage wastestreams from industrial wastestreams, and take all other measures to protect the POTW and determine the User's compliance with the requirements of this Ordinance.
- E. The Executive Director and the [City or County], based on the determination that

such devices are necessary for implementation of pretreatment requirements, may require any User to install and maintain, on their property and at their expense the following devices:

1. A sample taking facility accessible to the Executive Director
 2. A suitable storage and/or flow equalization tank
 3. Grease, oil, and/or grit interceptors
 4. An approved combustible gas detection meter
- F. Users installing any of the above devices shall ensure they are of the type and capacity approved by the [City or County], meet applicable building and plumbing codes, and conform to any separate requirements established by the [City or County] and the Executive Director. Users shall locate units in areas easily accessible for cleaning and inspection by representatives of the [City or County] or Executive Director. Users shall be responsible for all periodic inspection, cleaning, and repair of such devices.

3.3 Accidental Discharge/Slug Discharge Control Plans

The Executive Director, through a permit issued by the [City or County], may require any User to develop and implement an accidental discharge/slug discharge control plan and take other actions the Executive Director believes are necessary to control discharges, which may be caused by spills or periodic non-routine activities. Accidental discharge/slug discharge control plans shall include at least the following:

- A. A description of all discharge practices, including any non-routine batch discharges such as from cleaning, replenishment, or disposal;
- B. A description of all stored chemicals, disclosing all ingredients in formulations, which could violate a discharge prohibition if discharged to the sewer;
- C. The procedures for immediately notifying the Executive Director and the [City or County] of any accidental or slug discharge, as required by Section 6.6 of this Ordinance; and
- D. The procedures that will be taken to prevent the occurrence or adverse impact from any accidental or slug discharge. Such procedures shall address the inspection and maintenance of storage areas, handling and transfer of materials, loading and unloading operations, control of plant site runoff, worker training, building of containment structures or equipment, measures for containing toxic organic pollutants (including solvents), and/or measures and equipment for emergency response.

3.4 Hauled Wastewater

- A. Residential wastes meeting the definition of "Septic Tank Waste" may be introduced into the POTW at locations designated by the Executive Director, and at such times as are established by the Executive Director. The hauler of such wastes shall be responsible for ensuring such wastes comply with all discharge prohibitions (Section 2 of this Ordinance) and other applicable requirements of the Executive Director. The Executive Director may require septic tank waste haulers to obtain wastewater discharge permits issued by the City of Olympia or provide a manifest at the time of discharge identifying the customer name, address, and volume from each residence.
- B. The Executive Director shall require the hauler, and may also require the generator, of non-domestic waste to obtain a wastewater discharge permit. The Executive Director also may prohibit the disposal of any or all hauled industrial waste. The discharge of hauled industrial waste is subject to all relevant requirements of this Ordinance.
- C. Industrial waste haulers may discharge loads only at locations designated by the Executive Director and with the prior consent of the Executive Director. The Executive Director may collect samples of each hauled load to ensure compliance with applicable standards, and halt the discharge at any point in order to take additional samples or hold the load pending analysis. The Executive Director may require the industrial waste hauler to provide a waste analysis of any load prior to discharge, to characterize the waste, or to certify that the waste does not meet the definition of a "Hazardous Waste" under chapter 173-303 WAC.
- E. Industrial waste haulers must provide a waste-tracking form for every load. This form shall include at least:
 - 1. Name and address of the industrial waste hauler;
 - 2. Hauler permit number;
 - 3. Truck and driver identification;
 - 4. Names and addresses of the sources of waste;
 - 5. Type of industry, volume, brief description, known characteristics and presumed constituents of waste; and
 - 6. Any wastes, which are "Hazardous Wastes" under RCRA.
- F. Fees for dumping hauled wastewater may be established by the Executive Director, based on the current LOTT wastewater service charge.

SECTION 4 – WASTEWATER DISCHARGE PERMITS

4.1 Industrial User Surveys

The Executive Director is obligated under Federal law to identify all Users potentially subject to the pretreatment program, and the character and volume of pollutants discharged by such Users. To satisfy this requirement, all sources of non-domestic discharges to the POTW must, upon request of the Executive Director or the [City or County], periodically complete an Industrial User Survey form. Users shall fully disclose the information requested and sign the completed form in accordance with Section 4.7. Proper completion of survey requirements is a condition of initial and continued discharge to the public sewer system. Users failing to fully comply with survey requirements within 30 days shall be subject to all enforcement measures authorized under this chapter including termination of service. The Executive Director is authorized to prepare several forms for this purpose and require completion of the particular form, which the Executive Director determines appropriate to provide the information needed to categorize each User. The Executive Director shall be authorized to categorize each User, provide written notice of a User's categorization and what it means, and revise this categorization at any time.

4.2 Wastewater Discharge Permit Requirement

- A. No User categorized by the Executive Director as a Significant Industrial User shall discharge wastewater into the POTW without first obtaining an individual wastewater discharge permit developed by the Executive Director and issued by the [City or County] or, where applicable, a general permit from the Executive Director. A Significant Industrial User that has filed a timely application pursuant to Section 4.3 of this Ordinance may continue to discharge unless and until notified otherwise by the Executive Director.
- B. The Executive Director may require all other Users to obtain wastewater discharge permits, or implement Best Management Practices as necessary to carry out the purposes of this Ordinance. For example, a wastewater discharge permit may be required solely for flow equalization.
- C. Any failure to complete the required survey form, apply for and obtain a required permit, or violate the terms and conditions of a wastewater discharge permit shall be deemed violations of this Ordinance and subject the wastewater discharge permittee to the sanctions set out in Sections 10-12 of this Ordinance. Obtaining a wastewater discharge permit does not relieve a permittee of its obligation to comply with all Federal and State pretreatment standards or requirements or with any other requirements of Federal, State, and local law.

4.3 Wastewater Discharge Permitting: Existing Connections

Any User required to obtain a wastewater discharge permit who was discharging wastewater into the POTW prior to the effective date of this Ordinance and who wishes to continue such discharges shall, within thirty (30) days after said date, apply to the Executive Director for a wastewater discharge permit in accordance with Section 4.5 of this Ordinance, and shall not cause or allow discharges to the POTW to continue after sixty (60) days of the effective date of this Ordinance except in accordance with a wastewater discharge permit issued by the [City or County].

4.4 Wastewater Discharge Permitting: New Connections

Persons wishing to discharge non-domestic wastewater must first complete either a survey form (if they do not expect a permit is needed) or a permit application. Any User identified by the Executive Director through the survey as needing a permit must file a permit application. Applications for wastewater discharge permits, in accordance with Section 4.5 of this Ordinance, must be filed at least ninety (90) days prior to the desired date of discharge, and the discharge permit obtained prior to commencing discharge.

4.5 Wastewater Discharge Permit Application Contents

- A. All Users required to obtain a wastewater discharge permit must apply using the form provided by the Executive Director. Users eligible for coverage under a General Permit may request such coverage using an industry specific form if one has been developed (see Section 4.6). Users must supply the Executive Director the following information as part of the permit application if relevant to the Users operation unless waived by the Executive Director.
 - 1. Identifying information
 - a. The name and physical address of the facility, the names of the operator/facility manager and owner, and the name and address of the point of contact; and
 - b. A description of activities, facilities, and plant production processes on the premises.
 - 2. A list of any environmental control permits held by or for the facility.
 - 3. A description of operations and facilities including:
 - a. A brief description of the operations, average rate of production, and industrial classification (SIC or NAICS codes) of the operation(s) conducted on site; and
 - b. The number and type of employees, and proposed or actual hours of

operation.

- c. The type, amount, rate of production, and process used for each product produced.
 - d. The type and amount of raw materials used (average and maximum rates).
 - e. The raw materials and chemicals to be routinely stored at the facility (including products in rail cars and tank trucks located on site).
 - f. The types of wastes generated on a routine and periodic basis.
 - g. The times and durations when wastes will be discharged.
 - h. A schematic process diagram showing each process step, waste stream, treatment step, internal recycle, and point of discharge to the POTW. This diagram should identify which streams are subject to categorical standards.
 - i. Site plans, floor plans, mechanical and plumbing plans, and details to show all sewers, floor drains, and appurtenances by size, location, and elevation, and all points of discharge.
 - j. The sampling locations and provisions for monitoring discharges.
 - k. Whether plans for wastewater facilities under Chapter 173-240 WAC have been developed, and their approval status (Engineering Report, Plans and Specifications, and an Operations and Maintenance Manual).
4. Flow data: The average daily and maximum daily flow, in gallons per day, to the POTW from each waste stream. Information shall be complete enough to allow use of the combined wastestream formula per Section 2.2(C) and 40 CFR Part 403.6(e) where applicable.
5. Pollutant data:
- a. The categorical pretreatment standards applicable to each regulated process.
 - b. The results of sampling and analysis identifying the nature and concentration, (and mass where required by the standard or the Executive Director), of regulated pollutants in the discharge from each regulated process.

- c. The estimated peak instantaneous, daily maximum, and long-term average discharge concentrations (and mass) based on the sampling results.
- 6. Sampling data to show samples are:
 - a. Representative of daily operations.
 - b. Taken just downstream from pretreatment facilities if such exist, or just downstream of the regulated process(es) if no pretreatment exists.
 - c. Collected as required by Section 6.11 of this Ordinance.
 - d. Analyzed according to Section 6.10 of this Ordinance.
- 7. Information confirming BMPs. Where standards specify a BMP or pollution prevention alternative, the User must include the information needed by the Executive Director or the applicable standard to determine whether BMPs are (or will be) implemented.
- 8. Any requests for a monitoring waiver (or a renewal of an approved monitoring waiver) for a pollutant neither present nor expected to be present in the discharge must include new sampling showing (continued) absence of the pollutant in the raw wastewater and satisfying Section 6.4(B).
- 9. Any request to be covered by a general permit shall satisfy Section 4.6.
- 10. Any other information deemed necessary by the Executive Director to evaluate the situation and prepare a discharge permit.
- B. Incomplete or inaccurate applications will not be processed and will be returned to the User for revision. The Executive Director shall be held harmless for delays caused by returned applications.

4.6 General Permits

- A. The [City or County] may use general permits to control discharges to the POTW from all Users. Users covered by a general permit will be those that the Executive Director finds:
 - 1. Involve the same or substantially similar types of operations.
 - 2. Discharge the same types of wastes.
 - 3. Require the same effluent limitations.

4. Require the same or similar monitoring.
 5. Are more appropriately controlled under a general permit.
 6. Are not subject to production-based standards, mass limits, or require use of the Combined Wastestream Formula to calculate limits.
- B. To be covered by the general permit, the User must file a written request for coverage. The request must identify contact information, production processes, types of wastes generated, the general permit under which coverage is requesting, and the basis for believing the general permit is applicable. The User must also identify the location for monitoring all wastes covered by the general permit. If requesting a monitoring waiver, the application must provide information showing Section 6.4(B) has been complied with. The User must also provide any other information the Executive Director has requested to properly evaluate the situation. A monitoring waiver is not effective until the Executive Director has provided written notice granting the waiver.
- C. The Executive Director will retain the following for three (3) years after the expiration of the general permit. A copy of the general permit, the fact sheet, each User's request for coverage, and the POTW's determination to extend coverage to each User.

4.7 Application Signatories and Certifications

- A. All survey forms, wastewater discharge permit applications, and User reports must be signed by an authorized representative of the User and contain the certification statement in Section 6.14(A).
- B. Users shall submit a new authorization if the designation of an authorized representative is no longer accurate. This includes when a different individual or position has responsibility for the overall operation of the facility, or overall responsibility for environmental matters for the company. The User must submit the new authorization prior to or with any reports to be signed by the new authorized representative.
- C. A facility determined to be a Non-Significant Categorical Industrial User by the Executive Director pursuant to 1.4 (KK) (3) must annually submit the signed certification statement found at Section 6.14(B).

4.8 Wastewater Discharge Permit Decisions

After receipt of a complete wastewater discharge permit application, the Executive Director will determine whether or not to issue a wastewater discharge permit. The Executive Director may deny any application for a wastewater discharge permit or require additional safeguards, reports (including plans under Chapter 173-240 WAC), or information. For Users not meeting the criteria of Significant Industrial Users, the Executive Director may also waive or defer a permit, or allow discharges in the interim while a permit is being prepared.

SECTION 5 – WASTEWATER DISCHARGE PERMITS

5.1 Wastewater Discharge Permit Duration

The [City or County] may issue a wastewater discharge permit for a period of up to five (5) years from its effective date. Each wastewater discharge permit will indicate its expiration date.

5.2 Wastewater Discharge Permit Contents

Wastewater discharge permits will include conditions the Executive Director and the [City or County] deems reasonably necessary to carry out the goals of the pretreatment program (Section 1.1), Federal and State regulations, and the requirements of this Ordinance.

A. Wastewater discharge permits will contain:

1. The permit issuance date, expiration date, and effective date;
2. A statement that the wastewater discharge permit is nontransferable without prior notification to the [City or County] and the Executive Director in accordance with Section 5.5 of this Ordinance, and provisions for furnishing the new owner or operator with a copy of the existing wastewater discharge permit;
3. Effluent limits, including Best Management Practices, based on applicable pretreatment standards and requirements to apply AKART (see Section 2.3(I));
4. The pollutants to be monitored, and specific monitoring requirements. This includes the sampling location(s), sampling frequencies, and sample types consistent with Federal, State, and local law. (see Section 2.3(J));
5. Requirements to submit certain reports (as reflected in Section 6), provide various notifications, keep records, and implement Best Management Practices;
6. The process to be used to request a waiver from monitoring for a pollutant neither present nor expected to be present in the Discharge in accordance with Section 6.4(B), or a specific waived pollutant in the case of an individual permit;
7. A statement of applicable civil and criminal penalties for violation of pretreatment standards and requirements, and any applicable compliance schedule. Such schedule may not extend the time for compliance beyond that required by applicable Federal, State, or local law;

8. Requirements to control slug discharges, including to develop, update, and implement slug discharge control plans (find required content in Section 3.3) where the Executive Director determines such plans are important to preventing accidental, unanticipated, or non-routine discharges;
 9. Any monitoring, which has been conditionally waived by the Executive Director according to Section 6.4(B) but which automatically applies at any time the requirements of the conditional waiver are not met; and
 10. Reapplication requirements.
- B. Wastewater discharge permits may contain, but need not be limited to, the following conditions:
1. Pretreatment facilities and measures required by Section 3.1 and 3.2 of this Ordinance;
 2. Limits on the average and/or maximum rate of discharge, time of discharge, and/or requirements for flow regulation and equalization;
 3. Requirements to install pretreatment technology, pollution controls, or to construct appropriate containment devices to reduce, eliminate, or prevent the introduction of pollutants into the treatment works, ground, or stormwater;
 4. Requirements to develop and implement of waste minimization plans to reduce the amount of pollutants discharged to the POTW;
 5. Requirements to pay charges or fees for discharge to the POTW including high strength charges;
 6. Requirements to install and maintain inspection and sampling facilities and equipment, including flow measurement devices;
 7. Notice that compliance with the wastewater discharge permit does not relieve the permittee of responsibility for compliance with all applicable Federal and State pretreatment standards, including those which become effective during the term of the wastewater discharge permit; and
 8. Other conditions as deemed appropriate by the Executive Director or the [City or County] to ensure compliance with this Ordinance, and State and Federal laws, rules, and regulations.

5.3 Permit Issuance Process

- A. **Public Notice:** Users shall follow the procedures for public notice found in Section 2.3(G) and 2.3(H). The Executive Director shall consider and respond to public input as appropriate prior to issuance of a permit.
- B. **Permit Appeals:** The Executive Director shall provide public notice of the issuance of a wastewater discharge permit. Any person, including the User, may petition the [City or County] to reconsider the terms of a wastewater discharge permit within thirty (30) days of notice of its issuance.
 - 1. Failure to submit a timely petition for review shall be deemed to be a waiver of the administrative appeal.
 - 2. In its petition, the appealing party must indicate the wastewater discharge permit provisions objected to, the reasons for this objection, and the alternative condition, if any, it seeks to place in the wastewater discharge permit.
 - 3. The effectiveness of the wastewater discharge permit shall not be stayed pending the appeal.
 - 4. If the [City or County] fails to act within thirty (30) days, a request for reconsideration shall be deemed to be denied. Decisions not to reconsider a wastewater discharge permit, not to issue a wastewater discharge permit, or not to modify a wastewater discharge permit shall be considered final administrative actions for purposes of judicial review.
 - 5. Aggrieved parties seeking judicial review of the final administrative wastewater discharge permit decision must do so by filing a complaint with the Superior Court of Thurston County within ten (10) days of the final administrative action.

5.4 Wastewater Discharge Permit Modification

The [City or County], after consulting with the Executive Director, may modify a wastewater discharge permit for good cause, including, but not limited to, the following reasons:

- A. To incorporate any new or revised Federal, State, or local pretreatment standards or requirements including new or revised local limits;
- B. To address new or changed operations, processes, production rates, waste streams, or changes in water volume or character;
- C. To reflect conditions at the POTW requiring an authorized discharge to be

reduced or curtailed. Such requirements may be either temporary or permanent;

- D. Based on information indicating that a permitted discharge poses a threat to the Executive Director's and/or [City or County]'s POTW or staff, the receiving waters, or to violate a prohibition of this Chapter;
- E. To address violations of any terms or conditions of the wastewater discharge permit;
- F. To address misrepresentations or failure to fully disclose all relevant facts in the wastewater discharge permit application or in any required report;
- G. To incorporate revisions based on a variance from categorical pretreatment standards approved pursuant to 40 CFR Part 403.13;
- H. To correct typographical or other errors in the wastewater discharge permit; or
- I. To reflect a transfer of the facility ownership or operation to a new owner or operator as required under Section 5.5.

5.5 Wastewater Discharge Permit Transfer

Wastewater discharge permits may be transferred to a new owner or operator only if the permitted User gives at least thirty (30) days advance notice to the Executive Director and the [City or County], and the Executive Director and the [City or County] approves the wastewater discharge permit transfer. Failure to provide advance notice of a transfer renders the wastewater discharge permit void as of the date of facility transfer. The notice to the Executive Director and the [City or County] must include a written certification by the new owner or operator, which:

- A. States that the new owner and/or operator have no immediate intent to change the facility's operations and processes;
- B. Identifies the specific date on which the transfer is to occur; and
- C. Acknowledges full responsibility for complying with the existing wastewater discharge permit.

5.6 Wastewater Discharge Permit Revocation

The [City or County] may revoke a wastewater discharge permit for good cause, including, but not limited to, when a User has:

- A. Failed to notify the Executive Director of significant changes to the wastewater prior to the changed discharge;

- B. Failed to provide prior notification to the Executive Director of changed conditions pursuant to Section 6.5 of this Ordinance;
- C. Misrepresented or failed to fully disclose all relevant facts in the wastewater discharge permit application;
- D. Falsified self-monitoring reports or tampered with monitoring equipment;
- E. Refused to allow the Executive Director timely access to the facility premises and records;
- F. Failed to meet effluent limitations or permit conditions;
- G. Failed to pay applicable fines or sewer charges;
- H. Failed to meet compliance schedule deadline dates;
- I. Failed to complete a wastewater survey or wastewater discharge permit application;
- J. Failed to provide advance notice of the transfer of business ownership;
- K. Violated any pretreatment standard or requirement, or any terms of the wastewater discharge permit or this Ordinance;
- L. Ceased operations; or
- M. Transferred business ownership.

Wastewater discharge permits issued to a User are void upon the issuance of a new wastewater discharge permit to that User.

5.7 Wastewater Discharge Permit Reissuance

A User with an expiring wastewater discharge permit shall apply for wastewater discharge permit reissuance by submitting a complete permit application, in accordance with Section 4.5 of this Ordinance, a minimum of ninety (90) days prior to the expiration of the User's existing wastewater discharge permit.

SECTION 6 – REPORTING REQUIREMENTS

6.1 Baseline Monitoring Reports

- A. When “categorical standards” for an industry category are published, Users that perform that process and either currently discharge or are scheduled to discharge wastewater from the process to the POTW, must submit a “baseline monitoring report” to the Executive Director. This report must contain the information listed in paragraph C, below. The report is due within one hundred eighty (180) days after the effective date of a categorical pretreatment standard, unless the final administrative decision on a category determination comes later.
- B. Users that wish to begin discharging wastewater to the POTW from operations subject to categorical standards after USEPA has published the standards (called New Sources), shall also submit a “Baseline Monitoring Report” to the Executive Director containing the information listed in paragraph 6.1 C. However, for New Sources, the report must be provided at least ninety (90) days before desiring to discharge. New Sources shall describe the method of pretreatment they intend to use to meet applicable categorical standards. Because monitoring data will not be available for proposed facilities, New Sources instead must provide estimates of the anticipated flow rates and quantity of pollutants to be discharged.
- C. The Baseline Monitoring Report shall include the following information:
 - 1. All information required in Section 4.5.A(1-7).
 - 2. Additional Conditions for Existing Sources Measuring pollutants:
 - a. Users shall take a minimum of one representative sample to compile the data for the Baseline Monitoring Report.
 - b. Users shall take samples immediately downstream from pretreatment facilities if such exist or immediately downstream from the regulated process if no pretreatment exists. If the User mixes other wastewaters with the regulated wastewater prior to pretreatment, the User must provide the flows and concentrations necessary to apply the combined wastestream formula of Section 2.2(C) and 40 CFR Part 403.6(e). Where the User wants an alternate concentration or mass limit, and it is allowed by Federal rules at § 403.6(e), the User shall propose the adjusted limit and provide supporting data to the Control Authority.
 - c. Sampling and analysis shall be performed in accordance with Section 6.11 (Sample Collection), and Section 6.10 (Analytical Requirements).
 - d. The Executive Director may allow the report to use only historical data

if the data is good enough to allow the evaluation of whether (and which) industrial pretreatment measures are needed;

- e. The baseline report shall indicate the time, date, and place of sampling, methods of analysis. The User shall certify that the sampling and analysis presented is representative of normal work cycles and expected pollutant discharges to the POTW.
3. **Compliance Certification** – A statement, reviewed by the User's authorized representative as defined in Section 1.4(C) and certified by a qualified professional, such as a Professional Engineer indicating whether pretreatment standards are being met on a consistent basis, and, if not, whether additional operation and maintenance (O&M) and/or additional pretreatment steps are required to meet the pretreatment standards and requirements.
4. **Compliance Schedule** – While New Sources must install the treatment required to meet the Pretreatment standards prior to operation, Existing Sources may be granted a compliance schedule where they must provide additional pretreatment and/or O&M to meet the pretreatment standards. In such cases, the User shall propose the shortest schedule by which they can provide the additional pretreatment and/or O&M. The completion date, which the User proposes in this schedule may not be later than the compliance date established for the applicable pretreatment standard. Any compliance schedule authorized pursuant to this Section must also meet the requirements set out in Section 6.2 of this Ordinance.
5. **Signature and Report Certification** – All baseline monitoring reports must be certified in accordance with Section 6.14(A) of this Ordinance and signed by an authorized representative as defined by Section 1.4(C).

6.2 Compliance Schedule Progress Reports

The following conditions shall apply to compliance schedules proposed by Existing Sources according to Section 6.1(C)(4) of this Ordinance and incorporated into permits:

- A. The schedule shall contain progress increments in the form of dates for the commencement and completion of major events leading to the construction and operation of additional pretreatment required for the User to meet the applicable pretreatment standards (such events include, but are not limited to, hiring an engineer, completing preliminary and final plans, executing contracts for major components, commencing and completing construction, and beginning and conducting routine operation);
- B. No increment referred to above shall exceed nine (9) months;

- C. The User shall submit a progress report to the Executive Director no later than fourteen (14) days following each date in the schedule and the final date of compliance including, as a minimum, whether or not it complied with the increment of progress, the reason for any delay, and, if appropriate, the steps being taken by the User to return to the established schedule; and
- D. In no event shall more than nine (9) months elapse between such progress reports to the Executive Director.

6.3 Reports on Compliance with Categorical Pretreatment Standard Deadline

Both Existing Sources and New Sources must submit a report on whether compliance has been initially achieved. For Existing Sources, the report is due ninety (90) days after the date applicable categorical standards give as the final compliance date. For a new source, the report is due 90 days after starting to discharge to the POTW.

In both cases, the report must contain the information described in Sections 4.5(A)(3-6). For existing sources, it must also contain the compliance certification of 6.1(C)(3) and, if needed, the compliance schedule described in Section 6.1(C)(4). Users subject to equivalent mass or concentration limits, as allowed by Section 2.2, must include a reasonable measure of their long-term production rate. Other Users subject to standards based on a unit of production (or other measure of operation) must include their actual production during the sampling period. All compliance reports must be signed and certified in accordance with Section 6.14(A) of this Ordinance.

6.4 Periodic Compliance Reports

- A. The Executive Director may specify the necessary minimum sampling and reporting frequencies and include applicable requirements in permits issued by the [City or County]. Significant Industrial Users (SIUs), except those recognized as "middle tier" Users under Section 6.4(C), must:
 - 1. Report at least twice a year, in June and December unless otherwise specified;
 - 2. Report the flows and concentrations of regulated pollutants in all discharges subject to pretreatment standards;
 - 3. Report average and maximum daily flows for the reporting period and identify where flow estimates are used; and
 - 4. Include the documentation needed to show compliance with applicable BMPs, pollution prevention alternatives, maintenance, treatment, or record keeping requirements.
- B. The Executive Director may authorize a CIU to forego sampling of a pollutant

regulated by a categorical Standard when it is not present in raw wastewater provided:

1. The CIU submits a request for the waiver with their permit application or reapplication (see Section 4.5(A)(8));
2. The CIU analyzes a sample (or samples) representative of all wastewater from all processes before any treatment and includes all results with the request;
3. The CIU demonstrates through source water and untreated process water sample results that the pollutant never exceeds intake water levels. (Pollutants simply reduced by treatment to background levels are ineligible for the waiver.);
4. The CIU shows, where non-detectable sample results are returned in (2) or (3), that they used the method from 40 CFR Part 136 with the lowest detection level;
5. The duly authorized representative of the CIU signs the request using the certification statement of Section 6.14(A);
6. The CIU includes, in routine monitoring reports, the statement in Section 6.14(C), certifying that there has been no increase in the pollutant in its waste stream due to activities of the Industrial User; and
7. The CIU reports and immediately resumes the monitoring, which would otherwise have been required upon discovering that a waived pollutant is present or expected to be present based on changes to the User's operations

The Executive Director will document the reasons supporting the waiver in the Permit Fact Sheet, and keep any information submitted by the User and the fact sheet for three (3) years after the waiver expires. Monitoring waivers are valid after being incorporated in a User's permit. The waiver is in effect while the Permit is effective, up to five (5) years. The Executive Director may cancel a monitoring waiver at any time for cause.

- C. The Executive Director may reduce the minimum periodic compliance reporting frequency for CIU's from twice a year (Section 6.4(A)) to once a year where the CIU:
1. Discharges wastewater subject to categorical standards at a rate less than one gallon per every ten thousand (10,000) gallons of POTW design maximum monthly average flow capacity (per LOTT's NPDES permit). The CIU must measure their discharge using a continuous (or totalizing)

effluent flow meter. If the CIU discharges in batches, the Executive Director will determine eligibility by dividing total flows in all batches, which contain any proportion subject to categorical regulation by the number of days the CIU is in full operation in a given calendar month.

2. Discharges less than five thousand (5,000) gallons of wastewater subject to categorical standards on the maximum day (including batch dischargers).
 3. Discharges categorical wastewater with less than one pound of Biochemical Oxygen Demand per each ten thousand (10,000) pounds of POTW loading capacity. POTW loading capacity is the design maximum monthly average Biochemical Oxygen Demand loading capacity per LOTT's NPDES permit (or if not included in the permit, in approved Executive Director plans).
 4. Discharges less than 0.01 percent of the maximum allowable headworks loading for any pollutant regulated by both an applicable Categorical Standard and a local limit in Section 2.4 of this Ordinance.
 5. Has not been in Significant Noncompliance as defined in this Ordinance during the prior two (2) years.
 6. Has daily flow rates, production levels, or pollutant levels that are consistent enough the Executive Director believes will allow representative data at the decreasing reporting interval.
- D. Users must sign and certify all periodic compliance reports in accordance with Section 6.14(A) of this Ordinance.
- E. Users must take wastewater samples, which are representative of their range of discharge conditions and of any discharge not disclosed in their permit application. Users must properly operate, clean, and maintain sampling and flow metering facilities and devices and ensure they function properly. The Executive Director may not allow User claims that sampling results are unrepresentative due to a Users failure to meet this requirement.
- F. Users subject to the reporting requirements in this Section must report any additional monitoring, which might determine compliance with permit requirements. This includes any additional monitoring of regulated pollutant at their respective effluent monitoring locations using procedures prescribed in Section 6.11 of this Ordinance. In such cases, the results of this monitoring shall be included in periodic monitoring reports.
- G. Users that send electronic (digital) documents to the Executive Director to satisfy the requirements of this Section must meet all State and Federal electronic

signature requirements: electronic data shall be in the format required by the Executive Director. The Executive Director may also require reporting in both digital and traditional format.

6.5 Reports of Changed Conditions

Each User must notify the Executive Director of any significant changes to the User's operations or system, which might alter the nature, quality, or volume of its wastewater. This notification must be made at least thirty (30) days before the desired change and be sent to both the Control Authority (Executive Director) and the receiving POTW if they are different. In such cases:

- A. The Executive Director may require the User to submit whatever information is needed to evaluate the changed condition. The Executive Director may also require a new or revised wastewater discharge permit application under Section 4.5 of this Ordinance.
- B. The [City or County] may issue, reissue, or modify a wastewater discharge permit applying the procedures of Chapter 5 of this Ordinance in response to a User's notice under this Section.

6.6 Reports of Potential Problems

- A. Any User, which has any unusual discharge that could cause problems to the POTW must immediately notify the Executive Director by telephone of the incident. This notification shall include the location of the discharge, type of waste, concentration and volume, if known, and corrective actions taken by the User to control and curtail the discharge. Such discharges may include spills, slug loads, accidental discharges, or other discharges of a non-routine, episodic nature. Problems to the POTW, which require reporting under this Section include violating pretreatment prohibitions, treatment standards, or other requirements of Chapter 2 of this Ordinance such as vapor toxicity and explosivity limits.
- B. Within five (5) days following such discharge, the User shall submit a detailed written report describing the cause(s) of the discharge and the measures to be taken by the User to prevent similar future occurrences. Such notification shall not relieve the User of any expense, loss, damage, or other liability, which may be incurred as a result of damage to the POTW, natural resources, or any other damage to person or property; nor shall such notification relieve the User of any fines, penalties, or other liability, which may be imposed pursuant to this Ordinance.
- C. Regardless of whether the User has been required to submit a Slug Discharge Control Plan (per Section 3.3), all Users shall post notice in a prominent location advising employees who to call at the POTW to inform the Executive Director of

a potential problem discharge (Section 6.6(A)). Users shall ensure that all employees who may cause or witness such a discharge are advised of the emergency notification procedures.

- D. All Users must immediately notify the Executive Director of any changes at their facility, which might increase their potential for a slug discharge. This includes increasing the volume of materials stored or located on site, which, if discharged to the POTW, would cause problems. Users required to prepare a Slug Discharge Control Plan under Section 3.3 shall also modify their plans to include the new conditions prior to, or immediately after making such changes.

6.7 Reports from Unpermitted Users

All Users not required to obtain a wastewater discharge permit or general permit shall provide appropriate reports to the Executive Director as the Executive Director may require. This includes periodically completing and signing Industrial User Surveys.

6.8 Notice of Violation/Repeat Sampling and Reporting

If sampling performed by a User indicates a violation, the User must notify the Executive Director within twenty-four (24) hours of becoming aware of the violation. The User shall also repeat the sampling and analysis and submit the results of the repeat analysis to the Executive Director within thirty (30) days after becoming aware of the violation. The Executive Director may waive the repeat sampling requirement where the Executive Director has sampled the effluent for the pollutant in question prior to the User obtaining sampling results.

6.9 Notification of Discharge of Hazardous Waste

- A. Any User who discharges any substance, which, if otherwise disposed of, would be a hazardous waste under 40 CFR Part 261, or Chapter 173-303 WAC must also comply with the following requirements:
1. Notify the Executive Director, the USEPA Regional Waste Management Division Director, and State hazardous waste authorities, in writing, of the discharge. Maintain a copy of this notification and include it in all subsequent permit application or re-applications under this Chapter.
 2. Include the following information in the notification:
 - a. The name of the hazardous waste as found in 40 CFR Part 261;
 - b. The USEPA hazardous waste number; and
 - c. The type of discharge (continuous, batch, or other).

3. If the discharge totals more than two hundred and twenty (220) pound in any month, also provide:
 - a. The hazardous constituents contained in the wastes,
 - b. An estimate of the mass and concentration of hazardous constituents in the wastestream discharged during that calendar month, and
 - c. An estimate of the mass of constituents in the wastestream expected to be discharged during the following twelve (12) months.
 4. This notice shall be repeated for new or increased discharges of substances subject to this reporting requirement.
 5. All notifications must take place prior to discharging a substance for which these reporting requirements apply. If this is not possible, the notice must be provide as soon after discharge as practical and describe why prior notice was not possible.
 6. Users must provide notifications under this paragraph only once to USEPA and the State for each hazardous waste discharged. However, all of the information of these notices shall be repeated in each new permit application submitted under this Chapter.
 7. This requirement does not relieve the User from requirements to provide other notifications, such as of changed conditions under Section 6.5 of this Ordinance, or applicable permit conditions, permit application requirements, and prohibitions.
 8. The notification requirements in this Section do not apply to pollutants for which routine monitoring and reporting is required in a permit under this Ordinance.
- B. Users must report all discharges of more than thirty-three (33) pounds per month of substances, which, if otherwise disposed of, would be hazardous wastes. Users must also report any discharge of acutely hazardous wastes as specified in 40 CFR Parts 261.30(d) and 261.33(e). Subsequent months during which the User discharges more of a hazardous waste for which notice has already been provided do not require another notification to USEPA or the State, but must be reported to the Executive Director.
- C. If new regulations under RCRA describe additional hazardous characteristics or substances as a hazardous waste, the User must provide notifications under paragraphs A, if required by paragraph B within ninety (90) days of the effective date of such regulations.

- D. For any notification made under this Section, the User shall certify that it has a program in place to reduce the volume and toxicity of hazardous wastes generated to the degree it has determined to be economically practical and shall describe that program and reductions obtained through its implementation.
- E. This provision does not create a right to discharge any substance not otherwise permitted to be discharged by this Ordinance, a permit issued thereunder, or any applicable Federal or State law.

6.10 Analytical Requirements

All pollutant sampling and analyses required under this Ordinance shall conform to the most current version of 40 CFR Part 136, unless otherwise specified in an applicable categorical pretreatment standard. If 40 CFR Part 136 does not contain sampling or analytical techniques for a pollutant, or the Executive Director determines that the Part 136 sampling and analytical techniques are inconsistent with the goal of the sampling, the Executive Director may specify an analytical method. If neither case applies, Users shall use validated analytical methods or applicable sampling and analytical procedures approved by USEPA.

6.11 Sample Collection

Users must ensure all samples they collect to satisfy sampling requirements under this Ordinance are representative of the range of conditions occurring during the reporting period. Users must also ensure that, when specified, samples are collected during the specific period.

- A. Users must use properly cleaned sample containers appropriate for the sample analysis and sample collection and preservation protocols specified in 40 CFR Part 136 and appropriate USEPA guidance.
- B. Users must obtain samples for oil and grease, temperature, pH, cyanide, total phenols, sulfides, and volatile organic compounds using grab collection techniques.
- C. For certain pollutants, Users may composite multiple grab samples taken over a 24-hour period. Users may composite grab samples for cyanide, total phenols, and sulfides either in the laboratory or in the field, and may composite grab samples for volatile organics, and oil & grease in the laboratory prior to analysis.
- D. For all other pollutants, Users must employ 24-hour flow-proportional composite samplers unless the Executive Director authorizes or requires an alternative sample collection method.
- E. The Executive Director may authorize composite samples for parameters unaffected by the compositing procedures, as appropriate.

- F. The Executive Director may require grab samples either in lieu of or in addition to composite sampling to show compliance with instantaneous discharge limits.
- G. In all cases, Users must take care to ensure the samples are representative of their wastewater discharges.
- H. Users sampling to complete baseline monitoring and 90-day compliance reports required by Section 6.1 and 6.3, must satisfy some specific requirements. These reports require at least four (4) grab samples for pH, cyanide, total phenols, oil and grease, sulfide, and volatile organic compounds. Users may composite samples prior to analysis if allowed in 6.11.C. Where historical sampling data exists the Executive Director may also authorize fewer samples.
- I. For periodic monitoring reports (Section 6.4), the Executive Director may specify the number of grab samples necessary to assess and assure compliance with applicable pretreatment standards and requirements.

6.12 Date of Receipt of Reports

The Executive Director will credit written reports as having been submitted on the date of the post mark when mailed through the United States Postal Service. Reports delivered in any other manner will be credited as having been submitted on the business day received.

6.13 Record Keeping

Users subject to reporting requirements of this Ordinance shall retain the below records for all monitoring required by this Ordinance and for any additional monitoring, which could be used to satisfy minimum monitoring requirements. Users must make these records available for inspection and copying at the location of the discharge. Users must similarly maintain documentation associated with any Best Management Practices required under authority of Section 2.4(C). Monitoring records shall include at least:

- A. The time, date, and place of sampling;
- B. The sampling and preservation methods used;
- C. The person taking the sample, and persons with control of the sample prior to analysis;
- D. The person performing the analyses and the date the analysis was completed;
- E. The analytical techniques or methods used; and
- F. The results of analysis.

Users are encouraged to retain quality control and quality assurance information provided by the laboratory and submit this information in routine reporting. This information also has value in the event that the sample data is called into question. For analytes for which Washington State requires use of a certified/accredited laboratory, Users must maintain the scope of accreditation for laboratories performing any analyses for them.

Users shall maintain the above records for at least three (3) years, until any litigation concerning the User or the [City or County], or the Executive Director is complete, or for longer periods when the User has been specifically notified of a longer retention period by the Executive Director.

6.14 Certification Statements

A. The following certification statement must be signed by an authorized representative as defined by Section 1.4(C) and included when submitting:

1. A permit (re-)application in accordance with Section 4.7;
2. A Baseline Monitoring Report under Section 6.1(C)(5);
3. A report on compliance with the categorical pretreatment standard deadlines under Section 6.3;
4. A periodic compliance report required by Section 6.4(A-D); or
5. An initial request to forego sampling of a pollutant based on Section 6.4(B)(5).

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

B. Annual Certification for Non-Significant Categorical Industrial Users

A facility determined to be a Non-Significant Categorical Industrial User by the Executive Director pursuant to 1.4 (KK)(3) and 4.7 C must complete the below statement and submit it to the Executive Director annually. The statement must be signed by an authorized representative (Section 1.4(C)):

"Based on my inquiry of the person or persons directly responsible for managing compliance with the categorical Pretreatment Standards under 40 CFR _____, I certify that, to the best of my knowledge and belief that during the period from _____, _____ to _____, _____ [months, days, year]:

(a) The facility described as _____ [facility name] met the definition of a Non-Significant Categorical Industrial User as described in 1.4 FF (3) [40 CFR 403.3(v)(2)]; (b) the facility complied with all applicable Pretreatment Standards and requirements during this reporting period; and (c) the facility never discharged more than 100 gallons of total categorical wastewater on any given day during this reporting period.

This compliance certification is based upon the following information.

_____ "

C. Certification of Pollutants Not Present

Users that have an approved monitoring waiver based on Section 6.4(B) must also include the following certification statement in each report. This statement certifies that there has been no increase in the pollutant in its wastestream due to activities of the User:

"Based on my inquiry of the person or persons directly responsible for managing compliance with the Pretreatment Standard for 40 CFR _____ [specify applicable National Pretreatment Standard part(s)], I certify that, to the best of my knowledge and belief, there has been no increase in the level of _____ [list pollutant(s)] in the wastewaters due to the activities at the facility since filing of the last periodic report under Section 6.4.A."

SECTION 7 – COMPLIANCE MONITORING

7.1 Right of Entry: Inspection and Sampling

The Executive Director shall have the right to enter the premises of any User to determine whether the User is complying with all requirements of this Ordinance and any wastewater discharge permit or order issued hereunder. Users shall allow the Executive Director ready access to all parts of the premises for the purposes of inspection, sampling, records examination and copying, and the performance of any additional duties.

- A. Where a User has security measures in force, which require proper identification and clearance before entry into its premises, the User shall make necessary arrangements with its security guards so that, upon presentation of suitable identification, the Executive Director will be permitted to enter without delay for the purposes of performing specific responsibilities.
- B. The Executive Director shall have the right to set-up on the User's property, or require installation of, such devices as are necessary to conduct sampling and/or metering of the User's operations.
- C. Users shall provide full access to the Executive Director to use any monitoring facilities and utilities available or required in accordance with Section 3.1 and Section 3.2(E) and (F) to confirm that the standards or treatment required for discharge to the sewer are being met.
- D. Any temporary or permanent obstruction to safe and easy access to the facility to be inspected and/or sampled shall be promptly removed by the User at the written or verbal request of the Executive Director and shall not be replaced. The costs of clearing such access shall be born by the User.
- E. Any unreasonable delay in allowing the Executive Director full access to the User's premises and wastewater operations shall be a violation of this Ordinance.

7.2 Search Warrants

The [City or County], on behalf of the Executive Director, may seek issuance of a search warrant from the Superior Court of Thurston County. Such warrants may be secured when:

- A. The Executive Director has been refused access or is unable to locate a representative who can authorize access to a building, structure, or property, or any part thereof, and has probable cause that a violation of this Ordinance is occurring on the premises;
- B. The Executive Director has been denied access to inspect and/or sample as part

of a routine inspection and sampling program of the Executive Director designed to verify compliance with this Ordinance or any permit or order issued hereunder; or

- C. The Executive Director has cause to believe there is imminent endangerment of the overall public health, safety, and welfare of the community by an activity on the premises.

SECTION 8 – CONFIDENTIAL INFORMATION

Generally, information submitted to demonstrate compliance with pretreatment standards and requirements will be freely available to the public. To the extent such is consistent with State and Federal laws, Users may have certain information treated as confidential if the following process is followed.

- A. When a User submits information to the Executive Director or [City or County], or provides information to inspectors, Users may request that specific information be maintained as confidential. Users must promptly identify the specific information in writing, and describe why the release would divulge information, processes, or methods of production entitled to protection as trade secrets or confidential business information under applicable State or Federal laws.
- B. Dependent on the agency receiving the request, the Executive Director or the [City or County] shall review and approve or deny such requests. When approved, the information shall not be publicized by the [City or County] unless required by State or Federal law.
- C. All other information submitted to the Executive Director or the [City or County] and obtained from the Executive Director's or the [City or County]'s oversight shall be available to the public subject to the Executive Director or the [City or County] records review policy.
- D. Information held as confidential may not be withheld from governmental agencies for uses related to the NPDES program or pretreatment program, or in enforcement proceedings involving the person furnishing the report.
- E. Federal rules prevent wastewater constituents and characteristics and other effluent data, as defined by 40 CFR Part 2.302 from being recognized as confidential information.

SECTION 9 – PUBLICATION OF USERS IN SIGNIFICANT NONCOMPLIANCE

- A. **PUBLISHING:** The Executive Director must annually publish a list of the Users, which, at any time during the previous twelve (12) months, were in Significant Noncompliance with applicable pretreatment standards and requirements. The list will be published in a newspaper of general circulation that provides meaningful public notice within the jurisdictions served by the POTW.
- B. **DEFINITION:** The term Significant Noncompliance means:
1. Any violation of a pretreatment standard or requirement including numerical limits, narrative standards, and prohibitions, that the Executive Director determines has caused, alone or in combination with other discharges, Interference or Pass Through, including endangering the health of POTW personnel or the general public.
 2. Any discharge of a pollutant that has caused imminent endangerment to the public or to the environment, or has resulted in the Executive Director's or [City or County]'s exercise of its emergency authority to halt or prevent such a discharge.
 3. Any violation(s), including of Best Management Practices, which the Executive Director determines will adversely affect the operation or implementation of the local pretreatment program.
 4. Chronic violations of wastewater discharge limits, defined here as those in which sixty-six percent (66%) or more of all of the measurements taken for the same pollutant parameter taken during a rolling six (6) month period exceed, by any magnitude, a numeric pretreatment standard or requirement, including instantaneous limits of Section 2.
 5. Technical Review Criteria (TRC) violations, defined here as those in which thirty-three percent (33%) or more of wastewater measurements taken for each pollutant parameter during a rolling six (6) month period equal or exceed the product of the numeric pretreatment standard or requirement, (including instantaneous limits, as defined by Section 2), multiplied by the applicable criteria. Applicable criteria are 1.4 for Biochemical Oxygen Demand, Total Suspended Solids, fats, oils and greases, and 1.2 for all other pollutants except pH.
 6. Failure to meet, within ninety (90) days of the scheduled date, a compliance schedule milestone contained in a wastewater discharge permit or enforcement order for starting construction, completing construction, or attaining final compliance.
 7. Failure to provide any required report within forty-five (45) calendar days

after the due date. This includes initial and periodic monitoring reports, and reports on initial compliance and on meeting compliance schedules.

8. Failure to accurately report noncompliance.

C. **APPLICABILITY:** The criteria in Sections 9(B)(1-3) are applicable to all Users, whereas the criteria in Sections 9(B)(4-8) are only applicable to SIUs.

SECTION 10 – ADMINISTRATIVE ENFORCEMENT REMEDIES

In administering the LOTT Pretreatment Program, the Executive Director is obliged to follow the LOTT Pretreatment Program's approved procedures. In response to noncompliance with any requirement of this Ordinance, the Executive Director shall apply the LOTT Enforcement Response Plan, which is a part of these approved procedures. This plan ensures that the application of remedies provided for in Sections 10, 11, and 12 of this Ordinance is appropriate to the violation, and consistent with the treatment of other Users. Any person may review or obtain a copy (for a nominal charge) of the Enforcement Response Plan by contacting the Executive Director.

10.1 Notification of Violation

The [City or County] may serve a written Notice of Violation on any User that the [City or County] and/or the Executive Director finds has violated any provision of this Ordinance, including terms or requirements of a permit, order, or a pretreatment standard or requirement. In all cases in this Ordinance, a continuation of a violation of a provision of this Ordinance is a "violation." Users shall, in response to a Notice of Violation, provide the [City or County] a written explanation of the violation, its cause, and a corrective action plan within thirty (30) days of the receiving this notice. Users submitting plans to correct noncompliance must include the specific actions they will take to correct ongoing and prevent future violations at the soonest practicable date. The [City or County]'s acceptance of a plan does not relieve a User of liability for any violations. The [City or County] may also take any action, including emergency actions or any other enforcement action, without first issuing a Notice of Violation.

10.2 Consent Orders

The [City or County] may enter into a Consent Order or other voluntary agreement to memorialize agreements with Users violating any requirement of this Ordinance after consultation with the Executive Director. Such agreements must include the specific action(s) required and date(s) they are to be completed to correct the noncompliance. Such documents must be constructed in a judicially enforceable manner, and have the same force and effect as administrative orders issued pursuant to Sections 10.4 and 10.5 of this Ordinance.

10.3 Show Cause Hearing

After consultation with the Executive Director, the [City or County] may propose actions in response to a violation of any provision of this Ordinance, including a provision of a permit, order, or a pretreatment standard or requirement. The [City or County] will notify the User of the violation, the proposed action, the rationale, and the Users rights and obligations to provide evidence why the proposed enforcement action should not be taken, and to provide its support for any alternative it proposes at this meeting. A User shall have the right to a show cause hearing to contest the [City or County]'s action provided for by this Ordinance or determination that the User has violated a compliance

schedule order.

Any hearing pursuant to this Section must be requested by the User in writing within fifteen (15) business days after the User receives notice of the [City or County]'s proposed action. The User's written request for hearing shall be filed with the Executive Director.

The hearing authorized by this Section shall be held before the LOTT Technical Sub-Committee (TSC). Formal rules of evidence shall not apply, but the User and the [City or County] shall have the right to present witnesses and other evidence. The TSC shall issue a written decision within fourteen (14) business days of the conclusion of the hearing.

Any User shall have the right to make an electronic or stenographic record of the proceedings. Such record shall be made at the User's expense.

The TSC may by resolution or ordinance adopt additional rules for the conduct of hearings pursuant to this Section.

A show cause hearing shall not be a bar against, or prerequisite for, taking any other action against the User.

10.4 Compliance Orders

The [City or County], after consulting with the Executive Director, may issue a compliance order to any User, which has violated any provision of this Ordinance including a requirement of a permit, order, or a pretreatment standard or requirement. The compliance order may direct that the User come into compliance within a specified time, install and properly operate adequate treatment facilities or devices, or take such measures as the [City or County] or Executive Director finds are reasonably necessary. These measures may include additional self-monitoring and management practices designed to minimize the amount of pollutants discharged to the sewer. A compliance order may not extend the deadline for compliance established for a pretreatment standard or requirement, or relieve a User of liability for any violation, including a continuing violation. If the User does not come into compliance within the time provided, sewer service may be discontinued. Issuance of a compliance order shall not be a bar against, or a prerequisite for, taking any other action against the User.

10.5 Cease and Desist Orders

When [City or County] and/or Executive Director finds that a User has violated, or continues to violate, any provision of this Ordinance, a wastewater discharge permit or order issued hereunder, or any other pretreatment standard or requirement, or that the User's past violations are likely to recur, the [City or County] may, after consultation with the Executive Director, issue an order to the User directing it to cease and desist all such violations and directing the User to:

- A. Immediately comply with all requirements; and
- B. Take such appropriate remedial or preventive action as may be needed to properly address a continuing or threatened violation, including halting operations and/or terminating the discharge. Issuance of a cease and desist order shall not be a bar against, or a prerequisite for, taking any other action against the User.

10.6 Administrative Fines

- A. When the [City or County] finds that a User has violated, or continues to violate, any provision of this Ordinance, a wastewater discharge permit or order issued hereunder, or any other pretreatment standard or requirement, the [City or County] may, after consultation with the Executive Director, fine such User in an amount not to exceed ten thousand dollars (\$10,000). Such fines shall be assessed on a per violation, per day basis. In the case of monthly or other long-term average discharge limits, fines shall be assessed for each day during the period of violation.
- B. The [City or County] may add the costs of any emergency response, additional monitoring, investigation, and administrative costs related to the noncompliance and the [City or County]'s response to the situation, to the amount of the fine.
- C. The [City or County] will consider the economic benefit gained by a User as a result of the noncompliance in cases where there appears to have been a monetary benefit from not complying. In such cases, the [City or County] shall ensure that fines, to the maximum amounts allowable, exceed the benefit to the User from the noncompliance.
- D. Unpaid charges, fines, and penalties shall, at thirty (30) calendar days past the due date, be assessed an additional penalty of one percent (1%) of the unpaid balance, and interest shall accrue thereafter at a rate of one percent (1%) per month, or at the rate allowed by law if different from the foregoing. After thirty (30) days, the [City or County] shall be authorized to file a lien against the User's property for unpaid charges, fines, and penalties.
- E. Users desiring to dispute such fines must file a written request for the [City or County] to reconsider the fine along with full payment of the fine amount within fifteen (15) working days of being notified of the fine. Where a request has merit as determined by the [City or County] and Executive Director, the [City or County] may convene a hearing on the matter pursuant to Section 10.3 of this Ordinance. In the event the User's appeal is successful, the [City or County] shall rebate the difference between the initial and final penalty amounts to the User.
- F. Issuance of an administrative fine shall not be a bar against, or a prerequisite for, taking any other action against the User.

10.7 Emergency Suspensions

The [City or County] may immediately suspend a User's discharge (or threatened discharge) when it reasonably appears to present a substantial danger to the health or welfare of persons. In such cases, the [City or County] will first provide informal notice to the User. The [City or County] may also immediately suspend a User's discharge, after notice and opportunity to respond, that threatens to interfere with the operation of the POTW, or which presents, or may present, a danger to the environment.

- A. Any User notified of a suspension of its discharge shall immediately stop or eliminate its contribution. If a User fails to immediately comply voluntarily with the suspension order, the [City or County] may take such steps as deemed necessary to protect the public and its interest in the sewer system. Remedies available to the [City or County] include immediately severing the sewer connection, at the User's expense, turning off pump stations downstream of the User, and partnering with law enforcement. The [City or County] may not allow the User to recommence its discharge until the User has demonstrated to the satisfaction of the [City or County] that the situation warranting the suspension has been properly addressed and any proposed Termination proceeding has been resolved.
- B. A User that is responsible, in whole or in part, for any discharge presenting imminent endangerment shall submit a detailed written statement, describing the causes of the harmful contribution and the measures taken to prevent any future occurrence. Users shall submit this report to the [City or County] prior to the date of any show cause or termination hearing under Sections 10.3 and 10.8 of this Ordinance.

Nothing in this Section shall be interpreted as requiring a hearing prior to any Emergency Suspension under this Section.

10.8 Termination of Discharge

Any User who violates the following conditions is subject to having the privilege of discharging to the public sewer system withdrawn:

- A. Discharge of non-domestic wastewater without a permit, including
 - 1. Where the appropriate permit has not been requested;
 - 2. Where the appropriate permit has not yet been issued; or
 - 3. Where the permit has been denied or revoked based on the provisions of Section 5.6 (Permit Revocation) of this Ordinance.

- B. Violation of permit terms and conditions including:
 - 1. Exceeding any permit limit;
 - 2. Failing to meet other pretreatment standards or requirements;
 - 3. Violating any prohibition; or
 - 4. Failing to properly monitor and report discharges or changed conditions.
- C. Refusal of reasonable access to the User's premises for the purpose of inspection, monitoring, or sampling (whether subject to a permit or not).
- D. Violation of the pretreatment standards and requirements in Section 2 of this Ordinance, including failure to satisfy Industrial User Survey requirements.

When the [City or County] determines this remedy is necessary and appropriate to fulfill the intentions of this Ordinance, and after consulting with the Executive Director, such User will be notified of the proposed termination of its discharge and be offered an opportunity to show cause under Section 10.3 of this Ordinance why the proposed action should not be taken. Exercise of this option by the [City or County] shall not be a bar to, or a prerequisite for, taking any other action against the User.

SECTION 11 – JUDICIAL ENFORCEMENT REMEDIES

11.1 Injunctive Relief

The [City or County] may seek injunctive relief when a User has violated, or continues to violate a provision of this Ordinance, including a pretreatment standard or requirement, or a permit or order issued hereunder. In such cases, the [City or County] may petition the Superior Court of Thurston County through the [City or County]'s Attorney for the issuance of a temporary or permanent injunction, as appropriate, which restrains or compels the specific performance of the wastewater discharge permit, order, or other requirement imposed by this Ordinance on activities of the User. The [City or County] may also seek such other action as is appropriate for legal and/or equitable relief, including a requirement for the User to conduct environmental remediation. A petition for injunctive relief shall not be a bar against, or a prerequisite for, taking any other action against a User.

11.2 Civil Penalties

- A. A User, which has violated, or continues to violate a provision of this Ordinance, including a pretreatment standard or requirement, or a permit or order issued hereunder shall be liable to the [City or County] for a maximum civil penalty of ten thousand dollars (\$10,000) per violation, per day. In the case of a monthly or other long-term average discharge limit, penalties shall accrue for each day during the period of the violation.
- B. The [City or County] may recover reasonable attorneys' fees, court costs, and other expenses associated with any emergency response, enforcement activities, additional monitoring and oversight, and costs of any actual damages to the [City or County] or LOTT.
- C. Filing a suit for civil penalties shall not be a bar against, or a prerequisite for, any other action the [City or County] may take to resolve noncompliance by a User.

11.3 Criminal Prosecution

- A. A User who willfully or negligently violates any provision of this Ordinance, a wastewater discharge permit, or order issued hereunder, or any other pretreatment standard or requirement shall, upon conviction, be guilty of a misdemeanor, punishable by a fine of not more than ten thousand dollars (\$10,000) per violation, per day, or imprisonment for not more than one (1) year, or both.
- B. A User who negligently introduces any substance into the POTW, which causes personal injury or property damage shall, upon conviction, be guilty of a misdemeanor. A User who willfully introduces any substance into the POTW, which causes personal injury or property damage shall, upon conviction, be guilty

of a gross misdemeanor. A User who is convicted will also be subject to prosecution for violation of any other laws, which may be applicable.

- C. A User who knowingly makes any false statements, representations, or certifications in any application, record, report, plan, or other documentation filed, or required to be maintained, pursuant to this Ordinance, wastewater discharge permit, or order issued hereunder, or who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required under this Ordinance shall, upon conviction, be punished by a fine of not more than ten thousand dollars (\$10,000) per violation, per day, or imprisonment for not more than one (1) year, or both.
- D. In the event of a second conviction, a User shall be punished by a fine of not more than ten thousand dollars (\$10,000) per violation, per day, or imprisonment for not more than one (1) year, or both.

11.4 Remedies Nonexclusive

The remedies provided for in this Ordinance are not exclusive. The [City or County] may take any, all, or any combination of these actions against a noncompliant User. Enforcement of pretreatment violations will generally be in accordance with LOTT's Enforcement Response Plan. However, the [City or County] may take other action against any User when the circumstances warrant. Further, the [City or County] is empowered to take more than one enforcement action against any noncompliant User.

SECTION 12 – SUPPLEMENTAL ENFORCEMENT ACTION

12.1 Penalties for Late Reports

The [City or County] may assess a penalty of up to fifty dollars (\$50) to any User for each day that a report required by this Ordinance, a permit, or order issued hereunder is late. Penalties accrue beginning the fifth (5th) day after the report is due. The [City or County]'s actions to collect late reporting penalties shall not limit the [City or County]'s authority to initiate any other enforcement action.

12.2 Performance Bonds

The [City or County] may require a satisfactory bond, payable to the [City or County], in a sum not to exceed a value determined by the [City or County] and Executive Director as necessary to assure the User will achieve consistent compliance with this Ordinance. The Executive Director may require this bond as an enforcement response or as a prerequisite to issue or reissue a wastewater discharge permit. Any User who has failed to comply with any provision of this Ordinance, a previous permit or order issued hereunder, or any other pretreatment standard or requirement may be subject to this requirement. This bond may also be required of any category of User, which has led to public burdens in the past regardless of the compliance history of the particular User. The [City or County] may use this bond to pay any fees, costs, or penalties assessed to the User whenever the Users account is in arrears for over thirty (30) days. This includes the costs of cleanup of the site if the User goes out of business, sells the business to a person that does not first assume the bond, or goes bankrupt. Users may petition the [City or County] to convert their performance bond to a requirement to provide Liability Insurance, or to forego any such safeguard based on their performance. User may petition no more frequently than once in any twelve (12) month period.

12.3 Liability Insurance

The [City or County] may require any User to provide liability insurance at its discretion. In such cases, Users must provide proof that the insurance is sufficient to cover any liabilities incurred under this Ordinance, including the cost of damages to the POTW and the environment caused by the User. The [City or County] may require Users to provide the proof of such insurance prior to issuing or reissuing a wastewater discharge permit.

12.4 Payment of Outstanding Fees and Penalties

The [City or County] may decline to issue or reissue a wastewater discharge permit to any User who has failed to pay any outstanding fees, fines, or penalties incurred as a result of any provision of this Ordinance, a previous permit or order issued hereunder.

12.5 Water Supply Severance

The [City or County] may order water service to a User severed whenever a User has violated or continues to violate any provision of this Ordinance, a permit, or order issued hereunder, or any other pretreatment standard or requirement. Users wishing to restore their service must first demonstrate their ability to comply with this Ordinance and pay the related costs of this action.

12.6 Public Nuisances

A violation of any provision of this Ordinance or a permit or order issued hereunder, or any other pretreatment standard or requirement, is hereby declared a public nuisance and shall be corrected or abated as directed by the [City or County]. Any person creating a public nuisance shall be subject to the provisions of [City or County] [Municipal Code or County Code] governing such nuisances, including reimbursing the [City or County] for any costs incurred in removing, abating, or remedying said nuisance.

12.7 Informant Rewards

The [City or County] or LOTT may pay up to one thousand dollars (\$1,000) for information leading to the discovery of noncompliance by a User. In the event that the information provided results in a civil penalty or an administrative fine levied against the User, the [City or County] or LOTT may disperse up to ten percent (10%) of the collected fine or penalty to the informant. However, a single reward payment may not exceed one thousand dollars (\$1,000).

12.8 Contractor Listing

At the [City or County]'s or LOTT's discretion, Users, which have not achieved compliance with applicable pretreatment standards and requirements may be made ineligible to receive a contractual award for the sale of goods or services to the [City or County] or LOTT. Existing contracts for the sale of goods or services to the [City or County] or LOTT held by a User found to be in significant noncompliance with pretreatment standards or requirements may be terminated at the discretion of the [City or County] or LOTT.

SECTION 13 – AFFIRMATIVE DEFENSES TO DISCHARGE VIOLATIONS

13.1 Upset

- A. For the purposes of this Section, the word "upset" means an exceptional incident in which there is unintentional and temporary noncompliance with categorical pretreatment standards because of factors beyond the reasonable control of the User. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.
- B. An upset shall constitute an affirmative defense to punitive actions in response to noncompliance with categorical pretreatment standards (Section 2.2), but not local limits (Section 2.4) when the requirements of Section 13.1(C) must be met.
- C. A User who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:
 - 1. An upset occurred and the User can identify the cause(s) of the upset.
 - 2. The facility was at the time being operated in a prudent and workman-like manner and was in compliance with applicable operation and maintenance procedures.
 - 3. Where the upset involved reduction, loss, or failure of its treatment facility (i.e. a power failure), the User controlled production of all discharges to the extent necessary to maintain compliance with categorical pretreatment standards until the facility was restored or an alternative method of treatment was provided.
 - 4. The User submitted the following information to the Executive Director within twenty-four (24) hours of becoming aware of the upset. When initially provided orally, the User must have provided a written report within five (5) days that includes:
 - a. A description of the indirect discharge and cause of noncompliance;
 - b. The period of noncompliance, including exact dates and times or, if not corrected, the anticipated time the noncompliance is expected to continue; and
 - c. Steps being taken and/or planned to reduce, eliminate, and prevent recurrence of the noncompliance.
- D. In any enforcement proceeding, the User seeking to establish the occurrence of

an upset shall have the burden of proof.

- E. Users will have the opportunity for a judicial determination on any claim of upset only in an enforcement action brought for noncompliance with categorical pretreatment standards.

13.2 Prohibited Discharge Standards

A User will have an affirmative defense to an enforcement action brought against it for noncompliance with the prohibitions in Section 2.1(A) and (B)(3-7) of this Ordinance in certain cases, pursuant to 40 CFR Part 403.5(a)(2). The User must be able to prove that it did not know, or have reason to know, that its discharge, alone or in conjunction with discharges from other sources, would cause Pass Through or Interference and that either:

- A. A local limit exists for each pollutant discharged and the User was in compliance with each limit directly prior to, and during, the Pass Through or Interference; or
- B. No local limit exists, but the discharge did not change substantially in nature or constituents from the User's prior discharge when LOTT was regularly in compliance with its NPDES permit, and in the case of Interference, was in compliance with applicable sludge use or disposal requirements.

13.3 Bypass

- A. For the purposes of this Section:
 - 1. Bypass means the intentional diversion of wastestreams from any portion of a User's treatment facility.
 - 2. Severe property damage means substantial physical damage to property, damage to the treatment facilities, which causes them to become inoperable, or substantial and permanent loss of natural resources, which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.
- B. A User may allow a bypass to occur if it does not cause pretreatment standards or requirements to be violated and is for essential maintenance to assure efficient operation.
- C. Any other bypass must meet the following requirements:
 - 1. Users knowing in advance of the need for a bypass must submit prior notice to the Executive Director, at least ten (10) days before the bypass wherever possible; and

2. Users must tell the Executive Director of any unanticipated bypass that exceeds applicable pretreatment standards within twenty-four (24) hours of becoming aware of the bypass. Users must provide a written follow-up report within five (5) days. The Executive Director may waive the written report if the oral report was timely and complete. Unless waived, the written report must contain:
 - a. A description of the bypass (volume, pollutants, etc.);
 - b. What caused the bypass;
 - c. When, specifically, the bypass started and ended;
 - d. When the bypass is expected to stop (if ongoing); and
 - e. What steps the User has taken or plans to take to reduce, eliminate, and prevent the bypass from reoccurring.
- D. Bypass is prohibited, and the [City or County] may take an enforcement action against a User for a bypass, unless:
 1. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;
 2. There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass, which occurred during normal periods of equipment downtime or preventive maintenance; and
 3. The User submitted notices as required under Section 13.3(C).
- E. The Executive Director may approve an anticipated bypass, after considering its adverse effects, if the Executive Director determines that it will meet the three (3) conditions listed in Section 13.3(D).

SECTION 14 – WASTEWATER TREATMENT SURCHARGES AND PERMIT FEES

14.1 Excess Strength Charges

For industrial waste or other discharges exceeding the biochemical oxygen demand (BOD), total suspended solids (TSS), or total ammonia (TA) limits defined in Section 2.4(E) of this Ordinance, the following formula shall be used to determine the equivalent residential units (ERU) equivalency of the waste flow. The Executive Director may determine that all or part of a User's industrial waste or other discharge exceeding the limits defined in Section 2.4(E) results in a net benefit to the operation of the POTW, and may grant exemptions to the User from some or all of the resulting surcharges.

This formula applies only to BOD and/or TSS concentrations in excess of 300 mg/L and total ammonia in excess of 60 mg/L.

A. ERU Equivalent for High Strength Waste shall be the sum of the following:

1. Flow Calculation:

$$(P\text{-FLOW}) \times \frac{\text{Industry flow (cu ft/ month)}}{900 \text{ cu. ft. /ERU}} = \text{FLOW ERUs}$$

2. Biochemical Oxygen Demand Calculation:

$$(P\text{-BOD}) \times \frac{\text{Industry BOD (mg/L)}}{300 \text{ mg/L}} \times \frac{\text{Industry Flow (cu ft/month)}}{900 \text{ cu ft/ERU}} = \text{BOD ERUs}$$

3. Total Suspended Solids Calculation:

$$(P\text{-TSS}) \times \frac{\text{Industry TSS (mg/L)}}{300 \text{ mg/L}} \times \frac{\text{Industry Flow (cu ft/month)}}{900 \text{ cu ft/ERU}} = \text{TSS ERUs}$$

4. Total Ammonia Calculation:

$$(P\text{-TA}) \times \frac{\text{Industry TA (mg/L)}}{60 \text{ mg/L}} \times \frac{\text{Industry Flow (cu ft/month)}}{900 \text{ cu ft/ERU}} = \text{TA ERUs}$$

B. Explanation of terms

1. (P-FLOW) = Percentage treatment costs associated with hydraulic flow, equal to twenty-nine percent (29%)
2. (P-BOD) = Percentage treatment costs associated with biochemical oxygen demand, equal to thirty-four percent (34%)
3. (P-TSS) = Percentage treatment costs associated with total suspended

solids, equal to twenty-two percent (22%)

4. (P-TA) = Percentage treatment costs associated with total ammonia, equal to fifteen percent (15%)
5. ERU: (Equivalent Residential Unit) = to 900 cubic feet of wastewater containing a maximum of 300 mg/L of total suspended solids, a maximum of 300 mg/L of biochemical oxygen demand, and a maximum of 60 mg/L of total ammonia.
6. The percentage of treatment costs used in items Sections 14.1(B)(1)–(4) are calculated based on an average of documented treatment costs.
7. All monthly charges per ERU established by the "Interlocal Cooperation Act Agreement for Wastewater Management by the LOTT Wastewater Alliance by and among City of Lacey, City of Olympia, City of Tumwater, and Thurston County, dated November 5, 1999," as amended, shall apply to ERU's calculated by the preceding formulas.

14.2. Discharge Permit Fees

Annual discharge permit fees shall be levied on each Significant Industrial User (SIU) and each Minor Industrial User (MIU) based on three criteria: (1) permitted flow rate; (2) permit complexity; and (3) potential danger to the collection system or POTW. Each permitted User will be evaluated annually by the Executive Director and placed in one of three categories; with Category III having the highest combination of flow, complexity, and risk. The Executive Director shall use the Permit Fee Category Criteria set forth in the following table.

PERMIT FEE CATEGORY CRITERIA

CRITERION	RANGE	DESCRIPTION	SCORE
Flow	High	>25,000 gpd	3
	Medium	1,000 – 25,000 gpd	2
	Low	<1,000 gpd	1
Complexity	High	Categorical SIU	3
	Medium	Non-Categorical SIU	2
	Low	MIU	1
Potential Danger	High	Excess Strength Discharge, High Spill Potential, Large Quantity Of Toxic Materials, High Flows	3
	Medium	All Others	2
	Low	Low Spill Potential, No Excess Strength, Low Or No Toxics On Site, Low Flows	1

The total scores for all criteria determines the permit category and fee according to the following table.

PERMIT FEES
2005 BASE YEAR

SCORE	CATEGORY	FEE
3-4	I	\$240
5-7	II	\$360
8-9	III	\$480

These fees shall be adjusted each calendar year for inflation by an amount equal to ninety (90) percent of the change in the Seattle-Tacoma-Bremerton area Consumer Price Index for Urban Wage and Clerical Workers (CPI-W), as published by the United States Department of Commerce Bureau of Labor Statistics, for the preceding twelve (12) month period. These discharge permit fees are in addition to the excess strength charges required in this Section, and shall be collected by the [City or County] and remitted to the LOTT Fund prior to the end of the calendar month following collection. To encourage reduction in the use of water and generation of wastewater, the annual discharge permit fee will be waived for any permitted User that achieves zero industrial wastewater discharge to LOTT in the prior calendar year.

SECTION 15 – MISCELLANEOUS PROVISIONS

15.1 Pretreatment Charges and Fees

The [City or County] or LOTT may adopt reasonable fees for reimbursement of costs of operating LOTT's Pretreatment Program, which may include:

- A. Fees for wastewater discharge permit applications including the cost of processing such applications;
- B. Fees for monitoring, inspection, and surveillance procedures including the cost of collection and analyzing a User's discharge, and reviewing monitoring reports submitted by Users;
- C. Fees for reviewing and responding to accidental discharge procedures and construction;
- D. Fees for filing appeals;
- E. Fees to recover administrative and legal costs (not included in Section 15.1(B)) associated with the enforcement activity taken by the [City or County] to address User noncompliance; and
- F. Other fees as the [City or County] or LOTT may deem necessary to carry out the requirements contained herein. These fees relate solely to the matters covered by this Ordinance and are separate from all other fees, fines, and penalties chargeable by the [City or County] or LOTT.

15.2 Severability

If any provision, paragraph, word, section or article of this Ordinance is invalidated by any court of competent jurisdiction, the remaining provisions, paragraphs, words, sections, and chapters shall not be affected and shall continue in full force and effect.

15.3 Conflict

All other previously issued Ordinances and parts of other Ordinances inconsistent or conflicting with any part of this Ordinance are hereby repealed to the extent of such inconsistency or conflict.

SECTION 16 – EFFECTIVE DATE

This Ordinance shall be in full force and effect immediately following its passage, approval, and publication, as provided by law.

Z. PERMITTEE - A Person or Industrial User issued a wastewater discharge permit.

AA. PERSON - Any individual, partnership, co-partnership, firm, company, corporation, association, joint stock company, trust, estate, governmental entity, or any other legal entity; or their legal representatives, agents, or assigns. This definition includes all Federal, State, or local governmental entities.

BB. PLANT MANAGER shall mean the Manager of the regional Publicly Owned Treatment Works (POTW) facilities as described and built pursuant to the "Intergovernmental Contract for Wastewater Facilities Management" of November, 1976, and successor agreements, designated by the Participant as the person responsible determining Industrial User compliance with applicable pretreatment standards and requirements set forth in this ordinance, or that person's duly authorized representatives.

CC. POLLUTANT - Any substance discharged into the POTW which if discharged directly would alter the chemical, physical, biological, or radiological integrity of the water of the state. This includes, but is not limited to the priority pollutant list listed in 40 CFR Part 403.

DD. POTW shall mean the system of conduits, pumps, treatment plants, structures and properties, including without limitation all properties, interests, physical and intangible rights of every kind or nature owned or held by the Participant and all appurtenances thereto, however acquired, insofar as they relate to or concern drainage, transportation, storage, or treatment, in any manner whatsoever, of waste matter or storm and surface water of any nature now or hereafter permitted by this chapter to enter the POTW which is tributary to treatment facilities described in or built pursuant to the Intergovernmental Contract for Wastewater Facilities Management of November, 1976, and successor agreements. Sanitary Sewers and Storm Drains, separately and in combination, are, without limitation, included in the POTW.

EE. PREMISES shall be defined as a continuous tract of land, building, or group of adjacent buildings under a single control with respect to use of water and responsibility for payment therefore. Subdivision of such use or responsibility shall constitute a division into separate premises as herein defined, except where more than one dwelling is being served through the same water meter, in which case, each of said dwellings shall constitute a separate premises and shall be subject to the same separate charges as if separate single-family dwellings.

FF. PRETREATMENT - The reduction of the amount of pollutants, the elimination of pollutants, or the alteration of the nature of pollutant

properties in waste water to a less harmful state, prior to or in lieu of discharging or otherwise introducing such pollutants to the POTW in order to be consistent with the discharge requirements of this Ordinance. This reduction or alteration can be obtained by physical, chemical, or biological processes; by process changes; or by other means except by diluting the concentration of the pollutants unless specifically allowed by an applicable pretreatment standard.

GG. PRETREATMENT REQUIREMENT(S) - Any substantive or procedural requirement related to pretreatment imposed on a user, other than a pretreatment standard. Pretreatment requirements shall include, but not be limited to all permit requirements, reporting requirements, and other requirements specified by the Plant Manager as necessary to comply with the provisions of this ordinance.

HH. PRIORITY POLLUTANT - Any of the substances so designated by the Washington State Department of Ecology or the United States Environmental Protection Administration such as the Priority Pollutants listed in 40 CFR Part 403.

II. SANITARY SEWERS shall mean only those portions of the POTW which are designated by the Participant to carry, treat or dispose of waste matter not constituting storm or surface water permitted by or under this ordinance to enter the POTW.

JJ. SIGNIFICANT INDUSTRIAL USER (SIU) - Any industrial user of the POTW who:

1. Is subject to categorical pretreatment standards; or
2. Has a process wastewater flow of 25,000 gallons or more per average work day; or
3. Has a discharge flow greater than 5 percent or more of the average dry weather hydraulic or organic capacity of the treatment plant; or
4. Is designated as such by the Plant Manager on the basis that it has a reasonable potential, either singly or in combination with other contributing industries, for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement;
5. Upon a finding that a user meeting the criteria in Subsections 2-4 has no reasonable potential for adversely affecting the POTW's operation or for violating any applicable pretreatment standard or requirement, the Plant Manager may at any time, on his own

initiative or in response to a petition received from a user, and in accordance with procedures in 40 CFR 403.8(f)(6) determine that such user should not be considered a significant industrial user.

KK. SLUGLOAD shall mean any discharge of a non-routine, episodic nature including, but not limited to an accidental spill or non-customary batch discharge.

LL. STANDARD INDUSTRIAL CLASSIFICATION (SIC) CODE - A classification pursuant to the "Standard Industrial Classification Manual" issued by the United States Office of Management and Budget.

MM. STORM DRAINS shall mean only those collection and conveyance systems which do, or are designated by the Participant to; detain or retain, carry or dispose of storm and surface water and such other waters as are not required by or under this ordinance or other applicable law to be disposed of through sanitary sewers, in accordance with the provisions hereinafter set forth. Storm drains shall, without limitation, include all properties, interests, and rights of the Participant insofar as they relate to or concern storm or surface water sewerage, whether natural or constructed, in and to the drainage or storage, or both, of storm or surface waters, or both, including without limitation through, under or over lands, landforms, watercourses, sloughs, streams, ponds, lakes, and swamps.

NN. STORM WATER - Any flow occurring during or following any form of natural precipitation, and resulting from such precipitation, including snowmelt.

OO. TOTAL SUSPENDED SOLIDS (TSS) shall mean the total matter suspended in water removable by laboratory filtration using standard method 2540 D or equivalent, and expressed in mg/l.

PP. TOXIC POLLUTANT shall mean those pollutants, or combination of pollutants, including disease-causing agents, which after discharge and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will, on the basis of information available to the Plant Manager, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions in reproduction), or physical deformations, in such organisms or their offspring, including those listed as toxic in regulations promulgated by the U.S.EPA.

QQ. TREATMENT PLANT EFFLUENT - Discharge from the POTW into waters of the United States.

RR. UPSET shall mean an exceptional incident in which a user unintentionally and temporarily is in a state of noncompliance with the applicable pretreatment standards due to factors beyond the reasonable control of the user, and excluding noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or careless or improper operation thereof.

SS. USER (INDUSTRIAL USER- IU) shall mean any Person with a source of discharge which does not qualify that person as a Domestic User who discharges an effluent into the POTW by means of pipes, conduits, pumping stations, force mains, tank trucks, constructed drainage ditches, intercepting ditches, and all constructed devices and appliances appurtenant thereto.

TT. WASTEWATER - Industrial waste, sewage, treated or untreated waters, or any other waste including that which may be combined with any ground water, surface water or storm water, that may be discharged to the POTW.

UU. WASTEWATER DISCHARGE PERMIT (INDUSTRIAL WASTEWATER DISCHARGE PERMIT, OR DISCHARGE PERMIT) - An authorization or equivalent control document issued by the Participant to users discharging wastewater to the POTW. The permit may contain appropriate pretreatment standards and requirements as set forth in this ordinance.

3. PROHIBITED DISCHARGE STANDARDS.

General Prohibitions:

No user shall introduce or cause to be introduced into the POTW any pollutant or wastewater which causes pass through or interference. These general prohibitions apply to all users of the POTW whether or not they are subject to categorical pretreatment standards or any other National, State, or local pretreatment standards or requirements.

Specific Prohibitions:

No person, business, industry or entity shall discharge or permit or cause the discharge of waste or wastewater of any kind or nature into the POTW with any of the following properties:

A. Any liquids, solids or gases which by reason of their nature or quantity are, or may be, sufficient either alone or by interaction to cause fire or

explosion, or which have closed-cup flash point of less than 140 degrees F (60 degrees C), or be injurious in any other way to the operation of the POTW. At no time shall two successive readings on a combustible gas meter, at the point of discharge into the system, (or at any point in the system) be more than five percent (5%) or any single reading over ten percent (10%) of the Lower Explosive Limit (LEL) of the meter.

B. Solid or viscous substances which will or may cause obstruction to the flow in a sewer or other interference with the operation of the POTW, including but not limited to, any garbage or putrescible material that has not been properly comminuted to one-fourth inch or less in any direction. Waste from garbage grinders shall not be discharged into the POTW except wastes generated in preparation of food normally consumed on the premises. Such grinders must shred the waste to such a degree that all particles are comminuted to one fourth inch or less in any direction and are carried freely under normal flow conditions prevailing in sanitary sewers. Garbage grinders shall be connected to an approved grease trap. No discharge permitted by this section may contain plastic, paper products, or inert material.

C. Any wastewater having a pH of less than 6 or greater than 9 or having any other corrosive property capable of causing damage or hazard to structures, equipment, or personnel of the system.

D. Any wastewater having a fat waste, oil, or grease (FOG) content, whether or not emulsified, in excess of fifty (50) milligrams per liter; or any substance which may solidify or become discernibly viscous at temperatures above zero degrees Centigrade (32 degrees F.) This restriction applies to non-biodegradable cutting oil, or products of mineral origin. FOG is defined as the combined total of vegetable, animal, and petroleum based fats, oils, and greases.

E. Any wastewater containing any pollutant, including oxygen demanding pollutants, in sufficient quantity, either singly or by interaction, to injure or interfere with any wastewater treatment process, constitute a hazard to humans or animals, or be in violation of any applicable statute, rule, regulation or ordinance of any public agency, including U.S.EPA.

F. Any noxious or malodorous liquids, gases, or solids which either singly or by interaction are capable of creating a public nuisance or hazard to life or are sufficient to prevent entry into the sewers for their maintenance and repair, or capable of causing acute worker health or safety problems.

G. Any substance which may cause the POTW's treatment residues, sludges, or scums to be unsuitable for reclamation and reuse or permitted disposal or to interfere with the reclamation or disposal process. In no

case shall a substance be discharged to the POTW that will cause the POTW to be in noncompliance with sludge use or disposal criteria, guidelines or regulations developed under Section 503 of the Act; or with any criteria, guidelines, or regulations affecting sludge use or disposal developed pursuant to the Solid Waste Disposal Act; or with the Clean Air Act, the Toxic Substances Disposal Act, or State standards applicable to the sludge management method being used.

H. Any substance which will cause the POTW to violate its NPDES and/or other Disposal System Permits, or cause a violation of any state air or water quality standard or solid and hazardous waste regulation.

I. Any substance with objectionable color not removed in the treatment process, such as, but not limited to, dye wastes and vegetable tanning solutions.

J. Wastewater having a temperature which will inhibit biological activity in the treatment plant resulting in interference, in no case wastewater which causes the temperature at the introduction into the treatment plant to exceed 104 degrees F (40 degrees C) unless the Approval Authority, upon the request of the POTW, approves alternate temperature limits..

K. Any trucked or hauled pollutants, except at discharge points designated by the POTW, under permits issued by the Participant with the approval of the Plant Manager.

L. Any slugload of any type of pollutant, including Oxygen Demanding Pollutants.

M. Persistent pesticides and/or pesticides regulated by the Federal Insecticide Fungicide Rodenticide Act (FIFRA).

N. Concentrations of dissolved solids including but not limited to, sodium chloride, calcium chloride, or sodium sulfate which are so high as to constitute a danger to the wastewater treatment processes or equipment.

O. Concentrations of inert suspended solids such as, but not limited to, fuller's earth, lime slurries, lime residue, or fly ash which are so high as to constitute a danger to the POTW.

P. Any infectious wastes that, in the opinion of the County Health Officer, significantly increase the risk of disease transmission beyond the level of risk normally associated with domestic sewage.

Q. Wastewater containing any radioactive wastes or isotopes except under conditions developed by the Plant Manager in compliance with applicable State or Federal regulations. No person shall discharge or cause to be discharged any radioactive waste into the POTW except when that person is licensed for the use of those radioactive materials by the Department of Health and the waste meets all requirements of WAC 246-221-190, "Disposal By Release Into Sanitary Sewerage Systems", and the average concentration limits as defined in WAC 246-221-290 Appendix A, Table I, Column 2, and WAC 246-221-300 Appendix B and all other applicable local, State and Federal regulations.

R. Wastewater causing, alone or in conjunction with other sources, the treatment plant's effluent to fail a toxicity test.

4. PROHIBITIONS ON STORM DRAINAGE, GROUNDWATER AND UNPOLLUTED WATER.

Storm water, groundwater, rainwater, street drainage, subsurface drainage, yard drainage, roof drainage, or unpolluted water, including, but not limited to, non-contact cooling water, or blow-down from cooling towers or evaporative coolers, shall not be discharged through direct or indirect connection to any sanitary sewer. With the approval of the Plant Manager, the Participant may, but shall not be required to, permit such discharge when no reasonable alternative method of disposal is available. If a permit is granted for the discharge of such water into a sanitary sewer, the user shall pay the applicable charges and fees and meet such other conditions as required from time to time by the Participant.

5. DISCHARGE LIMITATIONS.

A. No person shall discharge wastewater containing in excess of (as measured on a daily average of composite samples):

mg/l		component
0.2	mg/l	arsenic
0.2	mg/l	cadmium
1.0	mg/l	chromium, total
0.25	mg/l	chromium, hexavalent
0.5	mg/l	copper
0.64	mg/l	cyanide, total
0.25	mg/l	cyanide, free
0.4	mg/l	lead
0.05	mg/l	mercury
0.5	mg/l	nickel

0.2	mg/l	non-halogenated phenols or cresols
0.2	mg/l	silver
1.0	mg/l	zinc

B. The above limits apply at the point where the wastewater is discharged to the POTW (end of pipe). All concentrations for metallic substances are for "total" metal unless indicated otherwise. The Plant Manager may develop mass limitations to be imposed in addition to, or in place of, the concentration-based limitations above. Where a user is subject to a categorical pretreatment standard and a discharge limitation as defined herein for a given pollutant, the more stringent limit or applicable pretreatment standard shall apply. A person will also be subject to more stringent and/or additional limits if required by the application of AKART.

C. No person, business, industry or entity shall increase the use of potable or process water in any way, nor mix separate waste streams for the purpose of diluting a discharge as a partial or complete substitute for adequate treatment to achieve compliance with the standards set forth in this chapter.

D. The discharge into the POTW of any wastewater or wastes having:

1. A 5 day biochemical oxygen demand greater than three hundred (300) parts per million by weight.
2. Containing more than three hundred (300) parts per million by weight of suspended solids,
3. Containing any quantity of substances having the characteristics described above in this section; or
4. Having an average daily flow greater than two percent (2%) of the average daily flow of the POTW;

shall require the evaluation and concurrence of the Plant Manager and be subject to payment as determined by applicable fees for waste strength and flow.

E. The National categorical pretreatment standards found in 40 CFR Chapter I, Subchapter N, Parts 405-471, as amended, are incorporated herein by reference as though fully set forth and shall apply to industries subject to these standards whenever categorical standards are more stringent than applicable state or local discharge limitations.

6. LIMITATIONS ON POINT OF DISCHARGE.

No person shall discharge any substance directly into a manhole or other opening in the POTW other than through an approved building sewer, unless that person has been issued a permit by the Participant. If a permit is issued for such direct discharge, the user shall pay the applicable charges and fees and shall meet such other conditions as determined by the Plant Manager. Septage haulers shall comply with the limitations set forth in their permits, as specified by the Plant Manager and;

A. Septic tank waste may be introduced into the POTW only at a designated receiving structure within the treatment plant area, and at such times as are established by the Plant Manager. Such wastes shall not violate this section of the ordinance or any other requirements established or adopted by the Participant. Wastewater discharge permits for individual vehicles to use such facilities shall be issued by the City of Olympia.

B. Septage haulers may only discharge loads at locations specifically designated by the Plant Manager. No load may be discharged without prior consent of the Plant Manager. The Plant Manager may collect samples of each hauled load to ensure compliance with applicable pretreatment standards. The Plant Manager may require the hauler to provide a waste analysis of any load prior to discharge.

C. Septage haulers must provide a waste-tracking form for every load. This form shall include, at a minimum, the name and address of the waste hauler, permit number, truck identification, sources of waste, and volume and characteristics of waste.

D. Fees for dumping hauled wastes may be established as part of the user fee system as authorized within this ordinance.

E. Septic Haulers may not discharge material designated as hazardous or dangerous wastes as specified by 173.303 WAC or knowingly discharge septage mixed with hazardous and/or dangerous wastes.

7. MATTER EXCLUDED FROM STORM DRAINS.

Unpolluted water regulated by this ordinance including, but not limited to, cooling water, or blow-down from cooling towers or evaporative coolers may not be directed into a storm drain except under the authorization and direction of the Participant and under engineering and technical conditions set by the Plant Manager to carry out the purposes of this chapter.

8. SAMPLING AND TESTING OF WASTEWATER.

Users shall allow the Plant Manager or his/her designee ready access to all parts of the premises for the purposes of inspection, sampling, records examination and copying, and the performance of any additional duties.

A. Where a user has security measures in force which require proper identification and clearance before entry into its premises, the user shall make necessary arrangements with its security guards so that, upon presentation of suitable identification, the Plant Manager will be permitted to enter without delay for the purposes of performing specific responsibilities.

B. The Plant Manager shall have the right to set up on the user's property, or require installation of, such devices as are necessary to conduct sampling and/or metering of the user's operations.

C. Any temporary or permanent obstruction to safe and easy access to the facility to be inspected and/or sampled shall be promptly removed by the user at the written or verbal request of the Plant Manager and shall not be replaced. The costs of clearing such access shall be born by the user.

D. Unreasonable delays in allowing the Plant Manager access to the user's premises shall be a violation of this ordinance.

E. Failure to allow inspection, sampling, monitoring, or metering as authorized by this section shall be grounds for revocation of the user's discharge permit.

F. Nothing herein shall be construed to limit the Participant's rights to obtain a criminal search warrant.

G. The Plant Manager will follow the sampling and testing procedures outlined in Section 26.

H. No person shall willfully or negligently break, damage, destroy, uncover, deface, tamper with, or prevent access to any structure, appurtenance or equipment, or other part of the POTW. Any person found in violation of this requirement shall be subject to the sanctions set out in this ordinance.

9. APPROVAL OF WASTEWATER DISCHARGES.

The Participant reserves the right to enter into special agreements with users setting out special terms under which they may discharge to the POTW. Any

such special agreements must be approved in advance by the Plant Manager. In no case will a special agreement waive compliance with a categorical pretreatment standard or federal pretreatment requirement. However, the user may request a net gross adjustment to a categorical standard in accordance with 40 CFR 403.15. They may also request a variance from the categorical pretreatment standard from the Approval Authority in accordance with 403.13. The Participant may allow discharge of high BOD, TSS, or flow rate for any permittee upon approval of the Plant Manager, and subject to charges as provided by section 14 of this ordinance.

10. PRETREATMENT OF INDUSTRIAL WASTES.

When at any time it becomes apparent to the Plant Manager or Participant that does not conform to the requirements outlined in Sections 3 through 7, or the applicable pretreatment standards or requirements; it is hereby required that before such matter may be discharged into the POTW, the producer thereof shall treat same at the producer's own expense to a degree that will produce an effluent which does conform to the said requirements.

A. Users shall provide all known, available, and reasonable methods of prevention, control and treatment (AKART) as required to comply with this ordinance and State and Federal regulations and shall achieve compliance with all applicable pretreatment standards and requirements within the time limitations as specified by appropriate statutes, regulations, chapters and ordinances. Any facilities required to treat wastewater to satisfy applicable pretreatment standards and requirements, shall be supplied, properly operated, and maintained at the user's expense. Such treatment plants may include, but shall not be limited to, grease traps, chemical or biochemical plants, sedimentation chambers, and any other devices which effect a change of any nature in the characteristics of the matter being treated toward the characteristics of matter permitted.

B. Detailed plans showing the pretreatment facilities shall be submitted to the Plant Manager for review and must be acceptable to the Plant Manager and the Participant, and meet the requirements of Chapter 173-240 WAC for Department of Ecology review, before construction of the facility. The review of such plans by the Participant shall in no way relieve the user from the responsibility of modifying its facility as necessary to produce an effluent acceptable to the Plant Manager under the provisions of this ordinance. The user shall obtain all necessary construction-operating permits from the Participant. Prior to completion of the Wastewater Treatment Facility, the user shall furnish its plan of operations and maintenance procedures for review. All treatment devices shall be subject to the approval of the Plant Manager.

11. TRAPS AND INTERCEPTORS.

Any non-residential occupancy shall install the proper type and capacity trap or interceptor to prevent materials from entering the sewer system that cause or may cause stoppages, impair the efficiency of the wastewater collection system, threaten collection system or treatment plant workers, or impair the efficiency of the wastewater treatment plant. Traps or interceptors shall be provided if required by the Uniform Plumbing Code or if determined necessary in the opinion of the Plant Manager.

When required, all non-residential occupancies handling any fats, oils, or greases shall install and maintain a fats, oils, and grease interceptor and/or trap to remove these materials prior to entrance into the sewer system. The use of biological or chemical treatment agents for the emulsification or separation of fats, oils, or greases shall be prohibited. Such non-residential occupancies include, but are not limited to restaurants, wash racks, vehicle service stations, engine or machinery repair shops, delis, cafes, slaughter houses, packing plants, bakeries, food processing operations and commercial, industrial or institutional cooking facilities.

When required, all non-residential occupancies handling flammable or combustible liquids shall install and maintain an oil and flammable liquids interceptor.

When required, all non-residential occupancies producing, handling or discharging solids shall provide adequate and approved sediment traps or interceptors. These traps or interceptors shall be used by, but not limited to, occupancies discharging, or with the potential to discharge, lint, rags, sand, grit, glass, metal, or any other dense material.

All interceptors shall be of a type and capacity approved by the Plant Manager and shall be located as to be readily and easily accessible for cleaning and inspection at the expense of the user or applicant. Where installed, all traps and interceptors shall be maintained by the owner, or at his expense, in a manner that will always prevent the above-mentioned wastes from being carried into the sewer system. Wastes removed from such a facility shall not be reintroduced or disposed of in sanitary or storm sewers.

12. MONITORING FACILITIES.

A. Each user shall provide and operate at its own expense a monitoring facility to allow inspection, sampling, and flow measurements of each sewer discharge to the POTW.

B. Each monitoring facility shall be situated on the user's premises, except where such a location would be impractical or cause undue hardship on

the user. The Participant may concur with the facility being constructed in the public street or sidewalk area, providing that the facility is located so that it will not be obstructed by landscaping or parked vehicles. The Plant Manager, whenever applicable, may specify the construction and maintenance of sampling facilities at other locations (for example, at the end of a manufacturing line or wastewater treatment system).

C. There shall be ample room in or near such sampling facility to allow accurate sampling and preparation of samples for analysis. Each user shall at all times maintain required facilities and sampling and measuring equipment in a safe and proper operating condition, at the user's own expense.

D. All monitoring facilities shall be constructed and maintained in accordance with all applicable local construction standards and specifications.

E. The Participant may require the user to install monitoring equipment determined by the Plant Manager to be necessary. The facility's sampling and monitoring equipment shall be maintained at all times in a safe and proper operating condition, by the user at its own expense. All devices used to measure wastewater flow and quality shall be calibrated to ensure their accuracy.

13. ACCIDENTAL DISCHARGE/SLUG CONTROL PLANS.

Each user shall provide protection from accidental discharge of prohibited or regulated materials or substances established by this ordinance. Where necessary, facilities to prevent accidental discharge of prohibited materials shall be provided and maintained at the user's own cost and expense. Detailed plans showing facilities and operating procedures to provide this protection shall be submitted as specified in this section.

Users shall immediately take action to correct the situation and verbally notify the LOTT facility console monitor upon the occurrence of a "slugload" or accidental discharge of substances prohibited by this ordinance. Written notification including location of the discharge, date and time thereof, type of waste, concentration and volume, and corrective actions must be filed with the Plant Manager within five days of the accidental discharge.

Any user who discharges a slugload of prohibited materials shall be liable for any expense, loss, or damage to the POTW, in addition to any other liabilities established by this ordinance and the amount of any fines imposed on the Participant and/or Plant Manager on account thereof under State or Federal law.

Signs shall be permanently posted in conspicuous places on the user's premises, advising employees whom to call in the event of a slug or accidental discharge. Employers shall instruct all employees who may cause or discover such a discharge with respect to emergency notification procedures.

The Participant may require any user to develop and implement an accidental discharge/slug control plan. Where deemed necessary by the Plant Manager or Participant, facilities to prevent accidental discharge or slug discharges of pollutants shall be provided and maintained at the user's cost and expense. An accidental discharge/slug control plan showing facilities and operating procedures to provide this protection shall be submitted to the Plant Manager for review and approval before implementation. The Plant Manager shall determine which user is required to develop a plan and require said plan to be submitted within 180 days after notification by the Plant Manager or Participant. Each user shall implement its accidental discharge/slug control plan as submitted or as modified after such plan has been reviewed and approved by the Plant Manager. Review and approval of such plans and operating procedures by the Plant Manager shall not relieve the user from the responsibility to modify its facility as necessary to meet the requirements of this Section.

A. Any user required to develop and implement an accidental discharge/slug control plan shall submit a plan which addresses, at a minimum, the following:

1. Description of discharge practices, including non-routine batch discharges;
2. Description of stored chemicals;
3. Procedures for immediately notifying the Plant Manager and Participant of any accidental or slug discharge. Such notification must also be given for any discharge which would violate any of the standards in Sections 3 through 7 of this ordinance; and
4. Procedures to prevent adverse impact from any accidental or slug discharge. Such procedures include, but are not limited to, inspection and maintenance of storage areas, handling and transfer of materials, loading and unloading operations, control of plant site runoff, worker training, building of containment structures or equipment, measures for containing toxic organic pollutants (including solvents), and/or measures and equipment for emergency response.

14. EXCESS STRENGTH CHARGES.

For industrial waste or other discharges exceeding the BOD and/or Suspended Solids limits defined in Section 5., the following formula shall be used to determine the ERU equivalency of the waste flow. This formula applies only to BOD and/or SS concentrations in excess of 300 mg/l.

A. ERU Equivalent for High Strength Waste shall be the sum of the following:

1. Flow Calculation

$$(P\text{-FLOW}) \times \frac{\text{Industry flow, cu. ft./ Month}}{900 \text{ cu. ft./ERU}} = \text{FLOW ERUs}$$

2. BOD Calculation

$$(P\text{-BOD}) \times \frac{\text{Industry BOD, mg/l}}{300 \text{ mg/l}} \times \frac{\text{Industry Flow, cu ft/Month}}{900 \text{ cu ft/ERU}} = \text{BOD ERU}$$

3. Suspended Solids (SS) Calculation

$$(P\text{-SS}) \times \frac{\text{Industry SS, mg/l}}{300 \text{ mg/l}} \times \frac{\text{Industry Flow, cu ft/Month}}{900 \text{ cu ft/ERU}} = \text{SS ERUs}$$

B. Explanation of terms

1. (P-FLOW) = Percentage treatment costs associated with hydraulic flow

2. (P-BOD) = Percentage treatment costs associated with BOD

3. (P-SS) = Percentage treatment costs associated with SS

4. ERU: (Equivalent Residential Unit) equal to 900 cubic feet of wastewater containing a maximum of 300 mg/l of suspended solids and a maximum of 300 mg/l of BOD.

5. Wastewater Treatment costs used in items 1,2 and 3 above are calculated at years end. The ratios determined shall apply throughout the following year.

6. All monthly charges per ERU established by the LOTT Intergovernmental Contract for Wastewater Facilities Management of November 1976, as amended, shall apply to ERU's calculated by the above formulas.

15. DISCHARGE PERMIT FEES.

Annual discharge permit fees shall be levied on each Significant Industrial User (SIU) and each Minor Industrial User (MIU) based on three criteria: (1) permitted flowrate, (2) permit complexity and (3) potential danger to the collection system or POTW. Each permittee will be evaluated annually by the Plant Manager and placed in one of three categories; with Category III having the highest combination of flow, complexity and risk. The Plant Manager shall use the Permit Fee Category Criteria set forth in the following table:

PERMIT FEE CATEGORY CRITERIA

CRITERION	RANGE	DESCRIPTION	SCORE
FLOW:	High	>25,000 GPD	3
	Medium	1,000 – 25,000 GPD	2
	Low	<1,000 GPD	1
COMPLEXITY	High	Categorical SIU	3
	Medium	Non-Categorical SIU	2
	Low	MIU	1
POTENTIAL DANGER	High	Excess Strength Discharge, High Spill Potential, Large Quantity Of Toxic Materials, High Flows	3
	Medium	All Others	2
	Low	Low Spill Potential, No Excess Strength, Low Or No Toxics On Site, Low Flows	1

The total scores for all criteria determines the permit category and fee according to the following table:

PERMIT FEE TABLE

SCORE	CATEGORY	FEE
3-4	I	\$200
5-7	II	\$300
8-9	III	\$400

These fees shall be indexed to the current ERU cost, rounded to the nearest \$10. The base level ERU cost is currently \$21. These discharge permit fees are in addition to the excess strength charges required in the previous ordinance section, and shall be collected by the Participant and remitted to the LOTT Fund prior to the end of the calendar month following collection. To encourage reduction in the use of water and generation of wastewater, the annual discharge permit fee will be waived for any permittee that achieves zero industrial wastewater discharge to LOTT in the prior calendar year.

16. PERMITS REQUIRED.

A. Permits Required: No Significant Industrial User (SIU) shall discharge wastewater into the POTW without first obtaining a wastewater discharge permit from the Participant. Any violation of the terms and conditions of a wastewater discharge permit shall be deemed a violation of this ordinance and subject the permittee to the sanctions set out in this ordinance. Obtaining a wastewater discharge permit does not relieve a permittee of their obligation to comply with all Federal and State pretreatment standards or requirements or with any other requirements of Federal, State, and local law. Leachate from a solid waste landfill, and condensate from gas recovery systems at a solid waste landfill shall be considered an industrial wastewater and a permit shall be required by the Participant in accordance with this ordinance.

B. Others Regulated: The Plant Manager or Participant may require users not meeting the criteria for a SIU, including liquid waste haulers, to obtain wastewater discharge permits to carry out the purposes of this ordinance, and shall designate these users as Minor Industrial Users (MIUs).

C. Permits for Existing Industrial Users: Any SIU or MIU discharging wastewater into the POTW prior to the effective date of this ordinance, that wishes to continue such discharges, shall within 30 days after notification submit a permit application to the Plant Manager in accordance with Section 18 of this ordinance. Such Dischargers shall not cause or allow discharges to the POTW to continue after one hundred eighty (180) days of the effective date of this ordinance except in accordance with a wastewater discharge permit issued by the Participant.

D. Permits for New Sources and New Users: At least 90 days prior to anticipated start-up, New Sources and New Users that fit the definition of an SIU or MIU shall apply for a wastewater discharge permit and will be required to submit to the Plant Manager at least the information listed in paragraphs (A)-(E) of Section 18. A New Source or New User cannot discharge without first receiving a wastewater discharge permit from the Participant. New Sources and New Users shall give estimates of the information requested in paragraphs C, D, and E of Section 18.

E. Newly Promulgated or Recognized Categorical Wastestreams: Users with wastewater from processes for which applicable categorical pretreatment standards are promulgated and users which are recognized by the Plant Manager as being subject to any existing applicable categorical pretreatment standard will provide actual data for all information of section 18 within 180 days after the effective date of the applicable categorical standard, or within 90 days of being informed by the Plant Manager of applicable categorical standards, whichever is sooner. Such users may continue discharging, subject to the approval and conditions of the Plant Manager, until a permit is issued.

F. Extrajurisdictional Users: Any non-domestic user located within the Lacey, Olympia, Tumwater, and Thurston County service districts shall be required to follow the above procedures.

17. INDUSTRIAL USER SURVEY.

All persons, upon request, shall complete an Industrial User Survey. Each person will provide the survey information in the form prescribed by the Plant Manager or Participant, complete the form to the best of their ability, and return it to the Participant within the allotted time. This requirement is separate from any requirements under this ordinance to complete a permit application.

18. PERMIT APPLICATION.

All users required to obtain a wastewater discharge permit must submit, at a minimum, the following information. The Plant Manager shall approve a form to be used as a permit application. Categorical users submitting the following information shall have complied with 40 CFR 403.12 (b).

A. Identifying information. The user shall submit the name and address of the facility including the name of the operator and owners.

B. Permits. The user shall submit a list of any environmental control permits held by or for the facility.

C. Description of operations. The user shall submit a brief description of the nature, average rate of production, and Standard Industrial Classification of the operation(s) carried out by such Industrial User, including a list of all raw materials and chemicals used or stored at the facility which are, or could accidentally or intentionally be, discharged to the POTW; number and type of employees; hours of operation; each product produced by type, amount, process or processes, and rate of production; type and amount of raw materials processed (average and maximum per day) and the time and duration of discharges. This description should also include a schematic process diagram which indicates points of discharge to the POTW from the regulated or manufacturing processes. Disclosure of site plans, floor plans, mechanical and plumbing plans and details to show all sewers, sewer connections, inspection manholes, sampling chambers and appurtenances by size, location and elevation.

D. Flow Measurement.

1. Categorical User:

The user shall submit information showing the measured average daily and maximum daily flow, in gallons per day, to the POTW from each of the following:

- a. Regulated or manufacturing process streams; and
- b. Other streams as necessary to allow use of the combined wastestream formula of 40 CFR 403.6(e).

2. All other users:

The user shall submit information showing the measured average daily and maximum daily flow, in gallons per day, to the POTW from each of the following:

- a. Total process flow, wastewater treatment plant flow, total plant flow or individual manufacturing process flow as specified by the Plant Manager.

The Plant Manager may accept verifiable estimates of these flows where justified by cost or feasibility considerations.

E. Measurements of pollutants.

1. Categorical User:

a. The user shall identify the applicable pretreatment standards for each regulated or manufacturing process.

b. In addition, the user shall submit the results of sampling and analysis identifying the nature and concentration (or mass), where required by the Categorical Pretreatment Standard or as specified by the Plant Manager, of regulated pollutants (including standards contained in Sections 3 through 7, as appropriate) in the discharge from each regulated or manufacturing process. Both daily maximum and average concentration (or mass, where required) shall be reported. The sample shall be representative of daily operations and shall conform to sampling and analytical procedures outlined in Section 26.

c. The user shall take a minimum of one representative sample to compile that data necessary to comply with the requirements of this paragraph.

d. Where an alternate concentration or mass limit has been calculated in accordance with 40 CFR 403.6(e) for a categorical user covered by a categorical pretreatment standard this adjusted limit along with supporting data shall be submitted as part of the application.

2. All other users:

a. The user shall identify the applicable pretreatment standards for its wastewater discharge.

b. In addition, the user shall submit the results of sampling and analysis identifying the nature and concentration (or mass) where specified by the Plant Manager, of regulated pollutants contained in Sections 3 through 7 as appropriate in the discharge. Both daily maximum and average concentration (or mass, where required) shall be reported. The sample shall be representative of daily operations and shall conform to sampling and analytical procedures outlined in Section 26.

c. The user shall take a minimum of one representative sample to compile that data necessary to comply with the requirements of this paragraph.

d. Where the Plant Manager has specified alternate concentration or mass limits because of dilution this adjusted limit along with supporting data shall be submitted as part of the application.

F. Certification. A statement, reviewed by an authorized representative of the user and certified by a qualified professional as outlined in subparagraph I of this section, indicating whether the applicable Pretreatment Standards are being met on a consistent basis, and, if not, whether additional operation and maintenance (O and M) and/or additional pretreatment is required for the user to meet the applicable Pretreatment Standards and Requirements;

G. Compliance Schedule. If additional pretreatment and/or O and M will be required to meet the applicable Pretreatment Standards; the shortest schedule by which the user will provide such additional pretreatment and/or O and M.

1. The schedule shall contain increments of progress in the form of dates for the commencement and completion of major events leading to the construction and operation of additional pretreatment required for the user to meet the applicable pretreatment standards (e.g., hiring an engineer, completing preliminary plans, completing final plans, executing contract for major components, commencing construction, completing construction, etc.).

2. No increment referred to in paragraph (A) of this section shall exceed 9 months.

3. Not later than 14 days following each date in the schedule and the final date for compliance, the user shall submit a progress report to the Plant Manager including, at a minimum, whether or not it complied with the increment of progress to be met on such date and, if not, the date on which it expects to comply with this increment of progress, the reason for delay, and the steps being taken by the user to return the construction to the schedule established. In no event shall more than 9 months elapse between such progress reports.

4. Where the user's categorical Pretreatment Standard has been modified by the combined wastestream formula (40 CFR 403.6(e)), and/or a Fundamentally Different Factors variance (40 CFR 403.13)

at the time the user submits the report required by this paragraph, the information required by paragraphs (F) and (G) of this section shall pertain to the modified limits.

5. If the categorical Pretreatment Standard is modified by the combined wastestream formula (40 CFR 403.6(e)), and/or a Fundamentally Different Factors variance (40 CFR 403.13) after the user submits the report required by paragraphs (F) and (G) of this section; a new report pertaining to the modified limit shall be submitted by the user within 60 days after the modified limit is approved.

The completion date in this schedule shall not be later than the compliance date established pursuant to Section 20 of this Ordinance.

H. Any other information as may be deemed necessary by the Plant Manager to evaluate the wastewater discharge permit application.

I. All wastewater discharge permit applications and user reports must be signed by an authorized representative of the user and contain the following certification statement:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Incomplete or inaccurate applications will not be processed and will be returned to the user for revision.

The Plant Manager will evaluate the data furnished by the user and may require additional information. The Plant Manager will prepare a written recommendation regarding issuance or non-issuance of the permit and submit it to the Participant. Within 30 days of receipt of a complete wastewater discharge permit application, including the Plant Manager's recommendation, the Participant will determine whether or not to issue a wastewater discharge permit. Upon a determination to issue, the permit shall be issued within 30 days of full evaluation and acceptance of the data furnished. The Participant may deny any

application for a wastewater discharge permit. An Industrial User denied a discharge permit may petition the Participant to reconsider the issuance of a discharge permit as described in section 25 of this ordinance.

19. PERMIT MODIFICATIONS.

The Participant reserves the right to amend any Wastewater Discharge permit issued hereunder in order to assure compliance or continued compliance by the Participant with applicable laws and regulations. Within nine (9) months of the promulgation of a National Categorical Pretreatment Standard, but not later than the deadline for final compliance with a standard when such is specified, the Wastewater Discharge Permit of each user subject to such standards shall be revised to require compliance with such standards within the time frame prescribed by such standards.

Where a user, subject to a National Categorical Pretreatment Standard, has not previously submitted an application for a Wastewater Discharge Permit as required by section 18; the user shall apply for a Wastewater Discharge Permit from the Participant within 90 days after the promulgation of the applicable National Categorical Pretreatment Standards by the EPA. In addition, the user with an existing Wastewater Discharge Permit shall submit to the Plant Manager within 90 days after the promulgation of an applicable National Categorical Pretreatment Standard, the information required by paragraphs (C) and (H) of section 18. The user shall be informed of any proposed changes in its permit at least 30 days prior to the effective date of change. Any changes or new conditions upon the user may require modifications of the Wastewater Discharge Permit, as well as include a reasonable time schedule for compliance.

On approval by the Plant Manager, the Participant may modify a wastewater discharge permit for any good cause, including but not limited to the following:

- A. To incorporate any new or revised Federal, State, or local pretreatment standards or requirements;
- B. To address significant alterations or additions to the user's operation, processes, or wastewater volume or character since the time of wastewater discharge permit issuance;
- C. A change in the POTW that requires either a temporary or permanent reduction or elimination of the authorized discharge;
- D. Information indicating that the permitted discharge poses a threat to the Participant's, the POTW's, or other personnel, or the receiving waters;
- E. Violation of any terms or conditions of the wastewater discharge permit;

F. Misrepresentations or failure to fully disclose all relevant facts in the wastewater discharge permit application or in any required reporting;

G. Revision of, or a grant of variance from, categorical pretreatment standards pursuant to 40 CFR 403.13;

H. To correct typographical or other errors in the wastewater discharge permit; or

I. To reflect a transfer of the facility ownership and/or operation to a new owner/operator.

20. PERMIT CONDITIONS.

Wastewater Discharge Permits for Significant Industrial Users shall specify no less than all of the following, and for Minor Industrial Users, shall specify the provisions from the following, as determined applicable by the Plant Manager:

A. Wastewater discharge permits must contain the following conditions:

1. A statement that indicates wastewater discharge permit duration, which in no event shall exceed five (5) years;

2. A statement that the wastewater discharge permits are transferable only upon compliance with section 22 of this ordinance, and provisions for furnishing the new owner or operator with a copy of the existing wastewater discharge permit;

3. Applicable pretreatment standards and requirements, including any special State requirements;

4. Self monitoring, sampling, reporting notification, submittal of technical reports, compliance schedules, and record-keeping requirements. These requirements shall include an identification of pollutants to be monitored, sampling location, sampling frequency, and sample type based on Federal, State, and local law; and

5. Requirement for immediate notification to the Plant Manager where self-monitoring results indicate non-compliance;

6. Requirement to report a by-pass or upset of a pretreatment facility;

7. Requirement for the SIU or MIU who reports non-compliance to repeat the sampling and analysis and submit results to the Plant Manager within 30 days after becoming aware of the violation;

8. A statement of applicable civil, criminal, and administrative penalties for violation of pretreatment standards and requirements, and any applicable compliance schedule;

9. The requirement to apply AKART to all wastewaters discharged.

B. Wastewater discharge permits may contain, but need no be limited to, the following conditions:

1. Limits on the average and/or maximum rate of discharge, time of discharge, and/or requirements for flow regulation and equalization;

2. Requirements for the installation of pretreatment technology, pollution control, or construction of appropriate containment devices, designed to reduce, eliminate, or prevent the introduction of pollutants into the treatment works;

3. Requirements for developing and implementing spill control plans or other special conditions including management practices necessary to adequately prevent accidental, unanticipated, or routine discharges;

4. Development and implementation of waste minimization plans to reduce the amount of pollutants discharged to the POTW;

5. The unit charge or schedule of user charges and fees for the management of the wastewater discharged to the POTW;

6. Requirements for installation and maintenance of inspection and sampling facilities and equipment;

7. A statement that compliance with the wastewater discharge permit does not relieve the permittee of responsibility for compliance with all applicable Federal and State pretreatment standards and requirements, including those which become effective during the term of the wastewater discharge permit;

8. Any special agreements developed or continued between the Participant and user with the approval of the Plant Manager;

9. Compliance schedule(s) for meeting applicable pretreatment standards and requirements. Compliance schedules shall conform

to the requirements specified in Section 18 subparts G.1. through G.3. of this ordinance.

10. Other conditions as deemed appropriate by the Plant Manager to ensure compliance with this ordinance, and State and Federal laws, rules, and regulations.

C. Deadline for Compliance with Applicable Pretreatment Requirements

Compliance by existing users (categorical users) covered by Categorical Pretreatment Standards shall be within 3 years of the date the Standard is effective unless a shorter compliance time is specified in the appropriate Standard. The Plant Manager shall establish a final compliance deadline date for any existing user not covered by Categorical Pretreatment Standards or for any categorical user when the local limits for said user are more restrictive than EPA's Categorical Pretreatment Standards. New source users and new users are required to comply with applicable pretreatment standards within the shortest feasible time (not to exceed 90 days from the beginning of discharge). New sources and new users shall install and have in operating condition, and shall start-up all pollution control equipment required to meet applicable pretreatment standards before beginning to discharge. Any wastewater discharge permit issued to a categorical user shall not contain a compliance date beyond any deadline date established in EPA's Categorical Pretreatment Standards.

Any other existing user or a categorical user that must comply with a more stringent local limit, which is in non-compliance with any local limits shall be provided with a compliance schedule placed in an industrial wastewater permit to insure compliance within the shortest time feasible.

21. PERMIT DURATION AND REISSUANCE.

All wastewater discharge permits shall be issued for a period of five years, subject to appendment or revocation as provided in this ordinance. Under extraordinary circumstances, a permit may be issued for a shorter period or may be stated on its face to expire on a specific date.

A user, required to have a wastewater discharge permit, shall apply for wastewater discharge permit reissuance by submitting a complete wastewater discharge permit application, in accordance with Section 18 of this ordinance, a minimum of 90 days prior to the expiration of the user's existing wastewater discharge permit. A user, whose existing wastewater discharge permit has expired and has submitted its re-application in the time period specified herein, shall be deemed to have an effective wastewater discharge permit until the Participant issues or denies the new wastewater discharge permit. A user, whose existing wastewater discharge permit has expired and who failed to

submit its re-application in the time period specified herein, will be deemed to be discharging without a wastewater discharge permit.

22. LIMITATIONS ON PERMIT TRANSFER.

This permit is automatically transferred to a new owner or operator if:

- A. A written agreement between the old and new owner or operator containing a specific date for transfer of permit responsibility, coverage, and liability is submitted to the Participant and the LOTT Industrial Waste Program Supervisor;
- B. A copy of the permit is provided to the new owner; and
- C. LOTT does not notify the Permittee of the need to modify the permit.

Unless this permit is automatically transferred according to section A above, this permit may be transferred only if it is modified to identify the new Permittee and to incorporate such other requirements as determined necessary by the Plant Manager.

23. PROPERTY RIGHTS.

The issuance of a permit shall not convey any property rights in either real or personal property, or any exclusive privileges, nor shall it authorize any invasion of personal rights nor any infringement of Federal, State or Local regulations.

24. PUBLIC NOTICE.

Public notice shall be given in accordance with Section 173-216-090 WAC. The Participant may initiate the Public Notice rather than requiring it of the user.

25. APPEAL OF PERMIT CONDITIONS.

Any person, including the user, may petition the Participant to reconsider the terms of a wastewater discharge permit within thirty (30) days of its issuance or denial.

A. Failure to submit a timely petition for review shall be deemed to be a waiver of the administrative appeal.

B. In its petition, the appealing party must indicate the wastewater discharge permit provisions objected to, the reasons for this objection, and the alternative condition, if any, it seeks to place in the wastewater discharge permit.

C. The effectiveness of the wastewater discharge permit shall not be stayed pending the appeal.

D. If the Participant fails to act within ninety (90) days, a request for reconsideration shall be deemed to be denied. Decisions not to reconsider a wastewater discharge permit, not to issue a wastewater discharge permit, or not to modify a wastewater discharge permit, shall be considered final administrative actions for purposes of judicial review.

E. Aggrieved parties seeking judicial review of the final administrative wastewater discharge permit decisions must do so by filing a petition with the Superior Court 10 days of final administrative action.

F. Industrial Users may request a meeting with the Plant Manager and Participant to present the petition required in this section. The Plant Manager shall arrange such a meeting within 30 days of the request by the Industrial User.

26. REPORTING REQUIREMENTS.

Reporting requirements specified in this section shall be inclusive of all Significant Industrial Users and shall also apply to those Minor Industrial Users as specifically required in their Waste Discharge Permits.

All reports of permittees shall contain all results of sampling and analysis of the discharge, including the flow and the nature and concentration or production and mass as specified by the Plant Manager. The frequency of monitoring by the user shall be as prescribed in the Wastewater Discharge Permit. All analyses shall be performed in accordance with 40 CFR, Part 136 and amendments thereto. Where 40 CFR, Part 136 does not include a sampling or analytical technique for the pollutant in question, sampling and analysis shall be performed in accordance with the procedures set forth in the EPA publication, "Sampling and Analysis Procedures for Screening of Industrial Effluents for Priority Pollutants", April 1977, and amendments thereto, or with any other sampling and analytical procedures approved by the Administrator of the EPA.

A. Initial Compliance Report.

Within 90 days following the date for final compliance with Applicable Pretreatment Standards and requirements set forth in this ordinance, or following commencement of the discharge of wastewaters into the POTW, any user subject to this ordinance shall submit a report to the Plant Manager that indicates compliance with Section 18, parts D through I, of this ordinance. The report shall state whether the Applicable Pretreatment

Standards or requirements are being met on a consistent basis and, if not, what additional O & M and/or pretreatment is necessary to bring the user into compliance with the Applicable Pretreatment Standards or requirements. This statement shall be signed by an authorized representative of the user. If permit conditions are not being met, the statement also must be signed by an engineer qualified in pretreatment system design.

For users subject to equivalent mass or concentration limits developed by the Plant Manager in accordance with procedures established in 40 CFR 403.6 (c), this report shall contain a reasonable measure of the user's long term production rate. For all other users subject to categorical pretreatment standards expressed in terms of allowable pollutant discharge per unit of production (or other measure of operation), this report shall include the users's actual production during the appropriate sampling period.

B. Periodic Compliance Report.

Any user subject to the Pretreatment Standards set forth in this ordinance, after the compliance date of such Pretreatment Standard or, in the case of a new user, after commencement of the discharge to the POTW, shall submit to the Plant Manager during the months of May and November of each year, unless specified more frequently by the Plant Manager, a report indicating the nature and concentration of prohibited or regulated substances in the effluent which are limited by the Permit and/or Pretreatment Standards hereof. Industrial Users subject to mass limitations as provided for in this ordinance and/or the Federal Categorical Pretreatment Standards shall indicate the mass of pollutants regulated by Pretreatment Standards in the discharge from the Industrial User. For users subject to equivalent mass or concentration limits developed by the Plant Manager in accordance with procedures established in 40 CFR 403.6 (c), this report shall contain a reasonable measure of the user's long term production rate. For all other users subject to categorical pretreatment standards expressed in terms of allowable pollutant discharge per unit of production (or other measure of operation), this report shall include the users's actual production during the appropriate sampling period.

In addition, this report shall include a record of all measured or estimated average and maximum daily flows during the reporting period specified in Section 20 hereof, and if a user monitors a pollutant more frequently than specified by the Plant Manager, using the procedures prescribed in 40 CFR part 136, the results of this monitoring shall be included in the report. Flows shall be reported on the basis of actual measurement, provided however, where cost or feasibility considerations justify, the Plant

Manager may accept reports of average and maximum flows estimated by verifiable techniques. The Plant Manager, for good cause shown, considering such factors as local high or low flow rates, holidays, budget cycles, or other extenuating factors, may authorize the submission of said reports on months other than those specified above.

C. Notification of Significant Production Changes.

Any user operating under a wastewater discharge permit incorporating equivalent mass or concentration limits shall notify the Plant Manager within two (2) business days after the user has a reasonable basis to know that the production level will significantly change within the next calendar month. Any user not providing a notice of such anticipated change will be required to comply with the existing limits contained in its wastewater discharge permit.

D. Hazardous Waste Notification.

Any user that is discharging 15 kilograms of hazardous wastes as defined in 40 CFR 261 (listed or characteristic wastes) in a calendar month or any facility discharging any amount of acutely hazardous wastes as specified in 40 CFR 261.30(d) and 261.33(e) is required to provide a one time notification in writing to the Plant Manager, EPA Regional Waste Management Division Plant Manager, and Hazardous Waste Division of Ecology. Any existing user exempt from this notification shall comply with the requirements contained herein within 30 days of becoming aware of a discharge of 15 kilograms of hazardous wastes in a calendar month or the discharge of acutely hazardous wastes to the LOTT sewer system. Such notification shall include:

1. The name of the hazardous waste as set forth in 40 CFR Part 261,
2. The EPA Hazardous waste number; and
3. The type of discharge (continuous, batch, or other),
4. If an industrial user discharges more than 100 kilograms of such waste per calendar month to the sewer system, the notification shall also contain the following information to the extent it is known or readily available to the industrial user:
 - a. an identification of the hazardous constituents contained in the wastes,

b. an estimation of the mass and concentration of such constituents in the wastestreams discharged during that calendar month, and

c. an estimation of the mass of constituents in the wastestreams expected to be discharged during the following 12 months.

These notification requirements do not apply to pollutants already reported under the self-monitoring requirements. Whenever the EPA publishes final rules identifying additional hazardous wastes or new characteristics of hazardous waste, a user shall notify the Plant Manager of the discharge of such a substance within 90 days of the effective date of such regulations. In the case of any notification made under this paragraph, an industrial user shall certify that it has a program in place to reduce the volume and toxicity of hazardous wastes generated to the degree it has determined to be economically practical.

E. Notice of potential problems, including accidental spills and/or slug loadings.

Any user shall notify the Plant Manager immediately of all discharges that could cause problems to the POTW, including any slug loadings, as defined in Section 2. The notification shall include the concentration and volume and corrective action. Steps being taken to reduce any adverse impact should also be noted during the notification. Any user who discharges a slug (or slugs) of pollutants shall be liable for any expense, loss, or damage to the POTW, in addition to the amount of any fines imposed on the Participant or Plant Manager under State or Federal law.

F. Notification of Changed Discharge.

All users shall promptly notify the Plant Manager in advance of any substantial change in the volume or character of pollutants in their discharge, including significant manufacturing process changes, pretreatment modifications, and the listed or characteristic hazardous wastes for which the user has submitted initial notification under 40 CFR 403.12(p).

G. Users subject to equivalent mass or concentration limits.

For users subject to equivalent mass or concentration limits developed by the Plant Manager in accordance with procedures established in 40 CFR 403.6 (c), this report shall contain a reasonable measure of the user's long term production rate. For all other users subject to categorical

pretreatment standards expressed in terms of allowable pollutant discharge per unit of production (or other measure of operation), this report shall include the users's actual production during the appropriate sampling period.

H. Non-Compliance Reporting.

If sampling performed by a user indicates a violation, the user shall notify the Plant Manager within 24 hours of becoming aware of the violation. The user shall also repeat the sampling within 5 days and submit the results of the report analysis to the Plant Manager within 30 days after becoming aware of the violation, except the user is not required to resample if:

1. The Plant Manager performs sampling at the user at a frequency of at least once per month, or
2. The Plant Manager performs sampling at the user between the time when the user performs its initial sampling and the time when the user receives the results of this sampling.

I. TTO Reporting.

Categorical users which are required by EPA to eliminate and/or reduce the levels of toxic organics (TTO's) discharged into the sewer system must follow the Categorical Pretreatment Standards for that industry. Those users must also meet the following three requirements:

1. Sample, as part of the application requirements, for all the organics listed under the TTO limit (no exceptions);
2. Either: routinely monitor for TTOs, (as specified in permit conditions), certify that no Toxic Organics are used at the facility, or develop a solvent management plan in lieu of required TTO monitoring;
3. Include a certification statement in self-monitoring reports that there has been no dumping of concentrated toxic organics into the wastewater and that it is implementing a solvent management plan as approved by the Plant Manager.

J. Reports from Minor Industrial Users.

Minor Industrial Users shall provide appropriate reports as the Plant Manager may require.

K. Reports for Unpermitted Users.

The Plant Manager may require non-domestic users which are otherwise not required to obtain a wastewater discharge permit or authorization to provide appropriate reports and complete Industrial User survey forms as necessary to properly implement the pretreatment program.

L. Sampling Requirements for Users.

A minimum of four (4) grab samples must be used for pH, cyanide, total phenols, oil and grease, sulfide, and volatile organics. The Plant Manager will determine on a case-by-case basis whether the user will be able to composite the individual grab samples. For all other pollutants, 24-hour composite samples must be obtained through flow-proportional composite sampling techniques where feasible.

The Plant Manager may waive flow-proportional composite sampling for any user that demonstrates that flow-proportional is infeasible. In such cases, samples may be obtained through time-proportional composite sampling techniques or through a minimum of four (4) grab samples where the user demonstrates that this will provide a representative sample of the effluent being discharged.

Samples should be taken immediately downstream from pretreatment facilities if such exist or immediately downstream from the regulated or manufacturing process if no pretreatment exists or as determined by the Plant Manager and contained in the user's wastewater discharge permit. For categorical users, if other wastewaters are mixed with the regulated wastewater prior to pretreatment the user should measure the flows and concentrations necessary to allow use of the combined wastestream formula of 40 CFR 403.6(e) in order to evaluate compliance with the Applicable Categorical Pretreatment Standards. For other SIUs, for which the Plant Manager has adjusted discharge limitations to factor out dilution flows, the user should measure the flows and concentrations necessary to evaluate compliance with the adjusted pretreatment standard(s).

All sample results shall indicate the time, date and place of sampling and methods of analysis and shall certify that such sampling and analysis is representative of normal work cycles and expected pollutant discharges from the user. If a user sampled and analyzed more frequently than was required in its wastewater discharge permit, using methodologies in 40 CFR Part 136, it must submit all results of sampling and analysis of the discharge as part of its self-monitoring report.

27. CONFIDENTIAL INFORMATION.

Information and data furnished to the Plant Manager and/or Participant with respect to the nature and frequency of discharge shall be available without restriction unless the user specifically requests and is able to demonstrate to the satisfaction of the Plant Manager and/or Participant that the release of such information would divulge information, processes or methods of production entitled to protection as trade secrets or proprietary information of the user under the laws or regulations of the State or Federal Government. If a user furnishing a report requests that information provided as part of a report or permit process be kept confidential, and the user marks said pages as confidential, then the portions of a report or other information which may disclose trade secrets or secret processes protected by State or Federal law shall not be made available for inspection by the public, subject to the provisions of RCW chapter 42.17, but shall be made available upon written request to governmental agencies for uses related to this ordinance, the National Pollutant Discharge Elimination System (NPDES) Permit, State Disposal System Permit and/or the Pretreatment Program; provided however that such portions of a report or other information shall be available for use by the State or any State Agency in judicial review or enforcement proceedings involving the user furnishing the report. Wastewater constituents and characteristics and other "effluent data" as defined by 40 CFR 2.302 will not be recognized as confidential information and will be available to the public without restriction.

Information accepted by the Plant Manager and/or Participant as confidential, shall not be transmitted to any governmental agency or to the general public by the Plant Manager and/or Participant until and unless a ten-day notification is given to the user. Once notice of intent to release information has been given to the user, if the user fails to contest the release, then any rights created by this section shall be deemed to have been waived.

28. BYPASS.

A. For the purposes of this section;

1. "Bypass" means the intentional diversion of wastestreams from any portion of a user's treatment facility.
2. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

B. A user may allow any bypass to occur which does not cause applicable pretreatment standards or requirements to be violated, but only if it also is for essential maintenance to assure efficient operation. These bypasses are not subject to the provision of paragraphs (C) and (D) of this section.

C. 1. If a user knows in advance of the need for a bypass, it shall submit prior notice to the Plant Manager, at least ten (10) days before the date of the bypass, if possible.

2. A user shall submit oral notice to the Plant Manager of an unanticipated bypass that exceeds applicable pretreatment standards within twenty four (24) hours from the time it becomes aware of the bypass. A written submission shall also be provided within five (5) days of the time the user becomes aware of the bypass. The written submission shall contain a description of the bypass and its cause; the duration of the bypass, including exact dates and times, and, if the bypass has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass. The Plant Manager may waive the written report on a case-by-case basis if the oral report has been received within twenty four (24) hours.

D. 1. Bypass is prohibited, and the Participant may take an enforcement action against a user for a bypass, unless:

a. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

b. There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

c. The user submitted notices as required under paragraph (C) of this section.

2. The Participant may approve an anticipated bypass, after considering its adverse effects, if the Plant Manager determines that it will meet the three conditions listed in paragraph (D)(1) of this section.

29. EMERGENCY SUSPENSION OF SERVICE AND PERMIT.

The Participant may order the suspension of wastewater treatment service and of the Discharge Permit of a user without advance notice if it appears to the Plant Manager and/or Participant that an actual or potential discharge:

A. Presents or threatens a substantial danger to the health or welfare of persons or to the environment; or,

B. Threatens to interfere with the operation of the POTW or to violate any pretreatment limits imposed by this chapter or by any Discharge Permit issued pursuant to this ordinance.

Any user notified of the Participant's suspension order shall cease immediately all discharges.

Any user whose permit has been suspended pursuant to this section shall have the right to a post-suspension hearing to be conducted in accordance with the procedures set forth in Section 36. The Participant shall reinstate the Discharge Permit and wastewater treatment services upon proof by the user of the elimination of the risk of actual or potential discharge, unless the Participant has commenced proceedings for service termination and permit revocation pursuant to Section 30.

In addition to all other rights and remedies, the Participant shall have the authority to physically cap, block, or seal the side sewer line at its juncture with the sewer line or elsewhere (whether on public or private property) if the Plant Manager determines that such action is reasonably necessary to suspend service as authorized by this section. The Participant shall have the right of access onto the user's private property to accomplish such capping, blocking, or sealing of the sewer line.

If the Participant has invoked an emergency suspension of service, the user must file a written report to the Plant Manager, describing the causes of the harmful contribution, and the measures taken to prevent any future occurrence. This report is required before service can resume.

30. TERMINATION OF TREATMENT SERVICES, PERMIT REVOCATION.

The Participant shall have authority to terminate wastewater treatment services and to revoke the discharge permit of any user if it determines that the user has:

A. Failed to accurately report wastewater constituents and characteristics;

- B. Failed to report significant changes in wastewater constituents, volume, characteristics, or user operations;
- C. Refused reasonable access to the user's premises for purposes of inspection, sampling, or monitoring;
- D. Violated conditions of the wastewater discharge permit;
- E. Violated any of the provisions of this ordinance or regulations promulgated thereunder; or
- F. Violated any lawful order of the Participant issued with respect to the user's permit or this ordinance.

The user shall be given written notice of the Participant's decision (and basis or bases therefore) to terminate wastewater services and shall have the right to a pre-termination hearing in accordance with the provisions of Section 36.

31. NOTIFICATION OF VIOLATION.

When the Plant Manager finds that a user has violated (or continues to violate) any provision of this ordinance, a wastewater discharge permit or order issued hereunder, or any other pretreatment standard or requirement, the Participant may serve upon that user a written Notice of Violation, via certified letter. Within ten (10) days of the receipt of this notice, an explanation of the violation and a plan for the satisfactory correction and prevention thereof, to include specific required actions, shall be submitted by the user to the Plant Manager. Submission of this plan in no way relieves the user of liability for any violations occurring before or after receipt of the Notice of Violation. Nothing in this section shall limit the authority of the Participant to take any action, including emergency actions or any other enforcement action, without first issuing a Notice of Violation.

32. CONSENT ORDERS.

The Participant may enter into Consent Orders, assurances of voluntary compliance, or other similar documents establishing an agreement with any user responsible for non-compliance. Such documents will include specific action to be taken by the user to correct the non-compliance within a time period specified by the document. Such documents shall have the same force and effect as the administrative orders issued pursuant to Sections 33 and 34 of this ordinance and shall be judicially enforceable. Use of a Consent Order shall not be a bar against, or prerequisite for, taking any other action against the user.

33. COMPLIANCE SCHEDULE ORDER.

When the Plant Manager finds that a user has violated or continues to violate any provision of this ordinance, a wastewater discharge permit or order issued hereunder, or any other pretreatment standard or requirement, the Participant may issue an order to the user responsible for the discharge describing the nature of the violation; directing that the user come into compliance within a time specified in the order; and describing the method of appeal. The order shall be served by personal service or by mail to the user's last known address.

If the user does not come into compliance within the time specified in the order, sewer service may be discontinued unless adequate treatment facilities, devices, or other related appurtenances are installed and properly operated. Compliance orders may also contain other requirements to address the non-compliance, including additional self-monitoring and management practices designed to minimize the amount of pollutants discharged to the sewer. Issuance of a compliance order shall not be a bar against, or a prerequisite for, taking any other action against the user. Compliance schedules shall conform to the requirements specified in Section 18 subparts G.1. through G.3. of this ordinance.

34. CEASE AND DESIST ORDERS.

When the Plant Manager finds that a user has violated (or continues to violate) any provision of this ordinance, a wastewater discharge permit or order issued hereunder, or any other pretreatment standard or requirement, or that the user's past violations are likely to recur, the Participant may issue an order to the user directing it to cease and desist all such violations and directing the user to:

A. Immediately comply with all requirements; and

B. Take such appropriate remedial or preventive action as may be needed to properly address a continuing or threatened violation, including halting operations and/or terminating the discharge.

Issuance of a cease and desist order shall not be a bar against, or a prerequisite for, taking any other action against the user.

35. ADMINISTRATIVE FINES.

A. When the Plant Manager finds that a user has violated or continues to violate any provision of this ordinance, a wastewater discharge permit or order issued hereunder, or any other pretreatment standard or

requirement, the Participant may fine such user in an amount not to exceed \$10,000. Such fines shall be assessed on a per violation, per day basis. In the case of monthly or other long term average discharge limits, fines shall be assessed for each day during the period of violation.

B. Unpaid charges, fines, and penalties shall, after thirty (30) calendar days, be assessed an additional penalty of fifteen percent (15%) of the unpaid balance, and interest shall accrue thereafter at a rate of ten percent (10%) per month. A lien against the user's property will be sought for unpaid charges, fines, and penalties.

C. Users desiring to dispute such fines must file a written request for the Participant to reconsider the fine along with full payment of the fine amount within fifteen (15) days of being notified of the fine. Where a request has merit, the Participant, in conjunction with the Plant Manager shall convene a hearing on the matter within fifteen (15) days of receiving the request from the user. In the event the user's appeal is successful, the payment, together with any interest accruing thereto, shall be returned to the user. The Participant may add the costs of preparing administrative enforcement actions, such as notices and orders, to the fine.

D. Issuance of an administrative fine shall not be a bar against, or a prerequisite for, taking any other action against the user.

36. ADMINISTRATIVE HEARING.

A. A user shall have the right to an administrative hearing to contest the Participant's determination:

1. To impose an enforcement action provided for by this ordinance;
2. That the user has violated a compliance schedule order.

B. Any hearing pursuant to this section must be requested by the user in writing within fifteen (15) business days after the user receives notice of the Participant's decision. The user's written request for hearing shall be filed with the Plant Manager.

The LOTT Technical Sub-Committee (TSC) shall conduct the hearing within fifteen (15) business days of the receipt of the request (or within five (5) business days if the user is contesting suspension of wastewater services and discharge permit.)

C. The administrative hearing authorized by this section shall be held before the TSC. Formal rules of evidence shall not apply but the user and the Participant shall have the right to present witnesses and other evidence. The TSC shall issue a written decision within fourteen (14) business days of the conclusion of the hearing.

D. Any user requesting a hearing shall have the right to make an electronic or stenographic record of the proceedings. Such record shall be made at the user's expense.

E. The TSC may by resolution or ordinance adopt additional rules for the conduct of hearings pursuant to this section.

F. The TSC shall serve notice, to the person requesting the hearing, of the meeting personally or by registered or certified mail (return receipt requested) at least five (5) days prior to the hearing. Such notice may be served on any authorized representative of the user.

G. The decision of the TSC shall be final.

37. INJUNCTIVE RELIEF.

When the Plant Manager finds that a user has violated (or continues to violate) any provision of this ordinance, a wastewater discharge permit, or order issued hereunder, or any other pretreatment standard or requirement, the Participant may petition the Superior Court for the issuance of a temporary or permanent injunction, as appropriate, which restrains or compels the specific performance of the wastewater discharge permit, order, or other requirement imposed by this ordinance on activities of the user. The Participant may also seek such other action as is appropriate for legal and/or equitable relief, including a requirement for the user to conduct environmental remediation. A petition for injunctive relief shall not be a bar against, or a prerequisite for, taking any other action against a user.

38. CIVIL PENALTIES.

A. A user which has violated or continues to violate any provision of this ordinance, a wastewater discharge permit, or order issued hereunder, or any other pretreatment standard or requirement shall be liable to the Participant for a maximum civil penalty of \$10,000 per violation, per day. In the case of a monthly or other long-term average discharge limit, penalties shall accrue for each day during the period of the violation.

B. The Participant may recover reasonable attorneys fees, court costs, and other expenses associated with enforcement activities, including sampling and monitoring expenses, and the cost of any actual damages incurred by the POTW and/or the Participant.

C. In determining the amount of civil liability, the Court shall take into account all relevant circumstances, including but not limited to, the extent of harm caused by the violation, the magnitude and duration, any economic benefit gained through the user's violation, corrective actions by the user, the compliance history of the user, and any other factor as justice requires.

D. Filing a suit for civil penalties shall not be a bar against, or a prerequisite for, taking any other action against a user.

39. JUDICIAL REVIEW.

Any final administrative decision of the Participant rendered pursuant to this Ordinance may be reviewed only by the Superior Court. The review shall be initiated by a petition filed by the Industrial User. Such review shall be timely and shall be filed no later than ten (10) business days after the Participant has provided notice of the decision.

40. ANNUAL PUBLICATION OF ENFORCEMENT ACTIONS.

The Participant shall publish annually, in the largest daily newspaper published in the municipality where the POTW is located, a list of the users which, during the previous twelve (12) months, were in significant non-compliance with applicable pretreatment standards and requirements. The term significant non-compliance shall mean:

A. Chronic violations of wastewater discharge limits, defined here as those in which sixty-six percent (66%) or more of wastewater measurements taken during a six (6) month period exceed the daily maximum limit or average limit for the same pollutant parameter by any amount;

B. Technical Review Criteria (TRC) violations, defined here as those in which thirty-three percent (33%) or more of wastewater measurements taken for each pollutant parameter during a six (6) month period equals or exceeds the product of the daily maximum limit or the average limit multiplied by the applicable criteria [1.4 for BOD, TSS, FOG, and 1.2 for all other pollutants except pH];

C. Any other discharge violation that the Plant Manager believes has caused alone or in combination with other discharges, interference or pass through (including endangering the health of POTW personnel or the general public);

D. Any discharge of pollutants that has caused imminent endangerment to the public or to the environment, or has resulted in the Plant Manager or Participant's exercise of its emergency authority to halt or prevent such a discharge;

E. Failure to meet, within ninety (90) days of the scheduled date, a compliance schedule milestone contained in a wastewater discharge permit or enforcement order for starting construction, completing construction, or attaining final compliance;

F. Failure to provide within thirty (30) days after the due date, any required reports, including baseline monitoring reports, reports on compliance with categorical pretreatment standard deadlines, periodic self-monitoring reports, and reports on compliance with compliance schedules;

G. Failure to accurately report non-compliance; or

H. Any other violation(s) which the Plant Manager or Participant determines will adversely affect the operation or implementation of the local pretreatment program.

41. RIGHT TO WRITTEN INTERPRETATION OF CHAPTER.

Any user or any interested party shall have the right to request an interpretation or ruling by the Participant on any matter covered by this ordinance. The request must be in writing and must be addressed to the Participant. The Plant Manager and/or Participant shall provide a prompt written response. A request pursuant to this section shall not stay or otherwise affect enforcement proceedings.

42. OPERATING UPSETS.

For the purposes of this section, "upset" means an exceptional incident in which there is unintentional and temporary non-compliance with applicable pretreatment standards because of factors beyond the reasonable control of the user. An upset does not include non-compliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

A. Reporting Requirements: The user will immediately inform the Plant Manager of an upset and submit the following information to the Plant Manager within five (5) days:

1. A description of the indirect discharge and cause of non-compliance;
2. The period of non-compliance, including exact dates and times or, if not corrected, the anticipated time the non-compliance is expected to continue;
3. Steps being taken and/or planned to reduce, eliminate, and prevent the recurrence of the non-compliance.

B. Required Actions: users shall control production of all discharges to the extent necessary to maintain compliance with applicable pretreatment standards upon reduction, loss, or failure of its treatment facility until the facility is restored or an alternative method of treatment is provided. This requirement applies in the situation where, among other things, the primary source of power of the treatment facility is reduced, lost, or fails.

C. Affirmative Defense: an upset shall constitute an affirmative defense to an action brought for non-compliance with applicable pretreatment standards if the user can demonstrate through properly signed, contemporaneous operation logs, or other relevant evidence that:

1. An upset occurred and the user can identify the cause(s) of the upset;
2. The facility was at the time being operated in a prudent and workman-like manner and in compliance with applicable operation and maintenance procedures; and
3. The user has complied with the reporting requirements of "A" (above).

D. Burden of Proof: In any enforcement proceeding, the user seeking to establish the occurrence of an upset shall have the burden of proof.

E. Defense applies only to enforcement actions: Users will have the opportunity for a judicial determination on any claim of upset only in an enforcement action brought for non-compliance with applicable pretreatment standards. Such defense shall not relieve the user of any liability for the upset, including liability for damages to the POTW, the Participant, or third persons.

43. RECORDS RETENTION.

All users subject to this ordinance shall retain and preserve for no less than three (3) years, any records, books, documents, memoranda, reports, correspondence and any and all summaries thereof, relating to monitoring, sampling and chemical analyses made by or in behalf of a user in connection with its discharge. Records shall include the date, exact place, method, and time of sampling; the name of the persons taking the samples; the dates analyses were performed; who performed the analyses; the analytical techniques or methods used; and the results of such analysis. All records which pertain to matters which are the subject of an enforcement action or litigation shall be retained and preserved by the user until all enforcement activities have concluded and all periods of limitation with respect to any and all appeals have expired.

44. REGULATIONS AND RIGHT OF REVISION.

The Plant Manager shall propose, subject to approval and adoption by the Participant, additional regulations consistent with this ordinance when necessary to reflect changes in applicable State and/or Federal regulations.

The Participant reserves the right to amend this ordinance and any permits it issues under it in a manner consistent with Section 4 of the Intergovernmental Agreement for Industrial Waste Pretreatment Program to provide for more stringent limitations or requirements on discharges to the POTW if such amendments are deemed necessary to comply with the objectives set forth in this ordinance, or are otherwise in the public interest. No vested right shall be created by the issuance of any permit under this ordinance.

45. RECOVERY OF COSTS INCURRED BY THE PARTICIPANT.

Any user violating any of the provisions of this ordinance who discharges or causes a discharge producing a deposit or obstruction or causes damage to or impairs the POTW shall be liable to the Participant for any reasonable expense, loss, fines or damage caused by such violation or discharge. The Participant shall bill the user for the cost incurred by the Participant for any cleaning, repair, replacement work, or other damages caused by the violation or discharge. Refusal to pay the assessed costs shall constitute a violation of this ordinance enforceable under the provisions of Part 35 of this ordinance.

46. CRIMINAL PROSECUTION.

A. A user which has willfully or negligently violated any provision of this ordinance, a wastewater discharge permit, or order issued hereunder, or any other pretreatment standard or requirement shall, upon conviction, be guilty of a misdemeanor, punishable by a fine of not more than \$10,000 per violation per day, or imprisonment for not more than one (1) year, or both.

B. A user which has willfully or negligently introduced any substance into the POTW which causes personal injury or property damage shall, upon conviction, be guilty of a misdemeanor and be subject to a penalty of not more than \$10,000 and/or be subject to imprisonment for one (1) year. This penalty shall be in addition to any other cause of action for personal injury or property damage available under State law.

C. A user which knowingly made any false statements, representations, or certifications in any application, record, report, plan, or other documentation filed, or required to maintained, pursuant to this ordinance, wastewater discharge permit, or order issued hereunder, or who falsified, tampered with, or knowingly rendered inaccurate any monitoring device or method required under this ordinance shall, upon conviction, be punished by a fine of not more than \$10,000 per violation per day, or imprisonment for not more than one (1) year, or both.

47. REMEDIES NON-EXCLUSIVE.

The provisions in Sections 29 through 38 and sections 45 and 46 of this ordinance are not exclusive remedies. The Participant reserves the right to take any, all, or any combination of these actions against a non-compliant user. Enforcement of pretreatment violations will generally be in accordance with the enforcement response plan provided by the Plant Manager. However, the Participant reserves the right to take other action against any user when the circumstances warrant. Subject to constitutional provisions relating to double jeopardy, the Participant is empowered to take more than one enforcement action against any non-compliant user. These actions may be taken concurrently.

48. STATE REQUIREMENTS.

State requirements and limitations on discharges to the POTW shall be met by all users which are subject to such standards in any instance in which they are more

stringent than federal requirements and limitations, or those in this ordinance or other applicable ordinance.

49. SEVERABILITY.

If any provision, paragraph, word, section or article of this ordinance is invalidated by any court of competent jurisdiction, the remaining provisions, paragraphs, words, sections, and chapters shall not be affected and shall continue in full force and effect.

50. CONFLICT.

All other previously issued ordinances and parts of other ordinances inconsistent or conflicting with any part of this ordinance are hereby repealed to the extent of such inconsistency or conflict.

51. EFFECTIVE DATE.

This ordinance shall be in full force and effect immediately following its passage, approval, and publication, as provided by law.

Introduced the ____ day of ____, 199 .
First reading: ____ day of ____, 199 .
Second Reading: ____ day of ____, 199 .
Passed this ____ day of ____, 199 .
Ayes:
Nays:
Absent:
Not Voting:
Approved by me this ____ day of ____, 199 .

[insert appropriate City official]

Attest:
[City] Clerk

Published:
[Publication Date]

Exhibit H

OPERATIONS AND MAINTENANCE AGREEMENT

by and between

The City of Olympia and the LOTT Alliance

THIS OPERATIONS AND MAINTENANCE AGREEMENT (“O&M Agreement”), dated _____, 2000, is entered into by and between the City of Olympia (“Olympia”), a Washington municipal corporation, and the LOTT Wastewater Alliance (“LOTT”), a nonprofit corporation formed and existing under Chapters 24.03 and 39.34 RCW. The parties are herein individually referred to as “Party” and collectively as the “Parties.”

Recitals

WHEREAS, prior to the creation of the LOTT Alliance, Olympia had acted on behalf of the LOTT Partners as the lead agency for certain joint facilities, which involved owning, operating and maintaining such facilities; and

WHEREAS, each year since 1976, Olympia presented the LOTT Advisory Committee with a proposed budget which projected expenses for the operation and maintenance of the facilities, and consistently accepted the Advisory Committee’s recommendations in its formal adoption of the budget; and

WHEREAS, with the execution of the Interlocal Cooperation Act Agreement, the LOTT Alliance has been created and will upon Consolidation take ownership of all Joint Facilities formerly owned by the individual partners;

WHEREAS, the LOTT Alliance and Olympia desire that Olympia continue to operate those facilities which it has been operating, using competent staff, following similar procedures, meeting the same standards of performance, and using similar budgeting methods as having prevailed in the past, except that the Parties desire that Olympia’s responsibilities be established through an operations and maintenance agreement entered directly between Olympia and the LOTT Alliance as the new owner of the facilities; and

1. Purpose.

The City of Olympia, a municipal corporation of the State of Washington, and the LOTT Alliance, a Washington nonprofit corporation formed and existing under Chapters 24.03 and 39.34 RCW owned jointly by the Cities of Lacey, Olympia, and Tumwater and Thurston County, enter this Operations and Maintenance Agreement (“O&M Agreement”) to provide contractual terms for Olympia’s operation Joint Facilities owned by the LOTT Alliance.

2. Effective Date.

This O&M Agreement shall take effect on the date when Consolidation occurs pursuant to the Interlocal Cooperation Act Agreement (“Effective Date”).

3. Term

Unless terminated for a cause pursuant to Section 13 below, the O&M Agreement shall remain in force until one year after written notice of termination is executed and delivered by either party. Prior to the LOTT Alliance giving such notice, the LOTT Alliance shall prepare a study of operating costs and practices of Olympia and alternatives in its operations of the Facilities. If such termination occurs, the LOTT Alliance will provide for an orderly, smooth transition which fairly takes into account the effect on Olympia’s employees.

4. Joint Facilities; Future Joint Facilities.

For the purpose of this Agreement, “Joint Facilities” shall mean all “existing Joint Facilities” described in Exhibit B to the Interlocal Cooperation Act Agreement For Wastewater Management By the LOTT Wastewater Alliance. Future Joint Facilities shall include any facilities hereafter constructed or acquired by the LOTT Alliance.

5. Joint Facility Operation and Maintenance Services.

Olympia shall, at the Effective Date, assume responsibility for control, security, maintenance and operational performance of the Joint Facilities on a twenty-four hour per day, seven day per week basis. Olympia shall have operations and maintenance oversight authority over future Joint Facilities to the extent necessary to perform its obligations under this section.

- a) **Compliance with Law; General Standards.** Olympia shall operate and maintain the Facilities in compliance with all applicable federal, state, and local laws, regulations, and ordinances, and in compliance with any orders or permits under which the Facilities operate. Olympia’s operation and maintenance of the Joint Facilities shall conform to generally accepted industry principles and practices and the Treatment Plant’s and other facilities’ design capacity and capability, producing treated wastewater in full compliance with the NPDES permit requirements of the Environmental Protection Agency. Olympia shall also perform in accord with the Operation and Maintenance Manual established under WAC 173-240-080, the Department of Ecology “Orange Book,” the Water

Environment Federation Manual of Practice, the Water Quality Laboratory Quality Assurance Manual, Water Quality Laboratory Standards of Practice Approved by the Department of Ecology, Water Environment Federation Standard Methods for Analysis of Water and Wastewater, Pretreatment Operation Manual as Approved by the Department of Ecology, and other applicable technical reference manuals that are pertinent to the operation of the LOTT Joint Facilities.

b) Regulatory Agency Relations. As operator of the Joint Facilities, Olympia shall work cooperatively with all regulatory agencies with jurisdiction over the Facilities to assure:

- Compliance with all permits and licenses
- Continued satisfaction of laboratory accreditation standards
- Conformance with personnel, practices, and equipment safety requirements
- Completion of all testing and certification required to assure safe Facility operations and environment
- That biosolids produced by the Facility are handled and utilized in compliance with law and applicable permits
- That the Facility meets all applicable air quality standards

c) Personnel. Olympia shall maintain an appropriately-sized workforce using qualified employees who have appropriate training, skill and, where required by law, appropriate certifications. Olympia shall further assure that employees are skilled and knowledgeable in their assigned duties.

d) Planning. Olympia shall look to future needs and submit plans to assure continuous and reliable performance of all Facility processes, in such a manner as to respond to and remain in compliance with changing regulations and other requirements.

e) Insurance. Olympia shall maintain during the life of this O&M Agreement Public Liability and General Liability Insurance in amounts deemed appropriate by the Alliance. The City of Olympia is a member of the Washington Cities Insurance Authority (WCIA) and this membership shall constitute adequate insurance coverage by Olympia for this Section. Olympia shall also maintain Worker's Compensation as required by state and federal law. The LOTT Alliance shall be responsible for providing fire and other property damage insurance to cover the Joint Facilities and equipment, vehicles, tools, and other property associated therewith.

f) **Reporting.** Olympia shall provide in a timely manner all necessary reporting functions to regulatory agencies and others as necessary in the operation of the facilities. These reports shall include, but not be limited to:

- NPDES Reports
- Lab Accreditation Reports
- Pretreatment Reports
- Annual Budget Requests
- Monthly operations report submitted to the LOTT Alliance by the 15th of the following month, including data reported under the NPDES permit, overview of statement of operation and any significant events.

g) **Emergency Response.** Olympia shall maintain in place emergency response plans for all major disasters and plans for restoration of Joint Facility processes following the disaster, including:

- Plans for continuous operations during a disaster
- Recovery following a disaster
- Community information

h) **Industrial Pretreatment.** Olympia shall administer a pretreatment program in accordance with authority delegated from the Department of Ecology in accordance with applicable pretreatment ordinances, and the Department of Ecology approved operations manual or pretreatment programs. In addition, Olympia shall:

- Provide an annual report to the LOTT Alliance
- Provide a permitting system for major and minor industrial dischargers
- Regularly inspect and communicate with industrial dischargers
- Enforce the pretreatment ordinance in concert with the applicable LOTT Partner in accord with the Interlocal Cooperation Act Agreement for Wastewater Management by the LOTT Wastewater Alliance

6. Permitting Responsibilities.

The LOTT Alliance will maintain and hold the NPDES Permit, permits for sludge management and any applicable air emission permits. Olympia shall cooperate with the LOTT Alliance in preparing information to apply for, amend, renew, or demonstrate compliance under such permits. Because the costs necessary to comply with any modifications in such permits cannot be determined, the LOTT Alliance shall approve requested amendments to Olympia=s budget for the reasonable costs of complying with changed or new permit conditions.

7. Budget.

The LOTT Alliance shall pay the costs incurred by Olympia in the performance of this O&M Agreement to the extent that such costs conform with a budget for responsibilities approved in advance by the LOTT Alliance in accordance with the following process. The year 2000 budget shall be that budget already adopted for that year by the City of Olympia on behalf of LOTT. On or before May 1 of each year preceding a new budget year, Olympia shall prepare a proposed budget including all costs and expenses anticipated to be incurred in the performance of its duties in the following calendar year. The proposed budget shall be in substantially the same form as Olympia's 2000 budget with respect to operation and maintenance of Joint Facilities. The budget shall include overhead costs in accordance with practices used prior to the effective date of this Agreement. The LOTT Alliance shall consider the proposed budget in good faith in accordance with the procedures for budgeting set forth in Section 3.7 of the Interlocal Cooperation Act Agreement for Wastewater Management by the LOTT Wastewater Alliance and shall, no later than August 31, approve a budget for the following calendar year to reasonably fund the services required herein. If Olympia objects to the budget as approved by the LOTT Alliance, it shall notify the LOTT Alliance within ten (10) days after the passage of such budget. Any such disputes shall be resolved pursuant to the provisions of Section 14 of this Agreement and such resolution shall occur prior to the commencement of the budget year in question.

Once approved, the Budget ("Budget" shall mean an approved budget) shall be the maximum compensation available to Olympia for its services under this O&M Agreement. Olympia may request and the LOTT Alliance shall consider and in good faith approve modifications at any time. Any unspent and uncommitted funds held by Olympia at the end of the budget year shall be carried over to the following budget year.

8. Payment.

City of Olympia shall receive from the LOTT Alliance as soon as practical, not to exceed thirty (30) days after the Effective Date of this O&M Agreement \$750,000 as an advance for payment of services under this Agreement. This amount may be modified by agreement of the parties. The City of Olympia shall place these funds in a Fund which is separate from assets of the City of Olympia. The City of Olympia shall invest advanced funds and credit any net earnings from those investments to the Fund into which the advance was placed. The City of Olympia shall not use these funds for any purpose not associated with this Agreement. From time to time, the City of Olympia shall notify the LOTT Alliance of the use of these funds, (hereafter referred to as the "reimbursement amount"). Upon such notification, the LOTT Alliance shall pay to the City of Olympia the reimbursement amount, so as to replenish the Fund to the advance amount. The reimbursement amount shall be the amount of costs paid from the advance since the previous reimbursement notification less net earnings on investments posted to the Fund into which the advance was placed since the previous reimbursement notification.

Replenishment of the advance shall be made within ten (10) business days after a request is made by the City of Olympia. If the LOTT Alliance disputes the reimbursement amount

requested by the City of Olympia, it shall pay the reimbursement amount and notify the City of Olympia of the amount disputed. If the City of Olympia agrees with the disputed amount, it shall adjust the next reimbursement request. If the City of Olympia and the LOTT Alliance do not agree upon any disputed amount to be adjusted, the dispute resolution process defined in this Agreement shall be utilized. Any advance sums remaining in the Fund upon the termination of this Agreement shall be paid to the LOTT Alliance together with any interest earned upon such sums.

9. Payment by Alliance for Capital Expenditures by Olympia.

A. Capital expenditures shall not be included within the scope of this Agreement as operation and maintenance costs. Capital expenditures will be made by Olympia only after approval and funding by the LOTT Alliance. If such expenditures are urgently necessary to continue operation of any or all of the Joint Facilities in order to provide for public safety and environmental protection, Olympia shall make such emergency expenditures and make every effort to immediately seek and gain approval of these expenditures from the LOTT Alliance. The LOTT Alliance will reimburse Olympia for these emergency capital expenditures so long as Olympia has acted in good faith in making the expenditures. Reimbursement will be made within thirty (30) days of notification by Olympia. Capital expenditures, except for emergency capital expenditures, shall not be considered part of this Agreement and shall be funded by the LOTT Alliance. The term "capital expenditures" shall be defined as any expenditure for: 1) the purchase of new equipment or Joint Facility items that cost more than \$5,000 and have a lifetime span of two (2) years or more; or 2) major repairs which significantly extend equipment or facility service life and cost more than \$5,000.

Purchases or repairs, except emergency expenditures, which fall below the amounts and life span above shall be considered part of the Operation and Maintenance Budget per Section 7 above.

B. Starting with the first Budget under this Agreement and for each subsequent year hereafter, Olympia shall prepare and propose for LOTT Alliance review and approval annual and six-year capital improvement plans identifying major repairs and capital expenditures that will be necessary for then existing Joint Facilities and to restore, maintain, replace, or upgrade the equipment for efficiency, safety, function, and/or compliance with current and anticipated regulatory requirements. Odor control, noise control, reduction of visual impacts and lighting impacts should be addressed. The Alliance shall make funding provisions for approved major repairs and capital expenditures and shall provide the ways and means for construction of same. The provisions of the paragraph shall not apply to planning by the LOTT Alliance for the construction or acquisition of Joint Facilities in the future.

C. Additional operation and maintenance costs resulting from new capital facilities shall be included in the budget approved for this Agreement by the LOTT Alliance. The amount of additional operation and maintenance costs for Joint Facility items that go on-line in the middle of a budget year shall be negotiated in good faith between Olympia and the LOTT Alliance.

10. Rolling Stock and Equipment.

Within the LOTT budget of this Agreement, Olympia shall pay for equipment rental of all rolling stock and equipment used for operation and maintenance of Joint Facilities. In the event Olympia's role under this Agreement is terminated, Olympia shall pay LOTT any depreciation reserves maintained for such rolling stock and equipment and shall convey without cost the applicable rolling stock and equipment to LOTT.

11. Contracts for Goods and Services.

Olympia shall in its own capacity and not as agent for the LOTT Alliance enter into contracts for the purchase and disposal of goods and for the performance of services as may be necessary to perform Olympia's obligations under this O&M Agreement, provided, however, that the LOTT Alliance shall enter into and maintain directly contracts relating to capital expenditures and major repairs discussed in Section 9 above. Any contracts entered into/by Olympia pursuant to this O&M Agreement for work or goods relating to the Joint Facilities shall be made expressly assignable to the LOTT Alliance, without restriction or condition of any kind, and Olympia shall, at the LOTT Alliance's request, assign such contracts to the LOTT Alliance at the termination of this O&M Agreement.

12. Notices; Authorized Representatives.

All notices shall be in writing and delivered in person or transmitted by certified mail, return receipt requested, postage prepaid. Notices required to be given to the City of Olympia shall be given to the City Manager or his/her designee.

Notices required to be given to the LOTT Alliance shall be given to the LOTT Alliance Board Chair or his or her designee.

13. Termination for Cause.

Either party may terminate the O&M Agreement upon material breach by the other party providing that the terminating party first provides written notice of such breach to the other party and such breach has not been corrected within a forty-five day cure period. By mutual agreement by the Parties, the forty-five day cure period may be extended where the situation warrants.

14. Force Majeure.

If a Party is rendered unable by Force Majeure to carry out, in whole or part, its obligations under this Agreement and such Party gives notice and full details of the event to the other Party as soon as practicable after occurrence, then during the pendency of such Force Majeure but for no longer period, the obligations of the Party affected by the event (other than the obligation to make payments due for performance prior to the event) shall be suspended to the extent required. The Party claiming Force Majeure shall remedy the Force Majeure as soon as possible.

15. Disputes.

Any disputes under this Agreement shall be resolved by negotiation, if possible. If impasse is reached, the Parties shall employ a panel with three arbitrators, one appointed by each party and the third by the two appointed arbitrators, to resolve the dispute. The ruling of the panel shall be binding, subject to judicial review under an arbitrary and capricious standard.

16. Access to Facilities.

LOTT Alliance staff shall have access to the Joint Facilities at all times but shall be required to first sign in at the entrance.

17. Independent Contractor.

The relationship of Olympia to the LOTT Alliance created by this O&M Agreement is that of an independent contractor, and none of Olympia's employees or agents shall be considered employees of the LOTT Alliance.

18. Non-Waiver.

The failure on the part of either party to enforce its right as to any provision of the Agreement shall not be construed as a waiver of its rights to enforce such provision in the future.

19. No Third Party Beneficiaries.

Except as expressly provided herein, this Agreement is not intended to create rights in, or to grant remedies to, any third party as a beneficiary of this Agreement or of any duty, obligation or undertaking established herein.

20. Governing Law.

This O&M Agreement shall be governed by the laws of the State of Washington.

21. Assignment.

This O&M Agreement shall inure to the benefit of, and shall bind, the respective successors and assigns of the Parties; provided, however, that neither Party shall assign this O&M Agreement without first obtaining the other Party's written consent, which shall not be unreasonably withheld.

22. Severability.

If one or more clauses, sections, or provision of this Agreement is held to be unlawful, invalid or unenforceable by any court with jurisdiction, the remainder of this Agreement shall not be affected thereby.

23. Modifications in Writing.

Except as expressly provided in this Agreement, no amendment or modification of this Agreement shall be effective unless made in writing and executed by all Parties.

IN WITNESS WHEREOF, the Parties have caused this O&M Agreement to be executed in their respective names and in their respective behalf, and have caused their respective names to be subscribed and affixed by their respective duly and legally elected and authorized officers, who are authorized to execute this O&M Agreement this _____ day of _____,

CITY OF OLYMPIA

LOTT WASTEWATER ALLIANCE

By: 
Its: Mayor
Date: 2/10/00

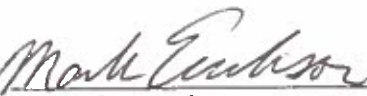
By: _____
Its: _____
Date: _____

ATTEST:

By: 

ATTEST:

By: _____
Approved as to form: _____

Approved as to form: _____

Legal Counsel

Legal Council

moe9319c
1/14/00

(This page intentionally left blank)

OPERATIONS AND MAINTENANCE AGREEMENT

by and between
The City of Olympia and the LOTT Alliance

THIS OPERATIONS AND MAINTENANCE AGREEMENT ("O&M Agreement"), dated Jan 18, 2000, is entered into by and between the City of Olympia ("Olympia"), a Washington municipal corporation, and the LOTT Wastewater Alliance ("LOTT"), a nonprofit corporation formed and existing under Chapters 24.03 and 39.34 RCW. The parties are herein individually referred to as "Party" and collectively as the "Parties."

Recitals

WHEREAS, prior to the creation of the LOTT Alliance, Olympia had acted on behalf of the LOTT Partners as the lead agency for certain joint facilities, which involved owning, operating and maintaining such facilities; and

WHEREAS, each year since 1976, Olympia presented the LOTT Advisory Committee with a proposed budget which projected expenses for the operation and maintenance of the facilities, and consistently accepted the Advisory Committee's recommendations in its formal adoption of the budget; and

WHEREAS, with the execution of the Interlocal Cooperation Act Agreement, the LOTT Alliance has been created and will upon Consolidation take ownership of all Joint Facilities formerly owned by the individual partners;

WHEREAS, the LOTT Alliance and Olympia desire that Olympia continue to operate those facilities which it has been operating, using competent staff, following similar procedures, meeting the same standards of performance, and using similar budgeting methods as having prevailed in the past, except that the Parties desire that Olympia's responsibilities be established through an operations and maintenance agreement entered directly between Olympia and the LOTT Alliance as the new owner of the facilities; and

1. Purpose.

The City of Olympia, a municipal corporation of the State of Washington, and the LOTT Alliance, a Washington nonprofit corporation formed and existing under Chapters 24.03 and

39.34 RCW owned jointly by the Cities of Lacey, Olympia, and Tumwater and Thurston County, enter this Operations and Maintenance Agreement ("O&M Agreement") to provide contractual terms for Olympia's operation Joint Facilities owned by the LOTT Alliance.

2. Effective Date.

This O&M Agreement shall take effect on the date when Consolidation occurs pursuant to the Interlocal Cooperation Act Agreement ("Effective Date").

3. Term

Unless terminated for a cause pursuant to Section 13 below, the O&M Agreement shall remain in force until one year after written notice of termination is executed and delivered by either party. Prior to the LOTT Alliance giving such notice, the LOTT Alliance shall prepare a study of operating costs and practices of Olympia and alternatives in its operations of the Facilities. If such termination occurs, the LOTT Alliance will provide for an orderly, smooth transition which fairly takes into account the effect on Olympia's employees.

4. Joint Facilities; Future Joint Facilities.

For the purpose of this Agreement, "Joint Facilities" shall mean all "existing Joint Facilities" described in Exhibit B to the Interlocal Cooperation Act Agreement For Wastewater Management By the LOTT Wastewater Alliance. Future Joint Facilities shall include any facilities hereafter constructed or acquired by the LOTT Alliance.

5. Joint Facility Operation and Maintenance Services.

Olympia shall, at the Effective Date, assume responsibility for control, security, maintenance and operational performance of the Joint Facilities on a twenty-four hour per day, seven day per week basis. Olympia shall have operations and maintenance oversight authority over future Joint Facilities to the extent necessary to perform its obligations under this section.

a) **Compliance with Law; General Standards.** Olympia shall operate and maintain the Facilities in compliance with all applicable federal, state, and local laws, regulations, and ordinances, and in compliance with any orders or permits under which the Facilities operate. Olympia's operation and maintenance of the Joint Facilities shall conform to generally accepted industry principles and practices and the Treatment Plant's and other facilities' design capacity and capability, producing treated wastewater in full compliance with the NPDES permit requirements of the Environmental Protection Agency. Olympia shall also perform in accord with the Operation and Maintenance Manual established under WAC 173-240-080, the Department of Ecology "Orange Book," the Water Environment

Federation Manual of Practice, the Water Quality Laboratory Quality Assurance Manual, Water Quality Laboratory Standards of Practice Approved by the Department of Ecology, Water Environment Federation Standard Methods for Analysis of Water and Wastewater, Pretreatment Operation Manual as Approved by the Department of Ecology, and other applicable technical reference manuals that are pertinent to the operation of the LOTT Joint Facilities.

b) Regulatory Agency Relations. As operator of the Joint Facilities, Olympia shall work cooperatively with all regulatory agencies with jurisdiction over the Facilities to assure:

- Compliance with all permits and licenses
- Continued satisfaction of laboratory accreditation standards
- Conformance with personnel, practices, and equipment safety requirements
- Completion of all testing and certification required to assure safe Facility operations and environment
- That biosolids produced by the Facility are handled and utilized in compliance with law and applicable permits
- That the Facility meets all applicable air quality standards

c) Personnel. Olympia shall maintain an appropriately-sized workforce using qualified employees who have appropriate training, skill and, where required by law, appropriate certifications. Olympia shall further assure that employees are skilled and knowledgeable in their assigned duties.

d) Planning. Olympia shall look to future needs and submit plans to assure continuous and reliable performance of all Facility processes, in such a manner as to respond to and remain in compliance with changing regulations and other requirements.

e) Insurance. Olympia shall maintain during the life of this O&M Agreement Public Liability and General Liability Insurance in amounts deemed appropriate by the Alliance. The City of Olympia is a member of the Washington Cities Insurance Authority (WCIA) and this membership shall constitute adequate insurance coverage by Olympia for this Section. Olympia shall also maintain Worker's Compensation as required by state and federal law.

The LOTT Alliance shall be responsible for providing fire and other property damage insurance to cover the Joint Facilities and equipment, vehicles, tools, and other property associated therewith.

f) Reporting. Olympia shall provide in a timely manner all necessary reporting functions to regulatory agencies and others as necessary in the operation of the facilities. These reports shall include, but not be limited to:

- NPDES Reports
- Lab Accreditation Reports
- Pretreatment Reports
- Annual Budget Requests
- Monthly operations report submitted to the LOTT Alliance by the 15th of the following month, including data reported under the NPDES permit, overview of statement of operation and any significant events.

g) Emergency Response. Olympia shall maintain in place emergency response plans for all major disasters and plans for restoration of Joint Facility processes following the disaster, including:

- Plans for continuous operations during a disaster
- Recovery following a disaster
- Community information

h) Industrial Pretreatment. Olympia shall administer a pretreatment program in accordance with authority delegated from the Department of Ecology in accordance with applicable pretreatment ordinances, and the Department of Ecology approved operations manual or pretreatment programs. In addition, Olympia shall:

- Provide an annual report to the LOTT Alliance
- Provide a permitting system for major and minor industrial dischargers
- Regularly inspect and communicate with industrial dischargers
- Enforce the pretreatment ordinance in concert with the applicable LOTT Partner in accord with the Interlocal Cooperation Act Agreement for Wastewater Management by the LOTT Wastewater Alliance

6. Permitting Responsibilities.

The LOTT Alliance will maintain and hold the NPDES Permit, permits for sludge management and any applicable air emission permits. Olympia shall cooperate with the LOTT Alliance in preparing information to apply for, amend, renew, or demonstrate compliance under such permits. Because the costs necessary to comply with any modifications in such permits cannot be determined, the LOTT Alliance shall approve requested amendments to Olympia's budget for the reasonable costs of complying with changed or new permit conditions.

7. Budget.

The LOTT Alliance shall pay the costs incurred by Olympia in the performance of this O&M Agreement to the extent that such costs conform with a budget for responsibilities approved in advance by the LOTT Alliance in accordance with the following process. The year 2000 budget shall be that budget already adopted for that year by the City of Olympia on behalf of LOTT. On or before May 1 of each year preceding a new budget year, Olympia shall prepare a proposed budget including all costs and expenses anticipated to be incurred in the performance of its duties in the following calendar year. The proposed budget shall be in substantially the same form as Olympia's 2000 budget with respect to operation and maintenance of Joint Facilities. The budget shall include overhead costs in accordance with practices used prior to the effective date of this Agreement. The LOTT Alliance shall consider the proposed budget in good faith in accordance with the procedures for budgeting set forth in Section 3.7 of the Interlocal Cooperation Act Agreement for Wastewater Management by the LOTT Wastewater Alliance and shall, no later than August 31, approve a budget for the following calendar year to reasonably fund the services required herein. If Olympia objects to the budget as approved by the LOTT Alliance, it shall notify the LOTT Alliance within ten (10) days after the passage of such budget. Any such disputes shall be resolved pursuant to the provisions of Section 14 of this Agreement and such resolution shall occur prior to the commencement of the budget year in question.

Once approved, the Budget ("Budget" shall mean an approved budget) shall be the maximum compensation available to Olympia for its services under this O&M Agreement. Olympia may request and the LOTT Alliance shall consider and in good faith approve modifications at any time. Any unspent and uncommitted funds held by Olympia at the end of the budget year shall be carried over to the following budget year.

8. Payment.

City of Olympia shall receive from the LOTT Alliance as soon as practical, not to exceed thirty (30) days after the Effective Date of this O&M Agreement \$750,000 as an advance for payment of services under this Agreement. This amount may be modified by agreement of the parties. The City of Olympia shall place these funds in a Fund which is separate from assets of the

City of Olympia. The City of Olympia shall invest advanced funds and credit any net earnings from those investments to the Fund into which the advance was placed. The City of Olympia shall not use these funds for any purpose not associated with this Agreement. From time to time, the City of Olympia shall notify the LOTT Alliance of the use of these funds, (hereafter referred to as the "reimbursement amount"). Upon such notification, the LOTT Alliance shall pay to the City of Olympia the reimbursement amount, so as to replenish the Fund to the advance amount. The reimbursement amount shall be the amount of costs paid from the advance since the previous reimbursement notification less net earnings on investments posted to the Fund into which the advance was placed since the previous reimbursement notification.

Replenishment of the advance shall be made within ten (10) business days after a request is made by the City of Olympia. If the LOTT Alliance disputes the reimbursement amount requested by the City of Olympia, it shall pay the reimbursement amount and notify the City of Olympia of the amount disputed. If the City of Olympia agrees with the disputed amount, it shall adjust the next reimbursement request. If the City of Olympia and the LOTT Alliance do not agree upon any disputed amount to be adjusted, the dispute resolution process defined in this Agreement shall be utilized. Any advance sums remaining in the Fund upon the termination of this Agreement shall be paid to the LOTT Alliance together with any interest earned upon such sums.

9. Payment by Alliance for Capital Expenditures by Olympia.

A. Capital expenditures shall not be included within the scope of this Agreement as operation and maintenance costs. Capital expenditures will be made by Olympia only after approval and funding by the LOTT Alliance. If such expenditures are urgently necessary to continue operation of any or all of the Joint Facilities in order to provide for public safety and environmental protection, Olympia shall make such emergency expenditures and make every effort to immediately seek and gain approval of these expenditures from the LOTT Alliance. The LOTT Alliance will reimburse Olympia for these emergency capital expenditures so long as Olympia has acted in good faith in making the expenditures. Reimbursement will be made within thirty (30) days of notification by Olympia. Capital expenditures, except for emergency capital expenditures, shall not be considered part of this Agreement and shall be funded by the LOTT Alliance. The term "capital expenditures" shall be defined as any expenditure for: 1) the purchase of new equipment or Joint Facility items that cost more than \$5,000 and have a lifetime span of two (2) years or more; or 2) major repairs which significantly extend equipment or facility service life and cost more than \$5,000.

Purchases or repairs, except emergency expenditures, which fall below the amounts and life span above shall be considered part of the Operation and Maintenance Budget per Section 7 above.

B. Starting with the first Budget under this Agreement and for each subsequent year hereafter, Olympia shall prepare and propose for LOTT Alliance review and approval annual and six-year capital improvement plans identifying major repairs and capital expenditures that will be necessary for then existing Joint Facilities and to restore, maintain, replace, or upgrade the equipment for efficiency, safety, function, and/or compliance with current and anticipated regulatory requirements. Odor control, noise control, reduction of visual impacts and lighting impacts should be addressed. The Alliance shall make funding provisions for approved major repairs and capital expenditures and shall provide the ways and means for construction of same. The provisions of the paragraph shall not apply to planning by the LOTT Alliance for the construction or acquisition of Joint Facilities in the future.

C. Additional operation and maintenance costs resulting from new capital facilities shall be included in the budget approved for this Agreement by the LOTT Alliance. The amount of additional operation and maintenance costs for Joint Facility items that go on-line in the middle of a budget year shall be negotiated in good faith between Olympia and the LOTT Alliance.

10. Rolling Stock and Equipment.

Within the LOTT budget of this Agreement, Olympia shall pay for equipment rental of all rolling stock and equipment used for operation and maintenance of Joint Facilities. In the event Olympia's role under this Agreement is terminated, Olympia shall pay LOTT any depreciation reserves maintained for such rolling stock and equipment and shall convey without cost the applicable rolling stock and equipment to LOTT.

11. Contracts for Goods and Services.

Olympia shall in its own capacity and not as agent for the LOTT Alliance enter into contracts for the purchase and disposal of goods and for the performance of services as may be necessary to perform Olympia's obligations under this O&M Agreement, provided, however, that the LOTT Alliance shall enter into and maintain directly contracts relating to capital expenditures and major repairs discussed in Section 9 above. Any contracts entered into by Olympia pursuant to this O&M Agreement for work or goods relating to the Joint Facilities shall be made expressly assignable to the LOTT Alliance, without restriction or condition of any kind, and Olympia shall, at the LOTT Alliance's request, assign such contracts to the LOTT Alliance at the termination of this O&M Agreement.

12. Notices; Authorized Representatives.

All notices shall be in writing and delivered in person or transmitted by certified mail, return receipt requested, postage prepaid. Notices required to be given to the City of Olympia shall be given to the City Manager or his/her designee.

Notices required to be given to the LOTT Alliance shall be given to the LOTT Alliance Board Chair or his or her designee.

13. Termination for Cause.

Either party may terminate the O&M Agreement upon material breach by the other party providing that the terminating party first provides written notice of such breach to the other party and such breach has not been corrected within a forty-five day cure period. By mutual agreement by the Parties, the forty-five day cure period may be extended where the situation warrants.

14. Force Majeure.

If a Party is rendered unable by Force Majeure to carry out, in whole or part, its obligations under this Agreement and such Party gives notice and full details of the event to the other Party as soon as practicable after occurrence, then during the pendency of such Force Majeure but for no longer period, the obligations of the Party affected by the event (other than the obligation to make payments due for performance prior to the event) shall be suspended to the extent required. The Party claiming Force Majeure shall remedy the Force Majeure as soon as possible.

15. Disputes.

Any disputes under this Agreement shall be resolved by negotiation, if possible. If impasse is reached, the Parties shall employ a panel with three arbitrators, one appointed by each party and the third by the two appointed arbitrators, to resolve the dispute. The ruling of the panel shall be binding, subject to judicial review under an arbitrary and capricious standard.

16. Access to Facilities.

LOTT Alliance staff shall have access to the Joint Facilities at all times but shall be required to first sign in at the entrance.

17. Independent Contractor.

The relationship of Olympia to the LOTT Alliance created by this O&M Agreement is that of an independent contractor, and none of Olympia's employees or agents shall be considered employees of the LOTT Alliance.

18. Non-Waiver.

The failure on the part of either party to enforce its right as to any provision of the Agreement shall not be construed as a waiver of its rights to enforce such provision in the future.

19. No Third Party Beneficiaries.

Except as expressly provided herein, this Agreement is not intended to create rights in, or to grant remedies to, any third party as a beneficiary of this Agreement or of any duty, obligation or undertaking established herein.

20. Governing Law.

This O&M Agreement shall be governed by the laws of the State of Washington.

21. Assignment.

This O&M Agreement shall inure to the benefit of, and shall bind, the respective successors and assigns of the Parties; provided, however, that neither Party shall assign this O&M Agreement without first obtaining the other Party's written consent, which shall not be unreasonably withheld.

22. Severability.

If one or more clauses, sections, or provision of this Agreement is held to be unlawful, invalid or unenforceable by any court with jurisdiction, the remainder of this Agreement shall not be affected thereby.

23. Modifications in Writing.

Except as expressly provided in this Agreement, no amendment or modification of this Agreement shall be effective unless made in writing and executed by all Parties.

4. *Phragmites* *communis* L.

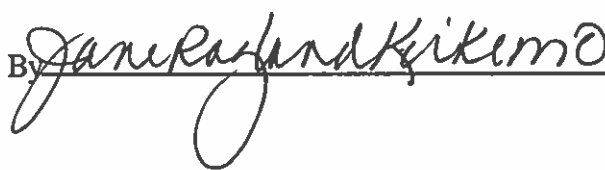
IN WITNESS WHEREOF, the Parties have caused this O&M Agreement to be executed in their respective names and in their respective behalf, and have caused their respective names to be subscribed and affixed by their respective duly and legally elected and authorized officers, who are authorized to execute this O&M Agreement this 18th day of January 2000

CITY OF OLYMPIA

By 
Its Mayor

Date: 1-26-00

ATTEST:

By 

APPROVED AS TO FORM:


Legal Counsel

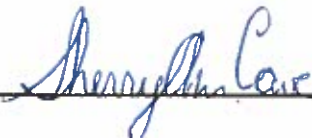
moe9319c
1/14/00

LOTT WASTEWATER ALLIANCE

By 
Its President

Date: July 14, 2000

ATTEST:

By 

APPROVED AS TO FORM:


Legal Counsel

Exhibit I

Agreement

Regarding Additional LOTT Joint Facilities

This Agreement, dated -----June 21-----, 1999, is entered into by and between the City of Olympia (“Olympia”), the City of Lacey (“Lacey”), the City of Tumwater (“Tumwater”), and Thurston County (the “County”), all of which are municipal corporations organized under the laws of the State of Washington and are herein collectively referred to as the “LOTT Partners.”

WHEREAS, the LOTT Partners entered into the Intergovernmental Contract for Wastewater Facilities Management of November, 1976, and

WHEREAS, that agreement provides that when The Advisory Committee deems it desirable and the LOTT Partners agree in writing that additional wastewater facilities be acquired or added, those facilities may become LOTT Joint Facilities, and

WHEREAS, as a result of several years of planning and deliberation, The Advisory Committee recommends the designation of existing City of Lacey facilities as LOTT Joint Facilities and LOTT’s construction of certain new facilities as LOTT Joint Facilities to prepare for expected future additions to the LOTT system and assure reliable management of existing wastewater flows in a manner consistent with the requirements of the Washington State Department of Ecology, and

WHEREAS, the facilities to be acquired from the City of Lacey were originally designed and constructed to be LOTT Joint Facilities and are integral to plans for future LOTT wastewater treatment, and

WHEREAS, the facilities to be constructed by LOTT as Joint Facilities are necessary to carry existing and future City of Tumwater and City of Olympia wastewater flows to Joint Facilities transmission and treatment structures, now

THEREFORE, IT IS AGREED by the LOTT Partners that the City of Lacey gravity sewer running west along Martin Way from Marvin Road to the City of Lacey Martin Village

Pump Station, the Martin Village Pump Station near Martin Way and Desmond Drive, and the sewer force main from the Martin Village Pump Station which runs west to its connection to the existing LOTT Joint Facility interceptor west of the intersection of Sleater-Kinney Road and Martin Way, together with all associated deeds, easements, and franchise agreements, shall become LOTT Joint Facilities as set forth in the terms of a Facilities Acquisition Agreement for total amount not to exceed \$2,390,000, said amount to be drawn 25% from LOTT's Capacity Development Charge account and 75% from LOTT monthly rate revenues, and

IT IS FURTHER AGREED by the LOTT Partners that a new gravity sewer line from the southern end of the Capitol Boulevard Bridge across the Deschutes River, west to Deschutes Parkway, and north along Deschutes Parkway to the existing LOTT Capitol Lake Pump Station, and the associated parallel sewer force main addition north from the Capitol Lake Pump Station through northwest downtown Olympia to an existing LOTT Joint Facility interceptor in the vicinity of Olympia Avenue and Adams Street shall be a LOTT Joint Facility to be engineered using funds already appropriated for that purpose and constructed for an amount estimated at \$5,274,353, 9% of which shall be drawn from LOTT's Capacity Development Charge account and 91% from LOTT monthly rate revenues.

CONTINUES ON NEXT PAGE

IN WITNESS WHEREOF, each party has caused this Agreement to be signed by its duly authorized officer or representative as of the date set forth below its signature.

City of Lacey:

By _____

Its: _____

Date: _____

Approved as to form:

By _____

Attest: By _____

City of Olympia:

By _____

Its: _____

Date: _____

Approved as to form:

By _____

Attest: By _____

City of Tumwater:

By _____

Its: _____

Date: _____

Approved as to form:

By _____

Attest: By _____

Thurston County:

By _____

Its: _____

Date: _____

Approved as to form:

By _____

Attest: By _____

K:\21918\00002\AWG\AWG_A209S

(This page intentionally left blank)

Exhibit J

Intergovernmental Contract For Inflow and Infiltration Management and New Capacity Planning

WHEREAS, pursuant to the Intergovernmental Contract for Wastewater Facilities Management dated November, 1976, (hereinafter "LOTT 1976 Contract") the LOTT Partners agreed to cooperatively construct and maintain joint facilities for wastewater treatment and discharge; and

WHEREAS, pursuant to the Intergovernmental Contract of September, 1991, (hereinafter "LOTT 1991 Contract") the LOTT Partners affirmed their intent to assure long-term availability of capacity in LOTT joint facilities to intercept, treat, and discharge sanitary sewage in an environmentally sound and cost effective manner for the benefit of all Partners; and

WHEREAS, under the terms of the LOTT 1991 Contract, the Partners agreed to conduct an engineering study of inflow and infiltration and thereafter set a standard for allowable inflow and infiltration, define an equalization basin service area and agree upon a program for the cost effective removal of inflow and infiltration; and

WHEREAS, the agreed-upon study of inflow and infiltration (hereinafter "LOTT I/I Study") is complete and the Partners have learned that the extent of inflow and infiltration is such that capacity for treating wastewater using existing LOTT joint facilities cannot reasonably be provided to the year 2010 as assumed in the LOTT 1991 Contract; and

WHEREAS, the Partners have concluded that standards for allowable inflow and infiltration cannot be established in the manner assumed in the LOTT 1991 Contract without either forcing construction of inflow and infiltration removal projects which are clearly not cost effective or creating the potential for additional inflow and infiltration into the LOTT system; and

WHEREAS, the Partners have also concluded that during a ten year storm the equalization basins in the existing LOTT Wastewater Treatment Plant are inadequate to

effectively manage inflow and infiltration from even a small portion of the combined sewer system; and

WHEREAS, using information developed during the LOTT I/I Study, the Partners found that while LOTT system inflow and infiltration, which originates primarily in the City of Olympia, can dramatically impact treatment capacity during heavy rain, the cost to treat such flows is, and has been, approximately equal to the value of in-kind contributions made by the City of Olympia to the LOTT Partnership; and

WHEREAS, during the course of the LOTT I/I Study, the LOTT Partners concluded that only through a combination of cost effective inflow and infiltration removal and water conservation efforts, and immediate initiation of planning for additional wastewater treatment capacity can adequate treatment capacity for all Partners be reasonably assured, and

WHEREAS, during the course of consideration of long-term capacity needs the Partners have determined that to the extent practicable new capacity should be financed using the principle that new connections should fund new capacity, now

THEREFORE, it is agreed by the LOTT Partners as follows:

1. Purpose of Agreement

In order to cooperatively preserve capacity in the existing LOTT treatment facilities and to plan for new wastewater treatment facilities on an accelerated basis, the LOTT Partners, collectively and individually, commit by this Contract to act on a cooperative basis by authorizing the LOTT Advisory Committee, with the assistance of the Technical Sub-Committee, to study, decide upon and implement necessary wastewater strategies as provided in this Contract. Each Partner recognizes that the successful implementation of those strategies may require each Partner to actively study and implement commensurate improvements in its local system.

To facilitate these reciprocal commitments, the LOTT Partners are formally recognizing by this Contract their respective legal and equitable interests in current LOTT facilities and their agreement in resolving any pending disputes or issues including the equitable allocation of past City of Olympia infiltration and inflow treatment costs.

This Contract is intended to amend and supersede inconsistent provisions of the LOTT 1976 Contract and LOTT 1991 Contract in recognition of changing conditions and capacity needs within the LOTT service area and to provide a mutually agreed basis among the LOTT Partners for future facility planning and implementation efforts.

2. Definitions

For the purposes of this Contract, the following words and phrases shall be defined as set forth below:

- a. "Advisory Committee" shall mean the committee of the same name defined in the Intergovernmental Contract for Wastewater Facilities Management of November 30, 1976 (LOTT 1976 Contract) as amended.
- b. "Cost Effective" shall mean the cost of capacity management options, such as conservation or removal of inflow and infiltration which is equal to or less than the value of the savings they achieve through delay of the anticipated date when a new wastewater treatment facility will be needed.
- c. "Equivalent Residential Unit" or "ERU" shall mean the flow unit established in the LOTT 1976 Contract, as amended.
- d. "Financial Responsibility" as used in reference to the LOTT Partners in Section 4, Subsection D of this contract shall mean each Partner has financial obligation based on each Partner's number of connected equivalent residential units consistent with the LOTT 1976 Contract, as amended, or as required by the Partner's allocation of new capacity as established pursuant to Section 6, Sub-Section B of this contract.
- e. "Joint Facilities" shall mean those facilities, either existing or future, as defined and described in the LOTT 1976 Contract, as amended.
- f. "I & I Removal" shall mean the actual or intended removal or reduction of inflow and/or infiltration present in the sewer systems tributary to LOTT joint facilities and the removal or reduction of inflow and /or infiltration originating in LOTT joint facilities.

- g. "Infiltration" shall mean ground water entering LOTT joint facilities and ground water entering the system of sanitary sewers tributary to LOTT joint facilities.
- h. "Inflow" shall mean storm water entering LOTT joint facilities and storm water entering the system of sanitary sewers tributary to LOTT joint facilities as a result of constructed combined storm/sanitary sewer facilities.
- i. "LOTT" shall mean the sewerage services, facilities and activities cooperatively performed, constructed and operated by the cities of Lacey, Olympia, and Tumwater and Thurston County pursuant to the LOTT 1976 Contract, as amended.
- j. "LOTT Fund" shall mean the City of Olympia fund used to accumulate and disperse revenues from monthly and other LOTT charges.
- k. "LOTT Inflow and Infiltration Study" shall mean the study of the same name prepared for the LOTT Wastewater Management Partnership between 1992 and 1994.
- l. "Partner" shall mean "Original Participant" as defined in the LOTT 1976 Contract, as amended.
- m. "Reserve Capacity Charge Receipts" shall mean the money collected from the Reserve Capacity Charge as defined in the LOTT 1976 Contract, as amended, and as further defined in the LOTT 1991 Contract, as amended.
- n. "Water conservation" shall mean those efforts which reduce, or are intended to reduce, the amount of residential, commercial and industrial wastewater entering the sewer systems tributary to LOTT joint facilities. Other efforts which reduce the amount of water consumed but which do not affect the amount of water entering the sewer systems tributary to LOTT are, for the purposes of this contract, not considered water conservation. Efforts which reduce inflow and infiltration are, for the purposes of this contract, not considered water conservation.
- o. "Technical Sub-Committee" shall mean the committee of the same name defined in the LOTT 1976 Contract, as amended.

- p. "Wet weather season" shall mean the calendar period November through February.

3. Confirmation of LOTT Partners' Interests

A. Capacity and Facility Use

The LOTT Partners, collectively and individually, acknowledge and agree that each Partner has a beneficial interest in the current LOTT joint facilities and in the capacity of such facilities due to their past funding of construction of the facilities and their continued payments for treatment services including financing and operating costs of the LOTT system. Pursuant to the LOTT 1976 Contract, the LOTT Partners, collectively and individually, also acknowledge and agree that each Partner has a right to utilize such current capacity on a "first come first serve" basis as defined in the LOTT 1976 Contract, as amended.

B. Property Use

The City of Olympia hereby acknowledges and agrees that such beneficial interests of the Partners extends to the continued use and enjoyment, in common with the City, of the LOTT treatment plant facilities and property for so long as the facilities are required by LOTT for wastewater treatment purposes.

4. Inflow and Infiltration

A. Inflow and Infiltration Standards

Section 3 of the LOTT 1991 Contract requires that the LOTT Partners adopt standards for acceptable levels of inflow and infiltration, and that Partners not meeting the adopted standards are to compensate the LOTT Partnership on an Equivalent Residential Unit Basis for the estimated flows in excess of adopted standards are to compensate the LOTT Partnership on an Equivalent Residential Unit Basis of the estimated flows in excess of adopted standards. As a result of the technical findings of the LOTT I/I Study, the LOTT Partners hereby rescind any LOTT 1991 Contract requirements to establish and enforce standards for acceptable levels of inflow and infiltration within the system of sewers flowing into LOTT joint facilities. From and after the effective date of this Contract, all binding Partnership requirements concerning

acceptable levels of inflow and infiltration shall be contained in and governed by this Contract. Further, the LOTT Partners agree that all new sewers tributary to LOTT joint facilities and all future LOTT joint facilities which are constructed subsequent to the date of this Contract by LOTT or by any participant shall be constructed to allow no more inflow and infiltration than 700 gallons per day per inch/mile of new sewer line.

B. Equalization Basin Service Area

Section 4 of the LOTT 1991 Contract requires that an Equalization Basin Service Area be determined. As a result of the technical findings of the LOTT I/I Study, the LOTT Partners hereby rescind any LOTT 1991 Contract requirements to establish an Equalization Basin Service Area.

C. Olympia Inflow and Infiltration Removal Program

The City of Olympia hereby agrees to design and implement in good faith the infiltration removal program recommended in the LOTT I/I Study which is expected to remove 2,712,000 gallons or 8.28 per cent of the current system-wide 10 year storm/24 hour peak inflow and infiltration from the LOTT joint facilities at an estimated cost of \$8,791,000 in 1994 dollars (including the cost of design, administration and construction). The City of Olympia will follow the I/I Study recommendation to the extent feasible and consistent with design-level findings and good civil engineering practice. The City of Olympia agrees to provide a reasonable opportunity for the LOTT Technical Sub-Committee to review design and construction decisions and expenditures related to this infiltration removal program.

The City of Olympia agrees to complete all such recommended program work by December 31, 2001. Should the City of Olympia fail to complete implementation of the Study's recommended infiltration removal by December 31, 2001, the City of Olympia shall compensate the LOTT Fund on an Equivalent Residential Unit basis for the difference between the 10 year storm/24 hour peak infiltration flows actually removed and the 2,712,000 gallon 10 year storm/24 hour peak flows estimated as likely to be removed in the LOTT I/I Study until such time as the Study's recommendation for Olympia facilities has been implemented or until the City of Olympia has expended the then current equivalent of \$8,791,000 in 1994 dollars on reasonable and appropriate efforts to complete implementation of the Study's recommendation.

At such time as the City of Olympia, according to pre- and post-construction flow measurements by LOTT, has removed infiltration or inflow in an amount equal to the 10 year storm/24 hour peak 2,712,000 gallon volume estimated in the LOTT I/I Study recommendation, or when the Technical Sub-Committee agrees the City Of Olympia has expended \$8,791,000 in 1994 dollars on reasonable and appropriate efforts to complete implementation of the Study recommendation, the City of Olympia's obligation to fund and manage inflow and infiltration removal is recognized by all present and future LOTT Partners as forever satisfied except as provided later in this section under Subsection F.

D. LOTT Inflow and Infiltration Projects

Should additional inflow and infiltration removal beyond that recommended in the LOTT I/I Study later be found by the LOTT Partners to be appropriate and cost effective, the LOTT Partners, acting through the Advisory Committee in their efforts to assure adequate treatment capacity, shall assume financial responsibility for such additional inflow and infiltration removal. Each Partner agrees to act in good faith and in a timely manner to cooperate with any such additional inflow and infiltration removal efforts recommended by the Advisory Committee provided that no such efforts will be conducted in a City of Olympia area bordered by Union Street on the south, Capitol Lake and Bud Inlet on the west, State Street on the north and Eastside Street on the east unless such removal can be part of otherwise required City of Olympia sewer repair or replacement projects within the specified area. In that case, the LOTT Partners, upon separate agreement with the City of Olympia, will be financially responsible for that portion of the work associated with inflow and infiltration removal which the LOTT Partners wish to pursue in their efforts to assure adequate treatment capacity.

If regulatory authorities require inflow and infiltration removal which the LOTT Partners do not consider cost effective, the Partner jurisdiction wherein the inflow and infiltration removal is required shall be financially responsible.

E. Cost of Treating Inflow and Infiltration, Benefits of Olympia Facilities and Services

The LOTT Partners agree that although the substantial portion of inflow and infiltration passing through LOTT joint facilities originates in the City of Olympia due to Olympia's combined sewer system, the cost of treating those flows on an annual basis is, and has been, approximately equal to the value provided by the City of Olympia to LOTT for land owned by the City of Olympia but fully utilized by the LOTT Wastewater Treatment Plant for the benefit of all LOTT Partners and the extra cost of administrative and overhead services and benefits provided to the LOTT Partners by the City of Olympia beyond those costs already compensated by the LOTT Partners. It is further agreed that the sum of these in-kind contributions by the City of Olympia and the continued contribution of such value and services shall be considered appropriate compensation for the past and future cost of treating the City's combined flows, provided payment for overhead services remains at its current level as adjusted annually for inflation according to the federal Seattle Area Consumer Price Index, and provided further, that LOTT Partners have continued use of Olympia property occupied by current LOTT joint facilities without charge.

F. Prevention of Further Inflow and Infiltration Degradation

The LOTT Partners agree that additional inflow and infiltration in the system of sewers tributary to and including LOTT joint facilities is to be avoided so as to prevent further capacity degradation of LOTT joint facilities beyond that which exists at the time of this Contract and that which is otherwise herein accepted or removed. Each LOTT Partner agrees to exercise sound engineering judgment in the repair and maintenance of its own sewers tributary to LOTT joint facilities to assure minimal additional inflow and infiltration will be allowed beyond that which exists at the time of this Contract and that which is otherwise herein accepted or removed.

Beginning March, 1996, and each year thereafter, it is agreed that each Partner with sewer lines tributary to LOTT joint facilities will prepare and submit to the LOTT Technical Sub-Committee an updated inventory of those sewer lines with an accompanying report identifying all updates, modifications, repairs and additions made during the preceding year to sewer lines which are tributary to LOTT joint facilities. The

inventory shall be similar to and substantially in the form of Appendix B of the LOTT I/I Study. LOTT will prepare a similar report for LOTT joint facility sewer lines. The Technical Sub-Committee will review the materials submitted and, commencing June, 1996, report annually to the Advisory Committee concerning the status of the systems of sewers tributary to LOTT joint facilities and the status of LOTT joint facilities relative to modifications, repairs and additions and the expected resulting changes in inflow and infiltration.

Beginning in the wet weather season of 1998-1999, and every seven years thereafter, the Partners agree that LOTT will conduct an update of the LOTT I/I Study to determine if significant additional inflow and infiltration exists which could result in a significant degradation of system capacity beyond that which exists at the time of this Contract and which is otherwise herein accepted or removed. Should such a condition(s) be present, each LOTT Partner agrees to act within twelve months of receiving such information to begin correction of the facilities contributing to degradation within its jurisdiction when such correction is cost effective. All sewer lines with inflow and infiltration no greater than 1,500 gallons per day per inch mile are exempt from correction under this agreement. The Partners further agree that LOTT, acting through the Advisory Committee, will act within twelve months of receiving of such information to initiate cost effective correction of facilities contributing to degradation in LOTT joint facilities.

5. Water Conservation

A. Purpose for Water Conservation Program

The LOTT Partners agree that reducing the amount of water consumed which reaches the Partner's local wastewater systems will delay the need for additional wastewater treatment facilities provided by or through LOTT. The LOTT Partners further agree that water conservation can be a cost effective method for delaying the need to construct additional wastewater treatment facilities. The LOTT Partners also agree that primary responsibility for water conservation, as defined herein, rests with water utilities providing water which, in the form of wastewater, reaches LOTT joint facilities.

B. Partner's Conservation Commitments

Each Partner operating a water utility(s) which provides water that reaches LOTT joint facilities agrees to individually pursue water conservation efforts which result in a per capita reduction in wastewater flow to LOTT joint facilities. The LOTT Technical Sub-Committee, using information on per capita wastewater flows in the LOTT I/I Study, will, on or before December 31, 1995, further refine and mutually establish specific, current per capita wastewater flows for each Partner operating a water utility(s) which provides water that reaches LOTT facilities. The LOTT Technical Sub-Committee shall also establish on or before December 31, 1995, a measuring system for calculating per capita wastewater flows from each Partner operating a water utility(s) which provides water that reaches LOTT facilities. Further, the LOTT Technical Sub-Committee shall establish a recommended cost effective per capita residential conservation goal, expressed in gallons per day, and a related cost effective conservation goal for commercial and industrial sewer users, both of which can be achieved within ten years. These recommended goals shall be presented to The Advisory Committee for consideration on or before December 31, 1995. The Advisory Committee shall, on or before February 28, 1996, adopt a ten year cost effective residential per capita conservation goal and a related ten year cost effective goal for commercial and industrial sewer users.

The conservation goals shall be targeted for achievement by December 31, 2005. Each February, commencing in 1996, each Partner operating a water utility(s) which provides water that reaches LOTT facilities will submit a report to The Advisory Committee which identifies the water conservation efforts undertaken or continued during the preceding calendar year, the current per capita wastewater flow using the agreed upon measuring system, and the progress toward the conservation goals.

C. LOTT Assistance

Each Partner operating a water utility(s) which provides water that reaches LOTT facilities is encouraged to present proposals to the Advisory Committee requesting LOTT funds to support water conservation as defined in this contract. Within sixty days of receipt of such proposals, the Advisory Committee, with the involvement of the Technical Sub-Committee, will respond to each proposal indicating the level of financial

support the LOTT Partners will provide and whether that support will be available immediately or during the following fiscal year. Proposals will be reviewed based on their likelihood of success and whether they will be cost effective in managing LOTT wastewater treatment capacity. It is the Partners' intent to fully support those conservation activities which have a high likelihood of success and which are cost effective.

D. LOTT's Role in Conservation

The LOTT Partners collectively will, in the manner described herein, support the conservation activities of the water utilities providing water which reaches LOTT joint facilities in the form of wastewater. LOTT will, while supporting and encouraging those activities, also search for and implement cost effective conservation activities which complement those of the water utilities and which can be effectively managed by LOTT acting on behalf of all the Partners.

6. New Capacity Planning

A. Initiate Wastewater Treatment Capacity Planning

The LOTT Partners agree that upon approval of this Contract, LOTT should act as quickly as feasible to secure engineering services, prepare a scope of work, and initiate facilities planning as defined by the United States Environmental Protection Agency pursuant to 40 CFR Part 35.917 and in Chapter 173-240 of the Washington Administrative Code to assure adequate future wastewater treatment capacity for the LOTT Partners. It is further agreed that the Advisory Committee, with assistance from the Technical Sub-Committee, is hereby authorized to conduct and timely complete facilities planning according to the general schedule described below. The planning effort will review all reasonable alternative for developing new capacity, including inflow and infiltration removal beyond that which is described in or provided for by Section 4 of this Contract. The planning will also consider population growth information consistent with local planning and regional growth management planning in developing refined flow projections beyond those already developed in the LOTT I/I Study.

The planning effort will be coordinated with other local, regional and state agencies and include an appropriate environmental review process consistent with

requirements of the Washington State Environmental Policy Act. The planning effort will provide adequate opportunity for citizens potentially affected by LOTT's planning outcomes to be aware of the planning process and to provide input to the Advisory Committee's planning decisions as plans are being prepared.

No later than June 30, 1998, and prior to completing facilities planning, the Partners agree to have convened and completed discussions about Partnership processes and operating procedures relative to decisions concerning planning, designing, financing and constructing future joint facilities.

B. Wastewater Treatment Capacity Allocation

Facilities planning effort identified above will include consideration of how new capacity is to be allocated among the LOTT Partners. The Partners hereby agree in principle that any allocation of future LOTT capacity should be based on each Partner's decision about its own future wastewater treatment capacity requirements provided that decision is consistent with State of Washington forecasts provided for growth management purposes, and maintaining prudent levels of reserve capacity. Until a new capacity allocation system is approved by the LOTT Partners, nothing herein shall be construed as changing the allocation established in the LOTT 1976 Contract as amended.

C. Financing Planning and New Wastewater Treatment Capacity

The facilities planning effort will be paid for using no less than sixty percent Reserve Capacity Charge receipts from LOTT funds and no more than forty percent from other LOTT revenues. It is hereby agreed that in considering how to finance new wastewater treatment capacity alternatives and recognizing the interest of existing rate payers, to the extent practicable the principle of "growth paying for growth" shall apply.

D. Schedule for Facilities Planning, Facilities Design and Facilities Construction

The LOTT Partners agree that time is of the essence in preparing a facilities plan so that the maximum amount of time is available for design and construction of whatever new capacity alternative(s) may be selected by the Advisory Committee. To that end, it is agreed that facilities planning will be completed no later than June 30, 1998, and that facilities planning information concerning estimates of remaining capacity

in existing LOTT joint facilities and schedules for timely implementation of new capacity alternatives will be made available as soon as possible to the Washington State Department of Ecology and each Partner for use in preparing each Partner's National Pollutant Discharge Elimination System Permit for LOTT joint facilities. It is further agreed that all reasonable efforts will be undertaken by the LOTT Partners collectively and individually to avoid Washington State Department of Ecology imposition of a sewer connection and septic tank permit moratorium as a result of insufficient wastewater treatment capacity or lack of reasonable progress in planning for wastewater treatment capacity.

7. Dispute Resolution

A. Advisory Committee Review

In the event of any dispute, claim or demand for performance ("issue") between or among Partners concerning, the Partner or Partners concerned with the issue shall present it to the Advisory Committee in detail and in writing for study and recommendation. Oral presentations shall be permitted and all Partners shall be given a reasonable opportunity to respond to the issue prior to consideration of a recommendation by the Advisory Committee. The Advisory Committee shall then make such findings and prepare such conclusions and recommendations as may represent the majority decision of the Advisory Committee on the issue within ninety (90) days after receipt of the initial written presentation of the issue.

B. Non-binding Mediation

In the event the Advisory Committee's actions do not resolve the issue to the satisfaction of all of the Partners, any Partner may refer the matter to mediation by filing a written request with the Advisory Committee within thirty (30) days of the issuance of the advisory Committee's decision. The Advisory Committee shall refer the request to the presiding judge of the Thurston County Superior Court with the request that the court appoint a qualified mediator to establish the rules, schedule and scope of the mediation, unless all of the Partners agree on an appropriate mediator and the rules, schedule and scope of the mediation. All Partners shall be parties to the mediation and shall equally share the cost of the mediator.

The mediation shall occur within ninety (90) days of the appointment of a mediator. The mediation shall be conducted de novo from prior dispute resolution proceedings.

C. Binding Arbitration

In the event the issue is not resolved by mediation, then the issue may be submitted to binding arbitration by any Partner pursuant to paragraph 15 of the LOTT 1976 Contract and Chapter 7.04 of the Revised Code of Washington. All Partners shall be parties to the arbitration and shall equally share the cost of the arbitrator. Such arbitration shall be limited to the interpretation and application of this Contract and may not impair the contract and debt obligations of any Partner, including Olympia. The arbitration shall be conducted de novo from prior dispute resolution proceedings.

D. Litigation

Completion of the Advisory Committee review, the mediation steps and binding arbitration shall be a prerequisite to the filing of any legal action relative to interpretation of this agreement in Thurston County Superior Court. Subject to this condition, the terms of this Contract shall be specifically enforceable.

--continues on next page--

So approved this 27th day of March, 1995.

City of Lacey:

By: Jon Halvorson

Its Mayor

Attest:

Charlotte Taylor

City of Olympia:

By: Bob Jacobs

Its Mayor

Attest:

By: Jane Ragland Kirkemo

City of Tumwater:

By: Ralph Osgood

Its Mayor

Attest:

Sheryle Wyatt

County of Thurston:

By: Judy Wilson

Its Chairperson

Attest:

LaBonita Bowman

(This page intentionally left blank)

Exhibit K

INTERLOCAL COOPERATION AGREEMENT BETWEEN THURSTON COUNTY AND THE CITIES OF LACEY, OLYMPIA AND TUMWATER REGARDING JOINT WASTEWATER FLOW REDUCTION AND WATER CONSERVATION PROJECTS

This agreement, dated May 28, 1997, hereinafter referred to as GENERAL AGREEMENT, is made and entered into by and between Thurston County and the cities of Lacey, Olympia and Tumwater for joint planning, management and operation of wastewater flow reduction and water conservation projects. The terms of agreement about each specific project will be described in separate agreements, hereinafter referred to as PROJECT AGREEMENTS.

WITNESSETH:

WHEREAS, it is in the public interest to effectively reduce LOTT wastewater flows and thereby help delay the need for developing additional sewage treatment capacity; and

WHEREAS, it is in the public interest to make most effective use of limited water resources; and

WHEREAS, it is to the mutual advantage of the parties to share the cost of preparing general water and wastewater reduction plans, developing public education, retrofit and other programs for water conservation and wastewater flow reduction; and

WHEREAS, coordinated water conservation and wastewater flow reduction programs and messages promote the wise use of resources and provide benefits across jurisdictional boundaries; and

WHEREAS, in the Intergovernmental Contract for Inflow and Infiltration Management and New Capacity Planning, dated March 27, 1995, the LOTT Partners agreed that water conservation can be a cost-effective method for delaying the need to construct additional wastewater treatment facilities; and

WHEREAS, the LOTT Partners further agreed in the March 27, 1995 contract that primary responsibility for water conservation rests with water utilities providing water which, in the form of wastewater, reaches LOTT joint facilities; and

WHEREAS, the LOTT Partners further agreed in the March 27, 1995 contract that each Partner operating such water utility(s) would individually pursue water conservation efforts which result in a per capita reduction in wastewater flow to LOTT joint facilities; and

WHEREAS, pursuant to Chapter 39.34 RCW, the parties are authorized to jointly exercise the powers, privileges, and authority described herein;

NOW, THEREFORE, in consideration of the mutual promises and covenants recited herein, the parties agree and resolve as follows:

I. PURPOSE

This GENERAL AGREEMENT establishes the benefits and obligations to the parties for participating in cooperative water conservation and wastewater flow reduction planning and management activities.

II. RELATIONSHIP

The parties agree that they intend to act jointly pursuant to the authority of Chapter 39.34 RCW to accomplish the purpose recited herein. No separate legal entity is created by this agreement.

III. MANAGEMENT

All activities conducted pursuant to this GENERAL AGREEMENT shall be coordinated and managed by the STEERING COMMITTEE, whose members shall be the Directors of Public Works or Directors of Water and Waste Management of the four jurisdictions.

IV. ACTIVITIES

Any water conservation or wastewater flow reduction activity or projects may be conducted under the terms of this GENERAL AGREEMENT by consent of two or more parties. For each activity or project, detailed terms of agreement related to the scope of work, responsibility of each party and financing shall be prepared as a PROJECT AGREEMENT attached to this document. Such activities shall be consistent with adopted policies and budgets of each jurisdiction and LOTT. Each PROJECT AGREEMENT shall be adopted and/or officially approved by each of the affected jurisdictions.

V. PUBLIC INFORMATION, EDUCATION AND INVOLVEMENT

It is understood and recognized that each activity or project completed under this GENERAL AGREEMENT will require varying amounts of public information, education and involvement. The specific scope and type of public activity shall be included in the PROJECT AGREEMENT attached to this GENERAL AGREEMENT.

VI. RESPONSIBILITY

Within each separate PROJECT AGREEMENT, one of the following two responsibility approaches will apply and will be specifically defined.

A. **Lead Agency Approach.** In this model, one jurisdiction will be designated in the applicable PROJECT AGREEMENT as lead agency and other participating jurisdictions, not serving as lead agency, shall be cooperating agencies.

1. **Lead Agency will be responsible to:**

- a. Administer the project, including managing any grant funds and coordinating with other jurisdictions and agencies to ensure that work proceeds in an acceptable manner and that performance is timely.
- b. Account for funds expended and bill each jurisdiction, as appropriate, for its agreed upon share of the project at regular intervals.
- c. Provide legal opinions and support as necessary to carry out the work.
- d. Provide required budget and program information and/or requirements to cooperating agencies allowing adequate time for preparation of their annual budgets and workplans.
- e. Coordinate the project with other County and City water conservation and/or wastewater flow reduction programs.

2. **Cooperating Agencies:**

For each project, cooperating agencies not serving as lead agency will be responsible to:

- a. Assign their chief public works or engineering manager or designee to participate and assist the lead agency in preparing the work program and directing the overall project.

- b. Reimburse the lead agency for their share of the total project or account for labor and other costs within the terms of the PROJECT AGREEMENT. Make payments within 45 days following billing by the lead agency.
- c. Keep a record of costs incurred as part of the project, whether or not they are to be reimbursed.
- d. Provide information required for the project.
- e. Review the data and findings of the project.
- f. Assist as appropriate with obtaining public participation and/or input.
- g. Provide feedback and evaluation where needed for development of future projects.

B. **Project Policy Agreement Approach.** In this model, participating jurisdictions will incorporate in the applicable PROJECT AGREEMENT the terms by which separate projects undertaken by each jurisdiction shall achieve common goals and will be carried out in a manner that provides consistent service to customers across jurisdictional boundaries. Elements incorporated in the PROJECT AGREEMENT may include provisions for joint selection of service providers, development and distribution of consistent educational and marketing messages, establishment and implementation of evaluation techniques and procedures, equitable allocation of charges and benefits to customers, and other issues deemed necessary to the promotion of a consistent regional program. Each participating jurisdiction will be responsible for carrying out and funding its own project.

VII. COST ALLOCATION

Costs for each project may be shared by LOTT, the participating water and/or sewer utilities, customers and/or other funding sources. Generally, costs for each project supported by LOTT and achieving wastewater flow reductions through activities targeting sewer customers shall be allocated based on LOTT's flow reduction program funding guidelines effective at the time the project is approved. Costs to serve water customers who are not also LOTT sewer customers shall be covered by the utilities, customers and/or other funding sources. The specific method of cost allocation shall be included in the detailed terms of the activity or project as described in the PROJECT AGREEMENT attached to this GENERAL AGREEMENT.

VIII. DURATION

This GENERAL AGREEMENT shall remain in effect for five years and may be extended upon agreement of the participating jurisdictions.

IX. WITHDRAWAL

Any party to this GENERAL AGREEMENT may withdraw after giving 30 days written notice to the other parties. The withdrawing party will remain responsible for fulfilling all financial commitments made under this GENERAL AGREEMENT and any PROJECT AGREEMENTS, except as mutually agreed upon by the affected parties.

CITY OF LACEY

BOARD OF COMMISSIONERS
Thurston County, Washington

By: Greg J. Cuoio

ABSENT
Chairman

ATTEST:

Charlotte M. Taylor

CITY OF OLYMPIA

By: Richard C. Cushing

ATTEST:

Jane Ragland Kirkemo
City Clerk

CITY OF TUMWATER

By: Ralph Osgood

ATTEST:

Sheryle Wyatt
City Clerk

APPROVED AS TO FORM:

P. Brock
City Attorney

Richard Q. Nichols
Commissioner

Judy Wilson
Commissioner

ATTEST:

LaBonita I. Bowmar
Clerk of the Board

APPROVED AS TO FORM:

Prosecuting Attorney

BY:

Mark H. Calkins
Deputy Prosecuting Attorney

Exhibit L

ADMINISTRATIVE AND TREASURY SERVICES CONTRACT

THIS CONTRACT ("Contract"), dated _____, 2000, is entered into by and between the City of Olympia ("Olympia"), a Washington municipal corporation, and the LOTT Wastewater Alliance ("LOTT"), a nonprofit corporation formed and existing under Chapters 24.03 and 39.34 RCW. The parties are herein individually referred to a "Party" and collectively as the "Parties."

RECITALS

WHEREAS, the Cities of Lacey, Olympia, and Tumwater and Thurston County (ALOTT Partners®) have entered the Interlocal Cooperation Act Agreement for Wastewater Management by the LOTT Wastewater Alliance, dated _____, 2000 ("Interlocal Cooperation Act Agreement"). Any capitalized terms not defined herein shall have the meaning as defined in the Interlocal Cooperation Act Agreement; and

WHEREAS, RCW 43.09.285 requires the funds of the LOTT Wastewater Alliance to be deposited in the public treasury of one of the LOTT Partners; and

WHEREAS, the Interlocal Cooperation Act Agreement provides for Olympia and LOTT to enter this Contract so that Olympia may continue to provide certain administrative and treasury services to LOTT for at least an initial period of time; and

WHEREAS, Olympia has historically provided administrative treasury, and financial services for the LOTT Partnership prior to the Interlocal Cooperation Act Agreement; and

WHEREAS, the Parties desire to set out the specific terms and conditions of Olympia's provision of services to LOTT.

NOW, THEREFORE, in consideration of the mutual promises and covenants contained herein, the Parties hereby agree as follows:

1. General Description of Roles.

The Parties intend for Olympia to perform limited treasury and accounting functions for LOTT, as defined below. This contract does not include providing financial advice, serving as a financial advisor to LOTT, capital facilities planning or financing, issuing of debt, administratively arbitrage regulations, or signing contracts or documents on behalf of LOTT, except for contracts or documents necessary to carry out the functions and intent of this contract. In addition, the Parties intend that Olympia provide informal consultations to LOTT regarding the above financial matters. LOTT will obtain formal advice and services regarding capital facilities financing, debt issuance, investment advice, and other financial matters from other sources.

2. Services Provided by Olympia.

As directed by the LOTT Board and its duly authorized representatives, Olympia shall provide the following services to LOTT:

- a) Hold LOTT funds in a separate fund (the "LOTT Fund") and establish special accounts within the LOTT Fund as requested by LOTT or as required by state law.
- b) Receive and disburse LOTT funds. Olympia may disburse funds for debt service obligations in accord with bond covenants of LOTT without specific direction from the LOTT Wastewater Alliance, and establish bank accounts as needed to carry out this contract.
- c) Perform basic accounting services including detail of accounting transactions, maintenance of budget, accounts payable, accounts receivable, and payroll. Maintenance of detailed inventory and fixed asset records shall be the responsibility of LOTT. Project and grant accounting shall be the responsibility of LOTT, although Olympia will within the standard design of its accounting system provide for tracking of financial transactions of projects and grants.
- d) Investment of LOTT funds consistent with investment policies adopted by the LOTT Board. Establish investment accounts as needed.
- e) Assist with audits of LOTT.
- f) Prepare annual financial reports as required by the State Auditor=s Office.

LOTT shall be responsible for retaining any and all documents produced which are necessary for Olympia to carry out the provisions of this contract. Upon completion of the audit by the State Auditor=s Office, all documents produced for the audited period shall be delivered to LOTT.

Olympia shall perform the above functions in accordance with Generally Accepted Accounting Principles ("GAAP"), rules promulgated by the Auditor of the State of Washington, and other applicable law.

Olympia shall have access to LOTT books and records as necessary or convenient in performing services for LOTT. LOTT shall provide reasonable notice to Olympia of requests to perform tasks under this Contract.

3. Compensation.

From the date of this agreement through December 31, 2001, the amount received by Olympia for overhead and indirect charges under the LOTT facilities Operations and Maintenance Agreement executed per Section 5.2 of the Interlocal Cooperation Act Agreement,

shall also cover the services rendered by Olympia under this contract. The Parties recognize that creation of the LOTT Wastewater Alliance as a separate entity will result in more effort for administration and treasury services than before. As a result, at least sixty (60) days prior to December 31, 2001, and for each year thereafter, Olympia will submit to LOTT for inclusion as an amendment to this contract the costs to perform the treasury and administrative functions separately under this agreement. LOTT will review these costs in good faith and, if these costs are acceptable to LOTT, that amount will be included in this contract as the payment to Olympia for services performed hereunder. If the Operation and Maintenance Contract for LOTT facilities is terminated prior to December 31, 2001, the Parties shall negotiate in good faith the compensation to be paid hereunder for the period this contract is in effect.

Separate from the above, each year LOTT will pay Olympia the out-of-pocket expenses Olympia incurs which are not customarily incurred in the provision of administrative and treasury services, such as investment fees, wire transfer fees, and setup costs.

4. Billings.

Overhead and indirect costs payable under the LOTT facilities Operations and Maintenance Contract which constitute compensation hereunder for the period indicated above, and reimbursement requests shall be billed by Olympia to LOTT. Payment on these billings shall be due within thirty (30) days of receipt thereof by LOTT. Delinquent amounts shall accrue interest at one percent per month. Compensation for services under this contract for any period after December 31, 2001 shall be billed and paid in the same manner.

5. Contract Relationship.

The relationship of Olympia to LOTT created by this Contract is that of an independent contractor, and none of Olympia's employees or agents shall be considered employees of LOTT.

6. Term of Agreement.

This contract shall take effect on the date Consolidation occurs pursuant to the Interlocal Cooperation Act Agreement ("Effective Date"). This Contract shall remain in effect unless and until earlier terminated for convenience by LOTT or Olympia.

7. Termination for Convenience.

Either party may terminate this Contract for convenience, which termination shall be effective one year after either party provides notice of termination to the other party. Neither party shall give notice of termination earlier than January 31, 2000. Prior to giving notice of termination of this Contract, LOTT shall have considered and documented Olympia's and alternate administrative and treasury service costs and practices as provided in the Interlocal Cooperation Act Agreement.

8. Termination for Cause.

Either Party may terminate this Contract upon material breach by the other party providing that the terminating Party first provides written notice of such breach to the other Party and such breach has not been corrected within a forty-five (45) day cure period, except if the cure cannot reasonably be completed within forty-five (45) days then the Party shall not be in default so long as it commences the cure within forty-five (45) days and promptly and diligently completes the same. The written notice shall specify the alleged breach and the action(s) that would cure it.

9. Notices; Authorized Representatives.

All notices shall be in writing and delivered in person or transmitted by certified mail, return receipt requested, postage prepaid. Notices required to be given to the City of Olympia shall be addressed as follows:

City Manager
City of Olympia
P.O. Box 1967
Olympia WA 98507-1967

Notices required to be given to the LOTT Wastewater Alliance shall be addressed as follows:

Executive Director
LOTT Partnership Administration
2101 - 4th Ave., E./Suite 101
Olympia WA 98506

10. Dispute Resolution.

Any disputes under this Agreement shall be resolved by negotiation, if possible. If impasse is reached, the Parties shall employ a panel with three arbitrators, one appointed by each party and the third by the two appointed arbitrators, to resolve the dispute. The ruling of the panel shall be binding, subject to judicial review under an arbitrary and capricious standard.

11. Non-waiver.

The failure on the part of either Party to enforce its right as to any provision of the Contract shall not be construed as a waiver of its rights to enforce such provision in the future.

12. No Third Party Beneficiaries

Except as expressly provided herein, this Contract is not intended to create rights in, or to grant remedies to, any third party as a beneficiary of this Contract or of any duty, obligation or undertaking established herein.

13. Governing Law.

This Contract shall be governed by the laws of the State of Washington.

14. Assignment.

With the approval of the LOTT Board, Olympia may assign this Contract to one of the other LOTT Partners.

15. Severability.

If one or more clauses, sections, or provisions of this Contract is held to be unlawful, invalid or unenforceable by any court with jurisdiction, the remainder of this Contract shall not be affected thereby.

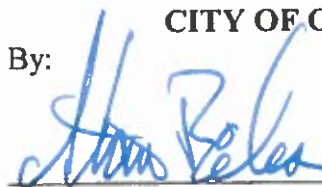
16. Modifications in Writing.

Except as expressly provided in this Contract, no amendment or modification of this Contract shall be effective unless made in writing and executed by all Parties.

IN WITNESS WHEREOF, each Party has caused this Contract to be signed by its duly authorized officer or representative as of the date set forth below its signature.

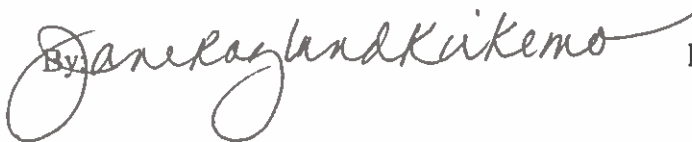
DATED this _____ day of _____ 2000.

By: **CITY OF OLYMPIA**



Its: Mayor

ATTEST:

By: 

Approved as to form:



Legal Counsel

By: **LOTT WASTEWATER ALLIANCE**

Its: _____

ATTEST:

By: _____

Approved as to form: _____

Legal Council

(This page intentionally left blank)

ADMINISTRATIVE AND TREASURY SERVICES CONTRACT

THIS CONTRACT ("Contract"), dated June 18, 2000, is entered into by and between the City of Olympia ("Olympia"), a Washington municipal corporation, and the LOTT Wastewater Alliance ("LOTT"), a nonprofit corporation formed and existing under Chapters 24.03 and 39.34 RCW. The parties are herein individually referred to a "Party" and collectively as the "Parties."

RECITALS

WHEREAS, the Cities of Lacey, Olympia, and Tumwater and Thurston County ("LOTT Partners") have entered the Interlocal Cooperation Act Agreement for Wastewater Management by the LOTT Wastewater Alliance, dated January 24, 2000 ("Interlocal Cooperation Act Agreement"). Any capitalized terms not defined herein shall have the meaning as defined in the Interlocal Cooperation Act Agreement; and

WHEREAS, RCW 43.09.285 requires the funds of the LOTT Wastewater Alliance to be deposited in the public treasury of one of the LOTT Partners; and

WHEREAS, the Interlocal Cooperation Act Agreement provides for Olympia and LOTT to enter this Contract so that Olympia may continue to provide certain administrative and treasury services to LOTT for at least an initial period of time; and

WHEREAS, Olympia has historically provided administrative treasury, and financial services for the LOTT Partnership prior to the Interlocal Cooperation Act Agreement; and

WHEREAS, the Parties desire to set out the specific terms and conditions of Olympia's provision of services to LOTT.

NOW, THEREFORE, in consideration of the mutual promises and covenants contained herein, the Parties hereby agree as follows:

1. General Description of Roles.

The Parties intend for Olympia to perform limited treasury and accounting functions for LOTT, as defined below. This contract does not include providing financial advice, serving as a financial advisor to LOTT, capital facilities planning or financing, issuing of debt, administratively arbitrage regulations, or signing contracts or documents on behalf of LOTT, except for contracts or documents necessary to carry out the functions and intent of this contract. In addition, the Parties intend that Olympia provide informal consultations to LOTT regarding the above financial matters. LOTT will obtain formal advice and services regarding capital facilities financing, debt issuance, investment advice, and other financial matters from other sources.

2. Services Provided by Olympia.

As directed by the LOTT Board and its duly authorized representatives, Olympia shall provide the following services to LOTT:

- a) Hold LOTT funds in a separate fund (the "LOTT Fund") and establish special accounts within the LOTT Fund as requested by LOTT or as required by state law.
- b) Receive and disburse LOTT funds. Olympia may disburse funds for debt service obligations in accord with bond covenants of LOTT without specific direction from the LOTT Wastewater Alliance, and establish bank accounts as needed to carry out this contract.
- c) Perform basic accounting services including detail of accounting transactions, maintenance of budget, accounts payable, accounts receivable, and payroll. Maintenance of detailed inventory and fixed asset records shall be the responsibility of LOTT. Project and grant accounting shall be the responsibility of LOTT, although Olympia will within the standard design of its accounting system provide for tracking of financial transactions of projects and grants.
- d) Investment of LOTT funds consistent with investment policies adopted by the LOTT Board. Establish investment accounts as needed.
- e) Assist with audits of LOTT.
- f) Prepare annual financial reports as required by the State Auditor's Office.

LOTT shall be responsible for retaining any and all documents produced which are necessary for Olympia to carry out the provisions of this contract. Upon completion of the audit by the State Auditor's Office, all documents produced for the audited period shall be delivered to LOTT.

Olympia shall perform the above functions in accordance with Generally Accepted Accounting Principles ("GAAP"), rules promulgated by the Auditor of the State of Washington, and other applicable law.

Olympia shall have access to LOTT books and records as necessary or convenient in performing services for LOTT. LOTT shall provide reasonable notice to Olympia of requests to perform tasks under this Contract.

3. Compensation.

From the date of this agreement through December 31, 2001, the amount received by Olympia for overhead and indirect charges under the LOTT facilities Operations and Maintenance Agreement executed per Section 5.2 of the Interlocal Cooperation Act Agreement, shall also cover the services rendered by Olympia under this contract. The Parties recognize that creation of the LOTT Wastewater Alliance as a separate entity will result in more effort for administration and treasury services than before. As a result, at least sixty (60) days prior to December 31, 2001, and for each year thereafter, Olympia will submit to LOTT for inclusion as an amendment to this contract the costs to perform the treasury and administrative functions separately under this agreement. LOTT will review these costs in good faith and, if these costs are acceptable to LOTT, that amount will be included in this contract as the payment to Olympia for services performed hereunder. If the Operation and Maintenance Contract for LOTT facilities is terminated prior to December 31, 2001, the Parties shall negotiate in good faith the compensation to be paid hereunder for the period this contract is in effect.

Separate from the above, each year LOTT will pay Olympia the out-of-pocket expenses Olympia incurs which are not customarily incurred in the provision of administrative and treasury services, such as investment fees, wire transfer fees, and setup costs.

4. Billings.

Overhead and indirect costs payable under the LOTT facilities Operations and Maintenance Contract which constitute compensation hereunder for the period indicated above, and reimbursement requests shall be billed by Olympia to LOTT. Payment on these billings shall be due within thirty (30) days of receipt thereof by LOTT. Delinquent amounts shall accrue interest at one percent per month. Compensation for services under this contract for any period after December 31, 2001 shall be billed and paid in the same manner.

5. Contract Relationship.

The relationship of Olympia to LOTT created by this Contract is that of an independent contractor, and none of Olympia's employees or agents shall be considered employees of LOTT.

6. Term of Agreement.

This contract shall take effect on the date Consolidation occurs pursuant to the Interlocal Cooperation Act Agreement ("Effective Date"). This Contract shall remain in effect unless and until earlier terminated for convenience by LOTT or Olympia.

7. Termination for Convenience.

Either party may terminate this Contract for convenience, which termination shall be effective one year after either party provides notice of termination to the other party. Neither party shall give notice of termination earlier than January 31, 2000. Prior to giving notice of termination of this Contract, LOTT shall have considered and documented Olympia's and alternate administrative and treasury service costs and practices as provided in the Interlocal Cooperation Act Agreement.

8. Termination for Cause.

Either Party may terminate this Contract upon material breach by the other party providing that the terminating Party first provides written notice of such breach to the other Party and such breach has not been corrected within a forty-five (45) day cure period, except if the cure cannot reasonably be completed within forty-five (45) days then the Party shall not be in default so long as it commences the cure within forty-five (45) days and promptly and diligently completes the same. The written notice shall specify the alleged breach and the action(s) that would cure it.

9. Notices; Authorized Representatives.

All notices shall be in writing and delivered in person or transmitted by certified mail, return receipt requested, postage prepaid. Notices required to be given to the City of Olympia shall be addressed as follows:

City Manager
City of Olympia
P.O. Box 1967
Olympia WA 98507-1967

Notices required to be given to the LOTT Wastewater Alliance shall be addressed as follows:

Executive Director
LOTT Partnership Administration
2101 - 4th Ave., E./Suite 101
Olympia WA 98506

10. Dispute Resolution.

Any disputes under this Agreement shall be resolved by negotiation, if possible. If impasse is reached, the Parties shall employ a panel with three arbitrators, one appointed by each party and the third by the two appointed arbitrators, to resolve the dispute. The ruling of the panel shall be binding, subject to judicial review under an arbitrary and capricious standard.

11. Non-waiver.

The failure on the part of either Party to enforce its right as to any provision of the Contract shall not be construed as a waiver of its rights to enforce such provision in the future.

12. No Third Party Beneficiaries

Except as expressly provided herein, this Contract is not intended to create rights in, or to grant remedies to, any third party as a beneficiary of this Contract or of any duty, obligation or undertaking established herein.

13. Governing Law.

This Contract shall be governed by the laws of the State of Washington.

14. Assignment.

With the approval of the LOTT Board, Olympia may assign this Contract to one of the other LOTT Partners.

15. Severability.

If one or more clauses, sections, or provisions of this Contract is held to be unlawful, invalid or unenforceable by any court with jurisdiction, the remainder of this Contract shall not be affected thereby.

16. Modifications in Writing.

Except as expressly provided in this Contract, no amendment or modification of this Contract shall be effective unless made in writing and executed by all Parties.

IN WITNESS WHEREOF, each Party has caused this Contract to be signed by its duly authorized officer or representative as of the date set forth below its signature.

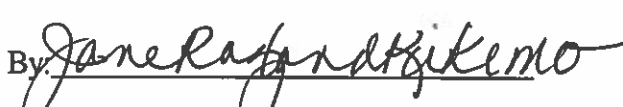
DATED this 18th day of January 2000.

CITY OF OLYMPIA

By: 

Its Mayor

ATTEST:

By: 

APPROVED AS TO FORM:


Legal Counsel

moe9304b
1/14/00

LOTT WASTEWATER ALLIANCE

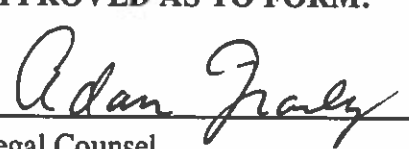
By: 

Its President

ATTEST:

By: 

APPROVED AS TO FORM:


Legal Counsel

RECLAIMED WATER DISTRIBUTION AGREEMENT NO. 1
BETWEEN THE LOTT WASTEWATER ALLIANCE,
THURSTON COUNTY AND THE CITIES OF
LACEY, OLYMPIA AND TUMWATER

This Agreement ("Distribution Agreement") is entered into as of the date of the latest signature below by and between the LOTT Wastewater Alliance ("LOTT Alliance"), Thurston County, and the Cities of Lacey, Olympia, and Tumwater, each a "Party" and together referred to as the "Parties."

1. RECITALS

WHEREAS:

1.1 The Parties entered into the General Interlocal Agreement Between the LOTT Wastewater Alliance, Thurston County and the Cities of Lacey, Olympia and Tumwater For Distribution and Use of Reclaimed Water ("General Agreement"), dated January 16, 2004, to provide a regional framework for distribution and use of reclaimed water and for conserving potable water supplies; and

1.2 Exhibit A of the General Agreement is a "Reclaimed Water Distribution Methodology," which defines a process for distribution of reclaimed water among the four LOTT Partner jurisdictions; and

1.3 The LOTT Partner representatives have completed negotiations for distribution of the first 1.0 million gallon per day increments of reclaimed water from all four planned LOTT reclaimed water facilities, consistent with the Reclaimed Water Distribution Methodology; and

1.4 The LOTT Partner representatives have further completed negotiations for distribution of the second 1.0 million gallon per day increment of reclaimed water from the Hawks Prairie Reclaimed Water Project, consistent with the Reclaimed Water Distribution Methodology; and

1.5 Table #1 attached hereto and incorporated by reference documents the negotiated distributions for the aforementioned increments of reclaimed water.

NOW, THEREFORE, in consideration of the recitals and the mutual promises and covenants contained herein the Parties commit to the negotiated distributions as follows.

2. AGREEMENT

2.1 The Parties agree to the reclaimed water distributions documented in Table #1 attached hereto.

2.2 The distributions documented in Table #1 shall be in effect until superseded by any future Reclaimed Water Distribution Agreement negotiated and approved consistent with the Reclaimed Water Distribution Methodology, or until the General Agreement is terminated, or until some other action is taken by the Parties that supersedes Table #1.

2.3 LOTT will incorporate documentation of the negotiated distribution in its next annual Flow and Capacity Report update.

2.4 This Reclaimed Water Distribution Agreement No. 1, or successor agreement(s), will be appended to the Supply Agreements for the Budd Inlet Reclaimed Water Facility, Hawks Prairie Reclaimed Water Satellite, Chambers Prairie Reclaimed Water Satellite, and Tumwater Reclaimed Water Satellite as each of those Supply Agreements is developed.

(continued on next page)

IN WITNESS WHEREOF, each Party has caused this Reclaimed Water Distribution Agreement No. 1 to be signed by its duly authorized officer or representative as of the date set forth below its signature.

LOTT Wastewater Alliance:

By [Signature]

Its: BOARD President

Date: 3-9-05

Approved as to Form:

By [Signature]

City of Lacey:

By [Signature]

Its: City Manager

Date: 1-13-05

Approved as to Form:

By [Signature]

City of Tumwater:

By [Signature]

Its: Mayor

Date: 1-4-05

Approved as to Form:

By Christy A. Toold

City of Olympia:

By [Signature]

Its: Public Works Director City Manager

Date: 10-20-04 3/01/05

Approved as to Form:

By [Signature]

Thurston County:

By [Signature]

Its: Water & Waste Mgt Director

Date: 12-02-04

Approved as to Form:

By [Signature]

Distribution Table #1

Facility	Year On-Line	Volume Produced	LOTT Reserve	Volume Available	Lacey Percent 1000 gpd	Olympia Percent 1000 gpd	Tumwater Percent 1000 gpd
First Increments:							
Budd Inlet	2004	1000	540	460	0.0%	0	0
Hawks Prairie	2007	1000	250	750	60.0%	450	0
Tumwater	2014	1000	250	750	0.0%	0	750
Chambers Pr	2016	1000	250	750	60.0%	450	0
Increment 1 Subtotals		4000	1290	2710	33.2%	900	750
Second Increment:							
Hawks Prairie	2007	1000	0	1000	100.0%	1000	0

Totals	<u>5000</u>	<u>1290</u>	<u>3710</u>	<u>51.2%</u>	<u>1900</u>	<u>28.6%</u>	<u>750</u>
			100%				

NOTE: Volumes are expressed in thousands of gallons per day



Issuance Date: August 26, 2011
Effective Date: October 1, 2011
Expiration Date: September 30, 2016

RECLAIMED WATER PERMIT NUMBER ST 6206

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
OLYMPIA, WASHINGTON 98504-7775

In compliance with the provisions of the
State of Washington Reclaimed Water Act, Chapter 90.46 Revised Code of Washington
and the
Water Pollution Control Law Chapter 90.48 Revised Code of Washington, as amended,

STATE OF WASHINGTON
DEPARTMENT OF HEALTH

In compliance with the provisions of
Chapter 90.46 and 43.70 Revised Code of Washington
Authorizes

LOTT Clean Water Alliance

500 Adams Street Northeast

Olympia, Washington 98501-6911

to produce and distribute reclaimed water in accordance with the special and general conditions which follow.

Plant Location:

Martin Way Reclaimed Water Plant
6121 Martin Way East
Lacey, WA

Discharge Location:

Reclaimed Water from the Martin Way Reclaimed Water Plant to reuse sites in the Lacey area, including groundwater recharge using surface percolation basins at NW1/4 of the SE1/4 of Sec. 2, T18N, R1W, W.M.

Treatment Type

Membrane Bioreactor (MBR), Class A Reclaimed Water

Latitude: 47.07761 N

Longitude: -122.77275 W

Robert W. Bergquist, LEED® AP
Southwest Region Manager
Water Quality Program
Washington State Department of Ecology

TABLE OF CONTENTS

SUMMARY OF PERMIT REPORT SUBMITTALS..... 4

SPECIAL CONDITIONS

R1. RECLAIMED WATER LIMITATIONS 5

R2. RECLAIMED WATER MONITORING REQUIREMENTS..... 7

 A. Influent Monitoring

 B. Class A Reclaimed Water Monitoring

 C. Ground Water Monitoring

 D. Sampling and Analytical Procedures and Plan

 E. Flow Measurement

 F. Laboratory Accreditation

 G. Reuse Instrument Calibration

R3. REPORTING AND RECORDKEEPING REQUIREMENTS 10

 A. Submittal Reporting

 B. Records Retention

 C. Recording of Results

 D. Additional Monitoring by the Permittee

 E. Noncompliance Notification

 F. Reclaimed Water Operational Records

R4. RECLAIMED WATER DISTRIBUTION AND USE 12

 A. Water Reuse Summary Plan

 B. Authorized Uses and Locations

 C. Authorization for New Direct Non-potable Uses of Reclaimed Water

 D. Revocation of Authorization

 E. Bypass Prohibited

 F. Reliability

 G. Use Area Responsibilities

 H. Service and Use Area Contract

 I. Reclaimed Water Ordinance

 J. Irrigation Use

 K. Surface Percolation Use

 L. Wetlands Use

 M. Other Uses of Reclaimed Water

R5. OPERATION AND MAINTENANCE 18

 A. Reclaimed Water System Maintenance

 B. Operations and Maintenance Manual

 C. Electrical Power Failure

R6. RESIDUAL SOLIDS..... 20

GENERAL CONDITIONS

G1. SIGNATORY REQUIREMENTS..... 21

G2. RIGHT OF INSPECTION AND ENTRY 22

G3. PERMIT ACTIONS..... 22

G4.	REPORTING A CAUSE FOR MODIFICATION	23
G5.	PLAN REVIEW REQUIRED NOTIFICATION OF NEW OR ALTERED SOURCES	24
G6.	COMPLIANCE WITH OTHER LAWS AND STATUTES	24
G7.	DUTY TO REAPPLY	24
G8.	TRANSFER OF THIS PERMIT	24
G9.	REDUCED PRODUCTION FOR COMPLIANCE	25
G10.	REMOVED SUBSTANCES	25
G11.	DUTY TO PROVIDE INFORMATION	25
G12.	OTHER REQUIREMENTS OF 40 CFR.....	25
G13.	ADDITIONAL MONITORING	25
G14.	PAYMENT OF FEES.....	25
G15.	PENALTIES FOR VIOLATING PERMIT CONDITIONS.....	25
G16.	DUTY TO COMPLY	26
G17.	TOXIC POLLUTANTS.....	26
G18.	PENALTIES FOR TAMPERING	26
G19.	REPORTING PLANNED CHANGES.....	26
G20.	REPORTING ANTICIPATED NON-COMPLIANCE	26
G21.	REPORTING OTHER INFORMATION	27
G22.	COMPLIANCE SCHEDULES	27

SUMMARY OF PERMIT REPORT SUBMITTALS

Refer to the Reclaimed Water and General Conditions of this permit for additional submittal requirements.

Permit Section	Submittal	Frequency	First Submittal Date
R2.D.	Ground Water Sampling Plan	1/permit cycle	May 1, 2012
R3.A.	Discharge Monitoring Report (DMR)	Monthly	November 15, 2011
R3.E.	Noncompliance Notification	As needed	
R3.F.3.	Monthly Summary of Operating Records	Monthly with DMR	November 15, 2011
R3.F.4.	Cross Connection Control Report	Annual	May 15, 2012
R4.A.	Water Reuse Summary Plan	Annual	January 31, 2012
R4.H.	Service and Use Area Contract	As needed	
R4.K	Surface Percolation Use	As needed	
R5.B	Operation and Maintenance Manual Update	As needed	
R5.B	Operation and Maintenance Manual Update/Review Letter	Annual	May 15, 2012
G7.	Application for permit renewal	1/permit cycle	March 1, 2016

DMRs and Reclaimed Water Reports shall be submitted to the following addresses:

1. Department of Ecology, Permit Coordinator, Southwest Regional Office, P.O. Box 47775, Olympia, Washington 98504-7775
2. Department of Health, Office of Shellfish and Water Protection, 16201 East Indiana Avenue, Suite 1500, Spokane Valley, Washington 99216

RECLAIMED WATER CONDITIONS

Beginning on the effective date of this permit and lasting through its expiration date, all reclaimed water produced at the Martin Way Reclaimed Water plant by the Permittee shall comply with the Reclaimed Water Conditions (R.) and General Conditions (G.) of this permit.

R1. RECLAIMED WATER LIMITATIONS

All discharges and activities authorized by this permit shall be consistent with the terms and conditions of this permit. The discharge of any of the following pollutants more frequently than, or at a concentration in excess of, that authorized by this permit shall constitute a violation of the terms and conditions of this permit.

The production and use of reclaimed water shall be in compliance with all specific conditions and requirements of the Washington State Water Reclamation and Reuse Standards, 1997, and is subject to the requirements listed below:

Beginning on the effective date and lasting through the expiration date of this permit, the Permittee is authorized to distribute Class A reclaimed water produced at the Martin Way Reclaimed Water plant to public and private entities for commercial and industrial uses, to apply reclaimed water to land for irrigation at agronomic rates, and recharge groundwater via surface percolation. The distribution and use of reclaimed water is subject to the following treatment and water quality limitations:

Reclaimed Water Limitations: Outfall #006		
Parameter	Average Monthly ^a	
Flow	2.0 MGD	Martin Way Reclaimed Water Plant Class A effluent
Disinfected - Reclaimed Water		
Parameter	Average Monthly ^a	Average Weekly ^b
BOD ₅	20 mg/L	30 mg/L
TSS	30 mg/L	45 mg/L
Dissolved Oxygen	Shall be measurably present in effluent at all times	
Parameter	Average Monthly ^a	Sample Maximum ^c
Turbidity	0.2 NTU	0.5 NTU
Total Nitrogen as N	10 mg/L	15 mg/L
Parameter	7-day Median ^d	Sample Maximum ^e
Total Coliform	2.2 MPN/ 100 ml	23 MPN/100 ml
pH	Shall be between 6.0 and 9.0 standard units at all times	

Reclaimed Water Limitations: Outfall #006		
Distribution System		
Parameter		Minimum Daily^f
Chlorine Residual		0.5 mg/L
^a The average monthly effluent limitation is defined as the highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.		
^b The average weekly effluent limitation is defined as the highest allowable average of daily discharges over a calendar week, calculated as the sum of all daily discharges measured during a calendar week divided by the number of daily discharges measured during that week.		
^c The sample maximum is defined as the value not to be exceeded by any single sample. When continuous monitoring is used, excursions of the sample maximum that last less than 5 minutes are not considered permit violations, as long as the excursion is not greater than 10 times the sample maximum and the excursions in any 24-hour period do not exceed 30 minutes total.		
^d The median number of total coliform organisms in the reclaimed water after disinfection does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last seven days for which analyses have been completed.		
^e The number of total coliform organisms shall not exceed 23 per 100 milliliters in any single sample.		
^f A chlorine residual of at least 0.5 mg/L shall be maintained in the reclaimed water during conveyance to the use area, unless the only use is groundwater recharge or if the limit is waived by the Departments of Health and Ecology.		

The distribution of reclaimed water for groundwater recharge via surface percolation is also subject to the following ground water quality limitations at MW1, MW5, MW6, MW8, MW9, and MW11:

GROUND WATER ENFORCEMENT LIMITATIONS:	
Primary Drinking Water Criteria	Sample Maximum^a
Nitrate as N	10 mg/L
Nitrite as N	1 mg/L
Arsenic	10 µg/L
Cadmium	5 µg/L
Chromium	100 µg/L
Fluoride	2 mg/L
Mercury	2 µg/L

GROUND WATER ENFORCEMENT LIMITATIONS:	
Nickel	100 µg/L
Total Trihalomethanes (TTHM)	0.08 mg/L
Other Groundwater Criteria	Sample Maximum^a
Total Dissolved Solids	500 mg/L
Chloride	250 mg/L
Sulfate	250 mg/L
Copper	1300 µg/L
Lead	15 µg/L
Manganese	50 µg/L
Iron	0.3 mg/L
Silver	100 µg/L
Zinc	5000 µg/L
^a The sample maximum is the highest allowable concentration for any sample as measured in the ground water at the top of the uppermost aquifer beneath or down gradient of the infiltration site.	
In the event of an exceedance of a groundwater enforcement limit, the Permittee shall: 1. Provide immediate verbal notification to Ecology's Southwest Regional Office, Water Quality Program. 2. Resample the well within 48 hours of receiving the laboratory report; 3. Provide written notification with the next monitoring report; and 4. Prepare a report documenting conditions and describing action taken and planned to reduce the level to below the enforcement limit as measured at the point of compliance.	

R2. RECLAIMED WATER MONITORING REQUIREMENTS

A. Influent Monitoring

The Permittee shall monitor the wastewater influent according to the following schedule:

Parameter	Units	Sample Point	Sampling Frequency	Sample Type
Flow	MGD	Influent	Continuous*	Recording meter
BOD ₅	mg/L	Influent	3 days/week	24-hour composite

Parameter	Units	Sample Point	Sampling Frequency	Sample Type
TSS	mg/L	Influent	3 days/week	24-hour composite
pH	Standard Units	Influent	Daily	Grab
Total Nitrogen (as N)	mg/L	Influent	1 day/week	24-hour composite
*Continuous means uninterrupted except for brief lengths of time for calibration, for power failure, or for unanticipated equipment repair or maintenance. Sampling shall be taken daily when continuous monitoring is not possible.				

B. Class A Reclaimed Water Monitoring

The Permittee shall monitor the reclaimed water according to the following schedule:

Parameter	Units	Sample Point ^a	Sampling Frequency	Sample Type
Flow	MGD	Disinfected reclaimed water	Continuous	Recording meter
BOD ₅	mg/L	Disinfected reclaimed water	3 days/week	24-hour composite
TSS	mg/L	Disinfected reclaimed water	Daily	24-hour composite
pH	Standard Units	Disinfected reclaimed water	Daily	Grab ^b
Dissolved Oxygen	mg/L	Disinfected reclaimed water	Daily	Grab ^b
Temperature	Celsius	Disinfected reclaimed water	Daily	Grab ^b
Turbidity ^c	NTU	Filter effluent prior to disinfection	Continuous	Recording meter
Total Nitrogen (as N)	mg/L	Disinfected reclaimed water	1 day/week	24-hour composite
Total Coliform ^d	MPN per 100 ml	Disinfected reclaimed water	Daily	Grab ^b
Total Chlorine Residual	mg/L	Water Reuse Distribution Line	Daily (when in use)	Grab ^b

Parameter	Units	Sample Point ^a	Sampling Frequency	Sample Type
Table II of Appendix D of 40 CFR part 122, as amended	µg/L	Disinfected reclaimed water	Annually	Grab and 24-hour composite, as appropriate
Table III of Appendix D of 40 CFR part 122, as amended	µg/L	Disinfected reclaimed water	Quarterly	Grab and 24-hour composite, as appropriate
^a Disinfected reclaimed water samples shall be taken before distribution system.				
^b Grab samples shall be taken at the same time daily when wastewater characteristics are the most demanding on the treatment facilities and disinfection processes.				
^c Effluent turbidity analysis must be performed by a continuous recording turbidimeter. For each day, the Permittee must report the average value and the maximum value that exceeds five minutes. "Continuous" means uninterrupted except for brief periods of time for calibration, for power failure, or for unanticipated equipment repair or maintenance. The Permittee must sample every four hours when continuous monitoring is not possible.				
^d As an alternate method, total coliform bacteria may be monitored using the ONPG-MUG test (also called Autoanalysis Colilert System) per latest edition of standard methods.				

C. Ground Water Monitoring

The sampling points for ground water will be monitoring wells MW1 to MW11.

The Permittee shall monitor the static well water elevation in MW2, MW3, MW4, MW7, and MW10 quarterly until these monitoring wells are properly decommissioned.

The Permittee shall monitor the ground water in MW1, MW5, MW6, MW8, MW9, and MW11 according to the following schedule:

Parameter	Units	Minimum Sampling Frequency	Sample Type
Static well water elevation	Feet above sea level	Quarterly ⁽¹⁾	Field Measurement
Temperature	°C	Quarterly ⁽¹⁾	Field Measurement
Dissolved Oxygen	mg/L	Quarterly ⁽¹⁾	Field Measurement
pH	Standard Units	Quarterly ⁽¹⁾	Field Measurement
Conductivity	umhos/cm	Quarterly ⁽¹⁾	Grab
Nitrate NO ₃ (as N)	mg/L	Quarterly ⁽¹⁾	Grab

Parameter	Units	Minimum Sampling Frequency	Sample Type
Nitrite NO ₂ (as N)	mg/L	Quarterly ⁽¹⁾	Grab
TKN (as N)	mg/L	Quarterly ⁽¹⁾	Grab
Total Dissolved Solids	mg/L	Quarterly ⁽¹⁾	Grab
Total Coliform Bacteria	cfu/100 ml	Quarterly ⁽¹⁾	Grab
Chloride	mg/L	Quarterly ⁽¹⁾	Grab
Cations/Anions: Calcium, Magnesium, Potassium, Sodium, Bicarbonate, Carbonate, Fluoride, Sulfate	mg/L	Yearly ⁽²⁾	Grab
Total Metals: Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Silver, Zinc ⁽³⁾	µg/L	Yearly ⁽²⁾	Grab
Total Trihalomethanes (TTHM)	mg/L	Quarterly ⁽¹⁾	Grab
⁽¹⁾ Quarterly is defined: January to March, report with March DMR April to June, report with June DMR July to September, report with September DMR October to December, report with December DMR			
⁽²⁾ Yearly is defined as January to December, report on the March DMR.			
⁽³⁾ Analytical method: Arsenic, EPA 206.3 or 206.2; Cadmium, EPA 2007.7 or 213.2; Chromium, EPA 200.7 or 218.2; Copper, EPA 200.7 or 220.2; Lead, EPA 239.2; Mercury, EPA 245.1 or 245.2; Nickel, EPA 249.2; Silver, EPA 272.2; Zinc, EPA 200.7 or 289.1.			

D. Sampling and Analytical Procedures and Plan

Samples and measurements taken to meet the requirements of this permit shall be representative of the volume and nature of the monitored parameters, including representative sampling of any unusual discharge or discharge condition, including bypasses, upsets and maintenance-related conditions affecting effluent quality.

Ground water sampling shall conform to the latest protocols in the *Implementation Guidance for the Ground Water Quality Standards*, (Ecology 1996). The Permittee shall maintain a ground water sampling and analysis plan that describes in detail the water level measurement method, purging and sampling procedures, decontamination procedures, sample bottle material and sizes, preservatives, holding times, quality assurance samples and analytical methods. The plan should describe the sampling procedures in sufficient detail that a person unfamiliar with the site could use the

document to obtain samples consistent with previous sample events. The Ground Water Sampling Plan shall be submitted for approval to Ecology by **May 1, 2012**.

Sampling and analytical methods used to meet the reclaimed water and wastewater monitoring requirements specified in this permit shall conform to the latest revision of the *Guidelines Establishing Test Procedures for the Analysis of Pollutants* contained in 40 Code of Federal Regulations (CFR) Part 136 or to the latest revision of *Standard Methods for the Examination of Water and Wastewater* (APHA), unless otherwise specified in this permit or approved in writing by the Department of Ecology (Ecology).

E. Flow Measurement

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to ensure the accuracy and reliability of measurements of the quantity of monitored flows. The devices shall be installed, calibrated, and maintained to ensure that the accuracy of the measurements are consistent with the accepted industry standard for that type of device. Frequency of calibration shall be in conformance with manufacturer's recommendations and at a minimum frequency of at least one calibration per year. Calibration records shall be maintained for at least three years.

F. Laboratory Accreditation

All monitoring data required by Ecology shall be prepared by a laboratory registered or accredited under the provisions of, *Accreditation of Environmental Laboratories*, Chapter 173-50 Washington Administrative Code (WAC). Flow, temperature, settleable solids, and internal process control parameters except those listed in Condition R2 are exempt from this requirement.

G. Reuse Instrumentation Calibration

Monitoring devices shall be installed, calibrated and maintained to ensure that the accuracy of the measurements is consistent with the accepted industry standard for that type of device. Frequency of calibration shall be in conformance with the manufacturer's recommendations. Calibration records shall be maintained for at least three years.

The Permittee shall also verify the accuracy of on-line turbidimeters at a minimum frequency of at least once every two weeks.

R3. REPORTING AND RECORDKEEPING REQUIREMENTS

The Permittee shall maintain records and report to the Departments of Ecology and Health in accordance with the following conditions. All records shall be retained for a minimum of three years. The falsification of information submitted to the Departments shall constitute a violation of the terms of this permit.

A. Submittal Reporting

The first monitoring period for reclaimed water begins on the effective date of the permit. Monitoring results shall be submitted monthly. Monitoring data obtained during the previous month shall be summarized and reported on a form provided, or otherwise

approved, by the Departments of Health and Ecology, and be received no later than the 15th day of the month following the completed reporting period, unless otherwise specified in this permit.

Monitoring Report forms must be submitted monthly whether or not the facility is reclaiming and distributing reclaimed water. If the reclamation facility was not operating during a given monitoring period, submit the form as required with the words "no reclamation or reuse" entered in place of the reclaimed water monitoring results.

Reclaimed water monitoring reports shall be submitted to the following addresses:

1. Department of Ecology, Municipal Permit Coordinator, Southwest Regional Office, P.O. Box 47775, Olympia, Washington 98504-7775
2. Department of Health, Office of Shellfish and Water Protection, 16201 East Indiana Avenue, Suite 1500, Spokane Valley, Washington 99216

B. Records Retention

The Permittee shall retain records of all monitoring information for a minimum of three years. Such information shall include all calibration and maintenance records and all original recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit. This period of retention shall be extended during the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by the Director.

C. Recording of Results

For each measurement or sample taken, the Permittee shall record the following information: (1) the date, exact place and time of sampling; (2) the individual who performed the sampling or measurement; (3) the dates the analyses were performed; (4) who performed the analyses; (5) the analytical techniques or methods used; and (6) the results of all analyses.

D. Additional Monitoring by the Permittee

If the Permittee monitors any pollutant more frequently than required by this permit using test procedures specified by Condition R2 of this permit, then the results of this monitoring shall be included in calculation and reporting of the data submitted in the Permittee's self-monitoring reports.

E. Noncompliance Notification

In the event the Permittee is unable to comply with any of the permit terms and conditions due to any cause, the Permittee shall:

1. Immediately take action to stop, contain, and cleanup unauthorized discharges or otherwise stop the violation, and correct the problem;

2. Repeat sampling and analysis of any violation and submit the results to Ecology within 30 days after becoming aware of the violation;
3. Within 24 hours, notify the Departments of Health and Ecology of the failure to comply; and
4. Submit a detailed written report to Ecology within 30 days, unless requested earlier by Ecology, describing the nature of the violation, corrective action taken and/or planned, steps to be taken to prevent a recurrence, results of the resampling, and any other pertinent information.

Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with the terms and conditions of this permit or the resulting liability for failure to comply.

F. Reclaimed Water Operational Records

1. Operating records shall be maintained at the treatment plant or within a central depository within the Permittee's operating agency. These records shall include: records of all analyses performed, records of operational problems, unit process and equipment breakdowns, and diversions to emergency storage or disposal; and all corrective or preventative action taken.
2. Process or equipment failures triggering an alarm that is key to maintaining reliability of reclaimed water quality shall be recorded and maintained as a separate record file. The recorded information shall include the time and cause of failure and corrective action taken.
3. A monthly summary of operating records as specified above shall be submitted with the Discharge Monitoring Report form to the Departments of Ecology and Health at that address listed under R3.A above.
4. Cross Connection Control Report. An **annual** cross-connection control report shall be submitted before distribution of reclaimed water and then by **May 15th** of each year to the Department of Health by a certified Cross-Control Specialist identifying all devices tested and any cross-connection incidents which occurred in the reuse system.

R4. RECLAIMED WATER DISTRIBUTION AND USE

The Permittee shall monitor the reclamation facility loading and the following conditions.

A. Water Reuse Summary Plan

The Permittee shall prepare a water reuse summary plan, which contains a summary description of the proposed water reuse system from the approved Engineering Report. The plan shall be submitted for approval to the Departments of Health and Ecology before distribution of reclaimed water and updated annually. The **annual** updates shall be due **January 31st** of each year, and cover the previous calendar year. A copy of the revised plan shall be submitted to the Departments of Ecology and Health. The plan shall contain, but not be limited to, the following:

1. Description of the reuse distribution system.
2. Identification and current list of all water purveyors, uses, users, and location of reuse sites.
3. Evaluation of reuse sites, estimated volume of reclaimed water use at reuse sites, means of application, and for irrigation or surface percolation uses, the application rates, water balance, expected agronomic uptake, potential to impact ground water or surface water at the site, background water quality and hydrogeological information necessary to evaluate potential water quality impacts.
4. Description of any additional treatment provided to the reclaimed water and any additional distribution system.

This Water Reuse Summary Plan may be combined with the plan required by the Budd Inlet Treatment Plant permit.

B. Authorized Uses and Locations

Beginning with the production of reclaimed water at the Martin Way plant and lasting through the expiration date of this permit, the Permittee is authorized to distribute reclaimed water from the Martin Way plant in accordance with the terms and conditions of this permit for authorized uses.

The distribution by the Permittee of reclaimed water from the Martin Way plant that does not meet the treatment, water quality and monitoring requirements established in this permit shall constitute a violation of the terms and conditions of this permit. The use of reclaimed water other than for authorized uses and locations that are listed or will be listed in the next update of a Departments of Health and Ecology approved Water Reuse Summary Plan shall constitute a violation of the terms and conditions of this permit.

The Permittee may produce and distribute Class A reclaimed water for the uses listed in the approved engineering report at the locations listed in the approved Water Reuse Summary Plan, and for new locations as described in R4.C.

C. Authorization for New Direct Non-potable Uses of Reclaimed Water

The Permittee may provide reclaimed water from the Martin Way plant for direct beneficial uses at locations not listed in the Water Reuse Summary Plan required by this permit in accordance with the terms and conditions of this permit provided the following conditions are met:

1. Direct beneficial uses and requirements for use are as listed in the Washington State Water Reclamation and Reuse Standards. The class of reclaimed water provided meets or exceeds the minimum requirements for the proposed use. Irrigation uses do not exceed agronomic rates of application.
2. The use area is located within Thurston County or other nearby counties. The water reclamation facility and use areas shall comply with local permitting and land use requirements.

3. The reclaimed water meets all applicable requirements of this permit for the approved class of reclaimed water including source control, treatment, water quality limitations, monitoring, recordkeeping, operation and maintenance, distribution and use.
4. The Permittee lists the new uses in the next annual Water Reuse Summary Plan and a copy of the revised plan is submitted to the Departments of Ecology and Health. The plan is described in R4.A.

D. Revocation of Authorization

Ecology may revoke authorization to provide service if the Permittee fails to comply with any requirement in this permit. Determination to revoke authorization shall be based on the risk to public health and safety or threat to waters of the state. Ecology may revoke the authorization for any or all facilities located within a specific geographic area if, due to a geologic or hydrologic condition, the cumulative effect of the facilities causes the violation of state water quality standards. Before revoking the authorization, Ecology shall notify the Permittee in writing and provide a reasonable opportunity and time frame to correct the noncompliance.

E. Bypass Prohibited

There shall be no bypassing of untreated or partially treated wastewater from the reclamation plant or any intermediate unit processes to the distribution system or point of use at any time. Diverting flows from the Martin Way plant to the Budd Inlet plant does not constitute a bypass provided such diversion does not cause an exceedance of the effluent limitations of National Pollutant Discharge Elimination System (NPDES) Permit No. WA0037061. All reclaimed water being distributed for beneficial use must meet Class A requirements at all times. Water not meeting Class A must be retained for additional treatment by diversion to a bypass storage lagoon or sent to another permitted treatment plant.

The Departments of Ecology and Health shall be notified by telephone within 24 hours of any diversion to a bypass storage lagoon. Substandard wastewater shall not be discharged to the reclaimed water distribution system or use areas without specific approval from the Departments of Health and Ecology.

F. Reliability

The Permittee shall maintain the highest reliability class as described in the Water Reclamation and Reuse Standards which require one of the following features for each of the critical reclamation treatment unit processes of oxidation, filtration, and disinfection:

1. Alarms and standby power source.
2. Alarms and automatically actuated short-term (24-hour) storage or disposal provisions.
3. Automatically actuated long-term storage or disposal provisions for treated wastewater.

G. Use Area Responsibilities

1. A standard notification sign shall be developed by the Permittee using colors and verbiage approved by the state Department of Health. The signs shall be used in all reclaimed water use areas, consistent with the Water Reclamation and Reuse Standards.
2. Reclaimed water use, including runoff and spray shall be confined to the designated and approved use area.
3. The Permittee shall control industrial and toxic discharges to the sanitary sewer that may affect reclaimed water quality through either a delegated pretreatment program with Ecology or assuring all applicable discharges have permits issued under the Water Pollution Control Act, Chapter 90.48 Revised Code of Washington (RCW), and the State Waste Discharge Permit Regulation, Chapter 173-216 WAC.
4. Where the reclaimed water production, distribution and use areas are under direct control of the Permittee, the Permittee shall maintain control and be responsible for all facilities and activities inherent to the production, distribution and use of the reclaimed water. The Permittee shall ensure that the reuse system operates as approved by the Departments of Health and Ecology.

H. Service and Use Area Contract

Where the reclaimed water additional treatment, distribution system or use area is not under direct control of the Permittee:

1. No reclaimed water shall be distributed by the Permittee or water purveyor without a binding Service and Use Area Contract in place. The contract shall ensure that construction, operation, maintenance, use area responsibilities, and monitoring meet all requirements of the Departments of Health and Ecology. This Service and Use Area contract must be consistent with the requirements of the Water Reclamation and Reuse Standards, 1997.
2. If a standard contract has been approved by the Departments, the Permittee or the water purveyor may certify that the individual contract copies submitted comply with the terms and conditions of the approved standard contract. If no standard contract has been approved, a copy of each Service and Use Area contract must be submitted to and approved by the Departments of Health and Ecology prior to implementation.
3. The Permittee or the water purveyor shall maintain all contracts for reclaimed water use for the duration of the permit. The Permittee shall inform the Departments of Health and Ecology in writing of any proposed changes to existing agreements.
4. Unless expressly stated otherwise in an approved contract, the Permittee is responsible for all reuse facilities and activities inherent to the production, distribution and use of the reclaimed water.

5. Each individual Service and Use Area contract shall provide the Permittee and the water purveyor with the authority to regulate distribution, enter and inspect the site and to terminate service of reclaimed water to any customer violating the states Water Reclamation and Reuse Standards. In lieu of specific language in each contract, the Permittee in conjunction with the contributing jurisdictions may complete local ordinances to include policies and procedures regulating the distribution and delivery of reclaimed water.

I. Reclaimed Water Ordinance

The Permittee shall complete interlocal agreements with the four contributing jurisdictions, and the contributing jurisdictions shall complete local ordinances to include policies and procedures for the distribution and delivery of reclaimed water. The interlocal agreements and ordinances shall provide the Permittee and jurisdictions with the authority to terminate service of reclaimed water from any jurisdiction or customer violating the state Water Reclamation and Reuse Standards and restrictions outlined in the service and use agreement.

J. Irrigation Use

1. For any irrigation use of reclaimed water, the hydraulic loading rate of reclaimed water shall be determined.
2. Irrigation uses shall conform to all requirements of the Washington State Water Reclamation and Reuse Standards. The Permittee in coordination with contributing jurisdictions shall assure that all customers or authorized personnel using reclaimed water have completed training in the requirements for appropriate use of the water. Users of reclaimed water must ensure that their irrigation systems are in good working order, maintained regularly, and kept free of leaks. They must further ensure that their irrigation controllers are set so that reclaimed water is applied appropriately to the landscape, to avoid excessive puddling or runoff of water. Sprinkler heads should be adjusted regularly to avoid application of water to impervious surfaces.

The Permittee or the water purveyor shall maintain all irrigation agreements for lands not owned for the duration of the permit. The Permittee shall inform the Departments of Health and Ecology in writing in the annual update to the Water Reuse Summary Plan of any proposed changes to existing agreements.

K. Surface Percolation Use

1. For any surface percolation of reclaimed water in the infiltration basin, the hydraulic loading rate shall be determined based on a detailed water balance. The calculated loading rate(s) and the parameters and methods used to determine the loading rates shall be submitted to Ecology for approval and is due by the start of surface percolation.
2. Background/natural groundwater quality must be documented and sampling locations identified and approved by Ecology.
3. Surface waters shall not be impaired due to the infiltration of reclaimed water.

L. Wetlands Use

The Permittee or the water purveyor may use reclaimed water for enhancement of natural wetlands, as long as the following conditions are met and Ecology has granted written approval for the specific wetland to be enhanced:

1. Augmentation of wetland hydrologic regime is not to exceed an additional (above background) average annual hydraulic loading rate of 2 cm/day to Category II wetlands and 3 cm/day to Category III and IV wetlands, unless monitoring can demonstrate that a net ecological benefit can be maintained at a higher rate.
2. Average monthly water level elevations shall not increase by more than 10 cm above the pre-augmentation water level.
3. In Accordance with the Water Reclamation and Reuse Standards, the Permittee shall monitor the vegetation cover, plant diversity, macroinvertebrate biomass, amphibian species, fish biomass and species, bird density and species, threatened/endangered density and species once per year during the 1st, 2nd, 4th, 6th, 8th, and 10th growing season. There shall be no more the 25 percent reduction in parameter measurements over the wetland or 50 percent reduction at any one location in the wetland. The Permittee shall submit a report to Ecology on the results of the biological monitoring within three months of-completion of the monitoring.

M. Other Uses of Reclaimed Water

Effluent used for sewage treatment plant purposes within the bounds of the wastewater treatment facility is not required to meet these standards unless potential public exposure, as determined by the Departments of Health and Ecology requires the use of reclaimed water.

The following uses require modification and public notice of this permit.

1. Groundwater recharge via direct injection.
2. Discharge of reclaimed water to surface waters, unless the discharge is covered by NPDES permit WA0037061.
3. Any reclamation facilities or uses that are not specifically authorized by this permit.
4. Any facilities or uses if determined necessary by the Department of Ecology or Health for public health or environmental protection.

R5. OPERATION AND MAINTENANCE

The Permittee shall at all times be responsible for the proper operation and maintenance of any facilities or systems of control installed to achieve compliance with the terms and conditions of this permit.

A. Reclaimed Water System Maintenance

The Permittee and the water purveyors shall institute an adequate operation and maintenance (O&M) program for the entire reclamation system. Maintenance records shall be maintained on all major electrical and mechanical components of the reclaimed water system, distribution system, and use areas. Such records shall clearly specify the frequency and type of maintenance recommended by the manufacturer and shall show the frequency and type of maintenance performed. These maintenance records shall be available for inspection at all times.

1. At all times, the reclamation system, distribution and use areas shall be maintained to ensure that all equipment is kept in a reliable operating condition.
2. A chlorine residual of at least 0.5 mg/L shall be maintained in the reclaimed water during conveyance from the reclamation system to the use area unless waived by the Departments of Health and Ecology.
3. Maintenance of a chlorine residual is not required in reclaimed water impoundments and storage ponds. At the discretion of the Departments of Health and Ecology, chlorine residual may not be required in reclaimed water distributed from storage ponds.

B. Operation and Maintenance (O&M) Manual

The Permittee must:

1. Review the O&M Manual at least **annually** and confirm this review by letter to Ecology by **May 15th** of each year.
2. Submit to Ecology for review and approval substantial changes or updates to the O&M Manual whenever it incorporates them into the manual.
3. Keep the approved O&M Manual at the permitted facility.
4. Follow the instructions and procedures of this manual.

In addition to the requirements of WAC 173-240-080 (1) through (5), the O&M Manual must include:

1. Emergency procedures for plant shutdown and cleanup in event of wastewater system upset or failure;
2. Irrigation system operational controls and procedures for systems that are under direct control of the Permittee;
3. Protocols and procedures for ground water monitoring network sampling and testing;
4. Plant maintenance procedures;

5. Alarm condition response plan to ensure that no untreated or inadequately-treated wastewater will be delivered to reclaimed water use areas.
6. Discussion of the cross-connection control and inspection program, including who will be responsible for compliance and testing of the cross-connection control devices.
7. Operational strategies for the reclaimed water use areas that are under direct control of the Permittee.

This O&M Manual may be electronic and may be combined with the O&M Manual required for the Budd Inlet plant by NPDES Permit No. WA0037061.

C. Electrical Power Failure

The Permittee is responsible for maintaining adequate safeguards to prevent the discharge of untreated wastes or wastes not treated in accordance with the requirements of this permit during electrical power failure at the water reclamation plant and/or sewage lift stations either by means of alternate power sources, standby generator, or retention of inadequately treated wastes. The power supply shall be provided with one of the following reliability features to assure that inadequately treated wastewater is not discharged to distribution or use areas:

1. An alarm and a standby power source
2. An alarm and automatically actuated short-term storage or alternative disposal provisions. All equipment other than pump-back equipment shall be either independent of the normal power supply or provided with a standby power supply.
3. Automatically actuated long-term storage or disposal provisions. All equipment other than pump-back equipment shall be either independent of the normal power supply or provided with a standby power supply.

R6. RESIDUAL SOLIDS

Residual solids include screenings, grit, scum, waste activated sludge and other solid waste. The Permittee shall store and handle all residual solids in such a manner so as to prevent their entry into state ground or surface waters. The waste activated sludge can be sent to the Budd Inlet Treatment Plant for further processing. The Permittee shall not discharge leachate from residual solids to state surface or ground waters.

GENERAL CONDITIONS

G1. SIGNATORY REQUIREMENTS

All applications, reports, or information submitted to Ecology shall be signed and certified.

- A. All permit applications shall be signed by either a principal executive officer or a ranking elected official.
- B. All reports required by this permit and other information requested by Ecology shall be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:
 - 1. The authorization is made in writing by a person described above and submitted to Ecology.
 - 2. The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility, such as the position of plant manager, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.)
- C. Changes to authorization. If an authorization under paragraph B.2 above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph B.2 above must be submitted to Ecology prior to or together with any reports, information, or applications to be signed by an authorized representative.
- D. Certification. Any person signing a document under this section shall make the following certification:

I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

G2. RIGHT OF INSPECTION AND ENTRY

The Permittee shall allow authorized representatives of the Departments of Ecology or Health, upon the presentation of credentials and such other documents as may be required by law:

- A. To enter upon the premises where a discharge is located or where any records must be kept under the terms and conditions of this permit.
- B. To have access to and copy - at reasonable times and at reasonable cost - any records required to be kept under the terms and conditions of this permit.
- C. To inspect - at reasonable times - any facilities, equipment (including monitoring and control equipment), practices, methods, or operations regulated or required under this permit.
- D. To sample or monitor - at reasonable times - any substances or parameters at any location for purposes of assuring permit compliance or as otherwise authorized by the Clean Water Act.

G3. PERMIT ACTIONS

This permit may be modified, revoked and reissued, or terminated either at the request of any interested person (including the permittee) or upon Ecology's initiative. However, the permit may only be modified, revoked and reissued, or terminated for the reasons specified in 40 CFR 122.62, 122.64 or WAC 173-220-150 according to the procedures of 40 CFR 124.5.

- A. The following are causes for terminating this permit during its term, or for denying a permit renewal application:
 - 1. Violation of any permit term or condition.
 - 2. Obtaining a permit by misrepresentation or failure to disclose all relevant facts.
 - 3. A material change in quantity or type of waste disposal.
 - 4. A determination that the permitted activity endangers human health or the environment, or contributes to water quality standards violations and can only be regulated to acceptable levels by permit modification or termination [40 CFR Part 122.64(3)].
 - 5. A change in any condition that requires either a temporary or permanent reduction, or elimination of any discharge or sludge use or disposal practice controlled by the permit [40 CFR Part 122.64(4)].
 - 6. Nonpayment of fees assessed pursuant to RCW 90.48.465.
 - 7. Failure or refusal of the permittee to allow entry as required in RCW 90.48.090.

- B. The following are causes for modification but not revocation and reissuance except when the permittee requests or agrees:
1. A material change in the condition of the waters of the state.
 2. New information not available at the time of permit issuance that would have justified the application of different permit conditions.
 3. Material and substantial alterations or additions to the permitted facility or activities which occurred after this permit issuance.
 4. Promulgation of new or amended standards or regulations having a direct bearing upon permit conditions, or requiring permit revision.
 5. The Permittee has requested a modification based on other rationale meeting the criteria of 40 CFR Part 122.62.
 6. Ecology has determined that good cause exists for modification of a compliance schedule, and the modification will not violate statutory deadlines.
 7. Incorporation of an approved local pretreatment program into a municipality's permit.
- C. The following are causes for modification or alternatively revocation and reissuance:
1. Cause exists for termination for reasons listed in A1 through A7 of this section, and Ecology determines that modification or revocation and reissuance is appropriate.
 2. Ecology has received notification of a proposed transfer of the permit. A permit may also be modified to reflect a transfer after the effective date of an automatic transfer (General Condition G8) but will not be revoked and reissued after the effective date of the transfer except upon the request of the new permittee.

G4. REPORTING A CAUSE FOR MODIFICATION

The Permittee shall submit a new application, or a supplement to the previous application, along with required engineering plans and reports whenever a material change to the facility or in the quantity or type of discharge is anticipated which is not specifically authorized by this permit. This application shall be submitted at least sixty days prior to any proposed changes. The filing of a request by the Permittee for a permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not relieve the Permittee of the duty to comply with the existing permit until it is modified or reissued.

G5. PLAN REVIEW REQUIRED

Prior to constructing or modifying any wastewater control facilities, an engineering report and detailed plans and specifications shall be submitted to Ecology for approval in accordance with Chapter 173-240 WAC. Engineering reports, plans, and specifications shall be submitted at least 180 days prior to the planned start of construction unless a shorter time is approved by Ecology. Facilities shall be constructed and operated in accordance with the approved plans.

G6. COMPLIANCE WITH OTHER LAWS AND STATUTES

Nothing in this permit shall be construed as excusing the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G7. DUTY TO REAPPLY

The Permittee shall apply for permit renewal by **March 1, 2016**.

G8. TRANSFER OF THIS PERMIT

In the event of any change in control or ownership of facilities from which the authorized discharge emanate, the Permittee shall notify the succeeding owner or controller of the existence of this permit by letter, a copy of which shall be forwarded to Ecology.

A. Transfers by Modification

Except as provided in paragraph (B) below, this permit may be transferred by the Permittee to a new owner or operator only if this permit has been modified or revoked and reissued under 40 CFR 122.62(b)(2), or a minor modification made under 40 CFR 122.63(d), to identify the new Permittee and incorporate such other requirements as may be necessary under the Clean Water Act.

B. Automatic Transfers

This permit may be automatically transferred to a new Permittee if:

1. The Permittee notifies Ecology at least 30 days in advance of the proposed transfer date.
2. The notice includes a written agreement between the existing and new Permittees containing a specific date transfer of permit responsibility, coverage, and liability between them.
3. Ecology does not notify the existing Permittee and the proposed new Permittee of its intent to modify or revoke and reissue this permit. A modification under this subparagraph may also be minor modification under 40 CFR 122.63. If this notice is not received, the transfer is effective on the date specified in the written agreement.

G9. REDUCED PRODUCTION FOR COMPLIANCE

The Permittee, in order to maintain compliance with its permit, shall control production and/or all discharges upon reduction, loss, failure, or bypass of the treatment facility until the facility is restored or an alternative method of treatment is provided. This requirement applies in the situation where, among other things, the primary source of power of the treatment facility is reduced, lost, or fails.

G10. REMOVED SUBSTANCES

Collected screenings, grit, solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall not be resuspended or reintroduced to the final effluent stream for discharge to state waters.

G11. DUTY TO PROVIDE INFORMATION

The Permittee shall submit to Ecology, within a reasonable time, all information which Ecology may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Permittee shall also submit to Ecology upon request, copies of records required to be kept by this permit [40 CFR 122.41(h)].

G12. OTHER REQUIREMENTS OF 40 CFR

All other requirements of 40 CFR 122.41 and 122.42 are incorporated in this permit by reference.

G13. ADDITIONAL MONITORING

Ecology may establish specific monitoring requirements in addition to those contained in this permit by administrative order or permit modification.

G14. PAYMENT OF FEES

The Permittee shall submit payment of fees associated with this permit as assessed by Ecology.

G15. PENALTIES FOR VIOLATING PERMIT CONDITIONS

Any person who is found guilty of willfully violating the terms and conditions of this permit shall be deemed guilty of a crime, and upon conviction thereof shall be punished by a fine of up to \$10,000 and costs of prosecution, or by imprisonment in the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

Any person who violates the terms and conditions of a waste discharge permit shall incur, in addition to any other penalty as provided by law, a civil penalty in the amount of up to \$10,000 for every such violation. Each and every such violation shall be a separate and distinct offense, and in case of a continuing violation, every day's continuance shall be deemed to be a separate and distinct violation.

G16. DUTY TO COMPLY

The Permittee shall comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

G17. TOXIC POLLUTANTS

The Permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if this permit has not yet been modified to incorporate the requirement.

G18. PENALTIES FOR TAMPERING

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than \$10,000 per violation, or by imprisonment for not more than two years per violation, or by both. If a conviction of a person is for a violation committed after a first conviction of such person under this Condition, punishment shall be a fine of not more than \$20,000 per day of violation, or by imprisonment of not more than four years, or by both.

G19. REPORTING PLANNED CHANGES

The Permittee shall, as soon as possible, give notice to Ecology of planned physical alterations or additions to the permitted facility, production increases, or process modification which will result in: 1) the permitted facility being determined to be a new source pursuant to 40 CFR 122.29(b); 2) a significant change in the nature or an increase in quantity of pollutants discharged; or 3) a significant change in the Permittee's sludge use or disposal practices. Following such notice, this permit may be modified, or revoked and reissued pursuant to 40 CFR 122.62(a) to specify and limit any pollutants not previously limited. Until such modification is effective, any new or increased discharge in excess of permit limits or not specifically authorized by this permit constitutes a violation of the terms and conditions of this permit.

G20. REPORTING ANTICIPATED NON-COMPLIANCE

The Permittee shall give advance notice to Ecology by submission of a new application or supplement thereto at least 180 days prior to commencement of such discharges, of any facility expansions, production increases, or other planned changes, such as process modifications, in the permitted facility or activity which may result in noncompliance with permit limits or conditions. Any maintenance of facilities, which might necessitate unavoidable interruption of operation and degradation of effluent quality, shall be scheduled during noncritical water quality periods and carried out in a manner approved by Ecology.

G21. REPORTING OTHER INFORMATION

Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application, or in any report to Ecology, it shall promptly submit such facts or information.

G22. COMPLIANCE SCHEDULES

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date.

APPENDIX A

EFFLUENT CHARACTERIZATION FOR POLLUTANTS THIS LIST INCLUDES EPA REQUIRED POLLUTANTS (PRIORITY POLLUTANTS) AND SOME ECOLOGY PRIORITY TOXIC CHEMICALS (PBTs)

The following table specifies analytical methods and levels to be used for effluent characterization in NPDES and State waste discharge permits. This appendix specifies effluent characterization requirements of the Department of Ecology unless other methods are specified in the body of this permit.

This permit specifies the compounds and groups of compounds to be analyzed. Ecology may require additional pollutants to be analyzed within a group. The objective of this appendix is to reduce the number of analytical “non-detects” in permit-required monitoring and to measure effluent concentrations near or below criteria values where possible at a reasonable cost. If a Permittee knows that an alternate, less sensitive method (higher DL and QL) from 40 CFR Part 136 is sufficient to produce measurable results in their effluent, that method may be used for analysis.

Pollutant & CAS No. (if available)	Recommended Analytical Protocol	Detection (DL)¹ μg/L unless specified	Quantitation Level (QL)² μg/L unless specified
CONVENTIONALS			
Biochemical Oxygen Demand	SM5210-B		2 mg/L
Chemical Oxygen Demand	SM5220-D		10 mg/L
Total Organic Carbon	SM5310-B/C/D		1 mg/L
Total Suspended Solids	SM2540-D		5 mg/L
Total Ammonia (as N)	SM4500-NH3-GH		0.3 mg/L
Flow	Calibrated device		
Dissolved oxygen	4500-OC/OG		0.2 mg/L
Temperature (max. 7-day avg.)	Analog recorder or Use micro-recording devices known as thermistors		0.2° C
pH	SM4500-H ⁺ B	N/A	N/A
NONCONVENTIONALS			
Total Alkalinity	SM2320-B		5 mg/L as CaCo3
Chlorine, Total Residual	4500 Cl G		50.0
Color	SM2120 B/C/E		10 color unit
Fecal Coliform	SM 9221D/E, 9222	N/A	N/A
Fluoride (16984-48-8)	SM4500-F E	25	100
Nitrate-Nitrite (as N)	4500-NO3-		100

Pollutant & CAS No. (if available)	Recommended Analytical Protocol	Detection (DL)¹ µg/L unless specified	Quantitation Level (QL)² µg/L unless specified
	E/F/H		
Nitrogen, Total Kjeldahl (as N)	4500-NH3-C/E/FG		300
Ortho-Phosphate (PO ₄ as P)	4500- PE/PF	3	10
Phosphorus, Total (as P)	4500-PE/PF	3	10
Oil and Grease (HEM)	1664A	1,400	5,000
Salinity	SM2520-B		3 PSS
Settleable Solids	SM2540 -F		100
Sulfate (as mg/L SO ₄)	SM4110-B		200
Sulfide (as mg/L S)	4500-S ² F/D/E/G		200
Sulfite (as mg/L SO ₃)	SM4500-SO3B		2000
Total dissolved solids	SM2540 C		20 mg/L
Total Hardness	2340B		200 as CaCO ₃
Aluminum, Total (7429-90-5)	200.8	2.0	10
Barium Total (7440-39-3)	200.8	0.5	2.0
Boron Total (7440-42-8)	200.8	2.0	10.0
Cobalt, Total (7440-48-4)	200.8	0.05	0.25
Iron, Total (7439-89-6)	200.7	12.5	50
Magnesium, Total (7439-95-4)	200.7	10	50
Molybdenum, Total (7439-98-7)	200.8	0.1	0.5
Manganese, Total (7439-96-5)	200.8	0.1	0.5
Tin, Total (7440-31-5)	200.8	0.3	1.5
METALS, CYANIDE & TOTAL PHENOLS			
Antimony, Total (7440-36-0)	200.8	0.3	1.0
Arsenic, Total (7440-38-2)	200.8	0.1	0.5
Beryllium, Total (7440-41-7)	200.8	0.1	0.5
Cadmium, Total (7440-43-9)	200.8	0.05	0.25
Chromium (hex) dissolved (18540-29-9)	SM3500-Cr EC	0.3	1.2
Chromium, Total (7440-47-3)	200.8	0.2	1.0
Copper, Total (7440-50-8)	200.8	0.4	2.0
Lead, Total (7439-92-1)	200.8	0.1	0.5
Mercury, Total (7439-97-6)	1631E	0.0002	0.0005
Nickel, Total (7440-02-0)	200.8	0.1	0.5
Selenium, Total (7782-49-2)	200.8	1.0	1.0
Silver, Total (7440-22-4)	200.8	0.04	0.2
Thallium, Total (7440-28-0)	200.8	0.09	0.36

Pollutant & CAS No. (if available)	Recommended Analytical Protocol	Detection (DL)¹ µg/L unless specified	Quantitation Level (QL)² µg/L unless specified
Zinc, Total (7440-66-6)	200.8	0.5	2.5
Cyanide, Total (57-12-5)	335.4	2	10
Cyanide, Weak Acid Dissociable	SM4500-CN I	2	10
Phenols, Total	EPA 420.1		50
DIOXIN			
2,3,7,8-Tetra-Chlorodibenzo-P-Dioxin (176-40-16)	1613B	1.3 pg/L	5 pg/L
VOLATILE COMPOUNDS			
Acrolein (107-02-8)	624	5	10
Acrylonitrile (107-13-1)	624	1.0	2.0
Benzene (71-43-2)	624	1.0	2.0
Bromoform (75-25-2)	624	1.0	2.0
Carbon tetrachloride (56-23-5)	624/601 or SM6230B	1.0	2.0
Chlorobenzene (108-90-7)	624	1.0	2.0
Chloroethane (75-00-3)	624/601	1.0	2.0
2-Chloroethylvinyl Ether (110-75-8)	624	1.0	2.0
Chloroform (67-66-3)	624 or SM6210B	1.0	2.0
Dibromochloromethane (124-48-1)	624	1.0	2.0
1,2-Dichlorobenzene (95-50-1)	624	1.9	7.6
1,3-Dichlorobenzene (541-73-1)	624	1.9	7.6
1,4-Dichlorobenzene (106-46-7)	624	4.4	17.6
Dichlorobromomethane (75-27-4)	624	1.0	2.0
1,1-Dichloroethane (75-34-3)	624	1.0	2.0
1,2-Dichloroethane (107-06-2)	624	1.0	2.0
1,1-Dichloroethylene (75-35-4)	624	1.0	2.0
1,2-Dichloropropane (78-87-5)	624	1.0	2.0
1,3-dichloropropylene (mixed isomers) (542-75-6)	624	1.0	2.0
Ethylbenzene (100-41-4)	624	1.0	2.0
Methyl bromide (74-83-9) (Bromomethane)	624/601	5.0	10.0
Methyl chloride (74-87-3)	624	1.0	2.0

Pollutant & CAS No. (if available)	Recommended Analytical Protocol	Detection (DL)¹ μg/L unless specified	Quantitation Level (QL)² μg/L unless specified
(Chloromethane)			
Methylene chloride (75-09-2)	624	5.0	10.0
1,1,2,2-Tetrachloroethane (79-34-5)	624	1.9	2.0
Tetrachloroethylene (127-18-4)	624	1.0	2.0
Toulene (108-88-3)	624	1.0	2.0
1,2-Trans-Dichloroethylene (156-60-5) (Ethylene dichloride)	624	1.0	2.0
1,1,1-Trichloroethane (71-55-6)	624	1.0	2.0
1,1,2-Trichloroethane (79-00-5)	624	1.0	2.0
Trichloroethylene (79-01-6)	624	1.0	2.0
Vinyl chloride (75-01-4)	624/SM6200B	1.0	2.0
ACID COMPOUNDS			
2-Chlorophenol (95-57-8)	625	1.0	2.0
2,4-Dichlorophenol (120-83-2)	625	0.5	1.0
2,4-Dimethylphenol (105-67-9)	625	0.5	1.0
4,6-dinitro-o-cresol (534-52-1) (2-methyl-4,6,-dinitrophenol)	625/1625B	1.0	2.0
2,4 dinitrophenol (51-28-5)	625	1.0	2.0
2-Nitrophenol (88-75-5)	625	0.5	1.0
4-nitrophenol (100-02-7)	625	0.5	1.0
Parachlorometa cresol (59-50-7) (4-chloro-3-methylphenol)	625	1.0	2.0
Pentachlorophenol (87-86-5)	625	0.5	1.0
Phenol (108-95-2)	625	2.0	4.0
2,4,6-Trichlorophenol (88-06-2)	625	2.0	4.0
BASE/NEUTRAL COMPOUNDS (compounds in bold are Ecology PBTs)			
Acenaphthene (83-32-9)	625	0.2	0.4
Acenaphthylene (208-96-8)	625	0.3	0.6
Anthracene (120-12-7)	625	0.3	0.6
Benzidine (92-87-5)	625	12	24
Benzyl butyl phthalate (85-68-7)	625	0.3	0.6
Benzo(a)anthracene (56-55-	625	0.3	0.6

Pollutant & CAS No. (if available)	Recommended Analytical Protocol	Detection (DL)¹ μg/L unless specified	Quantitation Level (QL)² μg/L unless specified
3)			
Benzo(j)fluoranthene (205-82-3)	625	0.5	1.0
Benzo(r,s,t)pentaphene (189-55-9)	625	0.5	1.0
Benzo(a)pyrene (50-32-8)	610/625	0.5	1.0
3,4-benzofluoranthene (Benzo(b)fluoranthene) (205-99-2)	610/625	0.8	1.6
11,12-benzofluoranthene (Benzo(k)fluoranthene) (207-08-9)	610/625	0.8	1.6
Benzo(ghi)Perylene (191-24-2)	610/625	0.5	1.0
Bis(2-chloroethoxy)methane (111-91-1)	625	5.3	21.2
Bis(2-chloroethyl)ether (111-44-4)	611/625	0.3	1.0
Bis(2-chloroisopropyl)ether (39638-32-9)	625	0.3	0.6
Bis(2-ethylhexyl)phthalate (117-81-7)	625	0.1	0.5
4-Bromophenyl phenyl ether (101-55-3)	625	0.2	0.4
2-Chloronaphthalene (91-58-7)	625	0.3	0.6
4-Chlorophenyl phenyl ether (7005-72-3)	625	0.3	0.5
Chrysene (218-01-9)	610/625	0.3	0.6
Dibenzo (a,j)acridine (224-42-0)	610M/625M	2.5	10.0
Dibenzo (a,h)acridine (226-36-8)	610M/625M	2.5	10.0
Dibenzo(a-h)anthracene (53-70-3)(1,2,5,6-dibenzanthracene)	625	0.8	1.6
Dibenzo(a,e)pyrene (192-65-4)	610M/625M	2.5	10.0
Dibenzo(a,h)pyrene (189-64-0)	625M	2.5	10.0
3,3-Dichlorobenzidine (91-94-1)	605/625	0.5	1.0
Diethyl phthalate (84-66-2)	625	1.9	7.6
Dimethyl phthalate (131-11-3)	625	1.6	6.4

Pollutant & CAS No. (if available)	Recommended Analytical Protocol	Detection (DL)¹ μg/L unless specified	Quantitation Level (QL)² μg/L unless specified
Di-n-butyl phthalate (84-74-2)	625	0.5	1.0
2,4-dinitrotoluene (121-14-2)	609/625	0.2	0.4
2,6-dinitrotoluene (606-20-2)	609/625	0.2	0.4
Di-n-octyl phthalate (117-84-0)	625	0.3	0.6
1,2-Diphenylhydrazine (as Azobenzene) (122-66-7)	1625B	5.0	20
Fluoranthene (206-44-0)	625	0.3	0.6
Fluorene (86-73-7)	625	0.3	0.6
Hexachlorobenzene (118-74-1)	612/625	0.3	0.6
Hexachlorobutadiene (87-68-3)	625	0.5	1.0
Hexachlorocyclopentadiene (77-47-4)	1625B/625	0.5	1.0
Hexachloroethane (67-72-1)	625	0.5	1.0
Indeno(1,2,3-cd)Pyrene (193-39-5)	610/625	0.5	1.0
Isophorone (78-59-1)	625	0.5	1.0
3-Methyl cholanthrene (56-49-5)	625	2.0	8.0
Naphthalene (91-20-3)	625	0.3	0.6
Nitrobenzene (98-95-3)	625	0.5	1.0
N-Nitrosodimethylamine (62-75-9)	607/625	2.0	4.0
N-Nitrosodi-n-propylamine (621-64-7)	607/625	0.5	1.0
N-Nitrosodiphenylamine (86-30-6)	625	0.5	1.0
Perylene (198-55-0)	625	1.9	7.6
Phenanthrene (85-01-8)	625	0.3	0.6
Pyrene (129-00-0)	625	0.3	0.6
1,2,4-Trichlorobenzene (120-82-1)	625	0.3	0.6
PESTICIDES/PCBs			
Aldrin (309-00-2)	608	0.025	0.05
alpha-BHC (319-84-6)	608	0.025	0.05
beta-BHC (319-85-7)	608	0.025	0.05
gamma-BHC (58-89-9)	608	0.025	0.05
delta-BHC (319-86-8)	608	0.025	0.05
Chlordane (57-74-9)	608	0.025	0.05
4,4'-DDT (50-29-3)	608	0.025	0.05

Pollutant & CAS No. (if available)	Recommended Analytical Protocol	Detection (DL)¹ µg/L unless specified	Quantitation Level (QL)² µg/L unless specified
4,4'-DDE (72-55-9)	608	0.025	0.05 ¹⁰
4,4' DDD (72-54-8)	608	0.025	0.05
Dieldrin (60-57-1)	608	0.025	0.05
alpha-Endosulfan (959-98-8)	608	0.025	0.05
beta-Endosulfan (33213-65-9)	608	0.025	0.05
Endosulfan Sulfate (1031-07-8)	608	0.025	0.05
Endrin (72-20-8)	608	0.025	0.05
Endrin Aldehyde (7421-93-4)	608	0.025	0.05
Heptachlor (76-44-8)	608	0.025	0.05
Heptachlor Epoxide (1024-57-3)	608	0.025	0.05
PCB-1242 (53469-21-9)	608	0.25	0.5
PCB-1254 (11097-69-1)	608	0.25	0.5
PCB-1221 (11104-28-2)	608	0.25	0.5
PCB-1232 (11141-16-5)	608	0.25	0.5
PCB-1248 (12672-29-6)	608	0.25	0.5
PCB-1260 (11096-82-5)	608	0.13	0.5
PCB-1016 (12674-11-2)	608	0.13	0.5
Toxaphene (8001-35-2)	608	0.24	0.5

1. Detection level (DL) or detection limit means the minimum concentration of an analyte (substance) that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero as determined by the procedure given in 40 CFR part 136, Appendix B.
2. Quantitation Level (QL) is equivalent to EPA's Minimum Level (ML) which is defined in 40 CFR Part 136 as the minimum level at which the entire GC/MS system must give recognizable mass spectra (background corrected) and acceptable calibration points. These levels were published as proposed in the Federal Register on March 28, 1997.

APPENDIX B

REFERENCE LIST

Note that only documents which do not have websites are included in this appendix.

- City of Lacey, 2010, Comprehensive Water Rights Mitigation Plan, December.
https://cityoflacey.org/lacey_mitigation_plan_updated_dec_2010/
- City of Lacey, 2016, Lacey Comprehensive Plan, August 11.
<https://cityoflacey.org/comprehensive-planning/>
- Huitt-Zollars, Inc., 2008, City of Lacey Reclaimed Water Study for Lacey Gateway and Surrounding Areas, September.
- LOTT Clean Water Alliance, 2015, 2015 Flows and Loadings Report, December.
- LOTT Clean Water Alliance, 2019, 2018 Capacity Assessment Report, May.
- LOTT Clean Water Alliance, 2022, Reclaimed Water Infiltration Study, August 23.
<https://www.lottcleanwater.org/reclaimed-water-study/>
- Pacific Groundwater Group, 2010, Woodland Creek Reclaimed Water Infiltration Facility Analyses Final Report, September
- Reclaimed Water Policy Task Force, 2019, Reclaimed Water Supply Agreement Revisions Technical Memorandum, December 4.

CITY OF LACEY, WASHINGTON
RECLAIMED WATER STUDY
Lacey Gateway and Surrounding Areas

September 2008

Prepared by:

Gerald Prusik, PE
HUITT-ZOLLARS, INC.
814 E. Pike Street
Seattle, WA 98122-3893

PROJECT ENGINEER'S CERTIFICATION

I hereby certify that this Reclaimed Water Study for Lacey Gateway has been prepared by me or under my supervision and generally meets the intent of the design criteria determined for this project by the City of Lacey, Washington and normal standards of engineering practice for similar projects in the City of Lacey. I understand that to the extent allowable by law the jurisdiction does not and will not assume liability for the sufficiency, suitability, or performance of reclaimed water facilities designed by me.

This document has been prepared based on a Gateway developer grading plan dated July 2007, with updates dated April 2008, and is to be considered a preliminary planning draft concept and is subject to change as design and development planning continues.

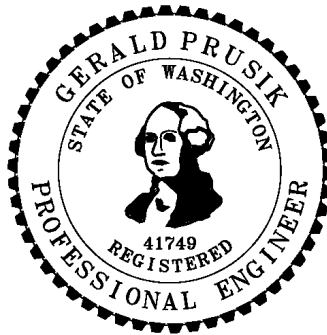


TABLE OF CONTENTS

I.	PROJECT SUMMARY	1
II.	PROJECT LOCATION AND PROPOSED LAND USE	3
	A. LOCATION	3
	B. EXISTING & PROPOSED LAND USE	4
	C. SURROUNDING AREAS	5
III.	SYSTEM MODELING GUIDELINES & ASSUMPTIONS	6
	A. PHYSICAL GUIDELINES	6
	B. LACEY SYSTEM FEED	6
	C. LOTT RECLAIMED WATER SUPPLY ALLOCATIONS FOR CITY OF LACEY	8
	D. DEMAND CALCULATIONS	8
	1.) COMMERCIAL AND OFFICE TOILET FLUSHING DEMAND ESTIMATION.....	9
	2.) NON-OWNER OCCUPIED RESIDENTIAL TOILET FLUSHING DEMAND ESTIMATION	9
	3.) IRRIGATION DEMAND ESTIMATION.....	10
	4.) WINTER DEMAND, AVERAGE DAY DEMAND, MAX DAY DEMAND, PEAK HOUR DEMAND	10
	E. SYSTEM PRESSURE	12
	F. ELEVATIONS.....	14
	G. FIRE FLOW	14
IV.	STORAGE DESIGN.....	15
	A. LOCATIONS.....	15
	B. EQUALIZING STORAGE	15
	C. STANDBY STORAGE	15
	D. OPERATIONAL STORAGE	16
	E. RAC STORAGE	17
	F. TOTAL STORAGE	17
	G. PRESSURE STORAGE	18
V.	PUMP STATIONS.....	20
	A. MAIN PUMP STATION	20
	B. RAC IRRIGATION	22
VI.	SCENARIO ANALYSIS	23
	A. AVERAGE DAY ANALYSIS	23
	B. MAX DAY ANALYSIS.....	23
	C. WINTER ANALYSIS.....	23
VII.	CONCLUSION AND RECOMMENDATIONS.....	26
	A. DEMANDS AND LOTT SUPPLY	26
	B. TANKS	27
	C. PUMP STATIONS	28

D. SYSTEM OPERATIONAL PRESSURES.....	28
VIII. REFERENCES.....	29
APPENDIX A -- Reclaimed Water Demand Calculations and Assumptions	
APPENDIX B -- Cabela's Requirement Information	
APPENDIX C -- Diurnal Curves	
APPENDIX D -- Storage Calculations	
APPENDIX E -- Average Day Analysis	
APPENDIX F -- Max Day Analysis	
APPENDIX G -- Winter Analysis	
APPENDIX H -- Topo Map (in Map Pocket)	

I. PROJECT SUMMARY

The City of Lacey and private developer(s) intend to construct specific public improvements, including streets and City utilities (stormwater, water, wastewater and reclaimed water) to serve the planned Lacey Gateway site in the City of Lacey, Thurston County, Washington. This study focuses on the reclaimed water improvements for the Gateway development and surrounding areas.

Reclaimed water is treated wastewater that can be used for irrigation, toilet flushing, and other non-potable applications. With current water supply concerns and several conservation measures in place, using reclaimed water is becoming a sought out option for water use. For the Lacey Gateway site and surrounding areas, various non-residential buildings will be double-plumbed so that reclaimed water can be used for toilet flushing. Irrigation is planned as the major use for reclaimed water in this area.

The reclaimed water infrastructure for the Lacey Gateway project, which includes the storage, pumping, and distribution infrastructure, will be owned, operated, and maintained by the City of Lacey. The source of reclaimed water supply is from the LOTT alliance (LOTT). LOTT stands for Lacey, Olympia, Tumwater, and Thurston County. LOTT was formed to provide wastewater management services and has developed a regional reclaimed water plant as part of the LOTT management plan. The City of Lacey is scheduled to receive a certain amount of reclaimed water from LOTT, depending on the wastewater supply and filtration units that are operational. The 14-inch ductile iron (DI) reclaimed water supply main, which is along the south side of Britton Parkway and north of the Lacey Gateway project, is owned, operated, and maintained by LOTT. The responsibility for the City of Lacey starts after the tap into the 14-inch LOTT transmission main. On initial startup and as build-out progresses, potable water may be needed to supplement the LOTT reclaimed water supply.

For this study, the anticipated full build-out reclaimed water system is modeled including Gateway, Regional Athletic Complex (RAC), and surrounding areas. Average Day Analysis, Maximum Day Analysis, and Winter (no irrigation) Analysis scenario models have been developed. Supporting calculations for demands and storage are provided within the study.

For full build out, the reclaimed water system includes 3 MG ground storage (Gateway Site), 1.4 MG elevated storage (Gateway Site), an additional 1.4 MG elevated storage (RAC Site), and a main pump station. Initial construction includes the main pump station with pumping capacity appropriate for initial conditions, minimum of one ground tank, sized between 1.0 MG and 1.5 MG, on Gateway, and the 1.4 MG elevated tank at the RAC. As development progresses, additional ground storage would be built at Gateway. Finally, the 1.4 MG elevated storage tank on Gateway would be constructed as demands encroach on full build out numbers. The initial infrastructure would be phased into the above full build out components.

As of July 2007, Reclaimed Water main lines were constructed with Phase I construction within Gateway Boulevard & Main Street, including the stubs for the future crossings at "A" Street, "B" Street, "C" Street, "D" Street, East Access Road, and West Access Road as well as mid-block irrigation stubs between these crossings. Phase II construction plans are being developed for construction of Main Street from Marvin Road to the East Gateway property line. A reclaimed water line is to be constructed within this portion of Main Street and is to be extended under Marvin Road to be stubbed/capped on the east side of Marvin Road. This segment of reclaimed water line will include stubs at the full intersection

providing access to the Lacey Town Center (North). The south stub as this full intersection is for future use. Mid-block stubs are also to be provided for irrigation purposes. These initial reclaimed water distribution pipelines are connected to the existing potable water supply at Britton Parkway, Gateway Boulevard, and Main Street/Marvin Road and will be disconnected from the potable water system when the reclaimed water storage and pumping systems are constructed.

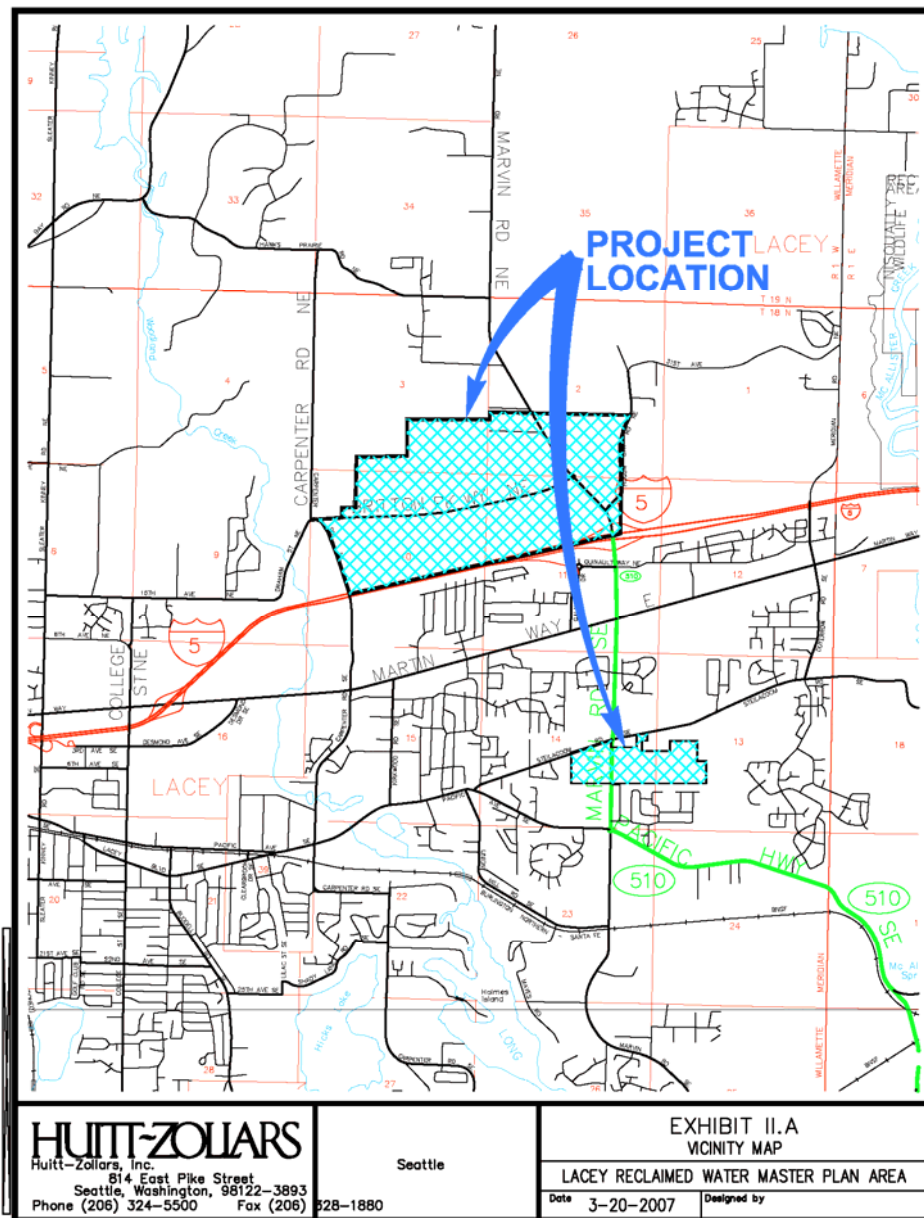
This study is not intended to address the private development utility requirements. This document will require updates and modifications as these private development planning efforts continue.

II. PROJECT LOCATION AND PROPOSED LAND USE

A. LOCATION

This Reclaimed Water Study is performed for the proposed Lacey Gateway site and surrounding area in the City of Lacey, Thurston County, Washington.

The overall project area is mainly in Sections 10 and 11, with parts in Sections 2, 3, 13, and 14, located in Township 18 North, Range 1 West of the Willamette Principal Meridian. The majority of the project area is north of I-5 with only the Regional Athletic Complex (RAC) being separate and south of I-5.



B. EXISTING AND PROPOSED LAND USE

The existing Gateway site is currently undeveloped native woodlands with the exception of Gateway Blvd, portions of Main St., and the Cabela's store and parking lots, which were constructed and opened in Summer/Fall 2007. Proposed land use includes retail, commercial, business and residential development (refer to Exhibit II.B for Lacey Gateway Site Plan).



C. SURROUNDING AREAS

In addition to the Gateway site, other developable areas surrounding the site are expected to use reclaimed water as well. These include the following:

The offsite Hawks Prairie Business District (HPBD) is located to the east and northeast of the Gateway site. Both the Offsite Business Park (OBP) and the Offsite Highway Commercial (OHC) sites are located north of Gateway. Britton Place Subdivision (BPS) is located northwest of Gateway while the Hall property (HALL) and FM Lacey (FML) site are located west of Gateway. South of I-5 and southeast of the Gateway site are several acres of athletic fields, known as the Regional Athletic Complex (RAC). Exhibit II.C shows the approximate areas of the offsite locations along with the Martin Way Reclaimed Water Plant for reference.

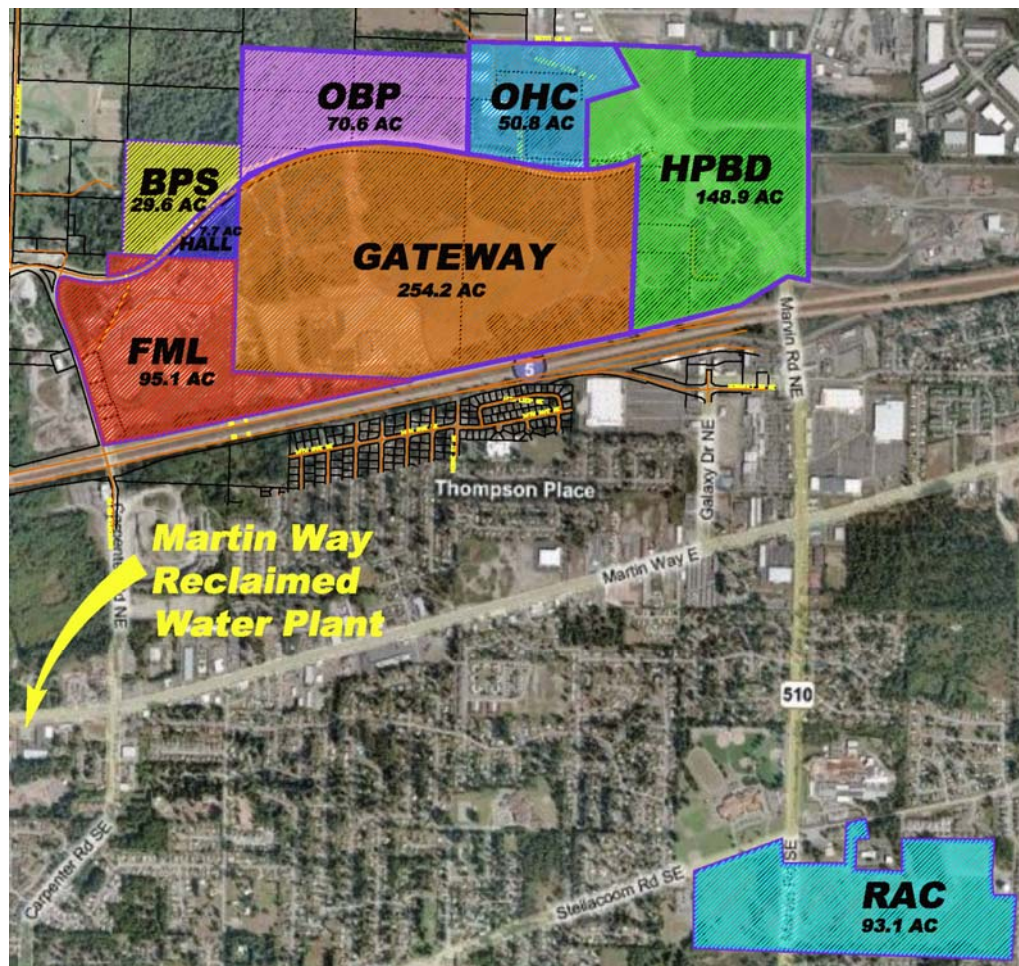


Exhibit II.C: Offsite Locations

The areas can also be seen on: Land Use Plan and Zoning Map Amendments, 5-16-06 for the Lacey Planning Commission Presentation on the City of Lacey, WA website:

http://www.ci.lacey.wa.us/building_and_planning/updates/planning_commission/planning_commission_presentation_05-16-06.pdf

III. SYSTEM MODELING GUIDELINES & ASSUMPTIONS

Many aspects define and regulate a distribution system, thus making each system unique. For the Lacey reclaimed water system analysis, these aspects are described below.

A. PHYSICAL GUIDELINES

The Washington State Department of Ecology "Water Reclamation and Reuse Standards," (September 1997), and the "Criteria for Sewage Works Design" (December 1998) or the "Orange Book", along with the City of Lacey, provided the design standards.

Base physical system design standards are:

- Pipe velocities below 7 ft/s
- Pipe adheres to Table C1-4. Water Main Standard Pipe Material of the Orange Book
- Minimum pipe size is 8-inch
- Reclaimed water pressures are recommended to be 10 psi below potable water pressures
- Minimum pressure for low-flow toilets is between 20 psi to 35 psi
- Lacey reclaimed water system is to be separate from LOTT facilities.
- Lacey will construct a reclaimed water intake facility off of/tapped to the LOTT pipeline to deliver reclaimed water to its reclaimed water storage facility.

The proposed reclaimed water collection system was modeled in Bentley WaterGEMS v. 3.0 using the Hazen-Williams Formula. The majority of the pipes throughout the models are designed as eight (8) inches, with a minimum pipe diameter of eight (8) inches and a maximum diameter of sixteen (16) inches. All pipes are PVC pipe analyzed with a Hazen-Williams roughness coefficient $C = 100$ for a conservative calculation.

B. LACEY SYSTEM FEED

The proposed feed for the site is a 12-inch line tapped off of the 14-inch LOTT line located in Britton PKWY NE. The 14-inch LOTT line continues east and eventually feeds the Hogum Bay Road Constructed Wetlands and Recharge Basins (HPPRB) located northeast of the Gateway site. The Hogum Bay Road Constructed Wetlands and Recharge Basins are also known as the Hogum Bay Facility and the Hawks Prairie Wetland Ponds/Recharge Basins Site. The LOTT line is supplied by the Martin Way Reclaimed Water Plant. Exhibit III.C shows the major LOTT infrastructure in relation to the Lacey reclaimed water service area. Note that City of Lacey has a 10-inch reclaimed water distribution (RWD) pipeline in Marvin Road south of I-5 which is not connected to any system currently.

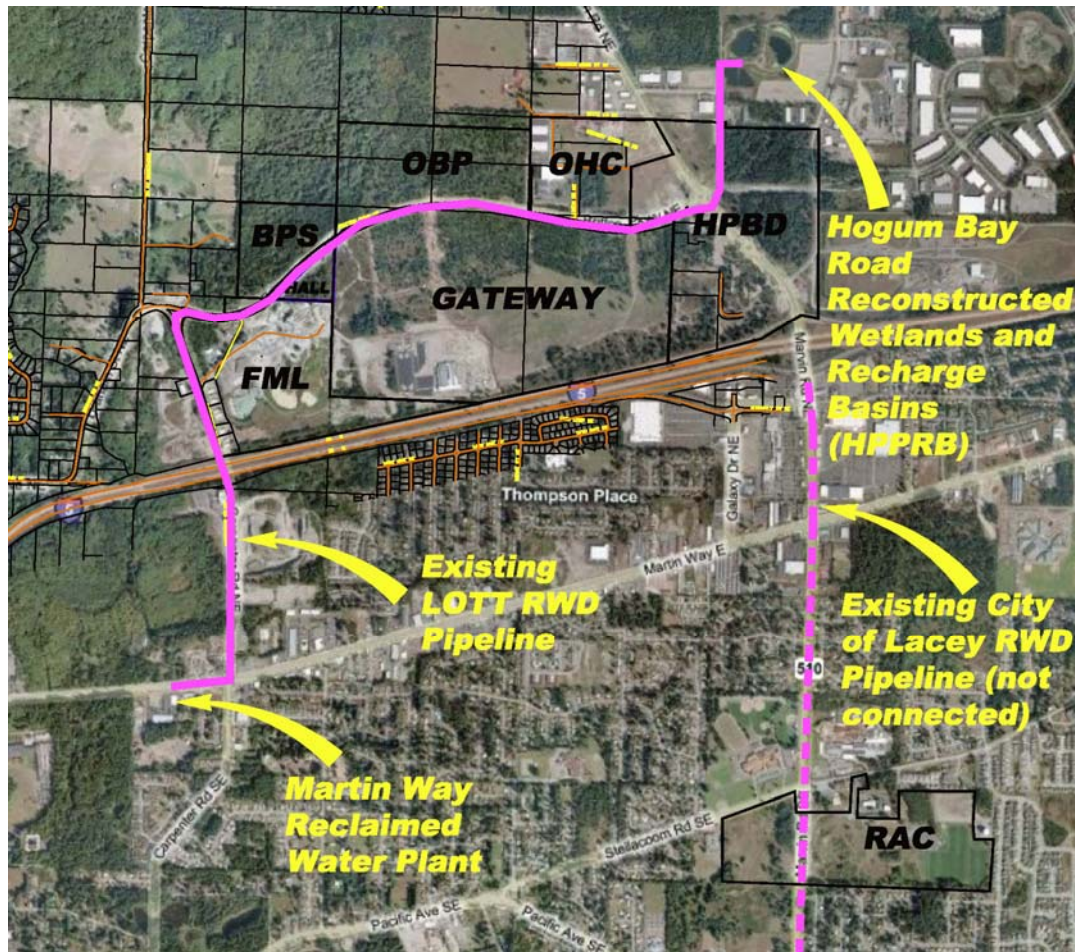


Exhibit III.C: Major Infrastructure

The minimum supply to the HPPRB is approximately 0.25 MGD which takes precedence over other proposed demands. If the remaining reclaimed water supply is not sufficient for the demands within the proposed distribution area, potable water will be used to supply the system. Backflow prevention, air gaps, and other cross-connection prevention measures are necessary to insure contamination of the potable system does not occur.

For the initial construction, the main system feed will tap into the Britton PKWY NE 14-inch line northwest of the Gateway site. A 12-inch main will convey water to a ground level tank on the Gateway site. Pumps will then supply the needed pressure to the reclaimed water system and to the elevated RAC tank.

At full build out, the system still only has the one LOTT feed with a potable feed including necessary cross-connection prevention as back up. The initial ground level Gateway tank and elevated RAC tank are eventually augmented by an additional ground storage tank and an elevated storage tank on the Gateway site. As development progresses, the main pump station capacity must be increased to match system demands.

C. LOTT RECLAIMED WATER SUPPLY ALLOCATIONS FOR CITY OF LACEY

The reclaimed water availability listed below is from pages 4-4 and 4-6 of the City of Lacey Class A Reclaimed Water Distribution Area Analysis dated August 2005. The figures represented here reflect projected supplies for fully functioning processing units at the Martin Way Reclaimed Water Plant (MWRWP). The supply quantities are averaged over a day and the actual instantaneous supply quantities will vary.

1 MGD Filtration Unit

Avg. Jan-May and May 2005 Reclaimed Water Available (RWA) = 0.94 MGD

LOTT's Wetland = 0.25 MGD

Lacey's Amount = 0.41 MGD

Olympia'a Amount = 0.28 MGD

2 MGD Filtration Unit

Month of May 2005 RWA = 1.61 MGD

LOTT's Wetland = 0.25 MGD

Lacey's Amount = 1.08 MGD

Olympia'a Amount = 0.28 MGD

Avg. Jan-May Weekend RWA = 1.75 MGD

LOTT's Wetland = 0.25 MGD

Lacey's Amount = 1.22 MGD

Olympia'a Amount = 0.28 MGD

Avg. Jan-May Week Day RWA = 1.83 MGD

LOTT's Wetland = 0.25 MGD

Lacey's Amount = 1.30 MGD

Olympia'a Amount = 0.28 MGD

The shown MWRWP reclaimed water supply to the City of Lacey ranges from 0.41 MGD to 1.3 MGD. For modeling, only full build out demands are used due to the unknown timing of area development. Modeling based on the above supply numbers is not provided due to the unknowns of what area will develop first. By designing the overall system for the future demand, the City of Lacey can then monitor development progress and add additional infrastructure, such as tanks, distribution lines, and pumps as necessary. The full build out demand calculations are compared to the MWRWP allocations to the City of Lacey in the Conclusion Section.

D. DEMAND CALCULATIONS

For the Lacey Gateway Reclaimed Water project, usage types are based on both land zoning areas and planned layouts. The Gateway Site has planned areas for Irrigation, Residential, Commercial, Government, Office, and Mixed Use. These demand types are proportioned according to the planned area. (See Exhibit II.B-1) HPBD, OBP, and OHC are more general and have irrigation demands (assumed 10% of area) and toilet flushing demands assigned. FML is broken into Mixed Use, Commercial, and Irrigation, while RAC and BPS are solely irrigation demand. WSDOT represents a specific demand for truck washing (300 gpm for one hour). Toilet flushing and irrigation for the WSDOT area are included under OHC site calculations.

Current understanding is that all toilets in non-owner occupied buildings after the first 2,000 will be on the reclaimed system. Where the first 2,000 toilets will be installed is yet to be determined. Therefore, for the model, the demands are placed under the assumption that all toilets are on the reclaimed system.

Since the only uses included in this study are toilet flushing and irrigation, the number of estimated toilets per planned area is needed for demand calculations. Sections 1 and 2 below describe how the toilet use is calculated. Section 3 covers the irrigation estimate. Sections 4 and 5 discuss total system demand followed by a summary demand table used for modeling. (See Table III.D.4) Assumptions and calculations are detailed further in Appendix A.

1. COMMERCIAL AND OFFICE TOILET FLUSHING DEMAND ESTIMATION

To provide toilet flushing demands at a master plan level, the demands per acre per type of development were estimated based on various other communities.

For example, the overall sanitary demand for Office usage is assumed at 1,000 gpd per acre. Of that 1,000 gpd, thirty three percent (33%) is considered toilet use. Office acreage totals 30.53 acres for the Gateway area. Therefore, the total daily toilet flushing demand for the Office acreage is calculated as:

$$1,000 \text{ gpd} \times 33\% \times 30.53 \text{ acres} = 10,074.9 \text{ gpd}$$

The toilet flushing demands per area were determined in the above manner for Commercial, Government, Office, Mixed Use, HPBD, OBP, and OHC. The results from the calculations are considered Average Day Demand (ADD) for modeling purposes.

2. NON-OWNER OCCUPIED RESIDENTIAL TOILET FLUSHING DEMAND ESTIMATION

Residential toilet flushing does not include single family homes or owner occupied dwellings as these will not be dual plumbed. **Only** residences that are not owner occupied such as condominiums, apartments, and hotels will be dual plumbed with reclaimed water. The number of non-owner occupied residential units for the total distribution area is estimated at 3,000. The number of toilets per unit is assumed to be 1.5 as the units are expected to have either one or two toilets.

Although current legislation requires low flow or 1.6 gallons per flush (gpf) toilets, leaks, multiple flushes, and the possible installation of higher flush toilets can all contribute to a higher gpf usage. Therefore, to provide a conservative estimate for the Non-owner occupied residential toilet flush demand estimation, the distribution and pumping systems are analyzed using a model based on 3.5 gpf toilets. Total daily demand for non-owner occupied residential toilet flushing using 3.5 gpf is 0.16 MGD, while using 1.6 gpf is 0.07 MGD – resulting in a difference of 0.1 MGD in full build out calculations.

3. IRRIGATION DEMAND ESTIMATION

Irrigation demand is calculated by using plant needs, potential evapotranspiration (PE), precipitation, and an inefficiency factor to find the maximum irrigation need in inches per month. Converted to gpm, the calculations yield 6.8 gpm per acre or 9,774.9 gpd per acre. (See Appendix A) This demand is placed on all general irrigation areas.

The Cabela's site needs a specific pressure and flow for irrigation. Per a June 28, 2007 email from Chris Aldrich at Hatton Godat Pantier, the Irrigation needs for the Cabela's site are 40 gpm nominal, 50 gpm max. Connections are at two locations with 1½" meters at each location. The residual pressure range needed at the point of connection is 65 - 70 psi. (Refer to Appendix B)

Entirely irrigation, the RAC demand is based on the demand for Rainier Vista Park, an existing park with 46 acres that has components similar to the RAC. Rainier Vista Park uses about 504,000 gpd on an average day which equates to 350 gpm. Although the RAC has about 93 acres total, only 68 acres is being developed at this time. The 68 acre RAC includes soccer fields, baseball diamonds, and parking just like Rainier Vista Park. The RAC does have a turf soccer field with possibly more turf fields to come, which do not need irrigation. Therefore, for this study, the irrigated area anticipated at the RAC is considered to be equivalent to the irrigated area at Rainier Vista Park, thus the average daily demand for the RAC is estimated at 504,000 gpd.

4. WINTER DEMAND, AVERAGE DAY DEMAND, MAX DAY DEMAND, PEAK HOUR DEMAND

The demands of the reclaimed water system vary greatly depending on the season. In summer, when the irrigation needs are on line, the system demand is much greater than in winter, when only the toilet flushing and truck washing are pulling from the supply. For the needs of this study, traditional use terms regarding demand require additional definition.

Winter Demand for the reclaimed water system, and as defined for this study, is just the toilet flushing and the truck washing per average day calculations. The main reason to review Winter Demand is to provide for the pump design and compare demand versus LOTT allocations.

Because the reclaimed water system is designed mainly for irrigation needs, the Average Day Demand which includes toilet flushing, truck washing, and irrigation is considered the Average Day Demand (ADD) for the rest of this study. Total ADD for the entire reclaimed system at full build out is about 1.9 MGD.

Typically, ADD, along with Max Day Demand (MDD) and Peak Hour Demand (PHD), is calculated using just residential demands. With irrigation being the biggest reclaimed water system user for Lacey, using the residential demands for ADD, MDD, and PHD would yield much lower values than what the system actually uses. ADD for this system uses the calculated results shown in Table III.D.4 on the next page.

Lacey Gateway -- Phase I & II

Toilet and Irrigation Demand Summary for Reclaim

Huitt-Zollars, Inc.

Project No. 15-0830-01

7/31/2008

TABLE III.D.4: USAGE SUMMARY (3.5 GPF TOILETS)

	Total System Demand (Irrigation & Toilets)				
	<i>Demand (gpad)</i>	<i>Demand (gpam)</i>	<i>Acreage (ac)</i>	<i>Average Daily Demand (gpd)</i>	<i>Average Daily Demand (gpm)</i>
Irrigation	9,774.9	6.8	80.0	781,989.1	893.0
Residential	8,472.3	5.9	18.6	157,500.0	109.4
Commercial	1,000.0	0.7	89.3	89,340.0	62.0
Government	330.0	0.2	10.3	3,395.7	2.4
Office	330.0	0.2	30.5	10,074.9	7.0
Mixed Use	1,200.0	0.8	75.2	90,192.0	62.6
HPBD	1,000.0	0.7	148.9	148,900.0	103.4
OBP	1,000.0	0.7	70.6	70,600.0	49.0
OHC	1,000.0	0.7	50.8	50,800.0	35.3
RAC	N/A	N/A	93.1	504,000.0	350.0
WSDOT*	N/A	N/A	-	18,000.0	300.0
Total	24,107.2	16.7	667.3	1,924,791.7	1,674.2

*WSDOT is a one hour demand to represent truck washing.

	Toilets	
	<i>Total</i>	<i>Per Acre</i>
Irrigation	N/A	N/A
Residential	4,500	242
Commercial	2,553	29
Government	97	9
Office	288	9
Mixed Use	2,577	34
HPBD	4,254	29
OBP	2,017	29
OHC	1,451	29
RAC	N/A	N/A
Total	17,737	409

Usage Summary	
Usage	Amount (MGD)
RAC Steady Demand:	0.5 MGD
Rest of Irrigation:	0.8 MGD
Total RAC + Irrigation:	1.3 MGD
Toilet Flushing + Truck Wash:	0.6 MGD
Total System:	1.9 MGD

Max Day Demand (MDD) for this study follows the guidelines laid out in State of Washington Department of Health, Chapter 5 where:

$$\text{MDD} = 2 \times \text{ADD}$$

Thus, the ADD values were multiplied by 2 for MDD values in the model.

Peak Hour Demand (PHD) is a little more complicated as usually, a factor is applied to residential demands for PHD determination. For this system, diurnal patterns are created from the City of Lacey potable water production curves, the Martin Way Treatment Facility Curve (Figure 4-3 of the Class A Reclaimed Water Distribution Area Analysis, August 2005, City of Lacey), and engineering judgment for each of the usage types (IE – Office, Commercial, Mixed Use, etc.). The Martin Way Reclaimed Water Plant was undergoing construction to convert to a reclaimed water treatment plant when the Class A Reclaimed Water Distribution Area Analysis, 2005, was published.

The modeled residential demand pattern follows the City of Lacey curve for January while the irrigation demand pattern follows the difference between the City of Lacey curve for January and the curve for July. The rest of the patterns, with the exception of RAC, are based on engineering judgment and the Martin Way Treatment Facility curve. The highest hour of demand from the model using MDD is used in this case for PHD.

Appendix C includes the curves and data used for the model along with copies of the Martin Way Treatment Facility Curve and the City of Lacey potable water production curves.

E. SYSTEM PRESSURE

Regular toilets require 15 psi to operate while low-flow toilets require between 20 psi and 35 psi depending on the toilet model. These pressures are at the toilet location and not at the service location in the street. Accounting for building height and line losses, the minimum system model pressure needs to be 40 psi at the highest toilet service elevation.

The Orange Book recommends that the reclaimed water system pressure be at least 10 psi below the potable water pressure (Section E1-5.1.2.A). Because the proposed system is within two potable water pressure zones, the full build out reclaimed water system requires two zones as well.

The two potable water pressure zones include one at 400-ft static hydraulic grade line (HGL) and the other at 337-ft static hydraulic grade line. The approximate division is the east side of the FML, Hall, and BPS properties and the west side of the Gateway and OBP properties. (Refer to Exhibit III.E below.) The 400-ft HGL pressure zone operates between 390-ft and 425-ft HGL elevation while the 337-ft HGL zone operates between 327-ft HGL and 353-ft HGL elevation.

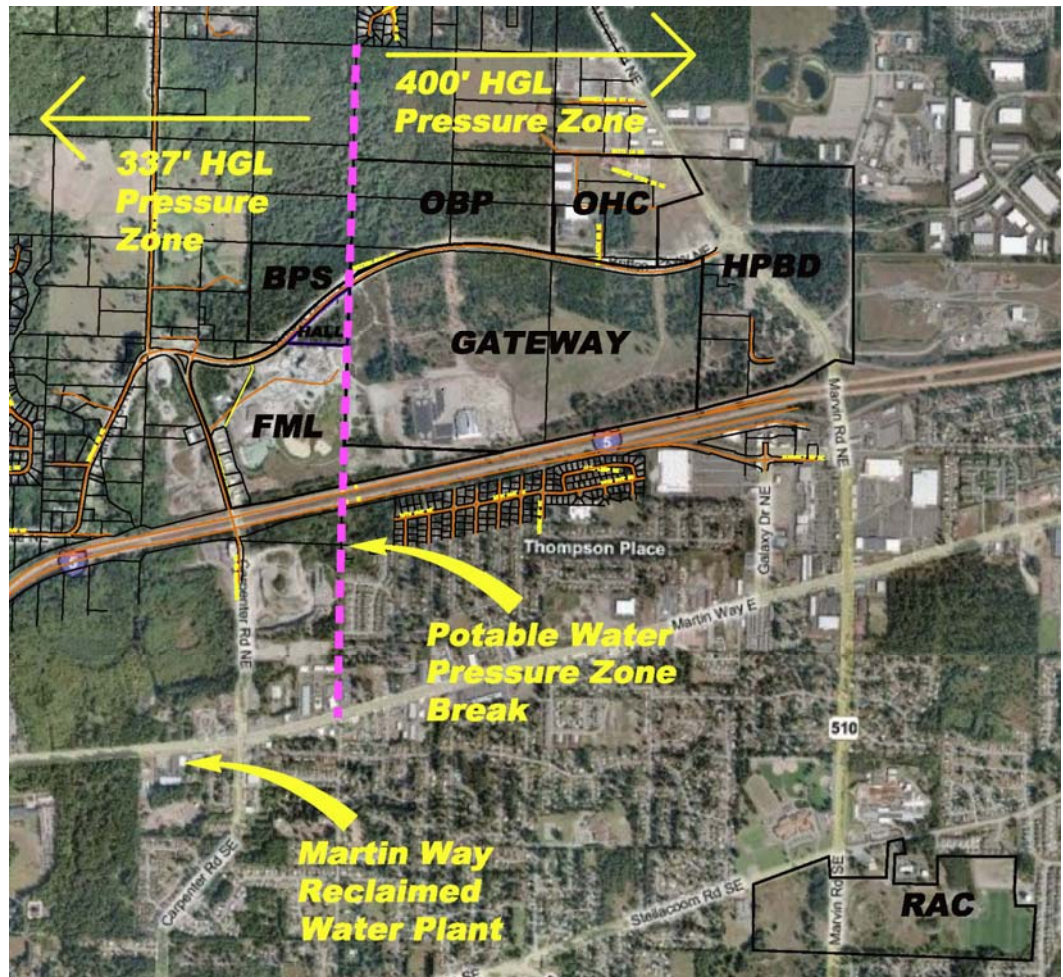


Exhibit III.E: Pressure Zone Delineation

A 365-ft nominal HGL for the upper zone provides about 10 psi differential between the potable and the reclaimed water distribution systems within the 400-ft HGL pressure zone. The main pumping systems should therefore supply the system with a nominal 365-ft HGL. The upper zone of the reclaimed water system as modeled has pressure ranges between 360 ft to 375 ft hydraulic grade line (HGL). The portion of the reclaimed water distribution system within the 337-ft HGL zone requires a lower hydraulic grade. For modeling, pressure reduction valves are set at 305-ft HGL for the lower zone. Table III.E below organizes the HGL information for clarity.

Table III.E – Pressure Zone Information		
	Potable HGL (ft)	Reclaimed HGL (ft)
Upper Pressure Zone	400	365
Upper Range	425	375
Lower Range	390	360
Lower Pressure Zone	337	305
Upper Range	353	305
Lower Range	327	304

F. ELEVATIONS

The ground elevations for all the reclaimed water distribution areas are still under design. For the purpose of modeling the system, the elevations for each junction were determined using known data from Gateway Blvd. and Main St. Phase I design as well as existing topography and the site grading plan (preliminary grading plan for master planning only, dated 07/17/07 from Hatton Godat Pantier). Developer grading updates as of 4/18/08 were included in the model junctions. The elevations for junctions representing the offsite areas were approximated from existing topography and weighted toward the highest elevations in the area. (Refer to Appendix H for Grading Plans used in the design.)

G. FIRE FLOW

The reclaimed water distribution system does not include any fire flow analysis as reclaimed water will not be used to fight fires. For reclaimed water system construction, however, hydrants and blow-off valves need to be strategically placed so that the system can be flushed and drained for maintenance when necessary.

IV. STORAGE DESIGN

As stated previously, the LOTT supply is intermittent and the amount available fluctuates based on the wastewater supply and reclaimed water plant operations. Storage tanks are needed to provide supply for times when the reclaimed water system demand is greater than the LOTT supply. The constructed tanks will have altitude valves. The total storage includes Equalization Storage, Standby Storage, and Operational Storage as outlined in the State of Washington Department of Health (DOH), Chapter 9. Fire Flow Storage is not included as the system will not be used for fire flows. Since the system is mainly irrigation, the DOH storage calculations are modified to include this demand as described in the following sections. Calculations for storage are located in Appendix D.

A. LOCATIONS

The modeled layout for the storage tanks includes a site for ground level storage and two sites for elevated storage. During the initial construction, a ground tank is located in the southwest portion of the Gateway Site due to the lower elevation. This tank is filled with the low pressure flow from the 14-inch LOTT line. The downstream main pump station then supplies pressure and flow to the distribution system. As demand increases, an additional ground tank or tanks are built per development rate.

The first elevated tank site is located on the RAC site. The RAC is also located over a mile from the rest of the system and is at the southeast end of the system thereby increasing continuous supply concerns. A tank onsite gives the RAC much needed redundancy to make sure the demand can still be met should the LOTT supply or the Lacey transmission line down Marvin Way become inoperable. Exhibit IV.A shows the proposed tank locations.

The second elevated tank is added to the system in the northeast portion of the Gateway Site between Eastern Blvd. and Central Blvd as development progresses. The main pump station downstream of the initial tank would be expanded to provide supply to the elevated tank. The specific upgrade of the pump station would depend on the system growth at that time.

B. EQUALIZING STORAGE

Equalizing Storage is equal to $(PHD - Q_{supply}) \times 150 \text{ min}$ per DOH standards. For this system, the Q_{supply} is equal to zero (0) because of the unknown reliability of the LOTT reclaimed water supply. PHD on MDD is equal to about 6,760 gpm per the model. This is from 4,200 gpm for RAC and 2,560 gpm for the rest of the system. Equalizing storage is equal to $6,760 \text{ gpm} \times 150 \text{ min} = 1.0 \text{ MGD}$.

C. STANDBY STORAGE

Standby Storage is usually calculated by using $2 \text{ days} \times \text{Number of Equivalent Residential Units (ERU)} \times \text{ADD (in gpd/ERU)}$. Since the residential units are small, the ADD for the entire system is used with no additional factor added. Therefore, for this system, the Standby Storage is equal to two ADD, or 3.8 MGD.

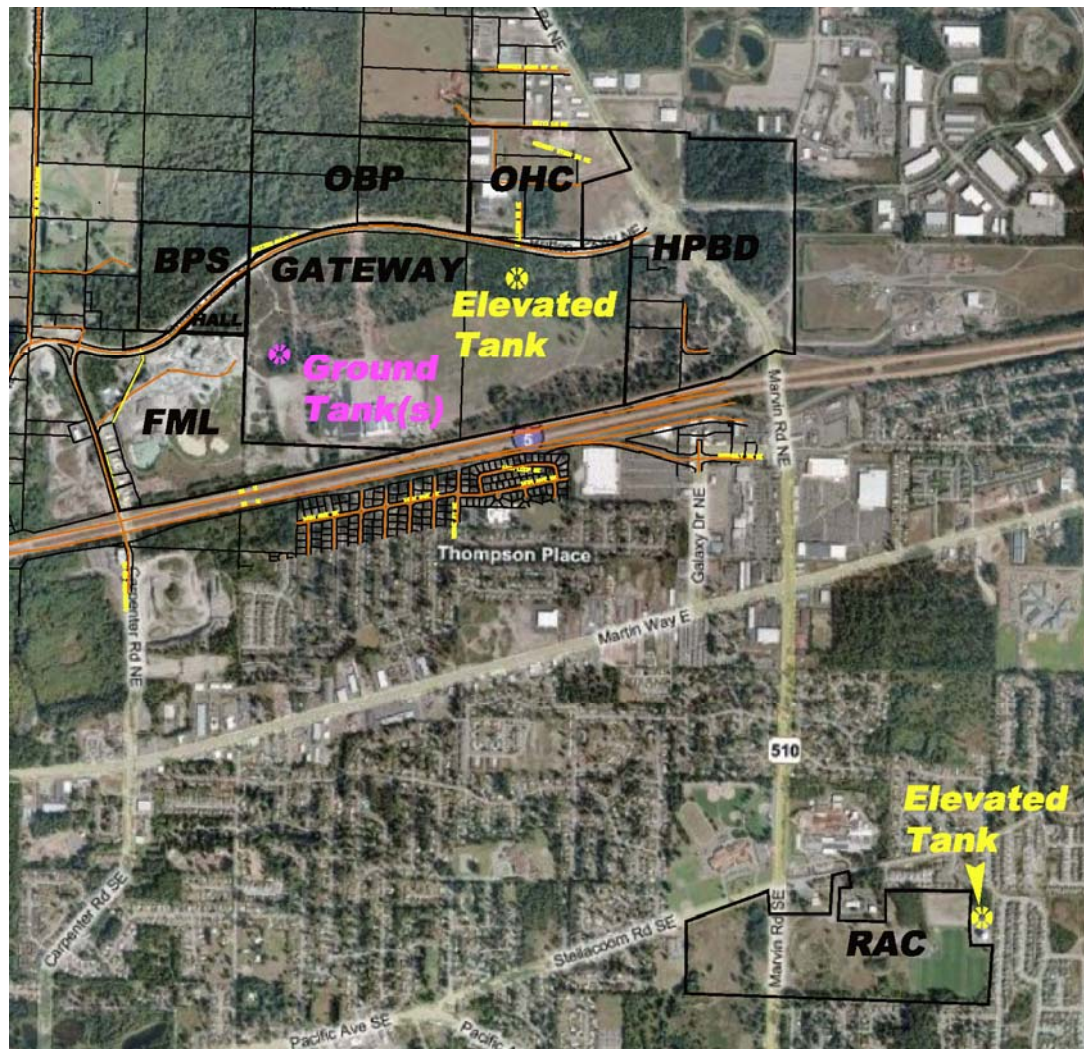


Exhibit IV.A: Proposed Tank Locations

D. OPERATIONAL STORAGE

Operational storage is the needed storage to supply the system under normal operating conditions when the supply source is “off.” In addition, it is the amount of storage needed to keep the pumps from cycling more per hour than the manufacturer’s recommendation. Typical design procedure for pump system design is to coordinate the pumps and the storage so that the pumps have no more than six starts per hour. For this entire system though, due to all the unknowns, operational storage is calculated at 20 percent of the overall storage capacity.

$$1.0 \text{ MG ES Storage} + 3.8 \text{ MG SS Storage} =$$

$$4.8 \text{ MG Storage} \times 0.2 = 1.0 \text{ MG OS Storage}$$

E. RAC STORAGE

Although within the entire system, the RAC storage is analyzed separately because of the distance to the site from the main system area. The figures calculated within this section are within the storage calculations listed above and are not in addition to those listed above.

RAC irrigation is modeled between the hours of 3:00 am and 7:00 am which creates a concentrated high demand during this time. With the area requiring 0.5 MGD within 4 hours on ADD and 1.0 MGD within 4 hours on MDD, the resulting demands of 2,100 gpm and 4,200 gpm, respectively, place a heavy burden on the system and supports the need for a RAC tank. No redundant reclaimed water lines are planned for this area.

For Equalization Storage (ES), the same equation from Section C is used: $PHD \times 150 \text{ min}$. Q_{supply} is assumed zero. PHD for RAC irrigation is 4,200 gpm (from the application of 1.0 MG in four (4) hours). For RAC Equalization Storage, the amount equals 0.6 MG.

For Standby Storage (SS), the DOH recommended factor is decreased to 1 day because of the potable water back up for the system. Standby Storage therefore equals one ADD or 0.5 MG.

Operational Storage (OS) for the RAC is calculated at 20% of the RAC storage capacity.

Total storage is equal to Equalization Storage plus Standby Storage plus Operational Storage. Therefore, the RAC, the total storage needed, not including dead storage, is:

$$0.6 \text{ MG ES} + 0.5 \text{ MG SS} = 1.1 \text{ MG} \times 1.20 \text{ (OS Factor)} = 1.4 \text{ MG RAC Storage}$$

F. TOTAL STORAGE

As stated above, total storage is equal to Operational Storage plus Equalization Storage plus Standby Storage. For the entire system:

<u>Storage Type</u>	<u>Amount</u>
Equalization Storage	1.0 MG
Standby Storage	3.8 MG
Operational Storage	1.0 MG
<u>Total:</u>	<u>5.8 MG Storage Needed</u>

With RAC needing a total of 1.4 MG of storage, the Gateway tanks need to supply 4.4 MG of storage. Building the initial infrastructure, however, can be costly and funding for additional infrastructure may take time to generate.

It is recommended that the initial Gateway tank, being a ground level tank, is at least 1.0 MG to 1.5 MG in size. As development progresses, additional ground tank(s) can increase the initial tank location supply to 3.0 MG.

The future elevated Gateway tank is 1.4 MG in size which equates to one ADD (for all areas except RAC) so that should the pumps fail, the system has a back up supply in the elevated tank in addition to the potable supply. The RAC tank is 1.4 MG in size.

For modeling purposes, all tanks are assumed circular with the following parameters:

Gateway Ground Tank*

Base Elevation	218 ft
Minimum Operation Elevation	220 ft
Maximum Operation Elevation	240 ft
Overflow Elevation	238 ft
Diameter	160 ft
Operating Capacity	3.0 MG

Gateway Elevated Tank

Base Elevation	220 ft
Minimum Operation Elevation	360 ft
Maximum Operation Elevation	375 ft
Overflow Elevation	377 ft
Diameter	126 ft
Operating Capacity	1.4 MG

RAC Elevated Tank

Base Elevation	265 ft
Minimum Operation Elevation	300 ft
Maximum Operation Elevation	365 ft
Overflow Elevation	367 ft
Diameter	60 ft
Operating Capacity	1.4 MG

**For modeling purposes only, the Gateway ground level tanks are represented as only one tank. For actual construction, the storage for the Gateway ground tank site may be phased into two or three tanks depending on development rate.*

These tank parameters may require modification in further design for construction documents. Tank storage may be built in phases and require adjustment for actual conditions.

G. PRESSURE STORAGE

Some sort of pressure storage is needed to reduce pressure fluctuations in the system. Preliminary design calculations for pressure storage used the Chapter 11 of the State of Washington Department of Health Water System Design Manual recommended procedure. For this system, the following parameters are used:

Base Elevation:	218 ft
Pump Off System HGL:	375 ft
Pump On System HGL:	360 ft
Pump Off Pressure:	68 psi
Pump On Pressure:	61 psi
Max Day Mid-Pressure Range Discharge:	3,400 gpm
Pump Cycles:	18 (assumes three constant speed pumps cycling)

The preliminary calculation result for a horizontal pressure tank storage is about 38,000 gallons which equals to about a 12 ft by 45 ft cylindrical tank, or two 12 ft x 23 ft tanks. Detailed calculations are provided in Appendix D.

V. PUMP STATIONS

One main pump station is needed for this system. The main pump station is located at the initial ground level storage of Gateway. The construction design for the station must include the station requirements at full build out but have the ability for phasing up from initial conditions to full build out. The pump station design needs to allow for future pumps to be added with minimal change to the structure and piping.

The RAC may need irrigation pumps on the downstream side of the tank to provide the needed irrigation pressure. Because the RAC has about a 40-ft elevation differential from the upper field to the lowest field, maintaining a 40 psi minimum is a challenge. The concept of irrigation side pumps is discussed briefly in Section B.

A. MAIN PUMP STATION

The main pump station requires the capacity to supply the Peak Hour Demand (PHD) and to have a back up of equal size and capacity. If the elevated tanks run to their lowest levels and are not able to keep supply at the operating pressure, this pump provides the capability to pump the PHD into the system. With the required supplied head and capacity, more than one pump may be necessary to supply the system with PHD.

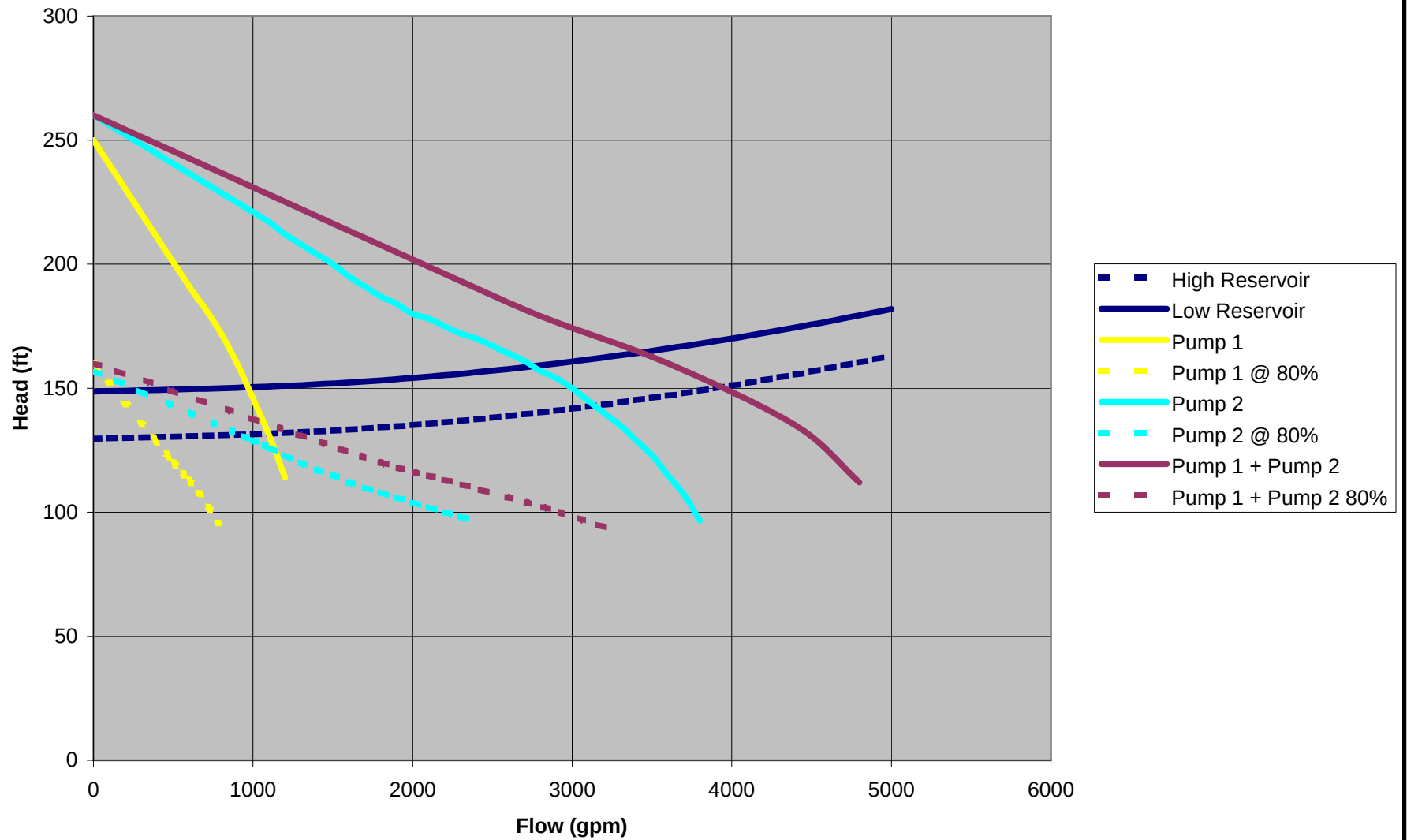
The Peak Hour on Max Day Demand (MDD) at Full Build Out (FBO) equals about 6,800 gpm. However, because 4,200 gpm is for the RAC and the 10-inch line between the RAC and the main system can only convey about 900 gpm reasonably, there is no sense in designing the main pump station for a flow that cannot be delivered to the needed locations. Therefore, with the Peak Hour for the rest of the system being 2,600 gpm and an additional 900 gpm for the RAC, results in a PH demand of 3,500 gpm.

Graph V on the following page shows a proposed system curve and pump curves that require verification at time of construction design. The pump station base elevation is 218 ft and is used as a basis for the system curves. The pumps associated with the pump curves are assumed to be on variable frequency drives (VFDs).

The main operational pumping need includes two pumps. First, a small pump capable of delivering between 400 gpm to 1,100 gpm at heads shown on the graph provides for winter use. A second larger pump capable of delivering between 1,000 gpm and 3,100 gpm provides for the higher use times. Running the two pumps together satisfies the peak hour demand. To fulfill the back up requirement, the station needs to have two of each pump, for a total of four pumps.

If constant speed pumps are desired, additional pumps may be needed from those listed above. Ultimately, the beginning design for the main pump station would probably include a combination of both constant speed and variable frequency drives due to the developmental phasing required. The pump station designers would need to investigate all possibilities to ensure the best type and combination of pumps are applied.

Graph V: Reclaimed Water System Curve



B. RAC IRRIGATION

The RAC reclaimed water supply is expected to be fed through the existing 10-inch pipe in Marvin Rd. The distance from the eastern edge of the Gateway site to the RAC is about a mile and a half (9,500 ft). The length of this single feed to the RAC impacts the pressure of the flow that can reach the RAC because of friction losses.

As mentioned previously, the RAC has a 40-foot elevation differential on site. This equates to about a 17 psi range. Modeled results show down to a 35 psi residual pressure at the lower elevation of the site, however, with the 17 psi range, the upper fields would only have a residual pressure of about 18 psi.

In addition, some fields are grass while others are artificial turf. Depending upon which fields are grass or turf and at what elevations those fields reside, the more economical and efficient choice for providing the needed irrigation pressure is using pumps on the irrigation side. While a booster station can be set up on the main system infrastructure, the possible progression of the field material may make the booster station a costly and unneeded item in the future. Therefore, irrigation pumps slated to the specific field needs are recommended.

VI. SCENARIO ANALYSIS

Three scenarios were analyzed for the Full Build Out of the Lacey Reclaimed Water Distribution System: Average Day Analysis, Max Day Analysis, and Winter Analysis. The model durations were two days (48 hours) using the diurnal curves mentioned in Section III.D.5 and shown in Appendix C. The tanks and pumps for each of the scenarios are set according to the parameters mentioned in previous sections. For modeling purposes, the main pump station was controlled according to the Gateway #2 (elevated) tank levels. The three tanks were considered operational in the model runs. The layout for all three scenarios is the same and is shown in Exhibit VI.

A. AVERAGE DAY ANALYSIS

Average Day Analysis included both irrigation and toilet flushing use for ADD since both are the main uses of the system. During the 48 hour run, the Upper Pressure Zone pressures for the Reclaimed Water System, including the RAC, varied from 51 psi to 86 psi. The Lower Pressure Zone pressures ranged from 49 psi to 67 psi. Pressures for Cabela's irrigation ranged from 66 psi to 73 psi.

Maximum pipe velocity within the system model was less than 7 ft/s with one exception. The pipe from the LOTT connection to the first ground tank had velocities ranging up to 9 ft/s for a modeled discharge of about 3,000 gpm. Because of the unknown supply from LOTT and need for additional potable supplementation at full build-out, the 12-inch connection to LOTT is considered adequate and does not need upsizing since the likelihood of 3,000 gpm being supplied from LOTT is unlikely with the current availability of reclaimed water.

Results of this analysis are presented in Appendix E.

B. MAX DAY ANALYSIS

Max Day Analysis included both irrigation and toilet flushing use for ADD for the model and multiplied the demand by two (2). The same operational levels of the tanks were used for the Max Day model as for the Average Day Model. During the 48 hour run, the Upper Pressure Zone pressures for the Reclaimed System varied from 55 psi to 85 psi, not including the RAC. The RAC pressures varied from 37 psi to 59 psi. The Lower Pressure Zone pressures ranged from 49 psi to 67 psi. Pressures for Cabela's irrigation ranged from 69 psi to 71 psi.

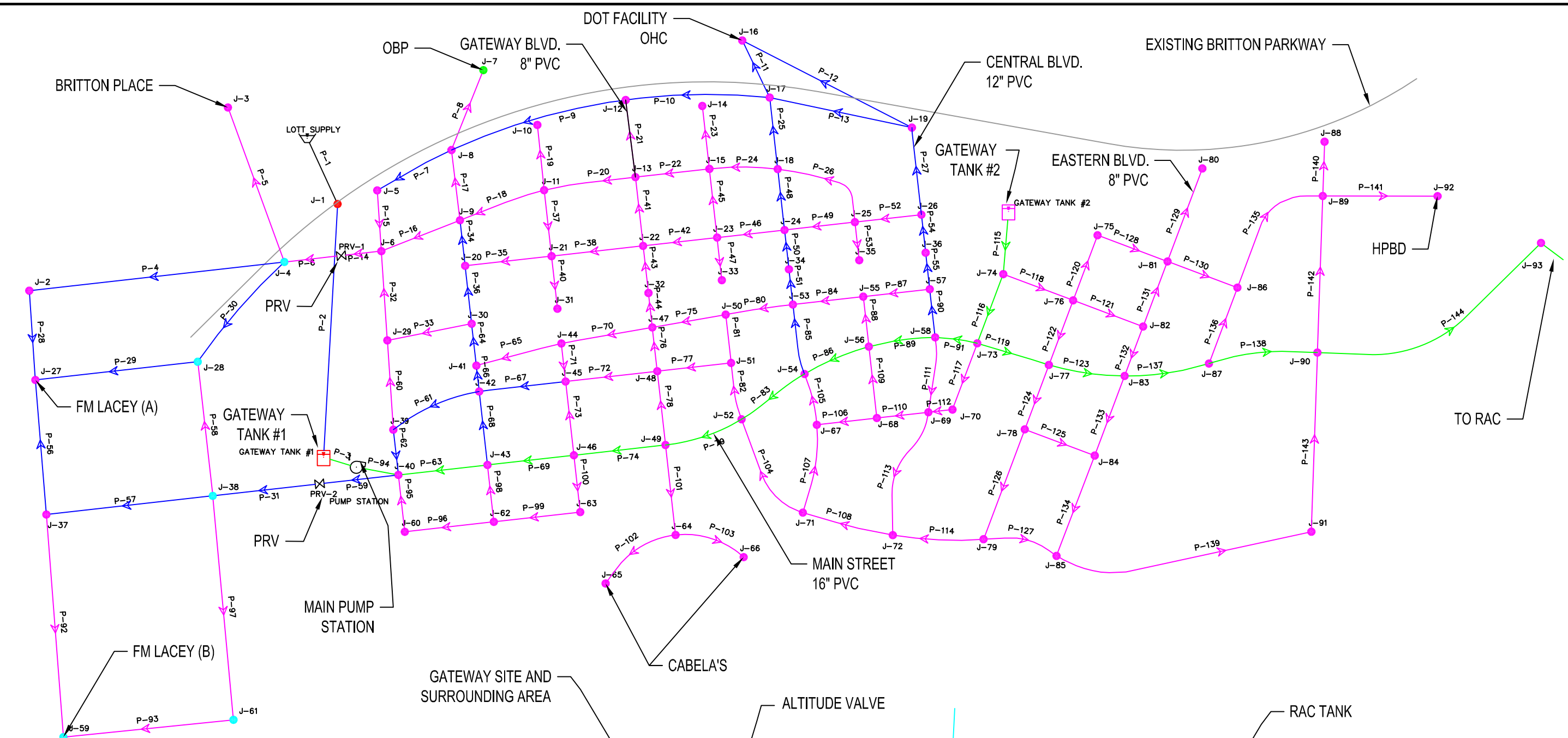
Maximum pipe velocity within the system model was less than 7 ft/s with same exception as Average Day. The pipe from the LOTT connection to the first ground tank had velocities ranging up to 9 ft/s for a modeled discharge of about 3,000 gpm. For the same reason given in Average Day Analysis, the 12-inch connection to LOTT is considered adequate.

Results for this analysis are located in Appendix F.

C. WINTER ANALYSIS

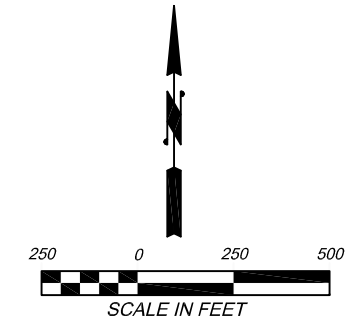
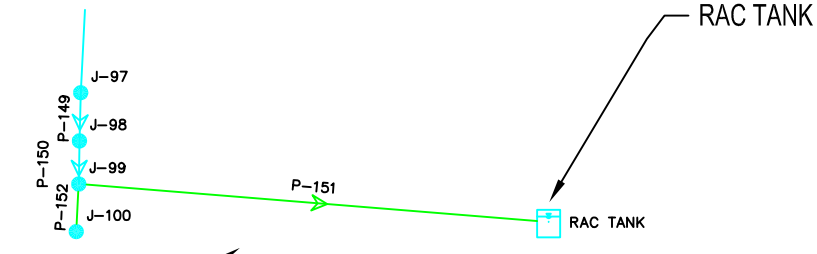
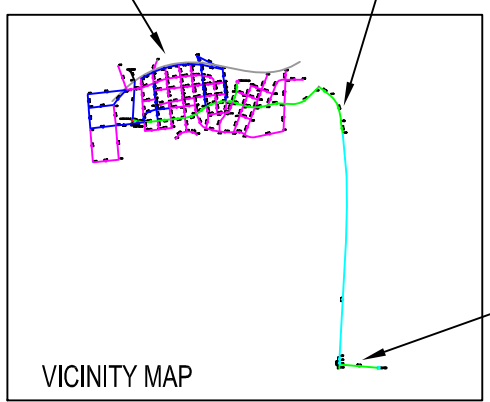
Since the toilet flushing continues throughout the winter months but the irrigation does not, the model was run with just toilet flushing demands. The RAC was assumed non operational. During the 48 hour run, the Upper Pressure Zone pressures for the

Sep 15, 2008 - 3:03pm - User shendon-gentry
H:\proj\15083001\docs\WaterCAD\Full Build Out -- Three Tanks -- Main Model.dwg



PIPE LEGEND	
DIAMETER	
8"	
EX. 10"	
12"	
16"	

NODE LEGEND	
PRESSURE (PSI)	
<20	
21-40	
41-60	
61-80	
80-100	



N.G.V.D. OF 1929
CALL 2 WORKING DAYS BEFORE YOU DIG
1-800-424-5555
UTILITIES UNDERGROUND LOCATION CENTER

CITY OF LACEY, WASHINGTON DEPARTMENT OF PUBLIC WORKS 420 COLLEGE STREET S.E. P.O. BOX 3400 LACEY, WA 98509-3400 (360) 491-5600		 LACEY		APPROVED FOR CONSTRUCTION DIRECTOR OF PUBLIC WORKS HUITT-ZOLLARS Huitt-Zollars, Inc. 814 East Pike Street Seattle, Washington, 98122-3893 Phone (206) 324-5500 Fax (206) 328-1880	DESIGNED BY _____ DATE _____ DRAWN BY _____ DATE _____ CHECKED BY _____ DATE _____ APPROVED BY _____ DATE _____ FILENAME: Full Build Out -- Three Tanks -- Main Model.dwg	LACEY GATEWAY PHASE I RECLAIMED WATER EXHIBIT Full Build Out EXHIBIT VI	<table><tr><th colspan="3">REVISION BLOCK</th></tr><tr><th>NO.</th><th>DATE</th><th>DESCRIPTION</th></tr><tr><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td></tr><tr><td> </td><td> </td><td> </td></tr></table>	REVISION BLOCK			NO.	DATE	DESCRIPTION																DRAWING NUMBER SHT ____ OF ____
REVISION BLOCK																													
NO.	DATE	DESCRIPTION																											

Reclaimed System varied from 56 psi to 85 psi in the main system area. The Lower Pressure Zone pressures ranged from 49 psi to 67 psi.

Maximum pipe velocity within the system model was less than 2 ft/s with same exception as May Day and Average Day above. The pipe from the LOTT connection to the first ground tank had velocities ranging up to 7.5 ft/s for a modeled discharge of about 2,600 gpm. For the same reason given in Average Day Analysis, the 12-inch connection to LOTT is considered adequate.

Results for this analysis are located in Appendix G.

VII. CONCLUSION AND RECOMMENDATIONS

The recommended layout for the City of Lacey Reclaimed Water system includes three storage areas and one pump station at Full Build Out (FBO) as shown in Exhibit VI. While toilet flushing is included in the demand, irrigation is the main demand for the system. As a result, calculations generally used for sizing water systems based on residential usage were modified to account for the irrigation use on this system.

A. DEMANDS AND LOTT SUPPLY

For full build out, the total reclaimed water system demands were calculated for Average Day (ADD), Max Day (MDD), and Winter. Below is the summary of these demands:

<u>Day</u>	<u>Demand</u>
Average Day	1.9 MGD
Max Day	3.8 MGD
Winter	0.6 MGD

For comparison, the LOTT supply available ranges from 0.41 MGD to 1.3 MGD depending on many factors. Treatment operating units, supply to the treatment plant, need at the recharge ponds among others affect the actual amount LOTT can provide.

The lowest allotment to City of Lacey from LOTT is 0.41 MGD, assuming there is supply. With the yearly system demands ranging from 0.6 MGD to 3.8 MGD at Full Build Out, potable water supplementation of the system will be necessary.

The information below shows the range based on minimum and maximum average instantaneous supply from LOTT.

<u>Day</u>	<u>Demand</u>	<u>LOTT Supply</u>	<u>Shortfall</u>
Max Day	3.8 MGD	1.3 MGD (max possible)	2.5 MGD
Max Day	3.8 MGD	0.4 MGD (min possible)	3.4 MGD
Average Day	1.9 MGD	1.3 MGD (max possible)	0.6 MGD
Average Day	1.9 MGD	0.4 MGD (min possible)	1.5 MGD
Winter	0.6 MGD	1.3 MGD (max possible)	-0.7 MGD
Winter	0.6 MGD	0.4 MGD (min possible)	0.2 MGD

If the LOTT supply shuts down, the system will have limited supply within the tanks before the system needs to supplement the reclaimed water system with water from the potable system. For phasing up to full build out, the City of Lacey will need to monitor the system demands versus the LOTT supply to determine the most appropriate method of operation at that time.

B. TANKS

The reclaimed water system will need a minimum of three tank sites. One site has ground storage while two sites have elevated storage. The elevated storage aids in supplying the system and keeping the system pressurized should the main pump station go offline. In addition, the LOTT supply is intermittent and may shut down entirely for a length of time during which, the tanks will supply the system for a limited time.

It is highly recommended that the tank levels be monitored in relation to the LOTT supply. If the LOTT supply is decreasing or stopped, and the reclaimed water system is showing signs of slipping below operating pressure, the controls and telemetry can supplement the reclaimed water supply with potable water before any reclaimed water system issues arise.

Modeled parameters for the tanks are below:

Gateway Ground Tank*

Base Elevation	218 ft
Minimum Operation Elevation	220 ft
Maximum Operation Elevation	240 ft
Overflow Elevation	238 ft
Diameter	160 ft
Operating Capacity	3.0 MG

Gateway Elevated Tank

Base Elevation	220 ft
Minimum Operation Elevation	360 ft
Maximum Operation Elevation	375 ft
Overflow Elevation	377 ft
Diameter	126 ft
Operating Capacity	1.4 MG

RAC Elevated Tank

Base Elevation	265 ft
Minimum Operation Elevation	300 ft
Maximum Operation Elevation	365 ft
Overflow Elevation	367 ft
Diameter	60 ft
Operating Capacity	1.4 MG

***For modeling purposes only, the Gateway ground level tanks are represented as only one tank. For actual construction, the storage for the Gateway ground tank site may be phased into two or three tanks depending on development rate.*

Note that the above parameters may change during continuing design. The constructed tanks will have altitude valves.

C. PUMP STATIONS

One pump station is recommended for the reclaimed system to operate. The main pump station is located by the Gateway #1 tank which is the only modeled ground tank location. Two pump types for full build out are recommended for the main pump station and are calculated using VFDs. Graph V in Section V provides the reclaimed system curves with pump curves. Pumps are assumed to use VFDs. Actual pump station design may affect the above recommendations.

To provide appropriate irrigation pressures at the RAC, irrigation pumps are recommended. A booster station on the main infrastructure is costly and not as efficient for this particular operation.

D. SYSTEM OPERATIONAL PRESSURES

The reclaimed water distribution system will operate at a nominal 365 foot HGL. Operational pressures for the upper pressure zone are between 360 feet and 375 feet HGL. The lower pressure zone will operate at a nominal 305 feet HGL with some fluctuations from valve settings, line losses, etc.

Pressures at the Cabela's irrigation tie-in range between 66 psi to 73 psi which is close to the design range of 65 psi to 70 psi. As mentioned above, the RAC needs some irrigation pumps to provide the needed 40 psi residual pressure.

Note that as design continues, the parameters recommended in this report may require modification as new information develops and/or design changes.

VIII. REFERENCES

Criteria for Sewage Works Design, Publication No. 98-37 WQ, State of Washington
Department of Ecology, December 1998

Water Reclamation and Reuse Standards, Publication No. 97-23, State of Washington
Department of Ecology and Washington State Department of Health, September 1997

Class A Reclaimed Water Distribution Area Analysis, Teri O'Neal, P.E., City of Lacey,
August 2005

Handbook of Landscape Architectural Construction, Volume III, Irrigation, Landscape
Architecture Foundation, 1988

Water System Design Manual, State of Washington Department of Health, August 2001

Web Sites:

City of Lacey, WA, Public Works Development Standards Web Page

http://www.ci.lacey.wa.us/pw/pw_main_page.html

Land Use Plan and Zoning Map Amendments, 5-16-06 for the Lacey Planning Commission
Presentation on the City of Lacey, WA website:

http://www.ci.lacey.wa.us/building_and_planning/updates/planning_commission/planning_commission_presentation_05-16-06.pdf

NOAA website for Normal Precipitation Tables

<http://ols.nndc.noaa.gov/plolstore/plsql/olstore.prodspecific?prodnum=C00095-PUB-A0001#TABLES>

Washington State Department of Ecology Water Reclamation and Reuse Web Page

<http://www.ecy.wa.gov/programs/wq/reclaim/index.html>

Toilet Information Websites

<http://www.theplumber.com>

<http://www.toiletology.com>

APPENDIX A – Reclaimed Water Demand Calculations and Assumptions

- Usage Summary
- Irrigation Demand Calculations
- Residential Demand Calculations
- Commercial Demand Calculations
- Government Demand Calculations
- Office Demand Calculations
- Mixed Use Demand Calculations
- HPBD Demand Calculations
- OBP Demand Calculations
- OHC Demand Calculations

Lacey Gateway -- Phase I & II

Toilet and Irrigation Demand Summary for Reclaim

Huitt-Zollars, Inc.

Project No. 15-0830-01

9/11/2008

USAGE SUMMARY (3.5 GPF TOILETS)

	Total System Demand (Irrigation & Toilets)				
	<i>Demand (gpad)</i>	<i>Demand (gpam)</i>	<i>Acreage (ac)</i>	<i>Average Daily Demand (gpd)</i>	<i>Average Daily Demand (gpm)</i>
Irrigation	9,774.9	6.8	80.0	781,989.1	893.0
Residential	8,472.3	5.9	18.6	157,500.0	109.4
Commercial	1,000.0	0.7	89.3	89,340.0	62.0
Government	330.0	0.2	10.3	3,395.7	2.4
Office	330.0	0.2	30.5	10,074.9	7.0
Mixed Use	1,200.0	0.8	75.2	90,192.0	62.6
HPBD¹	1,000.0	0.7	148.9	148,900.0	103.4
OBP²	1,000.0	0.7	70.6	70,600.0	49.0
OHC³	1,000.0	0.7	50.8	50,800.0	35.3
RAC⁴	N/A	N/A	93.1	504,000.0	350.0
WSDOT⁵	N/A	N/A	-	18,000.0	300.0
Total	24,107.2	16.7	667.3	1,924,791.7	1,674.2

	Toilets	
	<i>Total</i>	<i>Per Acre</i>
Irrigation	N/A	N/A
Residential	4,500	242
Commercial	2,553	29
Government	97	9
Office	288	9
Mixed Use	2,577	34
HPBD¹	4,254	29
OBP²	2,017	29
OHC³	1,451	29
RAC⁴	N/A	N/A
Total	17,737	409

Usage Summary	
Usage	Amount (MGD)
RAC Steady Demand:	0.5 MGD
Rest of Irrigation:	0.8 MGD
Total RAC + Irrigation:	1.3 MGD
Toilet Flushing + Truck Wash:	0.6 MGD
Total System:	1.9 MGD

¹ HPBD = Hawks Prairie Business District

² OBP = Offsite Business Park

³ OHC = Offsite Highway Commercial

⁴ RAC = Regional Athletic Complex

⁵ WSDOT = Washington State Department of Transportation; One hour demand to represent truck washing

Irrigation Demand for Lacey

Please note that the following calculations are draft and to be used for estimates only for Master Planning the Water Reclaim System.

Assumptions:

- 1.) Max irrigation will be from April to October
- 2.) Plant water needs per week = 1 Inch
- 3.) For calculating monthly plant water needs, the number of weeks = 4.3
- 4.) Supplemental plant water needs equate to monthly plant needs minus monthly precipitation plus evapotranspiration losses.
- 5.) Adjust for an assumed system inefficiency equal to: 70 Percent
- 6.) Multiply by the landscape area then divide by days in the month
- 7.) Use the Blaney-Criddle method for calculating monthly potential evapotranspiration (PE)
- 8.) Latitude of Lacey, WA = 47.03N (use 48N for daytime hours table)
- 9.) Irrigated Acreage = 80.0 ac
- 10.) ET for Seattle, WA from *Handbook of Landscape Architectural Construction*, Landscape Architecture Foundation,1988 = 0.15 in/day
- 11.) ET for Puget Sound Lowlands from *Handbook of Landscape Architectural Construction*, Landscape Architecture Foundation,1988
- 12.) Compare Blaney-Criddle with ET for Seattle, WA and ET for Puget Sound. Use the higher of the three.

Evapotranspiration

ET * number of days per week * number of weeks per month = 4.52 in/mo

Potential Evapotranspiration

Blaney-Criddle Formula: PE = Kf

K = Monthly crop coefficient (*Hydrology, An Introduction to Hydrologic Science*, Rafael L. Bras, 1990)
f = (t x p)/100
t = mean monthly temperature in degrees Fahrenheit(*NOAA for Olympia*)
p = monthly percentage of daytime hours(*Hydrology, An Introduction to Hydrologic Science*, Rafael L. Bras, 1990)

Month	t - Temperature (°F)	p	f	K (Grass)	PE (in/mo)
April	47.4	9.18	4.35	0.75	3.26
May	53.3	10.53	5.61	0.75	4.21
June	58.2	10.71	6.23	0.75	4.67
July	62.8	10.80	6.78	0.75	5.09
August	63.3	9.89	6.26	0.75	4.70
September	58.3	8.44	4.92	0.75	3.69
October	49.7	7.51	3.73	0.75	2.80

Plant Water Needs

Month	Plant Needs (in/wk)	Weeks per Month	Plant Needs (in/mo)
April	1	4.3	4.3
May	1	4.3	4.3
June	1	4.3	4.3
July	1	4.3	4.3
August	1	4.3	4.3
September	1	4.3	4.3
October	1	4.3	4.3

Overall System

Using PET

Month	Plant Needs (in/mo)	PE (in/mo)	Precipitation (in/mo)	Total Need (in/mo)	Inefficiency Factor	Total Need (in/mo)
April	4.3	3.26	3.58	3.98	1.43	5.69
May	4.3	4.21	2.27	6.24	1.43	8.91
June	4.3	4.67	1.78	7.19	1.43	10.28
July	4.3	5.09	0.82	8.57	1.43	12.24
August	4.3	4.70	1.10	7.90	1.43	11.28
September	4.3	3.69	2.03	5.96	1.43	8.51
October	4.3	2.80	4.19	2.91	1.43	4.16

Using ET for Seattle, WA

Month	Plant Needs (in/mo)	ET (in/mo)	Precipitation (in/mo)	Total Need (in/mo)	Inefficiency Factor	Total Need (in/mo)
April	4.3	4.52	3.58	5.24	1.43	7.48
May	4.3	4.52	2.27	6.55	1.43	9.35
June	4.3	4.52	1.78	7.04	1.43	10.05
July	4.3	4.52	0.82	8.00	1.43	11.42
August	4.3	4.52	1.10	7.72	1.43	11.02
September	4.3	4.52	2.03	6.79	1.43	9.69
October	4.3	4.52	4.19	4.63	1.43	6.61

Using ET for Puget Sound Lowlands (Seattle)

Month	Plant Needs (in/mo)	ET (in/mo)	Precipitation (in/mo)	Total Need (in/mo)	Inefficiency Factor	Total Need (in/mo)
April	4.3	2.14	2.54	3.90	1.43	5.57
May	4.3	3.35	2.00	5.65	1.43	8.07
June	4.3	4.26	1.89	6.67	1.43	9.53
July	4.3	5.02	0.89	8.43	1.43	12.04
August	4.3	4.40	1.01	7.69	1.43	10.99
September	4.3	3.13	2.06	5.37	1.43	7.67
October	4.3	1.83	4.11	2.02	1.43	2.89

Use the Maximum Irrigation Need =	12.24 in/mo
	or
	0.03 ft/day

Average Per Acre = 0.03 ac-ft/day (1 ac = 43560 sf)
(Using 1 acre) 1306.8 cf/day (1 cf = 7.48 gal)
9774.9 gal/day (1 day = 1440 min)

Average Per Acre =	6.8 gpm per acre
--------------------	------------------

Lacey Gateway -- Phase I & II

Residential Demand Estimate

Huitt-Zollars, Inc.

Project No. 15-0830-01

9/11/2008

Residential Demand for Lacey

Assumptions:

- 1.) Number of residential units total within proposed area = 3000 units
- 2.) The number of toilets per unit = 1.5 Toilets
- 3.) Number of times per day each toilet is flushed = 10 Flushes
- 4.) Gallons per flush = 3.5 gallons
- 5.) Total Residential Area = 18.6 acres

Demand per Residential Unit

Demand per Unit = Toilets * flushes * gallons per flush = 52.5 gpd

Units Per Acre

Number of units / Total Acreage = 161.4 unit/ac

Demand Per Acre

Demand per Acre = Demand per unit * Unit/ ac = 8472 gpad
or
5.9 gpm/ac

Total Residential Toilets

No. of Residential Units * Toilets per Unit = 4500 toilets

Toilets per Residential Acre

Total Toilets / Total Residential Area = 242 toilets/ac

Lacey Gateway -- Phase I & II

Commercial Demand Estimate

Huitt-Zollars, Inc.

Project No. 15-0830-01

9/11/2008

Commercial Demand for Lacey

Assumptions:

- 1.) Commercial Sanitary Demand per Acre = 2500 gpd
- 2.) Percent of Sanitary Demand which are toilets = 40 Percent
- 3.) Number of times per day each toilet is flushed = 10 Flushes
- 4.) Gallons per flush = 3.5 gallons
- 5.) Commercial Acreage = 89.3 acres

Commercial Demand Comprised of Toilets

$$\begin{aligned}\text{Toilet Demand} &= \text{Commercial Sanitary Demand per Acre} * \text{Percent} = 1000 \text{ gpad} \\ &\text{or} \\ &0.7 \text{ gpm/ac}\end{aligned}$$

Number of Toilets per Commercial Acre

$$\text{No. of Toilets per Acre} = \text{Toilet Demand} / (\text{Flushes} * \text{Gallons per flush}) = 29 \text{ Toilets/Acre}$$

Total Number of Commercial Toilets

$$\text{Total Commercial Toilets} = \text{No. of Toilets per Acre} * \text{Commercial Acreage} = 2553 \text{ Toilets}$$

Lacey Gateway -- Phase I & II

Government Demand Estimate

Huitt-Zollars, Inc.

Project No. 15-0830-01

9/11/2008

Government Demand for Lacey

Assumptions:

- 1.) Government Sanitary Demand per Acre = 1000 gpd
- 2.) Percent of Sanitary Demand which are toilets = 33 Percent
- 3.) Number of times per day each toilet is flushed = 10 Flushes
- 4.) Gallons per flush = 3.5 gallons
- 5.) Government Acreage = 10.3 acres

Government Demand Comprised of Toilets

$$\begin{aligned}\text{Toilet Demand} &= \text{Government Sanitary Demand per Acre} * \text{Percent} = 330 \text{ gpad} \\ &\text{or} \\ &0.2 \text{ gpm/ac}\end{aligned}$$

Number of Toilets per Government Acre

$$\text{No. of Toilets per Acre} = \text{Toilet Demand} / (\text{Flushes} * \text{Gallons per flush}) = 9 \text{ Toilets/Acre}$$

Total Number of Government Toilets

$$\text{Total Government Toilets} = \text{No. of Toilets per Acre} * \text{Government Acreage} = 97 \text{ Toilets}$$

Lacey Gateway -- Phase I & II

Office Demand Estimate

Huitt-Zollars, Inc.

Project No. 15-0830-01

9/11/2008

Office Demand for Lacey

Assumptions:

- 1.) Office Sanitary Demand per Acre = 1000 gpd
- 2.) Percent of Sanitary Demand which are toilets = 33 Percent
- 3.) Number of times per day each toilet is flushed = 10 Flushes
- 4.) Gallons per flush = 3.5 gallons
- 5.) Office Acreage = 30.5 acres

Office Demand Comprised of Toilets

$$\begin{aligned}\text{Toilet Demand} &= \text{Office Sanitary Demand per Acre} * \text{Percent} = && 330 \text{ gpad} \\ &&& \text{or} \\ &&& 0.2 \text{ gpm/ac}\end{aligned}$$

Number of Toilets per Office Acre

$$\text{No. of Toilets per Acre} = \text{Toilet Demand} / (\text{Flushes} * \text{Gallons per flush}) = 9 \text{ Toilets/Acre}$$

Total Number of Office Toilets

$$\text{Total Office Toilets} = \text{No. of Toilets per Acre} * \text{Office Acreage} = 288 \text{ Toilets}$$

Lacey Gateway -- Phase I & II

Mixed Use Demand Estimate

Huitt-Zollars, Inc.

Project No. 15-0830-01

9/11/2008

Mixed Use Demand for Lacey

Assumptions:

- 1.) Mixed Use Sanitary Demand per Acre = 3000 gpd
- 2.) Percent of Sanitary Demand which are toilets = 40 Percent
- 3.) Number of times per day each toilet is flushed = 10 Flushes
- 4.) Gallons per flush = 3.5 gallons
- 5.) Mixed Use Acreage = 75.2 acres

Mixed Use Demand Comprised of Toilets

$$\begin{aligned}\text{Toilet Demand} &= \text{Mixed Use Sanitary Demand per Acre} * \text{Percent} = 1200 \text{ gpad} \\ &\text{or} \\ &0.8 \text{ gpm/ac}\end{aligned}$$

Number of Toilets per Mixed Use Acre

$$\text{No. of Toilets per Acre} = \text{Toilet Demand} / (\text{Flushes} * \text{Gallons per flush}) = 34 \text{ Toilets/Acre}$$

Total Number of Mixed Use Toilets

$$\text{Total Mixed Use Toilets} = \text{No. of Toilets per Acre} * \text{Mixed Use Acreage} = 2577 \text{ Toilets}$$

Lacey Gateway -- Phase I & II

Offsite Hawks Prairie Business District (HPBD)

Huitt-Zollars, Inc.

Project No. 15-0830-01

9/11/2008

HPBD Demand for Lacey

Assumptions:

- 1.) HPBD Sanitary Demand per Acre = 2500 gpd
- 2.) Percent of Sanitary Demand which are toilets = 40 Percent
- 3.) Number of times per day each toilet is flushed = 10 Flushes
- 4.) Gallons per flush = 3.5 gallons
- 5.) HPBD Acreage = 148.9 acres

HPBD Demand Comprised of Toilets

Toilet Demand = HPBD Sanitary Demand per Acre * Percent = 1000 gpad
or
0.7 gpm/ac

Number of Toilets per HPBD Acre 103.4

No. of Toilets per Acre = Toilet Demand / (Flushes * Gallons per flush) = 29 Toilets/Acre

Total Number of HPBD Toilets

Total HPBD Toilets = No. of Toilets per Acre * HPBD Acreage = 4254 Toilets

Lacey Gateway -- Phase I & II

Offsite Business Park (OBP) Demand Estimate

Huitt-Zollars, Inc.

Project No. 15-0830-01

9/11/2008

OBP Demand for Lacey

Assumptions:

- 1.) OBP Sanitary Demand per Acre = 2500 gpd
- 2.) Percent of Sanitary Demand which are toilets = 40 Percent
- 3.) Number of times per day each toilet is flushed = 10 Flushes
- 4.) Gallons per flush = 3.5 gallons
- 5.) OBP Acreage = 70.6 acres

OBP Demand Comprised of Toilets

$$\begin{aligned}\text{Toilet Demand} &= \text{OBP Sanitary Demand per Acre} * \text{Percent} = && 1000 \text{ gpad} \\ &&& \text{or} \\ &&& 0.7 \text{ gpm/ac}\end{aligned}$$

Number of Toilets per OBP Acre

$$\text{No. of Toilets per Acre} = \text{Toilet Demand} / (\text{Flushes} * \text{Gallons per flush}) = 29 \text{ Toilets/Acre}$$

Total Number of OBP Toilets

$$\text{Total OBP Toilets} = \text{No. of Toilets per Acre} * \text{OBP Acreage} = 2017 \text{ Toilets}$$

Lacey Gateway -- Phase I & II

Offsite Highway Commercial (OHC) Demand Estimate

Huitt-Zollars, Inc.

Project No. 15-0830-01

9/11/2008

OHC Demand for Lacey

Assumptions:

- | | |
|--|-------------|
| 1.) OHC Sanitary Demand per Acre = | 2500 gpd |
| 2.) Percent of Sanitary Demand which are toilets = | 40 Percent |
| 3.) Number of times per day each toilet is flushed = | 10 Flushes |
| 4.) Gallons per flush = | 3.5 gallons |
| 5.) OHC Acreage = | 50.8 acres |

OHC Demand Comprised of Toilets

$$\begin{aligned}\text{Toilet Demand} &= \text{OHC Sanitary Demand per Acre} * \text{Percent} = && 1000 \text{ gpad} \\ &&& \text{or} \\ &&& 0.7 \text{ gpm/ac}\end{aligned}$$

Number of Toilets per OHC Acre

$$\text{No. of Toilets per Acre} = \text{Toilet Demand} / (\text{Flushes} * \text{Gallons per flush}) = 29 \text{ Toilets/Acre}$$

Total Number of OHC Toilets

$$\text{Total OHC Toilets} = \text{No. of Toilets per Acre} * \text{OHC Acreage} = 1451 \text{ Toilets}$$

APPENDIX B – Cabela’s Requirement Information

- Original Email

Spencer, Erica

From: Prusik, Gerald
Sent: Monday, July 09, 2007 12:18 PM
To: Spencer, Erica
Subject: FW: Gateway Coordination Notes 28 Jun 2007
Attachments: 06-107-IR-5.dwg

Erica,

Here are some Cabela's irrigation demand figures.

Jerry Prusik, PE

Huitt-Zollars, Inc
4582 South Ulster Street
Suite 240
Denver, CO 80237
Phone: (303) 740-7325
FAX: (303) 224-9997
Cell: (720) 320-6332
Email: gprusik@huitt-zollars.com

From: King, Alan [<mailto:aking@hwlochner.com>]
Sent: Monday, July 09, 2007 11:49 AM
To: Prusik, Gerald; Garcia, Jorge
Subject: Fw: Gateway Coordination Notes 28 Jun 2007

FYI

----- Original Message -----

From: Erik Ainsworth <ErikA@hattonpantier.com>
To: King, Alan
Sent: Mon Jul 09 12:40:50 2007
Subject: FW: Gateway Coordination Notes 28 Jun 2007

Here you go. Let me know if you need other information. Thanks.

From: Chris Aldrich
Sent: Monday, July 09, 2007 10:37 AM
To: Erik Ainsworth
Subject: RE: Gateway Coordination Notes 28 Jun 2007

Boiled down:

The irrigation system for Cabela's proposes two connection points (two 1.5" meters). Demand at each meter 40 gpm nominal, 50 gpm max. Thus the on-site civil sheets show a 4" reclaimed water line feeding the two POC's (100 gpm max through). We need 65-70 psi residual pressure at the POC's. Irrigation plans attached.

Chris Aldrich, LA

10/19/2007

Planning Manager
Hatton Godat Pantier
1840 Barnes Blvd SW
Tumwater, WA 98512
T 360.943.1599
F 360.357.6299
C 360.561.8586
chrisa@hattonpantier.com
www.hattonpantier.com <<http://www.hattonpantier.com/>>

From: Erik Ainsworth
Sent: Monday, July 09, 2007 7:57 AM
To: Chris Aldrich
Subject: FW: Gateway Coordination Notes 28 Jun 2007

I need irrigation demands to provide to these guys. Do you have something that you can provide me?

Erik B. Ainsworth, PE
Project Manager
Hatton Godat Pantier
1840 Barnes BLVD SW
Tumwater, WA 98512
t 360.943.1599
f 360.357.6299
ErikA@hattonpantier.com
www.hattonpantier.com <<http://www.hattonpantier.com/>>
<<http://www.hattonpantier.com/>>

From: King, Alan [<mailto:aking@hwlochner.com>]
Sent: Thursday, July 05, 2007 8:23 PM
To: AMiller@Ci.Lacey.Wa.US; DPingel@Ci.Lacey.Wa.US; DChriste@Ci.Lacey.Wa.US; GHooper@Ci.Lacey.Wa.US; JLitt@Ci.Lacey.Wa.US; MRussell@Ci.Lacey.Wa.US; MHoppe@Ci.Lacey.Wa.US; RWalk@Ci.Lacey.Wa.US; Engineering@Ci.Lacey.Wa.US; RSchoess@Ci.Lacey.Wa.US; TONeal@Ci.Lacey.Wa.US; TStiles@Ci.Lacey.Wa.US; AMcCluskey@Huitt-Zollars.Com; CarlS@Huitt-Zollars.Com; CAR@ShanWil.Com; DHelling@Huitt-Zollars.Com; EHalvorson@Huitt-Zollars.Com; FJWall@Huitt-Zollars.Com; GWillhelm@HWLochner.Com; JUlrich@Huitt-Zollars.Com; GPrusik@Huitt-Zollars.Com; JGarcia@HWLochner.Com; MJohnson@Adolfson.Com; MWP@ShanWil.Com; SLewis@HWLochner.Com; TVanderburg@Adolfson.Com
Cc: CraigS@Mithun.Com; Smelser@RyanLaw.Com; DougL@Mithun.Com; Erik Ainsworth; Jeff Pantier; GPS@DirtLogic.Com; Perry@SheaCarr.Com
Subject: Gateway Coordination Notes 28 Jun 2007

General Project Update

Phase I is proceeding in construction with minimal issues. Coordination of the intersection of Gateway and Main with Cabela's is tentatively resolved, with the City's contractor expecting a work order from Triway to reestablish the grades needed to tie the two designs together.

A brief discussion on finalizing the Phase I redesign efforts. The changed width did not reflect on the plan sheets with moving the centerline 1' south. The sewer, water and some of the reclaimed water is already installed, fortunately with no likely impact to the roadway or rights-of-way. Appropriate sheets will be revised (fairly simple task) to reflect the proper centerline, showing the now existing locations for installed utilities. Main east will continue with that design, transitioning to the City standard cross section locations in Phase II.

Roger asked to double check that manholes and utility lids will not end up in the wheel paths. Most, if not all, should be able to be easily adjusted to avoid that issue. Mark will double check with Jim, and will advise Jorge if there are issues to deal with.

All plans update should be in the City's hands by the end of next week, with Main east following, likely the week after that.

Frontage Road Utilities

The waste water line on the frontage road by Cabela's will not be constructed at this time, but accommodations in grading are being coordinated to minimize future impact on Cabela's. Final design of storm water and waste water will confirm if additional considerations are necessary.

Waste Water

Triway is interested in minimizing line depths on the west end by revising grading on the east end, and accommodating a two level cut transition on the west end, with the line on the lower cut. That will also provide more site flexibility for future development. H-Z will review with 0.25% grades minimum across the site to determine if inverts, depths, and velocities are acceptable.

Knowing that revisions may still be necessary, H-Z plans to provide the preliminary draft of the waste water plan within two weeks, and address future revisions as they be necessary. That will provide the information necessary to complete the SEPA process as well.

Storm Water

The preliminary draft of the storm water plan is planned for delivery in the next two weeks also. Again, future revisions may be necessary.

Private Utility Study

The private utility study is complete, and the final report will be delivered next week.

There was a brief discussion about utility coordination, and frustration expressed over the work accomplished, with limited success in keeping the project on track. The City's Contractor noted in a coordination meeting earlier in the week that he felt he could revise his work schedule to bring the project forward in a timely manner.

Reclaimed Water

Reclaimed water is in an early design stage. H-Z expressed some concern in that reclaimed is restricted from being delivered to where a private owner may repair his system and tap into potable water (basically private single family residences, R1 zoning.) H-Z noted that a more definitive design approach will likely be necessary to complete that work.

HGP will provide irrigation demands for the Cabela's site to H-Z to design for reclaimed supply needs.

Phase II

Will be discussed at the next coordination meeting. A final grading plan is still not available, and design cannot proceed without that.

Again, any questions, please let me know.

Al King, P.E.
LOCHNER

4224 6th Ave SE, Bldg 2C
Lacey, Washington 98503
p: (360) 438-2837
c: (360) 280-5450
f: (888) 875-9795
aking@hwlochner.com <<mailto:aking@hwlochner.com>>

www.hwlochner.com

APPENDIX C – Diurnal Curves

- Modeled Use Patterns
- Martin Way Treatment Facility Curves
- City of Lacey January 2005 Diurnal Curve
- City of Lacey July 2004 Diurnal Curve

Lacey, WA

Multiplying Factor Patterns for Use Designations

Huitt-Zollars, Inc.

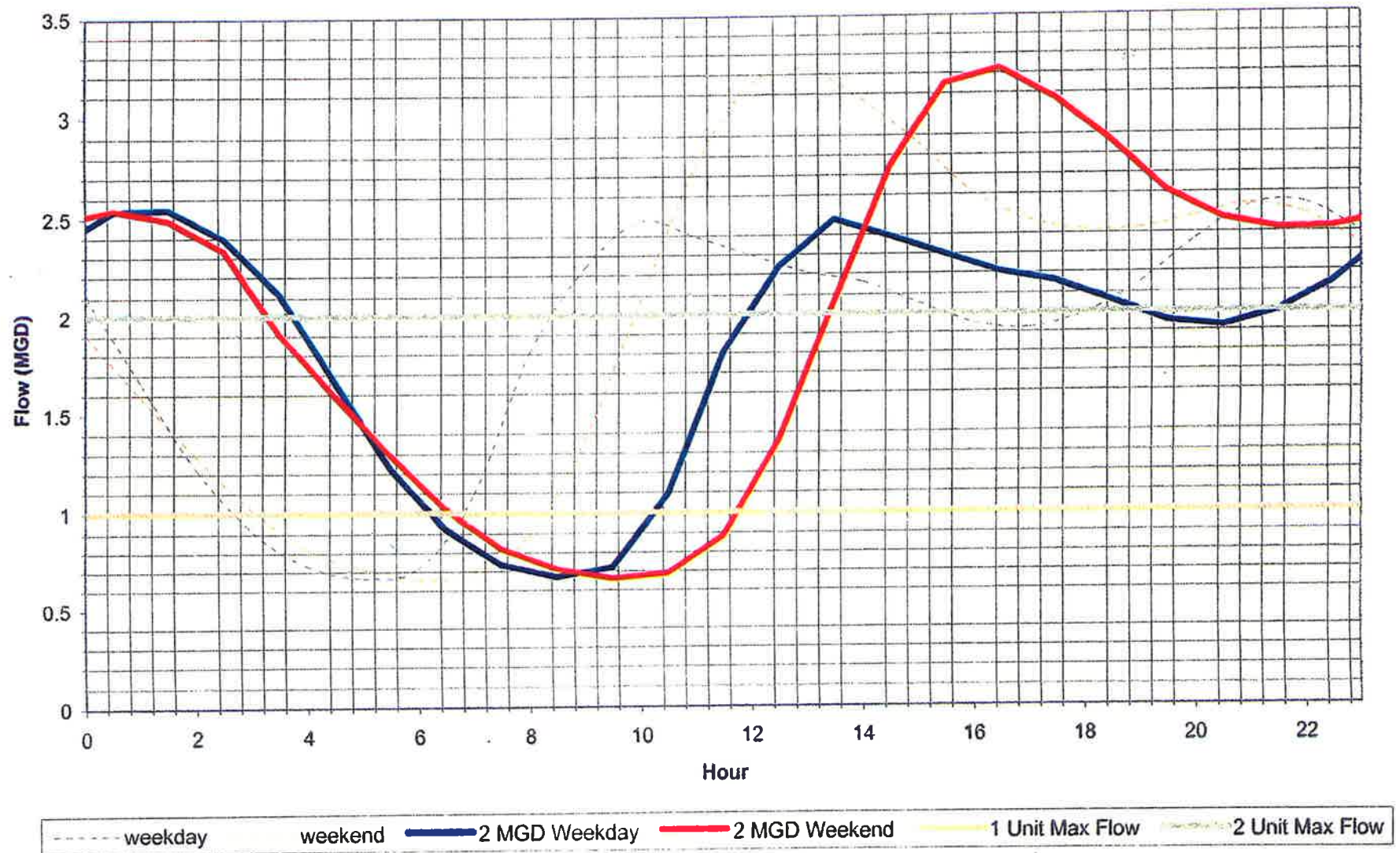
Project No. 15083001

7/31/2008

USE PATTERNS

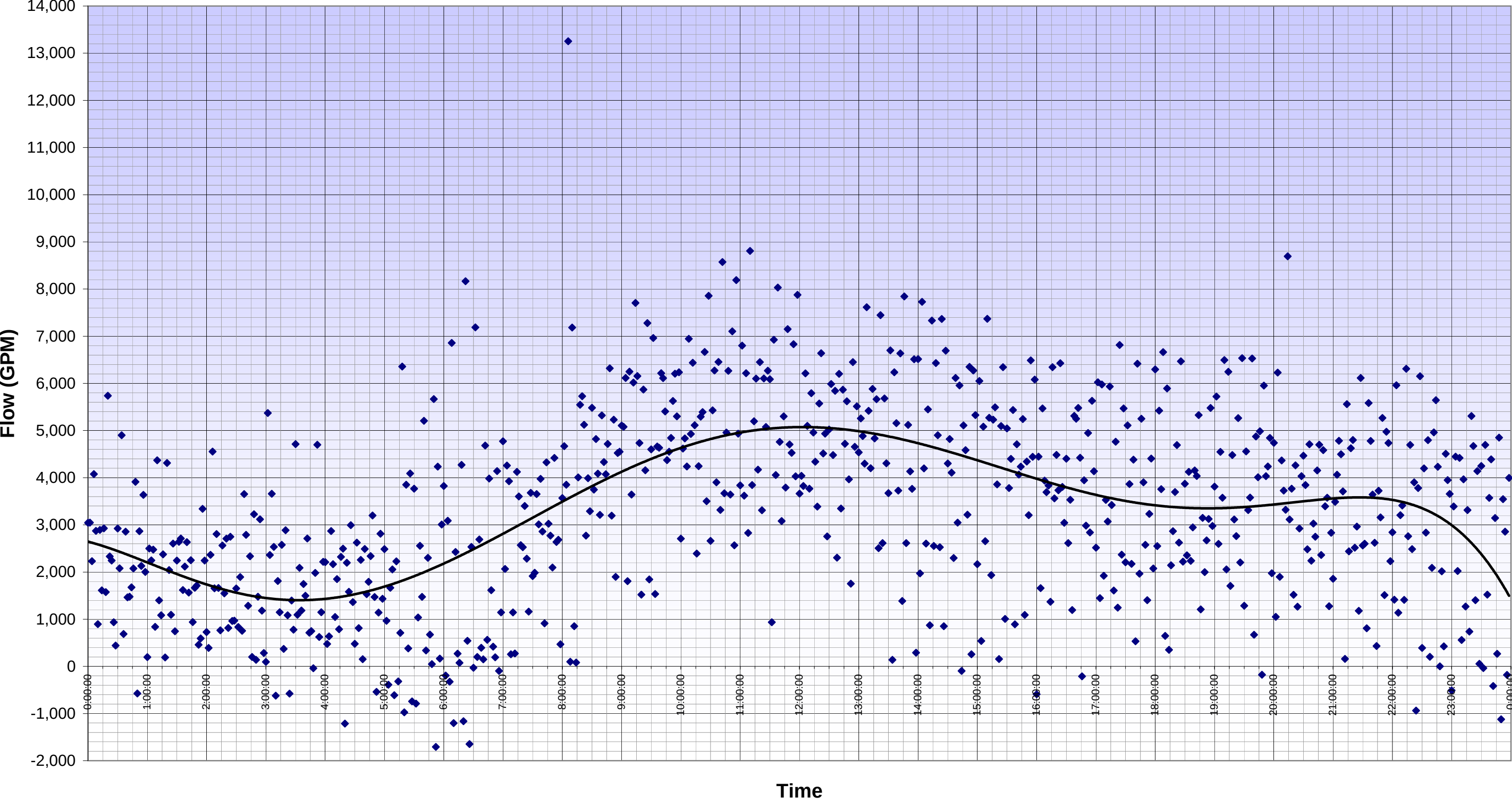
TIME	Irrigation	Residential	Commercial	Government	Office	Mixed Use	HPBD	OBP	OHC	RAC	WSDOT
1:00	0.68	0.76	0.00	0.20	0.10	0.50	0.50	0.50	0.50	0.00	0.00
2:00	0.72	0.62	0.00	0.20	0.10	0.50	0.50	0.50	0.50	0.00	0.00
3:00	0.94	0.49	0.50	0.20	0.20	0.50	0.50	0.50	0.50	1.00	0.00
4:00	1.19	0.43	1.00	0.50	0.50	0.80	1.00	1.00	1.00	1.00	0.00
5:00	1.39	0.44	1.00	0.70	0.80	1.00	1.00	1.00	1.00	1.00	0.00
6:00	1.49	0.54	1.20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00
7:00	1.48	0.70	1.20	1.30	1.20	1.30	1.30	1.30	1.30	0.00	0.00
8:00	1.39	0.89	1.50	1.50	1.30	1.30	1.30	1.30	1.30	0.00	0.00
9:00	1.22	1.09	1.50	1.50	1.30	1.50	1.30	1.30	1.30	0.00	1.00
10:00	1.00	1.28	1.50	1.80	1.80	1.50	1.60	1.60	1.60	0.00	0.00
11:00	0.78	1.41	1.80	1.80	1.80	1.50	1.60	1.60	1.60	0.00	0.00
12:00	0.58	1.49	1.80	2.00	2.00	1.50	1.60	1.60	1.60	0.00	0.00
13:00	0.45	1.51	1.80	2.00	2.00	1.50	1.50	1.50	1.50	0.00	0.00
14:00	0.40	1.48	1.80	2.00	2.00	1.30	1.00	1.00	1.00	0.00	0.00
15:00	0.44	1.39	1.50	1.80	1.80	1.30	1.00	1.00	1.00	0.00	0.00
16:00	0.55	1.29	1.50	1.50	1.80	1.10	1.00	1.00	1.00	0.00	0.00
17:00	0.74	1.16	1.20	1.20	1.30	1.00	1.20	1.20	1.00	0.00	0.00
18:00	0.95	1.07	1.20	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00
19:00	1.19	1.01	1.00	0.50	0.50	0.80	1.00	1.00	1.00	0.00	0.00
20:00	1.37	1.01	0.50	0.30	0.50	0.70	0.70	0.70	0.70	0.00	0.00
21:00	1.48	1.04	0.50	0.30	0.30	0.70	0.70	0.70	0.70	0.00	0.00
22:00	1.44	1.08	0.00	0.30	0.30	0.70	0.70	0.70	0.70	0.00	0.00
23:00	1.26	1.02	0.00	0.20	0.20	0.50	0.50	0.50	0.50	0.00	0.00
24:00	0.87	0.81	0.00	0.20	0.20	0.50	0.50	0.50	0.50	0.00	0.00

**Figure 4-3 Martin Way Treatment Facility
Average Hourly Flow (January-May)**



January 15, 2005 Diurnal Curve

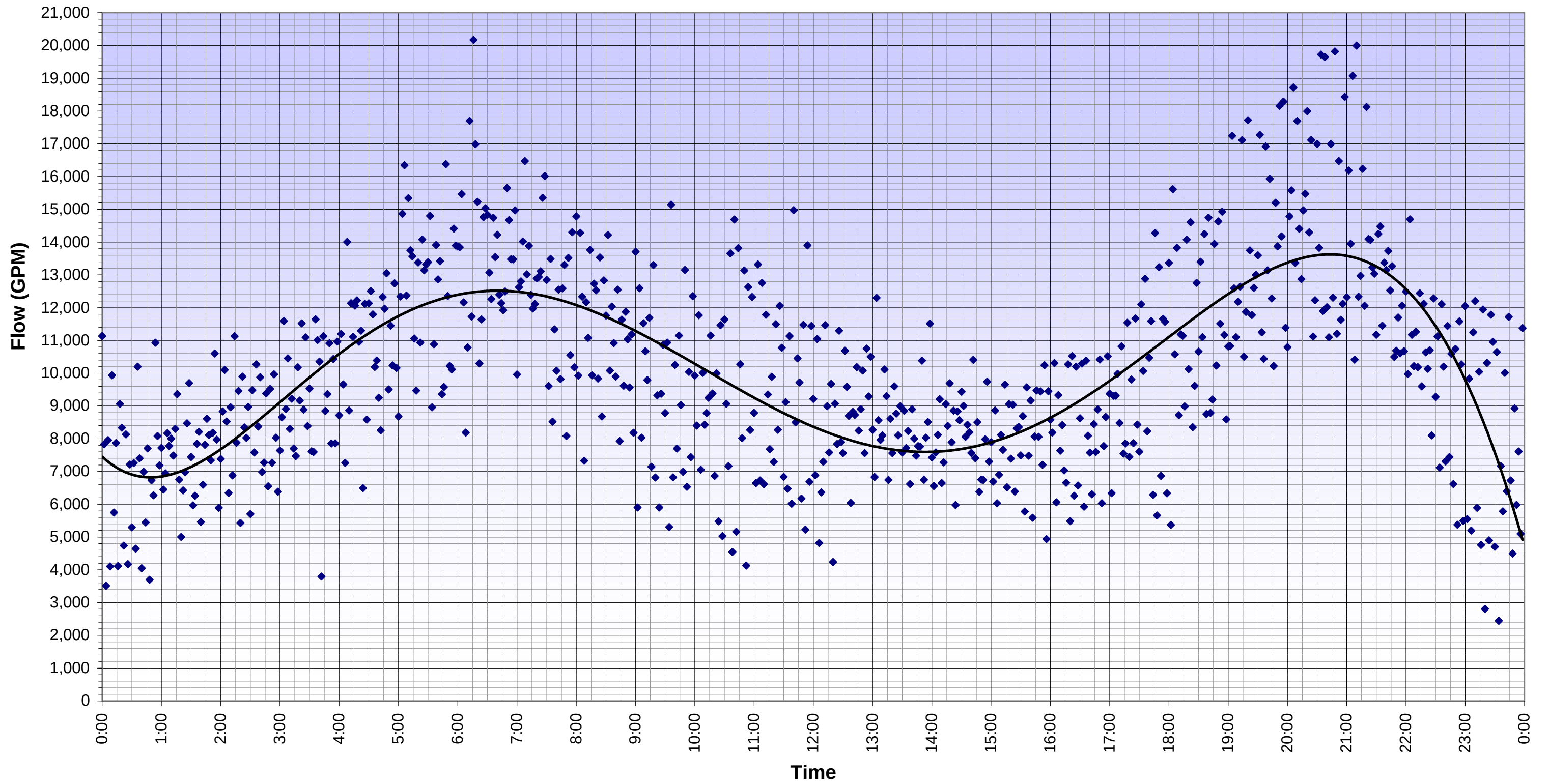
Trendline: $y = -941374x^6 + 3E+06x^5 - 3E+06x^4 + 1E+06x^3 - 104839x^2 - 7770.8x + 2643.8$



July 21, 2004 Duirnal Curve

Trendline:

$$y = 768489x^6 - 3E+06x^5 + 5E+06x^4 - 3E+06x^3 + 729241x^2 - 40102x + 7453.3$$



APPENDIX D – Storage Calculations

- Overall Storage Calculation
- RAC Storage Calculation
- Pressure Storage Calculation

Lacey Gateway -- Phase I & II

Storage Calculations

Huitt-Zollars, Inc.

Project No. 15-0830-01

9/11/2008

Reclaimed Water System Storage Calculations

Given:

Average Day Demand: 1,924,791.72 gpd or 1.9 MGD (from summary sheet)
Peak Hour Demand: 6,760.00 gpm (from model runs + RAC calc -- see below)

Needed Storage = Operational Storage (OS) + Equalizing Storage (ES) + Standby Storage (SB)
(Fire Flow and Dead Storage are not included.)

Find:

Equalizing Storage (ES)

Equalization Storage (ES) = (Peak Hour Demand - Qs)(150 min)
where Qs = Supply Source Discharge

Qs is assumed zero (0) for the reasons listed above under Operational Storage.

Equalization Storage: 1.0 MGD

Standby Storage (SB)

Standby Storage (SB) = (2 days)(Average Day Demand)(Number of ERUs)

Due to the number of ERUs for this system being small, the system being half irrigation, and the system having potable back up, the Standby Storage is calculated at one Average Day Demand.

Standby Storage: 3.8 MGD

Operational Storage (OS)

Operational Storage (OS) is the needed storage to supply the system under normal operating conditions when the supply source is "off". In addition, it is to keep the pumps from cycling more per hour than manufacturer's recommendations. Due to all the unknowns, the OS is calculated at 20% of Equalization Storage and Standby Storage.

Operational Storage: 1.0 MGD

Total Storage Required: 5.8 MGD
--

Lacey Gateway -- Phase I & II

Storage Calculations

Huitt-Zollars, Inc.

Project No. 15-0830-01

9/11/2008

Storage Needed for RAC

Given:

Average Day Demand:	350 gpm
Max Day Demand:	700 gpm
Peak Hour Demand:	4200 gpm*
Minutes per Day:	1440 min

(Max Day divided into 4 hours.)

Find:

Equalizing Storage (ES)

Equalizing Storage = PHD * 150 min

PHD = (4200 gpm -- assumes Max Day divided into only 4 hours)

PHD = 4,200.00 gpm

Equalization Storage (ES): 0.6 MGD

Standby Storage (SB)

Standby Storage = Average Day Demand = 350 gpm x 24 hours x 60 minutes

Standby Storage (SB): 0.5 MGD

Operational Storage (OS)

Operational Storage (OS) = 20% * (Equalizing Storage + Standby Storage)

Average Day Demand = 0.50 MGD

Operational Storage (OS): 0.2 MGD

Total RAC Storage Required:	1.4 MGD
------------------------------------	----------------

Gateway Storage Required:	4.4 MGD
----------------------------------	----------------

Total Storage for System:	5.8 MGD
----------------------------------	----------------

Lacey Gateway -- Phase I & II

Storage Calculations

Huitt-Zollars, Inc.

Project No. 15-0830-01

9/11/2008

Reclaimed Water System Pressure Storage Calculations

Main Pump Station

Given:

Base Elevation:	218	ft
Pump Off System HGL:	375	ft
Pump On System HGL:	360	ft
Resulting Pump Off Pressure (P1):	68	psi
Resulting Pump On Pressure (P2):	61	psi
Max Day Mid Pressure Range Discharge (Qp):	3,400	gpm (based on model)
Tank Diameter (D):	144	in
Multiplying Factor per D (MF):	1.04	<i>Horizontal Tank Only</i>
Number of Pump Cycles per hour (N):	18	<i>(three pumps alternating)</i>
Volume of Bladder Tank (Vb):	120	gal

Find:

Conventional Horizontal Tank Sizing

MD

$$V_t = \frac{[(P1+14.7)] * 15 * Q_p * (MF)}{[P1 - P2] * N}$$

Conventional Horizontal Tank Sizing: 37,512.44 gallons

Conventional Vertical Tank Sizing

MD

$$V_t = \frac{[(P1+14.7)] * 15 * Q_p}{[P1 - P2] * N} + 0.0204 * D^2$$

Conventional Vertical Tank Sizing: 36,069.66 gallons

Conventional Vertical Tank Sizing

MD

$$T_s \geq \frac{R * Q_p}{N_c * V_b}$$

$$R = \frac{15 * (P1 + 14.7) * (P2 + 14.7)}{(P1 - P2) * (P2 + 9.7)}$$

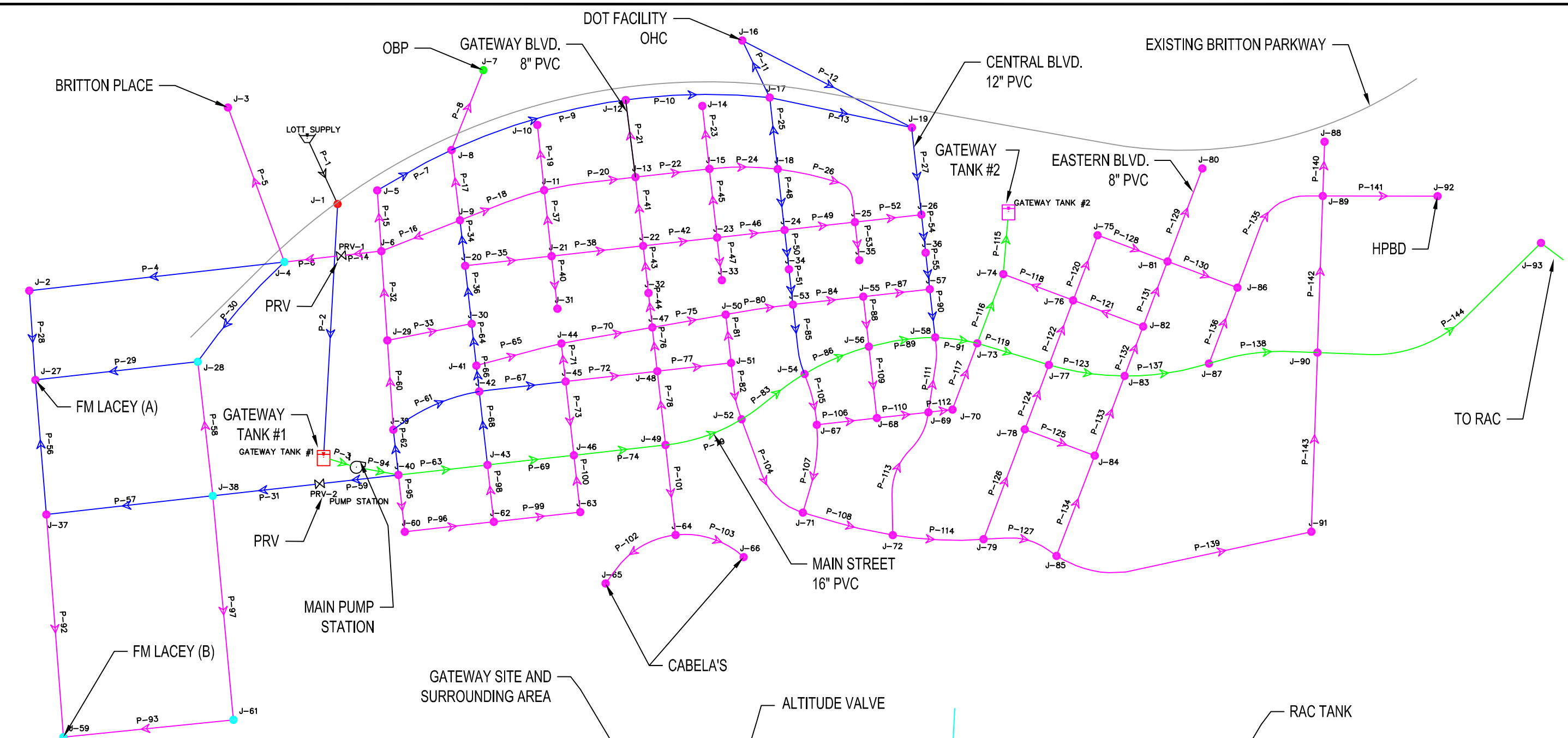
$$R = 204.4$$

Bladder Tank Number (Ts) >= 321.7 tanks

APPENDIX E – Average Day Analysis

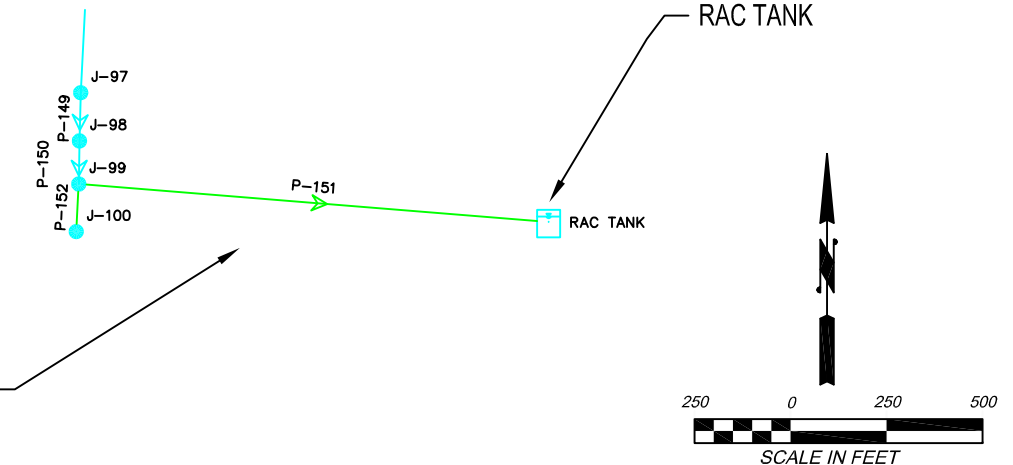
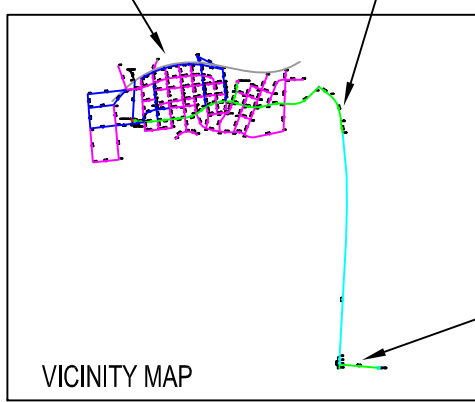
- Map Exhibit
- Junction Results
- Pipe Results
- Main Pump Station Results
- Overall Tank Summary
- Gateway Tank #1 Results
- Gateway Tank #2 Results
- RAC Tank Results
- Reservoir Results

Sep 11, 2008 - 3:07pm - User shendon-gentry
H:\proj\15083001\docs\WaterCAD\Full Build Out --- Three Tanks --- Main Model.dwg



PIPE LEGEND	
DIAMETER	
8"	
EX. 10"	
12"	
16"	

NODE LEGEND	
PRESSURE (PSI)	
<20	
21-40	
41-60	
61-80	
80-100	



CITY OF LACEY, WASHINGTON
DEPARTMENT OF PUBLIC WORKS
420 COLLEGE STREET S.E. P.O. BOX 3400
LACEY, WA 98509-3400 (360) 491-5600



APPROVED FOR CONSTRUCTION
DIRECTOR OF PUBLIC WORKS DATE
HUITT-ZOLLARS
Huitt-Zollars, Inc. Seattle
814 East Pike Street
Seattle, Washington, 98122-3893
Phone (206) 324-5500 Fax (206) 328-1880

DESIGNED BY	DATE
DRAWN BY	DATE
CHECKED BY	DATE
APPROVED BY	DATE
FILENAME:	Full Build Out -- Three Tanks -- Main Model.dwg

LACEY GATEWAY
PHASE I
RECLAIMED WATER EXHIBIT
Full Build Out
AVERAGE DAY

REVISION BLOCK			DRAWING NUMBER
NO.	DATE	DESCRIPTION	
			SHT ____ OF ____

N.G.V.D. OF 1929
CALL 2 WORKING DAYS BEFORE YOU DIG
1-800-424-5555
UTILITIES UNDERGROUND LOCATION CENTER

Scenario: Full Build Out Average Day
Extended Period Analysis: 0.00 hr / 48.00
Junction Report

Label	Elevation (ft)	Zone	Type	Base Flow (gpm)	Maximum Pressure (psi)	Minimum Pressure (psi)	Maximum Hydraulic Grade (ft)	Minimum Hydraulic Grade (ft)
J-1	217.50	Zone	Demand	0.00	18.39	18.22	260.00	259.62
J-2	160.00	Zone	Demand	0.00	62.73	62.67	305.00	304.84
J-3	160.00	Zone	Demand	50.91	62.72	62.59	304.97	304.65
J-4	190.00	Zone	Demand	13.07	49.75	49.69	305.00	304.85
J-5	210.00	Zone	Demand	0.00	71.74	65.18	375.81	360.65
J-6	206.00	Zone	Demand	18.62	73.64	66.90	376.20	360.64
J-7	175.00	Zone	Demand	96.95	86.77	80.23	375.55	360.44
J-8	216.00	Zone	Demand	0.00	69.11	62.58	375.74	360.65
J-9	213.42	Zone	Demand	8.92	70.47	63.72	376.29	360.69
J-10	218.00	Zone	Demand	2.99	68.34	61.74	375.96	360.70
J-11	214.50	Zone	Demand	3.94	69.86	63.25	375.96	360.70
J-12	221.00	Zone	Demand	0.00	66.79	60.43	375.37	360.68
J-13	216.00	Zone	Demand	2.61	69.02	62.61	375.53	360.71
J-14	219.00	Zone	Demand	2.44	67.58	61.32	375.19	360.74
J-15	218.00	Zone	Demand	3.26	68.01	61.76	375.19	360.74
J-16	226.00	Zone	Demand	369.76	64.38	58.24	374.80	360.61
J-17	219.85	Zone	Demand	0.00	67.07	60.93	374.87	360.69
J-18	217.22	Zone	Demand	10.16	68.21	62.10	374.87	360.75
J-19	220.16	Zone	Demand	0.00	66.86	60.82	374.71	360.73
J-20	210.93	Zone	Demand	10.36	71.63	64.80	376.48	360.70
J-21	210.00	Zone	Demand	8.79	71.81	65.20	375.97	360.70
J-22	212.00	Zone	Demand	1.54	70.81	64.35	375.67	360.73
J-23	213.92	Zone	Demand	6.05	69.78	63.52	375.20	360.74
J-24	215.45	Zone	Demand	7.71	68.97	62.88	374.86	360.79
J-25	217.00	Zone	Demand	6.36	68.25	62.21	374.75	360.79
J-26	219.00	Zone	Demand	8.09	67.26	61.37	374.47	360.85
J-27	150.00	Zone	Demand	95.17	67.06	66.99	305.00	304.84
J-28	170.00	Zone	Demand	0.00	58.41	58.34	305.00	304.85
J-29	199.00	Zone	Demand	0.00	77.02	69.96	377.02	360.70
J-30	205.63	Zone	Demand	18.58	74.12	67.10	376.95	360.71
J-31	206.00	Zone	Demand	10.09	73.54	66.93	375.97	360.70
J-32	207.00	Zone	Demand	4.35	73.07	66.52	375.88	360.76
J-33	209.00	Zone	Demand	6.50	71.90	65.65	375.20	360.74
J-34	211.00	Zone	Demand	6.33	70.89	64.83	374.85	360.84
J-35	213.00	Zone	Demand	6.28	69.98	63.94	374.75	360.79
J-36	216.00	Zone	Demand	6.80	68.47	62.71	374.27	360.95
J-37	165.00	Zone	Demand	0.00	60.57	60.51	305.00	304.85
J-38	170.00	Zone	Demand	0.00	58.41	58.37	305.01	304.91
J-39	201.00	Zone	Demand	5.18	76.72	69.11	378.32	360.73
J-40	202.50	Zone	Demand	0.69	76.41	68.46	379.12	360.73
J-41	202.90	Zone	Demand	5.50	75.43	68.28	377.25	360.73
J-42	203.58	Zone	Demand	4.77	75.25	67.99	377.50	360.74
J-43	208.00	Zone	Demand	1.66	73.50	66.09	377.87	360.75
J-44	206.00	Zone	Demand	7.33	73.99	66.95	377.02	360.75
J-45	213.00	Zone	Demand	4.43	71.03	63.92	377.16	360.75
J-46	219.00	Zone	Demand	1.59	68.43	61.34	377.15	360.77
J-47	206.00	Zone	Demand	4.17	73.57	66.97	376.05	360.78
J-48	216.00	Zone	Demand	1.38	69.29	62.65	376.14	360.80
J-49	227.00	Zone	Demand	1.44	64.55	57.90	376.19	360.82
J-50	209.75	Zone	Demand	3.78	71.75	65.37	375.58	360.84
J-51	215.00	Zone	Demand	0.85	69.49	63.10	375.62	360.85
J-52	220.00	Zone	Demand	1.51	67.25	60.96	375.44	360.90
J-53	210.00	Zone	Demand	4.02	71.32	65.28	374.84	360.89
J-54	222.00	Zone	Demand	1.38	66.11	60.12	374.80	360.96

Scenario: Full Build Out Average Day
Extended Period Analysis: 0.00 hr / 48.00
Junction Report

Label	Elevation (ft)	Zone	Type	Base Flow (gpm)	Maximum Pressure (psi)	Minimum Pressure (psi)	Maximum Hydraulic Grade (ft)	Minimum Hydraulic Grade (ft)
J-55	213.00	Zone	Demand	3.89	69.79	64.04	374.30	361.02
J-56	224.50	Zone	Demand	1.35	64.79	59.09	374.24	361.07
J-57	216.00	Zone	Demand	2.85	68.39	62.75	374.08	361.04
J-58	227.00	Zone	Demand	1.70	63.47	58.03	373.71	361.12
J-59	170.00	Zone	Demand	95.17	58.39	58.24	304.95	304.62
J-60	200.00	Zone	Demand	3.16	77.29	69.54	378.63	360.73
J-61	170.00	Zone	Demand	0.00	58.40	58.30	304.98	304.74
J-62	206.00	Zone	Demand	3.42	74.37	66.95	377.90	360.75
J-63	219.05	Zone	Demand	0.31	68.53	61.31	377.45	360.76
J-64	211.58	Zone	Demand	0.00	71.20	64.55	376.14	360.77
J-65	206.71	Zone	Demand	24.98	73.15	66.49	375.78	360.38
J-66	206.71	Zone	Demand	24.98	73.18	66.51	375.84	360.45
J-67	218.00	Zone	Demand	1.12	67.71	61.87	374.50	361.01
J-68	221.00	Zone	Demand	2.21	66.28	60.60	374.19	361.07
J-69	221.00	Zone	Demand	3.15	66.07	60.62	373.72	361.11
J-70	222.00	Zone	Demand	1.53	65.56	60.19	373.53	361.13
J-71	214.00	Zone	Demand	2.92	69.44	63.61	374.50	361.01
J-72	211.00	Zone	Demand	5.05	70.40	64.92	373.72	361.06
J-73	225.00	Zone	Demand	1.97	64.03	58.92	373.00	361.19
J-74	222.00	Zone	Demand	18.77	65.05	60.39	372.36	361.57
J-75	219.00	Zone	Demand	3.38	66.46	61.49	372.61	361.12
J-76	219.00	Zone	Demand	0.53	66.46	61.51	372.62	361.16
J-77	221.00	Zone	Demand	1.35	65.69	60.63	372.84	361.13
J-78	217.00	Zone	Demand	2.29	67.44	62.34	372.87	361.08
J-79	206.00	Zone	Demand	3.14	72.28	67.09	373.05	361.06
J-80	224.00	Zone	Demand	2.85	64.30	59.30	372.61	361.07
J-81	217.50	Zone	Demand	0.83	67.11	62.12	372.61	361.07
J-82	213.00	Zone	Demand	0.42	69.07	64.07	372.64	361.08
J-83	211.00	Zone	Demand	2.11	69.97	64.93	372.72	361.07
J-84	207.00	Zone	Demand	3.39	71.75	66.66	372.83	361.07
J-85	202.00	Zone	Demand	3.08	73.93	68.81	372.87	361.05
J-86	216.00	Zone	Demand	0.68	67.74	62.72	372.56	360.97
J-87	214.00	Zone	Demand	3.06	68.62	63.59	372.61	360.98
J-88	220.00	Zone	Demand	1.49	65.87	60.84	372.24	360.61
J-89	219.00	Zone	Demand	0.50	66.30	61.27	372.24	360.61
J-90	214.00	Zone	Demand	2.24	68.58	63.55	372.52	360.89
J-91	205.00	Zone	Demand	3.44	72.53	67.47	372.64	360.95
J-92	220.00	Zone	Demand	204.47	65.51	60.35	371.41	359.50
J-93	220.00	Zone	Demand	0.00	65.90	60.89	372.32	360.73
J-94	220.00	Zone	Demand	0.00	65.87	60.86	372.26	360.67
J-95	238.00	Zone	Demand	0.00	58.02	53.00	372.11	360.50
J-96	236.00	Zone	Demand	0.00	58.86	53.84	372.05	360.44
J-97	225.00	Zone	Demand	0.00	60.34	51.94	364.46	345.05
J-98	225.00	Zone	Demand	0.00	60.31	51.78	364.38	344.69
J-99	225.00	Zone	Demand	0.00	60.27	51.64	364.31	344.37
J-100	225.00	Zone	Demand	2,100.00	60.27	51.64	364.31	344.37

Scenario: Full Build Out Average Day
Extended Period Analysis: 0.00 hr / 48.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen- Williams C	Maximum Velocity (ft/s)	Minimum Velocity (ft/s)	Maximum Discharge (gpm)	Minimum Discharge (gpm)	Maximum Headloss Gradient (ft/1000ft)	Minimum Headloss Gradient (ft/1000ft)
P-1	345.00	24.0	PVC	100.0	2.16	0.00	3,040.13	-0.00	1.10	0.00
P-2	211.00	12.0	PVC	100.0	8.62	0.00	3,040.13	0.00	32.30	0.00
P-3	164.00	16.0	PVC	100.0	6.09	0.00	3,813.57	-0.00	12.11	0.00
P-4	225.00	12.0	PVC	100.0	0.09	0.04	33.42	13.21	0.01	0.00
P-5	785.00	8.0	PVC	100.0	0.48	0.13	75.86	20.36	0.25	0.02
P-6	273.00	8.0	PVC	100.0	0.84	0.36	131.15	56.97	0.69	0.15
P-7	404.00	12.0	PVC	100.0	0.68	0.06	45.14	-238.11	0.29	0.00
P-8	410.00	8.0	PVC	100.0	0.83	0.36	130.35	57.10	0.68	0.15
P-9	868.00	12.0	PVC	100.0	1.10	0.18	135.18	-388.84	0.72	0.02
P-10	689.00	12.0	PVC	100.0	1.48	0.12	125.24	-521.58	1.23	0.01
P-11	302.00	12.0	PVC	100.0	1.23	0.02	-6.51	-432.63	0.87	0.00
P-12	910.00	12.0	PVC	100.0	0.49	0.10	172.26	-152.80	0.16	0.01
P-13	694.00	12.0	PVC	100.0	0.81	0.11	93.34	-284.91	0.40	0.01
P-14	193.00	8.0	PVC	100.0	0.84	0.36	131.15	56.95	0.69	0.15
P-15	291.00	8.0	PVC	100.0	1.52	0.14	238.11	-45.14	2.08	0.02
P-16	403.00	8.0	PVC	100.0	0.53	0.16	83.24	24.88	0.30	0.03
P-17	338.00	8.0	PVC	100.0	1.67	0.10	-15.67	-262.39	2.49	0.01
P-18	427.00	8.0	PVC	100.0	1.13	0.10	177.53	-34.69	1.21	0.01
P-19	313.00	8.0	PVC	100.0	0.03	0.01	4.46	1.20	0.00	0.00
P-20	441.00	8.0	PVC	100.0	1.30	0.14	203.49	-44.95	1.56	0.03
P-21	371.00	8.0	PVC	100.0	0.85	0.02	132.74	2.98	0.71	0.00
P-22	355.00	8.0	PVC	100.0	1.26	0.13	196.77	-44.25	1.46	0.02
P-23	302.00	8.0	PVC	100.0	0.02	0.01	3.64	0.98	0.00	0.00
P-24	327.00	8.0	PVC	100.0	1.32	0.15	206.65	-47.41	1.60	0.03
P-25	344.00	12.0	PVC	100.0	0.56	0.00	7.81	-195.96	0.20	0.00
P-26	518.00	8.0	PVC	100.0	0.59	0.08	92.02	-43.23	0.36	0.01
P-27	418.00	12.0	PVC	100.0	1.24	0.21	436.92	-246.14	0.89	0.03
P-28	427.00	12.0	PVC	100.0	0.09	0.04	33.42	13.21	0.01	0.00
P-29	780.00	12.0	PVC	100.0	0.14	0.06	-19.80	-49.64	0.02	0.00
P-30	632.00	12.0	PVC	100.0	0.04	0.00	13.46	-1.08	0.00	0.00
P-31	513.00	12.0	PVC	100.0	0.63	0.27	220.44	95.17	0.25	0.05
P-32	427.00	8.0	PVC	100.0	1.81	0.16	283.08	24.66	2.87	0.03
P-33	410.00	8.0	PVC	100.0	0.52	0.06	24.02	-80.76	0.28	0.01
P-34	219.00	12.0	PVC	100.0	1.51	0.09	533.71	31.76	1.29	0.01
P-35	415.00	8.0	PVC	100.0	1.44	0.07	31.12	-225.35	1.88	0.01
P-36	278.00	12.0	PVC	100.0	2.19	0.07	772.33	23.04	2.55	0.00
P-37	317.00	8.0	PVC	100.0	0.22	0.01	4.22	-34.01	0.06	0.00
P-38	440.00	8.0	PVC	100.0	1.08	0.15	47.16	-168.47	1.10	0.03
P-40	253.00	8.0	PVC	100.0	0.08	0.04	12.56	6.72	0.01	0.00
P-41	330.00	8.0	PVC	100.0	0.83	0.04	129.26	6.75	0.67	0.00
P-42	355.00	8.0	PVC	100.0	1.52	0.12	41.71	-237.56	2.07	0.02
P-43	226.00	8.0	PVC	100.0	1.28	0.07	200.65	11.13	1.52	0.01
P-44	165.00	8.0	PVC	100.0	1.31	0.09	205.31	14.60	1.58	0.01
P-45	330.00	8.0	PVC	100.0	0.12	0.00	18.56	0.39	0.02	0.00
P-46	324.00	8.0	PVC	100.0	1.31	0.18	57.83	-205.90	1.59	0.04
P-47	205.00	8.0	PVC	100.0	0.05	0.03	-4.36	-8.19	0.00	0.00
P-48	292.00	12.0	PVC	100.0	0.48	0.02	168.82	-94.75	0.15	0.00
P-49	338.00	8.0	PVC	100.0	0.72	0.05	19.00	-113.35	0.53	0.00
P-50	189.00	12.0	PVC	100.0	0.65	0.01	229.04	-169.63	0.27	0.00
P-51	169.00	12.0	PVC	100.0	0.67	0.03	236.19	-164.05	0.28	0.00
P-52	319.00	8.0	PVC	100.0	1.20	0.19	65.93	-188.56	1.35	0.04
P-53	183.00	8.0	PVC	100.0	0.05	0.03	8.05	4.24	0.00	0.00
P-54	183.00	12.0	PVC	100.0	1.75	0.31	617.60	-320.75	1.69	0.07

Scenario: Full Build Out Average Day
Extended Period Analysis: 0.00 hr / 48.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen- Williams C	Maximum Velocity (ft/s)	Minimum Velocity (ft/s)	Maximum Discharge (gpm)	Minimum Discharge (gpm)	Maximum Headloss Gradient (ft/1000ft)	Minimum Headloss Gradient (ft/1000ft)
P-55	175.00	12.0	PVC	100.0	1.73	0.32	611.43	-327.93	1.66	0.07
P-56	644.00	12.0	PVC	100.0	0.13	0.05	47.58	17.56	0.01	0.00
P-57	799.00	12.0	PVC	100.0	0.33	0.14	117.49	50.81	0.08	0.02
P-58	644.00	8.0	PVC	100.0	0.28	0.12	44.48	19.38	0.09	0.02
P-59	379.00	12.0	PVC	100.0	0.63	0.27	220.44	95.17	0.25	0.05
P-60	427.00	8.0	PVC	100.0	2.32	0.09	362.98	14.12	4.55	0.01
P-61	453.00	12.0	PVC	100.0	2.26	0.07	60.52	-796.56	2.70	0.00
P-62	217.00	12.0	PVC	100.0	3.31	0.00	1,165.81	-31.93	5.47	0.00
P-63	428.00	16.0	PVC	100.0	3.50	0.13	2,195.62	-172.47	4.35	0.01
P-64	201.00	12.0	PVC	100.0	2.02	0.14	712.52	48.47	2.20	0.02
P-65	419.00	8.0	PVC	100.0	0.91	0.10	33.33	-143.02	0.81	0.01
P-66	124.00	12.0	PVC	100.0	2.44	0.11	860.62	37.32	3.12	0.01
P-67	415.00	12.0	PVC	100.0	1.48	0.11	80.95	-520.61	1.23	0.01
P-68	353.00	12.0	PVC	100.0	1.68	0.08	591.00	27.51	1.56	0.01
P-69	415.00	16.0	PVC	100.0	2.64	0.17	236.50	-1,656.38	2.58	0.02
P-70	441.00	8.0	PVC	100.0	1.96	0.14	45.51	-307.59	3.35	0.02
P-71	183.00	8.0	PVC	100.0	1.11	0.01	6.66	-173.68	1.16	0.00
P-72	440.00	8.0	PVC	100.0	2.01	0.15	49.19	-314.57	3.49	0.03
P-73	354.00	8.0	PVC	100.0	0.24	0.05	32.52	-37.59	0.07	0.00
P-74	440.00	16.0	PVC	100.0	3.01	0.21	305.81	-1,887.60	3.29	0.02
P-75	356.00	8.0	PVC	100.0	1.49	0.17	61.29	-233.12	2.00	0.04
P-76	211.00	8.0	PVC	100.0	0.86	0.08	134.86	12.34	0.73	0.01
P-77	355.00	8.0	PVC	100.0	1.57	0.16	52.80	-246.25	2.22	0.03
P-78	354.00	8.0	PVC	100.0	0.44	0.07	68.61	11.55	0.21	0.01
P-79	386.00	16.0	PVC	100.0	2.83	0.29	395.94	-1,770.87	2.92	0.04
P-80	324.00	8.0	PVC	100.0	2.02	0.19	63.01	-316.80	3.53	0.04
P-81	232.00	8.0	PVC	100.0	0.56	0.00	88.26	-3.44	0.33	0.00
P-82	275.00	8.0	PVC	100.0	1.04	0.15	63.59	-162.39	1.02	0.03
P-83	371.00	16.0	PVC	100.0	2.66	0.28	393.21	-1,664.70	2.61	0.04
P-84	338.00	8.0	PVC	100.0	1.66	0.24	95.48	-260.23	2.45	0.07
P-85	338.00	12.0	PVC	100.0	0.58	0.18	203.06	-201.26	0.22	0.03
P-86	334.00	16.0	PVC	100.0	2.62	0.35	1,640.90	-530.25	2.54	0.06
P-87	319.00	8.0	PVC	100.0	1.04	0.11	39.82	-162.58	1.03	0.02
P-88	240.00	8.0	PVC	100.0	0.60	0.14	66.18	-94.22	0.37	0.03
P-89	320.00	16.0	PVC	100.0	2.64	0.37	578.86	-1,656.16	2.58	0.07
P-90	231.00	12.0	PVC	100.0	2.19	0.38	771.51	-364.52	2.55	0.10
P-91	203.00	16.0	PVC	100.0	3.93	0.61	2,461.63	-979.81	5.38	0.17
P-92	066.00	8.0	PVC	100.0	0.45	0.19	70.17	29.52	0.22	0.04
P-93	816.00	8.0	PVC	100.0	0.37	0.16	-24.80	-58.48	0.15	0.03
P-94	204.00	16.0	PVC	100.0	6.09	0.00	3,813.57	-0.00	12.11	0.00
P-95	273.00	8.0	PVC	100.0	1.73	0.06	19.14	-271.69	2.66	0.00
P-96	428.00	8.0	PVC	100.0	1.70	0.06	266.95	-22.76	2.57	0.01
P-97	074.00	8.0	PVC	100.0	0.37	0.16	58.48	24.80	0.15	0.03
P-98	273.00	8.0	PVC	100.0	0.35	0.00	54.26	-2.37	0.13	0.00
P-99	415.00	8.0	PVC	100.0	1.32	0.08	207.57	-28.87	1.61	0.01
P-100	273.00	8.0	PVC	100.0	1.32	0.08	29.33	-207.10	1.61	0.01
P-101	432.00	8.0	PVC	100.0	0.48	0.13	-19.98	-74.44	0.24	0.02
P-102	422.00	4.0	PVC	100.0	0.95	0.26	37.22	9.99	1.96	0.17
P-103	352.00	4.0	PVC	100.0	0.95	0.26	37.22	9.99	1.96	0.17
P-104	558.00	8.0	PVC	100.0	1.70	0.17	266.29	-68.90	2.56	0.04
P-105	250.00	8.0	PVC	100.0	1.42	0.15	67.31	-222.48	1.84	0.03
P-106	288.00	8.0	PVC	100.0	1.34	0.18	70.64	-210.50	1.66	0.04
P-107	428.00	8.0	PVC	100.0	0.10	0.00	0.03	-16.33	0.01	0.00

Scenario: Full Build Out Average Day
Extended Period Analysis: 0.00 hr / 48.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen- Williams C	Maximum Velocity (ft/s)	Minimum Velocity (ft/s)	Maximum Discharge (gpm)	Minimum Discharge (gpm)	Maximum Headloss Gradient (ft/1000ft)	Minimum Headloss Gradient (ft/1000ft)
P-108	443.00	8.0	PVC	100.0	1.74	0.13	272.13	-72.50	2.67	0.02
P-109	343.00	8.0	PVC	100.0	0.49	0.02	20.64	-76.93	0.26	0.00
P-110	247.00	8.0	PVC	100.0	1.82	0.23	93.33	-284.69	2.90	0.06
P-111	361.00	8.0	PVC	100.0	0.26	0.07	40.22	-38.48	0.08	0.01
P-112	115.00	8.0	PVC	100.0	1.67	0.27	106.85	-261.94	2.48	0.08
P-113	633.00	8.0	PVC	100.0	0.34	0.00	53.55	-17.62	0.13	0.00
P-114	435.00	8.0	PVC	100.0	1.58	0.00	247.99	-39.12	2.24	0.00
P-115	300.00	16.0	PVC	100.0	3.58	1.20	1,867.47	-2,240.88	4.52	0.60
P-116	353.00	16.0	PVC	100.0	3.22	1.02	1,591.22	-2,015.64	3.72	0.44
P-117	338.00	8.0	PVC	100.0	1.66	0.27	108.77	-260.19	2.45	0.09
P-118	357.00	8.0	PVC	100.0	1.64	0.24	240.54	-257.15	2.40	0.07
P-119	357.00	16.0	PVC	100.0	1.12	0.33	703.96	209.64	0.53	0.06
P-120	332.00	8.0	PVC	100.0	0.52	0.01	81.58	-24.04	0.29	0.00
P-121	356.00	8.0	PVC	100.0	0.65	0.06	62.89	-102.04	0.43	0.01
P-122	330.00	8.0	PVC	100.0	1.08	0.19	169.33	-79.50	1.11	0.05
P-123	366.00	16.0	PVC	100.0	0.95	0.33	592.26	207.19	0.38	0.06
P-124	328.00	8.0	PVC	100.0	0.52	0.08	59.66	-81.46	0.29	0.01
P-125	356.00	8.0	PVC	100.0	0.31	0.09	48.05	13.38	0.11	0.01
P-126	560.00	8.0	PVC	100.0	0.71	0.10	48.16	-111.15	0.51	0.01
P-127	369.00	8.0	PVC	100.0	0.84	0.00	132.13	-0.55	0.70	0.00
P-128	356.00	8.0	PVC	100.0	0.49	0.01	76.95	-26.46	0.26	0.00
P-129	474.00	8.0	PVC	100.0	0.03	0.01	-1.14	-4.25	0.00	0.00
P-130	356.00	8.0	PVC	100.0	0.75	0.12	117.52	19.01	0.56	0.02
P-131	332.00	8.0	PVC	100.0	0.40	0.11	-17.81	-62.54	0.18	0.02
P-132	252.00	8.0	PVC	100.0	0.80	0.15	62.18	-126.11	0.64	0.03
P-133	406.00	8.0	PVC	100.0	0.61	0.00	23.12	-95.33	0.38	0.00
P-134	512.00	8.0	PVC	100.0	0.33	0.08	52.37	-44.63	0.13	0.01
P-135	671.00	8.0	PVC	100.0	0.98	0.42	-65.54	-154.31	0.93	0.19
P-136	387.00	8.0	PVC	100.0	0.53	0.08	-12.48	-83.02	0.30	0.01
P-137	409.00	16.0	PVC	100.0	0.99	0.36	618.20	227.61	0.42	0.07
P-138	524.00	16.0	PVC	100.0	0.92	0.33	576.92	208.26	0.37	0.06
P-139	252.00	8.0	PVC	100.0	0.48	0.13	-21.02	-75.14	0.25	0.02
P-140	259.00	8.0	PVC	100.0	0.01	0.00	-0.60	-2.22	0.00	0.00
P-141	548.00	8.0	PVC	100.0	1.75	0.77	-120.43	-274.91	2.72	0.59
P-142	748.00	8.0	PVC	100.0	0.81	0.33	-51.02	-126.57	0.65	0.12
P-143	856.00	8.0	PVC	100.0	0.45	0.13	-21.02	-69.98	0.22	0.02
P-144	259.00	16.0	PVC	100.0	0.81	0.28	508.42	173.24	0.29	0.04
P-145	432.00	16.0	PVC	100.0	0.81	0.28	-173.24	-508.42	0.29	0.04
P-146	948.00	16.0	PVC	100.0	0.81	0.28	508.42	173.24	0.29	0.04
P-147	369.00	16.0	PVC	100.0	0.81	0.28	508.42	173.24	0.29	0.04
P-148	975.00	10.0	PVC	100.0	2.08	0.71	508.42	173.24	2.86	0.39
P-149	126.00	10.0	PVC	100.0	2.08	0.71	508.42	173.24	2.86	0.39
P-150	112.00	10.0	PVC	100.0	2.08	0.71	508.42	173.24	2.86	0.39
P-151	228.00	16.0	PVC	100.0	2.91	0.28	508.32	-1,822.44	3.08	0.04
P-152	124.00	16.0	PVC	100.0	3.35	0.00	0.00	-2,100.00	4.01	0.00

Detailed Report for Pump: PUMP STATION

Scenario Summary

Scenario	Full Build Out Average Day
Active Topology Alternative	Full Build Out
Physical Alternative	Base-Physical
Demand Alternative	Average Day Demand
Initial Settings Alternative	Base-Initial Settings
Operational Alternative	Base-Operational
Age Alternative	Base-Age Alternative
Constituent Alternative	Base-Constituent
Trace Alternative	Base-Trace Alternative
Fire Flow Alternative	Base-Fire Flow
Capital Cost Alternative	Base-Capital Cost
Energy Cost Alternative	Base-Energy Cost
User Data Alternative	Base-User Data

Global Adjustments Summary

Demand	<None>	Roughness	<None>
--------	--------	-----------	--------

Geometric Summary

X	69,608.68 ft	Upstream Pipe	P-3
Y	639,305.92 ft	Downstream Pipe	P-94
Elevation	218.00 ft		

Pump Definition Summary

Pump Definition	Max Day Pump Station
-----------------	----------------------

Initial Status

Initial Pump Status	On	Initial Relative Speed Facto	1.00
---------------------	----	------------------------------	------

Simple Controls

Controls

Off if node GATEWAY TANK #2 ab

On if node GATEWAY TANK #2 bel

Calculated Results Summary

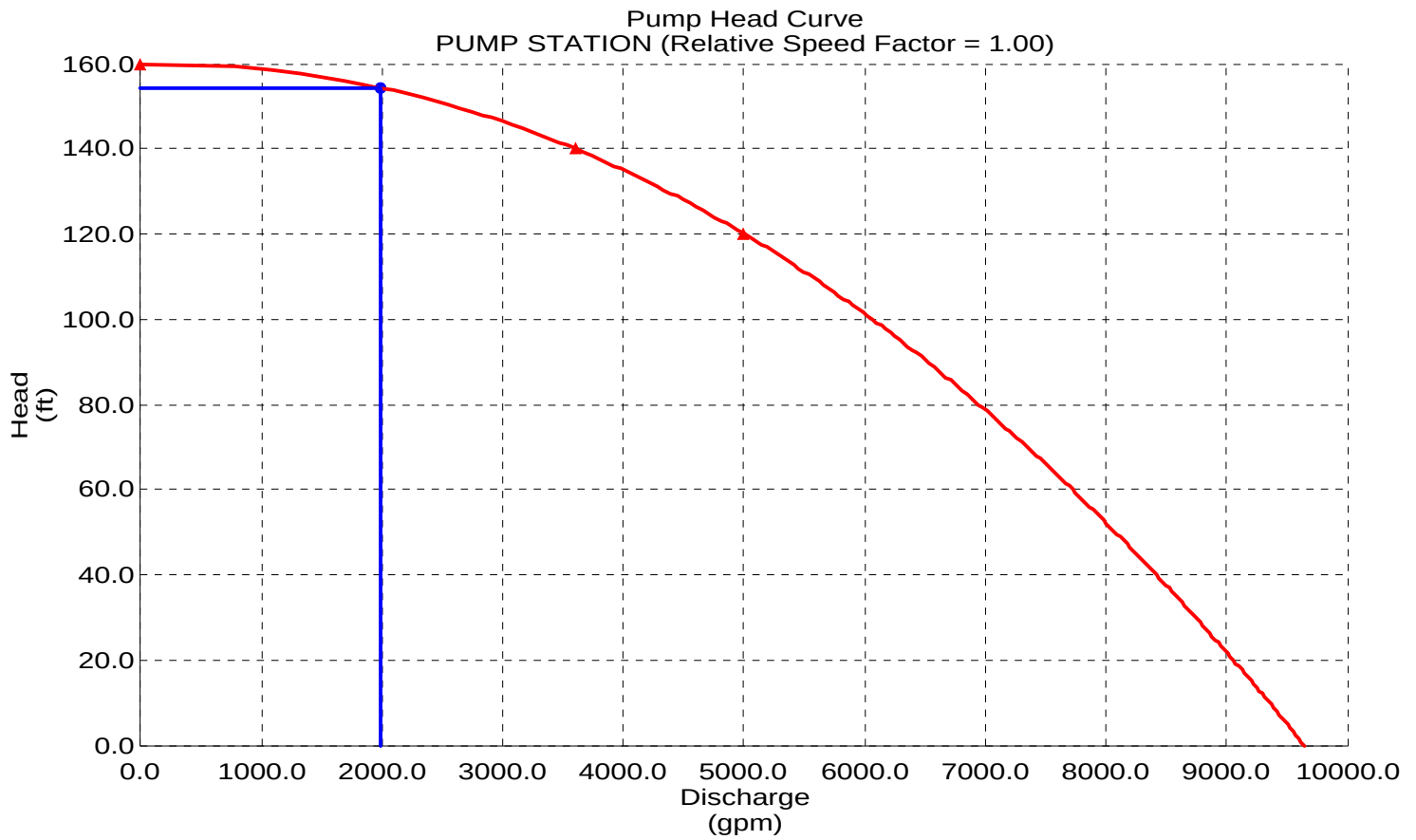
Time (hr)	Control Status	Intake Pump Grade (ft)	Discharge Pump Grade (ft)	Intake Pump Pressure (psi)	Discharge Pump Pressure (psi)	Discharge (gpm)	Pump Head (ft)	Relative Speed	Calculated Water Power (Hp)
0.00	On	19.91	374.20	0.82	67.58	1,986.95	54.29	1.00	77.40
1.00	On	20.34	374.77	1.01	67.83	1,964.19	54.43	1.00	76.58
2.00	On	20.76	375.19	1.19	68.01	1,964.71	54.43	1.00	76.60
3.00	On	21.16	375.47	1.37	68.13	1,985.11	54.30	1.00	77.33
3.07	Off	21.78	370.91	1.64	66.16	0.00	0.00	0.00	0.00
4.00	Off	22.89	369.62	2.12	65.60	0.00	0.00	0.00	0.00
5.00	Off	24.07	368.38	2.62	65.06	0.00	0.00	0.00	0.00
6.00	Off	25.22	367.17	3.12	64.54	0.00	0.00	0.00	0.00
7.00	Off	26.35	365.96	3.61	64.01	0.00	0.00	0.00	0.00
8.00	Off	27.46	364.99	4.09	63.60	0.00	0.00	0.00	0.00
9.00	Off	28.56	363.42	4.57	62.92	0.00	0.00	0.00	0.00
10.00	Off	29.63	363.12	5.03	62.78	0.00	0.00	0.00	0.00
11.00	Off	30.68	362.37	5.49	62.46	0.00	0.00	0.00	0.00
12.00	Off	31.71	361.65	5.93	62.15	0.00	0.00	0.00	0.00
13.00	Off	32.73	360.94	6.37	61.84	0.00	0.00	0.00	0.00

Detailed Report for Pump: PUMP STATION

Calculated Results Summary

Time (hr)	Control Status	Intake Pump Grade (ft)	Discharge Pump Grade (ft)	Intake Pump Pressure (psi)	Discharge Pump Pressure (psi)	Discharge Pump (gpm)	Pump Head (ft)	Relative Speed	Calculated Water Power (Hp)
13.01	On	31.17	373.97	5.70	67.48	3,351.53	42.80	1.00	120.83
14.00	On	30.91	374.79	5.59	67.84	3,250.19	43.88	1.00	118.07
15.00	On	30.68	375.40	5.49	68.10	3,169.63	44.71	1.00	115.80
16.00	On	30.48	375.87	5.40	68.30	3,102.29	45.39	1.00	113.87
17.00	On	30.30	376.26	5.32	68.47	3,044.49	45.96	1.00	112.19
18.00	On	30.14	376.61	5.25	68.62	2,991.11	46.47	1.00	110.61
19.00	On	30.01	377.01	5.20	68.79	2,935.60	47.00	1.00	108.95
20.00	On	29.91	377.53	5.15	69.02	2,868.14	47.62	1.00	106.89
21.00	On	29.84	378.06	5.12	69.25	2,801.12	48.22	1.00	104.82
22.00	On	29.82	378.82	5.11	69.58	2,711.81	49.00	1.00	102.01
22.22	Off	30.86	370.73	5.57	66.08	0.00	0.00	0.00	0.00
23.00	Off	31.67	370.60	5.91	66.02	0.00	0.00	0.00	0.00
24.00	Off	32.68	370.14	6.35	65.82	0.00	0.00	0.00	0.00
25.00	Off	33.68	369.60	6.78	65.59	0.00	0.00	0.00	0.00
26.00	Off	34.65	368.95	7.20	65.31	0.00	0.00	0.00	0.00
27.00	Off	35.61	368.05	7.62	64.92	0.00	0.00	0.00	0.00
28.00	Off	36.54	366.75	8.02	64.36	0.00	0.00	0.00	0.00
29.00	Off	37.46	365.54	8.42	63.83	0.00	0.00	0.00	0.00
30.00	Off	38.35	364.37	8.81	63.33	0.00	0.00	0.00	0.00
31.00	Off	39.23	363.19	9.18	62.82	0.00	0.00	0.00	0.00
31.90	Off	40.00	362.24	9.52	62.41	0.00	0.00	0.00	0.00
32.00	Off	40.00	362.26	9.52	62.41	0.00	0.00	0.00	0.00
33.00	Off	40.00	360.73	9.52	61.75	0.00	0.00	0.00	0.00
33.94	On	38.01	375.43	8.66	68.11	3,813.57	37.41	1.00	132.30
34.00	On	38.00	376.30	8.65	68.49	3,741.89	38.30	1.00	130.66
35.00	On	37.45	377.14	8.42	68.85	3,626.93	39.68	1.00	127.91
36.00	On	36.96	377.94	8.20	69.20	3,515.87	40.97	1.00	125.14
37.00	On	36.52	378.67	8.01	69.51	3,411.39	42.15	1.00	122.43
38.00	On	36.14	379.46	7.85	69.85	3,303.44	43.32	1.00	119.53
39.00	On	35.78	380.01	7.69	70.09	3,216.91	44.23	1.00	117.14
40.00	On	35.46	380.44	7.56	70.28	3,143.62	44.98	1.00	115.06
41.00	On	35.17	380.78	7.43	70.43	3,079.93	45.61	1.00	113.23
41.51	Off	36.35	370.62	7.94	66.03	0.00	0.00	0.00	0.00
42.00	Off	36.80	370.03	8.13	65.77	0.00	0.00	0.00	0.00
43.00	Off	37.71	368.99	8.53	65.33	0.00	0.00	0.00	0.00
44.00	Off	38.60	368.14	8.91	64.96	0.00	0.00	0.00	0.00
45.00	Off	39.47	367.31	9.29	64.60	0.00	0.00	0.00	0.00
45.63	Off	40.00	366.79	9.52	64.37	0.00	0.00	0.00	0.00
46.00	Off	40.00	366.75	9.52	64.36	0.00	0.00	0.00	0.00
47.00	Off	40.00	366.47	9.52	64.24	0.00	0.00	0.00	0.00
48.00	Off	40.00	366.07	9.52	64.06	0.00	0.00	0.00	0.00

Detailed Report for Pump: PUMP STATION



Scenario: Full Build Out Average Day
Extended Period Analysis: 0.00 hr / 48.00
Tank Report

Label	Zone	Base Elevation (ft)	Minimum Elevation (ft)	Initial HGL (ft)	Maximum Elevation (ft)	Tank Diameter (ft)	Total Volume (gal)
GATEWAY TANK	Zone	218.00	220.00	220.50	240.00	160.00	3,008,095.32
GATEWAY TANK	Zone	220.00	360.00	370.00	375.00	126.00	1,399,116.83
RAC TANK	Zone	265.00	300.00	360.00	365.00	60.00	1,374,793.56

Detailed Report for Tank: GATEWAY TANK #1

Scenario Summary

Scenario	Full Build Out Average Day
Active Topology Alternative	Full Build Out
Physical Alternative	Base-Physical
Demand Alternative	Average Day Demand
Initial Settings Alternative	Base-Initial Settings
Operational Alternative	Base-Operational
Age Alternative	Base-Age Alternative
Constituent Alternative	Base-Constituent
Trace Alternative	Base-Trace Alternative
Fire Flow Alternative	Base-Fire Flow
Capital Cost Alternative	Base-Capital Cost
Energy Cost Alternative	Base-Energy Cost
User Data Alternative	Base-User Data

Global Adjustments Summary

Demand	<None>	Roughness	<None>
--------	--------	-----------	--------

Geometric Summary

X	69,452.01 ft	Elevation	218.00 ft
Y	639,353.85 ft	Zone	Zone

Demand Summary

Type	Base Flow (gpm)	Pattern
Demand	0.00	Fixed

Operating Range Summary

Maximum Elevation	240.00 ft	Maximum Level	22.00 ft
Initial HGL	220.50 ft	Initial Level	2.50 ft
Minimum Elevation	220.00 ft	Minimum Level	2.00 ft
Base Elevation	218.00 ft		

Storage

Section Type	Constant Area	Circular Tank Shape?	true
Diameter	160.00 ft	Average Area	20,106.2 ft²
Inactive Volume	0.00 gal	Total Active Volume	3,008,095.32 gal

Calculated Results Summary

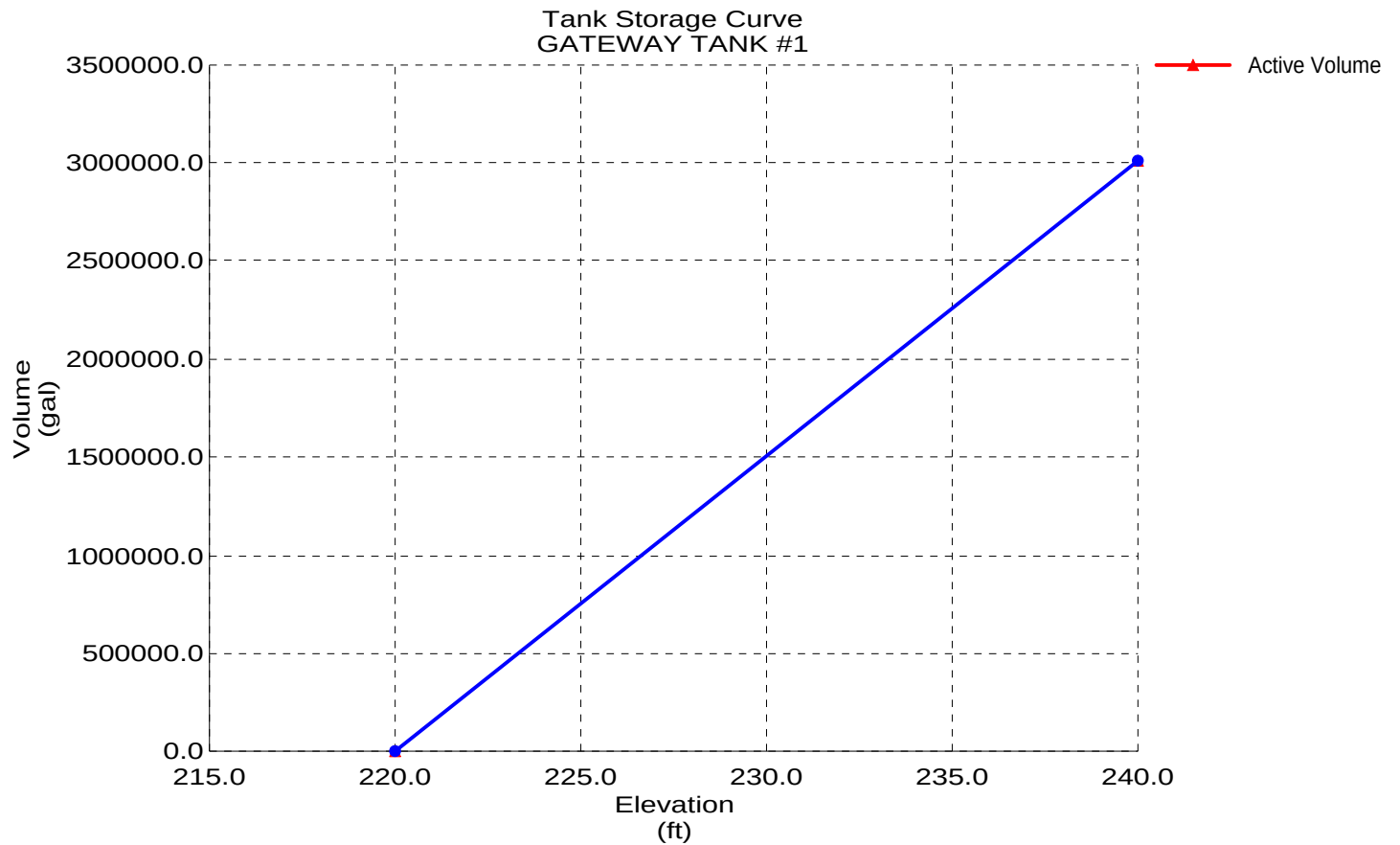
Time (hr)	Calculated Hydraulic (ft)	Calculated Grade Level (ft)	Pressure (psi)	Calculated Percent Full (%)	Calculated Volume (gal)	Inflow (gpm)	Outflow (gpm)	Current Status
0.00	220.50	2.50	1.08	2.5	75,202.38	1,053.18	1,053.18	Filling
1.00	220.92	2.92	1.26	4.6	138,392.76	1,058.44	1,058.44	Filling
2.00	221.34	3.34	1.45	6.7	201,899.85	1,040.25	1,040.25	Filling
3.00	221.76	3.76	1.63	8.8	264,314.53	1,002.38	1,002.38	Filling
3.07	221.78	3.78	1.64	8.9	268,440.93	2,986.34	2,986.34	Filling
4.00	222.89	4.89	2.12	14.5	435,328.34	2,939.20	2,939.20	Filling
5.00	224.07	6.07	2.62	20.3	611,680.32	2,888.68	2,888.68	Filling
6.00	225.22	7.22	3.12	26.1	785,000.61	2,838.28	2,838.28	Filling
7.00	226.35	8.35	3.61	31.8	955,298.39	2,788.01	2,788.01	Filling
8.00	227.46	9.46	4.09	37.3	1,225,578.25	2,737.87	2,737.87	Filling
9.00	228.56	10.56	4.57	42.8	1,86,849.37	2,687.85	2,687.85	Filling

Detailed Report for Tank: GATEWAY TANK #1

Calculated Results Summary

Time (hr)	Calculated Hydraulic Grade (ft)	Calculated Level (ft)	Pressure (psi)	Calculated Percent Full (%)	Calculated Volume (gal)	Inflow (gpm)	Outflow (gpm)	Current Status
10.00	229.63	11.63	5.03	48.1	148,120.93	2,637.97	2,637.97	Filling
11.00	230.68	12.68	5.49	53.4	106,399.83	2,588.22	2,588.22	Filling
12.00	231.71	13.71	5.93	58.6	761,692.93	2,538.60	2,538.60	Filling
13.00	232.73	14.73	6.37	63.6	114,009.43	2,489.11	2,489.11	Filling
13.01	232.73	14.73	6.37	63.7	115,088.07	-862.78	862.78	Draining
14.00	232.39	14.39	6.23	62.0	363,693.97	-744.65	744.65	Draining
15.00	232.09	14.09	6.10	60.5	319,015.01	-649.57	649.57	Draining
16.00	231.84	13.84	5.99	59.2	780,041.41	-569.61	569.61	Draining
17.00	231.61	13.61	5.89	58.0	745,864.35	-500.80	500.80	Draining
18.00	231.41	13.41	5.80	57.0	715,815.99	-437.77	437.77	Draining
19.00	231.23	13.23	5.73	56.2	389,549.78	-373.85	373.85	Draining
20.00	231.08	13.08	5.66	55.4	367,120.79	-299.23	299.23	Draining
21.00	230.96	12.96	5.61	54.8	349,164.76	-226.49	226.49	Draining
22.00	230.87	12.87	5.57	54.4	335,576.09	-132.86	132.86	Draining
22.22	230.86	12.86	5.57	54.3	333,859.44	2,579.50	2,579.50	Filling
23.00	231.67	13.67	5.91	58.4	755,266.95	2,540.67	2,540.67	Filling
24.00	232.68	14.68	6.35	63.4	107,707.37	2,491.17	2,491.17	Filling
25.00	233.68	15.68	6.78	68.4	157,178.07	2,441.82	2,441.82	Filling
26.00	234.65	16.65	7.20	73.3	203,685.94	2,392.61	2,392.61	Filling
27.00	235.61	17.61	7.62	78.0	347,242.44	2,343.53	2,343.53	Filling
28.00	236.54	18.54	8.02	82.7	487,854.47	2,294.60	2,294.60	Filling
29.00	237.46	19.46	8.42	87.3	525,531.19	2,245.81	2,245.81	Filling
30.00	238.35	20.35	8.81	91.8	760,279.50	2,197.17	2,197.17	Filling
31.00	239.23	21.23	9.18	96.1	392,108.58	2,148.68	2,148.68	Filling
31.90	240.00	22.00	9.52	100.0	108,095.32	0.00	-0.00	Full
32.00	240.00	22.00	9.52	100.0	108,095.32	0.00	-0.00	Full
33.00	240.00	22.00	9.52	100.0	108,095.32	0.00	-0.00	Full
33.94	240.00	22.00	9.52	100.0	108,095.32	3,813.57	3,813.57	Draining
34.00	239.91	21.91	9.48	99.6	395,066.63	1,631.72	1,631.72	Draining
35.00	239.26	21.26	9.20	96.3	397,162.16	1,480.13	1,480.13	Draining
36.00	238.67	20.67	8.94	93.4	308,355.05	1,336.28	1,336.28	Draining
37.00	238.14	20.14	8.71	90.7	728,177.12	1,202.55	1,202.55	Draining
38.00	237.66	19.66	8.51	88.3	356,024.78	1,068.56	1,068.56	Draining
39.00	237.23	19.23	8.32	86.2	391,911.82	-959.10	959.10	Draining
40.00	236.85	18.85	8.16	84.3	334,364.83	-865.40	865.40	Draining
41.00	236.51	18.51	8.01	82.5	482,440.57	-783.43	783.43	Draining
41.51	236.35	18.35	7.94	81.7	458,428.04	2,304.91	2,304.91	Filling
42.00	236.80	18.80	8.13	84.0	326,077.60	2,281.14	2,281.14	Filling
43.00	237.71	19.71	8.53	88.5	362,946.49	2,232.40	2,232.40	Filling
44.00	238.60	20.60	8.91	93.0	796,889.26	2,183.80	2,183.80	Filling
45.00	239.47	21.47	9.29	97.3	327,917.38	2,135.34	2,135.34	Filling
45.63	240.00	22.00	9.52	100.0	108,095.32	0.00	-0.00	Full
46.00	240.00	22.00	9.52	100.0	108,095.32	0.00	-0.00	Full
47.00	240.00	22.00	9.52	100.0	108,095.32	0.00	-0.00	Full
48.00	240.00	22.00	9.52	100.0	108,095.32	0.00	-0.00	Full

Detailed Report for Tank: GATEWAY TANK #1



Detailed Report for Tank: GATEWAY TANK #2

Scenario Summary

Scenario	Full Build Out Average Day
Active Topology Alternative	Full Build Out
Physical Alternative	Base-Physical
Demand Alternative	Average Day Demand
Initial Settings Alternative	Base-Initial Settings
Operational Alternative	Base-Operational
Age Alternative	Base-Age Alternative
Constituent Alternative	Base-Constituent
Trace Alternative	Base-Trace Alternative
Fire Flow Alternative	Base-Fire Flow
Capital Cost Alternative	Base-Capital Cost
Energy Cost Alternative	Base-Energy Cost
User Data Alternative	Base-User Data

Global Adjustments Summary

Demand	<None>	Roughness	<None>
--------	--------	-----------	--------

Geometric Summary

X	72,721.15 ft	Elevation	220.00 ft
Y	640,526.50 ft	Zone	Zone

Demand Summary

Type	Base Flow (gpm)	Pattern
Demand	0.00	Fixed

Operating Range Summary

Maximum Elevation	375.00 ft	Maximum Level	155.00 ft
Initial HGL	370.00 ft	Initial Level	150.00 ft
Minimum Elevation	360.00 ft	Minimum Level	140.00 ft
Base Elevation	220.00 ft		

Storage

Section Type	Constant Area	Circular Tank Shape?	true
Diameter	126.00 ft	Average Area	12,469.0 ft²
Inactive Volume	0.00 gal	Total Active Volume	1,399,116.83 gal

Calculated Results Summary

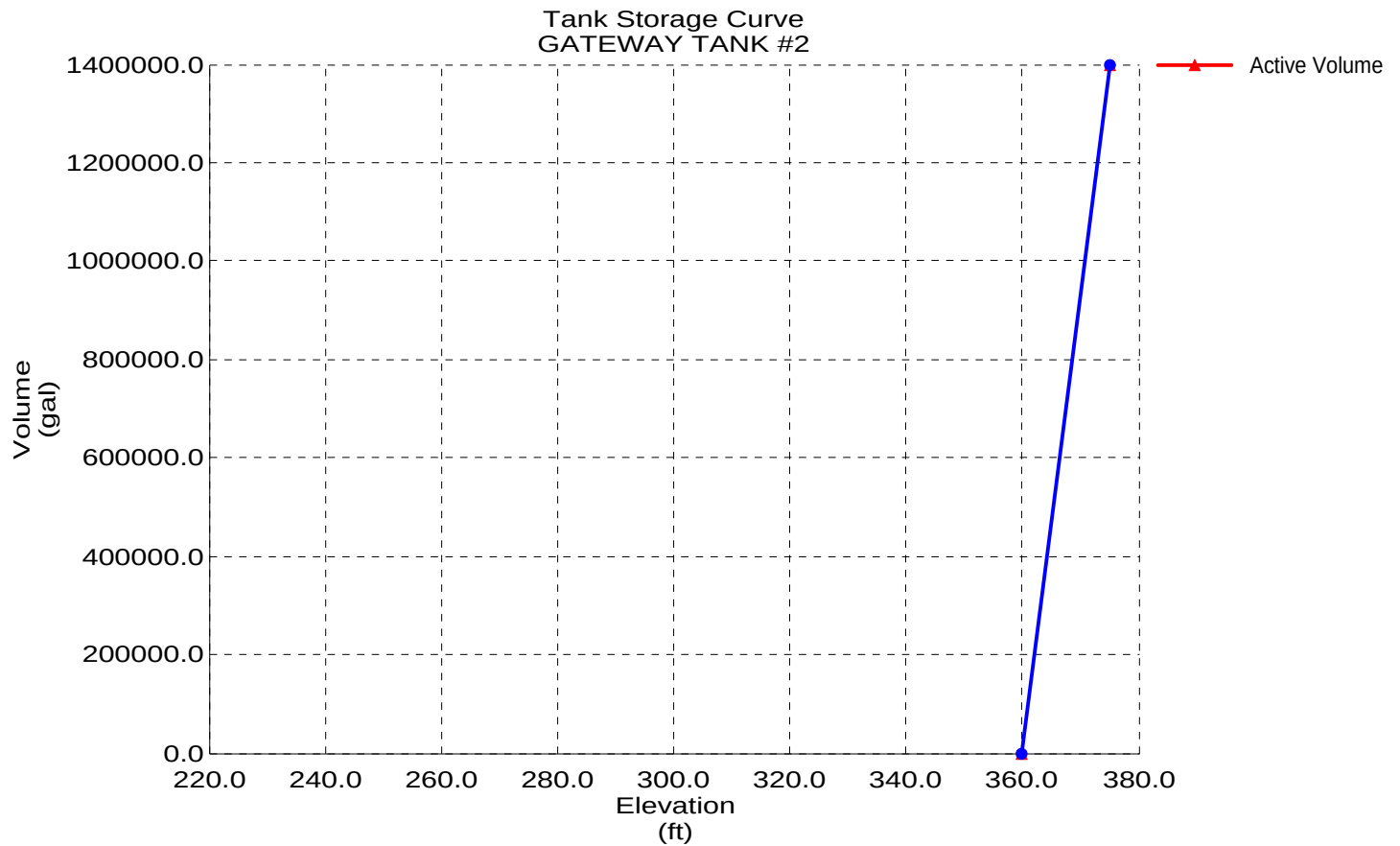
Time (hr)	Calculated Hydraulic (ft)	Calculated Grade (ft)	Calculated Level (ft)	Pressure (psi)	Calculated Percent Full (%)	Calculated Volume (gal)	Inflow (gpm)	Outflow (gpm)	Current Status
0.00	370.00	150.00	64.90	66.7	32,744.56	1,067.09	1,067.09	Filling	
1.00	370.69	150.69	65.19	71.2	36,771.12	1,044.00	1,044.00	Filling	
2.00	371.36	151.36	65.49	75.7	39,408.58	946.33	-946.33	Filling	
3.00	371.97	151.97	65.75	79.8	41,190.77	753.90	-753.90	Filling	
3.07	372.00	152.00	65.76	80.0	41,293.47	1,219.03	1,219.03	Draining	
4.00	371.27	151.27	65.45	75.1	35,170.78	1,524.65	1,524.65	Draining	
5.00	370.29	150.29	65.02	68.6	35,692.47	1,653.13	1,653.13	Draining	
6.00	369.23	149.23	64.56	61.5	30,502.97	1,722.71	1,722.71	Draining	
7.00	368.12	148.12	64.08	54.1	25,140.48	1,771.75	1,771.75	Draining	
8.00	366.98	146.98	63.59	46.5	20,834.70	1,690.37	1,690.37	Draining	
9.00	365.89	145.89	63.12	39.3	19,413.53	1,867.47	1,867.47	Draining	

Detailed Report for Tank: GATEWAY TANK #2

Calculated Results Summary

Time (hr)	Calculated Hydraulic Grade (ft)	Calculated Level (ft)	Pressure (psi)	Calculated Percent Full (%)	Calculated Volume (gal)	Inflow (gpm)	Outflow (gpm)	Current Status
10.00	364.69	144.69	62.60	31.3	137,366.34	1,496.49	1,496.49	Draining
11.00	363.73	143.73	62.18	24.8	147,576.01	1,385.61	1,385.61	Draining
12.00	362.84	142.84	61.80	18.9	164,437.98	1,289.38	1,289.38	Draining
13.00	362.01	142.01	61.44	13.4	187,075.52	1,210.31	1,210.31	Draining
13.01	362.00	142.00	61.44	13.3	186,551.76	2,090.31	2,090.31	Filling
14.00	363.33	143.33	62.01	22.2	111,063.82	2,078.76	2,078.76	Filling
15.00	364.67	144.67	62.59	31.1	135,789.37	1,969.26	1,969.26	Filling
16.00	365.94	145.94	63.14	39.6	153,945.17	1,827.62	1,827.62	Filling
17.00	367.11	147.11	63.65	47.4	163,604.14	1,660.62	1,660.62	Filling
18.00	368.18	148.18	64.11	54.6	163,240.55	1,526.97	1,526.97	Filling
19.00	369.16	149.16	64.54	61.1	154,858.34	1,407.59	1,407.59	Filling
20.00	370.07	150.07	64.93	67.1	139,314.30	1,373.85	1,373.85	Filling
21.00	370.95	150.95	65.31	73.0	121,746.40	1,329.05	1,329.05	Filling
22.00	371.81	151.81	65.68	78.7	101,488.54	1,376.53	1,376.53	Filling
22.22	372.00	152.00	65.76	80.0	119,290.62	1,301.26	1,301.26	Draining
23.00	371.34	151.34	65.48	75.6	158,045.10	-997.66	997.66	Draining
24.00	370.70	150.70	65.20	71.3	198,185.83	-862.22	862.22	Draining
25.00	370.15	150.15	64.96	67.6	146,453.35	-839.48	839.48	Draining
26.00	369.61	149.61	64.73	64.0	196,084.35	-913.10	913.10	Draining
27.00	369.02	149.02	64.47	60.1	141,297.56	1,128.76	1,128.76	Draining
28.00	368.29	148.29	64.16	55.3	173,573.38	1,454.73	1,454.73	Draining
29.00	367.36	147.36	63.75	49.1	186,287.98	1,593.27	1,593.27	Draining
30.00	366.33	146.33	63.31	42.2	190,693.62	1,670.02	1,670.02	Draining
31.00	365.26	145.26	62.85	35.1	190,490.76	1,719.97	1,719.97	Draining
31.90	364.26	144.26	62.42	28.4	197,643.28	1,690.65	1,690.65	Draining
32.00	364.15	144.15	62.37	27.7	187,469.85	1,638.14	1,638.14	Draining
33.00	363.10	143.10	61.91	20.7	189,179.85	1,814.08	1,814.08	Draining
33.94	362.00	142.00	61.44	13.3	186,534.68	1,975.45	1,975.45	Filling
34.00	362.07	142.07	61.47	13.8	193,283.75	2,240.88	2,240.88	Filling
35.00	363.51	143.51	62.09	23.4	127,735.83	2,204.38	2,204.38	Filling
36.00	364.93	144.93	62.71	32.9	159,998.94	2,157.86	2,157.86	Filling
37.00	366.32	146.32	63.31	42.1	189,469.62	2,101.31	2,101.31	Filling
38.00	367.67	147.67	63.89	51.1	115,550.11	2,085.53	2,085.53	Filling
39.00	369.01	149.01	64.47	60.1	140,682.71	1,972.06	1,972.06	Filling
40.00	370.28	150.28	65.02	68.5	159,006.46	1,826.25	1,826.25	Filling
41.00	371.46	151.46	65.53	76.4	168,580.04	1,654.97	1,654.97	Filling
41.51	372.00	152.00	65.76	80.0	119,304.85	1,386.46	1,386.46	Draining
42.00	371.56	151.56	65.57	77.1	178,611.14	1,452.98	1,452.98	Draining
43.00	370.63	150.63	65.17	70.9	191,433.91	1,486.39	1,486.39	Draining
44.00	369.67	149.67	64.76	64.5	102,249.89	1,422.24	1,422.24	Draining
45.00	368.76	148.76	64.36	58.4	116,917.20	1,369.03	1,369.03	Draining
45.63	368.21	148.21	64.12	54.7	165,509.22	1,346.84	1,346.84	Draining
46.00	367.88	147.88	63.98	52.6	135,273.58	1,202.67	1,202.67	Draining
47.00	367.11	147.11	63.65	47.4	163,111.70	-890.37	890.37	Draining
48.00	366.54	146.54	63.40	43.6	109,688.39	-752.61	752.61	Draining

Detailed Report for Tank: GATEWAY TANK #2



Detailed Report for Tank: RAC TANK

Scenario Summary

Scenario	Full Build Out Average Day
Active Topology Alternative	Full Build Out
Physical Alternative	Base-Physical
Demand Alternative	Average Day Demand
Initial Settings Alternative	Base-Initial Settings
Operational Alternative	Base-Operational
Age Alternative	Base-Age Alternative
Constituent Alternative	Base-Constituent
Trace Alternative	Base-Trace Alternative
Fire Flow Alternative	Base-Fire Flow
Capital Cost Alternative	Base-Capital Cost
Energy Cost Alternative	Base-Energy Cost
User Data Alternative	Base-User Data

Global Adjustments Summary

Demand	<None>	Roughness	<None>
--------	--------	-----------	--------

Geometric Summary

X	77,134.85 ft	Elevation	250.00 ft
Y	631,606.19 ft	Zone	Zone

Demand Summary

Type	Base Flow (gpm)	Pattern
Demand	0.00	Fixed

Operating Range Summary

Maximum Elevation	365.00 ft	Maximum Level	100.00 ft
Initial HGL	360.00 ft	Initial Level	95.00 ft
Minimum Elevation	300.00 ft	Minimum Level	35.00 ft
Base Elevation	265.00 ft		

Storage

Section Type	Constant Area	Circular Tank Shape?	true
Diameter	60.00 ft	Average Area	2,827.4 ft²
Inactive Volume	0.00 gal	Total Active Volume	1,374,793.56 gal

Calculated Results Summary

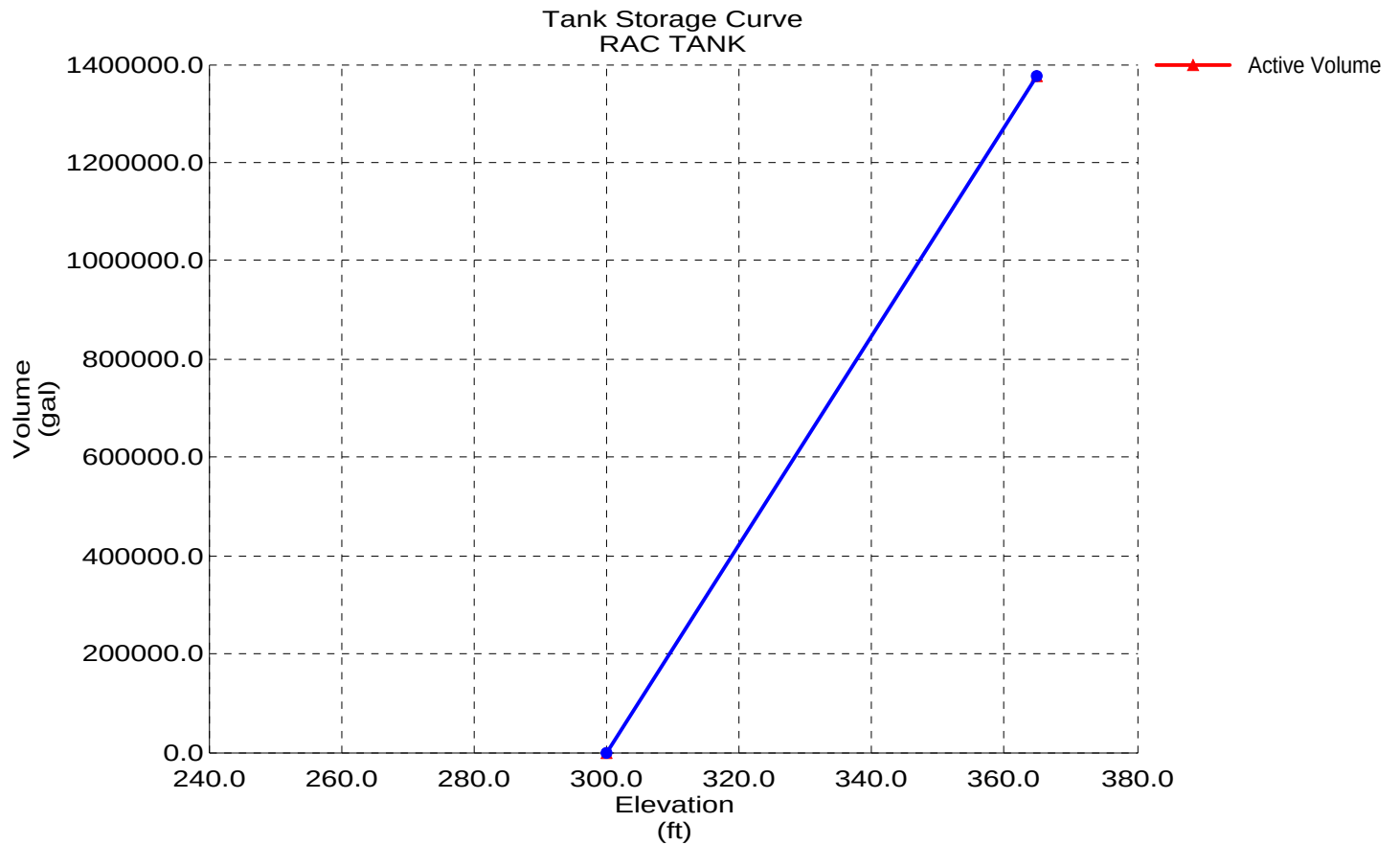
Time (hr)	Calculated Hydraulic Grade (ft)	Calculated Level (ft)	Pressure (psi)	Calculated Percent Full (%)	Calculated Volume (gal)	Inflow (gpm)	Outflow (gpm)	Current Status
0.00	360.00	95.00	41.10	92.3	269,040.21	340.50	-340.50	Filling
1.00	360.97	95.97	41.52	93.8	289,469.89	335.12	-335.12	Filling
2.00	361.92	96.92	41.93	95.3	309,576.84	328.08	-328.08	Filling
3.00	362.85	97.85	42.33	96.7	329,261.66	1,719.99	,719.99	Draining
3.07	362.51	97.51	42.19	96.2	322,180.88	1,732.17	,732.17	Draining
4.00	357.94	92.94	40.21	89.1	225,381.45	1,682.72	,682.72	Draining
5.00	353.16	88.16	38.14	81.8	124,418.11	1,634.57	,634.57	Draining
6.00	348.53	83.53	36.14	74.7	26,343.89	1,591.58	,591.58	Draining
7.00	344.01	79.01	34.18	67.7	30,848.95	508.32	-508.32	Filling
8.00	345.45	80.45	34.81	69.9	61,347.92	477.57	-477.57	Filling
9.00	346.81	81.81	35.39	72.0	90,002.15	440.79	-440.79	Filling

Detailed Report for Tank: RAC TANK

Calculated Results Summary

Time (hr)	Calculated Hydraulic Grade (ft)	Calculated Level (ft)	Pressure (psi)	Calculated Percent Full (%)	Calculated Volume (gal)	Inflow (gpm)	Outflow (gpm)	Current Status
10.00	348.06	83.06	35.94	73.9	16,449.52	414.53	-414.53	Filling
11.00	349.23	84.23	36.44	75.7	141,321.31	384.86	-384.86	Filling
12.00	350.33	85.33	36.92	77.4	164,412.90	355.14	-355.14	Filling
13.00	351.33	86.33	37.35	79.0	185,721.71	325.28	-325.28	Filling
13.01	351.34	86.34	37.35	79.0	185,862.42	376.20	-376.20	Filling
14.00	352.40	87.40	37.81	80.6	108,271.11	380.92	-380.92	Filling
15.00	353.48	88.48	38.28	82.3	131,126.46	381.56	-381.56	Filling
16.00	354.56	89.56	38.75	83.9	154,019.89	380.17	-380.17	Filling
17.00	355.64	90.64	39.22	85.6	176,830.05	376.74	-376.74	Filling
18.00	356.71	91.71	39.68	87.2	199,434.32	373.39	-373.39	Filling
19.00	357.77	92.77	40.14	88.9	221,837.84	369.15	-369.15	Filling
20.00	358.82	93.82	40.59	90.5	243,987.05	366.52	-366.52	Filling
21.00	359.86	94.86	41.04	92.1	265,978.11	363.04	-363.04	Filling
22.00	360.89	95.89	41.48	93.7	287,760.05	361.57	-361.57	Filling
22.22	361.11	96.11	41.58	94.0	292,436.46	327.55	-327.55	Filling
23.00	361.84	96.84	41.90	95.1	307,852.80	309.66	-309.66	Filling
24.00	362.71	97.71	42.28	96.5	326,433.22	282.85	-282.85	Filling
25.00	363.52	98.52	42.62	97.7	343,403.85	254.40	-254.40	Filling
26.00	364.24	99.24	42.94	98.8	358,667.85	222.80	-222.80	Filling
27.00	364.87	99.87	43.21	99.8	372,036.13	1,822.44	,822.44	Draining
28.00	359.70	94.70	40.97	91.8	262,690.10	1,752.64	,752.64	Draining
29.00	354.73	89.73	38.82	84.2	157,531.23	1,694.43	,694.43	Draining
30.00	349.92	84.92	36.74	76.8	155,865.62	1,644.27	,644.27	Draining
31.00	345.26	80.26	34.72	69.6	157,209.18	456.54	-456.54	Filling
31.90	346.42	81.42	35.23	71.4	181,855.06	427.22	-427.22	Filling
32.00	346.54	81.54	35.28	71.6	184,425.31	425.34	-425.34	Filling
33.00	347.75	82.75	35.80	73.5	109,945.79	387.41	-387.41	Filling
33.94	348.79	83.79	36.25	75.1	131,866.50	411.45	-411.45	Filling
34.00	348.85	83.85	36.28	75.2	133,271.69	419.05	-419.05	Filling
35.00	350.04	85.04	36.79	77.0	158,414.57	421.80	-421.80	Filling
36.00	351.24	86.24	37.31	78.8	183,722.70	423.79	-423.79	Filling
37.00	352.44	87.44	37.83	80.7	109,150.23	425.05	-425.05	Filling
38.00	353.65	88.65	38.35	82.5	134,653.29	427.39	-427.39	Filling
39.00	354.86	89.86	38.88	84.4	160,296.41	426.04	-426.04	Filling
40.00	356.07	91.07	39.40	86.3	185,858.85	422.86	-422.86	Filling
41.00	357.27	92.27	39.92	88.1	211,230.88	417.83	-417.83	Filling
41.51	357.87	92.87	40.18	89.0	224,037.59	379.34	-379.34	Filling
42.00	358.40	93.40	40.41	89.8	235,170.61	362.22	-362.22	Filling
43.00	359.43	94.43	40.85	91.4	256,904.14	327.54	-327.54	Filling
44.00	360.36	95.36	41.26	92.9	276,556.68	294.47	-294.47	Filling
45.00	361.19	96.19	41.62	94.1	294,224.41	259.99	-259.99	Filling
45.63	361.65	96.65	41.82	94.8	303,987.10	237.81	-237.81	Filling
46.00	361.90	96.90	41.93	95.2	309,325.76	228.96	-228.96	Filling
47.00	362.55	97.55	42.21	96.2	323,063.88	202.38	-202.38	Filling
48.00	363.13	98.13	42.46	97.1	335,206.41	173.24	-173.24	Filling

Detailed Report for Tank: RAC TANK



Detailed Report for Reservoir: LOTT SUPPLY

Scenario Summary

Scenario	Full Build Out Average Day
Active Topology Alternative	Full Build Out
Physical Alternative	Base-Physical
Demand Alternative	Average Day Demand
Initial Settings Alternative	Base-Initial Settings
Operational Alternative	Base-Operational
Age Alternative	Base-Age Alternative
Constituent Alternative	Base-Constituent
Trace Alternative	Base-Trace Alternative
Fire Flow Alternative	Base-Fire Flow
Capital Cost Alternative	Base-Capital Cost
Energy Cost Alternative	Base-Energy Cost
User Data Alternative	Base-User Data

Global Adjustments Summary

Demand	<None>	Roughness	<None>
--------	--------	-----------	--------

Geometric Summary

X	69,374.44 ft	Elevation	260.00 ft
Y	640,875.49 ft	Zone	Zone

Calculated Results Summary

Time (hr)	Calculated Hydraulic (ft)	Inflow Grade (gpm)	Outflow (gpm)
0.00	260.00	3,040.13	,040.13
1.00	260.00	3,022.63	,022.63
2.00	260.00	3,004.95	,004.95
3.00	260.00	2,987.49	,987.49
3.07	260.00	2,986.34	,986.34
4.00	260.00	2,939.20	,939.20
5.00	260.00	2,888.68	,888.68
6.00	260.00	2,838.28	,838.28
7.00	260.00	2,788.01	,788.01
8.00	260.00	2,737.87	,737.87
9.00	260.00	2,687.85	,687.85
10.00	260.00	2,637.97	,637.97
11.00	260.00	2,588.22	,588.22
12.00	260.00	2,538.60	,538.60
13.00	260.00	2,489.11	,489.11
13.01	260.00	2,488.76	,488.76
14.00	260.00	2,505.55	,505.55
15.00	260.00	2,520.07	,520.07
16.00	260.00	2,532.68	,532.68
17.00	260.00	2,543.69	,543.69
18.00	260.00	2,553.34	,553.34
19.00	260.00	2,561.75	,561.75
20.00	260.00	2,568.91	,568.91
21.00	260.00	2,574.63	,574.63
22.00	260.00	2,578.95	,578.95
22.22	260.00	2,579.50	,579.50
23.00	260.00	2,540.66	,540.66
24.00	260.00	2,491.17	,491.17
25.00	260.00	2,441.82	,441.82
26.00	260.00	2,392.60	,392.60

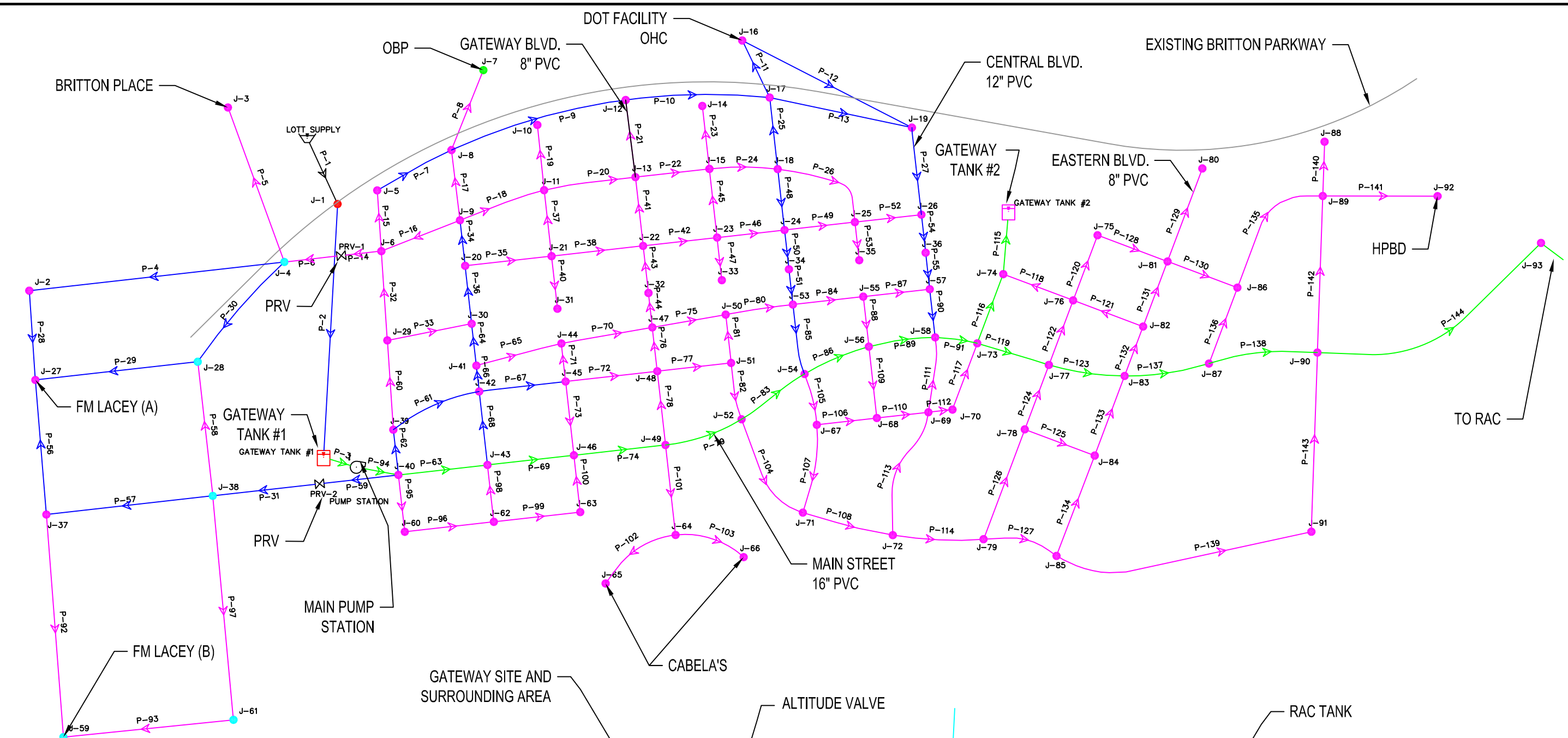
Detailed Report for Reservoir: LOTT SUPPLY

Calculated Results Summary			
Time (hr)	Calculated Hydraulic Grade (ft)	Inflow (gpm)	Outflow (gpm)
27.00	260.00	2,343.53	,343.53
28.00	260.00	2,294.60	,294.60
29.00	260.00	2,245.81	,245.81
30.00	260.00	2,197.17	,197.17
31.00	260.00	2,148.68	,148.68
31.90	260.00	0.00	0.00
32.00	260.00	0.00	0.00
33.00	260.00	0.00	0.00
33.94	260.00	0.00	0.00
34.00	260.00	2,110.17	,110.17
35.00	260.00	2,146.80	,146.80
36.00	260.00	2,179.59	,179.59
37.00	260.00	2,208.84	,208.84
38.00	260.00	2,234.88	,234.88
39.00	260.00	2,257.81	,257.81
40.00	260.00	2,278.22	,278.22
41.00	260.00	2,296.50	,296.50
41.51	260.00	2,304.91	,304.91
42.00	260.00	2,281.14	,281.14
43.00	260.00	2,232.40	,232.40
44.00	260.00	2,183.79	,183.79
45.00	260.00	2,135.34	,135.34
45.63	260.00	0.00	0.00
46.00	260.00	0.00	0.00
47.00	260.00	0.00	0.00
48.00	260.00	0.00	0.00

APPENDIX F – Max Day Analysis

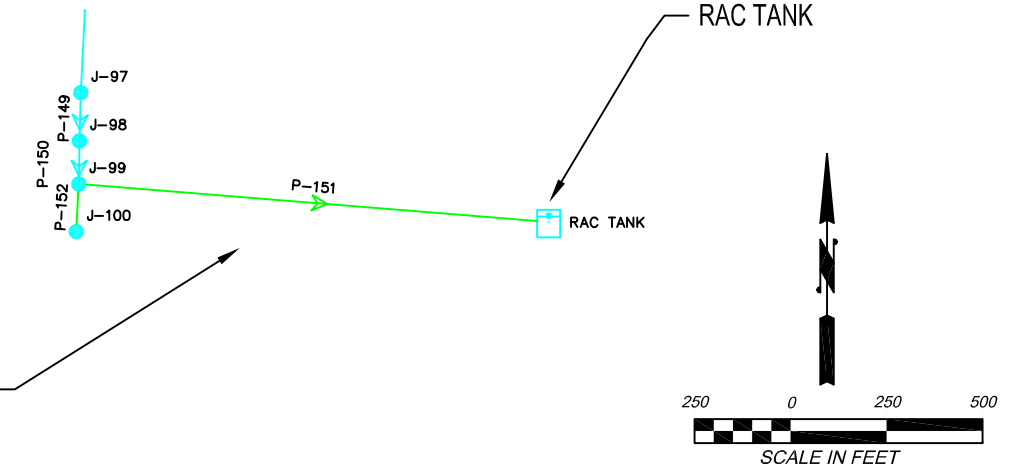
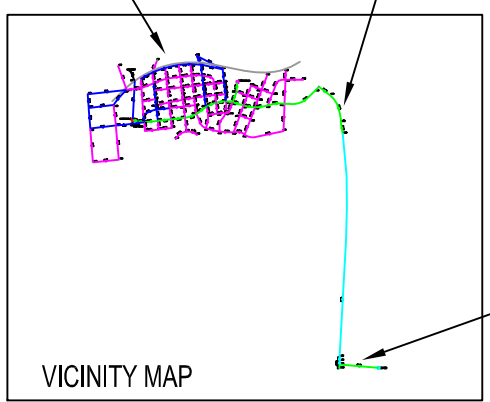
- Map Exhibit
- Junction Results
- Pipe Results
- Main Pump Station Results
- Overall Tank Summary
- Gateway Tank #1 Results
- Gateway Tank #2 Results
- RAC Tank Results
- Reservoir Results

Sep 11, 2008 - 3:07pm - User shendon-gentry
H:\proj\15083001\docs\WaterCAD\Full Build Out --- Three Tanks --- Main Model.dwg



PIPE LEGEND	
DIAMETER	
8"	
EX. 10"	
12"	
16"	

NODE LEGEND	
PRESSURE (PSI)	
<20	
21-40	
41-60	
61-80	
80-100	



CITY OF LACEY, WASHINGTON
DEPARTMENT OF PUBLIC WORKS
420 COLLEGE STREET S.E. P.O. BOX 3400
LACEY, WA 98509-3400 (360) 491-5600



APPROVED FOR CONSTRUCTION
DIRECTOR OF PUBLIC WORKS DATE
HUITT-ZOLLARS
Huitt-Zollars, Inc. Seattle
814 East Pike Street
Seattle, Washington, 98122-3893
Phone (206) 324-5500 Fax (206) 328-1880

DESIGNED BY	DATE
DRAWN BY	DATE
CHECKED BY	DATE
APPROVED BY	DATE
FILENAME:	Full Build Out -- Three Tanks -- Main Model.dwg

LACEY GATEWAY
PHASE I
RECLAIMED WATER EXHIBIT
Full Build Out
MAX DAY

REVISION BLOCK		
NO.	DATE	DESCRIPTION

DRAWING NUMBER
SHT ____ OF ____

N.G.V.D. OF 1929
CALL 2 WORKING DAYS BEFORE YOU DIG
1-800-424-5555
UTILITIES UNDERGROUND LOCATION CENTER

Scenario: Full Build Out Max Day
Extended Period Analysis: 0.00 hr / 48.00
Junction Report

Label	Elevation (ft)	Zone	Type	Base Flow (gpm)	Maximum Pressure (psi)	Minimum Pressure (psi)	Maximum Hydraulic Grade (ft)	Minimum Hydraulic Grade (ft)
J-1	217.50	Zone	Demand	0.00	18.25	18.22	259.67	259.62
J-2	160.00	Zone	Demand	0.00	62.69	62.44	304.89	304.33
J-3	160.00	Zone	Demand	101.82	62.65	62.15	304.80	303.66
J-4	190.00	Zone	Demand	26.13	49.71	49.48	304.89	304.36
J-5	210.00	Zone	Demand	0.00	70.12	68.64	372.08	368.65
J-6	206.00	Zone	Demand	37.23	71.95	70.41	372.29	368.74
J-7	175.00	Zone	Demand	193.91	85.15	83.45	371.82	367.87
J-8	216.00	Zone	Demand	0.00	67.51	66.04	372.04	368.63
J-9	213.42	Zone	Demand	17.84	68.79	67.31	372.41	368.99
J-10	218.00	Zone	Demand	5.97	66.72	65.29	372.22	368.90
J-11	214.50	Zone	Demand	7.90	68.24	66.80	372.22	368.90
J-12	221.00	Zone	Demand	0.00	65.28	63.87	371.88	368.63
J-13	216.00	Zone	Demand	5.24	67.49	66.10	371.98	368.77
J-14	219.00	Zone	Demand	4.89	66.11	64.78	371.80	368.72
J-15	218.00	Zone	Demand	6.51	66.54	65.21	371.80	368.72
J-16	226.00	Zone	Demand	439.53	62.98	61.62	371.58	368.43
J-17	219.85	Zone	Demand	0.00	65.66	64.34	371.62	368.57
J-18	217.22	Zone	Demand	20.33	66.81	65.51	371.63	368.64
J-19	220.16	Zone	Demand	0.00	65.49	64.21	371.53	368.56
J-20	210.93	Zone	Demand	20.71	69.92	68.45	372.54	369.14
J-21	210.00	Zone	Demand	17.58	70.19	68.75	372.23	368.91
J-22	212.00	Zone	Demand	3.08	69.26	67.87	372.08	368.87
J-23	213.92	Zone	Demand	12.10	68.31	66.98	371.80	368.73
J-24	215.45	Zone	Demand	15.41	67.57	66.29	371.63	368.67
J-25	217.00	Zone	Demand	12.73	66.87	65.59	371.56	368.60
J-26	219.00	Zone	Demand	16.19	65.94	64.69	371.41	368.52
J-27	150.00	Zone	Demand	190.33	67.01	66.76	304.88	304.31
J-28	170.00	Zone	Demand	0.00	58.36	58.13	304.89	304.36
J-29	199.00	Zone	Demand	0.00	75.25	73.76	372.92	369.49
J-30	205.63	Zone	Demand	37.17	72.36	70.89	372.88	369.48
J-31	206.00	Zone	Demand	20.17	71.92	70.48	372.22	368.90
J-32	207.00	Zone	Demand	8.70	71.49	70.12	372.24	369.07
J-33	209.00	Zone	Demand	12.99	70.44	69.10	371.80	368.72
J-34	211.00	Zone	Demand	12.67	69.50	68.22	371.63	368.68
J-35	213.00	Zone	Demand	12.57	68.60	67.32	371.56	368.60
J-36	216.00	Zone	Demand	13.61	67.19	65.97	371.31	368.49
J-37	165.00	Zone	Demand	0.00	60.52	60.29	304.89	304.35
J-38	170.00	Zone	Demand	0.00	58.38	58.22	304.94	304.57
J-39	201.00	Zone	Demand	10.34	74.78	73.30	373.85	370.42
J-40	202.50	Zone	Demand	1.38	74.37	72.87	374.40	370.93
J-41	202.90	Zone	Demand	11.01	73.64	72.18	373.11	369.74
J-42	203.58	Zone	Demand	9.53	73.43	71.98	373.30	369.94
J-43	208.00	Zone	Demand	3.32	71.63	70.18	373.57	370.20
J-44	206.00	Zone	Demand	14.66	72.25	70.82	372.98	369.68
J-45	213.00	Zone	Demand	8.85	69.26	67.84	373.09	369.80
J-46	219.00	Zone	Demand	3.18	66.67	65.25	373.09	369.82
J-47	206.00	Zone	Demand	8.33	71.98	70.62	372.36	369.22
J-48	216.00	Zone	Demand	2.74	67.68	66.33	372.44	369.31
J-49	227.00	Zone	Demand	2.89	62.94	61.59	372.47	369.37
J-50	209.75	Zone	Demand	7.56	70.23	68.93	372.08	369.06
J-51	215.00	Zone	Demand	1.70	67.98	66.67	372.12	369.09
J-52	220.00	Zone	Demand	3.03	65.77	64.48	372.01	369.03
J-53	210.00	Zone	Demand	8.03	69.93	68.66	371.63	368.70
J-54	222.00	Zone	Demand	2.74	64.73	63.48	371.62	368.72

Scenario: Full Build Out Max Day
Extended Period Analysis: 0.00 hr / 48.00
Junction Report

Label	Elevation (ft)	Zone	Type	Base Flow (gpm)	Maximum Pressure (psi)	Minimum Pressure (psi)	Maximum Hydraulic Grade (ft)	Minimum Hydraulic Grade (ft)
J-55	213.00	Zone	Demand	7.77	68.51	67.30	371.34	368.55
J-56	224.50	Zone	Demand	2.70	63.52	62.32	371.32	368.54
J-57	216.00	Zone	Demand	5.70	67.16	65.96	371.24	368.46
J-58	227.00	Zone	Demand	3.38	62.38	61.17	371.19	368.38
J-59	170.00	Zone	Demand	190.33	58.29	57.77	304.72	303.52
J-60	200.00	Zone	Demand	6.32	75.32	73.82	374.08	370.63
J-61	170.00	Zone	Demand	0.00	58.33	57.96	304.82	303.97
J-62	206.00	Zone	Demand	6.85	72.51	71.05	373.59	370.21
J-63	219.05	Zone	Demand	0.61	66.73	65.30	373.29	369.98
J-64	211.58	Zone	Demand	0.00	69.57	68.19	372.38	369.19
J-65	206.71	Zone	Demand	49.96	71.38	69.07	371.68	366.36
J-66	206.71	Zone	Demand	49.96	71.43	69.29	371.80	366.85
J-67	218.00	Zone	Demand	2.26	66.40	65.17	371.46	368.62
J-68	221.00	Zone	Demand	4.41	65.02	63.82	371.29	368.52
J-69	221.00	Zone	Demand	6.30	64.98	63.76	371.19	368.37
J-70	222.00	Zone	Demand	3.06	64.53	63.31	371.16	368.32
J-71	214.00	Zone	Demand	5.83	68.13	66.90	371.46	368.62
J-72	211.00	Zone	Demand	10.09	69.30	68.06	371.17	368.32
J-73	225.00	Zone	Demand	3.92	63.20	61.94	371.07	368.17
J-74	222.00	Zone	Demand	37.56	64.49	63.23	371.06	368.15
J-75	219.00	Zone	Demand	6.76	65.67	64.34	370.79	367.72
J-76	219.00	Zone	Demand	1.05	65.71	64.40	370.87	367.85
J-77	221.00	Zone	Demand	2.70	64.86	63.55	370.90	367.89
J-78	217.00	Zone	Demand	4.58	66.58	65.27	370.89	367.86
J-79	206.00	Zone	Demand	6.27	71.36	70.05	370.93	367.90
J-80	224.00	Zone	Demand	5.70	63.49	62.12	370.74	367.58
J-81	217.50	Zone	Demand	1.66	66.30	64.93	370.75	367.58
J-82	213.00	Zone	Demand	0.83	68.27	66.92	370.79	367.67
J-83	211.00	Zone	Demand	4.22	69.13	67.78	370.79	367.66
J-84	207.00	Zone	Demand	6.78	70.88	69.55	370.84	367.74
J-85	202.00	Zone	Demand	6.15	73.05	71.71	370.84	367.74
J-86	216.00	Zone	Demand	1.37	66.90	65.42	370.62	367.21
J-87	214.00	Zone	Demand	6.12	67.79	66.33	370.69	367.32
J-88	220.00	Zone	Demand	2.99	64.89	62.98	369.99	365.56
J-89	219.00	Zone	Demand	1.00	65.33	63.41	369.99	365.56
J-90	214.00	Zone	Demand	4.48	67.75	66.18	370.59	366.97
J-91	205.00	Zone	Demand	6.89	71.69	70.19	370.69	367.24
J-92	220.00	Zone	Demand	408.96	64.31	60.84	368.65	360.63
J-93	220.00	Zone	Demand	0.00	65.09	63.32	370.44	366.36
J-94	220.00	Zone	Demand	0.00	65.07	63.23	370.39	366.15
J-95	238.00	Zone	Demand	0.00	57.23	55.23	370.28	365.66
J-96	236.00	Zone	Demand	0.00	58.08	56.02	370.24	365.48
J-97	225.00	Zone	Demand	0.00	59.39	39.07	362.27	315.31
J-98	225.00	Zone	Demand	0.00	59.33	38.67	362.12	314.39
J-99	225.00	Zone	Demand	0.00	59.27	38.32	362.00	313.57
J-100	225.00	Zone	Demand	4,200.00	59.27	37.54	362.00	311.78

Scenario: Full Build Out Max Day
Extended Period Analysis: 0.00 hr / 48.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen- Williams C	Maximum Velocity (ft/s)	Minimum Velocity (ft/s)	Maximum Discharge (gpm)	Minimum Discharge (gpm)	Maximum Headloss Gradient (ft/1000ft)	Minimum Headloss Gradient (ft/1000ft)
P-1	345.00	24.0	PVC	100.0	2.16	1.98	3,040.13	2,793.05	1.10	0.94
P-2	211.00	12.0	PVC	100.0	8.62	7.92	3,040.13	2,793.05	32.30	27.61
P-3	164.00	16.0	PVC	100.0	4.38	3.35	2,747.19	2,098.38	6.59	4.00
P-4	225.00	12.0	PVC	100.0	0.19	0.07	66.84	26.42	0.03	0.00
P-5	785.00	8.0	PVC	100.0	0.97	0.26	151.71	40.73	0.90	0.08
P-6	273.00	8.0	PVC	100.0	1.67	0.73	262.29	113.93	2.49	0.53
P-7	404.00	12.0	PVC	100.0	0.39	0.09	-33.12	-135.89	0.10	0.01
P-8	410.00	8.0	PVC	100.0	1.66	0.73	260.71	114.21	2.46	0.53
P-9	868.00	12.0	PVC	100.0	0.54	0.00	69.20	-189.24	0.19	0.00
P-10	689.00	12.0	PVC	100.0	0.77	0.05	-16.89	-270.69	0.37	0.00
P-11	302.00	12.0	PVC	100.0	0.87	0.34	-119.25	-305.20	0.46	0.08
P-12	910.00	12.0	PVC	100.0	0.46	0.01	88.62	-161.40	0.14	0.00
P-13	694.00	12.0	PVC	100.0	0.44	0.10	-33.52	-153.86	0.13	0.01
P-14	193.00	8.0	PVC	100.0	1.67	0.73	262.29	113.93	2.49	0.53
P-15	291.00	8.0	PVC	100.0	0.87	0.21	135.89	33.12	0.74	0.05
P-16	403.00	8.0	PVC	100.0	0.86	0.48	134.31	75.91	0.72	0.25
P-17	338.00	8.0	PVC	100.0	1.15	0.86	-135.17	-179.45	1.23	0.73
P-18	427.00	8.0	PVC	100.0	0.66	0.32	102.81	49.56	0.44	0.11
P-19	313.00	8.0	PVC	100.0	0.06	0.02	8.90	2.39	0.00	0.00
P-20	441.00	8.0	PVC	100.0	0.73	0.41	114.69	64.76	0.54	0.19
P-21	371.00	8.0	PVC	100.0	0.65	0.43	102.34	66.79	0.44	0.20
P-22	355.00	8.0	PVC	100.0	0.71	0.28	111.95	43.88	0.51	0.09
P-23	302.00	8.0	PVC	100.0	0.05	0.01	7.29	1.96	0.00	0.00
P-24	327.00	8.0	PVC	100.0	0.72	0.34	112.31	53.22	0.52	0.13
P-25	344.00	12.0	PVC	100.0	0.61	0.15	-53.98	-214.04	0.24	0.02
P-26	518.00	8.0	PVC	100.0	0.35	0.11	55.11	17.71	0.14	0.02
P-27	418.00	12.0	PVC	100.0	0.69	0.03	242.48	-127.88	0.30	0.00
P-28	427.00	12.0	PVC	100.0	0.19	0.07	66.84	26.42	0.03	0.00
P-29	780.00	12.0	PVC	100.0	0.28	0.11	-39.61	-99.27	0.06	0.01
P-30	632.00	12.0	PVC	100.0	0.08	0.00	26.91	-2.17	0.01	0.00
P-31	513.00	12.0	PVC	100.0	1.25	0.54	440.85	190.33	0.90	0.19
P-32	427.00	8.0	PVC	100.0	1.47	1.06	230.12	165.87	1.95	1.07
P-33	410.00	8.0	PVC	100.0	0.30	0.11	-16.48	-46.31	0.10	0.01
P-34	219.00	12.0	PVC	100.0	1.14	0.85	403.46	300.18	0.77	0.44
P-35	415.00	8.0	PVC	100.0	0.89	0.58	-91.58	-139.38	0.77	0.35
P-36	278.00	12.0	PVC	100.0	1.60	1.18	564.85	415.34	1.43	0.81
P-37	317.00	8.0	PVC	100.0	0.20	0.11	-17.59	-31.21	0.05	0.02
P-38	440.00	8.0	PVC	100.0	0.57	0.22	-33.97	-89.85	0.34	0.06
P-40	253.00	8.0	PVC	100.0	0.16	0.09	25.11	13.43	0.03	0.01
P-41	330.00	8.0	PVC	100.0	0.57	0.42	89.80	65.79	0.34	0.19
P-42	355.00	8.0	PVC	100.0	0.89	0.50	-78.34	-139.76	0.78	0.27
P-43	226.00	8.0	PVC	100.0	0.99	0.68	155.23	107.18	0.94	0.47
P-44	165.00	8.0	PVC	100.0	1.05	0.73	164.54	114.14	1.05	0.53
P-45	330.00	8.0	PVC	100.0	0.15	0.05	23.70	7.10	0.03	0.00
P-46	324.00	8.0	PVC	100.0	0.72	0.24	-37.57	-113.25	0.53	0.07
P-47	205.00	8.0	PVC	100.0	0.10	0.06	-8.71	-16.38	0.01	0.00
P-48	292.00	12.0	PVC	100.0	0.52	0.03	183.33	10.68	0.18	0.00
P-49	338.00	8.0	PVC	100.0	0.45	0.31	-48.92	-71.04	0.22	0.11
P-50	189.00	12.0	PVC	100.0	0.61	0.04	214.49	-21.32	0.24	0.00
P-51	169.00	12.0	PVC	100.0	0.65	0.02	228.81	-12.23	0.27	0.00
P-52	319.00	8.0	PVC	100.0	0.68	0.31	-47.84	-106.18	0.47	0.11
P-53	183.00	8.0	PVC	100.0	0.10	0.05	16.12	8.49	0.01	0.00
P-54	183.00	12.0	PVC	100.0	0.96	0.02	338.10	-95.91	0.55	0.00

Scenario: Full Build Out Max Day
Extended Period Analysis: 0.00 hr / 48.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen- Williams C	Maximum Velocity (ft/s)	Minimum Velocity (ft/s)	Maximum Discharge (gpm)	Minimum Discharge (gpm)	Maximum Headloss Gradient (ft/1000ft)	Minimum Headloss Gradient (ft/1000ft)
P-55	175.00	12.0	PVC	100.0	0.93	0.00	328.65	-110.30	0.52	0.00
P-56	644.00	12.0	PVC	100.0	0.27	0.10	95.15	35.12	0.05	0.01
P-57	799.00	12.0	PVC	100.0	0.67	0.29	234.96	101.63	0.28	0.06
P-58	644.00	8.0	PVC	100.0	0.57	0.25	88.95	38.76	0.34	0.07
P-59	379.00	12.0	PVC	100.0	1.25	0.54	440.85	190.33	0.90	0.19
P-60	427.00	8.0	PVC	100.0	1.66	1.27	260.81	198.97	2.46	1.49
P-61	453.00	12.0	PVC	100.0	1.52	1.15	-404.52	-536.83	1.30	0.77
P-62	217.00	12.0	PVC	100.0	2.30	1.74	810.00	612.23	2.79	1.66
P-63	428.00	16.0	PVC	100.0	2.36	1.77	1,478.74	1,111.03	2.09	1.23
P-64	201.00	12.0	PVC	100.0	1.61	1.17	566.60	413.31	1.44	0.80
P-65	419.00	8.0	PVC	100.0	0.53	0.30	-47.32	-83.51	0.30	0.10
P-66	124.00	12.0	PVC	100.0	1.82	1.37	640.76	483.63	1.81	1.07
P-67	415.00	12.0	PVC	100.0	0.91	0.63	-223.71	-321.74	0.50	0.26
P-68	353.00	12.0	PVC	100.0	1.21	0.92	425.54	324.14	0.85	0.51
P-69	415.00	16.0	PVC	100.0	1.72	1.28	-802.76	-1,079.62	1.17	0.68
P-70	441.00	8.0	PVC	100.0	1.23	0.88	-137.76	-193.11	1.41	0.76
P-71	183.00	8.0	PVC	100.0	0.84	0.63	-99.07	-132.18	0.70	0.41
P-72	440.00	8.0	PVC	100.0	1.27	0.91	-143.02	-198.78	1.49	0.81
P-73	354.00	8.0	PVC	100.0	0.27	0.01	-2.14	-41.55	0.08	0.00
P-74	440.00	16.0	PVC	100.0	1.91	1.39	-871.48	-1,197.00	1.42	0.79
P-75	356.00	8.0	PVC	100.0	0.90	0.53	-83.77	-140.42	0.78	0.30
P-76	211.00	8.0	PVC	100.0	0.69	0.48	107.32	75.26	0.48	0.25
P-77	355.00	8.0	PVC	100.0	0.97	0.62	-97.89	-151.36	0.90	0.40
P-78	354.00	8.0	PVC	100.0	0.37	0.22	58.75	34.88	0.16	0.06
P-79	386.00	16.0	PVC	100.0	1.73	1.10	-691.78	-1,084.58	1.18	0.51
P-80	324.00	8.0	PVC	100.0	1.23	0.77	-121.41	-192.21	1.40	0.60
P-81	232.00	8.0	PVC	100.0	0.40	0.29	62.80	45.14	0.18	0.10
P-82	275.00	8.0	PVC	100.0	0.60	0.31	-48.11	-94.26	0.37	0.11
P-83	371.00	16.0	PVC	100.0	1.63	1.02	-642.29	-1,019.96	1.05	0.45
P-84	338.00	8.0	PVC	100.0	0.94	0.40	-62.58	-147.09	0.85	0.18
P-85	338.00	12.0	PVC	100.0	0.44	0.00	52.19	-156.63	0.13	0.00
P-86	334.00	16.0	PVC	100.0	1.51	0.74	946.03	462.93	0.92	0.24
P-87	319.00	8.0	PVC	100.0	0.62	0.41	-63.74	-96.49	0.39	0.18
P-88	240.00	8.0	PVC	100.0	0.29	0.01	18.83	-45.52	0.10	0.00
P-89	320.00	16.0	PVC	100.0	1.51	0.67	-421.69	-946.77	0.92	0.21
P-90	231.00	12.0	PVC	100.0	1.20	0.09	421.43	-35.66	0.83	0.01
P-91	203.00	16.0	PVC	100.0	2.20	0.71	1,379.49	446.08	1.84	0.23
P-92	066.00	8.0	PVC	100.0	0.90	0.38	140.33	59.03	0.78	0.16
P-93	816.00	8.0	PVC	100.0	0.75	0.32	-49.60	-116.95	0.56	0.11
P-94	204.00	16.0	PVC	100.0	4.38	3.35	2,747.19	2,098.38	6.59	4.00
P-95	273.00	8.0	PVC	100.0	1.20	0.88	-137.31	-188.51	1.35	0.75
P-96	428.00	8.0	PVC	100.0	1.13	0.85	177.13	133.66	1.20	0.71
P-97	074.00	8.0	PVC	100.0	0.75	0.32	116.95	49.60	0.56	0.11
P-98	273.00	8.0	PVC	100.0	0.26	0.17	41.49	26.09	0.08	0.03
P-99	415.00	8.0	PVC	100.0	0.86	0.64	134.95	100.72	0.73	0.42
P-100	273.00	8.0	PVC	100.0	0.86	0.64	-100.11	-134.52	0.72	0.42
P-101	432.00	8.0	PVC	100.0	0.95	0.26	-39.97	-148.88	0.87	0.08
P-102	422.00	4.0	PVC	100.0	1.90	0.51	74.44	19.98	7.07	0.62
P-103	352.00	4.0	PVC	100.0	1.90	0.51	74.44	19.98	7.07	0.62
P-104	558.00	8.0	PVC	100.0	1.01	0.61	158.88	95.73	0.98	0.39
P-105	250.00	8.0	PVC	100.0	0.80	0.42	-66.06	-125.34	0.63	0.19
P-106	288.00	8.0	PVC	100.0	0.79	0.37	-57.44	-123.51	0.62	0.15
P-107	428.00	8.0	PVC	100.0	0.06	0.00	7.32	-9.53	0.01	0.00

Scenario: Full Build Out Max Day
Extended Period Analysis: 0.00 hr / 48.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen- Williams C	Maximum Velocity (ft/s)	Minimum Velocity (ft/s)	Maximum Discharge (gpm)	Minimum Discharge (gpm)	Maximum Headloss Gradient (ft/1000ft)	Minimum Headloss Gradient (ft/1000ft)
P-108	443.00	8.0	PVC	100.0	1.02	0.61	159.10	95.17	0.99	0.38
P-109	343.00	8.0	PVC	100.0	0.28	0.16	-24.50	-43.58	0.09	0.03
P-110	247.00	8.0	PVC	100.0	1.05	0.50	-77.72	-164.52	1.05	0.26
P-111	361.00	8.0	PVC	100.0	0.18	0.00	28.06	-14.16	0.04	0.00
P-112	115.00	8.0	PVC	100.0	0.94	0.28	-43.48	-146.54	0.85	0.09
P-113	633.00	8.0	PVC	100.0	0.35	0.00	54.94	-0.81	0.14	0.00
P-114	435.00	8.0	PVC	100.0	1.08	0.69	168.54	108.52	1.10	0.49
P-115	300.00	16.0	PVC	100.0	1.42	0.01	787.31	-890.15	0.82	0.00
P-116	353.00	16.0	PVC	100.0	1.42	0.01	533.80	-887.44	0.81	0.00
P-117	338.00	8.0	PVC	100.0	0.92	0.25	-39.69	-144.75	0.83	0.08
P-118	357.00	8.0	PVC	100.0	1.29	0.01	35.48	-201.42	1.53	0.00
P-119	357.00	16.0	PVC	100.0	1.74	0.75	1,089.30	470.14	1.19	0.25
P-120	332.00	8.0	PVC	100.0	0.79	0.26	123.29	40.26	0.62	0.08
P-121	356.00	8.0	PVC	100.0	0.88	0.11	-16.83	-137.22	0.75	0.02
P-122	330.00	8.0	PVC	100.0	0.60	0.28	93.96	44.28	0.37	0.09
P-123	366.00	16.0	PVC	100.0	1.53	0.66	956.91	412.14	0.94	0.20
P-124	328.00	8.0	PVC	100.0	0.44	0.02	16.96	-68.64	0.21	0.00
P-125	356.00	8.0	PVC	100.0	0.65	0.23	101.43	35.96	0.43	0.06
P-126	560.00	8.0	PVC	100.0	0.42	0.20	-31.64	-65.27	0.19	0.05
P-127	369.00	8.0	PVC	100.0	0.73	0.41	114.13	64.62	0.53	0.19
P-128	356.00	8.0	PVC	100.0	0.73	0.23	114.02	36.23	0.53	0.06
P-129	474.00	8.0	PVC	100.0	0.05	0.01	-2.28	-8.49	0.00	0.00
P-130	356.00	8.0	PVC	100.0	1.27	0.51	199.39	79.46	1.50	0.27
P-131	332.00	8.0	PVC	100.0	0.61	0.30	-47.44	-95.28	0.38	0.10
P-132	252.00	8.0	PVC	100.0	0.27	0.05	43.00	-37.38	0.09	0.00
P-133	406.00	8.0	PVC	100.0	0.54	0.33	-51.58	-84.04	0.30	0.12
P-134	512.00	8.0	PVC	100.0	0.15	0.00	23.38	-11.06	0.03	0.00
P-135	671.00	8.0	PVC	100.0	1.91	0.82	-129.05	-298.63	3.17	0.67
P-136	387.00	8.0	PVC	100.0	0.66	0.26	-41.42	-104.00	0.45	0.08
P-137	409.00	16.0	PVC	100.0	1.72	0.71	1,076.70	442.89	1.16	0.22
P-138	524.00	16.0	PVC	100.0	1.55	0.62	974.02	390.44	0.97	0.18
P-139	252.00	8.0	PVC	100.0	0.74	0.32	-50.06	-115.94	0.55	0.12
P-140	259.00	8.0	PVC	100.0	0.03	0.01	-1.20	-4.46	0.00	0.00
P-141	548.00	8.0	PVC	100.0	3.51	1.54	-240.87	-549.84	9.81	2.13
P-142	748.00	8.0	PVC	100.0	1.65	0.68	-106.86	-258.81	2.43	0.47
P-143	856.00	8.0	PVC	100.0	0.69	0.32	-50.06	-107.67	0.48	0.12
P-144	259.00	16.0	PVC	100.0	1.35	0.49	843.61	309.78	0.74	0.12
P-145	432.00	16.0	PVC	100.0	1.35	0.49	-309.78	-843.61	0.74	0.12
P-146	948.00	16.0	PVC	100.0	1.35	0.49	843.61	309.78	0.74	0.12
P-147	369.00	16.0	PVC	100.0	1.35	0.49	843.61	309.78	0.74	0.12
P-148	975.00	10.0	PVC	100.0	3.45	1.27	843.61	309.78	7.31	1.14
P-149	126.00	10.0	PVC	100.0	3.45	1.27	843.61	309.78	7.31	1.14
P-150	112.00	10.0	PVC	100.0	3.45	1.27	843.61	309.78	7.31	1.14
P-151	228.00	16.0	PVC	100.0	5.89	0.49	814.19	-3,690.29	11.39	0.12
P-152	124.00	16.0	PVC	100.0	6.70	0.00	0.00	-4,200.00	14.47	0.00

Detailed Report for Pump: PUMP STATION

Scenario Summary

Scenario	Full Build Out Max Day
Active Topology Alternative	Full Build Out
Physical Alternative	Base-Physical
Demand Alternative	Max Day Demand
Initial Settings Alternative	Base-Initial Settings
Operational Alternative	Base-Operational
Age Alternative	Base-Age Alternative
Constituent Alternative	Base-Constituent
Trace Alternative	Base-Trace Alternative
Fire Flow Alternative	Base-Fire Flow
Capital Cost Alternative	Base-Capital Cost
Energy Cost Alternative	Base-Energy Cost
User Data Alternative	Base-User Data

Global Adjustments Summary

Demand	Multiply 1.0	Roughness	<None>
--------	--------------	-----------	--------

Geometric Summary

X	69,608.68 ft	Upstream Pipe	P-3
Y	639,305.92 ft	Downstream Pipe	P-94
Elevation	218.00 ft		

Pump Definition Summary

Pump Definition	Max Day Pump Station
-----------------	----------------------

Initial Status

Initial Pump Status	On	Initial Relative Speed Facto	1.00
---------------------	----	------------------------------	------

Simple Controls

Controls

Off if node GATEWAY TANK #2 ab

On if node GATEWAY TANK #2 bel

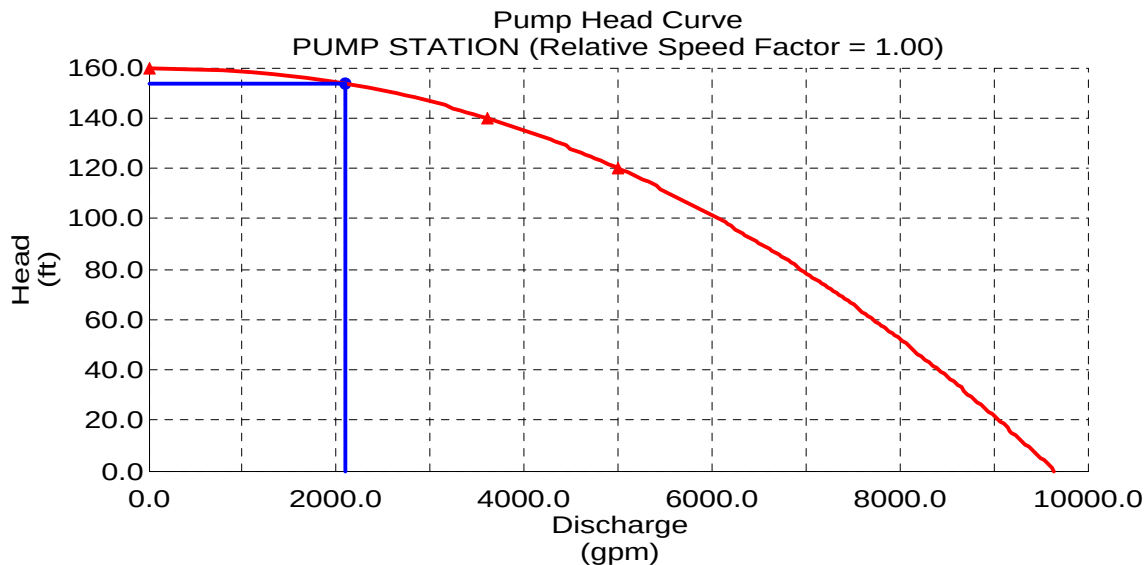
Calculated Results Summary

Time (hr)	Control Status	Intake Pump Grade (ft)	Discharge Pump Grade (ft)	Intake Pump Pressure (psi)	Discharge Pump Pressure (psi)	Discharge (gpm)	Pump Head (ft)	Relative Speed	Calculated Water Power (Hp)
0.00	On	19.84	373.44	0.80	67.25	2,098.42	53.60	1.00	81.37
1.00	On	20.22	373.82	0.96	67.41	2,098.38	53.60	1.00	81.37
2.00	On	20.57	373.95	1.11	67.47	2,131.22	53.38	1.00	82.53
3.00	On	20.89	373.88	1.25	67.44	2,189.12	53.00	1.00	84.56
4.00	On	21.15	373.57	1.36	67.31	2,273.45	52.42	1.00	87.48
5.00	On	21.38	373.21	1.46	67.15	2,356.42	51.82	1.00	90.32
6.00	On	21.58	372.87	1.55	67.00	2,428.61	51.28	1.00	92.76
7.00	On	21.75	372.54	1.62	66.86	2,493.00	50.79	1.00	94.91
8.00	On	21.91	372.38	1.69	66.79	2,533.50	50.47	1.00	96.25
9.00	On	22.04	372.12	1.75	66.68	2,581.14	50.09	1.00	97.81
10.00	On	22.18	372.25	1.81	66.74	2,583.23	50.07	1.00	97.88
11.00	On	22.31	372.33	1.86	66.77	2,589.13	50.02	1.00	98.07
12.00	On	22.44	372.48	1.92	66.84	2,587.12	50.04	1.00	98.00
13.00	On	22.58	372.65	1.98	66.91	2,582.98	50.07	1.00	97.87
14.00	On	22.72	372.91	2.04	67.02	2,568.25	50.19	1.00	97.39

Detailed Report for Pump: PUMP STATION

Calculated Results Summary

Time (hr)	Control Status	Intake Pump Grade (ft)	Discharge Pump Grade (ft)	Intake Pump Pressure (psi)	Discharge Pump Pressure (psi)	Discharge (gpm)	Pump Head (ft)	Relative Speed	Calculated Water Power (Hp)
15.00	On	22.85	373.05	2.10	67.08	2,568.31	50.19	1.00	97.39
16.00	On	22.98	373.05	2.15	67.08	2,582.54	50.08	1.00	97.85
17.00	On	23.09	372.98	2.20	67.05	2,604.54	49.90	1.00	98.57
18.00	On	23.18	372.82	2.24	66.98	2,635.50	49.64	1.00	99.57
19.00	On	23.26	372.69	2.27	66.93	2,661.26	49.43	1.00	100.40
20.00	On	23.33	372.63	2.31	66.90	2,676.65	49.30	1.00	100.89
21.00	On	23.41	372.65	2.34	66.91	2,683.16	49.24	1.00	101.10
22.00	On	23.50	372.96	2.38	67.04	2,657.64	49.46	1.00	100.28
23.00	On	23.65	373.84	2.44	67.42	2,568.72	50.19	1.00	97.40
24.00	On	23.81	374.52	2.51	67.72	2,503.86	50.70	1.00	95.27
25.00	On	23.97	374.91	2.58	67.89	2,473.42	50.94	1.00	94.26
26.00	On	24.12	375.01	2.65	67.93	2,479.54	50.89	1.00	94.46
27.00	On	24.24	374.86	2.70	67.86	2,515.59	50.61	1.00	95.66
28.00	On	24.34	374.55	2.74	67.73	2,566.01	50.21	1.00	97.31
29.00	On	24.41	374.23	2.77	67.59	2,614.10	49.82	1.00	98.88
30.00	On	24.47	373.93	2.80	67.47	2,656.92	49.46	1.00	100.26
31.00	On	24.51	373.63	2.82	67.33	2,697.28	49.12	1.00	101.55
32.00	On	24.54	373.49	2.83	67.27	2,718.20	48.94	1.00	102.22
33.00	On	24.56	373.26	2.84	67.17	2,747.19	48.69	1.00	103.13
34.00	On	24.60	373.39	2.86	67.23	2,736.15	48.79	1.00	102.78
35.00	On	24.64	373.50	2.87	67.28	2,728.25	48.86	1.00	102.53
36.00	On	24.68	373.67	2.89	67.35	2,713.78	48.98	1.00	102.08
37.00	On	24.74	373.84	2.91	67.43	2,699.12	49.11	1.00	101.61
38.00	On	24.80	374.11	2.94	67.54	2,675.10	49.31	1.00	100.84
39.00	On	24.86	374.23	2.97	67.59	2,667.79	49.37	1.00	100.61
40.00	On	24.91	374.22	2.99	67.59	2,675.36	49.31	1.00	100.85
41.00	On	24.95	374.12	3.01	67.55	2,691.27	49.17	1.00	101.36
42.00	On	24.98	373.94	3.02	67.47	2,716.05	48.96	1.00	102.15
43.00	On	25.00	373.79	3.03	67.40	2,735.95	48.79	1.00	102.78
44.00	On	25.02	373.72	3.04	67.37	2,745.57	48.71	1.00	103.08
45.00	On	25.04	373.73	3.04	67.38	2,747.00	48.70	1.00	103.13
46.00	On	25.08	374.04	3.06	67.51	2,716.76	48.96	1.00	102.17
47.00	On	25.18	374.91	3.11	67.89	2,624.12	49.74	1.00	99.20
48.00	On	25.29	375.58	3.15	68.18	2,556.59	50.29	1.00	97.00



Scenario: Full Build Out Max Day
Extended Period Analysis: 0.00 hr / 48.00
Tank Report

Label	Zone	Base Elevation (ft)	Minimum Elevation (ft)	Initial HGL (ft)	Maximum Elevation (ft)	Tank Diameter (ft)	Total Volume (gal)
GATEWAY TANK	Zone	218.00	220.00	220.50	240.00	160.00	3,008,095.32
GATEWAY TANK	Zone	220.00	360.00	370.00	375.00	126.00	1,399,116.83
RAC TANK	Zone	265.00	300.00	360.00	365.00	60.00	1,374,793.56

Detailed Report for Tank: GATEWAY TANK #1

Scenario Summary

Scenario	Full Build Out Max Day
Active Topology Alternative	Full Build Out
Physical Alternative	Base-Physical
Demand Alternative	Max Day Demand
Initial Settings Alternative	Base-Initial Settings
Operational Alternative	Base-Operational
Age Alternative	Base-Age Alternative
Constituent Alternative	Base-Constituent
Trace Alternative	Base-Trace Alternative
Fire Flow Alternative	Base-Fire Flow
Capital Cost Alternative	Base-Capital Cost
Energy Cost Alternative	Base-Energy Cost
User Data Alternative	Base-User Data

Global Adjustments Summary

Demand	Multiply 1.0	Roughness	<None>
--------	--------------	-----------	--------

Geometric Summary

X	69,452.01 ft	Elevation	218.00 ft
Y	639,353.85 ft	Zone	Zone

Demand Summary

Type	Base Flow (gpm)	Pattern
Demand	0.00	Fixed

Operating Range Summary

Maximum Elevation	240.00 ft	Maximum Level	22.00 ft
Initial HGL	220.50 ft	Initial Level	2.50 ft
Minimum Elevation	220.00 ft	Minimum Level	2.00 ft
Base Elevation	218.00 ft		

Storage

Section Type	Constant Area	Circular Tank Shape?	true
Diameter	160.00 ft	Average Area	20,106.2 ft²
Inactive Volume	0.00 gal	Total Active Volume	3,008,095.32 gal

Calculated Results Summary

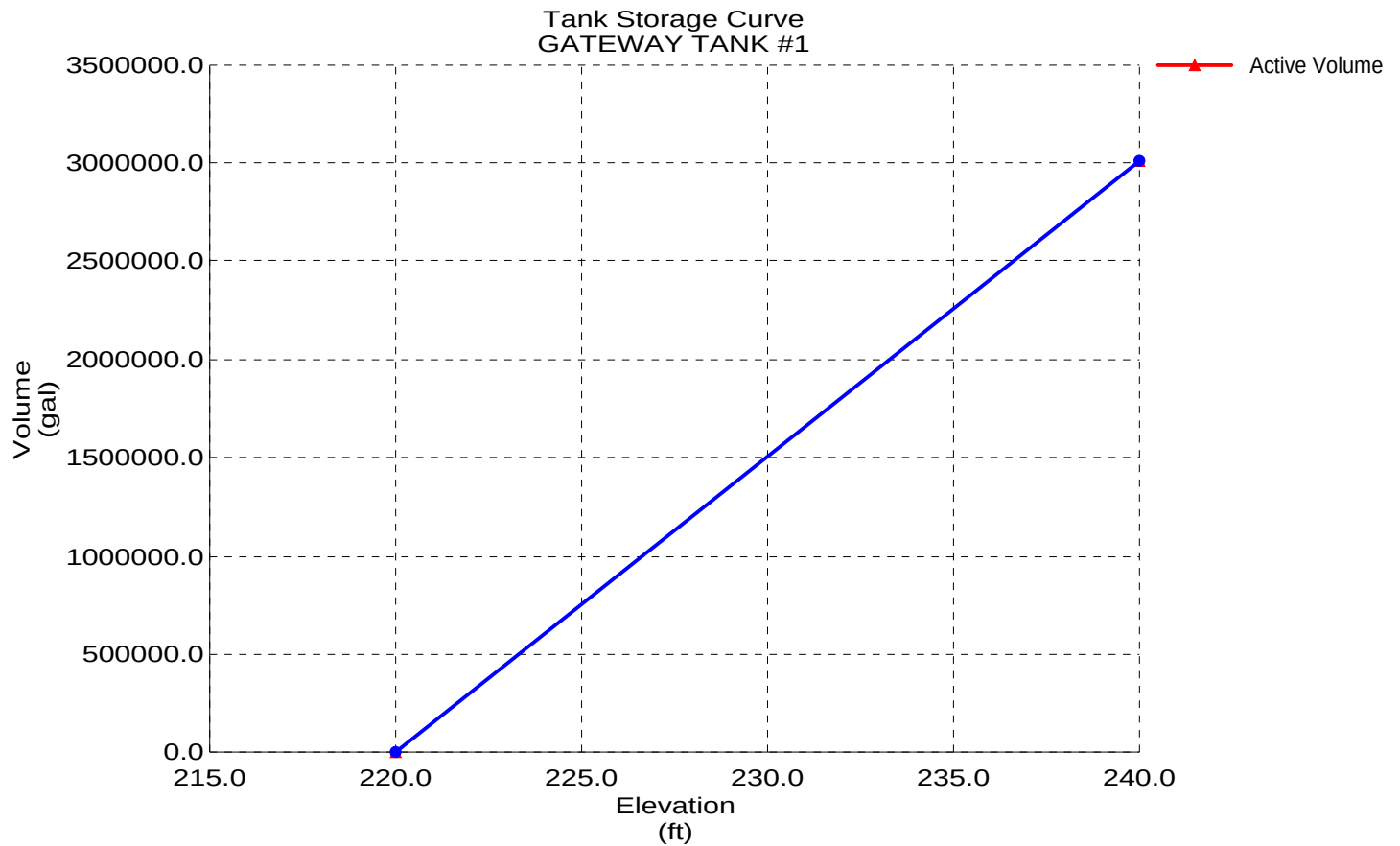
Time (hr)	Calculated Hydraulic Grade (ft)	Calculated Level (ft)	Pressure (psi)	Calculated Percent Full (%)	Calculated Volume (gal)	Inflow (gpm)	Outflow (gpm)	Current Status
0.00	220.50	2.50	1.08	2.5	5,202.38	141.72	941.72	Filling
1.00	220.88	2.88	1.24	4.4	11,705.15	126.10	926.10	Filling
2.00	221.25	3.25	1.40	6.2	17,271.56	177.81	877.81	Filling
3.00	221.60	3.60	1.56	8.0	19,939.39	105.21	805.21	Filling
4.00	221.92	3.92	1.69	9.6	18,253.62	107.32	707.32	Filling
5.00	222.20	4.20	1.82	11.0	10,692.66	112.41	612.41	Filling
6.00	222.44	4.44	1.92	12.2	17,435.52	129.85	529.85	Filling
7.00	222.65	4.65	2.01	13.3	19,228.08	156.45	456.45	Filling
8.00	222.84	4.84	2.09	14.2	16,614.25	108.18	408.18	Filling
9.00	223.00	5.00	2.16	15.0	11,104.14	153.57	353.57	Filling
10.00	223.14	5.14	2.22	15.7	12,319.07	145.44	345.44	Filling

Detailed Report for Tank: GATEWAY TANK #1

Calculated Results Summary

Time (hr)	Calculated Hydraulic Grade (ft)	Calculated Level (ft)	Pressure (psi)	Calculated Percent Full (%)	Calculated Volume (gal)	Inflow (gpm)	Outflow (gpm)	Current Status
11.00	223.28	5.28	2.28	16.4	13,045.16	133.62	333.62	Filling
12.00	223.41	5.41	2.34	17.1	3,062.11	129.90	329.90	Filling
13.00	223.54	5.54	2.40	17.7	12,856.43	128.37	328.37	Filling
14.00	223.67	5.67	2.45	18.4	12,558.96	137.45	337.45	Filling
15.00	223.81	5.81	2.51	19.0	2,805.41	131.57	331.57	Filling
16.00	223.94	5.94	2.57	19.7	12,700.71	111.61	311.61	Filling
17.00	224.07	6.07	2.62	20.3	1,395.74	184.22	284.22	Filling
18.00	224.18	6.18	2.67	20.9	18,449.84	148.34	248.34	Filling
19.00	224.28	6.28	2.72	21.4	13,351.24	118.27	218.27	Filling
20.00	224.36	6.36	2.75	21.8	16,446.48	99.08	199.08	Filling
21.00	224.44	6.44	2.79	22.2	18,391.93	89.11	189.11	Filling
22.00	224.52	6.52	2.82	22.6	9,738.38	111.34	211.34	Filling
23.00	224.60	6.60	2.86	23.0	12,418.23	196.58	296.58	Filling
24.00	224.72	6.72	2.91	23.6	0,213.62	156.26	356.26	Filling
25.00	224.86	6.86	2.97	24.3	11,589.20	180.48	380.48	Filling
26.00	225.02	7.02	3.04	25.1	14,417.51	167.69	367.69	Filling
27.00	225.16	7.16	3.10	25.8	16,479.29	125.19	325.19	Filling
28.00	225.29	7.29	3.16	26.5	15,991.34	169.05	269.05	Filling
29.00	225.40	7.40	3.20	27.0	2,134.33	116.22	216.22	Filling
30.00	225.49	7.49	3.24	27.4	15,107.93	69.59	169.59	Filling
31.00	225.55	7.55	3.27	27.8	15,281.64	26.24	126.24	Filling
32.00	225.60	7.60	3.29	28.0	12,857.42	03.09	103.09	Filling
33.00	225.65	7.65	3.31	28.2	19,042.43	72.28	-72.28	Filling
34.00	225.67	7.67	3.32	28.4	13,379.97	82.04	-82.04	Filling
35.00	225.71	7.71	3.33	28.5	18,300.44	88.49	-88.49	Filling
36.00	225.74	7.74	3.35	28.7	13,611.06	01.39	101.39	Filling
37.00	225.78	7.78	3.37	28.9	19,692.79	14.26	114.26	Filling
38.00	225.83	7.83	3.39	29.1	16,550.24	36.25	136.25	Filling
39.00	225.88	7.88	3.41	29.4	14,725.01	41.15	141.15	Filling
40.00	225.94	7.94	3.43	29.7	13,193.54	31.08	131.08	Filling
41.00	225.99	7.99	3.46	30.0	11,058.48	12.83	112.83	Filling
42.00	226.04	8.04	3.48	30.2	17,828.72	86.05	-86.05	Filling
43.00	226.07	8.07	3.49	30.4	2,990.16	64.62	-64.62	Filling
44.00	226.10	8.10	3.50	30.5	6,868.70	53.86	-53.86	Filling
45.00	226.12	8.12	3.51	30.6	10,100.05	51.46	-51.46	Filling
46.00	226.14	8.14	3.52	30.7	13,186.82	80.79	-80.79	Filling
47.00	226.17	8.17	3.53	30.9	18,033.85	71.99	171.99	Filling
48.00	226.24	8.24	3.56	31.2	18,354.44	136.46	236.46	Filling

Detailed Report for Tank: GATEWAY TANK #1



Detailed Report for Tank: GATEWAY TANK #2

Scenario Summary

Scenario	Full Build Out Max Day
Active Topology Alternative	Full Build Out
Physical Alternative	Base-Physical
Demand Alternative	Max Day Demand
Initial Settings Alternative	Base-Initial Settings
Operational Alternative	Base-Operational
Age Alternative	Base-Age Alternative
Constituent Alternative	Base-Constituent
Trace Alternative	Base-Trace Alternative
Fire Flow Alternative	Base-Fire Flow
Capital Cost Alternative	Base-Capital Cost
Energy Cost Alternative	Base-Energy Cost
User Data Alternative	Base-User Data

Global Adjustments Summary

Demand	Multiply 1.0	Roughness	<None>
--------	--------------	-----------	--------

Geometric Summary

X	72,721.15 ft	Elevation	220.00 ft
Y	640,526.50 ft	Zone	Zone

Demand Summary

Type	Base Flow (gpm)	Pattern
Demand	0.00	Fixed

Operating Range Summary

Maximum Elevation	375.00 ft	Maximum Level	155.00 ft
Initial HGL	370.00 ft	Initial Level	150.00 ft
Minimum Elevation	360.00 ft	Minimum Level	140.00 ft
Base Elevation	220.00 ft		

Storage

Section Type	Constant Area	Circular Tank Shape?	true
Diameter	126.00 ft	Average Area	12,469.0 ft²
Inactive Volume	0.00 gal	Total Active Volume	1,399,116.83 gal

Calculated Results Summary

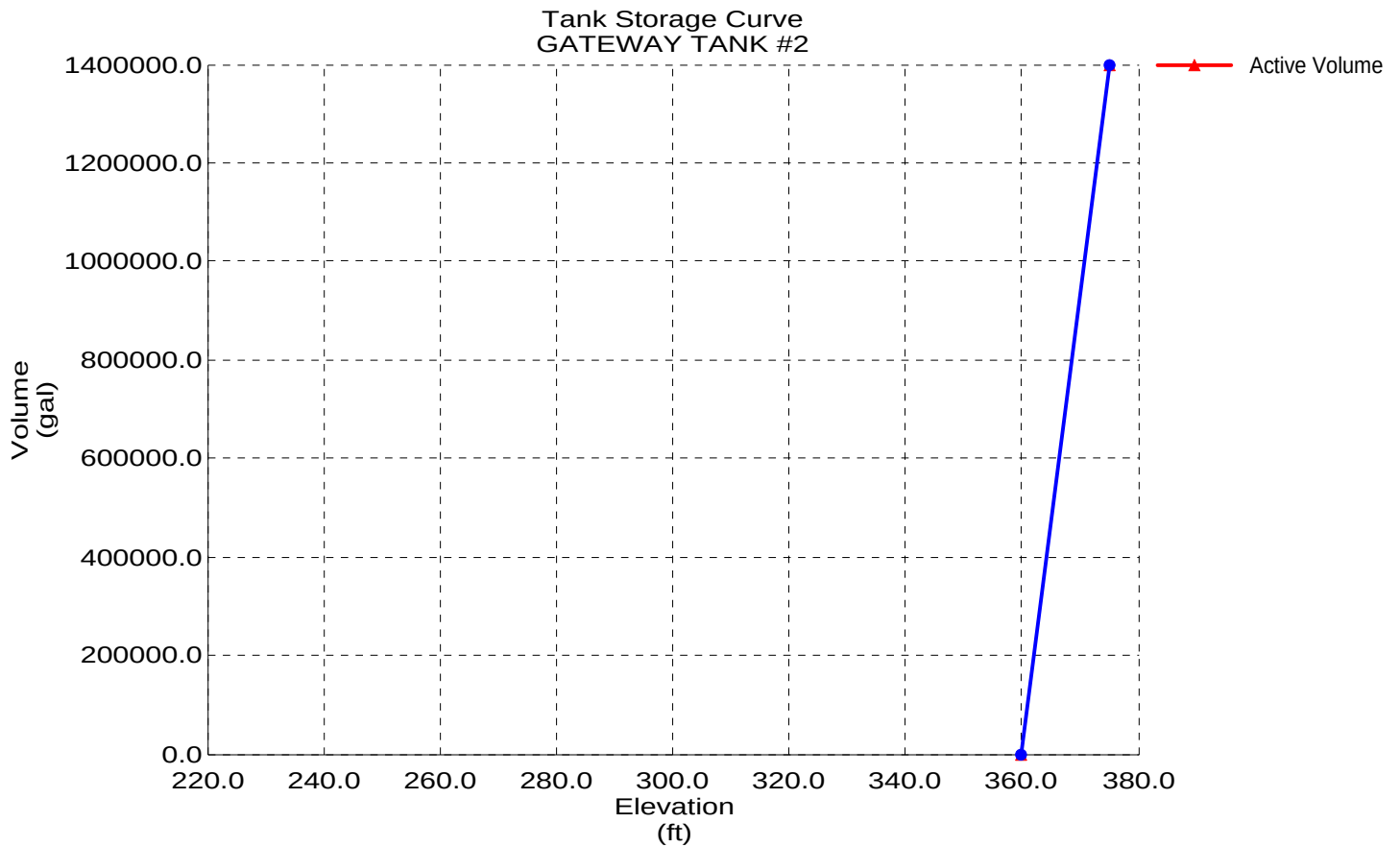
Time (hr)	Calculated Hydraulic (ft)	Calculated Grade (ft)	Pressure (psi)	Calculated Percent Full (%)	Calculated Volume (gal)	Inflow (gpm)	Outflow (gpm)	Current Status
0.00	370.00	150.00	64.90	66.7	32,744.56	607.78	607.78	Filling
1.00	370.39	150.39	65.07	69.3	369,211.20	606.34	606.34	Filling
2.00	370.78	150.78	65.24	71.9	405,592.45	440.81	440.81	Filling
3.00	371.06	151.06	65.36	73.8	432,039.38	-23.00	23.00	Draining
4.00	371.05	151.05	65.35	73.7	430,661.67	557.58	557.58	Draining
5.00	370.69	150.69	65.20	71.3	397,206.63	725.58	725.58	Draining
6.00	370.22	150.22	64.99	68.2	353,672.10	786.39	786.39	Draining
7.00	369.72	149.72	64.78	64.8	306,488.34	787.31	787.31	Draining
8.00	369.21	149.21	64.56	61.4	259,250.50	623.48	623.48	Draining
9.00	368.81	148.81	64.38	58.7	218,841.66	681.30	681.30	Draining
10.00	368.37	148.37	64.19	55.8	180,962.92	268.45	268.45	Draining

Detailed Report for Tank: GATEWAY TANK #2

Calculated Results Summary

Time (hr)	Calculated Hydraulic (ft)	Calculated Grade Level (ft)	Pressure (psi)	Calculated Percent Full (%)	Calculated Volume (gal)	Inflow (gpm)	Outflow (gpm)	Current Status
11.00	368.20	148.20	64.12	54.7	764,854.52	-80.58	80.58	Draining
12.00	368.15	148.15	64.10	54.3	760,021.15	68.96	-68.96	Filling
13.00	368.19	148.19	64.12	54.6	764,157.13	180.54	180.54	Filling
14.00	368.31	148.31	64.17	55.4	774,990.94	369.77	369.77	Filling
15.00	368.55	148.55	64.27	57.0	797,176.65	329.64	329.64	Filling
16.00	368.76	148.76	64.36	58.4	816,954.20	209.78	209.78	Filling
17.00	368.89	148.89	64.42	59.3	829,541.47	25.19	-25.19	Filling
18.00	368.91	148.91	64.43	59.4	831,052.97	-92.70	92.70	Draining
19.00	368.85	148.85	64.40	59.0	825,490.89	183.59	183.59	Draining
20.00	368.73	148.73	64.35	58.2	814,474.89	-87.71	87.71	Draining
21.00	368.68	148.68	64.32	57.8	809,211.69	-25.32	25.32	Draining
22.00	368.66	148.66	64.32	57.7	807,694.50	236.06	236.06	Filling
23.00	368.81	148.81	64.38	58.7	821,855.89	728.49	728.49	Filling
24.00	369.28	149.28	64.59	61.9	865,566.91	890.15	890.15	Filling
25.00	369.85	149.85	64.83	65.7	918,975.98	858.60	858.60	Filling
26.00	370.40	150.40	65.07	69.4	970,492.13	666.74	666.74	Filling
27.00	370.83	150.83	65.26	72.2	1,010,496.99	224.22	224.22	Filling
28.00	370.98	150.98	65.32	73.2	1,023,949.60	334.06	334.06	Draining
29.00	370.76	150.76	65.23	71.8	1,003,904.47	530.19	530.19	Draining
30.00	370.42	150.42	65.08	69.5	972,094.72	615.24	615.24	Draining
31.00	370.03	150.03	64.91	66.8	935,181.17	643.70	643.70	Draining
32.00	369.61	149.61	64.73	64.1	896,556.87	499.96	499.96	Draining
33.00	369.29	149.29	64.59	61.9	866,560.34	577.12	577.12	Draining
34.00	368.92	148.92	64.43	59.5	831,932.54	177.46	177.46	Draining
35.00	368.81	148.81	64.38	58.7	821,286.59	-3.72	3.72	Draining
36.00	368.80	148.80	64.38	58.7	821,061.72	133.08	133.08	Filling
37.00	368.89	148.89	64.42	59.3	829,046.18	234.03	234.03	Filling
38.00	369.04	149.04	64.48	60.3	843,088.01	414.04	414.04	Filling
39.00	369.31	149.31	64.60	62.0	867,929.51	366.76	366.76	Filling
40.00	369.54	149.54	64.70	63.6	889,935.88	240.47	240.47	Filling
41.00	369.70	149.70	64.77	64.6	904,364.85	49.99	-49.99	Filling
42.00	369.73	149.73	64.78	64.9	907,365.07	-73.94	73.94	Draining
43.00	369.68	149.68	64.76	64.5	902,927.36	170.63	170.63	Draining
44.00	369.57	149.57	64.71	63.8	892,691.31	-80.40	80.40	Draining
45.00	369.52	149.52	64.69	63.5	887,866.47	-22.88	22.88	Draining
46.00	369.50	149.50	64.68	63.4	886,491.61	234.17	234.17	Filling
47.00	369.65	149.65	64.75	64.4	900,541.98	723.80	723.80	Filling
48.00	370.12	150.12	64.95	67.5	943,971.19	883.97	883.97	Filling

Detailed Report for Tank: GATEWAY TANK #2



Detailed Report for Tank: RAC TANK

Scenario Summary

Scenario	Full Build Out Max Day
Active Topology Alternative	Full Build Out
Physical Alternative	Base-Physical
Demand Alternative	Max Day Demand
Initial Settings Alternative	Base-Initial Settings
Operational Alternative	Base-Operational
Age Alternative	Base-Age Alternative
Constituent Alternative	Base-Constituent
Trace Alternative	Base-Trace Alternative
Fire Flow Alternative	Base-Fire Flow
Capital Cost Alternative	Base-Capital Cost
Energy Cost Alternative	Base-Energy Cost
User Data Alternative	Base-User Data

Global Adjustments Summary

Demand	Multiply 1.0	Roughness	<None>
--------	--------------	-----------	--------

Geometric Summary

X	77,134.85 ft	Elevation	250.00 ft
Y	631,606.19 ft	Zone	Zone

Demand Summary

Type	Base Flow (gpm)	Pattern
Demand	0.00	RAC Tank

Operating Range Summary

Maximum Elevation	365.00 ft	Maximum Level	100.00 ft
Initial HGL	360.00 ft	Initial Level	95.00 ft
Minimum Elevation	300.00 ft	Minimum Level	35.00 ft
Base Elevation	265.00 ft		

Storage

Section Type	Constant Area	Circular Tank Shape?	true
Diameter	60.00 ft	Average Area	2,827.4 ft²
Inactive Volume	0.00 gal	Total Active Volume	1,374,793.56 gal

Calculated Results Summary

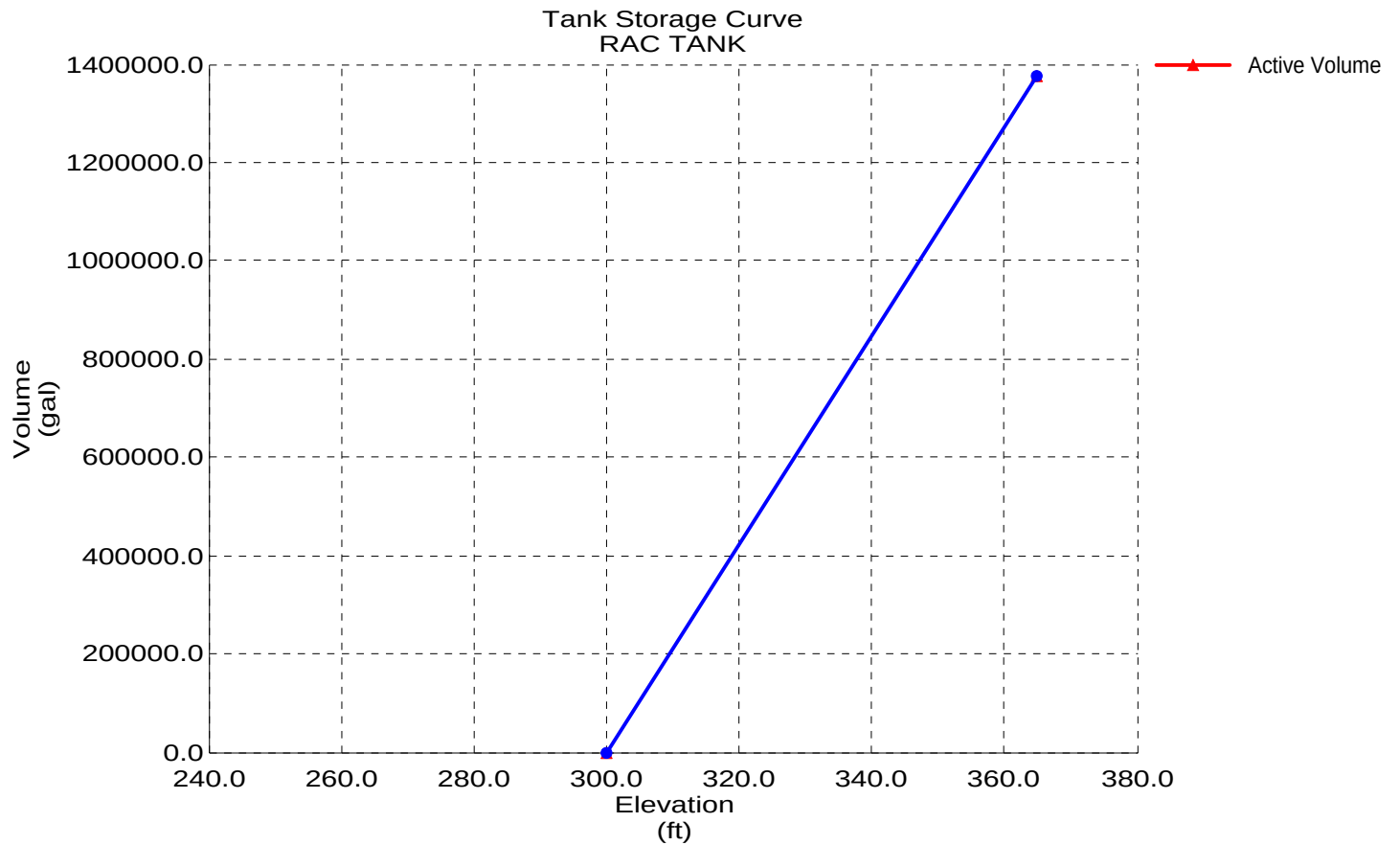
Time (hr)	Calculated Hydraulic (ft)	Calculated Grade (ft)	Pressure (psi)	Calculated Percent Full (%)	Calculated Volume (gal)	Inflow (gpm)	Outflow (gpm)	Current Status
0.00	360.00	95.00	41.10	92.3	269,040.21	331.89	-331.89	Filling
1.00	360.94	95.94	41.51	93.8	288,953.52	321.88	-321.88	Filling
2.00	361.85	96.85	41.90	95.2	308,265.90	309.78	-309.78	Filling
3.00	362.73	97.73	42.28	96.5	326,853.42	3,690.29	,690.29	Draining
4.00	352.26	87.26	37.76	80.4	105,435.57	3,583.68	,583.68	Draining
5.00	342.10	77.10	33.36	64.8	390,414.94	3,493.38	,493.38	Draining
6.00	332.19	67.19	29.07	49.5	380,812.37	3,413.54	,413.54	Draining
7.00	322.51	57.51	24.88	34.6	175,999.81	753.52	-753.52	Filling
8.00	324.64	59.64	25.80	37.9	21,210.92	731.48	-731.48	Filling
9.00	326.72	61.72	26.70	41.1	565,099.46	709.22	-709.22	Filling
10.00	328.73	63.73	27.57	44.2	307,652.53	687.87	-687.87	Filling

Detailed Report for Tank: RAC TANK

Calculated Results Summary

Time (hr)	Calculated Hydraulic (ft)	Calculated Grade Level (ft)	Pressure (psi)	Calculated Percent Full (%)	Calculated Volume (gal)	Inflow (gpm)	Outflow (gpm)	Current Status
11.00	330.68	65.68	28.42	47.2	348,925.00	668.36	-668.36	Filling
12.00	332.58	67.58	29.24	50.1	389,027.23	649.87	-649.87	Filling
13.00	334.42	69.42	30.04	53.0	428,019.26	632.55	-632.55	Filling
14.00	336.22	71.22	30.81	55.7	465,972.09	617.61	-617.61	Filling
15.00	337.97	72.97	31.57	58.4	503,029.01	601.19	-601.19	Filling
16.00	339.67	74.67	32.31	61.0	539,100.30	583.86	-583.86	Filling
17.00	341.33	76.33	33.02	63.6	574,132.39	565.17	-565.17	Filling
18.00	342.93	77.93	33.72	66.0	608,042.65	546.75	-546.75	Filling
19.00	344.48	79.48	34.39	68.4	640,847.23	527.17	-527.17	Filling
20.00	345.98	80.98	35.04	70.7	672,477.71	508.81	-508.81	Filling
21.00	347.42	82.42	35.66	73.0	703,005.73	490.40	-490.40	Filling
22.00	348.81	83.81	36.26	75.1	732,430.00	474.12	-474.12	Filling
23.00	350.16	85.16	36.84	77.2	760,877.03	464.22	-464.22	Filling
24.00	351.47	86.47	37.41	79.2	788,730.23	454.96	-454.96	Filling
25.00	352.77	87.77	37.97	81.2	816,028.33	444.65	-444.65	Filling
26.00	354.03	89.03	38.52	83.1	842,707.43	432.18	-432.18	Filling
27.00	355.25	90.25	39.05	85.0	868,637.78	3,611.03	,611.03	Draining
28.00	345.01	80.01	34.62	69.2	51,975.73	3,514.65	,514.65	Draining
29.00	335.04	70.04	30.30	53.9	741,097.07	3,431.07	,431.07	Draining
30.00	325.31	60.31	26.09	38.9	535,232.40	3,356.39	,356.39	Draining
31.00	315.78	50.78	21.97	24.3	333,849.21	814.19	-814.19	Filling
32.00	318.09	53.09	22.97	27.8	382,700.75	792.65	-792.65	Filling
33.00	320.34	55.34	23.94	31.3	430,260.06	771.09	-771.09	Filling
34.00	322.53	57.53	24.89	34.7	476,525.22	749.82	-749.82	Filling
35.00	324.66	59.66	25.81	37.9	521,514.28	730.64	-730.64	Filling
36.00	326.73	61.73	26.71	41.1	565,352.48	712.41	-712.41	Filling
37.00	328.75	63.75	27.58	44.2	608,097.26	695.20	-695.20	Filling
38.00	330.72	65.72	28.44	47.3	649,809.29	680.19	-680.19	Filling
39.00	332.65	67.65	29.27	50.2	690,620.24	663.54	-663.54	Filling
40.00	334.53	69.53	30.08	53.1	730,432.66	645.99	-645.99	Filling
41.00	336.37	71.37	30.88	55.9	769,192.32	627.10	-627.10	Filling
42.00	338.15	73.15	31.65	58.7	806,818.55	608.55	-608.55	Filling
43.00	339.87	74.87	32.39	61.3	843,331.98	588.90	-588.90	Filling
44.00	341.54	76.54	33.12	63.9	878,665.50	570.41	-570.41	Filling
45.00	343.16	78.16	33.82	66.4	912,890.11	551.81	-551.81	Filling
46.00	344.73	79.73	34.49	68.8	945,998.71	535.14	-535.14	Filling
47.00	346.24	81.24	35.15	71.1	978,106.83	524.31	-524.31	Filling
48.00	347.73	82.73	35.79	73.4	1,009,565.61	513.87	-513.87	Filling

Detailed Report for Tank: RAC TANK



Detailed Report for Reservoir: LOTT SUPPLY

Scenario Summary

Scenario	Full Build Out Max Day
Active Topology Alternative	Full Build Out
Physical Alternative	Base-Physical
Demand Alternative	Max Day Demand
Initial Settings Alternative	Base-Initial Settings
Operational Alternative	Base-Operational
Age Alternative	Base-Age Alternative
Constituent Alternative	Base-Constituent
Trace Alternative	Base-Trace Alternative
Fire Flow Alternative	Base-Fire Flow
Capital Cost Alternative	Base-Capital Cost
Energy Cost Alternative	Base-Energy Cost
User Data Alternative	Base-User Data

Global Adjustments Summary

Demand	Multiply 1.0	Roughness	<None>
--------	--------------	-----------	--------

Geometric Summary

X	69,374.44 ft	Elevation	260.00 ft
Y	640,875.49 ft	Zone	Zone

Calculated Results Summary

Time (hr)	Calculated Hydraulic (ft)	Inflow (gpm)	Outflow (gpm)
0.00	260.00	3,040.13	,040.13
1.00	260.00	3,024.49	,024.49
2.00	260.00	3,009.03	,009.03
3.00	260.00	2,994.32	,994.32
4.00	260.00	2,980.77	,980.77
5.00	260.00	2,968.83	,968.83
6.00	260.00	2,958.45	,958.45
7.00	260.00	2,949.45	,949.45
8.00	260.00	2,941.68	,941.68
9.00	260.00	2,934.71	,934.71
10.00	260.00	2,928.66	,928.66
11.00	260.00	2,922.75	,922.75
12.00	260.00	2,917.02	,917.02
13.00	260.00	2,911.35	,911.35
14.00	260.00	2,905.70	,905.70
15.00	260.00	2,899.88	,899.88
16.00	260.00	2,894.15	,894.15
17.00	260.00	2,888.76	,888.76
18.00	260.00	2,883.84	,883.84
19.00	260.00	2,879.53	,879.53
20.00	260.00	2,875.73	,875.73
21.00	260.00	2,872.27	,872.27
22.00	260.00	2,868.98	,868.98
23.00	260.00	2,865.30	,865.30
24.00	260.00	2,860.12	,860.12
25.00	260.00	2,853.89	,853.89
26.00	260.00	2,847.23	,847.23
27.00	260.00	2,840.78	,840.78
28.00	260.00	2,835.06	,835.06
29.00	260.00	2,830.32	,830.32

Detailed Report for Reservoir: LOTT SUPPLY

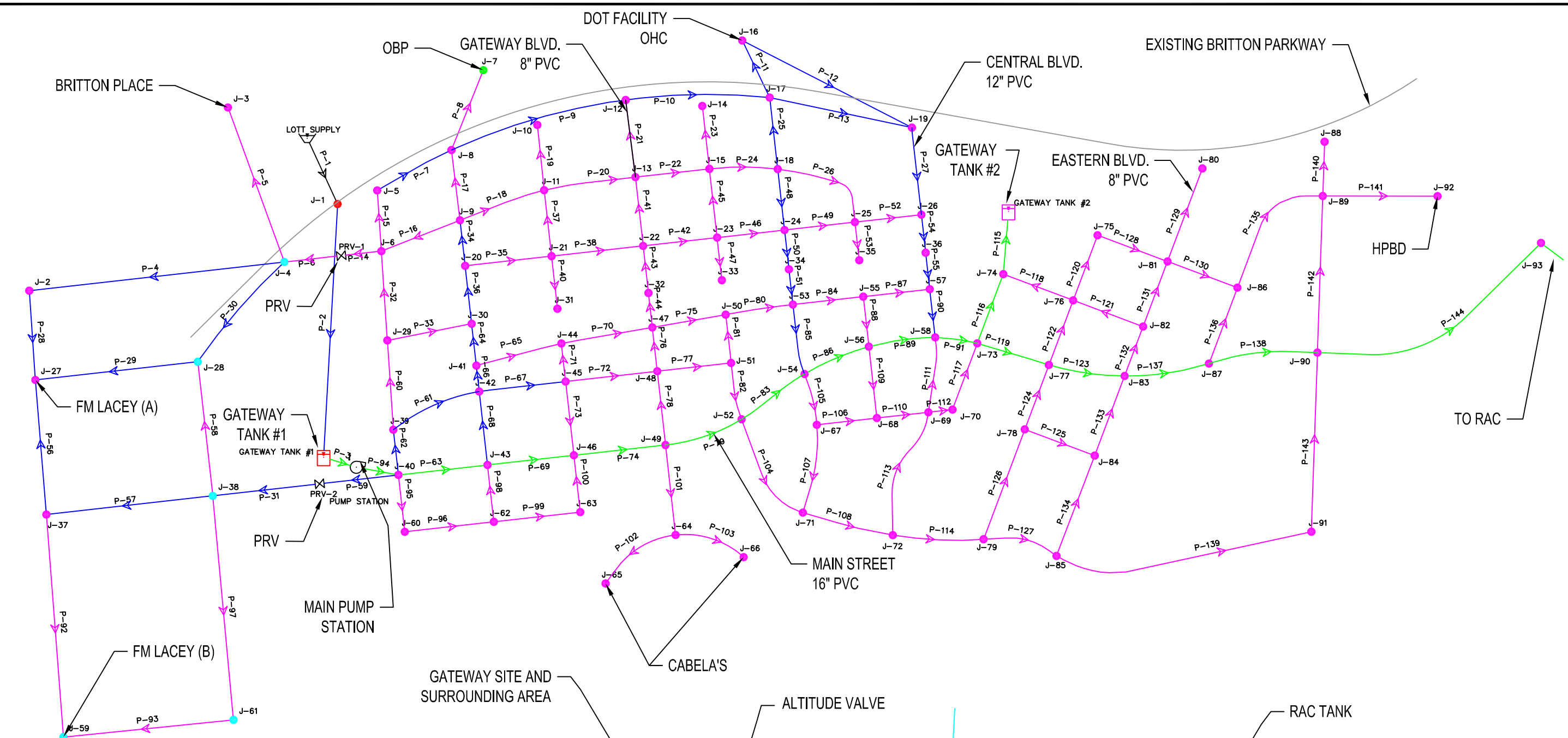
Calculated Results Summary

Time (hr)	Calculated Hydraulic Grade (ft)	Inflow (gpm)	Outflow (gpm)
30.00	260.00	2,826.51	,826.51
31.00	260.00	2,823.52	,823.52
32.00	260.00	2,821.29	,821.29
33.00	260.00	2,819.47	,819.47
34.00	260.00	2,818.19	,818.19
35.00	260.00	2,816.74	,816.74
36.00	260.00	2,815.17	,815.17
37.00	260.00	2,813.38	,813.38
38.00	260.00	2,811.35	,811.35
39.00	260.00	2,808.94	,808.94
40.00	260.00	2,806.43	,806.43
41.00	260.00	2,804.11	,804.11
42.00	260.00	2,802.10	,802.10
43.00	260.00	2,800.57	,800.57
44.00	260.00	2,799.42	,799.42
45.00	260.00	2,798.47	,798.47
46.00	260.00	2,797.55	,797.55
47.00	260.00	2,796.11	,796.11
48.00	260.00	2,793.05	,793.05

APPENDIX G – Winter Analysis

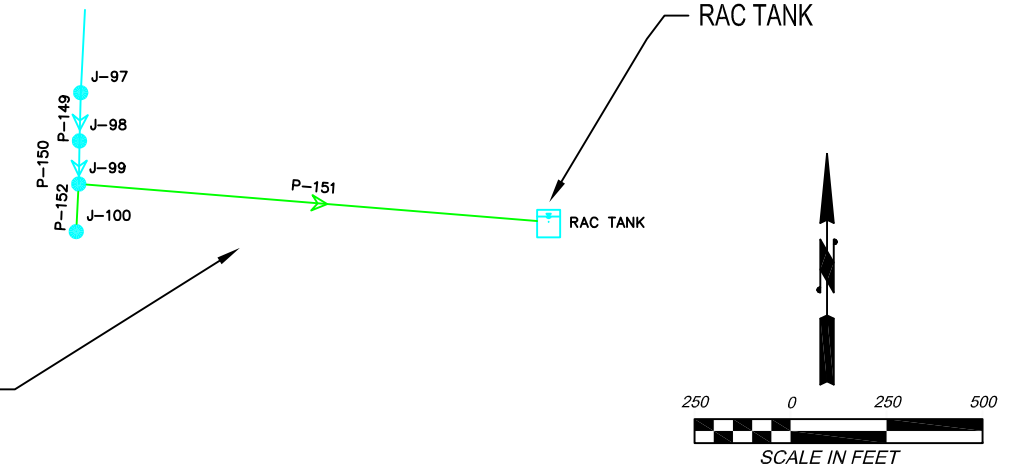
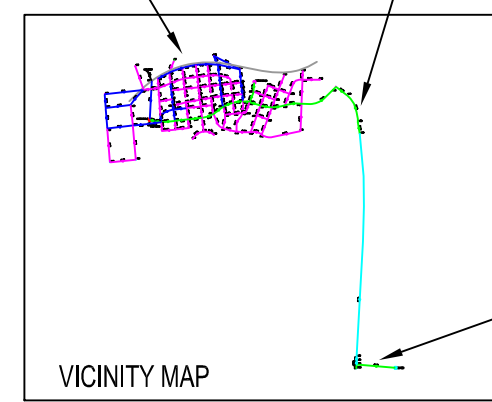
- Map Exhibit
- Junction Results
- Pipe Results
- Main Pump Station Results
- Overall Tank Summary
- Gateway Tank #1 Results
- Gateway Tank #2 Results
- Reservoir Results

Sep 11, 2008 - 3:06pm - User shendon-gentry
H:\proj\15083001\docs\WaterCAD\Full Build Out --- Three Tanks --- Main Model.dwg



PIPE LEGEND	
DIAMETER	
8"	
EX. 10"	
12"	
16"	

NODE LEGEND	
PRESSURE (PSI)	
<20	
21-40	
41-60	
61-80	
80-100	



CITY OF LACEY, WASHINGTON
DEPARTMENT OF PUBLIC WORKS
420 COLLEGE STREET S.E. P.O. BOX 3400
LACEY, WA 98509-3400 (360) 491-5600



APPROVED FOR CONSTRUCTION
DIRECTOR OF PUBLIC WORKS
HUITT-ZOLLARS
Huitt-Zollars, Inc. Seattle
814 East Pike Street
Seattle, Washington, 98122-3893
Phone (206) 324-5500 Fax (206) 328-1880

DESIGNED BY	DATE
DRAWN BY	DATE
CHECKED BY	DATE
APPROVED BY	DATE
FILENAME:	Full Build Out -- Three Tanks -- Main Model.dwg

**LACEY GATEWAY
PHASE I**
RECLAIMED WATER EXHIBIT
Full Build Out
WINTER

REVISION BLOCK		
NO.	DATE	DESCRIPTION

DRAWING NUMBER
SHT ____ OF ____

N.G.V.D. OF 1929
CALL 2 WORKING DAYS BEFORE YOU DIG
1-800-424-5555
UTILITIES UNDERGROUND LOCATION CENTER

Scenario: Winter
Extended Period Analysis: 0.00 hr / 48.00
Junction Report

Label	Elevation (ft)	Zone	Type	Base Flow (gpm)	Maximum Pressure (psi)	Minimum Pressure (psi)	Maximum Hydraulic Grade (ft)	Minimum Hydraulic Grade (ft)
J-1	217.50	Zone	Demand	0.00	18.39	18.26	260.00	259.71
J-2	160.00	Zone	Demand	0.00	62.75	62.74	305.04	305.02
J-3	160.00	Zone	Demand	50.91	62.75	62.74	305.04	305.02
J-4	190.00	Zone	Demand	13.07	49.77	49.77	305.04	305.02
J-5	210.00	Zone	Demand	0.00	69.42	68.55	370.46	368.44
J-6	206.00	Zone	Demand	18.62	71.16	70.28	370.47	368.45
J-7	175.00	Zone	Demand	96.95	84.56	83.66	370.45	368.37
J-8	216.00	Zone	Demand	0.00	66.83	65.96	370.46	368.44
J-9	213.42	Zone	Demand	8.92	67.95	67.08	370.48	368.46
J-10	218.00	Zone	Demand	2.99	65.97	65.09	370.47	368.45
J-11	214.50	Zone	Demand	3.94	67.48	66.61	370.47	368.45
J-12	221.00	Zone	Demand	0.00	64.66	63.79	370.45	368.44
J-13	216.00	Zone	Demand	2.61	66.83	65.96	370.46	368.45
J-14	219.00	Zone	Demand	2.44	65.52	64.66	370.45	368.45
J-15	218.00	Zone	Demand	3.26	65.96	65.09	370.45	368.45
J-16	226.00	Zone	Demand	369.76	62.49	61.63	370.44	368.44
J-17	219.85	Zone	Demand	0.00	65.15	64.29	370.44	368.44
J-18	217.22	Zone	Demand	10.16	66.29	65.43	370.44	368.44
J-19	220.16	Zone	Demand	0.00	65.02	64.15	370.44	368.44
J-20	210.93	Zone	Demand	10.36	69.03	68.16	370.48	368.47
J-21	210.00	Zone	Demand	8.79	69.43	68.56	370.47	368.45
J-22	212.00	Zone	Demand	1.54	68.56	67.69	370.46	368.45
J-23	213.92	Zone	Demand	6.05	67.72	66.86	370.45	368.45
J-24	215.45	Zone	Demand	7.71	67.06	66.19	370.44	368.45
J-25	217.00	Zone	Demand	6.36	66.38	65.52	370.44	368.44
J-26	219.00	Zone	Demand	8.09	65.52	64.66	370.43	368.44
J-27	150.00	Zone	Demand	95.17	67.08	67.07	305.04	305.02
J-28	170.00	Zone	Demand	0.00	58.42	58.42	305.04	305.02
J-29	199.00	Zone	Demand	0.00	74.20	73.33	370.50	368.49
J-30	205.63	Zone	Demand	18.58	71.33	70.46	370.50	368.49
J-31	206.00	Zone	Demand	10.09	71.16	70.29	370.47	368.45
J-32	207.00	Zone	Demand	4.35	70.73	69.86	370.47	368.47
J-33	209.00	Zone	Demand	6.50	69.85	68.98	370.45	368.45
J-34	211.00	Zone	Demand	6.33	68.98	68.12	370.44	368.45
J-35	213.00	Zone	Demand	6.28	68.12	67.25	370.44	368.44
J-36	216.00	Zone	Demand	6.80	66.81	65.95	370.42	368.44
J-37	165.00	Zone	Demand	0.00	60.59	60.58	305.04	305.02
J-38	170.00	Zone	Demand	0.00	58.42	58.42	305.04	305.03
J-39	201.00	Zone	Demand	5.18	73.36	72.49	370.55	368.55
J-40	202.50	Zone	Demand	0.69	72.72	71.86	370.58	368.58
J-41	202.90	Zone	Demand	5.50	72.52	71.65	370.51	368.51
J-42	203.58	Zone	Demand	4.77	72.23	71.36	370.52	368.52
J-43	208.00	Zone	Demand	1.66	70.32	69.46	370.54	368.54
J-44	206.00	Zone	Demand	7.33	71.17	70.31	370.51	368.50
J-45	213.00	Zone	Demand	4.43	68.15	67.28	370.51	368.51
J-46	219.00	Zone	Demand	1.59	65.55	64.69	370.51	368.51
J-47	206.00	Zone	Demand	4.17	71.16	70.30	370.48	368.48
J-48	216.00	Zone	Demand	1.38	66.84	65.97	370.48	368.48
J-49	227.00	Zone	Demand	1.44	62.08	61.22	370.48	368.49
J-50	209.75	Zone	Demand	3.78	69.53	68.67	370.46	368.47
J-51	215.00	Zone	Demand	0.85	67.26	66.40	370.47	368.47
J-52	220.00	Zone	Demand	1.51	65.10	64.24	370.46	368.47
J-53	210.00	Zone	Demand	4.02	69.41	68.55	370.44	368.45
J-54	222.00	Zone	Demand	1.38	64.22	63.36	370.44	368.45

Scenario: Winter
Extended Period Analysis: 0.00 hr / 48.00
Junction Report

Label	Elevation (ft)	Zone	Type	Base Flow (gpm)	Maximum Pressure (psi)	Minimum Pressure (psi)	Maximum Hydraulic Grade (ft)	Minimum Hydraulic Grade (ft)
J-55	213.00	Zone	Demand	3.89	68.11	67.25	370.43	368.45
J-56	224.50	Zone	Demand	1.35	63.14	62.28	370.43	368.45
J-57	216.00	Zone	Demand	2.85	66.81	65.95	370.42	368.44
J-58	227.00	Zone	Demand	1.70	62.05	61.19	370.41	368.44
J-59	170.00	Zone	Demand	95.17	58.42	58.40	305.03	304.98
J-60	200.00	Zone	Demand	3.16	73.79	72.93	370.56	368.56
J-61	170.00	Zone	Demand	0.00	58.42	58.41	305.04	305.00
J-62	206.00	Zone	Demand	3.42	71.19	70.32	370.54	368.54
J-63	219.05	Zone	Demand	0.31	65.54	64.67	370.52	368.52
J-64	211.58	Zone	Demand	0.00	68.75	67.89	370.48	368.49
J-65	206.71	Zone	Demand	24.98	70.86	69.99	370.48	368.49
J-66	206.71	Zone	Demand	24.98	70.86	69.99	370.48	368.49
J-67	218.00	Zone	Demand	1.12	65.95	65.09	370.43	368.45
J-68	221.00	Zone	Demand	2.21	64.65	63.79	370.42	368.45
J-69	221.00	Zone	Demand	3.15	64.64	63.79	370.41	368.44
J-70	222.00	Zone	Demand	1.53	64.21	63.36	370.41	368.44
J-71	214.00	Zone	Demand	2.92	67.68	66.82	370.43	368.45
J-72	211.00	Zone	Demand	5.05	68.97	68.12	370.41	368.44
J-73	225.00	Zone	Demand	1.97	62.91	62.06	370.40	368.44
J-74	222.00	Zone	Demand	18.77	64.21	63.36	370.40	368.44
J-75	219.00	Zone	Demand	3.38	65.50	64.65	370.39	368.42
J-76	219.00	Zone	Demand	0.53	65.50	64.65	370.39	368.43
J-77	221.00	Zone	Demand	1.35	64.64	63.79	370.39	368.43
J-78	217.00	Zone	Demand	2.29	66.37	65.52	370.39	368.43
J-79	206.00	Zone	Demand	3.14	71.13	70.28	370.40	368.43
J-80	224.00	Zone	Demand	2.85	63.33	62.48	370.38	368.42
J-81	217.50	Zone	Demand	0.83	66.15	65.30	370.38	368.42
J-82	213.00	Zone	Demand	0.42	68.09	67.25	370.39	368.43
J-83	211.00	Zone	Demand	2.11	68.96	68.11	370.39	368.43
J-84	207.00	Zone	Demand	3.39	70.69	69.84	370.39	368.43
J-85	202.00	Zone	Demand	3.08	72.86	72.00	370.39	368.43
J-86	216.00	Zone	Demand	0.68	66.79	65.94	370.38	368.41
J-87	214.00	Zone	Demand	3.06	67.66	66.81	370.39	368.42
J-88	220.00	Zone	Demand	1.49	65.05	64.14	370.36	368.25
J-89	219.00	Zone	Demand	0.50	65.49	64.57	370.36	368.25
J-90	214.00	Zone	Demand	2.24	67.66	66.81	370.39	368.42
J-91	205.00	Zone	Demand	3.44	71.56	70.70	370.39	368.42
J-92	220.00	Zone	Demand	204.47	65.03	63.91	370.29	367.71
J-93	220.00	Zone	Demand	0.00	65.07	64.21	370.39	368.42
J-94	220.00	Zone	Demand	0.00	65.07	64.21	370.39	368.42
J-95	238.00	Zone	Demand	0.00	57.28	56.43	370.39	368.42
J-97	225.00	Zone	Demand	0.00	62.90	58.61	370.39	360.46
J-98	225.00	Zone	Demand	0.00	62.90	58.48	370.39	360.16
J-99	225.00	Zone	Demand	2,100.00	62.90	58.48	370.39	360.16
J-224	225.00	Zone	Demand	0.00	62.90	58.54	370.39	360.30
J-225	236.00	Zone	Demand	0.00	58.14	57.29	370.39	368.42

Scenario: Winter
Extended Period Analysis: 0.00 hr / 48.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen- Williams C	Maximum Velocity (ft/s)	Minimum Velocity (ft/s)	Maximum Discharge (gpm)	Minimum Discharge (gpm)	Maximum Headloss Gradient (ft/1000ft)	Minimum Headloss Gradient (ft/1000ft)
P-1	345.00	24.0	PVC	100.0	1.86	0.00	2,620.48	0.00	0.84	0.00
P-2	211.00	12.0	PVC	100.0	7.43	0.00	2,620.48	0.00	24.53	0.00
P-3	164.00	16.0	PVC	100.0	0.91	0.06	570.53	38.26	0.36	0.00
P-4	225.00	12.0	PVC	100.0	0.05	0.01	18.35	3.82	0.00	0.00
P-5	785.00	8.0	PVC	100.0	0.00	0.00	0.00	-0.00	0.00	0.00
P-6	273.00	8.0	PVC	100.0	0.21	0.04	32.99	6.87	0.05	0.00
P-7	404.00	12.0	PVC	100.0	0.11	0.00	1.44	-37.20	0.01	0.00
P-8	410.00	8.0	PVC	100.0	0.50	0.16	78.45	24.51	0.27	0.03
P-9	868.00	12.0	PVC	100.0	0.13	0.00	34.84	-45.75	0.01	0.00
P-10	689.00	12.0	PVC	100.0	0.19	0.00	18.52	-66.19	0.03	0.00
P-11	302.00	12.0	PVC	100.0	0.63	0.02	-5.44	-222.09	0.25	0.00
P-12	910.00	12.0	PVC	100.0	0.35	0.00	19.94	-124.08	0.09	0.00
P-13	694.00	12.0	PVC	100.0	0.10	0.00	20.47	-34.22	0.01	0.00
P-14	193.00	8.0	PVC	100.0	0.21	0.04	32.99	6.85	0.05	0.00
P-15	291.00	8.0	PVC	100.0	0.24	0.01	37.20	-1.44	0.07	0.00
P-16	403.00	8.0	PVC	100.0	0.20	0.04	30.81	6.96	0.05	0.00
P-17	338.00	8.0	PVC	100.0	0.33	0.05	-7.46	-52.13	0.12	0.00
P-18	427.00	8.0	PVC	100.0	0.16	0.02	24.80	-2.55	0.03	0.00
P-19	313.00	8.0	PVC	100.0	0.00	0.00	0.00	-0.00	0.00	0.00
P-20	441.00	8.0	PVC	100.0	0.16	0.02	25.75	-5.94	0.03	0.00
P-21	371.00	8.0	PVC	100.0	0.26	0.01	40.60	2.18	0.08	0.00
P-22	355.00	8.0	PVC	100.0	0.16	0.02	25.54	-4.54	0.03	0.00
P-23	302.00	8.0	PVC	100.0	0.00	0.00	0.00	-0.00	0.00	0.00
P-24	327.00	8.0	PVC	100.0	0.16	0.01	25.36	-6.94	0.03	0.00
P-25	344.00	12.0	PVC	100.0	0.40	0.02	-8.20	-139.39	0.11	0.00
P-26	518.00	8.0	PVC	100.0	0.13	0.00	12.99	-19.95	0.02	0.00
P-27	418.00	12.0	PVC	100.0	0.41	0.00	54.15	-144.55	0.11	0.00
P-28	427.00	12.0	PVC	100.0	0.05	0.01	18.35	3.82	0.00	0.00
P-29	780.00	12.0	PVC	100.0	0.07	0.01	-4.90	-23.52	0.00	0.00
P-30	632.00	12.0	PVC	100.0	0.04	0.01	14.65	3.05	0.00	0.00
P-31	513.00	12.0	PVC	100.0	0.18	0.04	63.01	13.13	0.02	0.00
P-32	427.00	8.0	PVC	100.0	0.37	0.07	58.73	10.99	0.16	0.01
P-33	410.00	8.0	PVC	100.0	0.07	0.00	1.15	-11.47	0.01	0.00
P-34	219.00	12.0	PVC	100.0	0.30	0.05	105.89	15.96	0.06	0.00
P-35	415.00	8.0	PVC	100.0	0.20	0.02	-2.87	-32.05	0.05	0.00
P-36	278.00	12.0	PVC	100.0	0.42	0.08	147.89	26.70	0.12	0.00
P-37	317.00	8.0	PVC	100.0	0.08	0.00	0.76	-12.66	0.01	0.00
P-38	440.00	8.0	PVC	100.0	0.13	0.00	7.13	-20.48	0.02	0.00
P-40	253.00	8.0	PVC	100.0	0.05	0.02	8.26	2.35	0.00	0.00
P-41	330.00	8.0	PVC	100.0	0.19	0.03	29.12	4.15	0.04	0.00
P-42	355.00	8.0	PVC	100.0	0.20	0.01	1.95	-31.34	0.05	0.00
P-43	226.00	8.0	PVC	100.0	0.35	0.06	54.82	10.10	0.14	0.01
P-44	165.00	8.0	PVC	100.0	0.36	0.07	55.75	10.41	0.14	0.01
P-45	330.00	8.0	PVC	100.0	0.13	0.00	20.29	-0.19	0.02	0.00
P-46	324.00	8.0	PVC	100.0	0.16	0.00	13.49	-25.55	0.03	0.00
P-47	205.00	8.0	PVC	100.0	0.03	0.01	-1.39	-4.89	0.00	0.00
P-48	292.00	12.0	PVC	100.0	0.30	0.00	104.99	-1.67	0.06	0.00
P-49	338.00	8.0	PVC	100.0	0.14	0.00	0.31	-21.84	0.02	0.00
P-50	189.00	12.0	PVC	100.0	0.42	0.01	148.99	-7.94	0.12	0.00
P-51	169.00	12.0	PVC	100.0	0.43	0.00	152.75	-6.49	0.13	0.00
P-52	319.00	8.0	PVC	100.0	0.15	0.00	11.06	-23.40	0.03	0.00
P-53	183.00	8.0	PVC	100.0	0.03	0.01	4.26	1.21	0.00	0.00
P-54	183.00	12.0	PVC	100.0	0.45	0.00	76.82	-158.25	0.14	0.00

Scenario: Winter
Extended Period Analysis: 0.00 hr / 48.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen- Williams C	Maximum Velocity (ft/s)	Minimum Velocity (ft/s)	Maximum Discharge (gpm)	Minimum Discharge (gpm)	Maximum Headloss Gradient (ft/1000ft)	Minimum Headloss Gradient (ft/1000ft)
P-55	175.00	12.0	PVC	100.0	0.45	0.00	76.16	-160.00	0.14	0.00
P-56	644.00	12.0	PVC	100.0	0.02	0.00	6.14	1.28	0.00	0.00
P-57	799.00	12.0	PVC	100.0	0.09	0.02	32.92	6.86	0.01	0.00
P-58	644.00	8.0	PVC	100.0	0.06	0.01	8.87	1.85	0.00	0.00
P-59	379.00	12.0	PVC	100.0	0.18	0.04	63.01	13.13	0.02	0.00
P-60	427.00	8.0	PVC	100.0	0.39	0.06	61.03	9.85	0.17	0.01
P-61	453.00	12.0	PVC	100.0	0.32	0.02	-8.55	-114.52	0.07	0.00
P-62	217.00	12.0	PVC	100.0	0.49	0.06	173.23	20.86	0.16	0.00
P-63	428.00	16.0	PVC	100.0	0.50	0.01	314.88	4.61	0.12	0.00
P-64	201.00	12.0	PVC	100.0	0.43	0.09	152.52	31.96	0.13	0.01
P-65	419.00	8.0	PVC	100.0	0.12	0.01	4.34	-18.43	0.02	0.00
P-66	124.00	12.0	PVC	100.0	0.44	0.08	155.98	28.61	0.13	0.01
P-67	415.00	12.0	PVC	100.0	0.20	0.01	3.90	-69.47	0.03	0.00
P-68	353.00	12.0	PVC	100.0	0.29	0.05	102.97	19.02	0.06	0.00
P-69	415.00	16.0	PVC	100.0	0.37	0.02	13.31	-232.10	0.07	0.00
P-70	441.00	8.0	PVC	100.0	0.27	0.02	2.54	-42.17	0.08	0.00
P-71	183.00	8.0	PVC	100.0	0.22	0.03	-4.48	-33.99	0.06	0.00
P-72	440.00	8.0	PVC	100.0	0.28	0.03	4.21	-43.26	0.09	0.00
P-73	354.00	8.0	PVC	100.0	0.15	0.00	0.41	-23.68	0.03	0.00
P-74	440.00	16.0	PVC	100.0	0.41	0.03	21.62	-257.82	0.08	0.00
P-75	356.00	8.0	PVC	100.0	0.20	0.01	6.71	-31.08	0.05	0.00
P-76	211.00	8.0	PVC	100.0	0.22	0.04	34.00	6.51	0.06	0.00
P-77	355.00	8.0	PVC	100.0	0.22	0.03	4.74	-33.82	0.06	0.00
P-78	354.00	8.0	PVC	100.0	0.15	0.04	23.27	5.56	0.03	0.00
P-79	386.00	16.0	PVC	100.0	0.39	0.04	27.89	-245.75	0.08	0.00
P-80	324.00	8.0	PVC	100.0	0.28	0.03	4.87	-43.52	0.09	0.00
P-81	232.00	8.0	PVC	100.0	0.18	0.01	27.78	2.21	0.04	0.00
P-82	275.00	8.0	PVC	100.0	0.13	0.02	18.28	-21.00	0.02	0.00
P-83	371.00	16.0	PVC	100.0	0.37	0.07	41.15	-231.00	0.07	0.00
P-84	338.00	8.0	PVC	100.0	0.21	0.01	17.94	-33.12	0.05	0.00
P-85	338.00	12.0	PVC	100.0	0.31	0.00	15.58	-108.19	0.07	0.00
P-86	334.00	16.0	PVC	100.0	0.34	0.02	213.31	-65.58	0.06	0.00
P-87	319.00	8.0	PVC	100.0	0.14	0.03	5.33	-21.52	0.02	0.00
P-88	240.00	8.0	PVC	100.0	0.25	0.00	38.44	-11.33	0.07	0.00
P-89	320.00	16.0	PVC	100.0	0.34	0.02	76.80	-214.38	0.06	0.00
P-90	231.00	12.0	PVC	100.0	0.40	0.01	97.53	-140.86	0.11	0.00
P-91	203.00	16.0	PVC	100.0	0.51	0.00	317.41	-199.03	0.12	0.00
P-92	066.00	8.0	PVC	100.0	0.17	0.04	26.78	5.58	0.04	0.00
P-93	816.00	8.0	PVC	100.0	0.14	0.03	-4.42	-21.22	0.02	0.00
P-94	204.00	16.0	PVC	100.0	0.91	0.06	570.53	38.26	0.36	0.00
P-95	273.00	8.0	PVC	100.0	0.26	0.00	0.37	-40.63	0.08	0.00
P-96	428.00	8.0	PVC	100.0	0.24	0.00	38.08	-0.37	0.07	0.00
P-97	074.00	8.0	PVC	100.0	0.14	0.03	21.22	4.42	0.02	0.00
P-98	273.00	8.0	PVC	100.0	0.06	0.01	9.08	1.10	0.00	0.00
P-99	415.00	8.0	PVC	100.0	0.19	0.01	29.22	-1.47	0.04	0.00
P-100	273.00	8.0	PVC	100.0	0.19	0.01	1.47	-29.22	0.04	0.00
P-101	432.00	8.0	PVC	100.0	0.00	0.00	0.00	-0.00	0.00	0.00
P-102	422.00	4.0	PVC	100.0	0.00	0.00	0.00	-0.00	0.00	0.00
P-103	352.00	4.0	PVC	100.0	0.00	0.00	0.00	-0.00	0.00	0.00
P-104	558.00	8.0	PVC	100.0	0.23	0.04	35.55	6.10	0.06	0.00
P-105	250.00	8.0	PVC	100.0	0.18	0.00	3.68	-28.26	0.04	0.00
P-106	288.00	8.0	PVC	100.0	0.18	0.00	10.67	-27.75	0.04	0.00
P-107	428.00	8.0	PVC	100.0	0.06	0.00	1.88	-9.63	0.01	0.00

Scenario: Winter
Extended Period Analysis: 0.00 hr / 48.00
Pipe Report

Label	Length (ft)	Diameter (in)	Material	Hazen- Williams C	Maximum Velocity (ft/s)	Minimum Velocity (ft/s)	Maximum Discharge (gpm)	Minimum Discharge (gpm)	Maximum Headloss Gradient (ft/1000ft)	Minimum Headloss Gradient (ft/1000ft)
P-108	443.00	8.0	PVC	100.0	0.22	0.03	35.12	5.01	0.06	0.00
P-109	343.00	8.0	PVC	100.0	0.06	0.01	3.52	-9.59	0.01	0.00
P-110	247.00	8.0	PVC	100.0	0.23	0.01	9.66	-36.68	0.07	0.00
P-111	361.00	8.0	PVC	100.0	0.06	0.00	9.98	-5.97	0.01	0.00
P-112	115.00	8.0	PVC	100.0	0.22	0.00	19.95	-34.10	0.06	0.00
P-113	633.00	8.0	PVC	100.0	0.11	0.00	17.87	-3.94	0.02	0.00
P-114	435.00	8.0	PVC	100.0	0.25	0.03	38.72	5.23	0.07	0.00
P-115	300.00	16.0	PVC	100.0	0.80	0.00	499.39	-326.01	0.28	0.00
P-116	353.00	16.0	PVC	100.0	0.67	0.01	418.16	-288.54	0.20	0.00
P-117	338.00	8.0	PVC	100.0	0.22	0.00	21.12	-33.71	0.06	0.00
P-118	357.00	8.0	PVC	100.0	0.52	0.00	37.61	-81.10	0.28	0.00
P-119	357.00	16.0	PVC	100.0	0.45	0.09	280.03	59.06	0.10	0.01
P-120	332.00	8.0	PVC	100.0	0.20	0.01	31.23	-3.46	0.05	0.00
P-121	356.00	8.0	PVC	100.0	0.25	0.02	10.82	-39.45	0.07	0.00
P-122	330.00	8.0	PVC	100.0	0.15	0.02	23.42	-13.08	0.03	0.00
P-123	366.00	16.0	PVC	100.0	0.41	0.07	256.42	46.22	0.08	0.00
P-124	328.00	8.0	PVC	100.0	0.14	0.01	10.11	-22.53	0.03	0.00
P-125	356.00	8.0	PVC	100.0	0.17	0.02	26.56	3.21	0.04	0.00
P-126	560.00	8.0	PVC	100.0	0.09	0.01	6.65	-14.43	0.01	0.00
P-127	369.00	8.0	PVC	100.0	0.18	0.05	28.74	7.17	0.04	0.00
P-128	356.00	8.0	PVC	100.0	0.20	0.01	31.11	-3.57	0.05	0.00
P-129	474.00	8.0	PVC	100.0	0.00	0.00	0.00	-0.00	0.00	0.00
P-130	356.00	8.0	PVC	100.0	0.32	0.04	50.28	6.02	0.12	0.00
P-131	332.00	8.0	PVC	100.0	0.15	0.06	-9.00	-23.57	0.03	0.00
P-132	252.00	8.0	PVC	100.0	0.13	0.01	20.08	-20.51	0.02	0.00
P-133	406.00	8.0	PVC	100.0	0.13	0.01	4.65	-20.74	0.02	0.00
P-134	512.00	8.0	PVC	100.0	0.05	0.00	8.15	-6.93	0.00	0.00
P-135	671.00	8.0	PVC	100.0	0.53	0.16	-24.66	-82.85	0.29	0.03
P-136	387.00	8.0	PVC	100.0	0.26	0.02	5.99	-41.46	0.08	0.00
P-137	409.00	16.0	PVC	100.0	0.47	0.06	296.63	37.92	0.11	0.00
P-138	524.00	16.0	PVC	100.0	0.48	0.03	302.62	20.06	0.11	0.00
P-139	252.00	8.0	PVC	100.0	0.21	0.04	-6.27	-32.52	0.05	0.00
P-140	259.00	8.0	PVC	100.0	0.00	0.00	0.00	-0.00	0.00	0.00
P-141	548.00	8.0	PVC	100.0	1.06	0.33	-51.70	-165.44	1.06	0.12
P-142	748.00	8.0	PVC	100.0	0.53	0.05	-7.64	-83.61	0.30	0.00
P-143	856.00	8.0	PVC	100.0	0.21	0.02	-2.72	-32.52	0.05	0.00
P-144	259.00	16.0	PVC	100.0	0.52	0.00	327.46	-0.00	0.13	0.00
P-145	432.00	16.0	PVC	100.0	0.52	0.00	0.00	-327.46	0.13	0.00
P-146	948.00	16.0	PVC	100.0	0.52	0.00	327.46	0.00	0.13	0.00
P-147	369.00	16.0	PVC	100.0	0.52	0.00	327.46	0.00	0.13	0.00
P-148	975.00	10.0	PVC	100.0	1.34	0.00	327.46	0.00	1.27	0.00
P-149	126.00	10.0	PVC	100.0	1.34	0.00	327.46	0.00	1.27	0.00
P-150	112.00	10.0	PVC	100.0	1.34	0.00	327.46	0.00	1.27	0.00
P-151	228.00	16.0	PVC	100.0	0.52	0.00	327.46	0.00	0.13	0.00
P-152	124.00	16.0	PVC	100.0	0.00	0.00	0.00	-0.00	0.00	0.00

Detailed Report for Pump: PUMP STATION

Scenario Summary

Scenario	Winter
Active Topology Alternative	Full Build Out
Physical Alternative	Base-Physical
Demand Alternative	Average Day Demand
Initial Settings Alternative	Base-Initial Settings
Operational Alternative	Base-Operational
Age Alternative	Base-Age Alternative
Constituent Alternative	Base-Constituent
Trace Alternative	Base-Trace Alternative
Fire Flow Alternative	Base-Fire Flow
Capital Cost Alternative	Base-Capital Cost
Energy Cost Alternative	Base-Energy Cost
User Data Alternative	Base-User Data

Global Adjustments Summary

Demand	<None>	Roughness	<None>
--------	--------	-----------	--------

Geometric Summary

X	69,608.68 ft	Upstream Pipe	P-3
Y	639,305.92 ft	Downstream Pipe	P-94
Elevation	218.00 ft		

Pump Definition Summary

Pump Definition	Average Day Pump Station
-----------------	--------------------------

Initial Status

Initial Pump Status	On	Initial Relative Speed Facto	1.00
---------------------	----	------------------------------	------

Calculated Results Summary

Time (hr)	Control Status	Intake Pump Grade (ft)	Discharge Pump Grade (ft)	Intake Pump Pressure (psi)	Discharge Pump Pressure (psi)	Discharge (gpm)	Pump Head (ft)	Relative Speed	Calculated Water Power (Hp)
0.00	On	:30.00	369.83	5.19	65.69	38.26	39.83	1.00	1.35
1.00	On	:31.17	369.63	5.70	65.60	170.23	38.47	1.00	5.95
2.00	On	:32.25	369.50	6.16	65.55	251.92	37.25	1.00	8.73
3.00	On	:33.26	369.41	6.60	65.51	316.32	36.14	1.00	10.87
4.00	On	:34.23	369.31	7.02	65.46	372.71	35.08	1.00	12.71
5.00	On	:35.15	369.21	7.42	65.42	423.05	34.06	1.00	14.32
6.00	On	:36.03	369.12	7.80	65.38	467.64	33.10	1.00	15.71
6.51	On	:36.45	369.12	7.98	65.38	487.33	32.66	1.00	16.32
7.00	On	:36.85	369.13	8.16	65.39	504.28	32.28	1.00	16.84
8.00	On	:37.65	369.14	8.50	65.39	538.07	31.50	1.00	17.86
8.39	On	:37.94	369.15	8.63	65.40	550.26	31.21	1.00	18.23
9.00	On	:37.79	369.02	8.56	65.34	549.40	31.23	1.00	18.20
9.20	On	:37.94	368.99	8.63	65.33	557.13	31.04	1.00	18.43
10.00	On	:37.74	368.92	8.54	65.30	551.64	31.18	1.00	18.27
10.27	On	:37.94	368.91	8.63	65.29	560.41	30.97	1.00	18.53
11.00	On	:37.76	368.85	8.55	65.26	555.31	31.09	1.00	18.38
11.25	On	:37.94	368.83	8.63	65.26	563.53	30.89	1.00	18.62
12.00	On	:37.75	368.77	8.55	65.23	558.30	31.02	1.00	18.47
12.25	On	:37.94	368.75	8.63	65.22	566.77	30.81	1.00	18.72
13.00	On	:37.75	368.70	8.55	65.20	561.31	30.94	1.00	18.56
13.25	On	:37.94	368.69	8.63	65.20	569.56	30.75	1.00	18.80

Detailed Report for Pump: PUMP STATION

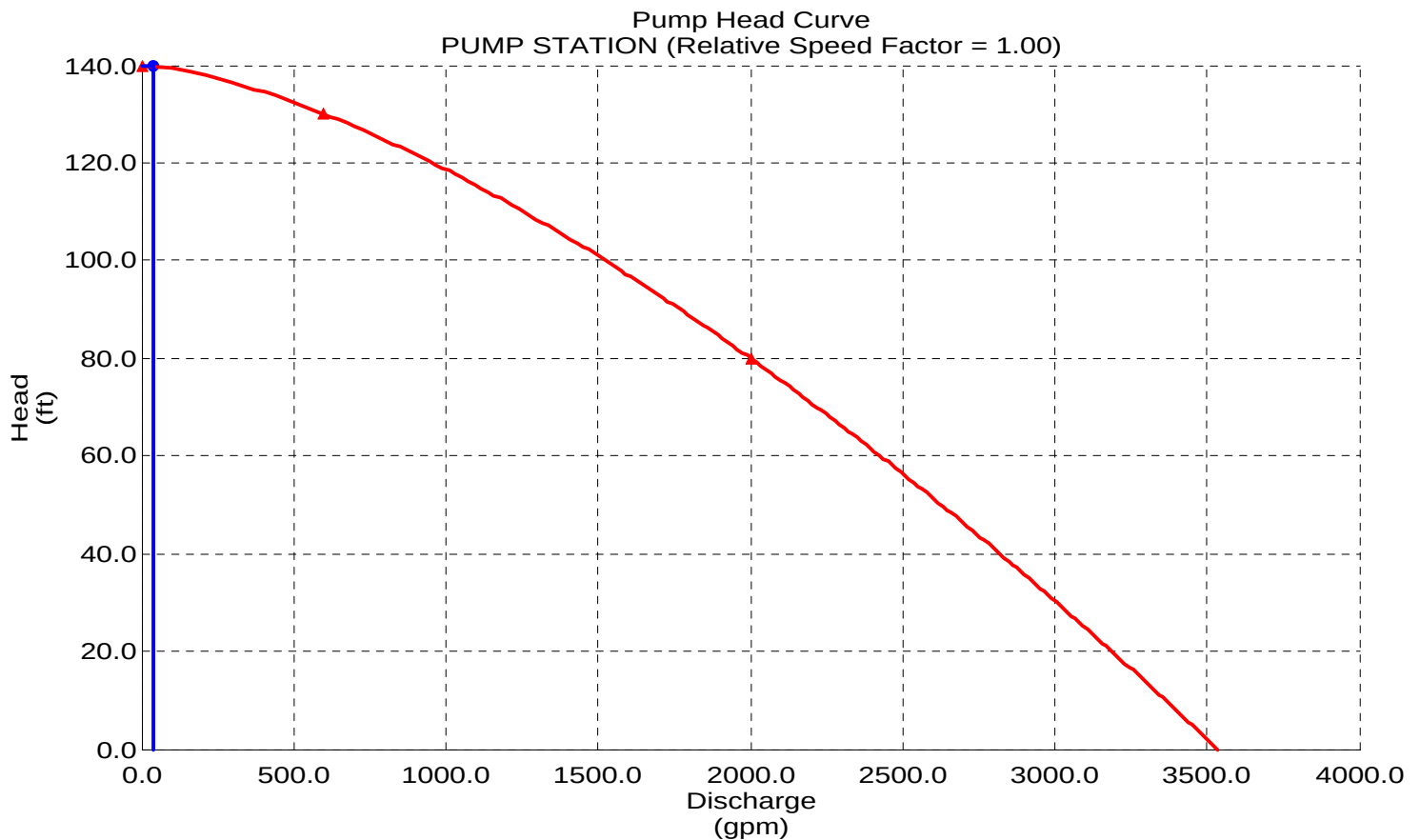
Calculated Results Summary

Time (hr)	Control Status	Intake Pump Grade (ft)	Discharge Pump Grade (ft)	Intake Pump Pressure (psi)	Discharge Pump Pressure (psi)	Discharge (gpm)	Pump Head (ft)	Relative Speed	Calculated Water Power (Hp)
14.00	On	37.75	368.65	8.54	65.18	562.97	30.90	1.00	18.61
14.26	On	37.94	368.66	8.63	65.18	570.53	30.72	1.00	18.83
15.00	On	37.75	368.68	8.54	65.19	562.10	30.93	1.00	18.58
15.26	On	37.94	368.69	8.63	65.20	569.43	30.75	1.00	18.80
16.00	On	37.75	368.72	8.55	65.21	560.41	30.97	1.00	18.53
16.25	On	37.94	368.74	8.63	65.22	567.55	30.79	1.00	18.74
17.00	On	37.75	368.77	8.55	65.23	558.18	31.02	1.00	18.46
17.25	On	37.94	368.79	8.63	65.24	565.33	30.85	1.00	18.68
18.00	On	37.75	368.83	8.55	65.26	555.82	31.08	1.00	18.39
18.25	On	37.94	368.85	8.63	65.27	562.66	30.91	1.00	18.60
19.00	On	37.75	368.92	8.55	65.29	552.21	31.16	1.00	18.29
19.25	On	37.94	368.95	8.63	65.31	558.87	31.00	1.00	18.48
20.00	On	37.76	369.04	8.55	65.35	546.87	31.29	1.00	18.13
20.25	On	37.94	369.09	8.63	65.37	552.95	31.14	1.00	18.31
21.00	On	37.76	369.18	8.55	65.41	541.23	31.42	1.00	17.96
21.25	On	37.95	369.22	8.63	65.43	547.36	31.28	1.00	18.14
22.00	On	37.76	369.34	8.55	65.48	534.57	31.58	1.00	17.76
22.24	On	37.95	369.39	8.63	65.50	540.49	31.44	1.00	17.94
23.00	On	37.76	369.54	8.55	65.56	526.22	31.77	1.00	17.51
23.24	On	37.95	369.59	8.63	65.59	531.71	31.65	1.00	17.67
24.00	On	37.77	369.73	8.55	65.65	517.98	31.96	1.00	17.26
24.24	On	37.95	369.79	8.63	65.67	523.47	31.84	1.00	17.42
25.00	On	37.77	369.93	8.55	65.73	509.38	32.16	1.00	17.00
25.23	On	37.95	369.99	8.63	65.76	514.82	32.04	1.00	17.16
26.00	On	37.77	370.14	8.56	65.82	500.58	32.36	1.00	16.73
26.23	On	37.95	370.19	8.63	65.85	505.97	32.24	1.00	16.89
27.00	On	37.78	370.31	8.56	65.90	492.94	32.54	1.00	16.49
27.23	On	37.95	370.36	8.63	65.92	498.53	32.41	1.00	16.67
28.00	On	37.78	370.42	8.56	65.94	488.46	32.64	1.00	16.36
28.22	On	37.95	370.44	8.63	65.96	494.99	32.49	1.00	16.56
29.00	On	37.78	370.49	8.56	65.97	485.29	32.71	1.00	16.26
29.22	On	37.96	370.51	8.63	65.98	492.01	32.56	1.00	16.47
30.00	On	37.78	370.54	8.56	66.00	482.92	32.76	1.00	16.19
30.22	On	37.96	370.56	8.63	66.01	489.85	32.61	1.00	16.40
31.00	On	37.78	370.57	8.56	66.01	481.83	32.79	1.00	16.15
31.22	On	37.96	370.57	8.63	66.01	489.40	32.62	1.00	16.39
32.00	On	37.78	370.54	8.56	66.00	482.94	32.76	1.00	16.19
32.22	On	37.96	370.54	8.63	66.00	490.74	32.59	1.00	16.43
33.00	On	37.78	370.36	8.56	65.92	491.14	32.58	1.00	16.44
33.22	On	37.95	370.31	8.63	65.90	500.68	32.36	1.00	16.73
34.00	On	37.78	370.24	8.56	65.87	496.37	32.46	1.00	16.60
34.23	On	37.95	370.22	8.63	65.86	504.76	32.27	1.00	16.86
35.00	On	37.78	370.13	8.56	65.82	501.09	32.35	1.00	16.74
35.23	On	37.95	370.11	8.63	65.81	509.60	32.16	1.00	17.00
36.00	On	37.77	370.02	8.56	65.77	505.88	32.24	1.00	16.89
36.23	On	37.95	370.00	8.63	65.76	514.41	32.05	1.00	17.15
37.00	On	37.77	369.91	8.55	65.73	510.28	32.14	1.00	17.02
37.23	On	37.95	369.90	8.63	65.72	518.68	31.95	1.00	17.28
38.00	On	37.77	369.85	8.55	65.70	513.09	32.08	1.00	17.11
38.23	On	37.95	369.85	8.63	65.70	520.83	31.90	1.00	17.34
39.00	On	37.77	369.84	8.55	65.69	513.59	32.07	1.00	17.12
39.23	On	37.95	369.84	8.63	65.69	521.15	31.89	1.00	17.35
40.00	On	37.77	369.84	8.55	65.70	513.26	32.07	1.00	17.11

Detailed Report for Pump: PUMP STATION

Calculated Results Summary

Time (hr)	Control Status	Intake Pump Grade (ft)	Discharge Pump Grade (ft)	Intake Pump Pressure (psi)	Discharge Pump Pressure (psi)	Discharge (gpm)	Pump Head (ft)	Relative Speed	Calculated Water Power (Hp)
40.23	On	37.95	369.85	8.63	65.70	520.63	31.90	1.00	17.34
41.00	On	37.77	369.87	8.55	65.71	512.22	32.10	1.00	17.08
41.23	On	37.95	369.88	8.63	65.71	519.57	31.93	1.00	17.31
42.00	On	37.77	369.89	8.55	65.72	511.11	32.12	1.00	17.05
42.23	On	37.95	369.91	8.63	65.72	518.16	31.96	1.00	17.26
43.00	On	37.77	369.95	8.55	65.74	508.63	32.18	1.00	16.97
43.23	On	37.95	369.97	8.63	65.75	515.49	32.02	1.00	17.18
44.00	On	37.77	370.05	8.55	65.78	504.48	32.27	1.00	16.85
44.23	On	37.95	370.08	8.63	65.80	510.77	32.13	1.00	17.04
45.00	On	37.78	370.16	8.56	65.83	499.69	32.38	1.00	16.70
45.23	On	37.95	370.19	8.63	65.85	506.03	32.24	1.00	16.89
46.00	On	37.78	370.29	8.56	65.89	493.98	32.51	1.00	16.53
46.23	On	37.95	370.33	8.63	65.91	500.10	32.37	1.00	16.71
47.00	On	37.78	370.46	8.56	65.96	486.57	32.68	1.00	16.30
47.22	On	37.96	370.51	8.63	65.98	492.27	32.55	1.00	16.47
48.00	On	37.78	370.63	8.56	66.04	479.07	32.85	1.00	16.07



Scenario: Winter
Extended Period Analysis: 0.00 hr / 48.00
Tank Report

Label	Zone	Base Elevation (ft)	Minimum Elevation (ft)	Initial HGL (ft)	Maximum Elevation (ft)	Tank Diameter (ft)	Total Volume (gal)
GATEWAY TANK	Zone	214.00	216.00	230.00	238.00	150.00	2,908,217.15
GATEWAY TANK	Zone	220.00	360.00	370.00	375.00	126.00	1,399,116.83
RAC TANK	Zone	265.00	300.00	360.00	365.00	60.00	1,374,793.56

Detailed Report for Tank: GATEWAY TANK #1

Scenario Summary

Scenario	Winter
Active Topology Alternative	Full Build Out
Physical Alternative	Base-Physical
Demand Alternative	Average Day Demand
Initial Settings Alternative	Base-Initial Settings
Operational Alternative	Base-Operational
Age Alternative	Base-Age Alternative
Constituent Alternative	Base-Constituent
Trace Alternative	Base-Trace Alternative
Fire Flow Alternative	Base-Fire Flow
Capital Cost Alternative	Base-Capital Cost
Energy Cost Alternative	Base-Energy Cost
User Data Alternative	Base-User Data

Global Adjustments Summary

Demand	<None>	Roughness	<None>
--------	--------	-----------	--------

Geometric Summary

X	69,452.01 ft	Elevation	214.00 ft
Y	639,353.85 ft	Zone	Zone

Demand Summary

Type	Base Flow (gpm)	Pattern
Demand	0.00	Fixed

Operating Range Summary

Maximum Elevation	238.00 ft	Maximum Level	24.00 ft
Initial HGL	230.00 ft	Initial Level	16.00 ft
Minimum Elevation	216.00 ft	Minimum Level	2.00 ft
Base Elevation	214.00 ft		

Storage

Section Type	Constant Area	Circular Tank Shape?	true
Diameter	150.00 ft	Average Area	17,671.5 ft²
Inactive Volume	0.00 gal	Total Active Volume	2,908,217.15 gal

Calculated Results Summary

Time (hr)	Calculated Hydraulic (ft)	Calculated Grade (ft)	Pressure (psi)	Calculated Percent Full (%)	Calculated Volume (gal)	Inflow (gpm)	Outflow (gpm)	Current Status
0.00	230.00	16.00	6.92	63.6	350,683.64	,582.22	2,582.22	Filling
1.00	231.17	17.17	7.43	69.0	305,615.95	,394.47	2,394.47	Filling
2.00	232.26	18.26	7.90	73.9	149,284.85	,260.10	2,260.10	Filling
3.00	233.28	19.28	8.34	78.6	284,891.46	,145.12	2,145.12	Filling
4.00	234.26	20.26	8.76	83.0	113,597.63	,039.87	2,039.87	Filling
5.00	235.18	21.18	9.17	87.2	335,990.32	,942.29	1,942.29	Filling
6.00	236.07	22.07	9.55	91.2	352,527.41	,851.95	1,851.95	Filling
6.51	236.50	22.50	9.73	93.2	709,506.03	,809.61	1,809.61	Filling
7.00	236.90	22.90	9.91	95.0	762,406.10	,771.45	1,771.45	Filling
8.00	237.70	23.70	10.25	98.6	368,694.39	,694.56	1,694.56	Filling
8.39	238.00	24.00	10.38	100.0	308,217.15	-550.26	550.26	Draining

Detailed Report for Tank: GATEWAY TANK #1

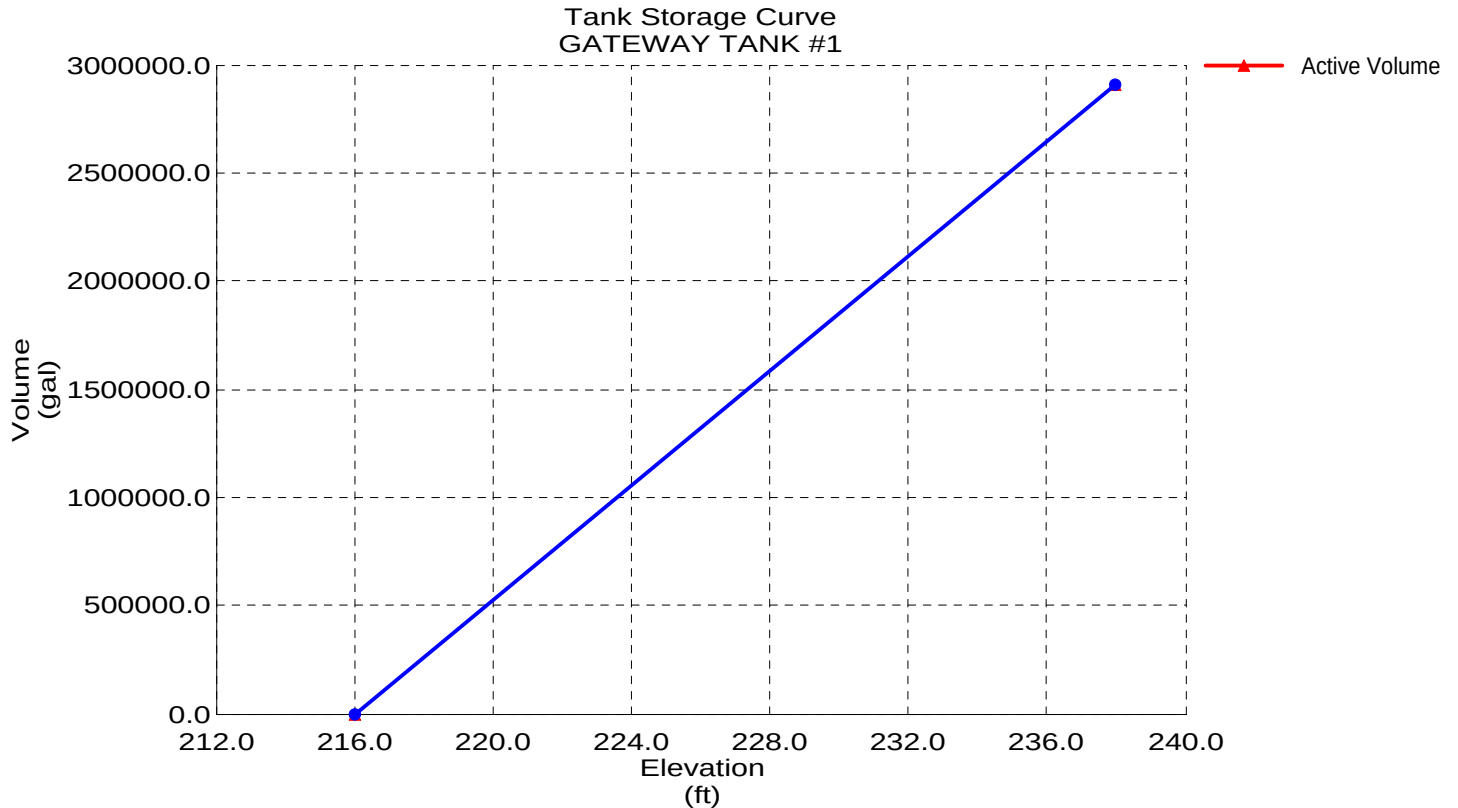
Calculated Results Summary

Time (hr)	Calculated Hydraulic Grade (ft)	Calculated Level (ft)	Pressure (psi)	Calculated Percent Full (%)	Calculated Volume (gal)	Inflow (gpm)	Outflow (gpm)	Current Status
9.00	237.85	23.85	10.32	99.3	388,032.18	,675.30	1,675.30	Filling
9.20	238.00	24.00	10.38	100.0	308,217.15	-557.13	557.13	Draining
10.00	237.80	23.80	10.30	99.1	381,502.88	,675.74	1,675.74	Filling
10.27	238.00	24.00	10.38	100.0	308,217.15	-560.41	560.41	Draining
11.00	237.81	23.81	10.30	99.2	383,532.06	,671.23	1,671.23	Filling
11.25	238.00	24.00	10.38	100.0	308,217.15	-563.53	563.53	Draining
12.00	237.81	23.81	10.30	99.1	382,727.25	,668.57	1,668.57	Filling
12.25	238.00	24.00	10.38	100.0	308,217.15	-566.77	566.77	Draining
13.00	237.81	23.81	10.30	99.1	382,872.48	,665.51	1,665.51	Filling
13.25	238.00	24.00	10.38	100.0	308,217.15	-569.56	569.56	Draining
14.00	237.81	23.81	10.30	99.1	382,711.11	,663.91	1,663.91	Filling
14.26	238.00	24.00	10.38	100.0	308,217.15	-570.53	570.53	Draining
15.00	237.81	23.81	10.30	99.1	382,733.30	,664.77	1,664.77	Filling
15.26	238.00	24.00	10.38	100.0	308,217.15	-569.43	569.43	Draining
16.00	237.81	23.81	10.30	99.1	382,763.55	,666.45	1,666.45	Filling
16.25	238.00	24.00	10.38	100.0	308,217.15	-567.55	567.55	Draining
17.00	237.81	23.81	10.30	99.1	382,828.10	,668.65	1,668.65	Filling
17.25	238.00	24.00	10.38	100.0	308,217.15	-565.33	565.33	Draining
18.00	237.81	23.81	10.30	99.1	382,900.72	,670.98	1,670.98	Filling
18.25	238.00	24.00	10.38	100.0	308,217.15	-562.66	562.66	Draining
19.00	237.81	23.81	10.30	99.1	382,981.40	,674.56	1,674.56	Filling
19.25	238.00	24.00	10.38	100.0	308,217.15	-558.87	558.87	Draining
20.00	237.81	23.81	10.30	99.1	383,104.44	,679.85	1,679.85	Filling
20.25	238.00	24.00	10.38	100.0	308,217.15	-552.95	552.95	Draining
21.00	237.81	23.81	10.30	99.1	383,306.15	,685.41	1,685.41	Filling
21.25	238.00	24.00	10.38	100.0	308,217.15	-547.36	547.36	Draining
22.00	237.81	23.81	10.30	99.1	383,467.52	,692.00	1,692.00	Filling
22.24	238.00	24.00	10.38	100.0	308,217.15	-540.49	540.49	Draining
23.00	237.81	23.81	10.30	99.2	383,697.46	,700.26	1,700.26	Filling
23.24	238.00	24.00	10.38	100.0	308,217.15	-531.71	531.71	Draining
24.00	237.82	23.82	10.30	99.2	383,979.86	,708.38	1,708.38	Filling
24.24	238.00	24.00	10.38	100.0	308,217.15	-523.47	523.47	Draining
25.00	237.82	23.82	10.31	99.2	384,234.01	,716.88	1,716.88	Filling
25.23	238.00	24.00	10.38	100.0	308,217.15	-514.82	514.82	Draining
26.00	237.82	23.82	10.31	99.2	384,518.42	,725.56	1,725.56	Filling
26.23	238.00	24.00	10.38	100.0	308,217.15	-505.97	505.97	Draining
27.00	237.82	23.82	10.31	99.2	384,806.86	,733.08	1,733.08	Filling
27.23	238.00	24.00	10.38	100.0	308,217.15	-498.53	498.53	Draining
28.00	237.82	23.82	10.31	99.2	385,034.79	,737.47	1,737.47	Filling
28.22	238.00	24.00	10.38	100.0	308,217.15	-494.99	494.99	Draining
29.00	237.83	23.83	10.31	99.2	385,125.56	,740.60	1,740.60	Filling
29.22	238.00	24.00	10.38	100.0	308,217.15	-492.01	492.01	Draining
30.00	237.83	23.83	10.31	99.2	385,224.40	,742.93	1,742.93	Filling
30.22	238.00	24.00	10.38	100.0	308,217.15	-489.85	489.85	Draining
31.00	237.83	23.83	10.31	99.2	385,292.98	,744.00	1,744.00	Filling
31.22	238.00	24.00	10.38	100.0	308,217.15	-489.40	489.40	Draining
32.00	237.83	23.83	10.31	99.2	385,288.94	,742.88	1,742.88	Filling
32.22	238.00	24.00	10.38	100.0	308,217.15	-490.74	490.74	Draining
33.00	237.83	23.83	10.31	99.2	385,226.41	,734.72	1,734.72	Filling
33.22	238.00	24.00	10.38	100.0	308,217.15	-500.68	500.68	Draining
34.00	237.82	23.82	10.31	99.2	384,810.90	,729.66	1,729.66	Filling
34.23	238.00	24.00	10.38	100.0	308,217.15	-504.76	504.76	Draining
35.00	237.82	23.82	10.31	99.2	384,762.48	,724.95	1,724.95	Filling

Detailed Report for Tank: GATEWAY TANK #1

Calculated Results Summary

Time (hr)	Calculated Hydraulic Grade (ft)	Calculated Level (ft)	Pressure (psi)	Calculated Percent Full (%)	Calculated Volume (gal)	Inflow (gpm)	Outflow (gpm)	Current Status
35.23	238.00	24.00	10.38	100.0	308,217.15	-509.60	509.60	Draining
36.00	237.82	23.82	10.31	99.2	384,570.86	720.24	1,720.24	Filling
36.23	238.00	24.00	10.38	100.0	308,217.15	-514.41	514.41	Draining
37.00	237.82	23.82	10.31	99.2	384,425.63	715.90	1,715.90	Filling
37.23	238.00	24.00	10.38	100.0	308,217.15	-518.68	518.68	Draining
38.00	237.82	23.82	10.31	99.2	384,288.47	713.15	1,713.15	Filling
38.23	238.00	24.00	10.38	100.0	308,217.15	-520.83	520.83	Draining
39.00	237.82	23.82	10.31	99.2	384,242.08	712.66	1,712.66	Filling
39.23	238.00	24.00	10.38	100.0	308,217.15	-521.15	521.15	Draining
40.00	237.82	23.82	10.31	99.2	384,244.09	713.00	1,713.00	Filling
40.23	238.00	24.00	10.38	100.0	308,217.15	-520.63	520.63	Draining
41.00	237.82	23.82	10.31	99.2	384,268.30	714.03	1,714.03	Filling
41.23	238.00	24.00	10.38	100.0	308,217.15	-519.57	519.57	Draining
42.00	237.82	23.82	10.31	99.2	384,298.56	715.12	1,715.12	Filling
42.23	238.00	24.00	10.38	100.0	308,217.15	-518.16	518.16	Draining
43.00	237.82	23.82	10.31	99.2	384,355.03	717.58	1,717.58	Filling
43.23	238.00	24.00	10.38	100.0	308,217.15	-515.49	515.49	Draining
44.00	237.82	23.82	10.31	99.2	384,453.87	721.69	1,721.69	Filling
44.23	238.00	24.00	10.38	100.0	308,217.15	-510.77	510.77	Draining
45.00	237.82	23.82	10.31	99.2	384,619.27	726.41	1,726.41	Filling
45.23	238.00	24.00	10.38	100.0	308,217.15	-506.03	506.03	Draining
46.00	237.82	23.82	10.31	99.2	384,770.55	732.06	1,732.06	Filling
46.23	238.00	24.00	10.38	100.0	308,217.15	-500.10	500.10	Draining
47.00	237.82	23.82	10.31	99.2	384,978.31	739.38	1,739.38	Filling
47.22	238.00	24.00	10.38	100.0	308,217.15	-492.27	492.27	Draining
48.00	237.83	23.83	10.31	99.2	385,260.70	746.77	1,746.77	Filling



Detailed Report for Tank: GATEWAY TANK #2

Scenario Summary

Scenario	Winter
Active Topology Alternative	Full Build Out
Physical Alternative	Base-Physical
Demand Alternative	Average Day Demand
Initial Settings Alternative	Base-Initial Settings
Operational Alternative	Base-Operational
Age Alternative	Base-Age Alternative
Constituent Alternative	Base-Constituent
Trace Alternative	Base-Trace Alternative
Fire Flow Alternative	Base-Fire Flow
Capital Cost Alternative	Base-Capital Cost
Energy Cost Alternative	Base-Energy Cost
User Data Alternative	Base-User Data

Global Adjustments Summary

Demand	<None>	Roughness	<None>
--------	--------	-----------	--------

Geometric Summary

X	72,721.15 ft	Elevation	220.00 ft
Y	640,526.50 ft	Zone	Zone

Demand Summary

Type	Base Flow (gpm)	Pattern
Demand	0.00	Fixed

Operating Range Summary

Maximum Elevation	375.00 ft	Maximum Level	155.00 ft
Initial HGL	370.00 ft	Initial Level	150.00 ft
Minimum Elevation	360.00 ft	Minimum Level	140.00 ft
Base Elevation	220.00 ft		

Storage

Section Type	Constant Area	Circular Tank Shape?	true
Diameter	126.00 ft	Average Area	12,469.0 ft²
Inactive Volume	0.00 gal	Total Active Volume	1,399,116.83 gal

Calculated Results Summary

Time (hr)	Calculated Hydraulic (ft)	Calculated Grade (ft)	Pressure (psi)	Calculated Percent Full (%)	Calculated Volume (gal)	Inflow (gpm)	Outflow (gpm)	Current Status
0.00	370.00	150.00	64.90	66.7	12,744.56	499.39	499.39	Draining
1.00	369.68	149.68	64.76	64.5	12,782.19	329.79	329.79	Draining
2.00	369.47	149.47	64.67	63.1	12,993.24	213.45	213.45	Draining
3.00	369.33	149.33	64.61	62.2	10,186.79	154.72	154.72	Draining
4.00	369.23	149.23	64.56	61.5	10,904.32	225.77	225.77	Draining
5.00	369.08	149.08	64.50	60.6	17,357.78	181.76	181.76	Draining
6.00	368.97	148.97	64.45	59.8	16,452.80	149.98	149.98	Draining
6.51	368.92	148.92	64.43	59.5	11,838.61	76.55	-76.55	Filling
7.00	368.94	148.94	64.44	59.6	14,075.96	-4.49	4.49	Draining
8.00	368.94	148.94	64.44	59.6	13,805.54	-12.38	12.38	Draining
8.39	368.94	148.94	64.44	59.6	13,518.05	-0.19	0.19	Draining

Detailed Report for Tank: GATEWAY TANK #2

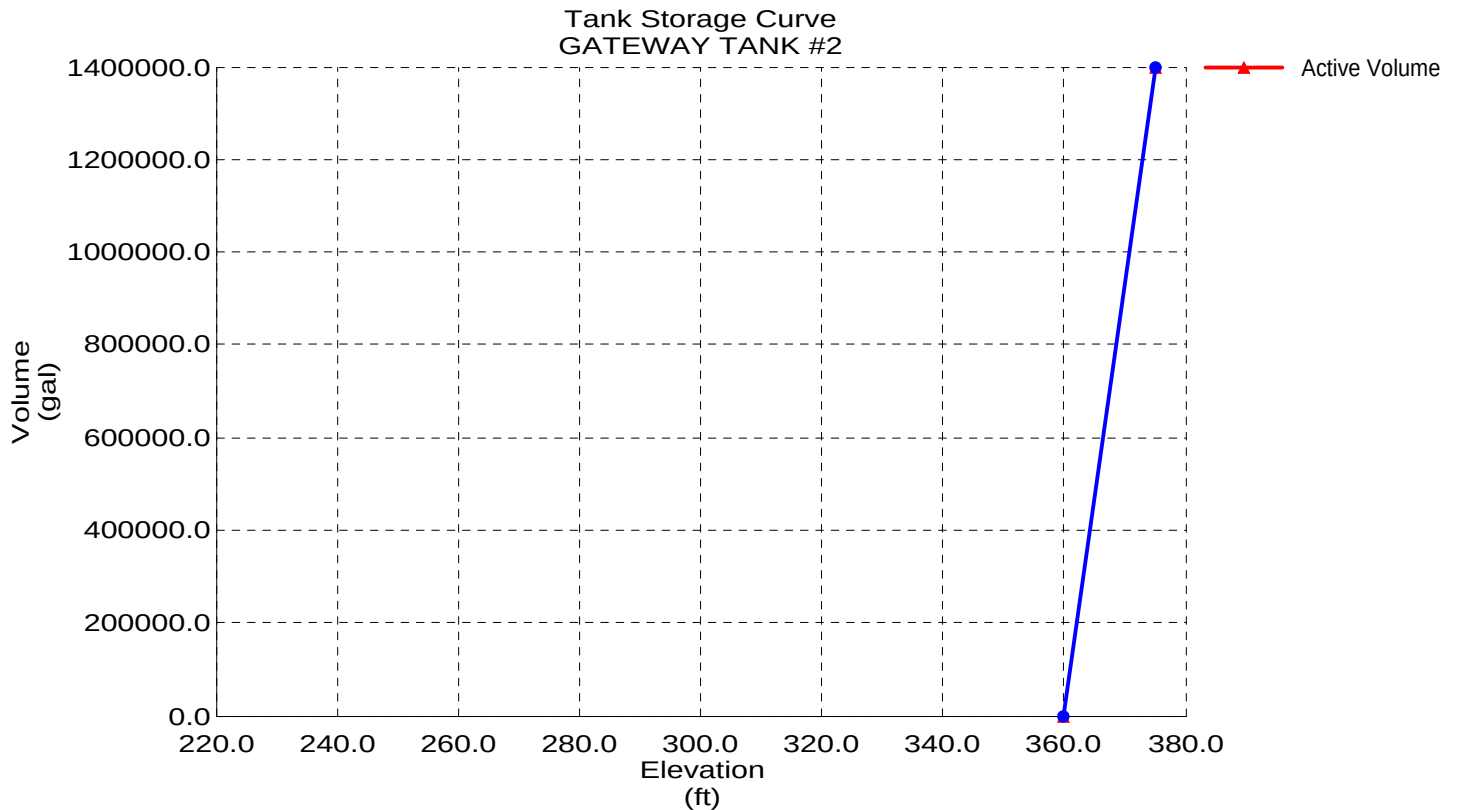
Calculated Results Summary

Time (hr)	Calculated Hydraulic Grade (ft)	Calculated Level (ft)	Pressure (psi)	Calculated Percent Full (%)	Calculated Volume (gal)	Inflow (gpm)	Outflow (gpm)	Current Status
9.00	368.94	148.94	64.44	59.6	13,509.51	334.36	334.36	Draining
9.20	368.89	148.89	64.42	59.3	19,481.69	326.62	326.62	Draining
10.00	368.73	148.73	64.35	58.2	3,820.19	106.85	106.85	Draining
10.27	368.71	148.71	64.34	58.0	2,115.13	-98.08	98.08	Draining
11.00	368.66	148.66	64.32	57.7	17,794.13	130.55	130.55	Draining
11.25	368.64	148.64	64.31	57.6	15,867.04	122.33	122.33	Draining
12.00	368.58	148.58	64.28	57.2	10,333.43	131.61	131.61	Draining
12.25	368.56	148.56	64.27	57.1	18,323.79	123.14	123.14	Draining
13.00	368.50	148.50	64.25	56.7	12,815.79	106.56	106.56	Draining
13.25	368.48	148.48	64.24	56.5	11,193.28	-98.31	98.31	Draining
14.00	368.44	148.44	64.22	56.2	16,792.58	11.34	-11.34	Filling
14.26	368.44	148.44	64.22	56.2	16,966.21	18.89	-18.89	Filling
15.00	368.45	148.45	64.23	56.3	17,808.78	41.90	-41.90	Filling
15.26	368.45	148.45	64.23	56.4	18,452.09	49.23	-49.23	Filling
16.00	368.48	148.48	64.24	56.5	10,652.44	67.66	-67.66	Filling
16.25	368.49	148.49	64.24	56.6	11,685.73	74.81	-74.81	Filling
17.00	368.52	148.52	64.26	56.8	15,030.38	66.83	-66.83	Filling
17.25	368.53	148.53	64.26	56.9	16,046.58	73.97	-73.97	Filling
18.00	368.57	148.57	64.28	57.1	19,359.92	111.15	111.15	Filling
18.25	368.59	148.59	64.29	57.3	11,045.05	117.98	117.98	Filling
19.00	368.64	148.64	64.31	57.6	16,336.72	137.15	137.15	Filling
19.25	368.67	148.67	64.32	57.8	18,403.28	143.81	143.81	Filling
20.00	368.74	148.74	64.35	58.2	4,864.86	222.62	222.62	Filling
20.25	368.77	148.77	64.37	58.5	8,192.43	228.70	228.70	Filling
21.00	368.88	148.88	64.41	59.2	18,493.96	214.00	214.00	Filling
21.25	368.92	148.92	64.43	59.4	11,659.27	220.12	220.12	Filling
22.00	369.02	149.02	64.48	60.2	11,613.52	244.94	244.94	Filling
22.24	369.06	149.06	64.49	60.4	15,197.28	250.86	250.86	Filling
23.00	369.18	149.18	64.54	61.2	16,577.63	310.57	310.57	Filling
23.24	369.23	149.23	64.57	61.5	11,055.19	316.05	316.05	Filling
24.00	369.39	149.39	64.63	62.6	15,461.38	307.80	307.80	Filling
24.24	369.43	149.43	64.65	62.9	19,825.08	313.29	313.29	Filling
25.00	369.59	149.59	64.72	63.9	14,180.03	315.21	315.21	Filling
25.23	369.63	149.63	64.74	64.2	18,583.58	320.64	320.64	Filling
26.00	369.79	149.79	64.81	65.3	3,342.74	320.62	320.62	Filling
26.23	369.84	149.84	64.83	65.6	7,746.29	326.01	326.01	Filling
27.00	370.00	150.00	64.90	66.7	12,829.95	287.82	287.82	Filling
27.23	370.04	150.04	64.92	67.0	16,715.44	293.40	293.40	Filling
28.00	370.19	150.19	64.98	67.9	10,358.76	135.74	135.74	Filling
28.22	370.21	150.21	64.99	68.1	12,171.99	142.28	142.28	Filling
29.00	370.28	150.28	65.02	68.5	18,807.21	106.54	106.54	Filling
29.22	370.29	150.29	65.03	68.6	10,221.92	113.26	113.26	Filling
30.00	370.35	150.35	65.05	69.0	15,513.58	72.15	-72.15	Filling
30.22	370.36	150.36	65.05	69.1	16,467.16	79.08	-79.08	Filling
31.00	370.40	150.40	65.07	69.3	10,167.63	-26.94	26.94	Draining
31.22	370.40	150.40	65.07	69.3	19,814.66	-19.37	19.37	Draining
32.00	370.39	150.39	65.07	69.3	18,906.62	-67.50	67.50	Draining
32.22	370.38	150.38	65.06	69.2	18,018.51	-59.70	59.70	Draining
33.00	370.35	150.35	65.05	69.0	15,220.39	392.62	392.62	Draining
33.22	370.29	150.29	65.02	68.6	10,019.82	383.07	383.07	Draining
34.00	370.10	150.10	64.94	67.3	12,109.57	162.12	162.12	Draining
34.23	370.08	150.08	64.93	67.2	19,914.92	153.73	153.73	Draining
35.00	370.00	150.00	64.90	66.7	12,773.02	184.77	184.77	Draining

Detailed Report for Tank: GATEWAY TANK #2

Calculated Results Summary

Time (hr)	Calculated Hydraulic Grade (ft)	Calculated Level (ft)	Pressure (psi)	Calculated Percent Full (%)	Calculated Volume (gal)	Inflow (gpm)	Outflow (gpm)	Current Status
35.23	369.97	149.97	64.89	66.5	10,259.55	176.26	176.26	Draining
36.00	369.89	149.89	64.85	65.9	12,081.53	184.04	184.04	Draining
36.23	369.86	149.86	64.84	65.7	9,550.98	175.50	175.50	Draining
37.00	369.77	149.77	64.80	65.1	1,432.73	157.59	157.59	Draining
37.23	369.75	149.75	64.79	65.0	9,249.46	149.19	149.19	Draining
38.00	369.67	149.67	64.76	64.5	12,366.60	-38.55	38.55	Draining
38.23	369.67	149.67	64.75	64.5	11,828.60	-30.80	30.80	Draining
39.00	369.65	149.65	64.75	64.4	10,411.04	-6.61	6.61	Draining
39.23	369.65	149.65	64.75	64.3	10,317.11	0.95	-0.95	Filling
40.00	369.65	149.65	64.75	64.4	10,362.65	20.52	-20.52	Filling
40.23	369.66	149.66	64.75	64.4	10,647.30	27.88	-27.88	Filling
41.00	369.67	149.67	64.75	64.5	11,931.08	20.86	-20.86	Filling
41.23	369.67	149.67	64.76	64.5	12,221.42	28.22	-28.22	Filling
42.00	369.69	149.69	64.76	64.6	13,522.28	66.43	-66.43	Filling
42.23	369.70	149.70	64.77	64.6	14,447.39	73.48	-73.48	Filling
43.00	369.73	149.73	64.78	64.9	17,831.90	93.57	-93.57	Filling
43.23	369.75	149.75	64.79	65.0	19,132.75	100.43	100.43	Filling
44.00	369.80	149.80	64.81	65.3	3,764.02	180.22	180.22	Filling
44.23	369.82	149.82	64.82	65.5	6,249.03	186.52	186.52	Filling
45.00	369.92	149.92	64.86	66.1	14,868.26	172.46	172.46	Filling
45.23	369.94	149.94	64.87	66.3	17,225.17	178.80	178.80	Filling
46.00	370.03	150.03	64.91	66.9	15,508.52	204.34	204.34	Filling
46.23	370.06	150.06	64.92	67.1	18,272.48	210.47	210.47	Filling
47.00	370.16	150.16	64.97	67.8	18,053.09	270.92	270.92	Filling
47.22	370.20	150.20	64.99	68.0	11,673.85	276.61	276.61	Filling
48.00	370.34	150.34	65.05	68.9	14,574.24	268.88	268.88	Filling



Detailed Report for Tank: RAC TANK

Scenario Summary	
Scenario	Winter
Active Topology Alternative	Full Build Out
Physical Alternative	Base-Physical
Demand Alternative	Average Day Demand
Initial Settings Alternative	Base-Initial Settings
Operational Alternative	Base-Operational
Age Alternative	Base-Age Alternative
Constituent Alternative	Base-Constituent
Trace Alternative	Base-Trace Alternative
Fire Flow Alternative	Base-Fire Flow
Capital Cost Alternative	Base-Capital Cost
Energy Cost Alternative	Base-Energy Cost
User Data Alternative	Base-User Data

Global Adjustments Summary			
Demand	<None>	Roughness	<None>

Geometric Summary			
X	77,134.85 ft	Elevation	250.00 ft
Y	631,606.19 ft	Zone	Zone

Demand Summary		
Type	Base Flow (gpm)	Pattern
Demand	0.00	Fixed

Operating Range Summary			
Maximum Elevation	365.00 ft	Maximum Level	100.00 ft
Initial HGL	360.00 ft	Initial Level	95.00 ft
Minimum Elevation	300.00 ft	Minimum Level	35.00 ft
Base Elevation	265.00 ft		

Storage			
Section Type	Constant Area	Circular Tank Shape?	true
Diameter	60.00 ft	Average Area	2,827.4 ft²
Inactive Volume	0.00 gal	Total Active Volume	1,374,793.56 gal

Calculated Results Summary								
Time (hr)	Calculated Hydraulic Grade (ft)	Calculated Level (ft)	Pressure (psi)	Calculated Percent Full (%)	Calculated Volume (gal)	Inflow (gpm)	Outflow (gpm)	Current Status
0.00	360.00	95.00	41.10	92.3	269,040.21	127.46	327.46	Filling
1.00	360.93	95.93	41.50	93.7	288,688.23	105.85	305.85	Filling
2.00	361.80	96.80	41.88	95.1	307,038.87	85.42	285.42	Filling
3.00	362.61	97.61	42.23	96.3	324,164.40	65.91	265.91	Filling
4.00	363.36	98.36	42.56	97.5	340,119.06	45.77	245.77	Filling
5.00	364.06	99.06	42.86	98.6	354,865.41	26.05	226.05	Filling
6.00	364.70	99.70	43.14	99.5	368,427.96	6.85	206.85	Filling
6.51	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
7.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
8.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
8.39	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full

Detailed Report for Tank: RAC TANK

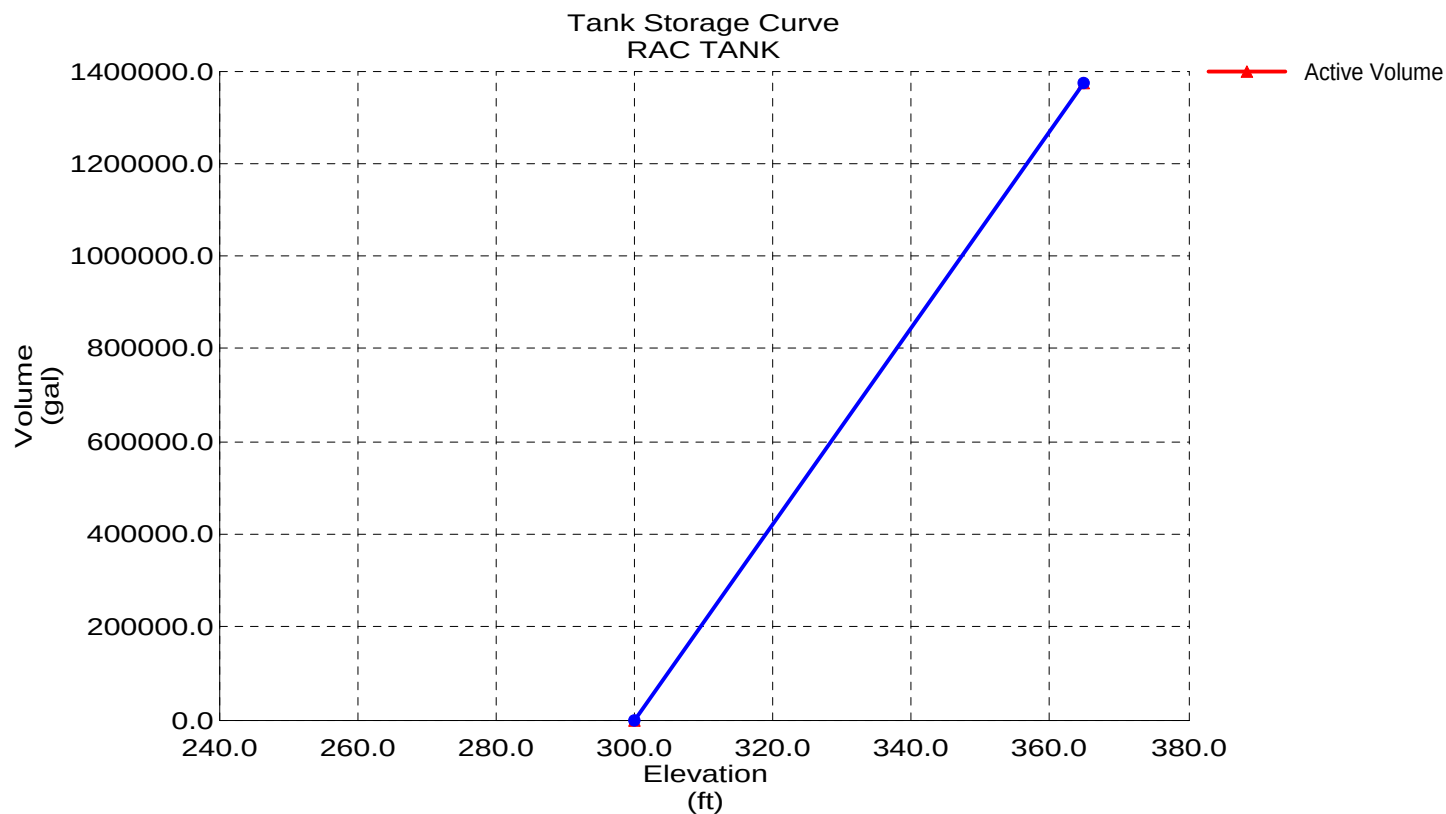
Calculated Results Summary

Time (hr)	Calculated Hydraulic Grade (ft)	Calculated Level (ft)	Pressure (psi)	Calculated Percent Full (%)	Calculated Volume (gal)	Inflow (gpm)	Outflow (gpm)	Current Status
9.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
9.20	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
10.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
10.27	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
11.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
11.25	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
12.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
12.25	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
13.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
13.25	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
14.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
14.26	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
15.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
15.26	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
16.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
16.25	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
17.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
17.25	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
18.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
18.25	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
19.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
19.25	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
20.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
20.25	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
21.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
21.25	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
22.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
22.24	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
23.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
23.24	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
24.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
24.24	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
25.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
25.23	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
26.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
26.23	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
27.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
27.23	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
28.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
28.22	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
29.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
29.22	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
30.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
30.22	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
31.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
31.22	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
32.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
32.22	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
33.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
33.22	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
34.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
34.23	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
35.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full

Detailed Report for Tank: RAC TANK

Calculated Results Summary

Time (hr)	Calculated Hydraulic Grade (ft)	Calculated Level (ft)	Pressure (psi)	Calculated Percent Full (%)	Calculated Volume (gal)	Inflow (gpm)	Outflow (gpm)	Current Status
35.23	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
36.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
36.23	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
37.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
37.23	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
38.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
38.23	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
39.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
39.23	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
40.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
40.23	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
41.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
41.23	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
42.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
42.23	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
43.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
43.23	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
44.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
44.23	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
45.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
45.23	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
46.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
46.23	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
47.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
47.22	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full
48.00	365.00	100.00	43.27	100.0	374,793.56	0.00	0.00	Full



Detailed Report for Reservoir: LOTT SUPPLY

Scenario Summary

Scenario	Winter
Active Topology Alternative	Full Build Out
Physical Alternative	Base-Physical
Demand Alternative	Average Day Demand
Initial Settings Alternative	Base-Initial Settings
Operational Alternative	Base-Operational
Age Alternative	Base-Age Alternative
Constituent Alternative	Base-Constituent
Trace Alternative	Base-Trace Alternative
Fire Flow Alternative	Base-Fire Flow
Capital Cost Alternative	Base-Capital Cost
Energy Cost Alternative	Base-Energy Cost
User Data Alternative	Base-User Data

Global Adjustments Summary

Demand	<None>	Roughness	<None>
--------	--------	-----------	--------

Geometric Summary

X	69,374.44 ft	Elevation	260.00 ft
Y	640,875.49 ft	Zone	Zone

Calculated Results Summary

Time (hr)	Calculated Hydraulic (ft)	Inflow Grade (gpm)	Outflow (gpm)
0.00	260.00	2,620.48	,620.48
1.00	260.00	2,564.70	,564.70
2.00	260.00	2,512.03	,512.03
3.00	260.00	2,461.43	,461.43
4.00	260.00	2,412.58	,412.58
5.00	260.00	2,365.33	,365.33
6.00	260.00	2,319.58	,319.58
6.51	260.00	2,296.94	,296.94
7.00	260.00	2,275.73	,275.73
8.00	260.00	2,232.62	,232.62
8.39	260.00	0.00	0.00
9.00	260.00	2,224.70	,224.70
9.20	260.00	0.00	0.00
10.00	260.00	2,227.38	,227.38
10.27	260.00	0.00	0.00
11.00	260.00	2,226.55	,226.55
11.25	260.00	0.00	0.00
12.00	260.00	2,226.88	,226.88
12.25	260.00	0.00	0.00
13.00	260.00	2,226.82	,226.82
13.25	260.00	0.00	0.00
14.00	260.00	2,226.88	,226.88
14.26	260.00	0.00	0.00
15.00	260.00	2,226.87	,226.87
15.26	260.00	0.00	0.00
16.00	260.00	2,226.86	,226.86
16.25	260.00	0.00	0.00
17.00	260.00	2,226.83	,226.83
17.25	260.00	0.00	0.00
18.00	260.00	2,226.80	,226.80

Detailed Report for Reservoir: LOTT SUPPLY

Calculated Results Summary			
Time (hr)	Calculated Hydraulic Grade (ft)	Inflow (gpm)	Outflow (gpm)
18.25	260.00	0.00	0.00
19.00	260.00	2,226.77	2,226.77
19.25	260.00	0.00	0.00
20.00	260.00	2,226.72	2,226.72
20.25	260.00	0.00	0.00
21.00	260.00	2,226.64	2,226.64
21.25	260.00	0.00	0.00
22.00	260.00	2,226.57	2,226.57
22.24	260.00	0.00	0.00
23.00	260.00	2,226.48	2,226.48
23.24	260.00	0.00	0.00
24.00	260.00	2,226.36	2,226.36
24.24	260.00	0.00	0.00
25.00	260.00	2,226.26	2,226.26
25.23	260.00	0.00	0.00
26.00	260.00	2,226.14	2,226.14
26.23	260.00	0.00	0.00
27.00	260.00	2,226.02	2,226.02
27.23	260.00	0.00	0.00
28.00	260.00	2,225.93	2,225.93
28.22	260.00	0.00	0.00
29.00	260.00	2,225.89	2,225.89
29.22	260.00	0.00	0.00
30.00	260.00	2,225.85	2,225.85
30.22	260.00	0.00	0.00
31.00	260.00	2,225.82	2,225.82
31.22	260.00	0.00	0.00
32.00	260.00	2,225.83	2,225.83
32.22	260.00	0.00	0.00
33.00	260.00	2,225.85	2,225.85
33.22	260.00	0.00	0.00
34.00	260.00	2,226.02	2,226.02
34.23	260.00	0.00	0.00
35.00	260.00	2,226.04	2,226.04
35.23	260.00	0.00	0.00
36.00	260.00	2,226.12	2,226.12
36.23	260.00	0.00	0.00
37.00	260.00	2,226.18	2,226.18
37.23	260.00	0.00	0.00
38.00	260.00	2,226.24	2,226.24
38.23	260.00	0.00	0.00
39.00	260.00	2,226.26	2,226.26
39.23	260.00	0.00	0.00
40.00	260.00	2,226.25	2,226.25
40.23	260.00	0.00	0.00
41.00	260.00	2,226.24	2,226.24
41.23	260.00	0.00	0.00
42.00	260.00	2,226.23	2,226.23
42.23	260.00	0.00	0.00
43.00	260.00	2,226.21	2,226.21
43.23	260.00	0.00	0.00
44.00	260.00	2,226.17	2,226.17
44.23	260.00	0.00	0.00
45.00	260.00	2,226.10	2,226.10

Detailed Report for Reservoir: LOTT SUPPLY

Calculated Results Summary

Time (hr)	Calculated Hydraulic Grade (ft)	Inflow (gpm)	Outflow (gpm)
45.23	260.00	0.00	0.00
46.00	260.00	2,226.04	226.04
46.23	260.00	0.00	0.00
47.00	260.00	2,225.95	225.95
47.22	260.00	0.00	0.00
48.00	260.00	2,225.84	225.84

APPENDIX H – Topos

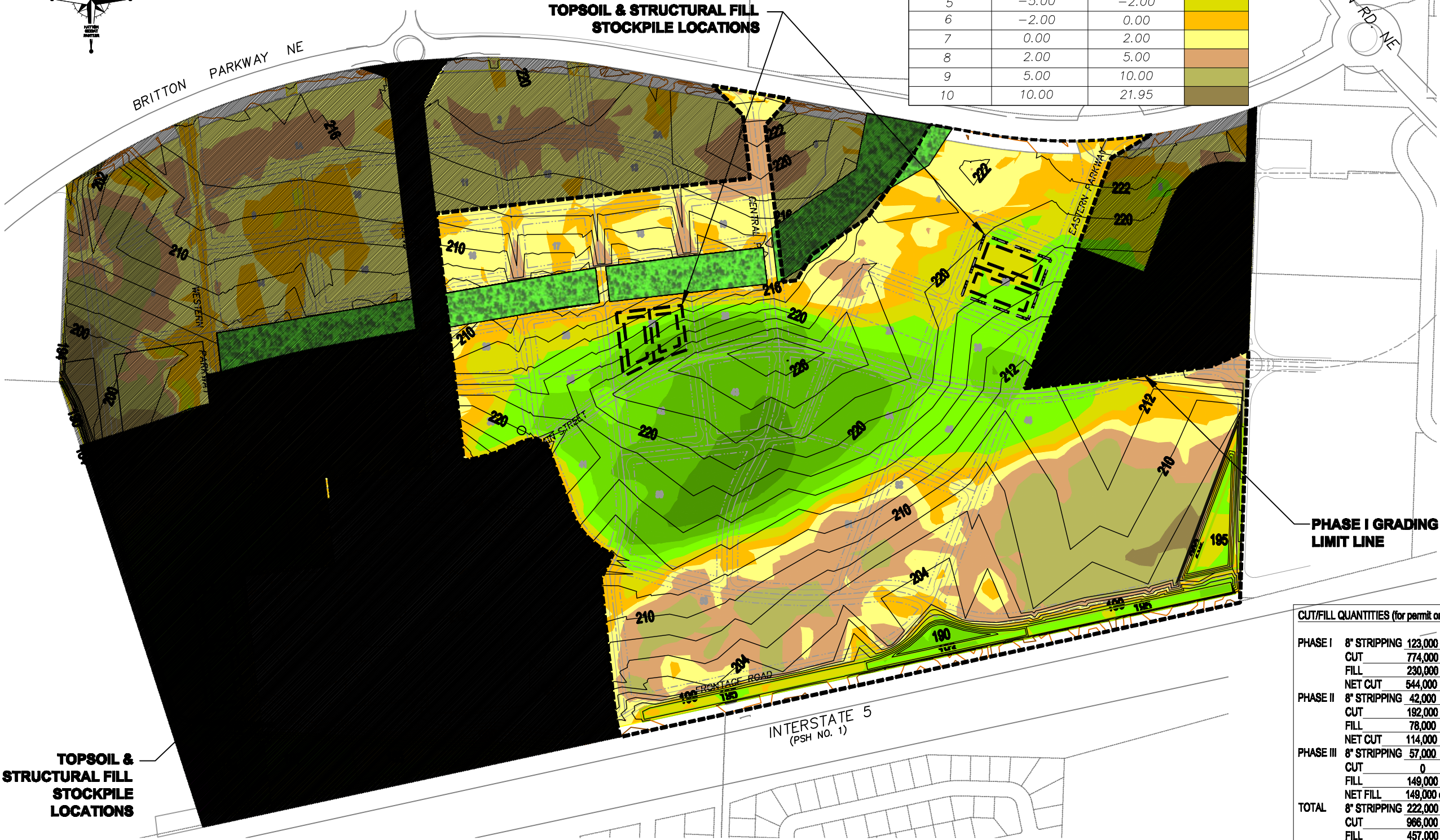
- Map Exhibit

LACEY GATEWAY MASTER PLAN EXHIBIT

PHASE I PRELIMINARY GRADING PLAN

A PORTION OF THE NE 1/4 OF SECTION 10 & THE NW 1/4 OF SECTION 11, TOWNSHIP 18N, RANGE 1W, W.M.

CUT/FILL ELEVATIONS TABLE			
NUMBER	MINIMUM ELEVATIONS	MAXIMUM ELEVATIONS	COLOR
1	-31.58	-25.00	
2	-25.00	-15.00	
3	-15.00	-10.00	
4	-10.00	-5.00	
5	-5.00	-2.00	
6	-2.00	0.00	
7	0.00	2.00	
8	2.00	5.00	
9	5.00	10.00	
10	10.00	21.95	



CUT/FILL QUANTITIES (for permit only)		
PHASE I	8" STRIPPING	123,000 cy
	CUT	774,000 cy
	FILL	230,000 cy
	NET CUT	544,000 cy
PHASE II	8" STRIPPING	42,000 cy
	CUT	192,000 cy
	FILL	78,000 cy
	NET CUT	114,000 cy
PHASE III	8" STRIPPING	57,000 cy
	CUT	0 cy
	FILL	149,000 cy
	NET FILL	149,000 cy
TOTAL	8" STRIPPING	222,000 cy
	CUT	966,000 cy
	FILL	457,000 cy
	NET CUT	509,000 cy

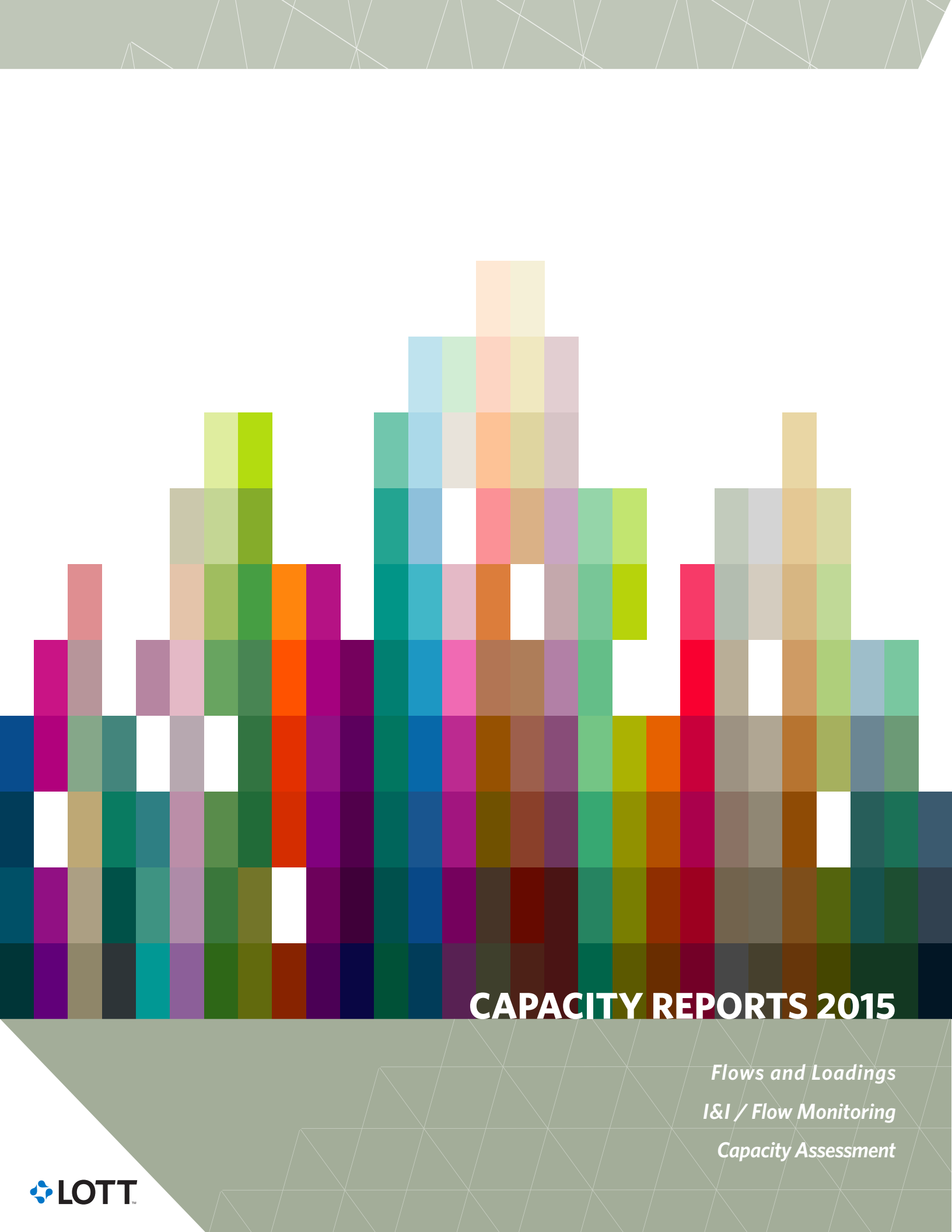


DESIGNED BY: EBA
DRAWN BY: JSK
CHECKED BY: JSK
DATE: SEPT. 2007
SCALE: 1" = 400'

HATTON GODAT PANTIER
ENGINEERS AND SURVEYORS
1840 BARNES BOULEVARD S W
TUMWATER, WA 98512
TEL: 360.943.1599 FAX: 360.357.6299
hattonpantier.com

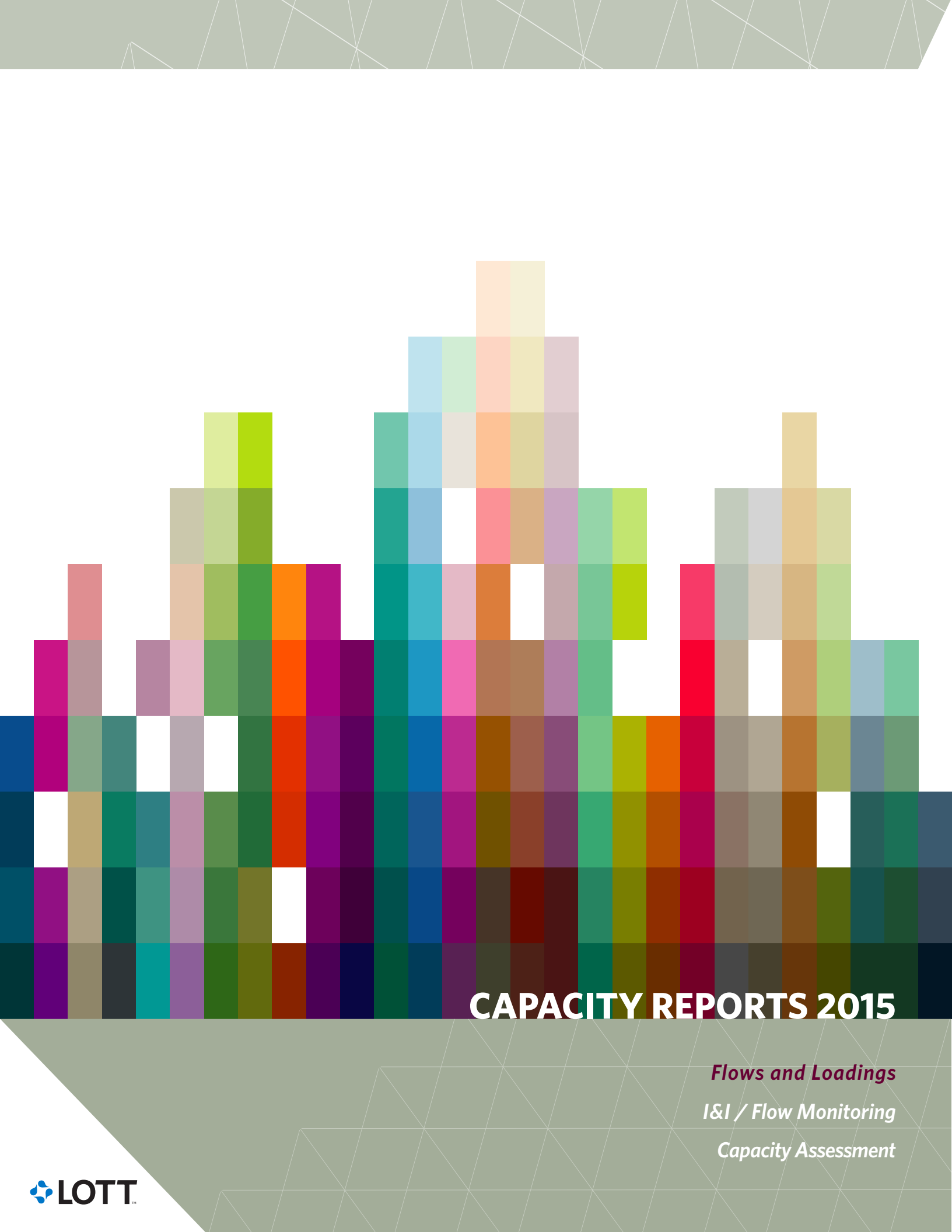
LACEY GATEWAY
MASTER PLAN EXHIBIT
BRITTON PARKWAY, LACEY WA
PHASE I PRELIMINARY GRADING PLAN

REVISIONS: DATE: _____
AGENCY NO. _____
SHEET: 1 OF 3
INDEX: gdtAT11907.dwg
JOB: 04-145



CAPACITY REPORTS 2015

*Flows and Loadings
I&I / Flow Monitoring
Capacity Assessment*



CAPACITY REPORTS 2015

Flows and Loadings

I&I / Flow Monitoring

Capacity Assessment



2015 Flows and Loadings Report

December 2015

Prepared By:

Tyle Zuchowski, LOTT Clean Water Alliance

With assistance from Adam Klein and Hannah McClean, Brown & Caldwell

PREFACE

The Flows and Loadings Report is one of three related documents that are part of the process to monitor and evaluate capacity in the entire LOTT system. The intent, under LOTT's Wastewater Resource Management Plan (also known as the Highly Managed Plan), is to assure that needed new capacity is brought on-line "just in time" to meet system needs. Capacity needs evaluated include wastewater treatment, Budd Inlet discharge, reclaimed water use/recharge, and conveyance capacity in the entire LOTT system. These three reports are prepared annually, and are used to help identify capital projects for inclusion in the annual Capital Improvements Plan.

- **Flows and Loadings Report** – analyzes residential and employment population projections within the Urban Growth Boundary and estimates the impact on wastewater flows and loading within the LOTT wastewater system.

- **Inflow and Infiltration Report** – uses dry and wet weather sewer flow monitoring results to quantify the amount of unwanted surface (inflow) and subsurface (infiltration) water entering the sewer system and to prioritize sewer line rehabilitation projects.

- **Capacity Assessment Report** – uses flows and loadings data and inflow & infiltration evaluation results to analyze system components (i.e. conveyance, treatment, and discharge/use), determine when limitations will occur, and provide a timeline for new system components and upgrades.

Together, these reports become chapters in an overall "Capacity Reports" document. The combined report will be posted each year in the "Library" on LOTT's website – www.lottcleanwater.org.

Table of Contents

Executive Summary	iii
1. Introduction	1
1.1 Purpose	1
1.2 Data Elements	1
1.3 Modeling Software	1
1.4 Changes From Previous Reports	1
2. Study Area	2
2.1 Service Area	2
2.2 Current Sewered Area	3
2.3 Future Sewered Area	4
2.4 On-site Septic Systems	7
3. Population and Employment Forecast	8
3.1 Projections	8
3.2 Equivalent Residential Units	10
3.3 New Connections	10
4. Flows and Loadings	12
4.1 Permit Requirements	12
4.2 Drinking Water Analysis	12
4.3 Base Sanitary Flow	14
4.4 Comparison with Historical Wastewater Generation Rates	16
4.5 Flow Projections	17
4.6 Inflow and Infiltration Projections	17
4.7 Loading Projections	19
4.8 Projections Analysis	22

Executive Summary

In accordance with the Wastewater Resource Management Plan, also known as the “Highly Managed Plan,” LOTT is continuously planning to ensure it maintains adequate operational capacity to meet the community needs. The primary goal of the annual Flows and Loadings Report is to define the current and projected wastewater characteristics of the LOTT service area in terms of both wastewater flows and pollutant constituents (loads). The information in this report was used to develop the 2015 Capacity Assessment Report and the 2016 Capital Improvements Plan.

The Thurston Regional Planning Council (TRPC) updates its population and employment projections every five years. The latest update was published in the spring of 2013. These projections were used to develop the flows and loadings included in this report. Additional data included flow monitoring data collected as part of LOTT’s inflow and infiltration evaluation program, timelines for sewerage of non-sewered areas provided by each of the jurisdictions (Lacey, Olympia, and Tumwater) and updated current sewerage areas.

This report also includes a drinking water evaluation using 2014 drinking water consumption data obtained from the jurisdictions. This analysis was used to recalibrate wastewater generation rate profiles for each of the jurisdictions.

The updated flows and loading projections are reduced from last years’ reports. Account data provided by the partner jurisdictions, previously unavailable, has shown that the current residential population served by LOTT is larger than estimated in earlier projections. This is resulting in a decreased estimate of the average daily per capita contribution of wastewater to the system.

By 2050, it is estimated that conversions of existing septic tanks could account for 24% of the total average daily flow and 20% of the average loadings, although the rate at which conversions will actually take place is unclear. A more detailed analysis of septic conversions will be included in future reports.

1. Introduction

1.1 Purpose

Accurate projections of future wastewater flows and loadings are essential in planning for new treatment capacity. In accordance with the Highly Managed Plan, LOTT is continuously monitoring and planning to assure that adequate new wastewater treatment capacity is available “just in time.” The primary goal of the annual Flows and Loadings Report is to define the current and projected wastewater characteristics of the LOTT service area in terms of both wastewater flows and pollutant constituents (loads). Flows and loadings projections cover the 36-year planning cycle (2015-2050) and will be used to evaluate the existing LOTT Capital Improvements Plan and develop recommendations for the timing of future capacity related projects.

1.2 Data Elements

Data used for the development of this report included wastewater flow monitoring data, sewer and non-sewered population projections, existing sewer lines, estimated timelines for sewerage of non-sewered areas within the overall Urban Growth Area (UGA), and 2014 drinking water consumption data. Flow data was collected at the Budd Inlet Treatment Plant and at various flow monitoring locations throughout the collection system. Population projections, updated in 2013, were obtained from the Thurston Regional Planning Council (TRPC) in the form of projected residential and employment populations per parcel. The estimated sewerage timelines, drinking water consumption data, and existing collection system piping information were obtained from each of the partner jurisdictions (Lacey, Olympia, and Tumwater).

1.3 Modeling Software

To develop flow and loading projections, the drinking water data were combined in Excel and then uploaded to a map of the parcels in Thurston County in a geographic information system (GIS) database. The drinking water data were allocated to specific parcels which contained population data and projections provided by the TRPC. This combined data was exported and extrapolated in Excel.

1.4 Changes From Previous Reports

This year’s projections were developed similarly to those developed in the 2014 Flow and Loadings Report.

Drinking water data was collected from each of the partner jurisdictions (Olympia, Tumwater, and Lacey) along with parcel identification numbers, rate classes and units per parcel. This drinking water data was sorted and organized and assigned to their respective parcels in GIS. The GIS map held other pertinent data for each parcel including its physical location, drinking water basin, sewer basin, future sewer basin, and population projection from the TRPC.

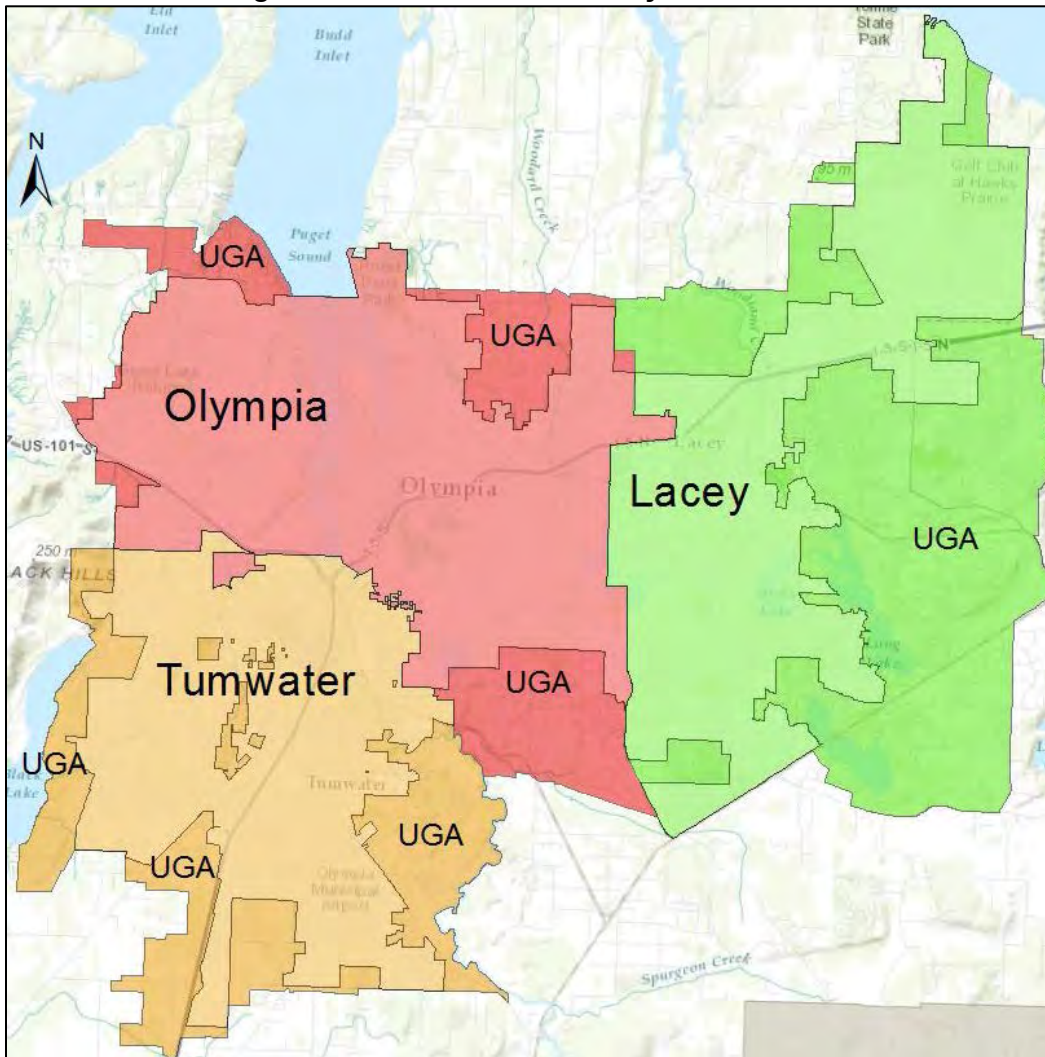
The raw drinking water data from the jurisdictions, along with the population projections from TRPC, were used to project future wastewater and loading production rates.

2. Study Area

2.1 Service Area

The LOTT Service area includes the urban growth areas (UGAs) for the cities of Lacey, Olympia, and Tumwater. In 2010, the service area decreased by approximately 856 acres as a result of the Tumwater S.W. UGA Resizing and Land Use Analysis. The current combined UGA encompasses approximately 52,276 acres, with a current residential population of 167,807 and an employment population of 114,988.

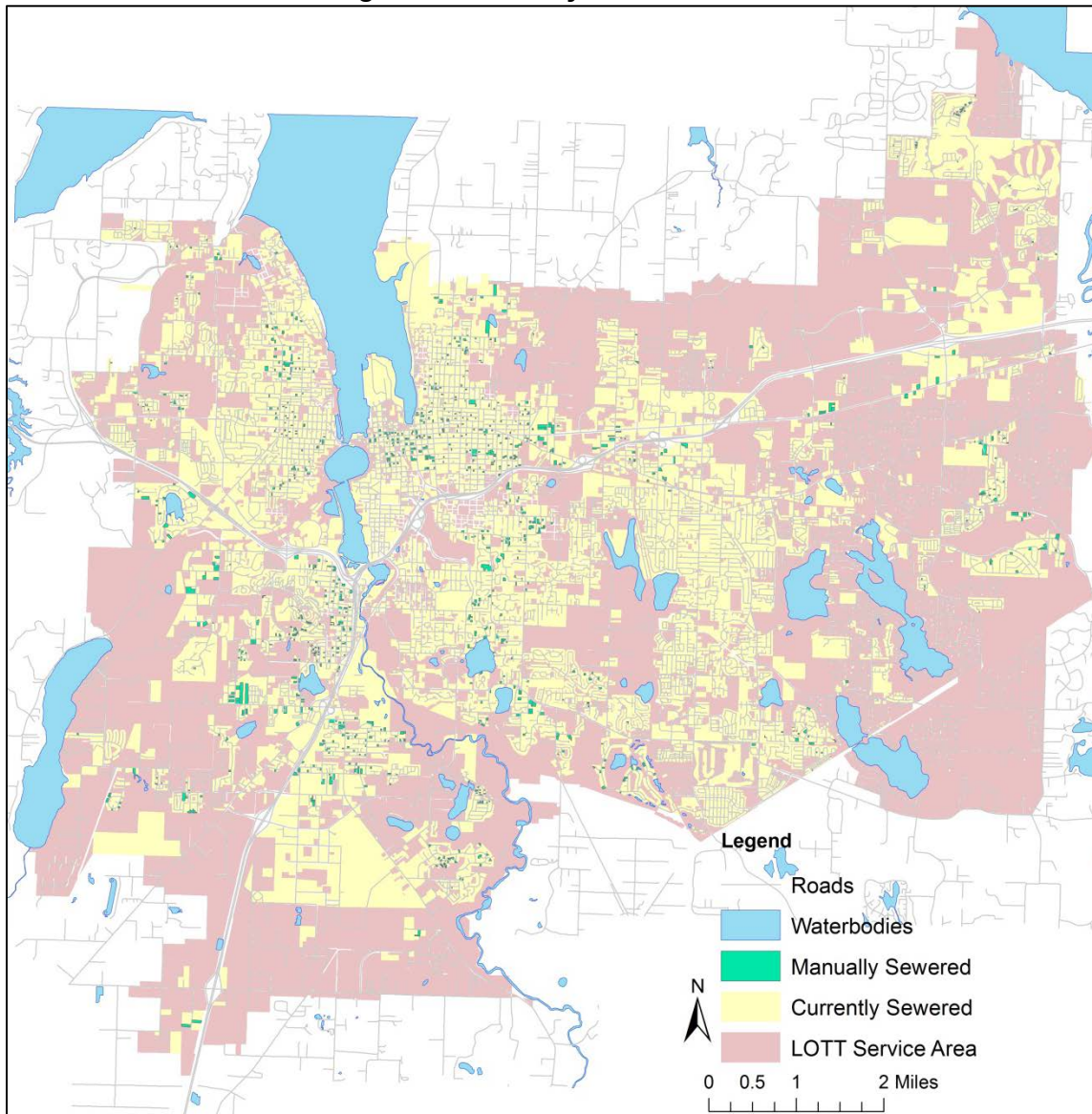
Figure 1. LOTT Service Area by Jurisdiction



2.2 Current Sewered Area

Within the LOTT service area, approximately 16,516 acres are sewered, serving a residential population of 117,700 and an employment population of 91,000. The currently sewered parcels, shown in yellow on Figure 2, depict the parcels for which the jurisdictions provided drinking water data. We assumed that if a parcel had drinking water consumption data that it was currently sewered and LOTT was receiving their wastewater flow. The areas shown in green on Figure 2 depict the parcels for which we did not receive drinking water consumption data but which were physically surrounded by sewered parcels. We assumed these parcels were most likely sewered and we manually added them to our sewered count.

Figure 2. Currently Sewered Area



2.3 Future Sewered Area

In order to properly project future flows and loadings, it is necessary to account for future sewered areas. For each sewer basin shown in Figure 3, the jurisdictions were asked to associate a start and end date for connecting to the sewer system, to include conversions from septic systems. Note that full sewerage includes conversion of all existing on-site septic systems to sewer. Figure 3 illustrates the future sewered areas and Table 1 illustrates their associated timeline for the expected conversion rate.

There are four separate estimations, or rates, of sewerage that were taken into account: low rate, expected rate, aggressive rate, and full sewerage:

- **Low Rate** – The low rate of sewerage assumes the majority of sewer basins containing parcels with no existing septic tank would begin the connection process by 2020 and that by 2050 about 40% of these parcels would be connected to the sewer system. For the parcels that currently have a septic tank, the start date for the connection process would begin between 2025 and 2030 and only about 17% of the parcels would be connected to the sewer system by 2050.
- **Expected Rate** – The expected projection rate assumes that the parcels with no existing septic tanks that began connection to the sewer system before 2020 would be 100% converted to sewer by 2050. This projection rate also assumes that the majority of parcels with an existing septic tank would begin sewer connection in 2030 and would be about 20% converted to sewer by 2050.
- **Aggressive Rate** – The aggressive projection rate assumes that all of the parcels with no existing septic tank, regardless of sewer basin, will be fully sewerage by 2050. The parcels with an existing septic tank will be roughly 40-50% sewerage by 2050.
- **Full Sewerage** – The full sewerage rate assumes that by 2050 all parcels, those with and without septic tanks, regardless of sewer basin, will be connected to the sewer system. The latest start date for any sewer basin is 2030. End sewerage dates are all 2050 (build-out) for every sewer basin. This reflects the assumption made in previous LOTT flow and loading projections.

The method of calculating future sewerage rates assumed a front-loaded projection. This means that the rate of sewer connection is expected to occur at a faster rate in the next ten years than is expected to occur in the following twenty to thirty years. The rate of septic conversion is assumed to follow a more linear trend.

The majority of the tables and projections discussed in this report assume the “expected” sewerage rate. Other projections are occasionally shown for comparison.

Figure 3. Future Sewer Basins



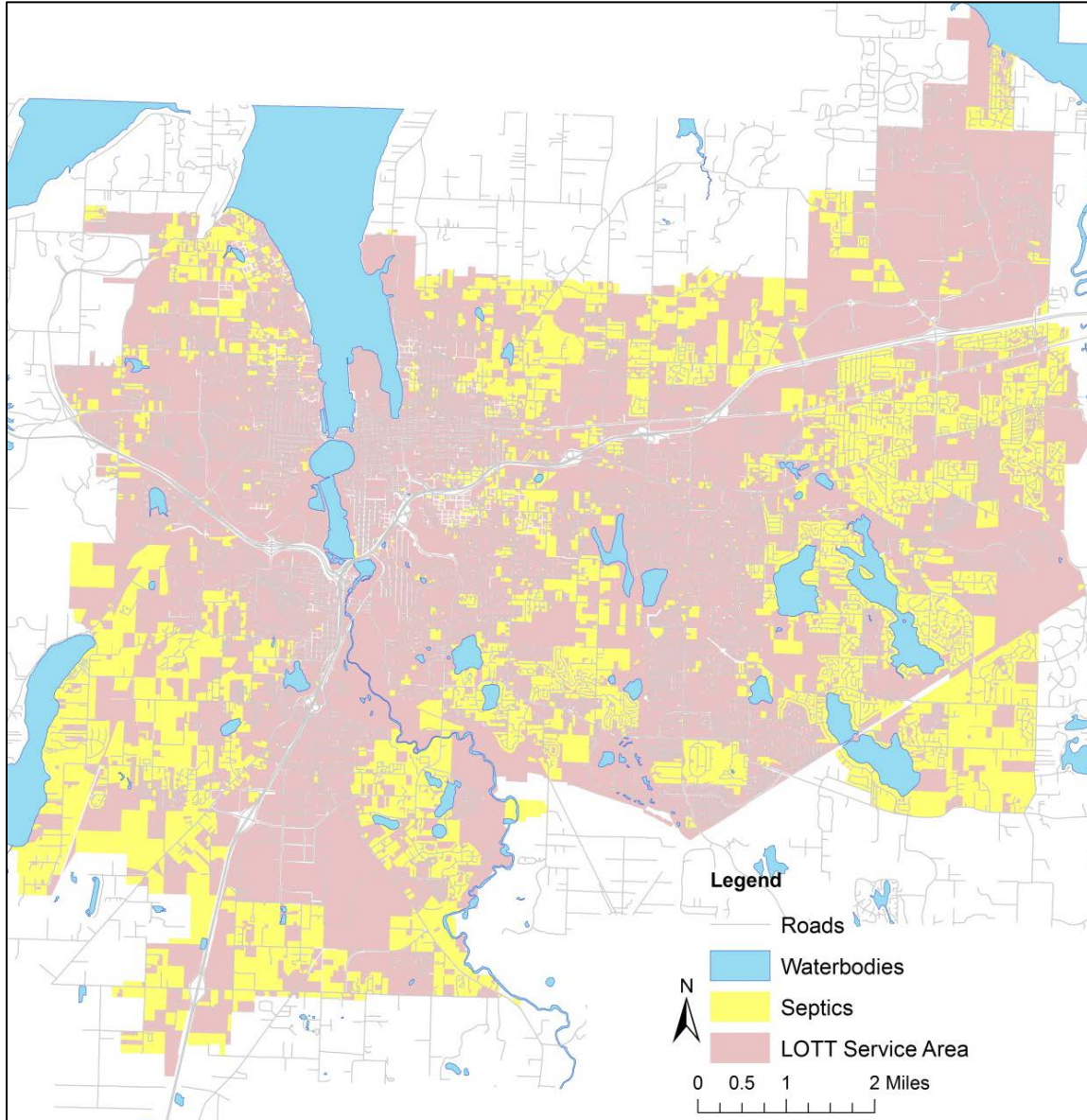
Table 1. Expected Future Sewering Schedule

ID	Name	Current Sewer Coverage (0-5, 5=Full)	Septic Conversion Priority (1-3, 3 = High)	Parcels with no existing septic tank			Parcels with existing septic tank		
				Start	End	% Parcels Connected at Build-out	Start	End	% Existing Septics Converted at Build-out
1	Thompson Place E	3	3	2020	2050	100%	2030	2125	21%
2	Hawks Prairie	2	3	2016	2075	58%	2030	2125	21%
3	Thompson Place W	1	3	2020	2050	100%	2025	2075	50%
4	Woodland Creek	1	3	2015	2050	100%	2012	2075	60%
5	Lilly Road	3	3	2017	2050	100%	2030	2125	21%
6	South Bay	1	3	2020	2080	50%	2030	2125	21%
7	Ridgeview	1	3	2020	2100	38%	2030	2125	21%
8	Tanglewilde	0	1	2020	2060	75%	2025	2060	71%
9	Meadows	2	1	2016	2060	77%	2020	2075	55%
10	Central Lacey	3	1	2016	2050	100%	2020	2075	55%
11	Lake Forest	2	2	2019	2080	51%	2030	2100	29%
12	SE Lacey	1	2	2020	2080	50%	2030	2100	29%
13	Horizon	4	1	2015	2040	100%	2030	2075	44%
14	Carpenter Road	2	1	2017	2050	100%	2030	2075	44%
15	Hwy 99	2	3	2021	2075	54%	2030	2125	21%
16	Trails End	2	3	2020	2075	55%	2030	2125	21%
17	S Tumwater	2	3	2018	2075	56%	2030	2125	21%
18	SW Little Rock	0	1	2025	2060	71%	2025	2075	50%
19	Black Hills	2	3	2021	2075	54%	2030	2125	21%
20	Trosper	0	3	2020	2080	50%	2030	2125	21%
21	Central Tumwater	4	2	2015	2040	100%	2030	2100	29%
22	Pioneer	4	3	2015	2040	100%	2030	2125	21%
23	Black Lake	0	2	2020	2080	50%	2030	2100	29%
24	N Black Lake	0	1	2020	2060	75%	2030	2075	44%
25	Mottman	4	3	2017	2040	100%	2030	2125	21%
26	Ken Lake	4	1	2017	2040	100%	2025	2075	50%
27	West Side	4	3	2015	2040	100%	2030	2125	21%
28	Green Cove	2	3	2020	2075	55%	2030	2125	21%
29	West Bay	4	3	2015	2040	100%	2030	2125	21%
30	East Bay	4	3	2016	2040	100%	2030	2125	21%
31	E Olympia	5	3	2017	2025	100%	2030	2125	21%
32	Indian Creek	4	3	2016	2040	100%	2030	2125	21%
33	W Chambers Prairie	0	2	2022	2080	48%	2030	2100	29%
34	SE Olympia	2	3	2020	2075	55%	2030	2125	21%
35	Wilderness	3	3	2020	2050	100%	2030	2125	21%
36	Chambers Prairie	4	1	2016	2040	100%	2030	2075	44%
37	Downtown Olympia	5	3	2015	2025	100%	2030	2125	21%

2.4 On-site Septic Systems

As discussed in the previous section, future sewerage considers extension of sewer to new developments, as well as conversion of existing on-site septic systems. Figure 4 illustrates the locations of the parcels with septic systems. In separate work done by the Regional Septic Work Group, it was determined that an estimated 16,744 septic systems are in use in the UGA. Over 5,000 are considered high priority for conversion.

Figure 4. Existing Parcels with Septic System



3. Population and Employment Forecast

3.1 Projections

Population projections are updated by TRPC once every five years, with the most recent projections being released in the spring of 2013. Projections used for this analysis were in the form of a GIS parcel file, which included projected residential population for the years 2010, 2015, 2020, 2025, and 2030. Employment projections included the years 2010 and 2035. In addition, a build-out, or maximum density estimate, was included and estimated to occur in 2050. All of this population projection data was allocated among the parcels supplied by the TRPC.

Based on each parcel location, the following attributes were assigned: jurisdiction, drinking water basin, sewer basin, future sewer basin, drinking water consumption, whether the parcel was sewered or septic, and whether the parcel was predominately residential or commercial. The parcel data and associated attributes were exported from the GIS file into an Access database. In Access, the parcels were grouped according to their attributes. A total of 1,370 unique groups were formed: each parcel in each group was located in the same drinking water, sewer, and future sewer basin, and jurisdiction; their drinking water consumption data was summed per group, as well as all of the population prediction data.

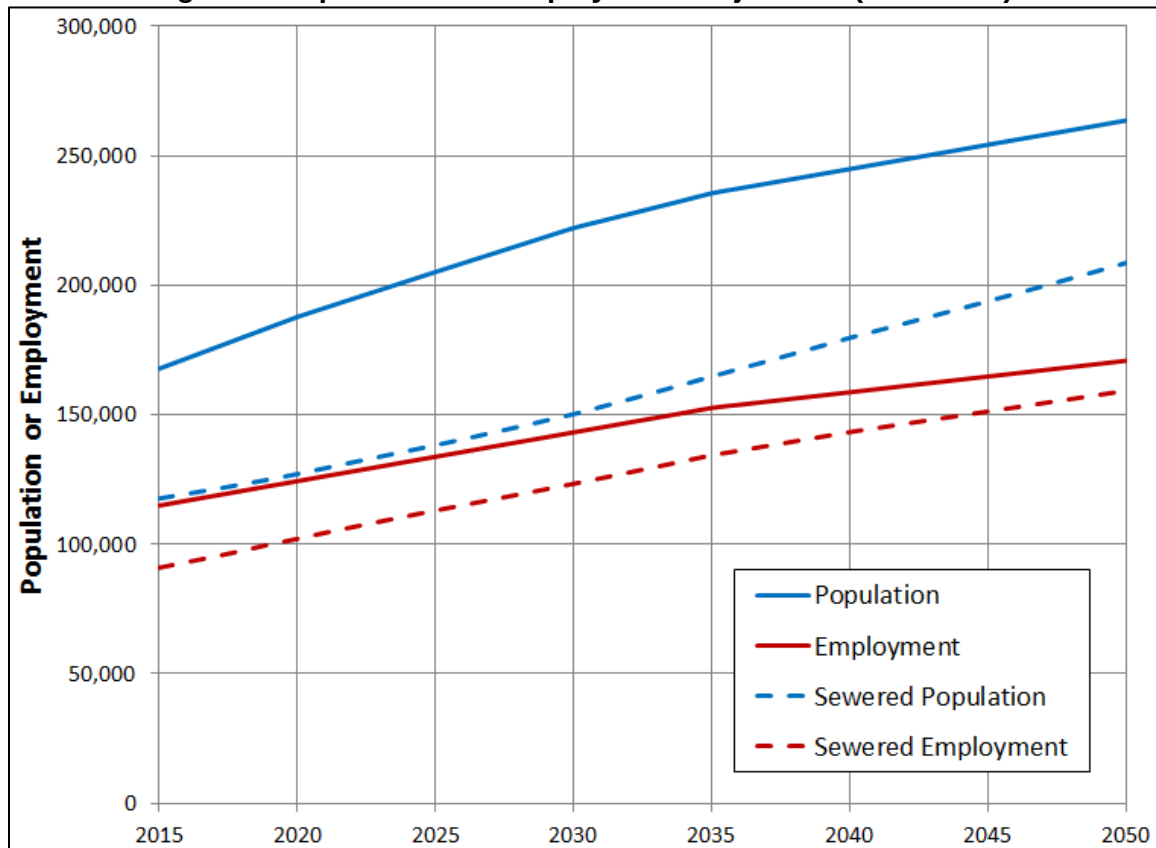
These groups were then exported from the Access database into Excel to complete all forecasting calculations. Table 2 displays the results of the population analysis to include the developments data collected from the jurisdictions. The future population data was calculated by linear extrapolation using the projection data provided by the TRPC. Excel allowed the use of pivot tables which were useful in summing the flow and loading data by specific attributes such as sewer basin or jurisdiction.

The residential and employment populations include all residents and employees within the UGA. The sewered residential population and sewered employment population include only those contained within the sewered areas. Future expansion of the sewered areas is accounted for in the projections throughout the forecast period. Figure 5 displays the projected population and employment forecasts for the planning period (2015-2050).

Table 2. Population and Employment Projections

Year	Residential Population	Employee Population	Sewered Residential Population	Sewered Employee Population
2015	167,807	114,988	117,722	91,009
2016	171,804	116,871	119,473	93,136
2017	175,802	118,754	121,276	95,237
2018	179,800	120,637	123,144	97,525
2019	183,798	122,520	125,066	99,985
2020	187,795	124,404	127,152	102,095
2021	191,266	126,287	129,373	104,446
2022	194,736	128,170	131,641	106,647
2023	198,206	130,053	133,863	108,806
2024	201,676	131,936	136,048	110,938
2025	205,147	133,819	138,249	113,062
2026	208,541	135,702	140,581	115,116
2027	211,936	137,586	142,944	117,169
2028	215,330	139,469	145,343	119,228
2029	218,724	141,352	147,782	121,294
2030	222,119	143,235	150,261	123,370
2031	224,796	145,118	153,063	125,545
2032	227,473	147,001	155,916	127,735
2033	230,150	148,884	158,821	129,939
2034	232,827	150,768	161,779	132,158
2035	235,504	152,651	164,791	134,393
2036	237,378	153,865	167,715	136,185
2037	239,252	155,080	170,670	137,976
2038	241,125	156,295	173,657	139,768
2039	242,999	157,509	176,676	141,561
2040	244,873	158,724	179,728	143,356
2041	246,747	159,938	182,498	144,943
2042	248,621	161,153	185,294	146,530
2043	250,495	162,368	188,117	148,119
2044	252,368	163,582	190,967	149,710
2045	254,242	164,797	193,844	151,303
2046	256,116	166,011	196,748	152,897
2047	257,990	167,226	199,679	154,493
2048	259,864	168,440	202,637	156,092
2049	261,738	169,655	205,622	157,693
2050	263,611	170,870	208,634	159,296
Full Sewering	263,611	170,870	263,545	170,855

Figure 5. Population and Employment Projections (2015-2050)



3.2 Equivalent Residential Units

3.3 New Connections

New connections to the system are billed a one-time connection fee, called a Capacity Development Charge (CDC). One CDC is assessed for each ERU connected to the system. Table 3 lists the number of CDCs collected over the last 16 years. Table 4 lists the projected new connections over the planning period.

Table 3. New Connections 16-Year Comparison

Year	Lacey	Olympia	Tumwater	Total
1997	533	381	109	1,023
1998	663	1,361	429	2,453
1999	1,062	882	214	2,159
2000	316	301	144	761
2001	498	306	164	968
2002	489	410	130	1,029
2003	541	296	273	1,110
2004	750	580	414	1,744
2005	942	392	368	1,702
2006	1,888	488	208	2,584
2007	1,129	219	400	1,748
2008	688	201	288	1,178
2009	510	247	119	875
2010	436	346	192	974
2011	462	429	176	1,066
2012	385	336	187	908
2013	384	399	187	970
2014	398	421	163	982

**Table 4. New Connection Projections
Through the Year 2050**

Year	Lacey	Olympia	Tumwater	Total
2016	494	213	259	965
2017	389	436	156	981
2018	422	392	218	1,032
2019	389	385	303	1,078
2020	390	464	233	1,087
2021	485	419	269	1,173
2022	430	400	337	1,168
2023	478	402	264	1,145
2024	469	407	251	1,127
2025	474	413	244	1,132
2026	445	472	252	1,170
2027	451	479	251	1,181
2028	457	487	252	1,195
2029	463	494	253	1,211
2030	470	502	256	1,228
2031	447	637	278	1,362
2032	452	650	281	1,383
2033	458	662	285	1,405
2034	463	675	288	1,427
2035	469	688	292	1,449
2036	429	620	302	1,350
2037	431	626	305	1,362
2038	433	633	308	1,374
2039	435	639	311	1,386
2040	438	646	315	1,398
2041	368	624	270	1,263
2042	370	629	274	1,273
2043	372	634	277	1,283
2044	374	639	280	1,293
2045	376	644	283	1,303
2046	378	649	287	1,314
2047	380	654	290	1,324
2048	382	659	293	1,334
2049	384	665	296	1,345
2050	386	670	300	1,355

4. Flows and Loadings

4.1 Permit Requirements

The National Pollutant Discharge Elimination System (NPDES) permit number WA0037061 for the Budd Inlet Treatment Plant was issued by the Department of Ecology on August 26, 2011, and became effective on October 1, 2011. The compliance is based primarily on loadings of biological oxygen demand (BOD), total suspended solids (TSS), and total inorganic nitrogen (TIN), rather than flow. The permit will be in effect through September 30, 2016. Table 5 lists the loadings-based permit limitations.

Table 5. NPDES Permit Limitations

	Winter		Shoulder		Summer	
	(November-March)		(April, May, October)		(June-September)	
Parameter	Monthly	Weekly	Monthly	Weekly	Monthly	Weekly
BOD (lbs/day)	5,640	8,460	900	1,350	671	1,006
TSS (lbs/day)	5,265	7,898	5,265	7,898	5,265	7,898
TIN			3 mg/L, 338 lbs/day		3 mg/L, 288 lbs/day	
Ammonia (as N)	26 mg/L	36 mg/L				

4.2 Drinking Water Analysis

For this report, drinking water consumption data for 2014 were collected from each of the jurisdictions. Drinking water consumption was reported monthly for each parcel. In order to determine the baseline drinking water consumption rate and minimize the effect of irrigation, winter (November, December, January, and February) drinking water consumption data were used for sewered customers only. The total consumption was divided by the total number of days to determine the gallons per day per parcel. The wastewater generation rates were then updated using the population and employment data provided by TRPC.

The drinking water basins were created by consolidating sewer basins with similar consumption characteristics into larger basins. Figure 6 illustrates the drinking water basins included in this analysis. The wastewater generation rates are organized by drinking water basin in Table 6. The large geographic differences in drinking water consumption (and therefore, wastewater generation) between basins may be attributed to a number of contributing factors. These include the predominant type of residential units in the basin (single-family, multi-family, senior housing, etc.), the predominant era of home construction, the average age of the residents, and the various commercial, industrial, or public sector employers present in each basin.

Figure 6. 2012 Drinking Water Basins

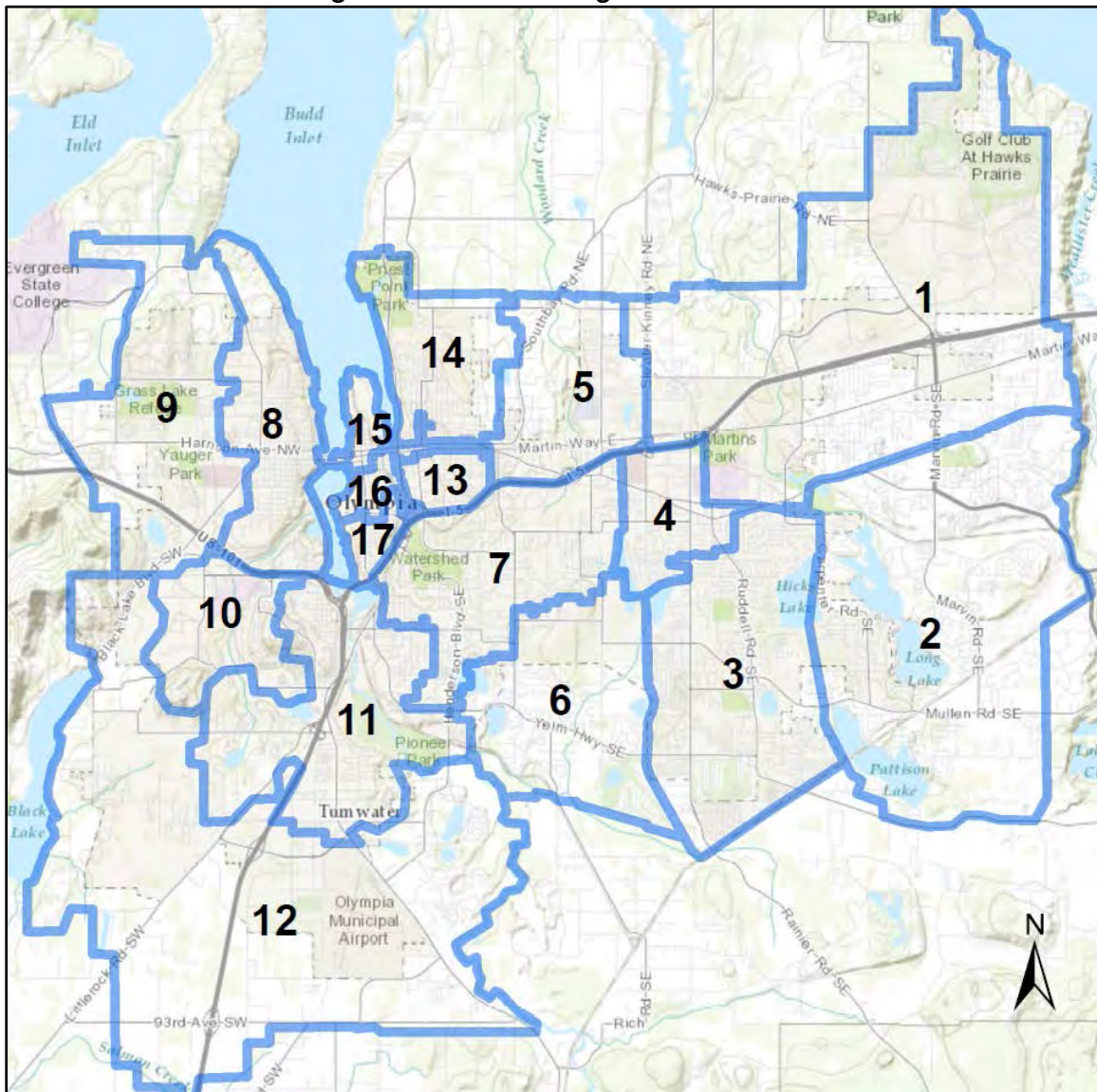


Table 6. Wastewater Generation Rates by Drinking Water Basin

Basin	Population		Drinking Water Consumption ¹			Adjusted Wastewater Generation Rate		Base Flow gpd
	Sewered Residential	Sewered Employee	Total gpd	Residential gpd	Employee gpd	Residential gpcd ²	Employee gped ³	
1	9,827	11,125	990,522	680,803	309,718	62.8	25.2	897,667
2	6,432	655	643,599	608,900	34,699	85.8	48.0	583,265
3	22,445	4,562	1,372,821	1,238,209	134,612	50.0	26.7	1,244,128
4	6,281	7,929	479,306	347,060	132,245	50.1	15.1	434,374
5	5,161	8,977	473,912	294,312	179,600	53.8	18.9	446,979
6	7,444	993	422,996	398,806	24,190	50.5	23.0	398,957
7	10,304	3,213	872,117	681,703	190,414	62.4	55.9	822,554
8	10,556	6,009	901,528	731,460	170,068	65.4	26.7	850,294
9	9,646	8,908	835,969	611,311	224,658	59.8	23.8	788,460
10	2,660	2,830	294,439	198,252	96,187	58.9	26.8	232,534
11	10,391	7,725	887,952	667,793	220,159	50.8	22.5	701,264
12	3,664	5,389	352,383	222,779	129,604	48.0	19.0	278,296
13	2,117	2,914	163,990	126,176	37,814	56.2	12.2	154,670
14	5,914	926	322,685	307,650	15,035	49.1	15.3	304,346
15	1,251	5,190	292,326	57,526	234,799	43.4	42.7	275,713
16	808	11,127	173,581	51,736	121,845	60.4	10.3	163,716
17	1,517	1,482	115,867	99,938	15,929	62.1	10.1	109,283
Total	116,582	89,952	9,613,080	7,337,417	2,275,663	57.0 ⁴	22.8 ⁴	8,686,500

¹ Raw data, only a portion of total parcels accounted for. Data not adjusted for sewer base flows.

² Gallons per capita per day

³ Gallons per employee per day

⁴ Averages

4.3 Base Sanitary Flow

In order to accurately forecast flows based on population changes within the service area, a base sanitary flow (BSF) must be established to calibrate residential and employee wastewater generation rates. The base sanitary flow is defined as the minimum average flow registered over a 7-day period in each year, and is assumed to have little to no influence from inflow and infiltration. The BSFs, measured in million gallons per day (mgd), from 2001 to 2014 are provided in Table 7 and exclude flows from the Tumwater brewery while it was still in operation.

Base sanitary flow is measured in the influent pipeline as it enters the Budd Inlet Treatment Plant. The Martin Way Reclaimed Water Plant, which diverts flow from the Budd Inlet Treatment Plant, was put on-line in August 2006. Reclaimed water produced at the Martin Way Plant and conveyed to the Hawks Prairie Ponds/ Recharge Basins was added to monitored flows at the Budd Inlet Treatment Plant to determine total flows generated within the entire system.

Table 7. Base Sanitary Flow in LOTT Service Area

Year	Base Sanitary Flow (mgd) ¹
2001	7.94
2002	7.92
2003	8.12
2004	8.79
2005	8.77
2006	8.50
2007	8.40
2008	8.68
2009	8.77
2010	9.29
2011	9.21
2012	8.77
2013	8.94
2014	9.22

¹Equals the raw dewatered sewage flow at the Budd Inlet Treatment Plant, minus brewery flow, plus flow discharged to the Hawks Prairie Ponds/Recharge Basins.

The current NPDES permit requires that the LOTT Alliance conduct an annual infiltration and inflow evaluation such that the entire collection system is evaluated once every seven years. LOTT currently has a total of 10 flow monitors, 5 of which are rotated on an annual basis. In the winter of 2014, LOTT rotated the 5 flow meters to new locations within the system. This, along with flows recorded during previous years, allows for a more detailed analysis of each jurisdiction's base flows. The BSF for each of the jurisdictions is provided in Table 8. A more detailed analysis is included in the 2015 Inflow & Infiltration and Flow Monitoring Report (November 2015).

Table 8. Base Sanitary Flow by Jurisdiction (mgd)

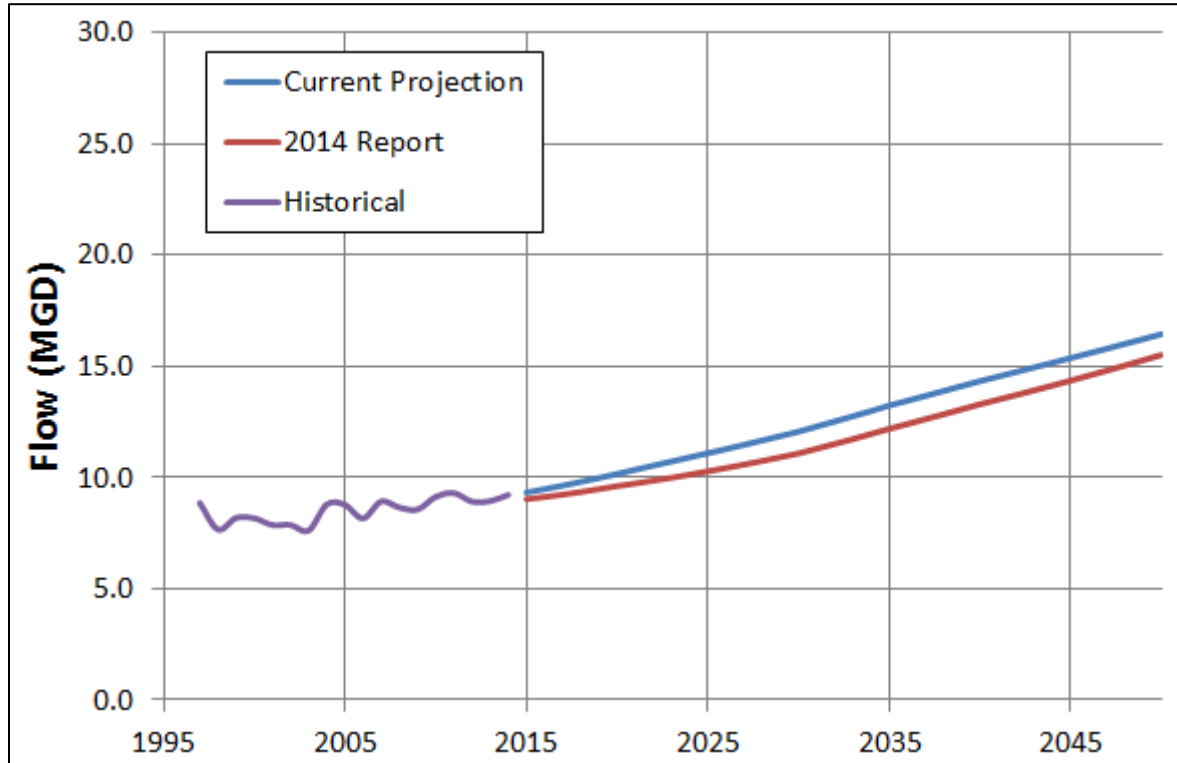
Year	Lacey	Olympia	Tumwater	Point Sources (TESC ¹ , etc.)	Total
2006	2.63	4.31	1.73	0.05	8.27
2007	2.63	4.32	1.21	0.1	8.26
2008	2.94	4.02	1.14	0.48	8.58
2009	3.09	3.42	1.41	0.54	8.47
2010	3.14	3.56	1.19	0.45	8.34
2012 ²	3.28	4.11	1.37	0.42	9.18
2013	3.10	4.14	1.23	0.41	8.88
2014	3.16	4.31	1.21	0.54	9.22

¹ The Evergreen State College (TESC), Artesian wells, and Pepsi

² June 2011 - May 2012 Average

Figure 7 presents the base sanitary flow projections and compares them with those published in the 2014 LOTT Flows and Loadings Report, as well as historical observations since 1997. The projections represent a close approximation to the projections presented in the 2014 report, which reinforces the slower rate of sewerage assumption, as well as the decreased per capita wastewater generation rates. The projections do track more closely to historical trends, which have shown a very slow rate of base flow increase over the past 20 years.

Figure 7. Base Sanitary Flow Projections



4.4 Comparison with Historical Wastewater Generation Rates

Historically, wastewater generation rates were developed for each city based upon flow monitoring data. Beginning in 2007, drinking water consumption data have been obtained from each of the jurisdictions, enabling a more precise estimation of the wastewater generation rate profiles as shown in Table 6. These profiles have been organized into city-specific profiles for comparison with previous estimates. Table 9 summarizes the historical rate profiles, along with the corresponding values developed in this report. These values are extrapolated from the values in Table 6 though they were not used in the model. They are presented for the sake of comparison to previous years' profiles.

Table 9. Previous Wastewater Generation Rate Gallons Per Capita Per Day (gpcd)

Source	Lacey	Olympia	Tumwater	Employment
1995-2002 CIP	66	85	73	40
2003 CIP	64	81	69	39
Budd Inlet Master Plan (2004)	64	75	69	35
2005 CIP	68	62	65	35
2006 Flows and Loadings	71	64	61	34
2007 Flows and Loadings	69	67	74	22
2008 Flows and Loadings	62	66	82	26
2009 Flows and Loadings	66	67	73	20
2010 Flows and Loadings	66	69	69	25
2012 Flows and Loadings	63	67	66	18
2014 Flows and Loadings	57	64	58	19
2015 Flows and Loadings	58	58	51	23

4.5 Flow Projections

Flow projections are calculated by multiplying the projected sewer populations by the wastewater generation rate. The per capita generation rates are drinking water basin specific. The sewer population projections are dependent on whether the parcel is currently sewer, on a septic system, or not sewer and not septic. The model assumes that these generation rates are constant throughout the simulation period (2016-2050). Each year these wastewater generation rates will be recalibrated based on ongoing flow monitoring and population estimates. Figure 8 displays the projected base flow, annual average, compliance period (winter, summer, shoulder), and peak flows through the year 2050.

4.6 Inflow and Infiltration Projections

The impact of inflow and infiltration on projected flows was also modeled using the projected inflow and infiltration rates as documented in the 2015 I&I and Flow Monitoring Report. Projections were developed for the following risk-based I&I scenarios: 1) annual average; 2) 10-year peak day; 3) 10-year peak hour; 4) 10-year peak month; 5) summer (June-September); 6) shoulder (April, May, and October); and 7) winter (November-March) time period flows. Flow projections are displayed in Figure 8 and listed in Table 10.

Figure 8. Flow Projections

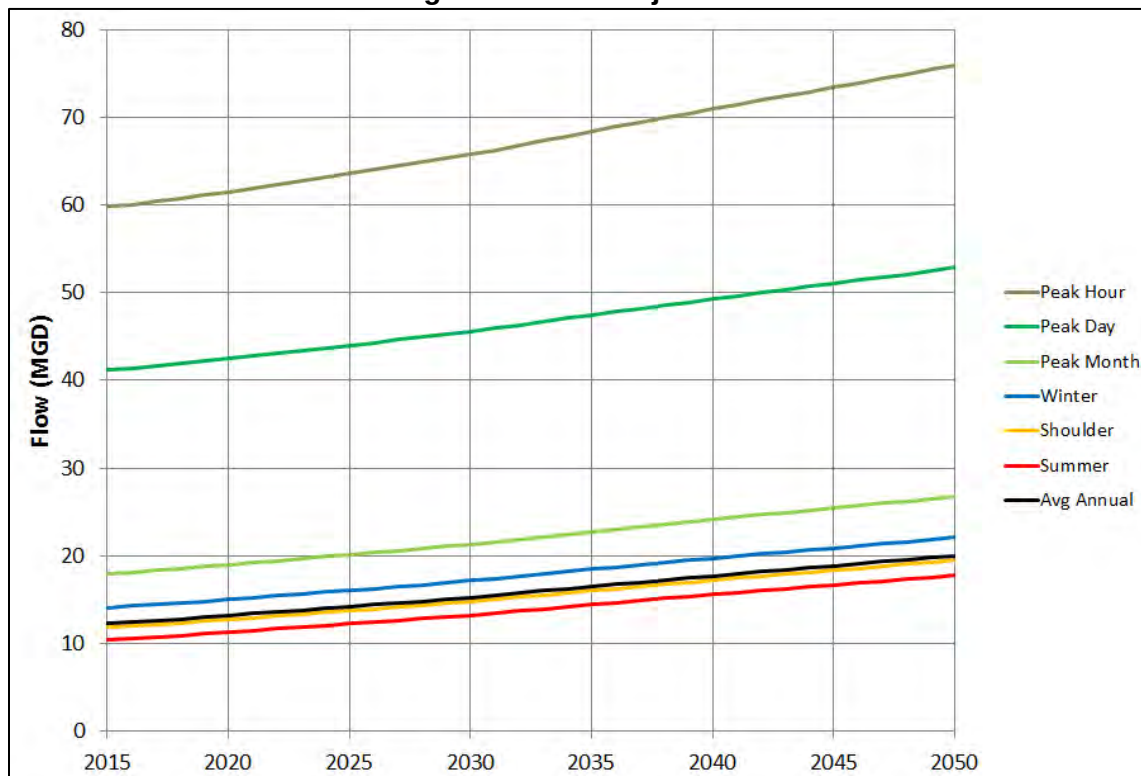


Table 10. Flow Projections (mgd)

Year	Base Sanitary Flow	Annual Average	Peak Hour (10-year)	Peak Day (10-year)	Peak Month (10-year)	Shoulder ¹	Summer ²	Winter ³
2015	9.3	12.3	59.9	41.3	18.0	11.9	10.4	14.1
2016	9.5	12.5	60.0	41.4	18.1	12.0	10.6	14.3
2017	9.6	12.6	60.4	41.7	18.4	12.2	10.8	14.4
2018	9.8	12.8	60.7	41.9	18.6	12.4	10.9	14.6
2019	10.0	13.0	61.1	42.2	18.8	12.5	11.1	14.8
2020	10.2	13.2	61.5	42.5	19.0	12.7	11.3	15.0
2021	10.3	13.4	61.9	42.8	19.2	12.9	11.5	15.2
2022	10.5	13.6	62.3	43.1	19.5	13.1	11.7	15.5
2023	10.7	13.8	62.7	43.4	19.7	13.3	11.9	15.7
2024	10.9	14.0	63.1	43.7	19.9	13.5	12.1	15.9
2025	11.1	14.2	63.6	44.0	20.1	13.7	12.3	16.1
2026	11.3	14.4	64.0	44.3	20.4	13.9	12.4	16.3
2027	11.5	14.6	64.4	44.6	20.6	14.2	12.6	16.5
2028	11.7	14.8	64.9	44.9	20.8	14.4	12.8	16.7
2029	11.9	15.0	65.3	45.2	21.1	14.6	13.0	16.9
2030	12.1	15.3	65.8	45.6	21.3	14.8	13.2	17.2
2031	12.3	15.5	66.3	45.9	21.6	15.0	13.5	17.4
2032	12.5	15.8	66.8	46.3	21.9	15.3	13.7	17.7
2033	12.8	16.0	67.3	46.7	22.2	15.5	14.0	17.9
2034	13.0	16.3	67.8	47.1	22.5	15.8	14.2	18.2
2035	13.2	16.5	68.4	47.5	22.8	16.0	14.5	18.5
2036	13.4	16.8	68.9	47.8	23.0	16.3	14.7	18.7
2037	13.7	17.0	69.4	48.2	23.3	16.5	14.9	19.0
2038	13.9	17.2	69.9	48.6	23.6	16.8	15.1	19.2
2039	14.1	17.5	70.4	48.9	23.9	17.0	15.4	19.5
2040	14.3	17.7	71.0	49.3	24.2	17.2	15.6	19.7
2041	14.5	18.0	71.4	49.7	24.4	17.5	15.8	20.0
2042	14.7	18.2	71.9	50.0	24.7	17.7	16.0	20.2
2043	14.9	18.4	72.4	50.3	24.9	17.9	16.2	20.4
2044	15.2	18.6	72.9	50.7	25.2	18.1	16.4	20.7
2045	15.4	18.9	73.4	51.0	25.4	18.4	16.7	20.9
2046	15.6	19.1	73.9	51.4	25.7	18.6	16.9	21.1
2047	15.8	19.3	74.4	51.8	26.0	18.8	17.1	21.4
2048	16.0	19.6	74.9	52.1	26.3	19.1	17.3	21.6
2049	16.2	19.8	75.4	52.5	26.5	19.3	17.5	21.9
2050	16.4	20.0	76.0	52.9	26.8	19.5	17.8	22.1
Full Sewering	20.3	24.3	85.3	59.4	31.7	23.7	21.7	26.5

1. April, May, and October

2. June, July, August, and September

3. November, December, January, February, and March

4.7 Loading Projections

Loading projections are updated each year based upon observed BOD and TSS loadings at the Budd Inlet Treatment Plant. In 2014, the average monthly BOD and TSS loads to the Budd Inlet Treatment Plant were 27,415 lbs/d and 25,817 lbs/d, respectively. Load removal at the Martin Way Reclaimed Water Plant is taken into account when estimating ERU generation rate profiles. In 2014, the Martin Way Plant removed approximately 1,874 lbs/d of BOD and 1,050 lbs/d of TSS.

Projected BOD and TSS loadings for this report are based on a correlation of loadings from 2003-2014, with the 2007 through 2014 values corrected to account for loadings removal at the Martin Way Reclaimed Water Plant. These values are broken down into blanket residential and employment generation rates based upon the latest population and employment projections. These rates are provided in Table 11.

**Table 11. Wastewater Load Generation Rate Profiles
(lbs per capita/employee day)**

Residential		Employment	
BOD	TSS	BOD	TSS
0.127	0.123	0.127	0.123

Figure 9 displays the historical influent loading characteristics at the Budd Inlet Treatment Plant to include monthly averages for BOD and TSS.

Figure 9. Historical Primary Influent Loads (Monthly Average)

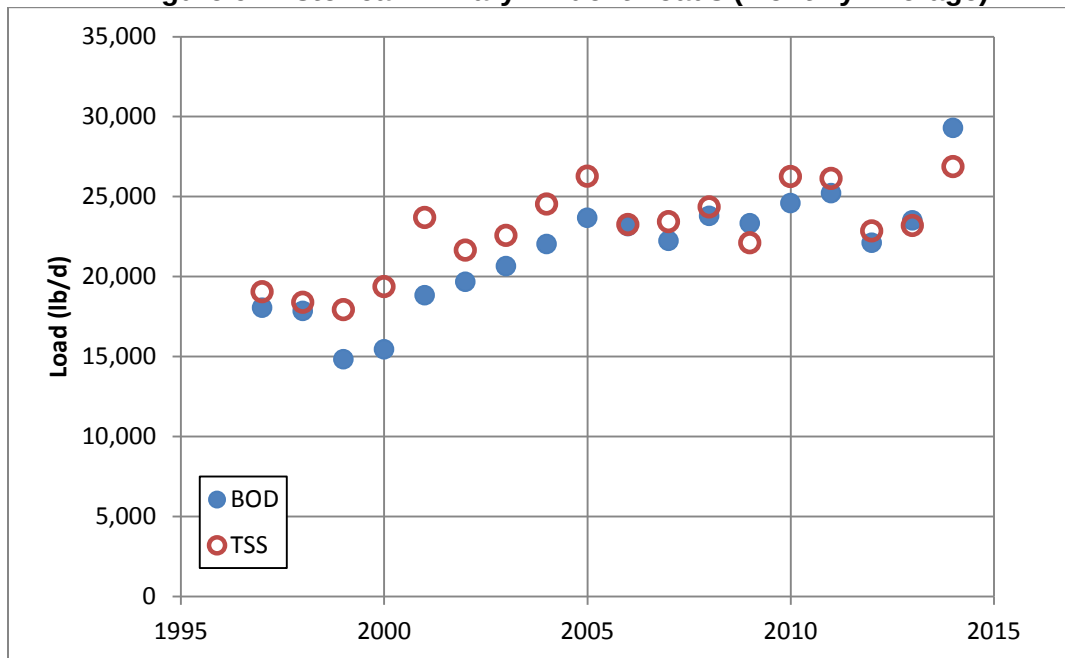


Figure 10 and Table 12 present the projected BOD and TSS loadings in the LOTT service area through 2050. These loading rates are calculated by multiplying the projected sewer populations by the per capita loading rates detailed in Table 11.

Figure 10. Projected Loadings

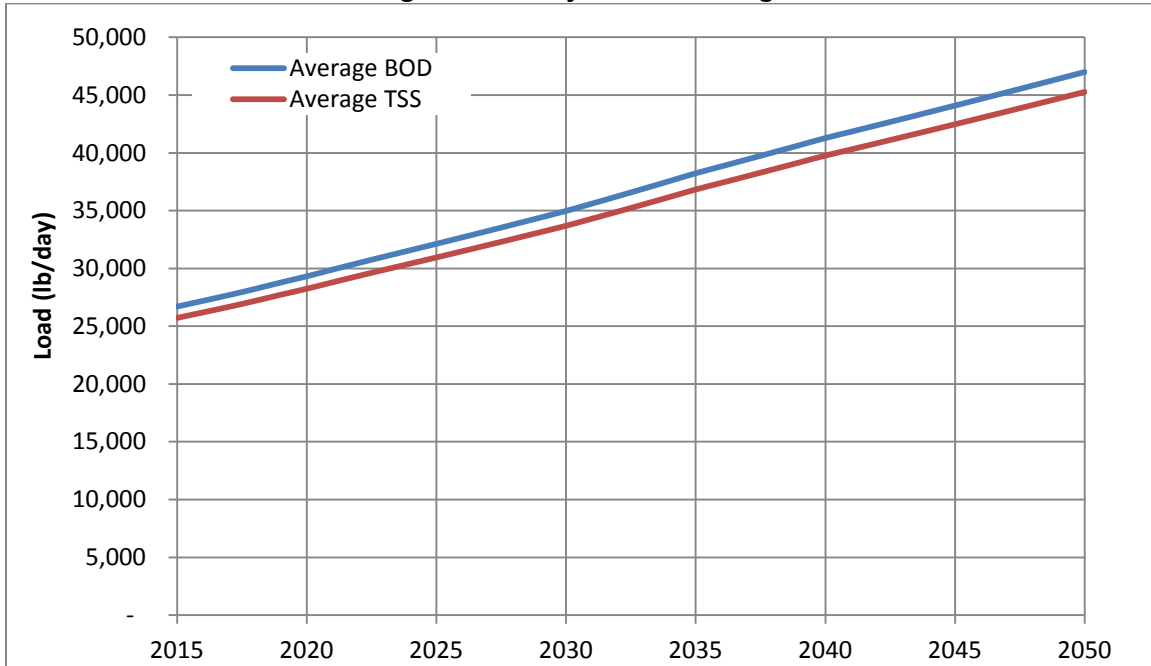


Table 12. Projected Loadings

Year	Average Day BOD (lbs/day)	Average Day TSS (lbs/day)
2016	27,193	26,195
2017	27,691	26,674
2018	28,221	27,185
2019	28,779	27,723
2020	29,314	28,238
2021	29,897	28,800
2022	30,467	29,349
2023	31,026	29,887
2024	31,576	30,417
2025	32,128	30,949
2026	32,687	31,487
2027	33,250	32,030
2028	33,819	32,577
2029	34,393	33,131
2030	34,974	33,690
2031	35,609	34,302
2032	36,252	34,921
2033	36,903	35,549
2034	37,564	36,185
2035	38,233	36,829
2036	38,834	37,408
2037	39,439	37,992
2038	40,049	38,579
2039	40,662	39,170
2040	41,280	39,765
2041	41,836	40,300
2042	42,395	40,839
2043	42,958	41,381
2044	43,524	41,926
2045	44,094	42,475
2046	44,667	43,028
2047	45,245	43,584
2048	45,826	44,144
2049	46,410	44,707
2050	46,999	45,274
Full Sewering	55,475	53,439

4.8 Projections Analysis

The flow and loading projections summarized in this report closely match what was projected in the 2014 Report and further support the assessment that previous projections (2013 and earlier) were overly aggressive. The following charts compare the four separate projection rates (low, expected, aggressive, and full sewerage) with historical data. With the publication of the Wastewater Resource Management Plan in 1998, LOTT has always carried the planning assumption of full sewerage of the cities and UGA by service area build-out. However, since that time, observed flows and loadings show little change. This year's projections also predict a reduced rate of sewerage and septic conversion, as did last year's, and further brings the projections more in line with historical observations.

To reiterate, the aggressive rate assumes full sewerage by 2070 and the full sewerage rate assumes full sewerage by 2050. The low rate assumes that full sewerage of the cities and UGA will not be achieved until after 2150 and that most conversion of parcels with existing septic systems would not begin until 2030. The expected rate assumes full sewerage of parcels without septic tanks by 2080 and full conversion of parcels with septic tanks after 2125. These projections are compared against the expected projection rate used in this report, the expected projection rate from the 2014 report, as well as historical flows observed since 1997.

Figure 11. Comparison of Historical Base Flow and Base Flow Projected from Four Different Projection Models

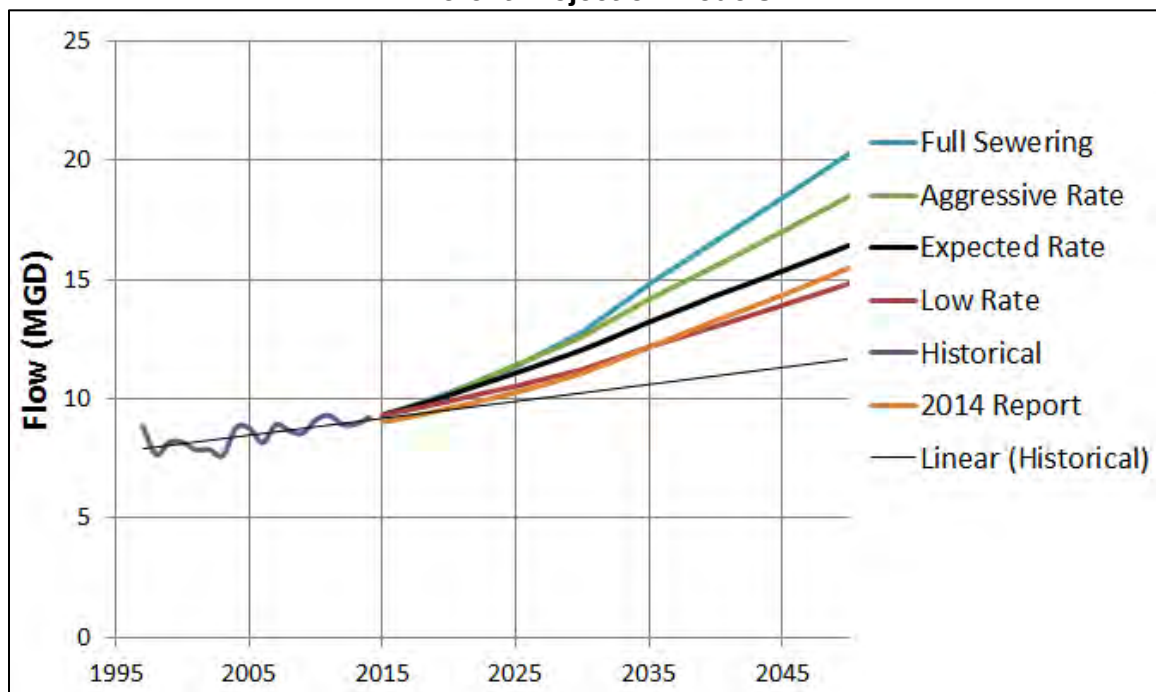


Figure 12. Comparison of Historical BOD Loadings and BOD Projected from Four Different Projection Models

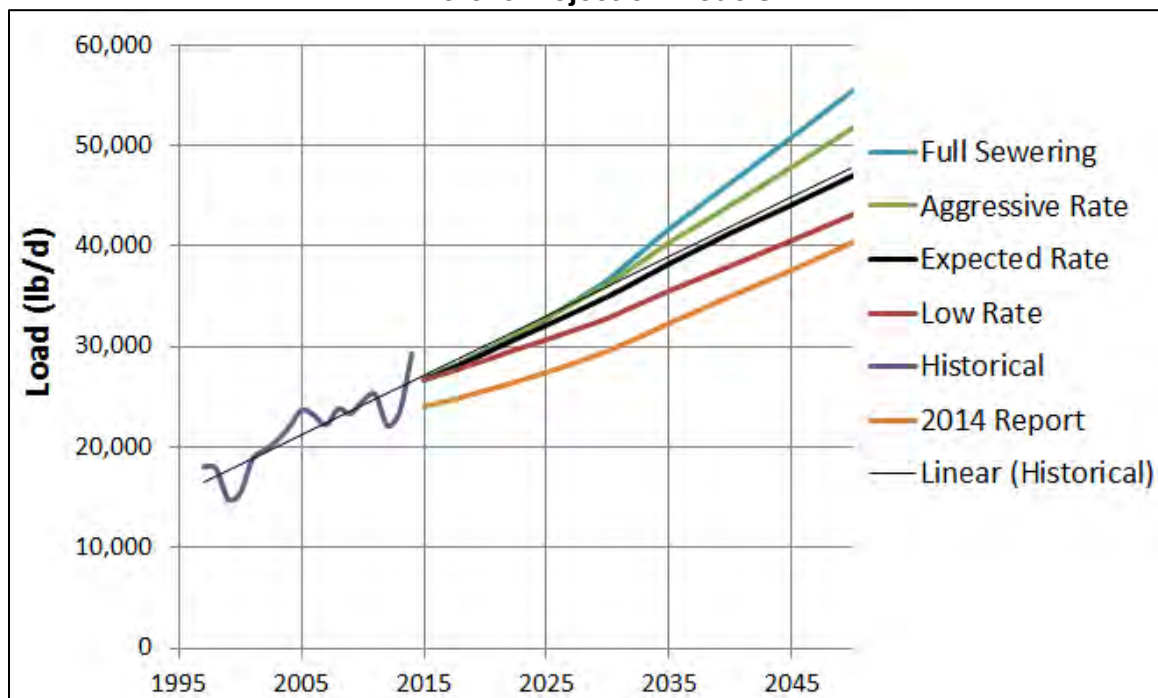


Figure 13. Comparison of Historical TSS Loadings and TSS Projected from Four Different Projection Models

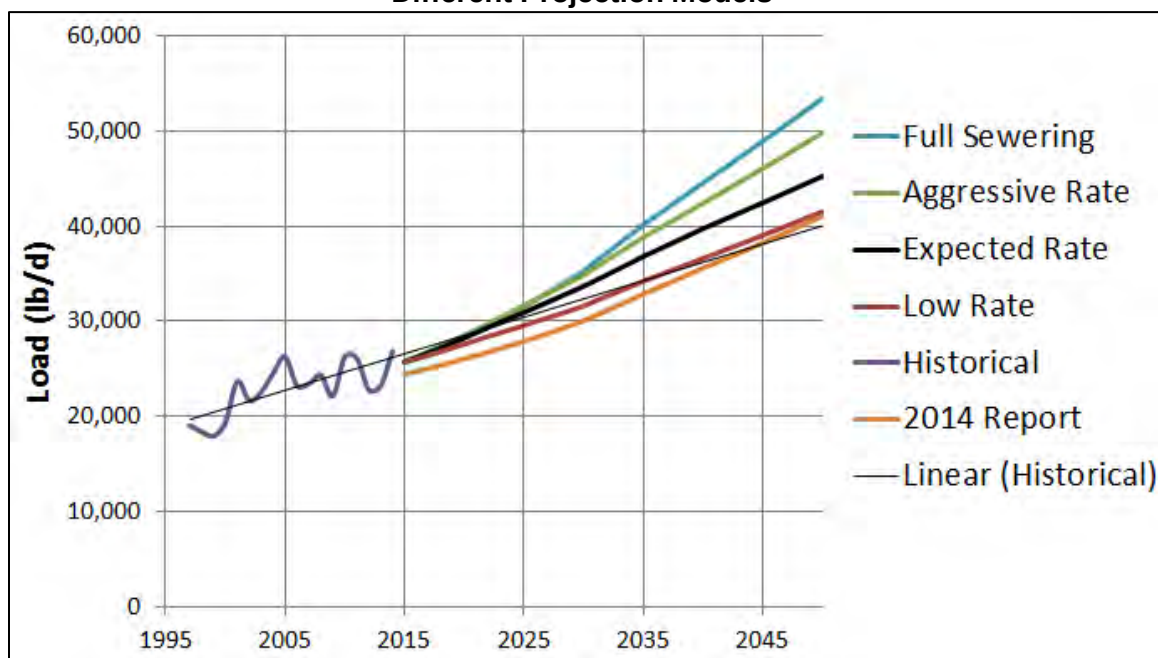
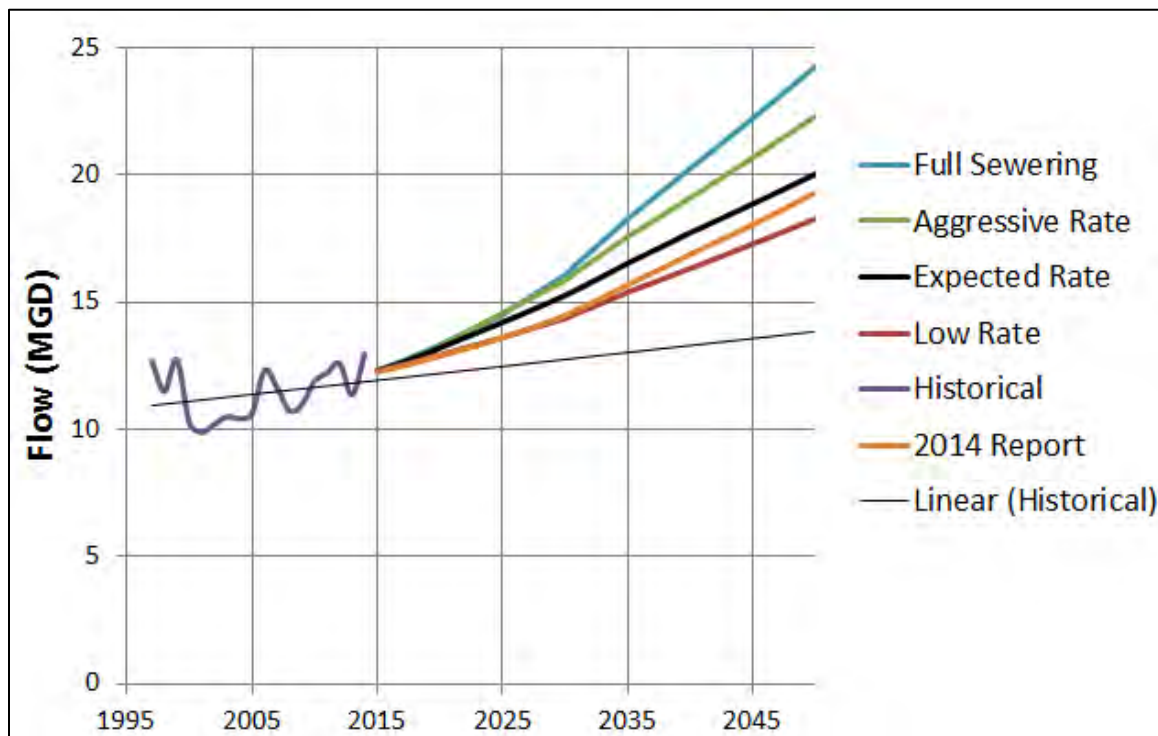


Figure 14. Comparison of Historical ADF and ADF Projected from Four Different Projection Models



In general, the updated projections represent a small increase compared to those in the 2014 Report. The updated BOD projection represents a larger increase, which appears related to the high BOD loadings measured in 2014. The BOD and TSS loadings are sensitive to annual shifts in observed loadings, as these projections are scaled to linear extrapolations of influent loadings to the BITP.

Figures 15 and 16 below illustrate the projected flow coming from each sewer basin at build-out (2050) for the expected projection and for the full sewerage projection, respectively. Figure 17 shows the difference, which represents areas projected to lag behind other areas in sewerage. These areas, concentrated in southeastern Lacey, are relatively far from the existing sewer network, and have a high proportion of parcels with septic tanks. More aggressive sewerage and septic conversion would result in higher sewer flows originating in these areas, with impacts to the LOTT Martin Way sewer interceptors, the Indian Creek Interceptor, the Martin Way Pump Station, and the Martin Way Reclaimed Water Plant.

Figure 15. Flow Projections with Expected Sewering (2050) (gpd)

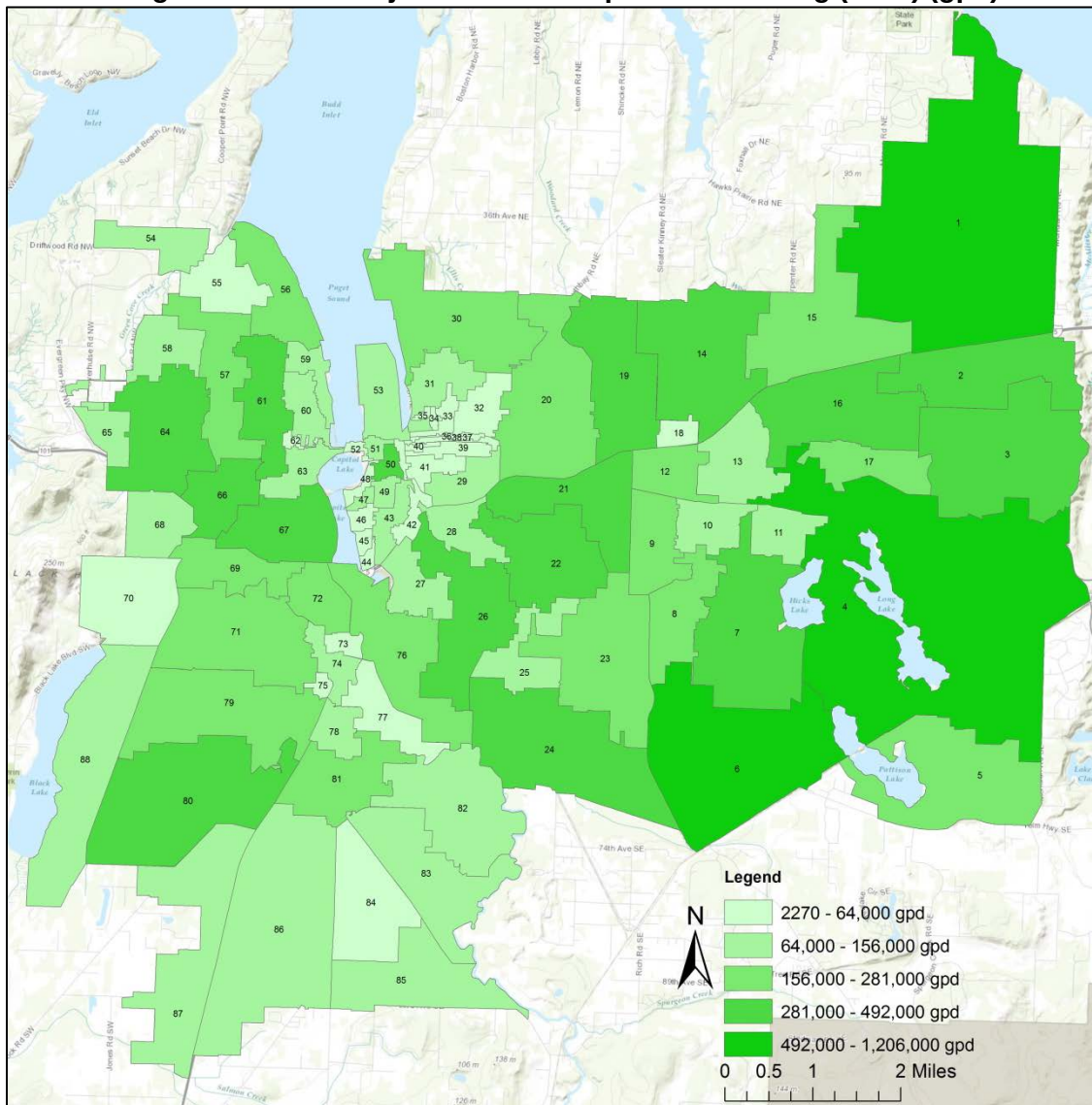


Figure 16. Flow Projections with Full Sewering (gpd)

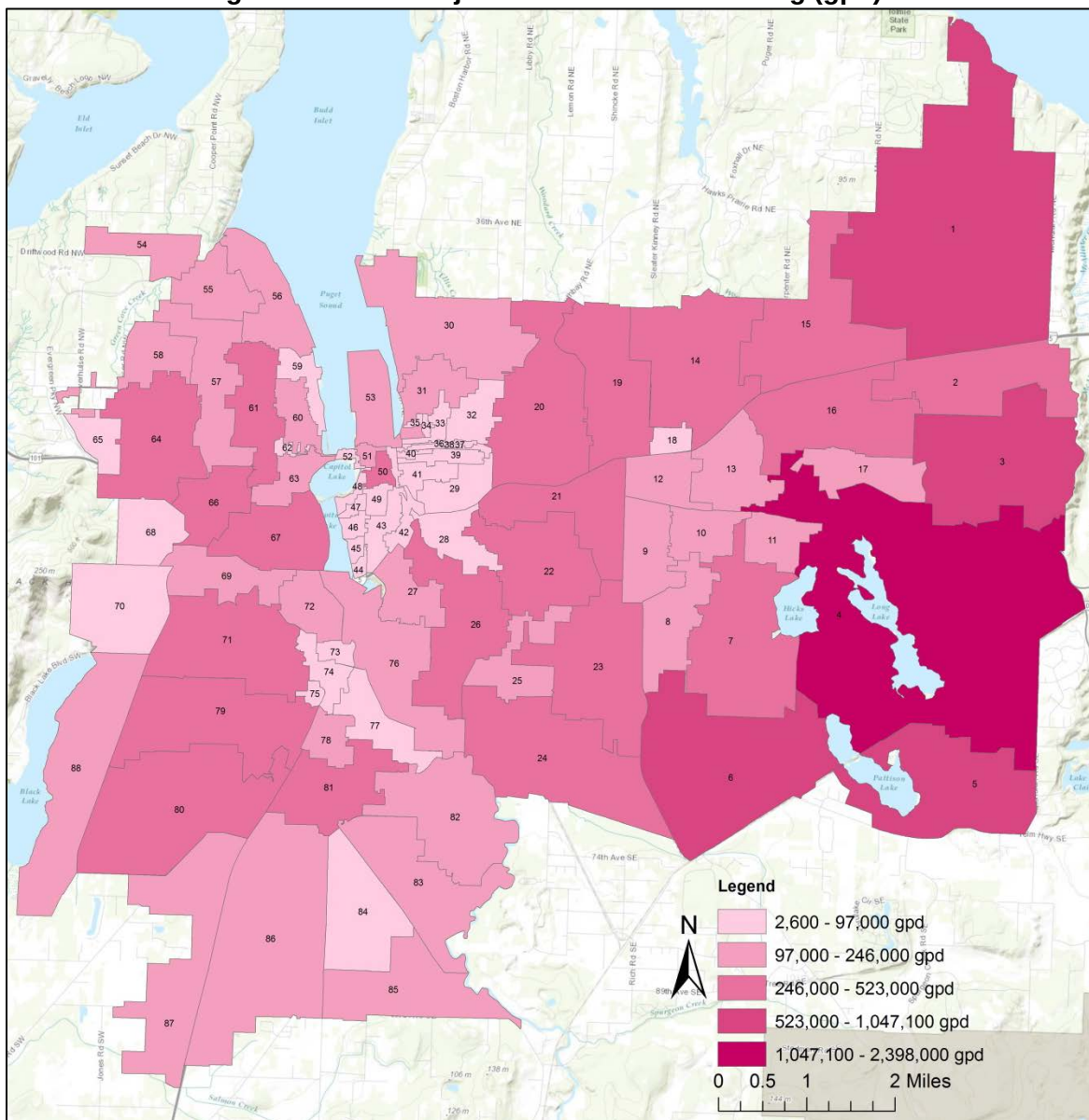
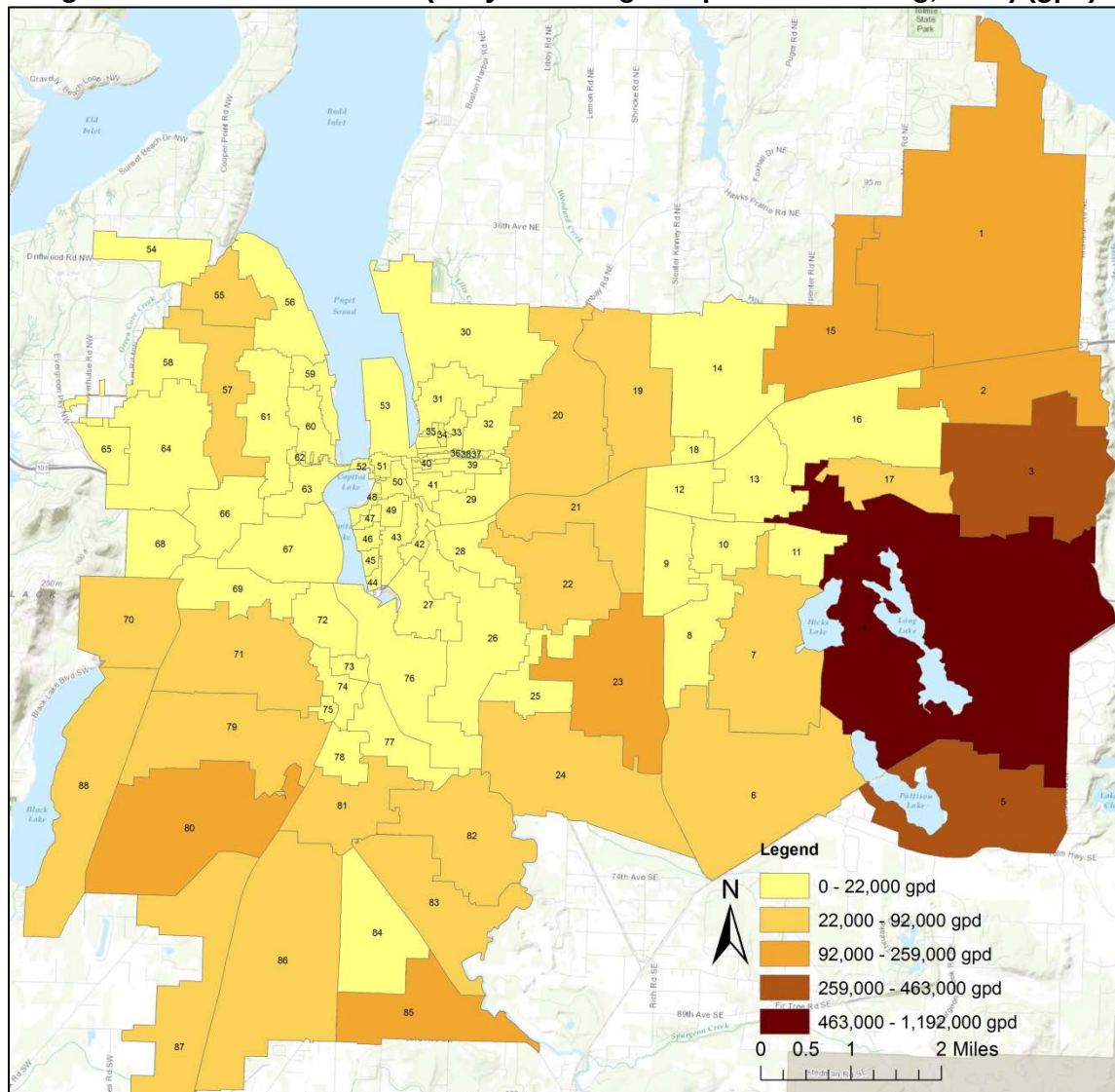
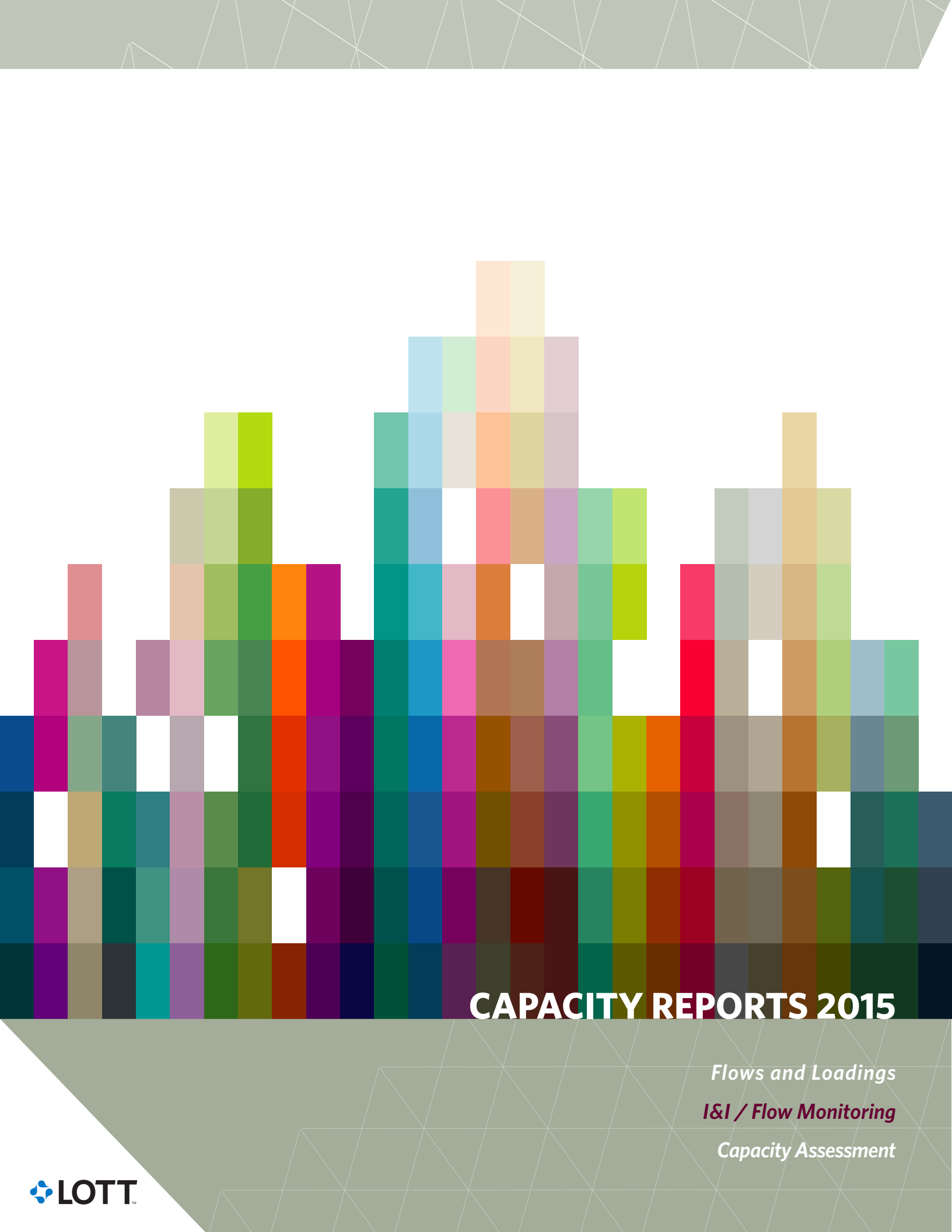


Figure 17. Difference in flow (Fully Sewering – Expected Sewering, 2050) (gpd)





CAPACITY REPORTS 2015

Flows and Loadings

I&I / Flow Monitoring

Capacity Assessment



2015 Inflow & Infiltration and Flow Monitoring Report

**December 2015
(Data from August 2014 - August 2015)**

Prepared By:

Tyle Zuchowski, LOTT Clean Water Alliance
with assistance from Hannah McLean and Adam Klein, Brown & Caldwell

Table of Contents

PREFACE	ii
1. Introduction	1
2. Overview	2
2.1 Program History	2
2.2 Flow Measurement Methodology	5
2.3 Basin Summary	5
2.4 Year 10 Flow Monitoring Site Summary	6
2.5 Flow Monitoring Data	7
2.6 Inflow and Infiltration Analysis	8
3. Flow Data Analysis	9
3.1 Summary of I&I Statistics for All Flow Monitoring Sites	9
3.2 Analysis of Base Flow	10
3.3 Analysis of Inflow and Infiltration	12
3.3.1 Site Assessments	13
3.3.2 Updated I&I Model	16
3.3.3 I&I Benchmarks and Basin Ranking	19
3.3.4 Comparison of I&I from Year 5 to Year 12	27
4. Recommendations	29

PREFACE

The Inflow & Infiltration and Flow Monitoring Report is one of three related documents that are part of the annual process to monitor and evaluate capacity in the entire LOTT system. The intent, under LOTT's Wastewater Resource Management Plan (also known as the Highly Managed Plan), is to assure that needed new capacity is brought on line "just-in-time" to meet system needs. Capacity needs evaluated include wastewater treatment, Budd Inlet discharge, reclaimed water use/recharge, and conveyance capacity in the entire LOTT system. These three reports are prepared annually, and are used to help identify capital projects for inclusion in the annual Capital Improvements Plan.

- **Flows and Loadings Report** – analyzes residential and employment population projections within the Urban Growth Boundary and estimates the impact on wastewater flows and loading within the LOTT wastewater system.

- **Inflow and Infiltration Report** – uses dry and wet weather sewer flow monitoring results to quantify the amount of unwanted surface (inflow) and subsurface (infiltration) water entering the sewer system and to prioritize sewer line rehabilitation projects.

- **Capacity Assessment Report** – uses flows and loadings data and inflow & infiltration evaluation results to analyze system components (i.e. conveyance, treatment, and discharge), determine when limitations will occur, and provide a timeline for new system components and upgrades.

Together, these reports become chapters in an overall "Capacity Reports" document. The combined report will be posted each year in the "Library" on LOTT's website – www.lottcleanwater.org.

1. Introduction

The LOTT Clean Water Alliance flow monitoring program was initiated in 2003. In accordance with National Pollutant Discharge Elimination System (NPDES) Permit WA0037061, an inflow and infiltration (I&I) evaluation for all sub-basins within the LOTT system is required such that the entire system is evaluated once every seven years. The purpose of this program is to ensure permit compliance, characterize flows within the collection system, identify areas of concern for I&I, and aid in the prioritization of rehabilitation projects to reduce I&I. The program is also intended to fulfill requirements of the Intergovernmental Contract for Inflow and Infiltration Management and New Capacity Planning, originally dated March 27, 1995, as presented in Exhibit J to the LOTT Interlocal Cooperation Act Agreement for Wastewater Management by the LOTT Wastewater Alliance. This report includes an overview of the LOTT I&I program as well as the results and analysis of the monitoring program for the 2014-2015 monitoring cycle. This monitoring cycle is the fifth year in the second 7-year cycle and the twelfth year overall in the monitoring program.

Brown & Caldwell provides data quality assurance and control, and assists in annual I&I analyses. LOTT has contracted with SFE Global NW to install and monitor flow monitors throughout the system (Table 1). This year's flow monitors include five "permanent" monitoring sites, and five "temporary" sites. The five temporary sites rotate throughout the LOTT tributary system on an annual basis. As this is the fifth year of the second 7-year cycle, the five LOTT-administered temporary sites were placed at the same location as the fifth year of monitoring (2007-2008) in order to compare how flows at these sites have changed over the past seven years.

This report covers the monitoring year 2014-2015. The report is arranged as follows:

- Section 2 provides an overview of the program, including a summary of the sewer basins being studied, and an inventory and assessment of the flow monitoring sites, equipment, and technology
- Section 3 presents the results of the inflow and infiltration analyses
- Section 4 discusses the implications of the data presented in this report, and provides recommendations

2. Overview

Inflow is defined as surface water entering the sewer via manholes, flooded sewer vents, illicitly connected storm drains, basement drains, and by means other than groundwater. Inflow is usually the result of rain and/or snowmelt events. *Infiltration* is defined as groundwater that enters the sewer, usually through leaky sewer pipe joints, manholes, and service connections.

2.1 Program History

Figure 1 shows all monitoring locations to date. Table 1 lists the flow monitoring sites included in this program and the associated tributary sewer basins measured by each site. Monitors installed and operated by the City of Olympia in association with LOTT are included in the table.

Figure 1. Location of 2003-2015 Flow Monitoring Sites

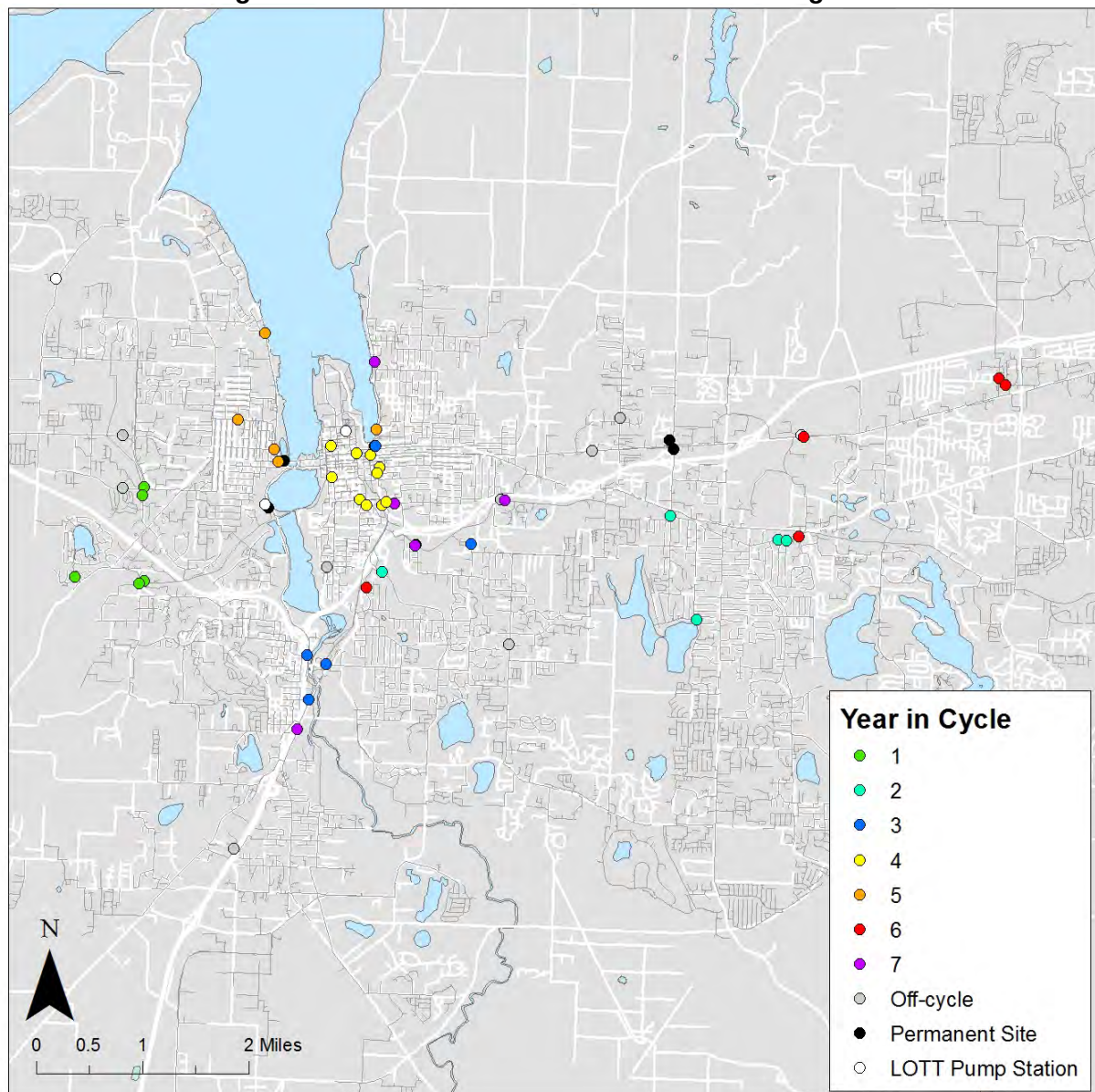


Table 1. Flow Monitoring Sites, with Tributary Basins

Name	Cycle Year	Manhole	Pipe Diameter	Location	Basins Served
OL25	P	700004	30"	Private Drive off of Deschutes Parkway	54,55,57,58,64,65,66,67,68,69,70,71,TESC,
OL31	P	300039	30"	Indian Creek Bypass	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,25,
OL33	P	SSMH9	24"	4th Avenue Bridge	56,59,60,61,62,63,
L6	P	UXS02 / 3A0002	30"	8468 Martin Way E. (Jack in the Box)	1,2,3,4,5,6,7,10,11,13,14,15,16,17,
L7	P	UY401	24"	8503 Martin Way E. (Arco Station)	8,9,12,
OL26	1	700040	24"	R.R Grade W. of Mottman Road	54,55,57,58,64,65,66,68,69,70,71,TESC,
OL27	1	720001	18"	Access Road East of Mottman Road	69,70,71,
OL28	1	740012	8"	Swimming Pool Grounds off Park Drive	68,
OL29	1	700061	21"	Cooper Pt. Road East of Capital Mall Drive	54,55,57,58,64,65,TESC,
OL30	1	780001	12"	Off the Road at Cooper Pt. Road and Capital Mall Drive (at the Keg)	57,
L1	2	VCJ01	15"	Lacey Blvd and Sleater Kinney Road	8,9,
L2	2	WGD01	12"	5223 Lacey Blvd.	10,
L3	2	WGF02	27"	1310 Lebanon Street	6,7,
L5	2	VSE01	15"	4405 26th Loop SE	8,
O1	2	400009	15"	Henderson Road @ I-5 exit	24,26,
O2	3	370043	24"	16th Avenue @ Wilson Street	22,23,25,
O4	3	110001	15"	East Bay and State (?)	33,
T1	3	608	12"	Deschutes Parkway next to Simmons Road	72,
T2	3	642	10"	Custer Way at Capitol Blvd.	76,
T3	3	2571	12"	Capitol Blvd at E Str.	73,74,75,78,79,
D1	4	520001	21"	222 Capitol Way	51,
D2	4	510009	15"	621 Capitol Way	44,45,46,47,48,
D3	4	534001	10"	505 Jefferson St	49,
D5	4	530017	12"	1067 11th St	43,
D6	4	300015	36"	1109 Plum St SE	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,28,
D7	4	530001	24"	114 Jefferson	50,
D8	4	203001	8"	705 4th Ave	38,
D9	4	11002	15"	809 Legion	32,37,39,
D10	4	200013	8"	700 Plum St	27,41,42
D11	4	200020	36"	Plum and Union Parking Lot	27,42
WB1	5	640018	15"	Madison and Thomas	61,
WB12	5	600024	15"	West Bay Dr	59,
WB3	5	1582711	8"	200 Oly Way (from Harrison)	62,
WB4	5	1582706	12"	400 Oly Way (from SW)	63,
WB5	5	120008	15"	508 E Bay Rd NE (San Francisco Line)	31,
NL01	6	WB801	10"	5815 Clearbrook Dr SE	11,
NL03	6	RK602	18"	1200 Galaxy Ave (LA Fitness)	2,
NL04	6	RK401	24"	1200 Galaxy Ave N	1,
NL05	6	TYH01	8"	5750 Martin Way E	1,2,15,16,17,
NL06	6	230001	10"	2424 Hillside Dr	27,
SV01	7	110014	15"	1627 East Bay	30,
SV04	7	220001	15"	1102 Quince St. SE	29,
SV05	7	380001	8"	1705 Boundary St. SE	28,

Name	Cycle Year	Manhole	Pipe Diameter	Location	Basins Served
SV06	7	360001	18"	Indian Creek Trail east of Blvd and Wheeler	21,
SV11	7	2460	NA	4503 Capitol Blvd S	75,78,79,
NL02C	Off-Cycle	WA401	27"	Lacey Blvd and Pacific Roundabout	3,4,5,6,7,10,11,
O3	Off-Cycle	370029	15"	Boulevard Road @ 31st Avenue	25,
O5	Off-Cycle	320006	14"	406 Lilly Road	partial - 19
SV07	Off-Cycle	300060	30"	Indian Creek Path east of Blvd and Wheeler	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,
SV08	Off-Cycle	300087	36"	333 Martin Way E	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,
SV10	Off-Cycle	70B003	18"	101 Capitol Mall Dr.	partial - 64,65,
T4	Off-Cycle	1489	24"	Tyee Drive (Home Depot)	80,87,88,
WS02	Off-Cycle	761002	15"	Harrison near Cooper Pt	partial - 64,65
WS05	Off-Cycle	517001	8"	Columbia & 21st	45

1. Permanent flow monitoring site.
2. Site operated by the City of Olympia.
3. Flow monitoring occurred at these sites for two time periods.

2.2 Flow Measurement Methodology

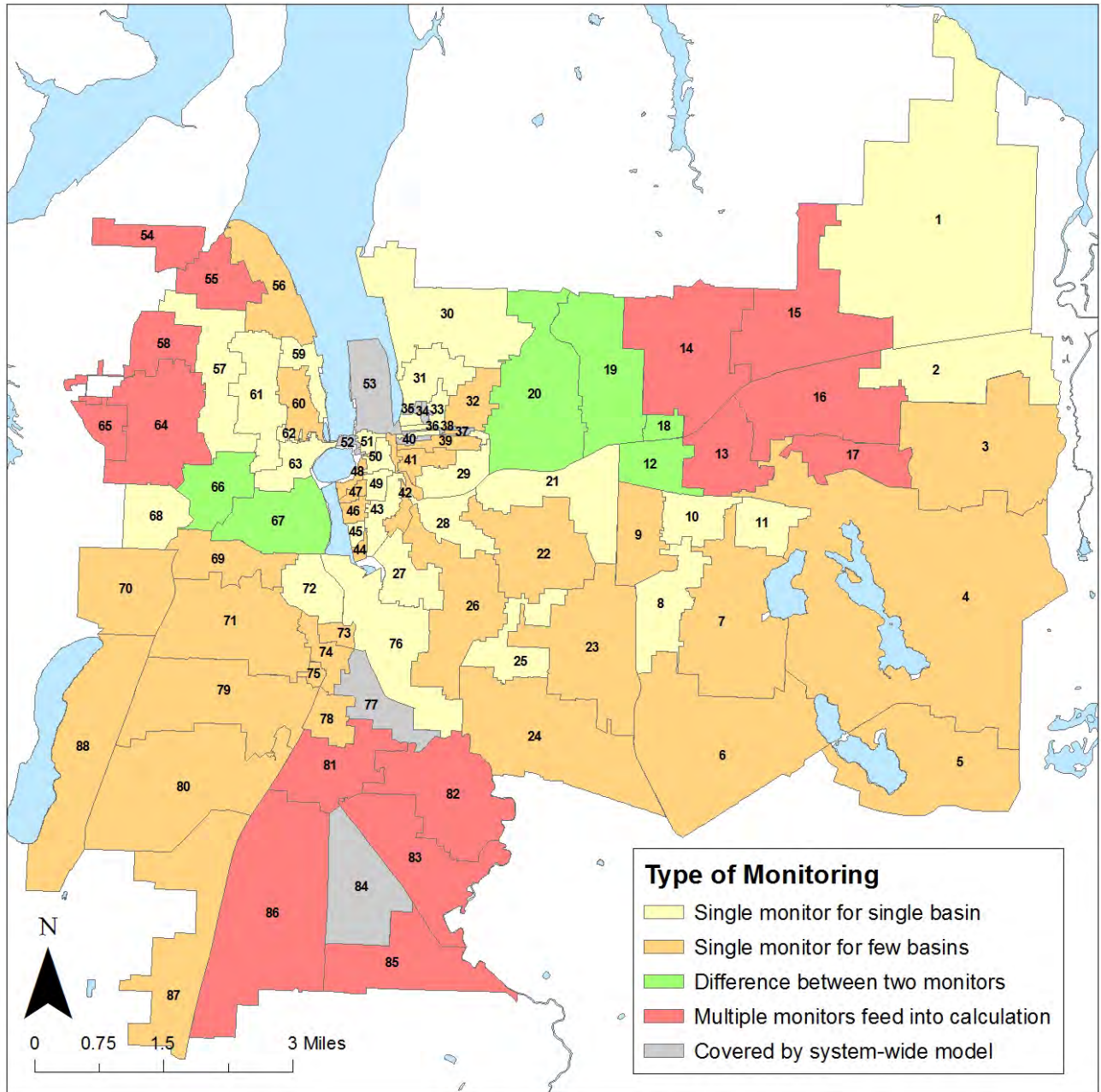
All monitoring sites installed and monitored by SFE Global consist of SFE Custom Compound Weirs or area-velocity meters. The SFE Weir is a variant of the V-notch type weir. Permanent flow monitoring sites feature a Lexan-bodied weir, while the rotating temporary sites contain weirs constructed of $\frac{3}{4}$ -inch thick plywood. Flow was calculated by measuring the depth of water flowing over the weir, and then applying a rating curve, which was developed individually for each weir during installation and calibration. SFE Global maintains the sites on a monthly basis, during which time data is downloaded from on-site data logging equipment.

The flow monitor located at LOTT's Budd Inlet Treatment Plant (BITP) uses a different technology to measure flows. An Acoustic Doppler Flow Monitor (ADFM) was installed by MGD Technologies, Inc., in the 60-inch influent pipe in September 2004. The Martin Way Pump Station (MWPS), Capitol Lake Pump Station (CLPS), and Kaiser Road Pump Station (KRPS) all have Doppler Ultrasonic strap-on flow meters installed on the discharge piping. These monitoring locations were integrated into the Budd Inlet Treatment Plant SCADA system in January 2005, and are now included in the I&I evaluation program.

2.3 Basin Summary

The 88 LOTT sewer basins were redefined as part of the 2014 Flows and Loadings Report based upon sewer maps and basin realignments provided by the cities of Olympia, Lacey, and Tumwater. Seven basins are currently unsewered. Of the remaining 81 basins, 27 have been directly monitored with a single flow monitor, 32 have been monitored, in small groups, by a single flow monitor, and six have been monitored on the upstream and downstream ends, allowing for flow assessment by difference. I&I in the remaining basins is estimated through a system-wide regression model, which incorporates data from 63 flow monitors and pump stations, measured over the past seven years. The 88 sewer basins are illustrated on Figure 2.

Figure 2. Flow Monitoring Basins



2.4 Year 10 Flow Monitoring Site Summary

Five temporary sites were monitored during the 2014-2015 period. All of these sites were previously monitored during the 2007-2008 period. Section 3.3.5 assesses the change in inflow and infiltration over the 7-year period.

Table 2 lists attributes for the area served by each site monitored within the 2014-2015 period, including permanent flow monitors and LOTT pump stations.

The equivalent residential units (ERU) values shown in Table 2 are based on 2014-2015 data and the inch-diameter-mile (IDM) values are based on 2014-2015 data.

Table 2. Flow Meter Basin Summary

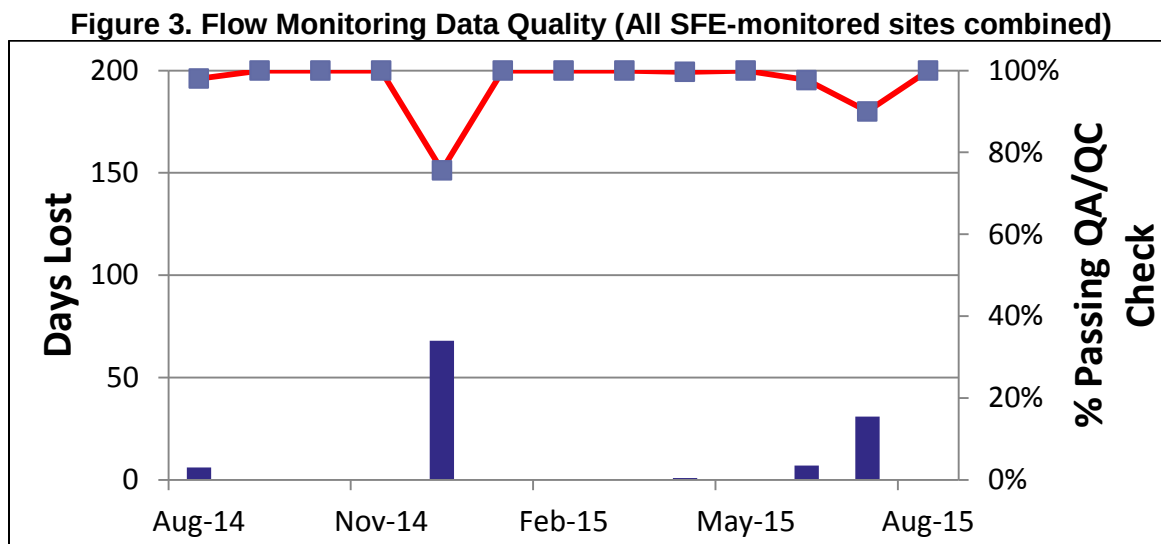
Flow Monitor	Sewered Residents	Sewered Employees	ERU ¹	IDM ²	Acres	% Sewered
WB01	3,406	1,570	1,497	81	462	98%
WB03	194	215	104	6	27	98%
WB04	1,574	198	613	49	190	86%
WB05	1,999	297	786	55	274	98%
WB12	395	207	177	30	143	75%
OL25	15,372	15,117	7,950	653	5,815	84%
OL31	59,833	36,177	27,609	2,366	25,320	67%
OL33	8,343	2,796	3,511	263	1,476	92%
L6	38,492	16,915	24,652	1,727	19,314	57%
L7	6,971	6,726	3,586	196	1,142	91%
CLPS	28,363	27,597	14,625	1,412	18,140	74%
KRPS	1,893	164	727	36	294	92%
WWTP	115,425	90,095	56,249	5,051	50,574	74%
MWPS	38,104	16,119	16,537	1,838	18,156	58%

1. ERU: Equivalent Residential Unit (see Flow and Loadings Report for more details)

2. IDM: Inch-diameter-mile of sewer pipe (includes gravity and STEP sewers)

2.5 Flow Monitoring Data

SFE Global's contracted data quality objectives were met over 97% of the time during the 2014-2015 monitoring period. Figure 3 summarizes the flow monitoring reliability by showing the portion of flow data that was available and passed quality assurance checks.



2.6 Inflow and Infiltration Analysis

To effectively evaluate the amount of I&I within each basin, a base sanitary flow (BSF) was computed based on each basin's local population and employment wastewater generation rates. The wastewater generation rates were calibrated in 2015 based on an analysis of drinking water consumption throughout the LOTT service area.

The rates are calibrated annually based upon flows observed at the Budd Inlet Treatment Plant, and on drinking water consumption data made available by LOTT's partner jurisdictions. The flow measured at each site in excess of the BSF was assumed to be due to I&I.

An I&I analysis was performed using the Capacity Assessment and Planning Environment (CAPE) modeling software, a wastewater forecasting and management tool provided by Brown & Caldwell. The record of observed flow data was plotted alongside a concurrent record of rainfall data. The model calculates flow based upon rainfall using a variety of hydrologic parameters. These parameters were calibrated until the model flows matched the observed flows over the period of record. Once calibrated, the model was applied to a long-term historical precipitation record (in this case, rainfall observed at the Olympia Regional Airport from 1955 to 2015). The long-term simulation produced risk-based estimates of the I&I flow over the full range of weather conditions contained in the historical rainfall record.

An example of a CAPE calibration plot is presented on Figure 4. This plot depicts flow monitored at the BITP (blue), rainfall (green), and modeled flow at the BITP (red). The model has been calibrated such that the modeled and observed flows match very closely.

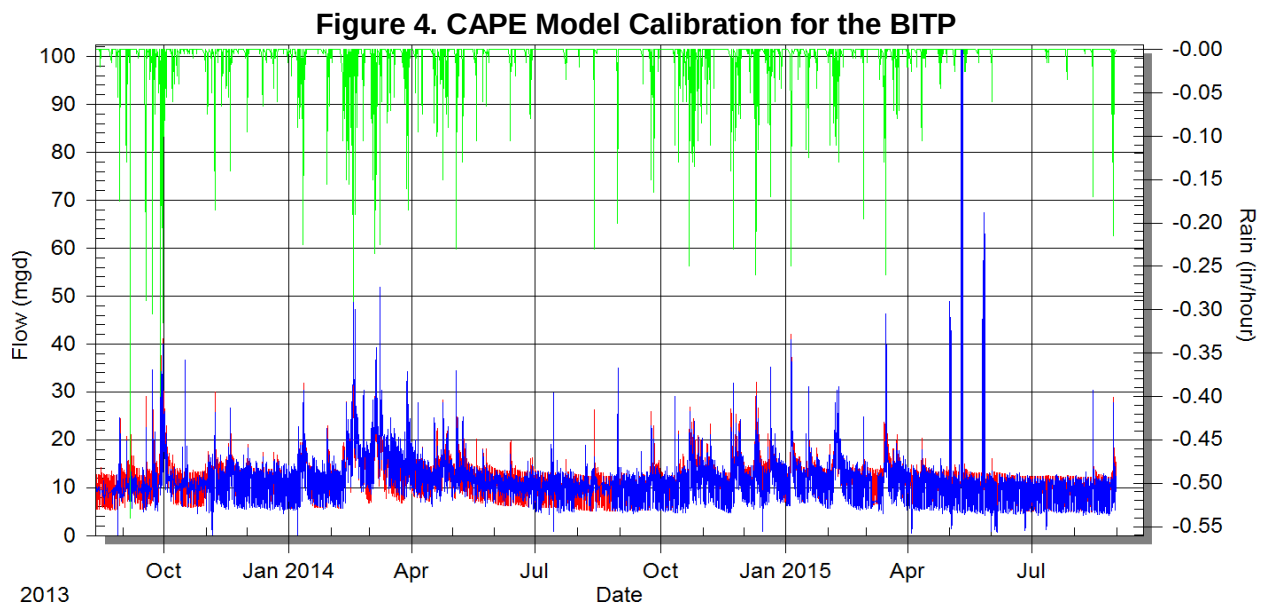
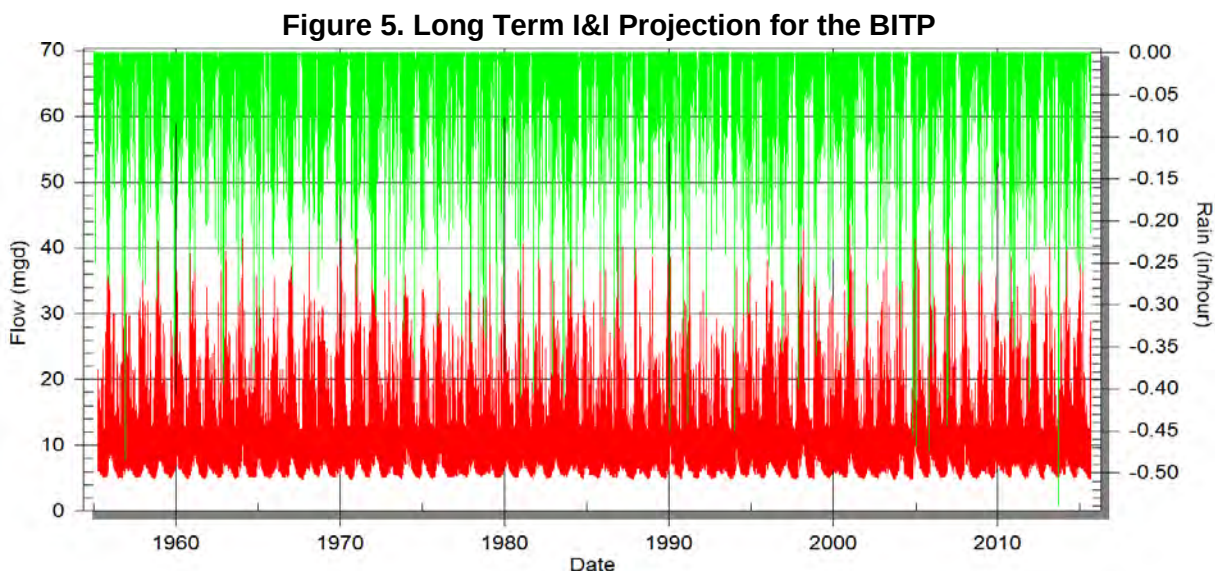


Figure 5 presents the model calibration from Figure 4 applied to the long-term precipitation record.



The data on Figure 5 are used to calculate risk-based I&I. LOTT uses a 10-year return period as the basis of its peak flow projections. A 10-year peak flow carries a 10% risk of being surpassed in any given year.

The CAPE model was used to calculate risk-based I&I for each of the flow monitoring sites and combinations presented in Table 3. These data are presented and analyzed in the next section.

3. Flow Data Analysis

This section describes the results of the analysis conducted using the flow data collected during the 2014-15 monitoring season.

3.1 Summary of I&I Statistics for All Flow Monitoring Sites

A summary of the I&I results for each of the flow monitoring sites is provided in Table 3.

Table 3. 2014-2015 Flow Monitoring Sites Inflow and Infiltration Summary (Total Flow, mgd)

Flow Monitor	Base Sanitary Flow	Average Annual	10-Year Peak Month	10-Year Peak Day	10-Year Peak Hour	Summer	Shoulder	Winter
WB01	0.27	0.24	0.70	2.29	3.01	0.09	0.21	0.38
WB03	0.02	0.01	0.08	0.69	1.88	0.01	0.01	0.03
WB04	0.09	0.05	0.17	0.48	0.65	0.01	0.04	0.08
WB05	0.10	0.15	0.50	1.41	2.08	0.05	0.12	0.25
WB12	0.02	0.01	0.06	0.15	0.20	0.003	0.01	0.03
L6	2.52	0.18	0.47	1.14	1.84	0.08	0.16	0.26
L7	0.59	0.18	0.51	0.91	1.48	0.07	0.16	0.29
OL25	1.50	0.54	1.45	3.03	3.53	0.22	0.48	0.85
OL31	3.72	1.02	2.24	3.17	4.22	0.60	1.05	1.35
OL33	0.45	0.41	1.36	4.40	5.73	0.14	0.33	0.68
CLPS	2.49	0.71	2.09	4.46	5.55	0.25	0.60	1.16
KRPS	0.09	0.04	0.12	0.22	0.25	0.01	0.04	0.07
MWPS	3.43	0.28	0.78	1.22	1.70	0.13	0.27	0.41
WWTP	9.10	2.96	8.66	31.86	50.39	1.11	2.52	4.77

3.2 Analysis of Base Flow

Base sanitary flow (BSF) is wastewater which does not include I&I. There are two ways to determine BSF:

1. Direct measurement (flow monitoring), with the BSF typically calculated from the minimum 7-day average flow during the year.
2. Model based on population and employment data, using the per capita wastewater generation rates, which are based on winter drinking water consumption data.

Table 4 lists an estimate of measured base sanitary flow versus population and employment-based modeled BSF.

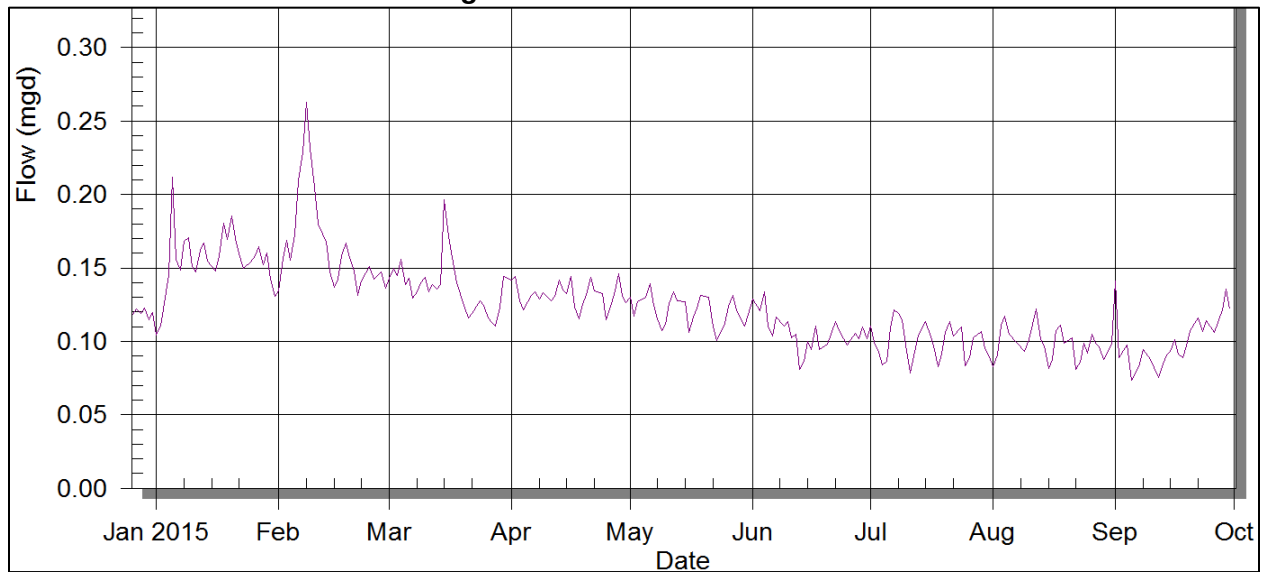
Table 4. Comparison Between Measured Base Sanitary Flow and Modeled Base Sanitary Flow (gpd)

Monitoring Location	Measured Base Sanitary Flow	Modeled Base Sanitary Flow	Difference	Difference as % of Modeled BSF
WB01	274,170	263,523	-10,647	-4%
WB03	24,139	18,426	-5,713	-24%
WB04	92,723	108,134	15,411	17%
WB05	103,209	102,640	-570	-1%
WB12	23,721	31,357	7,636	32%
L6	2,525,197	3,086,476	561,279	22%
L7	599,058	454,231	-144,827	-24%
OL25	1,507,569	1,439,381	-68,188	-5%
OL31	3,719,925	4,312,054	592,129	16%
OL33	453,616	618,867	165,251	36%
CLPS	2,492,196	2,351,540	-140,656	-6%
KRPS	92,805	153,377	60,572	65%
MWPS	3,434,846	2,673,459	-761,387	-22%
WWTP	9,105,645	9,192,589	86,944	1%

The largest differences between measured and model base flows were observed at the Kaiser Road Pump Station (KRPS), site OL33, and site WB12. The remaining sites were all within 25 percent of the model projection.

The discrepancy at the Kaiser Road Pump Station can be attributed to the flux of students at The Evergreen State College (TESC). It is difficult to measure base flow due to the seasonal differences in student population. Figure 6 shows how widely the flow at KRPS varies; the flow in January to April is much higher than the flow during the summer months, and depressions in December and March appear related to winter and spring vacations. Since drinking water consumption is tracked during the winter months, and base flow occurs during the summer, there is a disconnect at this site which is reflected in the difference between model and measured base flow.

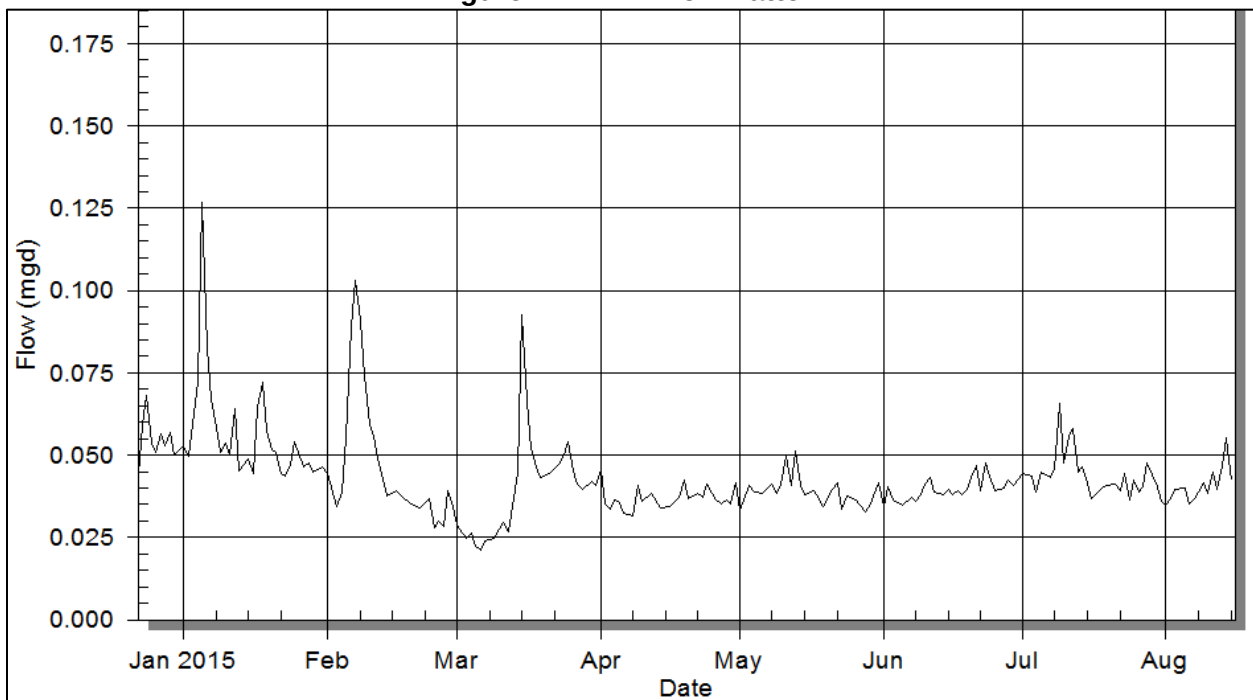
Figure 6. KRPS Flow Pattern



Site OL33 measures flow in the West Bay area of Olympia. This is a permanent flow monitoring site. The measured base flow was 165,000 gpd, 36 percent lower than the model. The base flow has been stable over the past few years, averaging close to 500,000 gpd. The model base flow of 620,000 gpd seems high. This probably reflects some relatively high drinking water consumption during the winter months in this area. This could be associated with irrigation, or commercial uses.

WB12 monitors flow from an area in northwest Olympia along West Bay Road, which contains residential homes and businesses. The measured base flow was 32 percent lower than the model projection. However, this site had an unusual flow record (Figure 7).

Figure 7. WB12 Flow Pattern



The base flow of 23,700 gpd was measured in March 2015. However, flow averaged closer to 40,000 gpd during the summer of 2015. The model base flow of 31,400 gpd sits between those values. It is likely that the low flow in March 2015 was an anomaly, either related to issues with the flow monitoring apparatus, or some issue with the nearby pump station.

3.3 Analysis of Inflow and Infiltration

There are a number of ways to assess the quality and integrity of the sewer system. Some of the most commonly used methods involve a calculation of I&I per inch-diameter-mile (IDM) of pipe, I&I per ERU, and the ratio of the peak hour flow to the base flow. Table 5 summarizes these statistics for each of the flow monitors. These may be compared with benchmark values established in the 2007 Inflow & Infiltration and Flow Monitoring Report. The benchmark ratio provides an aggregate estimate of the relative magnitude of I&I in each basin. A ratio of 1.0 corresponds to an area of relatively new pipe construction and/or low groundwater, such as central Lacey.

Table 5. Summary of I&I Statistics

Flow Monitor	Annual Average I&I/ERU (gpd)	Peak Day I&I/ERU (gpd)	Peak Hour I&I/ERU (gpd)	Average Annual I&I/IDM (gpd)	Peak Day I&I/IDM (gpd)	Peak Hour I&I/IDM (gpd)	Peak Hour Flow/Base flow (mgd)	Benchmark Ratio ¹
WB01	163	1,530	2,011	3,005	28,184	37,045	12.0	11.9
WB03	175	6,636	18,081	3,130	118,355	322,474	78.9	47.6
WB04	88	783	1,060	1,099	9,808	13,281	8.0	5.2
WB05	197	1,794	2,647	2,827	25,681	37,883	21.2	13.2
WB12	96	845	1,127	567	5,012	6,682	9.4	4.3
L6	11	68	109	104	660	1,066	1.7	0.5
L7	52	254	413	956	4,652	7,566	3.5	2.9
OL25	69	381	444	837	4,641	5,407	3.3	3.0
OL31	37	115	153	433	1,340	1,784	2.1	1.3
OL33	118	1,253	1,632	1,580	16,717	21,770	13.6	8.1
CLPS	49	305	379	508	3,159	3,931	3.2	2.2
KRPS	62	303	344	1,248	6,069	6,897	3.7	3.5
MWPS	17	74	103	154	664	925	1.5	0.6
WWTP	53	566	896	588	6,308	9,976	6.5	3.4
Benchmark ²	20	150	250	200	1,500	2,400	2.5	1.0

1. The benchmark ratio is the average value of seven ratios, corresponding to the first seven columns of the table (starting with average annual I&I/ERU and ending with the peak hour flow/base flow). The value in this table is divided by the benchmark. For example, the benchmark ratio at site OL25 is the average of the following values: {118/20; 1,253/150; 1,632/250; 1,409/200; 14,909/1,500; 19,416/2,400; 13.6/2.5} = 7.6.

2. I&I benchmarks established in the 2007 LOTT Inflow and Infiltration Report.

As a rule of thumb, new pipe construction should limit I&I to 100 to 200 gpd/IDM or less on an average annual basis. For existing pipe, the amount of I&I will vary widely depending on the age of pipe, local maintenance standards, and most importantly, the degree of sewer separation (i.e. whether downspouts are strictly disconnected or whether any sewer to storm pipe cross-connections exist) during the original design of the collection system.

3.3.1 Site Assessments

Pump stations and permanent sites experienced similar I&I patterns to previous years. Of the temporary sites, site WB03 by far had the most I&I. Sites WB04 and WB12 had lower levels of I&I compared to the other temporary sites this cycle, but were still somewhat higher than the overall system average (benchmark ratio of 3.4).

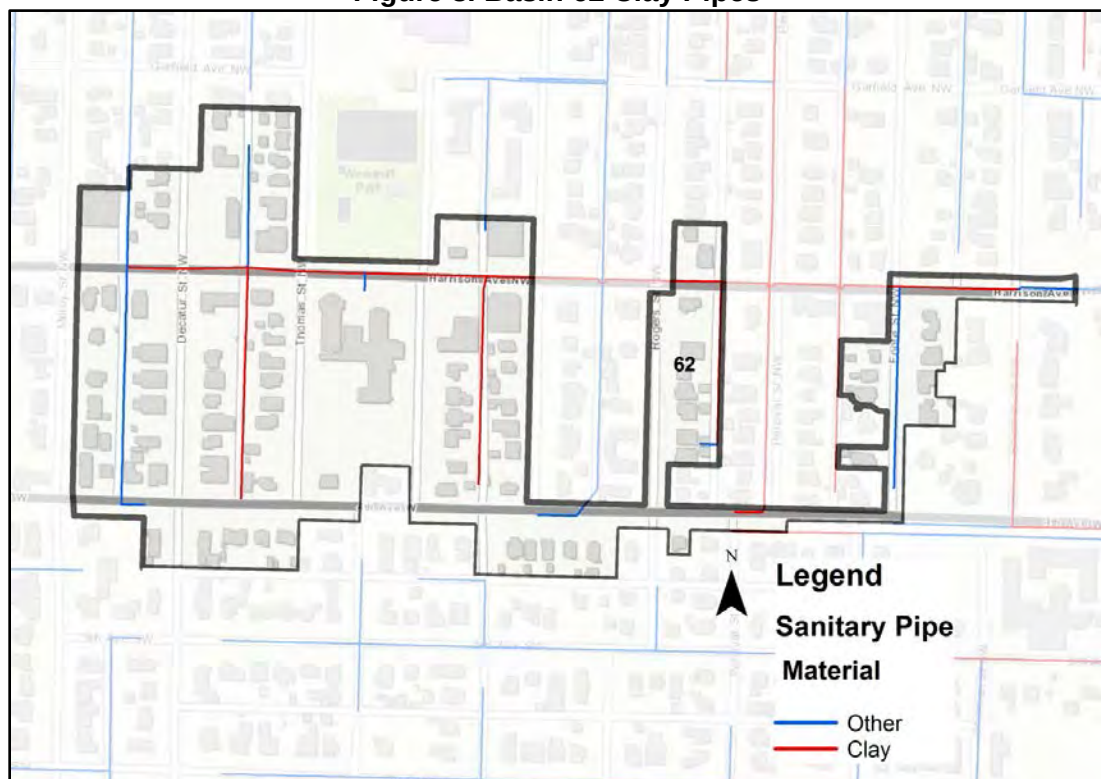
Site WB01

This site measures flow generated in West Olympia (Basin 61). This basin has a number of very old sewers, some of which are clay piping and prone to I&I. Jefferson Middle School is located in this basin among residential homes. The southern portion of the basin, close to Harrison Avenue, is mostly comprised of concrete pipes built in the 1950s. The high benchmark ratio in this basin (11.9) likely reflects the clay pipes and other old sewers.

Site WB03

Site WB03 measures flow from Basin 62, a small area in West Olympia along Harrison Avenue. This small basin is almost entirely composed of aged clay pipes installed between 1920 and 1933 (Figure 8). In this basin there are several commercial businesses, including a car wash. The very high I&I in this basin is likely related to the aged clay pipes.

Figure 8. Basin 62 Clay Pipes

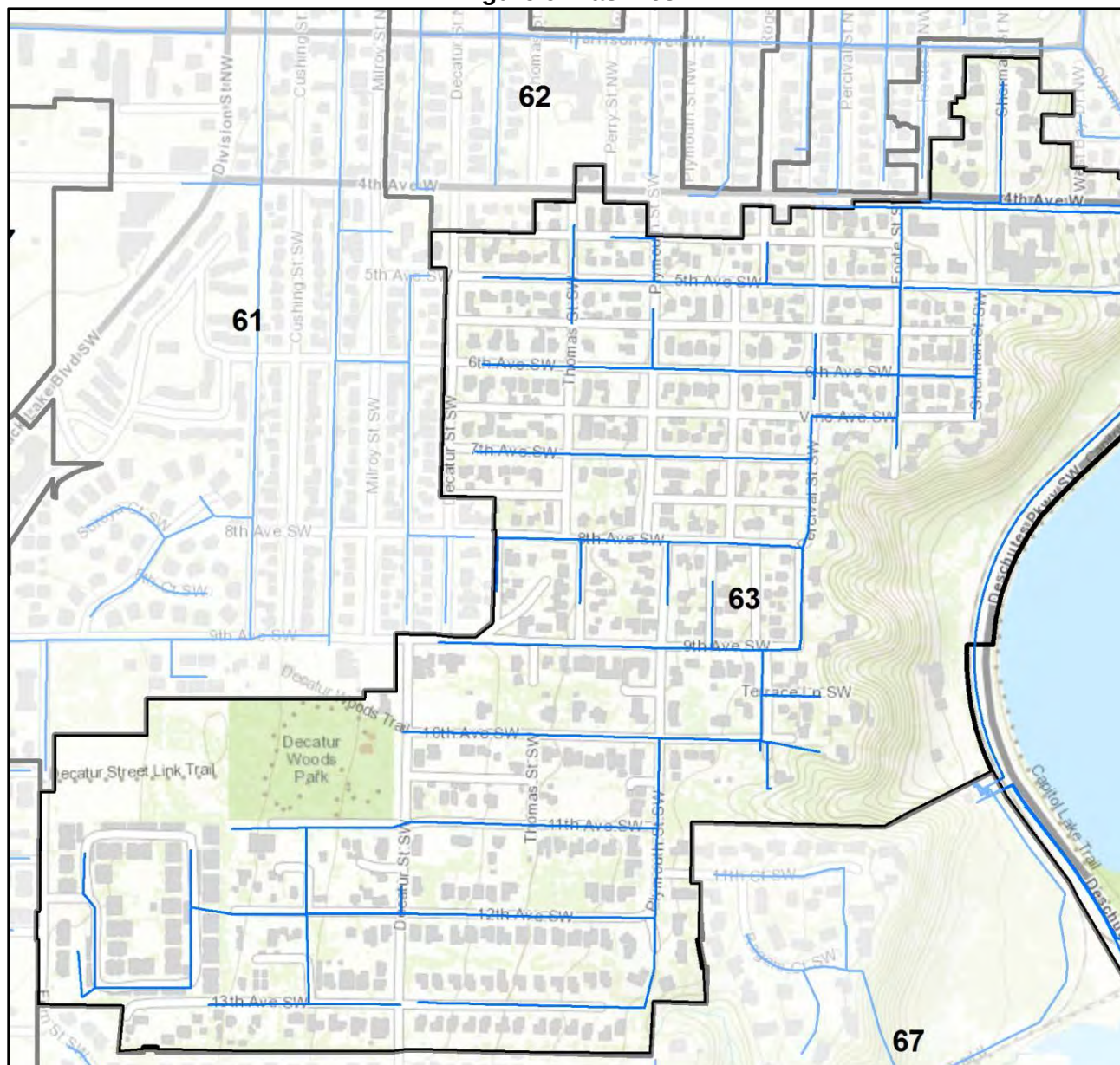


In 2009, the City of Olympia installed porous concrete sidewalks along 4th Avenue from Division Street to Thomas Street. The porous concrete allows stormwater to infiltrate to the underlying soils and potentially into cracked wastewater pipes.

Site WB04

Site WB04 measures flow generated in Basin 63, just south of 4th Avenue on the west side of Olympia (Figure 9). Pipes in this basin are slightly newer than those in Basins 61 and 62. In 2009, the City of Olympia also completed a low impact development project on Decatur Street SW, between 9th and 11th Avenues. The project redirected stormwater from these two blocks into an on-site stormwater treatment and infiltration area. The benchmark ratio in this area was 5.2.

Figure 9. Basin 63

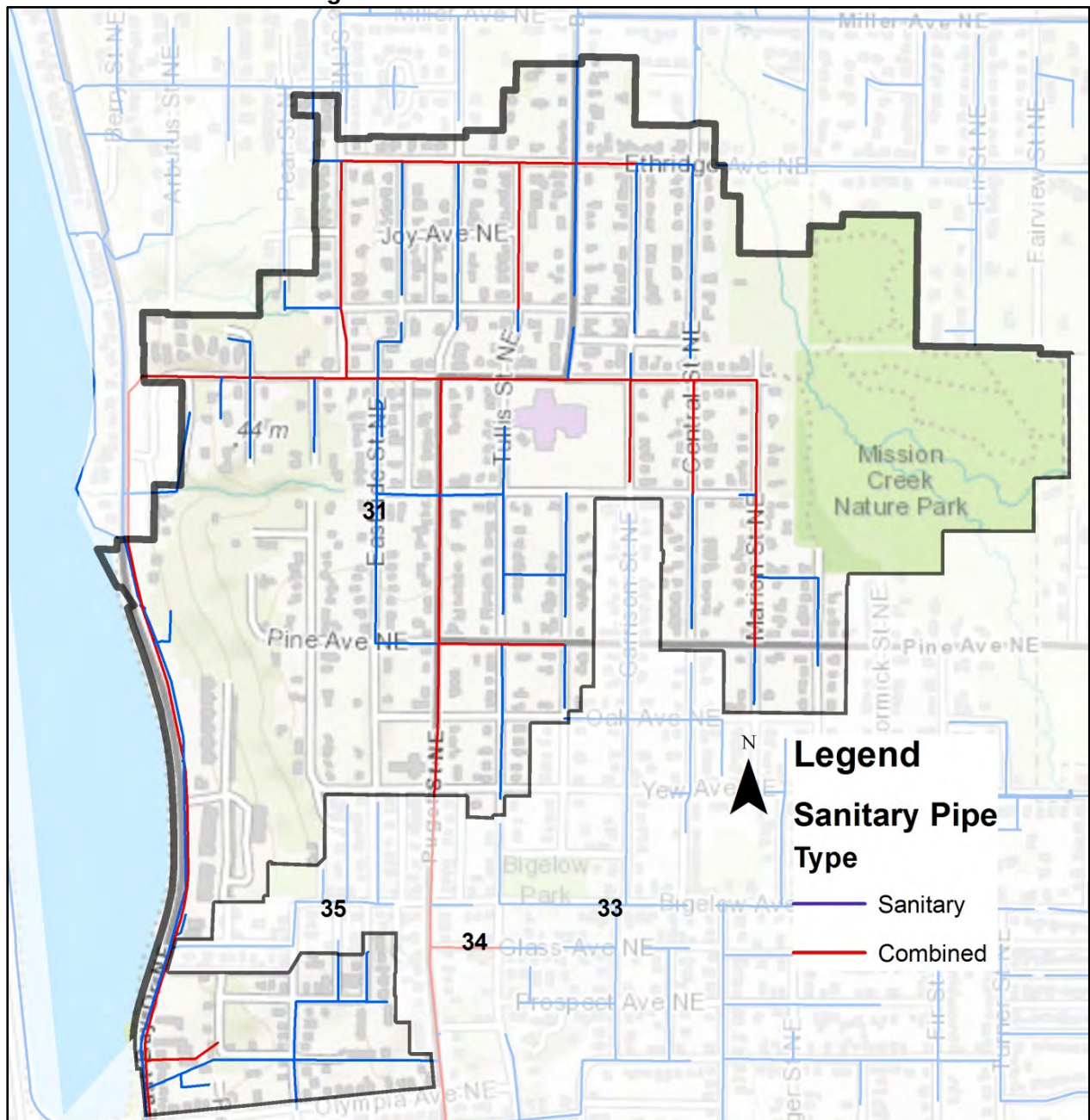


Site WB05

Site WB05 measures flow generated in the East Bay neighborhood along San Francisco Street. There are several combined sewers in this basin which appear to generate high levels of I&I. The benchmark ratio in this area was 13.2, which ranks 17th-highest among the 88 LOTT sewer basins.

Combined sewers in Basin 31 are shown in red on Figure 10. This area also includes an elementary school and some commercial businesses.

Figure 10. Combined Sewers in Basin 31



Site WB12

Site WB12 serves an area along West Bay Road. The City of Olympia built a new West Bay forcemain in 2011 to convey wastewater from its West Bay Pump Station to the gravity main going across the 4th Avenue bridge. The City of Olympia also completed an upgrade to the West Bay Pump Station. The upgrade included replacing existing pumps, increasing wet well storage volume, and improving electrical and control systems. Of the WB sites, this site had the lowest I&I benchmark ratio, at 4.3.

Permanent Sites

I&I benchmarks at the LOTT pump stations and permanent sites were similar to those recorded last year. The largest change was a reduction from 3.5 to 2.9 at the KRPS, but this most likely reflects the volatile nature of flow recordings at that site, rather than a change in the collection system.

LOTT

LOTT system-wide I&I is summarized in Table 6. This year, the model showed a reduction in I&I for all averaging periods except the summer. Although the model is designed to limit the influence of annual variations in precipitation, it must be noted that the winter of 2014-2015 was quite dry, and lacked large events typical of most years. It is possible that this influenced the model to some degree, and may have contributed to the slight reductions in projected I&I.

Table 6. LOTT System-Wide I&I Profile (mgd)

Averaging period	2010 Report	2011 Report	2012 Report	2013 Report	2014 Report	This Report	Percent Change From 2014
Average annual	2.7	2.7	2.8	2.7	3.2	2.9	-10%
10-year peak month	8.4	8.2	8.3	8.2	9.8	8.6	-12%
10-year peak day	34.5	33.4	33.0	33.4	33.4	31.8	-5%
10-year peak hour	55.4	53.2	53.6	53.2	53.4	50.4	-6%
Summer (Jun-Sept)	0.9	1.0	1.0	1.0	1.1	1.1	3%
Shoulder (Apr,May,Oct)	2.2	2.2	2.3	2.2	2.7	2.5	-7%
Winter (Nov-Mar)	4.4	4.3	4.5	4.3	5.3	4.7	-11%

3.3.2 Updated I&I Model

Inflow and infiltration estimates for each flow meter are translated to basin I&I estimates using a best-fit technique taking all of the data from all of the meters into account. In this way, basin I&I estimates will be updated on an annual basis, and compared with the previous year's estimate in the annual Flow Monitoring and I&I Evaluation.

As the I&I program progresses, model projections for each of the permanent stations will become more accurate. By recalibrating the full set of basin I&I profiles each year, the overall system model will increase its accuracy on a continuous basis. Note that approximately one-third of the basins have not been monitored directly (as discussed under Figure 2). In these basins, the I&I estimates are based on the regression of data from all downstream flow monitors, as well as the system as a whole. Table 7 summarizes the basin I&I statistics.

Table 7. Basin I&I (gpd)

Basin	City	Location	Average Annual	Peak Month	Peak Day	Peak Hour	Summer (6,7,8,9)	Shoulder (4,5,10)	Winter (Nov-Mar)
1	L	Hawks Prairie	45,924	121,501	245,264	357,739	18,959	37,431	72,447
2	L	Meridian	8,579	27,230	51,340	80,477	4,692	8,561	12,429
3	L	Meadows	17,133	25,752	32,781	54,031	3,744	9,683	20,699
4	L	Lacey STEP	17,133	29,885	32,781	54,031	5,928	14,574	20,699
5	L	SE Corner	17,133	31,792	32,781	54,031	3,328	5,477	20,699
6	L	Horizon View	3,443	33,687	108,772	257,864	3,499	4,576	9,304

Basin	City	Location	Average Annual	Peak Month	Peak Day	Peak Hour	Summer (6,7,8,9)	Shoulder (4,5,10)	Winter (Nov-Mar)
7	L	Ruddell	3,443	46,393	108,772	165,749	2,946	7,010	9,304
8	L	S Chambers Lake	20,076	88,740	128,124	200,766	5,794	13,778	37,389
9	L	N Chambers Lake	34,940	75,499	150,931	238,465	16,159	30,793	54,745
10	L	Lacey Blvd	68,210	179,388	217,912	264,405	30,463	60,094	105,015
11	L	Lacey Confluence	27,195	82,005	124,716	200,014	13,502	25,485	39,545
12	L	South Sound Center	131,556	354,885	469,017	549,982	53,514	105,249	205,456
13	L	St. Martins	17,133	25,964	32,781	54,031	8,112	14,476	20,699
14	L	Chinook	16,678	28,424	33,763	54,333	13,090	14,114	21,689
15	L	Britton Pkwy.	7,632	25,365	40,801	62,819	3,914	7,151	12,504
16	L	N Tanglewilde	7,632	17,355	40,801	58,507	2,409	3,433	12,504
17	L	S Tanglewilde	7,632	14,069	40,801	74,874	2,108	6,961	12,504
18	O	Motel 8	38,698	130,332	208,978	257,966	12,547	26,573	58,402
19	O	Lilly Rd.	38,698	130,332	208,978	257,966	12,547	26,573	58,402
20	O	South Bay Rd.	1,190	1,286	1,606	2,170	251	570	1,080
21	O	Fones	111,104	315,470	623,543	800,939	55,465	100,895	177,171
22	O	Boulevard	26,329	69,727	93,984	123,351	12,360	25,296	40,563
23	O	Wiggins	0	0	0	0	0	0	0
24	O	Indian Summer	9,049	15,575	88,123	154,381	4,495	8,193	14,249
25	O	South Boulevard	19,559	53,716	82,643	85,747	7,954	16,804	31,560
26	O	Henderson	9,049	26,206	88,123	128,781	3,269	7,793	14,249
27	O	North St.	33,079	94,751	326,695	525,292	11,052	27,026	51,954
28	O	Indian Creek	5,859	17,080	67,162	82,005	2,315	5,048	9,450
29	O	SE Downtown	45,538	108,343	396,761	483,785	17,844	42,679	82,581
30	O	Priest Point	137,264	477,380	769,163	899,822	70,919	144,176	216,749
31	O	San Francisco	154,817	500,445	1,567,456	2,111,107	47,325	126,957	259,421
32	O	NE Downtown	8,139	33,757	427,615	1,640,970	2,494	3,556	14,056
33	O	Bigelow	27,467	58,205	243,330	267,326	10,438	24,284	44,902
34	O	Puget St.	5,987	21,655	208,125	450,923	2,745	6,068	11,237
35	O	Bigelow Springs	5,987	21,655	208,125	450,923	2,745	6,068	11,237
36	O	State Ave.	5,987	21,762	209,730	454,331	2,889	6,200	11,352
37	O	Lybarger	8,139	24,698	409,332	486,526	2,014	7,606	14,056
38	O	4 th Ave. E	11,538	32,806	195,371	331,286	4,128	9,414	19,302
39	O	5 th Ave. E	8,139	39,739	498,136	590,284	2,590	7,013	14,056

Basin	City	Location	Average Annual	Peak Month	Peak Day	Peak Hour	Summer (6,7,8,9)	Shoulder (4,5,10)	Winter (Nov-Mar)
40	O	Pear	13,522	48,884	469,522	1,017,302	6,356	13,852	25,485
41	O	Plum	123,539	386,785	1,616,961	2,511,731	42,987	106,028	168,550
42	O	I-5 Interchange	4,857	20,591	169,142	381,600	1,944	4,534	9,125
43	O	Stevens Field	60,298	192,259	1,668,080	3,550,248	19,652	53,095	104,143
44	O	S Capitol 24th	14,524	28,638	300,483	437,293	2,819	22,798	25,946
45	O	S Capitol 22nd	8,480	35,036	466,196	708,501	769	4,123	16,362
46	O	S Capitol 17th	16,879	21,685	338,073	468,695	8,094	11,552	19,043
47	O	State Capitol	15,996	39,102	338,073	428,425	8,367	12,677	25,752
48	O	N Capitol Campus	16,094	32,700	161,476	253,028	3,183	9,099	24,197
49	O	State Offices	23,953	71,873	448,063	693,061	7,882	18,015	38,402
50	O	Central Downtown	102,261	271,088	1,665,931	3,506,866	33,412	83,679	167,715
51	O	Sylvester	132,868	364,539	2,703,510	7,011,953	45,206	99,872	212,192
52	O	Heritage Park	56,977	249,571	3,282,630	3,767,759	11,878	74,662	115,402
53	O	Port Peninsula	13,522	48,884	469,522	1,017,302	6,356	13,852	25,485
54	O	Cedrona	13,861	17,014	30,678	44,323	8,101	10,299	16,276
55	O	Westwood	0	0	0	0	0	0	0
56	O	Old Port	56,165	181,086	469,334	720,206	20,784	48,155	97,246
57	O	Cooper Point	55,736	105,636	265,604	277,792	10,475	43,492	76,759
58	O	Goldcrest	55,001	118,704	257,985	266,760	11,006	45,016	85,519
59	O	West Bay	17,029	57,562	135,737	202,271	4,095	11,796	31,656
60	O	West Side	52,054	196,268	1,100,793	1,391,110	16,330	49,009	75,247
61	O	Jefferson	222,672	686,749	1,784,987	2,084,136	85,894	175,720	372,089
62	O	Harrison	18,196	74,126	374,094	407,020	7,002	13,816	31,727
63	O	Decatur Woods	54,469	168,495	603,425	912,466	11,322	38,640	89,547
64	O	Grass Lake	20,804	50,738	101,184	105,860	12,369	28,274	34,532
65	O	West Olympia	0	0	0	0	0	0	0
66	O	Capital Mall	51,816	150,080	438,966	531,248	15,844	42,560	83,814
67	O	Percival Creek	41,623	101,742	291,718	460,776	13,160	33,271	59,231
68	O	Ken Lake	109,950	288,368	492,404	573,374	37,474	84,590	179,067
69	O	Mottman	62,558	244,081	580,578	710,946	19,388	48,790	103,173
70	T	N Black Lake	0	0	0	0	0	0	0
71	T	Sapp	99,057	322,399	503,811	757,633	66,578	99,521	171,364

Basin	City	Location	Average Annual	Peak Month	Peak Day	Peak Hour	Summer (6,7,8,9)	Shoulder (4,5,10)	Winter (Nov-Mar)
72	T	Tumwater Hill	79,910	203,973	474,462	549,646	28,165	70,215	141,435
73	T	E Street	6,316	17,855	38,604	41,650	2,414	5,129	11,558
74	T	H Street	6,316	17,855	38,604	41,650	2,414	5,129	11,558
75	T	Barnes Lake	11,953	36,195	64,616	66,387	3,910	10,791	19,088
76	T	NE Tumwater	22,361	41,325	109,305	164,227	8,036	19,031	36,404
77	T	Tumwater Valley	750	868	959	1,053	501	600	802
78	T	Southgate	78,875	226,691	482,852	525,935	27,415	67,422	126,613
79	T	Trosper	8,802	15,022	20,186	24,999	1,798	7,848	12,528
80	T	Littlerock	5,163	8,981	22,576	48,543	1,718	4,423	8,637
81	T	Tumwater City Hall	4,441	12,760	36,496	46,174	1,408	3,626	7,540
82	T	Trails End	4,441	12,760	36,496	46,174	1,408	3,626	7,540
83	T	Hwy 99	4,441	12,760	36,496	46,174	1,408	3,626	7,540
84	T	Airport	0	0	0	0	0	0	0
85	T	S Airport	4,441	12,760	36,496	46,174	1,408	3,626	7,540
86	T	Kimmie	4,441	12,760	36,496	46,174	1,408	3,626	7,540
87	T	Salmon Creek	0	0	0	0	0	0	0
88	T	Black Lake	0	0	0	0	0	0	0
TESC		The Evergreen State College	28,789	49,902	81,274	127,353	8,706	18,225	41,289

3.3.3 I&I Benchmarks and Basin Ranking

The intergovernmental agreement which established the LOTT I&I program includes a non-degradation clause. Based upon this clause, LOTT will annually evaluate I&I in each of its sewer basins. If the amount of I&I in a basin is found to be significantly increasing, LOTT and its partners will prioritize work in that basin to remedy the situation. In order to provide a measure which can be tracked on an annual basis, the I&I benchmarks listed in Table 8 have been selected. These benchmarks are drawn from a statistical analysis of the LOTT basins. They represent the top 33rd percentile of I&I measures across all of the basins when the benchmark was established in 2007. That is, two-thirds of the LOTT basins exhibited I&I parameters worse than these benchmarks at that time.

Table 8. LOTT Sewer Basin I&I Benchmarks

Average Annual I&I per ERU	20	gpd/eru
Peak Month I&I per ERU	50	gpd/eru
Peak Day I&I per ERU	150	gpd/eru
Peak Hour I&I per ERU	250	gpd/eru
Average Annual I&I per IDM	200	gpd/idm
Peak Month I&I per IDM	500	gpd/idm
Peak Day I&I per IDM	1,500	gpd/idm
Peak Hour I&I per IDM	2,400	gpd/idm
Peak Hour Flow to Base Flow Ratio	2.5	

Each LOTT basin is compared with the benchmark in each of the nine categories. A benchmark average is then calculated, which provides a representation of how each basin compares to the benchmark. A basin in the top one-third in each of the nine categories will have a score less than 1.0. A ranking of the 88 LOTT basins, along with some key I&I figures and the benchmark score, is provided in Table 9.

Table 9. LOTT Sewer Basins Inflow and Infiltration Ranked from Highest to Lowest Severity of I&I

Rank	Basin	City	Location	Average Annual I&I/ERU (gpd)	Average Annual I&I/IDM (gpd)	Peak Hour/BSF	Benchmark Ratio	2014-2015 Benchmark Ratio	Change	Absolute Difference
1	52	O	Heritage Park	952	6,292	226.7	149.0	176.1	-15%	-27.1
2	37	O	Lybarger	198	6,519	52.3	67.7	51.2	32%	16.5
3	51	O	Sylvester	310	7,145	66.2	55.1	36.1	52%	18.9
4	75	T	Barnes Lake	1,654	3,386	65.7	40.3	10.0	305%	30.4
5	34	O	Puget St	89	4,214	50.1	40.0	17.3	131%	22.6
6	45	O	S Capitol 22nd	160	2,157	91.8	39.2	45.1	-13%	-5.8
7	40	O	Pear	140	3,278	49.0	36.6	21.9	68%	14.8
8	47	O	State Capitol	145	6,279	56.7	32.6	24.0	36%	8.6
9	50	O	Central Downtown	290	4,935	9.1	31.1	32.3	-4%	-1.3
10	35	O	Bigelow Springs	115	1,959	67.0	25.9	16.9	54%	9.0
11	44	O	S Capitol 24th	245	3,269	48.9	24.5	27.1	-10%	-2.6
12	41	O	Plum	261	3,725	50.6	22.2	19.0	17%	3.2
13	62	O	Harrison	175	3,121	23.1	20.5	17.5	18%	3.1
14	43	O	Stevens Field	96	1,629	47.2	17.6	16.4	8%	1.3
15	18	O	Motel 8	280	4,056	12.0	14.3	10.5	37%	3.8
16	46	O	S Capitol 17th	91	2,753	20.0	14.1	11.1	27%	3.0
17	31	O	San Francisco	197	2,820	21.6	13.6	12.9	5%	0.7
18	36	O	State Ave	67	970	25.9	13.3	9.2	45%	4.1
19	48	O	N Capitol Campus	58	4,347	11.6	12.7	11.6	9%	1.1
20	49	O	State Offices	35	2,193	15.1	10.7	8.3	29%	2.4
21	68	O	Ken Lake	335	2,571	11.8	10.6	11.7	-9%	-1.0
22	61	O	Jefferson	149	2,741	8.9	10.0	8.3	20%	1.7
23	32	O	NE Downtown	21	316	33.0	9.1	9.7	-6%	-0.6
24	12	L	South Sound Center	153	3,780	7.1	8.9	6.0	47%	2.8
25	60	O	West Side	90	1,012	14.6	8.6	8.1	6%	0.5

Rank	Basin	City	Location	Average Annual I&I/ERU (gpd)	Average Annual I&I/IDM (gpd)	Peak Hour/BSF	Benchmark Ratio	2014-2015 Benchmark Ratio	Change	Absolute Difference
26	78	T	Southgate	131	2,402	7.2	7.6	7.7	-2%	-0.2
27	69	T	Mottman	92	1,826	4.3	7.4	5.4	37%	2.0
28	39	O	5th Ave E	29	356	16.2	6.9	6.1	13%	0.8
29	30	O	Priest Point	165	1,469	9.3	6.8	6.8	-1%	-0.1
30	33	O	Bigelow	117	1,770	9.8	6.7	6.5	4%	0.2
31	38	O	4th Ave E	78	837	11.0	6.6	6.0	9%	0.5
32	63	O	Decatur Woods	89	1,113	9.4	6.1	6.9	-11%	-0.8
33	56	O	Old Port	104	1,226	8.6	6.0	7.6	-21%	-1.6
34	21	O	Fones	123	1,529	4.9	5.5	5.0	11%	0.5
35	29	O	SE Downtown	94	1,351	8.3	5.4	6.1	-11%	-0.7
36	72	T	Tumwater Hill	109	1,442	6.5	5.0	5.8	-13%	-0.8
37	58	O	Goldcrest	150	1,071	5.5	4.4	5.8	-24%	-1.4
38	71	T	Sapp	106	953	6.2	4.3	4.5	-5%	-0.2
39	53	O	Port Peninsula	38	104	16.1	4.3	2.3	88%	2.0
40	59	O	West Bay	96	569	7.5	4.1	5.5	-27%	-1.5
41	27	O	North St	70	545	7.0	3.6	2.9	26%	0.7
42	85	T	S Airport	115	208	10.4	3.5	1.5	141%	2.1
43	10	L	Lacey Blvd	92	1,205	3.8	3.5	3.2	8%	0.3
44	66	O	Capital Mall	37	1,026	3.4	3.4	3.0	12%	0.4
45	5	L	SE Corner	--	994	--	2.8	2.2	27%	0.6
46	17	L	S Tanglewilde	81	545	5.5	2.7	2.1	27%	0.6
47	54	O	Cedrona	59	1,177	2.1	2.4	0.8	193%	1.6
48	73	T	E Street	68	346	4.2	2.2	2.1	2%	0.0
49	42	O	I5 Interchange	15	56	12.7	2.1	2.1	-2%	-0.1
50	57	O	Cooper Point	62	518	2.9	1.9	2.1	-8%	-0.2
51	11	L	Lacey Confluence	41	474	3.2	1.8	1.8	3%	0.1
52	67	O	Percival Creek	33	393	3.1	1.7	1.9	-12%	-0.2
53	15	L	Britton Pkwy	50	187	3.4	1.6	5.3	-70%	-3.7
54	25	O	South Boulevard	27	600	1.9	1.5	2.2	-31%	-0.7
55	14	L	Chinook	64	337	2.1	1.3	1.1	17%	0.2
56	9	L	N Chambers Lake	21	455	2.1	1.2	1.0	22%	0.2

Rank	Basin	City	Location	Average Annual I&I/ERU (gpd)	Average Annual I&I/IDM (gpd)	Peak Hour/BSF	Benchmark Ratio	2014-2015 Benchmark Ratio	Change	Absolute Difference
57	8	L	S Chambers Lake	19	239	2.4	1.2	1.3	-10%	-0.1
58	19	O	Lilly Rd	17	368	1.8	1.2	1.0	16%	0.2
59	13	L	St Martins	34	542	1.7	1.1	0.8	38%	0.3
60	74	T	H Street	22	180	2.0	0.9	0.9	1%	0.0
61	76	T	NE Tumwater	28	161	2.5	0.8	0.9	-3%	0.0
62	28	O	Indian Creek	17	94	2.3	0.8	0.8	-1%	0.0
63	82	T	Trails End	15	160	2.2	0.8	1.5	-46%	-0.7
64	3	L	Meadows	29	301	1.4	0.8	0.9	-15%	-0.1
65	64	O	Grass Lake	18	215	1.6	0.7	1.0	-24%	-0.2
66	16	L	N Tanglewilde	22	100	2.0	0.7	0.7	-6%	0.0
67	22	O	Boulevard	16	200	1.4	0.7	0.7	-3%	0.0
68	1	L	Hawks Prairie	17	118	1.8	0.6	0.7	-4%	0.0
69	2	L	Meridian	8	97	1.5	0.4	0.4	4%	0.0
70	26	O	Henderson	8	66	1.6	0.4	0.5	-8%	0.0
71	79	T	Trosper	14	159	1.3	0.4	0.5	-16%	-0.1
72	24	O	Indian Summer	6	84	1.7	0.4	0.6	-33%	-0.2
73	83	T	Hwy 99	7	82	1.5	0.4	0.7	-45%	-0.3
74	86	T	Kimmie	9	49	1.7	0.4	0.5	-15%	-0.1
75	7	L	Ruddell	2	16	1.6	0.3	0.3	-2%	0.0
76	80	T	Littlerock	7	51	1.5	0.3	0.4	-27%	-0.1
77	81	T	Tumwater City Hall	3	36	1.2	0.2	0.3	-18%	0.0
78	4	L	Lacey STEP	7	55	1.1	0.2	0.2	-5%	0.0
79	6	L	Horizon View	1	10	1.4	0.2	0.2	-3%	0.0

Figure 11. LOTT Sewer Basins, Magnitude of I&I as Expressed by Ratio of I&I Parameters to Benchmark Values Basins Labeled by Basin ID

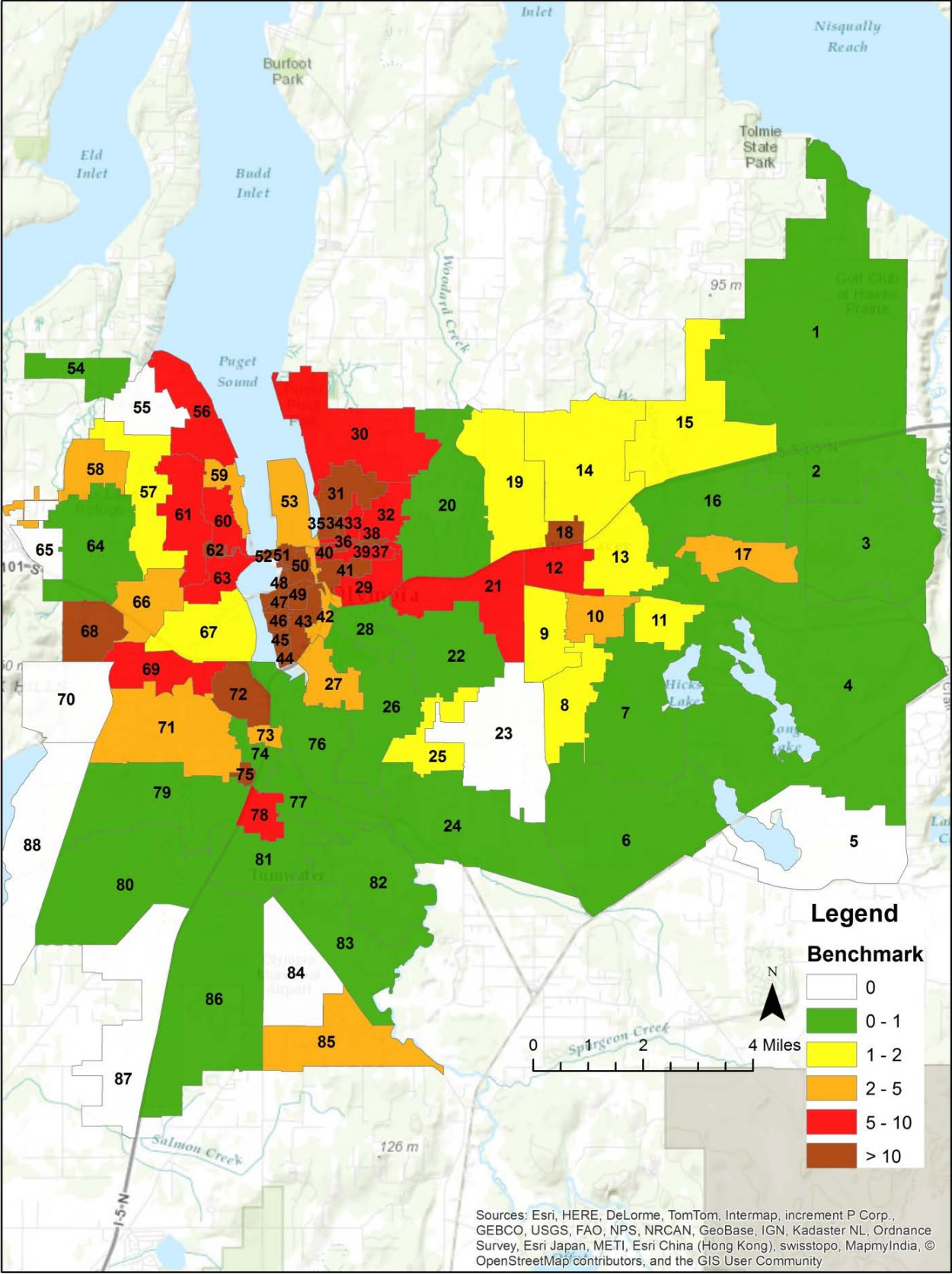
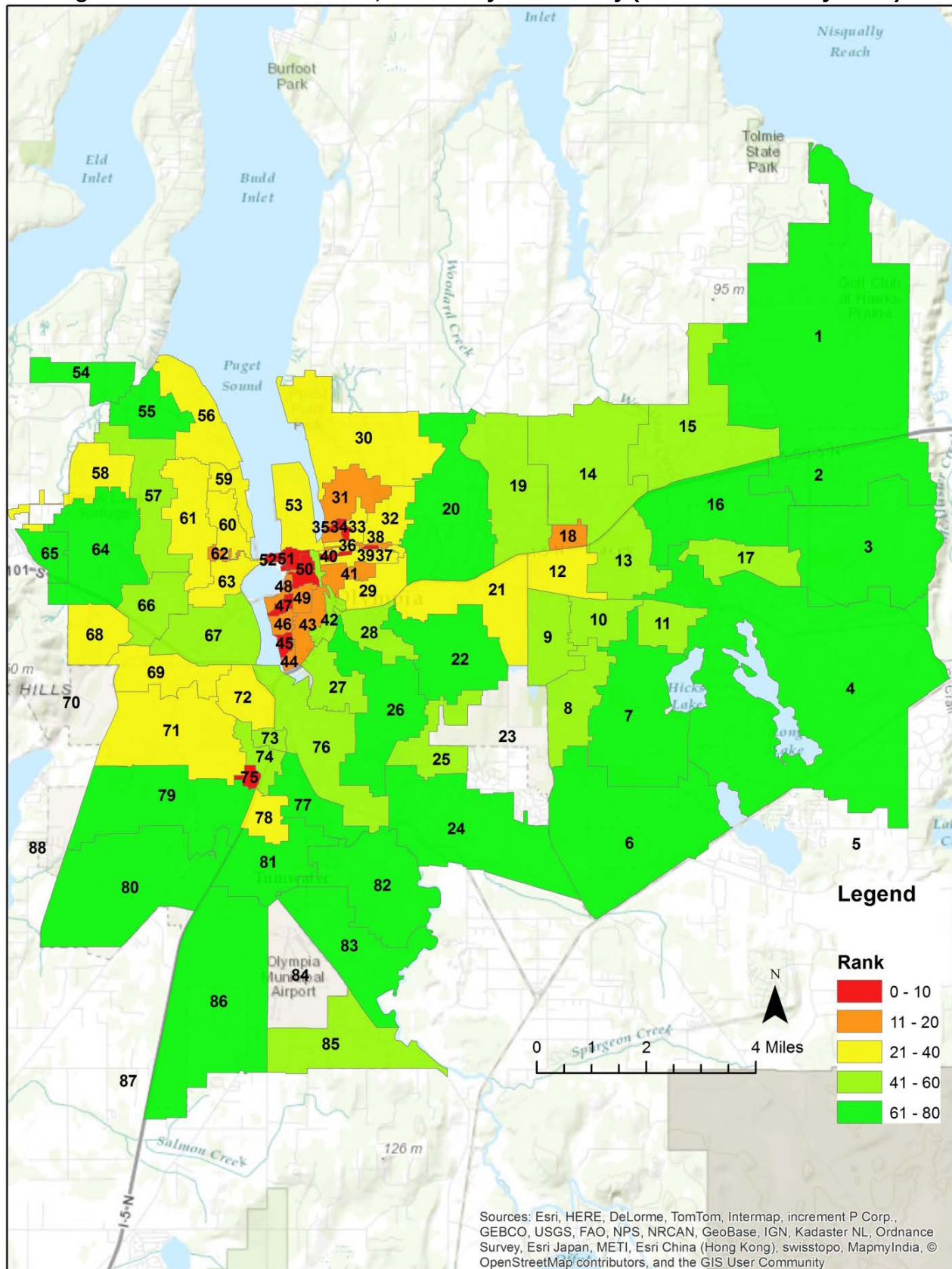


Figure 12. LOTT Sewer Basins, Ranked by I&I Severity (Basins Labeled by Rank)



The basins with the most I&I are concentrated in the central downtown area of Olympia (low ranking). This corresponds with the location of most of the combined sewer pipes in the system. High levels of I&I were also noted in both the East Bay and West Bay areas of Olympia, corresponding to the areas with the oldest residential developments.

Outside of central Olympia, the highest levels of I&I were noted in the Tumwater Hill area of Tumwater and the Ken Lake area of Olympia.

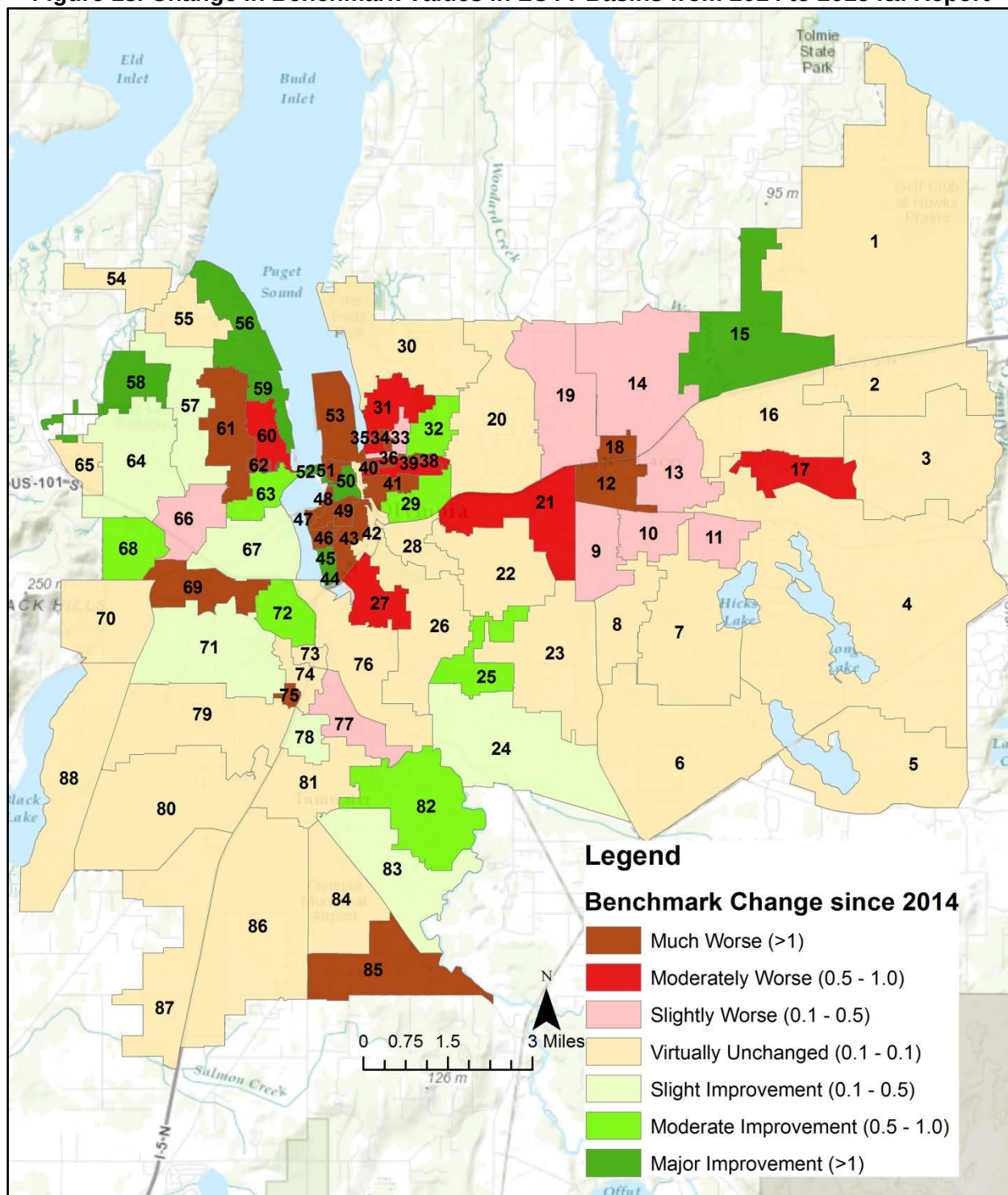
The lowest levels of I&I were found in south Lacey, southwest Tumwater, and the STEP areas of southeast Lacey and southeast Olympia.

Overall, the system benchmark ratio was 3.36, which is 5 percent lower than the previous year's average (3.54). Average ratios for the LOTT partners were:

- Lacey: 1.0
- Olympia: 5.7
- Tumwater: 1.8

It was recommended in the 2010 I&I Report that the 2010 benchmark values serve as a baseline for comparison of future values. There is annual variation in I&I due to weather and groundwater level fluctuations, so a small amount of annual variation in I&I benchmarks is expected. The difference in benchmark values from the 2014 I&I Report to the 2015 I&I Report is shown on Figure 13.

Figure 13. Change in Benchmark Values in LOTT Basins from 2014 to 2015 I&I Report



The largest changes are concentrated in the downtown and west side areas. This is typical, since these areas represent the last two areas to be monitored. Changes in outlying basins, such as basin 85 in southern Tumwater, appears to be related to improvement in ERU tracking. The magnitude of I&I in those basins was largely unchanged, but the count of either ERUs or IDM changed based on improvements to the system geodatabase.

3.3.4 Comparison of I&I from Year 5 to Year 12

27

Table 10. Comparison of I&I, 2007 versus 2014

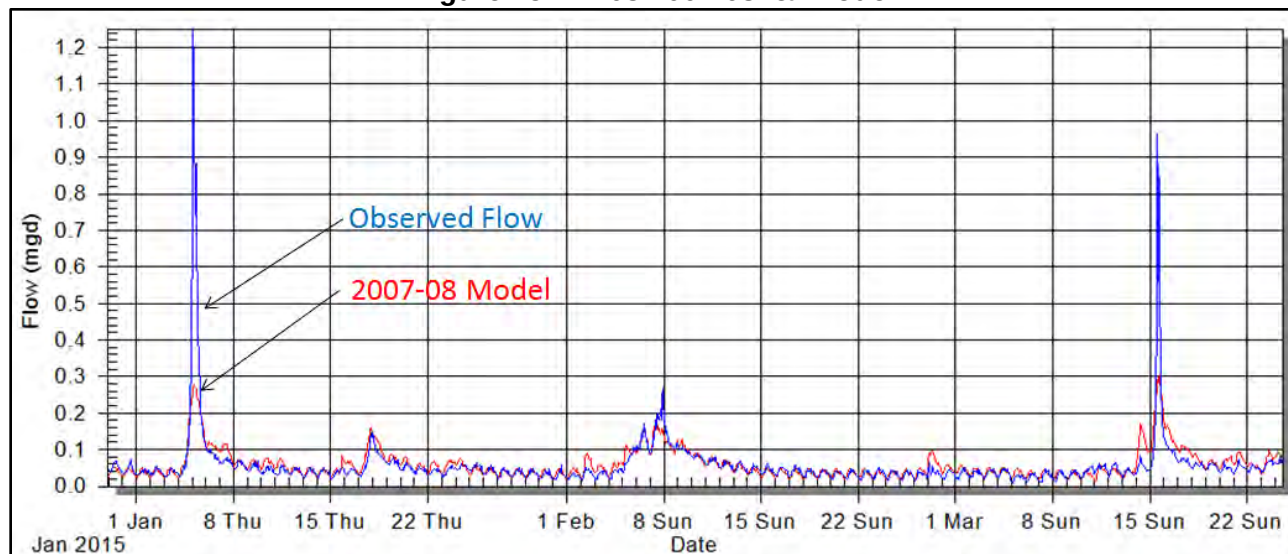
Year	I&I (mgd)									
	WB01		WB03		WB04		WB05		WB12	
	2007-2008	2014-2015	2007-2008	2014-2015	2007-2008	2014-2015	2007-2008	2014-2015	2007-2008	2014-2015
Base sanitary flow	0.237	0.274	0.022	0.024	0.110	0.092	0.052	0.103	0.020	0.023
Annual average	0.202	0.244	0.025	0.018	0.044	0.053	0.168	0.155	0.021	0.016
10-year peak month	0.704	0.700	0.085	0.08	0.202	0.17	0.553	0.50	0.072	0.06
10-year peak day	1.500	2.29	0.306	0.69	0.907	0.48	1.557	1.41	0.208	0.15
10-year peak hour	2.002	3.01	0.416	1.88	1.273	0.65	2.211	2.08	0.260	0.20

Table 11. Comparison of ERUs and Benchmark Ratios for 2007 versus 2014

FM Site	ERU			Percent Difference	Benchmark Ratio			Percent Difference
	2007-2008	2014-2015	Change		2007-2008	2014-2015	Change	
WB01	1,674	1,497	-177	-12%	7.5	11.9	4.39	37%
WB03	115	104	-11	-11%	19.1	47.6	28.5	60%
WB04	737	613	-124	-20%	7.5	5.2	-2.26	-43%
WB05	799	786	-13	-2%	13.9	13.2	-0.69	-5%
WB12	157	177	20	11%	6.1	4.3	-1.82	-43%

Base flow at site WB05 has nearly doubled since 2007-08, but the number of ERU has remained constant. The measured base flow matched very closely to the drinking water-based model, so the issue appears to be an unusually low base flow measured in 2007-08. Otherwise, base flow values were similar between 2007-08 and the present.

Since 2007-08, the benchmark ratio for WB03 increased by 60 percent, from 19.1 to 47.6. This represents a major increase in I&I. The pipes in Basin 62, served by WB03, are almost all made of clay dating back to the 1920s (refer back to Figure 8). The total IDM for the basin is 5.83 and the clay pipes have a total IDM of 4.42 (75 percent of the basin). When it rains, the basin observes very high peaks of short duration. The previous I&I model, developed in 2007-08, did not adequately simulate those peaks. Figure 15 presents the performance of the 2007-08 model with the more recent data. Note how the model does not capture peaks in January and March 2015. Adjusting the model to capture these peaks has resulted in the increased benchmark ratio.

Figure 15. WB03 2007-08 I&I Model

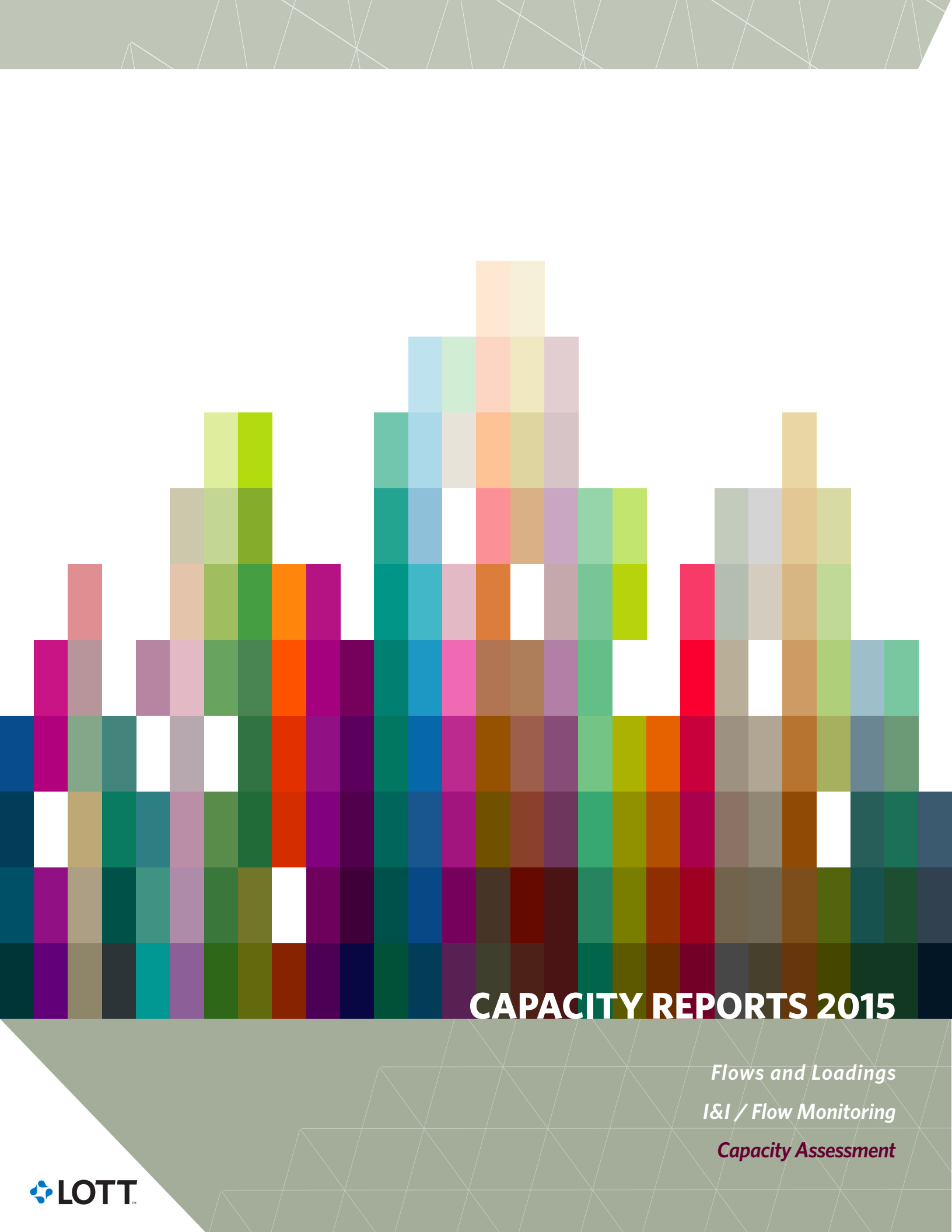
The peak hour flow observed during the winter of 2007-08 was 0.4 mgd. It is possible that some of the difference in short-duration high-intensity I&I is related to the porous concrete installation in 2009.

The I&I benchmark ratio at site WB01 increased by 37 percent, with a 1.0 mgd increase in 10-year peak hour I&I. As noted above, this basin has a large proportion of old concrete pipes, and I&I is expected to increase until those pipes are renovated or replaced.

I&I benchmarks have improved for sites WB04 and WB12. The improvement at site WB04 may be attributed to the stormwater diversion project previously mentioned in Section 3.3.1. The improvement at site WB12 may be related to upgrades and improvements around the City of Olympia West Bay Pump Station. I&I benchmarks at the others sites were comparable to those observed in 2007-08.

4. Recommendations

- The City of Olympia may wish to investigate the increase in I&I at site WB03, particularly whether recent road work in that area may have contributed to the increase.
- The City of Tumwater may wish to investigate the increase in I&I at in Basin 75.
- Temporary flow monitors should be moved to north Lacey, to allow assessment of sites monitored during Year 6 of the program (2008-2009).



CAPACITY REPORTS 2015

Flows and Loadings
I&I / Flow Monitoring
Capacity Assessment



2015 Capacity Assessment Report

December 2015

Prepared By:

Tyle Zuchowski, LOTT Clean Water Alliance

With assistance from Adam Klein and Hannah McLean, Brown and Caldwell

PREFACE

The Capacity Assessment Report is one of three related documents that are part of the annual process to monitor and evaluate capacity in the entire LOTT system. The intent, under LOTT's Wastewater Resource Management Plan (also known as the Highly Managed Plan), is to assure that needed new capacity is brought on line "just-in-time" to meet system needs. Capacity needs evaluated include wastewater treatment, Budd Inlet discharge, reclaimed water use/recharge, and conveyance capacity in the entire LOTT system. These three reports are prepared annually, and are used to help identify capital projects for inclusion in the annual Capital Improvements Plan.

- **Flows and Loadings Report** – analyzes residential and employment population projections within the Urban Growth Boundary and estimates the impact on wastewater flows and loading within the LOTT wastewater system.

- **Inflow and Infiltration Report** – uses dry and wet weather sewer flow monitoring results to quantify the amount of unwanted surface (inflow) and subsurface (infiltration) water entering the sewer system and to prioritize sewer line rehabilitation projects.

- **Capacity Assessment Report** – uses flows and loadings data and inflow & infiltration evaluation results to analyze system components (i.e. conveyance, treatment, and discharge), determine when limitations will occur, and provide a timeline for new system components and upgrades.

Together, these reports become chapters in an overall "Capacity Reports" document. The combined report will be posted each year in the "Library" on LOTT's website – www.lottcleanwater.org.

Table of Contents

PREFACE	i
Table of Contents	iii
Executive Summary	v
1. Introduction	1
1.1 Purpose	1
1.2 Terms	1
1.3 Current and Projected Flows and Loadings	1
2. Reclaimed Water Production Capacity	5
2.1 Budd Inlet Reclaimed Water Plant	5
2.2 Martin Way Reclaimed Water Plant	6
2.3 Mullen Road Reclaimed Water Plant	9
2.4 Deschutes Valley Reclaimed Water Plant	9
3. Budd Inlet Treatment Plant Capacity	10
3.1 Headworks	10
3.1.1 Capacity Analysis	11
3.1.2 Completed and Planned Projects	16
3.1.3 Asset Management.....	17
3.2 Primary Treatment	17
3.2.1 Capacity Analysis	19
3.2.2 Completed and Planned Projects	20
3.2.3 Asset Management.....	21
3.3 Secondary Clarifiers	21
3.3.1 Capacity Analysis	22
3.3.2 Completed and Planned Projects	24
3.3.3 Asset Management.....	25
3.4 Biological Process	25
3.4.1 Capacity Analysis	26
3.4.2 Completed and Planned Projects	27
3.4.3 Asset Management.....	28
3.5 Ultraviolet Disinfection and Outfalls	28
3.5.1 Capacity Analysis	29
3.5.2 Completed and Planned Projects	33
3.5.3 Asset Management.....	33
3.6 Sludge Thickening	33
3.6.1 Capacity Analysis	34
3.6.2 Completed and Planned Projects	36
3.6.3 Asset Management.....	36
3.7 Digesters (Sludge Stabilization)	37
3.7.1 Capacity Analysis	38
3.7.2 Completed and Planned Projects	39
3.7.3 Asset Management.....	40
3.8 Sludge Dewatering	40
3.8.1 Capacity Analysis	41
3.8.2 Completed and Planned Projects	43
3.8.3 Asset Management.....	43
3.9 Ongoing and Planned Projects Overview	43
4. Discharge Capacity	45
4.1 Budd Inlet Outfall Permit Limitations	45
4.2 Budd Inlet Treatment Plant Process Improvements	47
4.3 Budd Inlet Treatment Plant Site Planning	49
4.4 Budd Inlet Discharge Capacity Analysis	49
4.5 Alternative Discharge Planning	52
4.5.1 Reclaimed Water Treatment.....	52

4.5.2 Alternative Discharge Locations	53
4.5.3 Summary.....	54
5. Conveyance System Analysis.....	56
5.1 Model Description.....	56
5.2 Model Scenarios Summary.....	56
5.2.1 Scenario 1: 2015 Ten Year Peak Hour Flow with 2 mgd of Diversion Flow to the MWRWP	57
5.2.2 Scenario 2: 2015 Ten Year Peak Hour Flow with 2 mgd of Diversion Flow to MWRWP and West Bay, Downtown and South Olympia Bottlenecks Removed	58
5.2.3 Scenario 3: 2020 Ten Year Peak Hour Flow with 2 mgd of Diversion Flow to the MWRWP and with West Bay, Downtown and South Olympia Bottlenecks Removed	60
5.2.4 Scenario 4: 2030 Ten Year Peak Hour Flow with 2 mgd of Diversion Flow to the MWRWP and West Bay, Downtown and South Olympia, and Henderson Bottlenecks Removed	61
5.2.5 Scenario 5: 2040 Ten Year Peak Hour Flow with 3 mgd of Diversion Flow to the MWRWP and West Bay, Downtown and South Olympia, and Henderson Bottlenecks Removed	62
5.2.6 Scenario 6: 2050 Ten Year Peak Hour Flow with 3 mgd of Diversion Flow to the MWRWP and West Bay, Downtown and South Olympia, and Henderson Bottlenecks Removed	63
5.3 Existing Capacity Limits	64
5.4 LOTT System Analysis.....	64
5.4.1 Martin Way Interceptor (East).....	64
5.4.2 Martin Way Interceptor (West).....	66
5.4.3 Cooper Point Interceptor.....	68
5.4.4 Percival Creek Interceptor	69
5.4.5 Indian Creek Interceptor	70
5.4.6 Cherry Street Interceptor	73
5.4.7 Chestnut Street Interceptor.....	74
5.4.8 Plum Street Interceptor.....	75
5.4.9 State Street Interceptor.....	76
5.5 Sewer System Modeling Summary.....	77
5.5.1 Pressure Mains	77
5.5.2 Pump Stations.....	78
5.6 Required Capacity Improvements Projects	78
5.6.1 Martin Way Interceptor (East).....	78
5.6.2 Indian Creek Interceptor	78
5.6.3 Martin Way Force main.....	79
5.6.4 Percival Creek / Mottman Road Interceptor	79
5.7 Summary of Pipe Capacity Projects.....	80
5.8 Reclaimed Water Conveyance Lines.....	80
6. Operational Capacity Analysis Summary.....	82

Executive Summary

For the 2015 Capacity Assessment Report, updated flows and loadings projections, along with inflow and infiltration and flow monitoring data, were used to evaluate the current and projected capacity limitations within the LOTT system. This resulted in several changes in the timing of various planned projects.

Much of the capacity discussion is centered on the Budd Inlet Treatment Plant's National Pollutant Discharge Elimination System (NPDES) Permit, which limits discharge to a fixed load of biological oxygen demand (BOD) and total inorganic nitrogen (TIN). The more the treatment plant can reduce its effluent concentration of BOD and TIN, the more flow it can discharge to Budd Inlet. The proposed Process Improvements project is evaluating options, which will increase the consistency of effluent BOD and TIN levels, and make it easier for staff to consistently and efficiently achieve performance targets.

Effective operational capacity equals the minimum combination of treatment, discharge, and conveyance capacity. Discharge capacity analysis utilized two modeled flow projections – average flows and 10-year peak flows. All three seasonal conditions (summer, shoulder, and winter) were taken into account, with the summer and shoulder conditions being the most limiting. Summer limitations occur in 2040 for peak flows, and 2049 for average flows. Shoulder season limitations occur in 2042 for peak flows, and post-2050 for average flows. These limitations assume 2 million gallons a day (mgd) of treatment capacity at the Martin Way Reclaimed Water Plant, an average effluent BOD concentration of 5.0 mg/L, and an average effluent TIN concentration of 2.25 mg/L. This report discusses how the LOTT Clean Water Alliance aims to meet those capacity limitations.

LOTT maintains a 1.5 mgd reserve of treatment/discharge capacity at the Budd Inlet Treatment Plant. This allows for additional operational flexibility during peak flow events, minimizing the likelihood of a permit violation, and protects the system from unforeseeable rapid population growth and/or delays in the construction of new capacity.

Treatment capacity at the Budd Inlet Treatment Plant was assessed as part of the 2006 Budd Inlet Treatment Plant Master Plan. Some of the key capacity limitations identified include UV disinfection, aeration basin diffusers and air flow, dissolved air floatation thickener units, and digestion. Each of these capacity limitations will be discussed, and tied to a capital improvements project at the treatment plant.

A portion of this document discusses plans for increased water reclamation, reuse, and alternative discharge. This is a contingency plan which would allow LOTT to generate 20-30 mgd of reclaimed water, suitable for various uses and/or discharges outside of Budd Inlet. This plan gives LOTT the flexibility to respond to changes in demand for a water reuse product, or changes to its NPDES and/or Reclaimed Water Permit regulations.

LOTT's Reclaimed Water Infiltration Study is expected to be completed in 2017. The goal of the study is to provide local scientific data and community perspectives to help policymakers make informed decisions about future reclaimed water treatment and uses. LOTT will continue to maintain flexibility in its capacity planning process to ensure its ability to meet community expectations and future regulatory requirements.

1. Introduction

1.1 Purpose

In accordance with the Wastewater Resource Management Plan, LOTT is continuously monitoring system demands and planning for future capacity on a “just-in-time” basis. The primary purpose of this document is to evaluate system capacity requirements based on projected demands, and identify and evaluate capital improvement projects to meet these requirements.

1.2 Terms

LOTT considers three types of capacity when describing operational capacity – treatment capacity, discharge/use capacity, and conveyance capacity. Treatment capacity is defined as the amount of wastewater that can be treated within permit limitations. Discharge/use capacity is a combination of the amount of treated wastewater that can be discharged into the environment within permit limitations (i.e. Budd Inlet outfall), the amount of Class A Reclaimed Water that can be infiltrated into the ground (i.e. Hawks Prairie Reclaimed Water Ponds/Recharge Basins), and the amount of Class A Reclaimed Water that can be utilized for other beneficial uses (i.e. reclaimed water customers). Conveyance capacity represents the hydraulic capacity of both: 1) sewer lines to convey wastewater from the point of collection to the point of treatment; and 2) reclaimed water lines to convey Class A Reclaimed Water from the point of treatment to the point of infiltration or other use.

1.3 Current and Projected Flows and Loadings

Consistent with the updated flows and loadings projections in 2014, the 2015 projections indicate a significant reduction in capacity needs compared to previous years (2013 and earlier). Previously unavailable data provided by the partner jurisdictions has enabled LOTT to more precisely estimate current per capita wastewater generation rates, which are used to project flows and loadings attributed to future population growth. In addition, continued work by the Regional Septic Work Group has assisted in better estimating the rate and magnitude at which current septic systems will be connected to the system within the LOTT service area shown in Figure 1-1.

Figure 1-1. LOTT Service Area by Jurisdiction

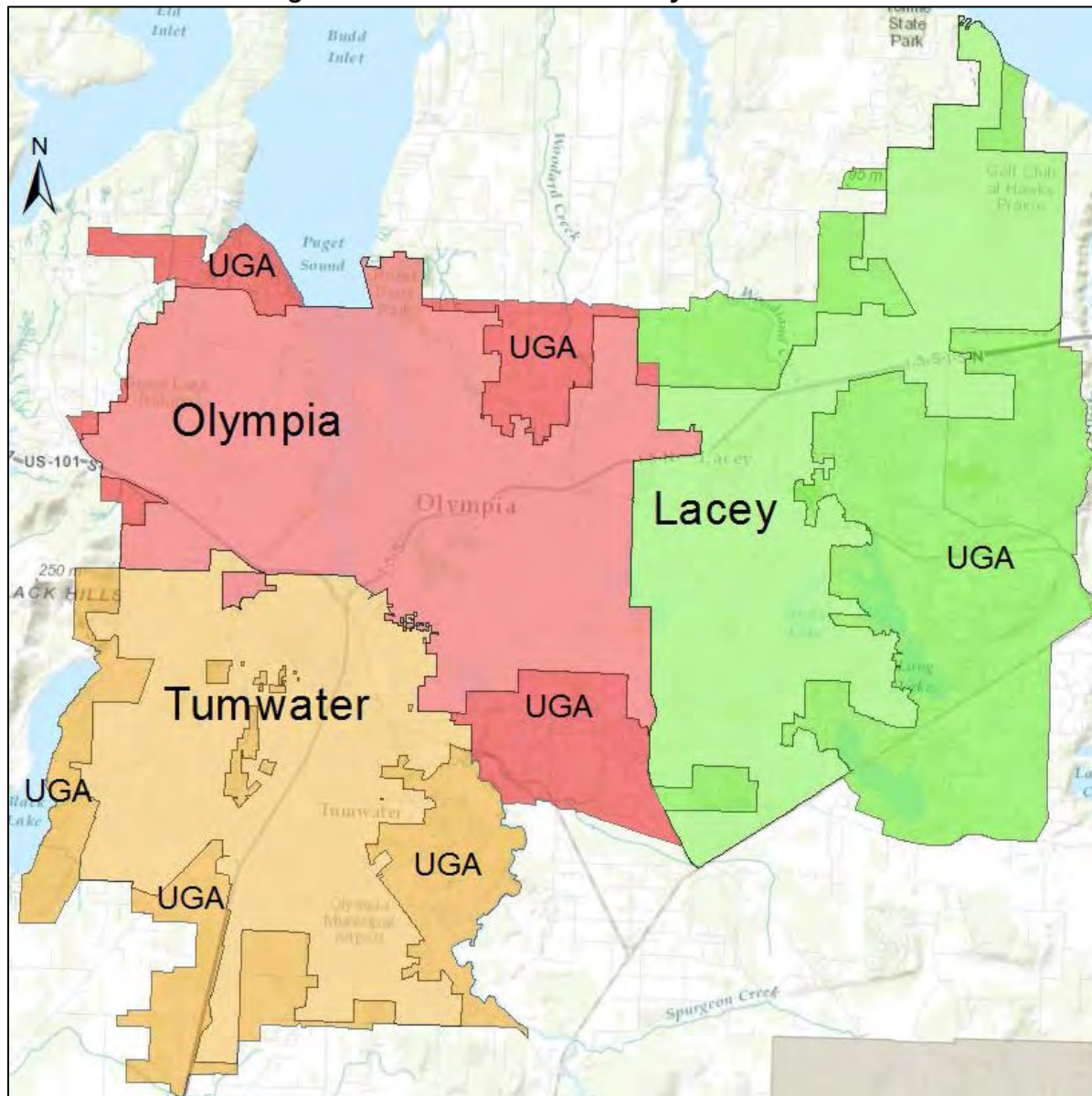


Figure 1-2 compares the projected base sanitary flows for the past few flows and loadings projections. For details on per capita wastewater generation rates, refer to the 2015 Flows and Loadings Report.

Figure 1-2. Base Sanitary Flow Projection Comparison

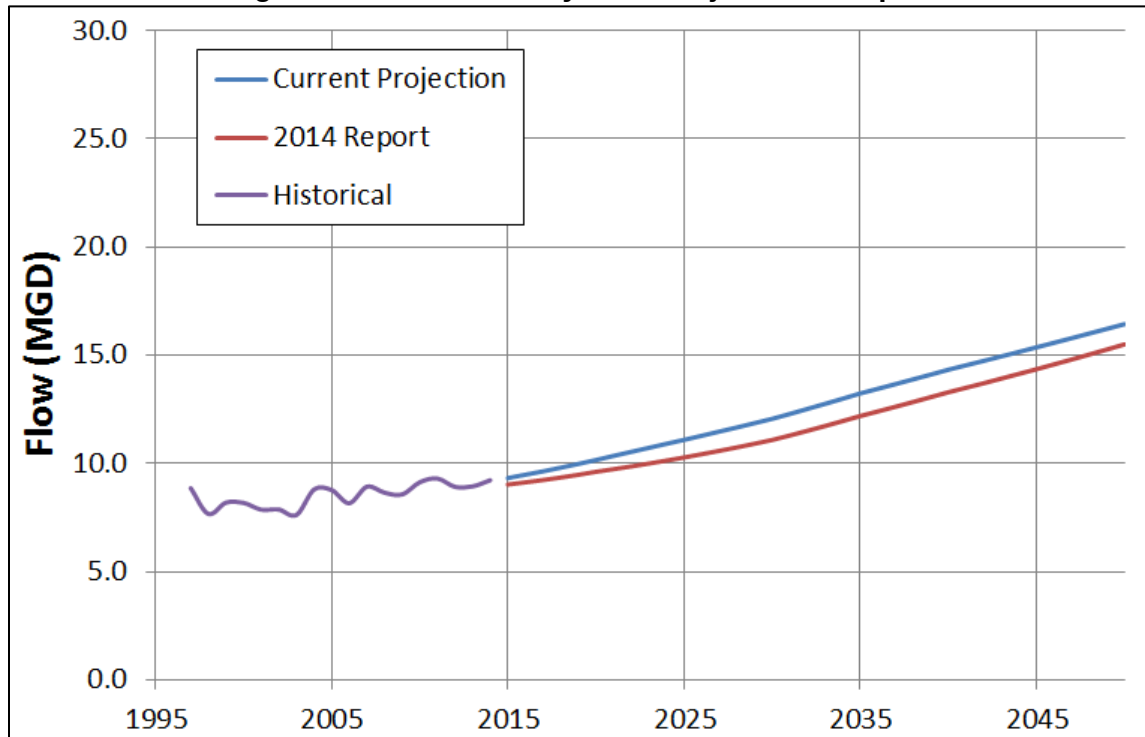


Table 1-1 lists the projected flows generated in the LOTT service area in million gallons a day (mgd). The summer and shoulder compliance periods represent the average monthly values. The 10-year peak values are based upon the 10-year return period flows. In any given year, there would be a 10% chance of averaging the projected flow for each period.

Table 1-1. LOTT Service Area Projected Flows (mgd)

Year	Summer ¹	Shoulder ²	Winter ³	10-Year Peak Month	10-Year Peak Day	10-Year Peak Hour
2015	10.4	11.9	14.1	18.0	41.3	59.9
2016	10.6	12.0	14.3	18.1	41.4	60.0
2017	10.8	12.2	14.4	18.4	41.7	60.4
2018	10.9	12.4	14.6	18.6	41.9	60.7
2019	11.1	12.5	14.8	18.8	42.2	61.1
2020	11.3	12.7	15.0	19.0	42.5	61.5
2021	11.5	12.9	15.2	19.2	42.8	61.9
2022	11.7	13.1	15.5	19.5	43.1	62.3
2023	11.9	13.3	15.7	19.7	43.4	62.7
2024	12.1	13.5	15.9	19.9	43.7	63.1
2025	12.3	13.7	16.1	20.1	44.0	63.6
2026	12.4	13.9	16.3	20.4	44.3	64.0
2027	12.6	14.2	16.5	20.6	44.6	64.4
2028	12.8	14.4	16.7	20.8	44.9	64.9
2029	13.0	14.6	16.9	21.1	45.2	65.3
2030	13.2	14.8	17.2	21.3	45.6	65.8
2031	13.5	15.0	17.4	21.6	45.9	66.3
2032	13.7	15.3	17.7	21.9	46.3	66.8
2033	14.0	15.5	17.9	22.2	46.7	67.3
2034	14.2	15.8	18.2	22.5	47.1	67.8
2035	14.5	16.0	18.5	22.8	47.5	68.4
2036	14.7	16.3	18.7	23.0	47.8	68.9
2037	14.9	16.5	19.0	23.3	48.2	69.4
2038	15.1	16.8	19.2	23.6	48.6	69.9
2039	15.4	17.0	19.5	23.9	48.9	70.4
2040	15.6	17.2	19.7	24.2	49.3	71.0
2041	15.8	17.5	20.0	24.4	49.7	71.4
2042	16.0	17.7	20.2	24.7	50.0	71.9
2043	16.2	17.9	20.4	24.9	50.3	72.4
2044	16.4	18.1	20.7	25.2	50.7	72.9
2045	16.7	18.4	20.9	25.4	51.0	73.4
2046	16.9	18.6	21.1	25.7	51.4	73.9
2047	17.1	18.8	21.4	26.0	51.8	74.4
2048	17.3	19.1	21.6	26.3	52.1	74.9
2049	17.5	19.3	21.9	26.5	52.5	75.4
2050	17.8	19.5	22.1	26.8	52.9	76.0

1. June, July, August, and September

2. April, May, and October

3. November, December, January, February, and March

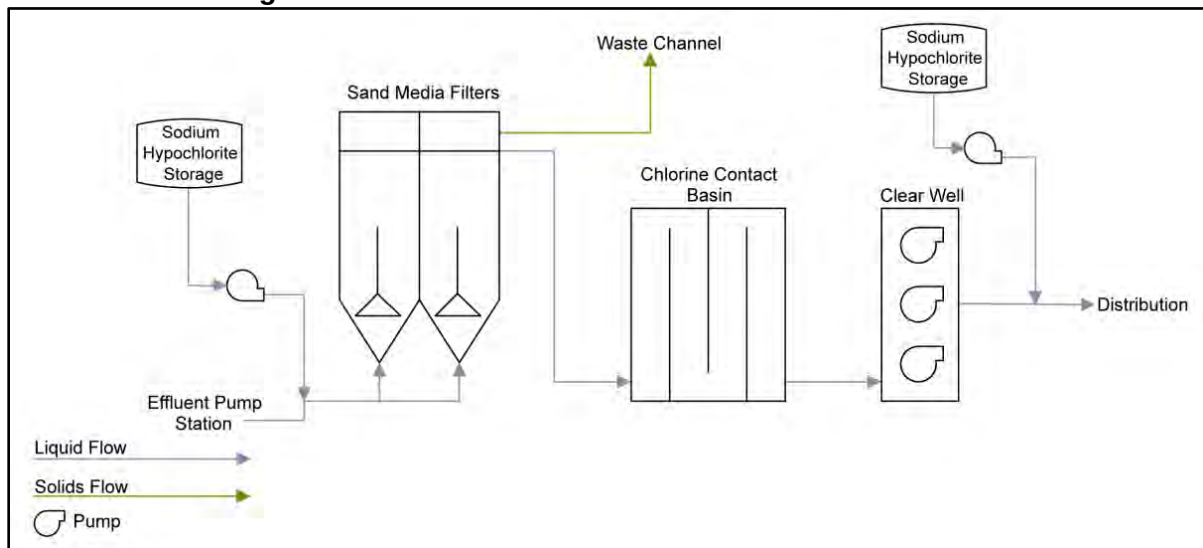
2. Reclaimed Water Production Capacity

Reclaimed water production capacity is an essential component of LOTT's overall treatment program. To better understand the necessary effluent quality standards expected by the community, and the level of treatment required to meet these expectations, LOTT has initiated the multi-year Reclaimed Water Infiltration Study. The study is designed to identify the risks from infiltrating reclaimed water into groundwater because of chemicals that may remain in the water from products people use every day, and determine what can be done to reduce those risks. The study is expected to continue through 2017. At the completion of the study, LOTT will re-examine the treatment technologies for existing and proposed reclaimed water treatment facilities to ensure that they align with community expectations and regulatory requirements for the intended uses of the reclaimed water.

2.1 Budd Inlet Reclaimed Water Plant

The Budd Inlet Reclaimed Water Plant (BIRWP), completed in 2004, produces Class A Reclaimed Water using sand media and sodium hypochlorite to filter and disinfect secondary effluent. The facility is capable of treating up to a maximum of 1.5 mgd in the form of three bays of sand filters (0.5 mgd each). Some of the water is used for internal processes at the Budd Inlet Treatment Plant and the Capitol Lake Pump Station. The City of Olympia also has various customers in the downtown and Port peninsula area that irrigate using reclaimed water.

Figure 2-1. Budd Inlet Reclaimed Water Plant Process



Planned and Completed Projects

The Reclaimed Water Storage project was completed in 2015, providing one million gallons of reclaimed water storage capacity in Tumwater. The tank is able to provide water back to the Budd Inlet Treatment Plant and is located along the conveyance route south to potential future infiltration sites.

The Budd Inlet Reclaimed Water Plant Improvements project will be completed in 2016 and includes the replacement of valves, deteriorating ladders, wet well coatings and other improvements necessary to ensure reliable operation.

The Reclaimed Water Plant Expansion project, currently scheduled to be complete in 2022, will add an additional 1.5 mgd to the existing 1.5 mgd for a total of 3 mgd of reclaimed water production capacity. The schedule may vary based on community demand for reclaimed water, which may include irrigation of the Capitol Campus.

Table 2-1. Completed and Planned Project Summary

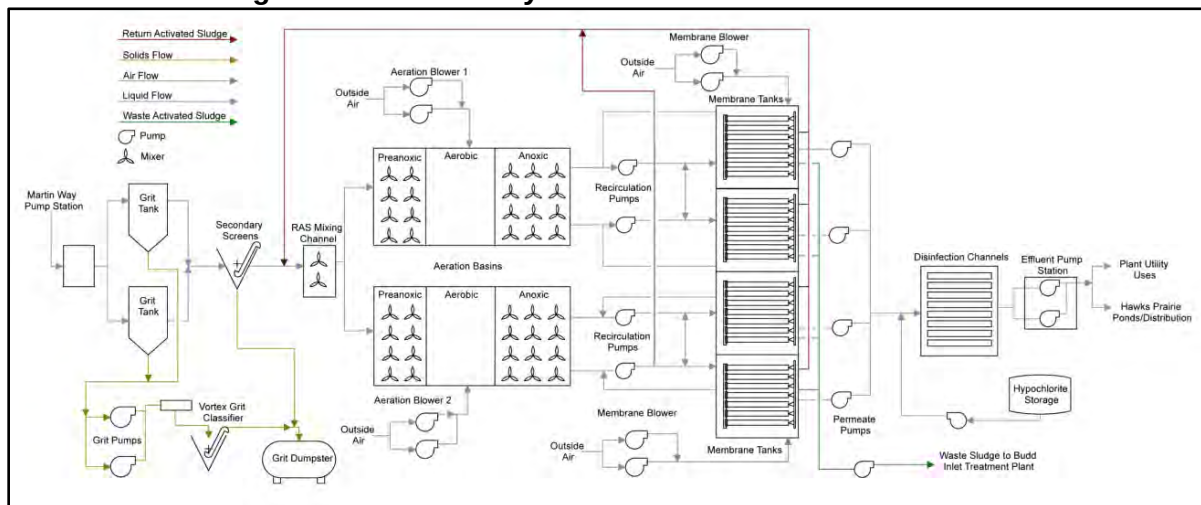
On-line	Name	Cost/Estimate	Status	Description
2015	Reclaimed Water Storage	\$4,978,772	Complete	One million gallon storage tank in Tumwater
2016	BIRWP Improvements	\$412,801	Active	Upgrades to the existing facility
2022	BIRWP Expansion to 3 mgd	\$3,800,000	Future	Add 1.5 mgd of capacity to existing facility

2.2 Martin Way Reclaimed Water Plant



The Martin Way Reclaimed Water Plant is membrane bioreactor and currently has a treatment capability of 2 MGD. The plant was originally planned to be expandable up to 5.0 mgd of treatment capacity with additional construction at the site. Property adjacent to the site has been secured and provides enough space to expand the capacity to 8.0 mgd if needed. Process tanks for a 3rd mgd of treatment capacity were included during the original construction, requiring only the installation of the membrane filtering equipment to expand to 3.0 mgd. Expansion at the plant will occur as soon as there is sufficient raw wastewater flow available at the Martin Way Pump Station. This is largely dependent on the septic conversion schedule for the City of Lacey.

Figure 2-2. Martin Way Reclaimed Water Plant Process



Based on the updated flows and loadings projections, adding the 3rd mgd of capacity may be pushed out to as late as 2038. A potential driver that could modify the schedule is the timing of connecting neighborhoods currently on septic tanks. The current service population of the

Martin Way Pump Station collection basin is 94,000, of which 38,100 (40%) are currently on septic systems.

Table 2-2 lists the timing of flow availability to the Martin Way Plant. These projections are based on the assumption that parcels with existing septic tanks in the Tanglewilde and Thompson Place areas will be 60-70 percent connected to sewer by 2050. They also include 500,000 gallons a day as a buffer, to ensure sufficient flow remains in the sewers to convey waste activated sludge from the reclaimed water plant to the Budd Inlet Treatment Plant.

Table 2-2: Flow Availability for the Martin Way Plant¹

Flow (mgd)	Year	
	Without Flow Equalization	With Flow Equalization
1	Existing	Existing
2	Existing	Existing
3	2038	2026
4	2050	2036
5	--	2045

1. Allows for 500,000 gpd of base flow remaining in the system.

With flow equalization, flow could be sequestered during the day, and treated at night, resulting in a relatively constant flow to the membranes. Flow equalization would therefore eliminate the constraint of overnight low flows as shown in Figure 2-3.

Figure 2-3. Diurnal Flow at the Martin Way Pump Station

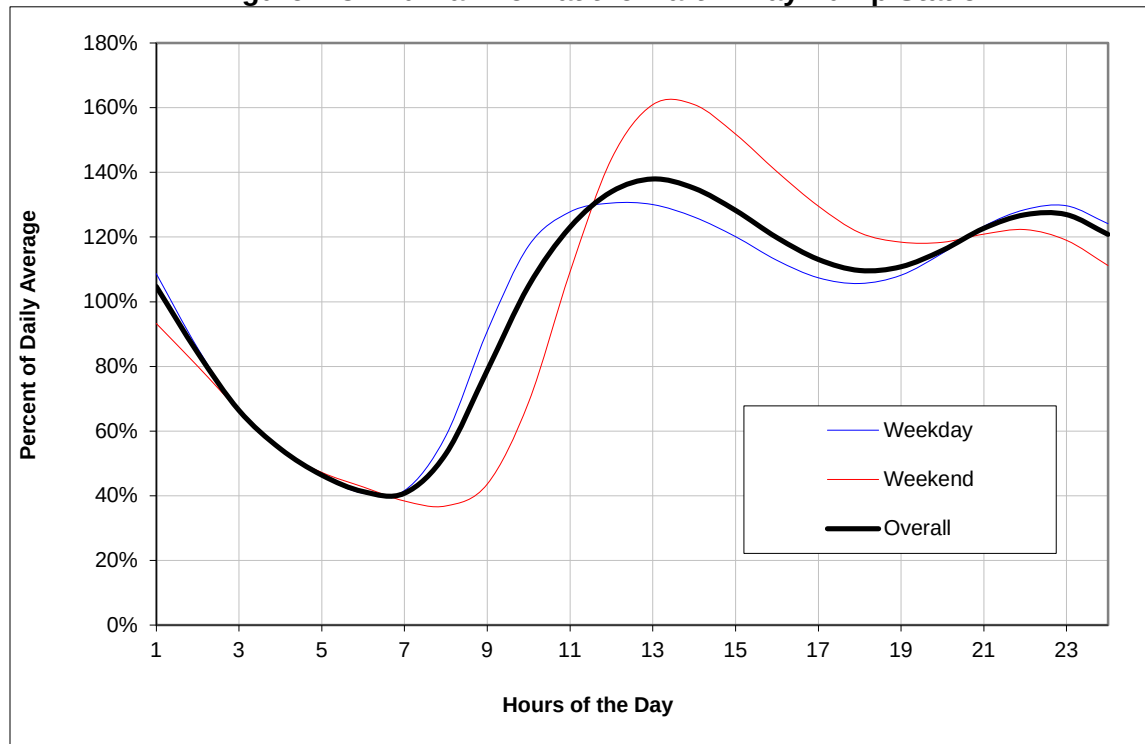
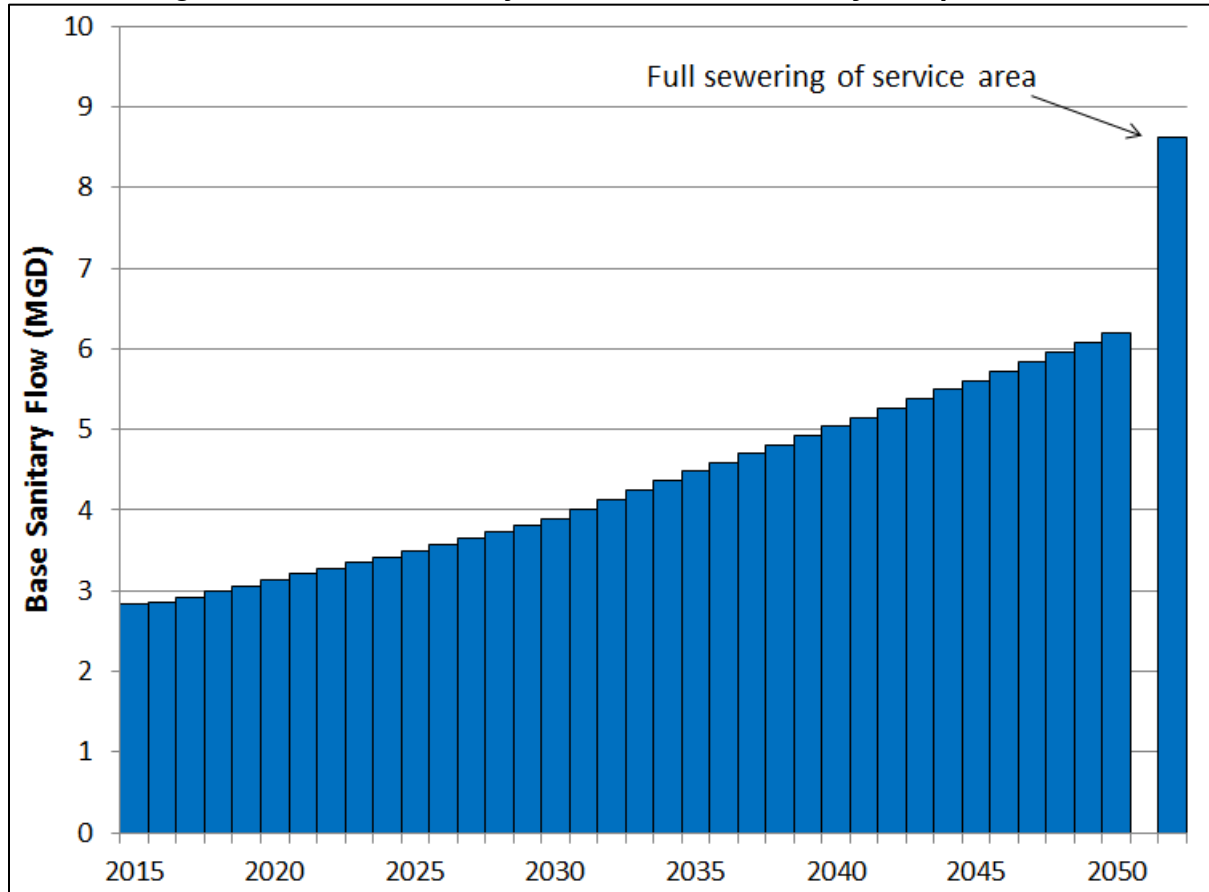


Figure 2-4 depicts the base flow projections at the Martin Way Pump Station through the planning period. Note that this discussion is based entirely upon average daily base sanitary flow. Even during the summer, there is likely to be some component of inflow and infiltration,

meaning that actual average daily flows should be higher than those included in this evaluation.

Figure 2-4. Base Flow Projections at the Martin Way Pump Station



Planned Projects

Consistent and reliable operation of the facility is increasingly important now that the Olympia/Lacey Woodland Creek Groundwater Recharge Facility is online. The Martin Way Reclaimed Water Plant Improvements project will include additional blower and screenings capacity and replacement of aging process valves and equipment. Design will begin in 2016 with construction estimated to be complete in 2017.

The existing membranes will be due for replacement in 2021 based on estimated useful life.

Expansion to the 3rd mgd of treatment capacity is currently scheduled for 2038, dependent on flow availability.

Table 2-3. Completed and Planned Project Summary

On-line	Name	Cost/Estimate	Status	Description
2014	MWRWP Membrane Upgrade	\$2,674,297	Complete	Upgrades to the existing facility and filter replacement
2017	MWRWP Improvements	\$ 2,932,588	Design	Upgrades to the existing facility
2021	Membrane Filter Replacement	\$2,100,000	Future	Replace the membrane filters at the end of their service life
2038	MWRWP 3 rd MGD Equipment	\$5,800,000	Future	Add equipment to bring facility capacity to 3 MGD.

2.3 Mullen Road Reclaimed Water Plant

Based on the updated flows and loadings projections, the Mullen Road Reclaimed Water Plant will not be needed. LOTT will retain the property for the foreseeable future in the event that plans change.

2.4 Deschutes Valley Reclaimed Water Plant

LOTT has purchased approximately 45 acres of the former brewery property in the Deschutes River valley as a location for the future development of the Deschutes Valley Reclaimed Water Plant (DVRWP) as shown in Figure 2-5. The facility could draw raw sewage from Tumwater and portions of southeast Olympia, or treat secondary effluent pumping from the Budd Inlet Treatment Plant. Depending on regulatory constraints or demand, product quality could range from Class A reclaimed water to water suitable for direct potable reuse.

Figure 2-5. Deschutes Valley Property Owned by LOTT



LOTT initiated a master planning effort in 2014 to guide the use and ultimate development of the property. The effort will ensure the coordination with ongoing planning efforts with the City of Tumwater and local stakeholders, evaluate existing infrastructure, complete an environmental and hydraulic site characterization, and develop utilities and plant layout alternatives. A focus will be to maintain flexibility at the site, ensuring the ability to adjust to changing conditions and requirements. Results of the Reclaimed Water Infiltration Study will assist in evaluating and planning of potential advanced treatment options at the site. Table 2-4 includes planned capacity projects at the future Deschutes Valley plant.

Table 2-4. Completed and Planned Project Summary

On-line	Name	Cost/Estimate	Status	Description
2015	Deschutes Valley Master Planning	\$800,000	Active	Develop master plan for Tumwater property reserved for future treatment facilities

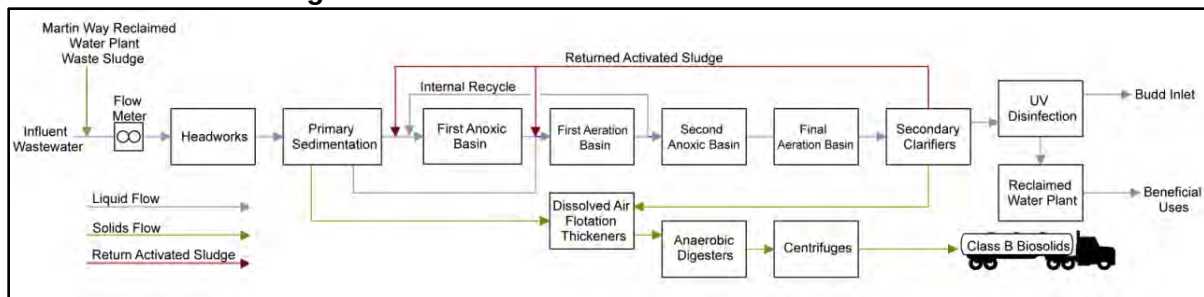
3. Budd Inlet Treatment Plant Capacity

The capacity of the Budd Inlet Treatment Plant was established at the last major facility upgrade, in the mid-1990s. Since that time, many systems have been upgraded, and the Plant capacity has very likely increased. LOTT assesses capacity of the Plant's individual unit processes every year in the Capacity Assessment Report. LOTT is considering a more formal Plant re-rating effort in the future, as well as an update to the 2006 Budd Inlet Treatment Plant Master Plan.

Treatment capacity at the Budd Inlet Treatment Plant is tied to the capacity of each individual process element within the plant. The 2006 Budd Inlet Treatment Plant Master Plan evaluated each of these elements and identified capacity limitations and their associated timelines based on projected flows and loadings. The annual Capacity Reports expand upon this analysis, and assess capacity in light of ongoing upgrades and changes to the flow and loading projections.

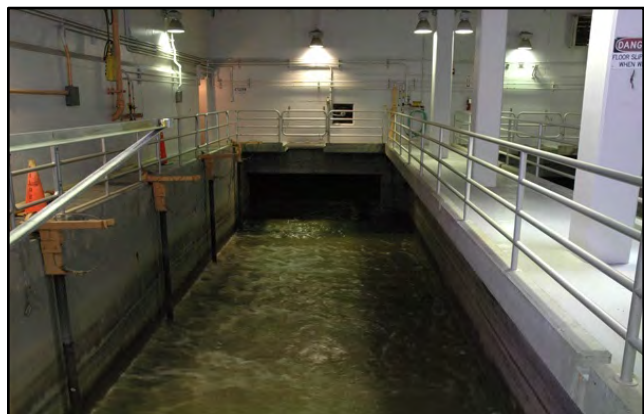
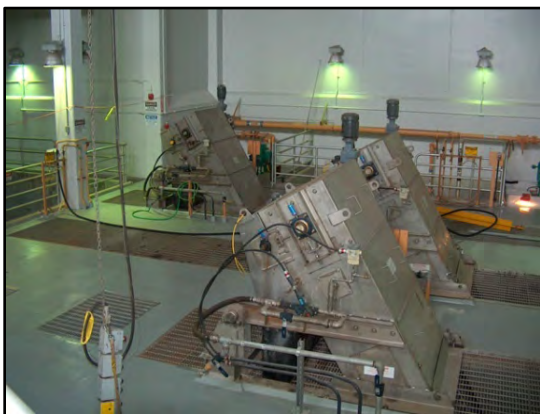
The following sections will provide an overview of each process unit to include a system profile, capacity analysis, planned improvements, and asset management. The asset risk score is based on a score of 1 through 6, with 1 being the highest risk and 6 being the lowest risk.

Figure 3-1. Budd Inlet Treatment Plant Process



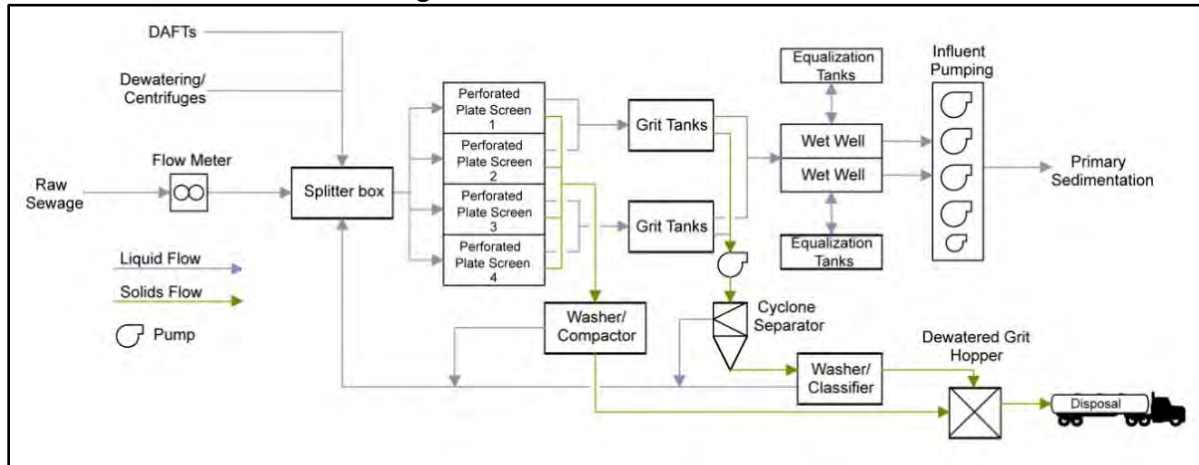
3.1 Headworks

The headworks facility consists of preliminary treatment (screens and grit removal) and influent pumping. The raw sewage influent flow rate entering the plant is measured by a flow meter in the 60-inch plant influent pipe. A splitter box directs flow through four influent channels. Motor-operated sluice gates at the head of each channel control the flow to four mechanically cleaned screens that remove large debris from the influent wastewater. Screenings are conveyed to two screenings pits where chopper pumps convey ground-up screenings to a washer/compactor unit. Dewatered screenings are collected and hauled to the Thurston County Waste and Recovery Center for disposal.



After being screened, wastewater enters two aerated grit removal tanks that remove large inorganic and organic particles. Grit collects in hoppers at the bottom of each tank and is removed by 10 grit pumps. Grit is conveyed to the grit screening/handling room where the grit is processed through a cyclone separator and a grit washer/classifier to remove organic material. Washed grit is stored in hoppers and then hauled to the Waste and Recovery Center for disposal. Liquid supernatant from the separator and classifier is recycled to the plant influent splitter box. Degritted sewage overflows from the grit tanks into two influent wet wells. Four variable speed, 200-hp pumps and one variable speed, 50-hp pump provide the influent pumping capacity. The influent pumping system conveys degritted raw sewage to the primary sedimentation tanks.

Figure 3-2. Headworks Process



Equalization tanks provide up to 2.5 million gallons of storage in five tanks. As the water level rises in the wet wells during peak flows, the tanks fill in series with the flow controlled by internal weirs.

The scum handling system at the headworks facility provides a single means of concentrating, storing, and disposing of scum collected from the primary sedimentation tanks and the influent wet wells. Scum from other sources, such as the secondary clarifiers, and aeration and anoxic tanks, is routed directly to the influent splitter box through the septage and sanitary drain piping systems.

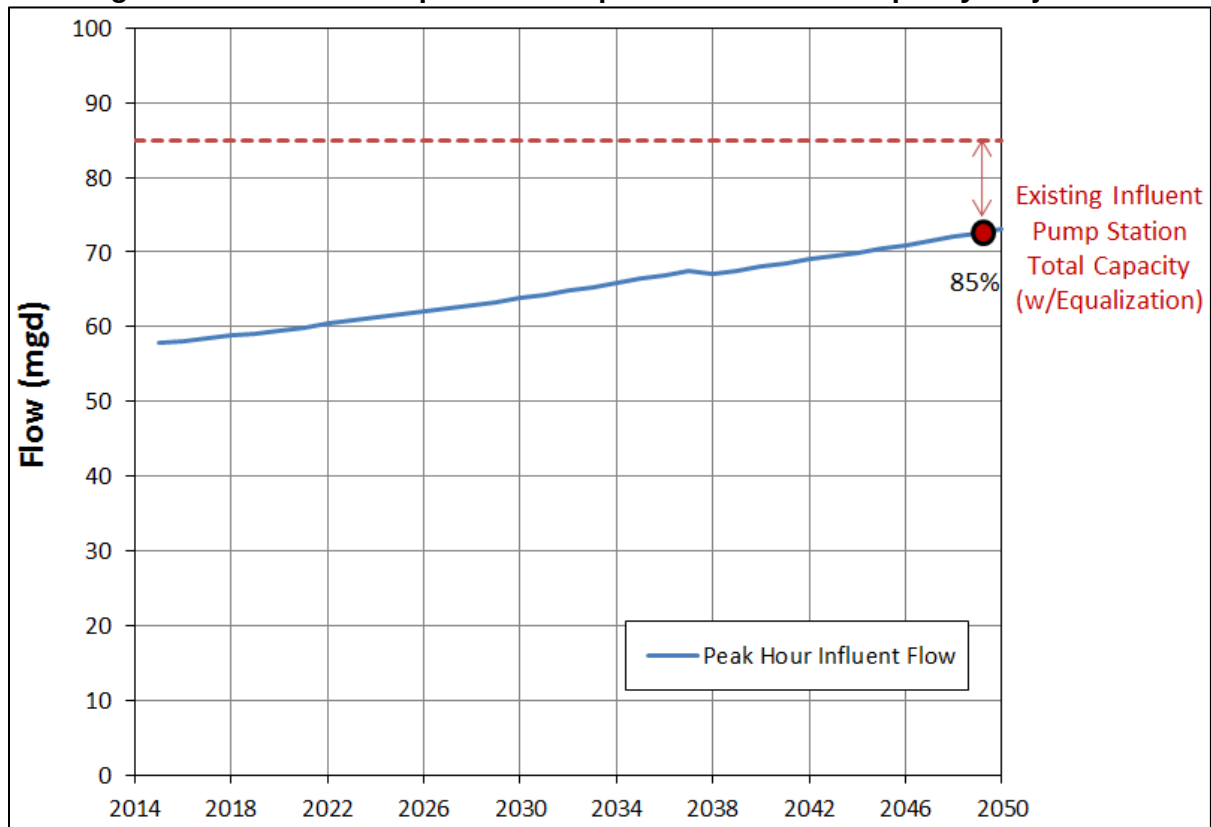
3.1.1 Capacity Analysis

Influent Pump Station / Equalization Basins

The influent pump station has an operational capacity of 72 mgd, and a firm capacity (one pump out of service) of 54 mgd. A hydraulic analysis was conducted to determine the impact of the existing 2.5 million gallon equalization basins on flow through the influent pump station. This analysis projected that the EQ basins could buffer approximately 13 mgd of peak hour flow, meaning that the equalized capacity of the influent pump station is approximately 85 mgd.

Figure 3-3 plots the peak hour influent flow against the estimated capacity of the influent pump station and equalization basins at a 10% risk level. Utilization is projected to reach 85% of capacity in 2030, at which time a project to expand influent flow equalization is planned.

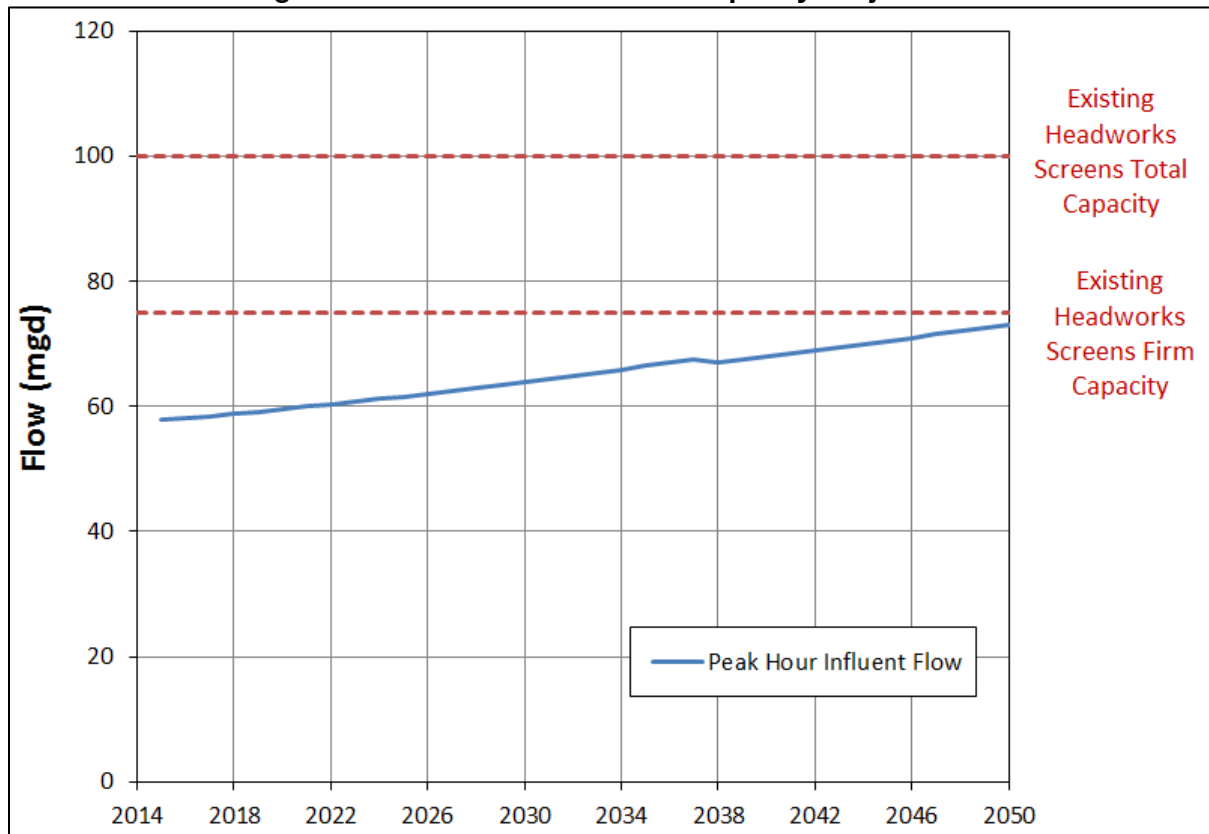
Figure 3-3. Influent Pump Station / Equalization Basins Capacity Projection



Headworks Screens

Each of the existing headworks screens has a rated peak hour influent flow capacity of 25 mgd. With a total of four screens, the operational capacity of the screening facility is 100 mgd and the firm capacity is 75 mgd. Figure 3-4 shows the existing firm and total screening capacities relative to the projected peak hour influent flow. Because the plant has the ability to bypass excessive peak flows around the screens, the screening system is evaluated based upon the total, rather than the firm capacity. No capacity-related projects are planned for the headworks screens.

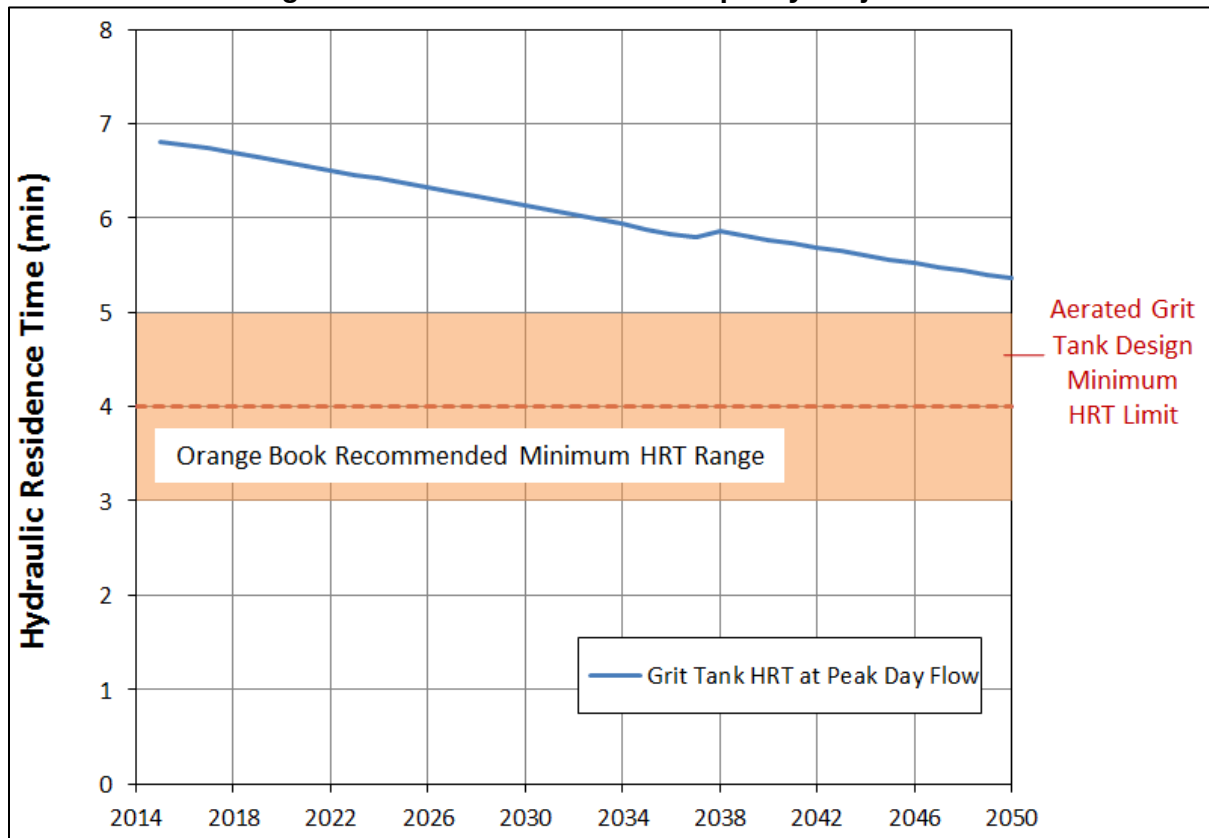
Figure 3-4. Headworks Screens Capacity Projection



Aerated Grit Tanks

The capacity of the aerated grit tanks is expressed relative to the hydraulic retention time at peak day flow. Ecology's Orange Book recommends that aerated grit tanks be designed to maintain a minimum hydraulic retention time of three to five minutes in order to effectively remove grit during peak wet weather events. For the purposes of this capacity analysis, a minimum hydraulic retention of four minutes at peak day flows is assumed as shown in Figure 3-5. The retention time with both aerated grit tanks in service is projected to remain above four minutes through 2050. Therefore, no capacity-related projects are planned for the aerated grit tanks.

Figure 3-5. Aerated Grit Tanks Capacity Projection



Headworks System Capacity Summary

Table 3-1 provides a summary of the capacity analysis and assumptions for the headworks system. This includes the influent pump station and equalization basins, the headworks screens, and the aerated grit tanks.

Table 3-1. Headworks System Capacity Summary

Parameter	Units	Observed	Projection				
		2014	2015	2020	2030	2040	2050
Infrastructure Characteristics							
Influent Pumps							
Number		4	4	4	4	4	4
Unit Capacity	mgd	18	18	18	18	18	18
Firm Capacity	mgd	54	54	54	54	54	54
Total Capacity	mgd	72	72	72	72	72	72
Equalization Basins							
Number	5	5	5	5	6	6	6
Total Volume	Mgal	2.5	2.5	2.5	4	4	4
Headworks Screens							
Number		4	4	4	4	4	4
Unit Capacity	mgd	25	25	25	25	25	25
Firm Capacity	mgd	75	75	75	75	75	75
Total Capacity	mgd	100	100	100	100	100	100
Aerated Grit Tanks							
Number		2	2	2	2	2	2
Length	ft	55	55	55	55	55	55
Width	ft	20	20	20	20	20	20
Depth	ft	11.3	11.3	11.3	11.3	11.3	11.3
Unit Volume	gal	92,983	92,983	92,983	92,983	92,983	92,983
Controlling Parameters for Capacity							
Flow equalization capacity	mgd	85	85	85	95	95	95
Headworks screens total capacity	Mgd	100	100	100	100	100	100
Grit tank hydraulic retention time	min	4	4	4	4	4	4
Capacity Related Assumptions							
Influent Pumps / Equalization Basins							
Capacity averaging basis				Peak One-Hour			
Capacity utilization basis				Utilization > 85%			
Headworks Screens							
Units held in reserve		0	0	0	0	0	0
Capacity averaging basis				Peak One-Hour			
Capacity utilization basis				Utilization > 85%			
Aerated Grit Tanks							
Units held in reserve		0	0	0	0	0	0
Capacity averaging basis				Peak One-Day			
Capacity utilization basis				Utilization > 85%			
Projected Capacity Condition							
Peak Hour Flow	mgd	60.3	57.9	59.5	63.8	68.0	73.0
Peak Day Flow	mgd	40.3	39.3	40.5	43.6	46.4	49.9
Grit tank hydraulic retention time	min	6.6	6.8	6.6	6.1	5.8	5.4
Projected Utilization							
Flow equalization		71%	68%	70%	75%	80%	86%
Headworks screens		60%	58%	60%	64%	68%	73%
Grit tanks		60%	59%	61%	65%	69%	75%

3.1.2 Completed and Planned Projects

The recent reduction in flow and loading projections has pushed the need for additional flow equalization past 2050. However, given changing weather patterns and potential impacts related to sea level rise, LOTT maintains plans to expand capacity as needed. Influent equalization capacity may be expanded by increasing the capacity of the influent pumps, or building additional flow equalization basins. In 2013 LOTT purchased a 1.44-acre property adjacent to the Budd Inlet Treatment Plant formally owned by the Washington State Department of Fish and Wildlife. This property could be used for an equalization basin expansion, if needed in the future. Capacity related projects for the headworks system are listed in Table 3-2.

Figure 3-6. Potential Future Equalization Basin Site



Table 3-2. Completed and Planned Project Summary

On-line	Name	Cost/Estimate	Status	Description
2004	Bar Screens Replacement	\$420,000	Completed	New bar screens (4) were added to the influent channels
2011	Influent Drive Replacement	\$324,344	Completed	Replaced the variable frequency drives that operate the influent pumps
2013	Screenings Pumps	\$315,026	Completed	Included installation of additional screening pumps to ensure process redundancy and reliability
2013	Grit Blower Replacement	\$197,585	Completed	Two new grit blowers were added with one existing blower remaining as a redundant backup
2013	Motor Control Center Upgrade	\$600,966	Completed	Replaced motor control centers that provide power to the headworks
2014	Headworks Improvements	\$910,000	Completed	Includes replacement of the grit channel diffusers, influent wet well transfer gates, equalization valves, and coatings for the grit basin and influent channels
2015	Interim Property Restoration	\$550,000	In Design	Deconstruct the former Fish and Wildlife building which is the location for potential future equalization basins
2016	Influent Screens Refurbishment	\$110,000	Planning	Asset management project to refurbish influent escalator screens

3.1.3 Asset Management

A variety of mechanical equipment is involved in the operation of the headworks system. Major equipment includes the influent pumps, headworks screens and associated screenings and grit handling equipment. This equipment is shown in Figure 3-2 and summarized in Table 3-3.

Table 3-3. Existing Headworks Equipment

System	Count	Unit Capacity	Motor	Date of Last Upgrade	Risk Score (1-6)
Influent Flow Meter	1			2012	2
Influent Pumps	4	18 mgd	200 hp	1994	3
	1	5 mgd	50 hp	1993	3
Headworks Screens	4	25 mgd	2 hp	2004	4
Screenings Pumps	2	200 gpm	20 hp	2012	2
Screenings Compactors	2	45 ft ³ /hr	7.5 hp	2003	3
Grit Pumps	10	150 gpm	25 hp	1980	3
Grit Separators	2	200 gpm	20 hp	2004	3
Grit Washer	2	1.5 ton/hr	0.5 hp	2004	3
Grit Chamber Blowers	3	263 cfm/11.6 psi	20 hp	2013	1

3.2 Primary Treatment

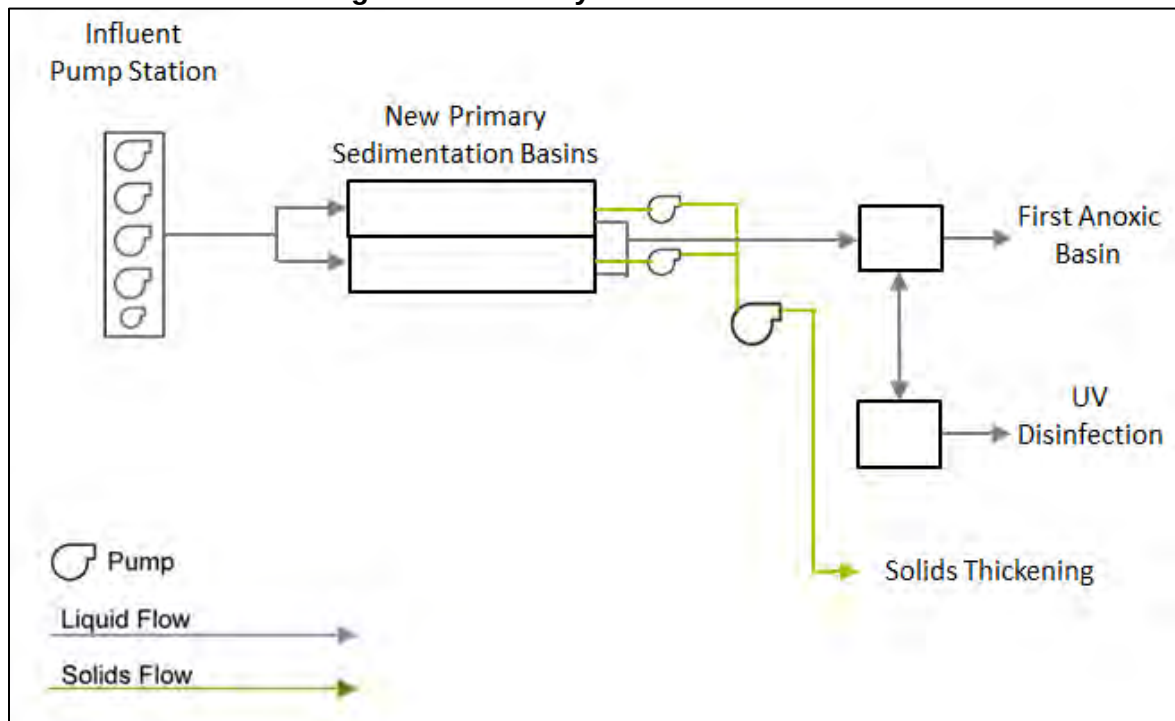
The primary treatment process removes easily settleable material from the screened and degritted wastewater. Primary treatment includes two sets of primary clarifiers. The old clarifiers have been in service for over 50 years, and consist of four basins, one of which is typically used for centrate storage. The new clarifiers, brought into service in 2013, consist of four basins. Flow is routed to the new basins.

The primary treatment system includes magnetic flow meters, which provide an estimate of primary influent flow. This flow measurement is used to control influent gates and the pump speed for influent pumping, return activated sludge, waste activated sludge, and internal mixed liquor recycle pumping.



All of the primary clarifiers include scum collectors, surface return flight sludge collectors, and primary sludge pumps. Primary scum is sent to an aerated tank where a proprietary mixture of designer biomass is used to digest the scum under controlled conditions. Primary sludge is removed from the primary sedimentation tanks and pumped to the dissolved air flotation thickeners. Each of the primary clarifiers has its own set of primary sludge pumps.

Figure 3-7. Primary Treatment Process



Primary effluent is routed from the clarifiers to an effluent diversion structure. This structure can feed the first anoxic basin via a 60-inch pipeline. Under emergency conditions, the effluent diversion structure can send flow through a 48-inch pipeline to the ultraviolet disinfection system.

As part of the construction of the new primary clarifiers, a new primary odor control facility and a new primary chemical building have also been built and are sized to accommodate a potential primary sedimentation basins expansion. The primary odor control facility receives foul air from the new primary clarifiers, and treats it with a chemical (sodium hydroxide) scrubber followed by a set of carbon scrubbers. The chemical building includes space and conduit for chemically enhanced primary treatment in the event that LOTT elects to augment solids removal in the future.

3.2.1 Capacity Analysis

The capacity of the primary treatment system may be defined as either hydraulic capacity or treatment capacity. The new primary clarifiers can hydraulically pass up to 75 mgd of flow without flooding though they are designed to treat flows up to 37.5 mgd. This corresponds to a surface overflow rate of 4,716 gpd/ft², with all four basins in service. While higher than Orange Book recommendations, preliminary testing supports operation to this flow rate. At a high surface overflow rate (SOR), the performance of the primary clarifiers will degrade, and total suspended solids (TSS) and biological oxygen demand (BOD) removal rates will decrease. This will increase loadings to the secondary biological process and secondary clarifiers, and will have a cascading effect on the capacity of downstream systems. The relationship between SOR and performance will be monitored, and the overall BITP capacity model is based upon that relationship.

Figure 3-8 plots the projected SOR of the primary treatment system. Table 3-4 includes a summary of the various capacity parameters assessed and the related assumptions.

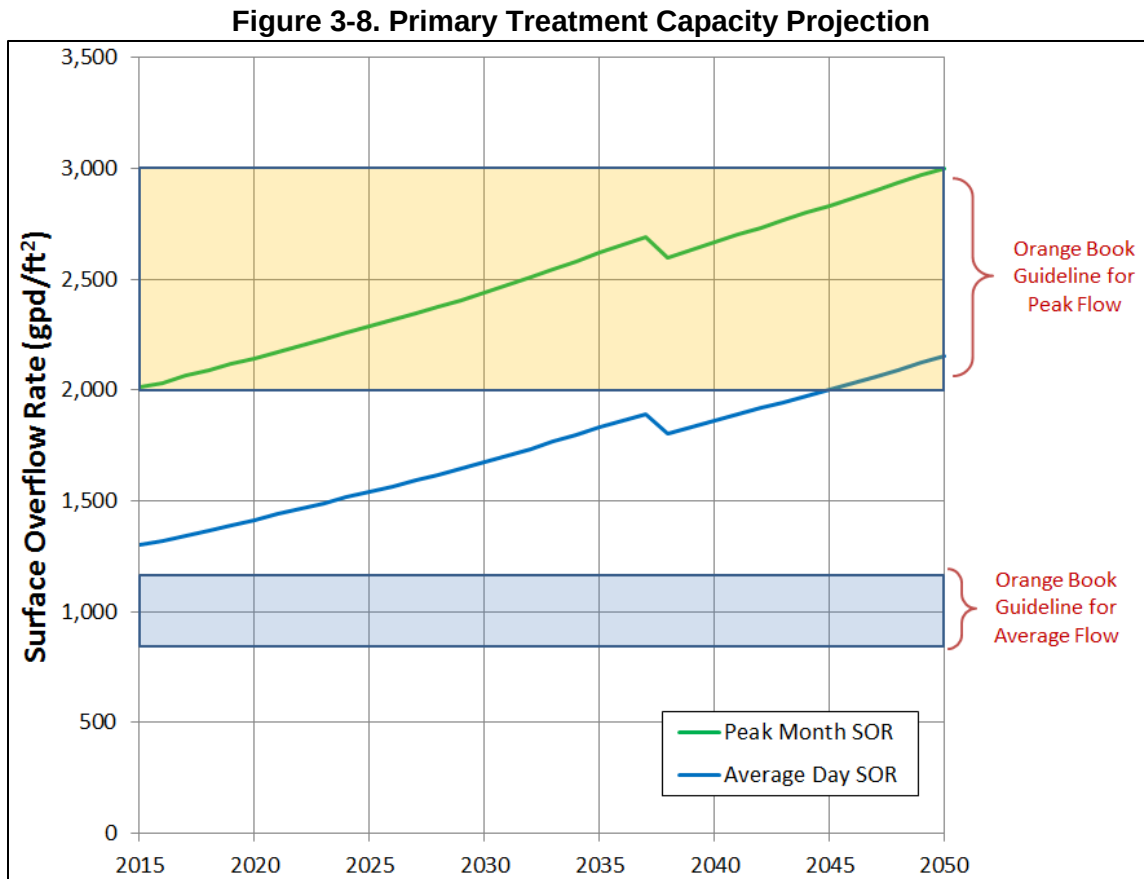


Table 3-4. Primary Clarifiers Capacity Summary

		Observed	Projection				
Parameter	Units	2014	2015	2020	2030	2040	2050
Infrastructure Characteristics							
Old Primary Clarifiers							
Number		0	0	0	0	0	0
Unit Surface Area	ft ²						
New Primary Clarifiers							
Number		4	4	4	4	8	8
Unit Surface Area	ft ²	1,988	1,988	1,988	1,988	1,988	1,988
Controlling Parameters for Capacity							
Surface Overflow Rate	gpd/ft ²	3,000	3,000	3,000	3,000	3,000	3,000
Capacity Related Assumptions							
Units in service		New primaries only					
Capacity averaging basis		Peak Month					
Capacity utilization basis		85%					
Projected Loadings							
Peak Month Flow	mgd	16.0	16.2	17.0	19.4	21.2	23.9
Projected Capacity Condition							
Surface Overflow Rate	gpd/ft ²	2,014	2,034	2,143	2,438	1,335	1,501
Projected Utilization							
Surface Overflow Rate		67%	68%	71%	81%	44%	50%

The plant can operate at peak day SORs under 2,500 gpd/ft² through 2031. While the average day SORs are projected to be higher than Orange Book standards with the new clarifiers, preliminary testing suggests that performance under such conditions will be on target.

3.2.2 Completed and Planned Projects

LOTT currently plans to replace the old primary clarifiers with four additional new primary clarifiers in 2034. The timing of this project is based upon two factors -- the peak month SOR reaching 85% of the Orange Book recommended peak SOR of 3,000 gpd/ft² with just the new clarifiers in service; and the age and conditions of the old primary clarifiers, constructed in 1952. LOTT currently sends centrate to the old primary clarifiers for equalization. A project to reutilize the tanks for centrate management and solids removal is planned for 2017.

Table 3-5. Primary Treatment Completed and Planned Project Summary

On-line	Name	Cost/Estimate	Status	Description
2010	Centrate Metering Pump Upgrade	\$30,000	Completed	Replaced aging centrate metering pump in the old primaries.
2010	Port of Olympia Land Purchase	\$2,156,297	Completed	Purchased property to locate the new primaries.
2013	Primary Sedimentation Basins	\$60,587,598	Completed	Project added new primary clarifiers, odor control, and chemical feed and storage facilities.
2017	Centrate Management Upgrade	\$3,543,608	Planning	Renovate portion of West Primaries for centrate storage, equalization, and solids removal and upgrade roof and odor control equipment
2034	Primary Sedimentation Basins: Phase II	\$28,400,000	Future	Project will add a second set of primary clarifiers. Odor control and chemical upgrades completed with Phase I.

3.2.3 Asset Management

A variety of mechanical equipment is involved in the operation of the primary treatment system. Major equipment includes the influent flow meters, the chain and flight sludge and scum collectors, and the primary sludge pumps. This equipment is shown on Figure 3-7 and summarized in Table 3-6 below.

Table 3-6. Existing Primary Treatment Equipment

System	Count	Unit Capacity	Motor	Date of Last Upgrade	Risk Score (1-6)
Influent flow meters	2	NA	NA	2013	1
New clarifier chain and flight collectors	4	NA	0.5 hp	2013	1
Old clarifier chain and flight collectors	8	NA	0.75 hp	2004	5
New clarifier primary sludge pumps	4	230 gpm	15 hp	2013	1
Old clarifier primary sludge pumps					
Progressing Cavity	1	200 gpm		1993	4
ODS Diaphragm	4	100 gpm	N/A	1980	4

3.3 Secondary Clarifiers

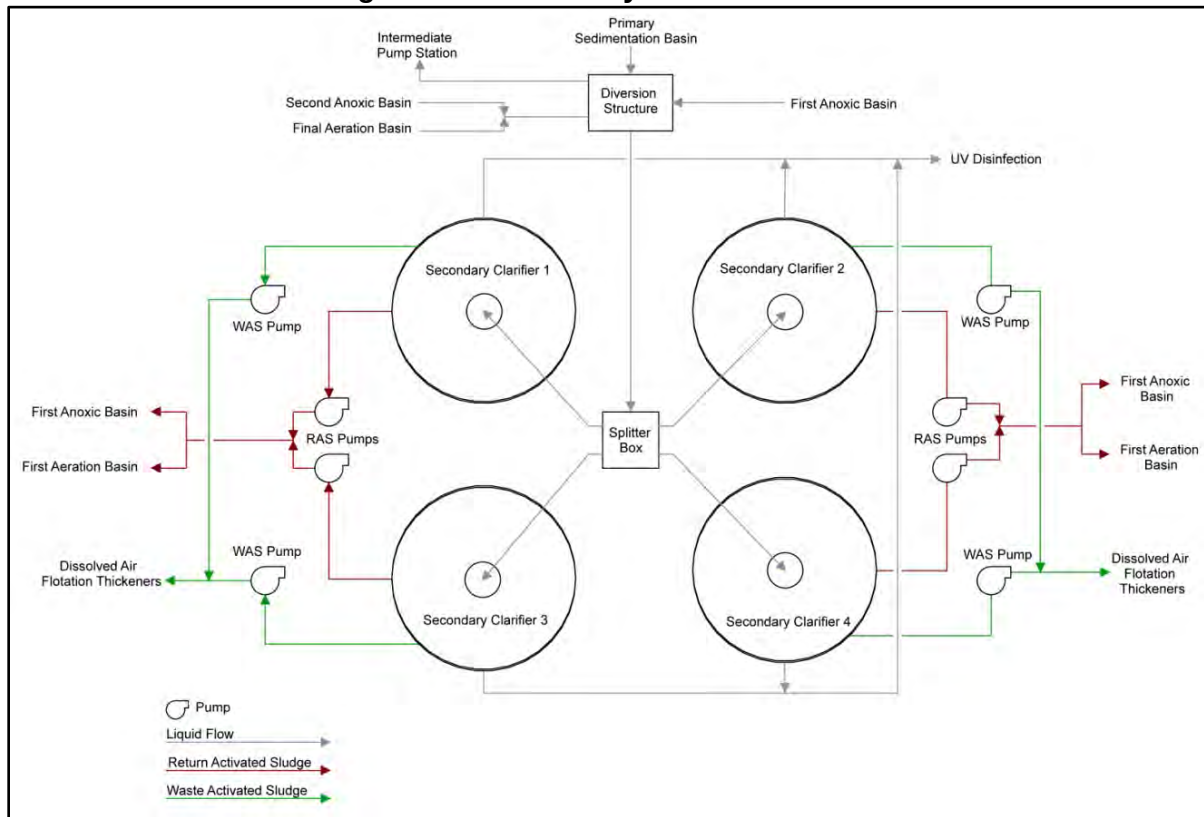
The purpose of the secondary clarifiers is to separate suspended solids from the biological treatment process mixed liquor prior to disinfection of the treated plant effluent. The clarifiers receive flow from the final aeration basin, and clarified effluent from the clarifiers flows to the ultraviolet disinfection system. There are four clarifiers at the plant with a diameter of 120 feet and a 14.5-foot sidewater depth. A project to upgrade the secondary clarifiers was completed in 2007. The project included the replacement of the clarifier mechanisms, the effluent launders and both the waste activated sludge (WAS) and return activated sludge (RAS) pumping systems.

Each clarifier is equipped with two RAS pumps and one WAS pump. Settled sludge is withdrawn from each clarifier through dedicated RAS pumps that are connected to a manifold of pipes located on the clarifier's rotating sludge collector rake arms.

A magnetic flow meter measures the flow from each pair of pumps. RAS is recycled by the pumps back to the first anoxic basin. The pumping rate is adjusted to maintain a blanket of thickened sludge in the clarifier.



Figure 3-9: Secondary Clarifier Process



WAS is withdrawn from each RAS wet well and directed to the dissolved air flotation thickeners for solids processing. The WAS pumps are used to maintain the solids inventory in the system and the solids retention time in the secondary treatment process to allow the biological treatment process to operate correctly. The WAS pumps are operated continuously to even out the load to the dissolved air flotation thickeners.

3.3.1 Capacity Analysis

The capacity of the secondary clarifiers was established through stress testing and fluid dynamic modeling in late 2008. Unit capacity is a function of the mixed liquor suspended solids (MLSS) concentration in the aeration basins and the mixed liquor settleability velocity index (SVI) (Figure 3-10). MLSS is a function of the BOD loading to the aeration basins and the total aeration basin volume. In addition, the BOD loading to the aeration basins is itself a function of both satellite plant diversion and primary sedimentation performance.

As noted above, secondary clarifier capacity is a function of several factors and is linked to the influent flows and loads to the plant, primary sedimentation performance, and operation of the aeration basins (MLSS). Figure 3-11 shows a simplified plot of the secondary clarifier capacity under specific conditions, and at an SVI of less than 200 mL/g. Effluent flow capacity is estimated based on the projected maximum seasonal MLSS concentrations for each year and the clarifier capacity model from Figure 3-11.

Figure 3-10. Secondary Clarifier Capacity as a Function of MLSS and SVI

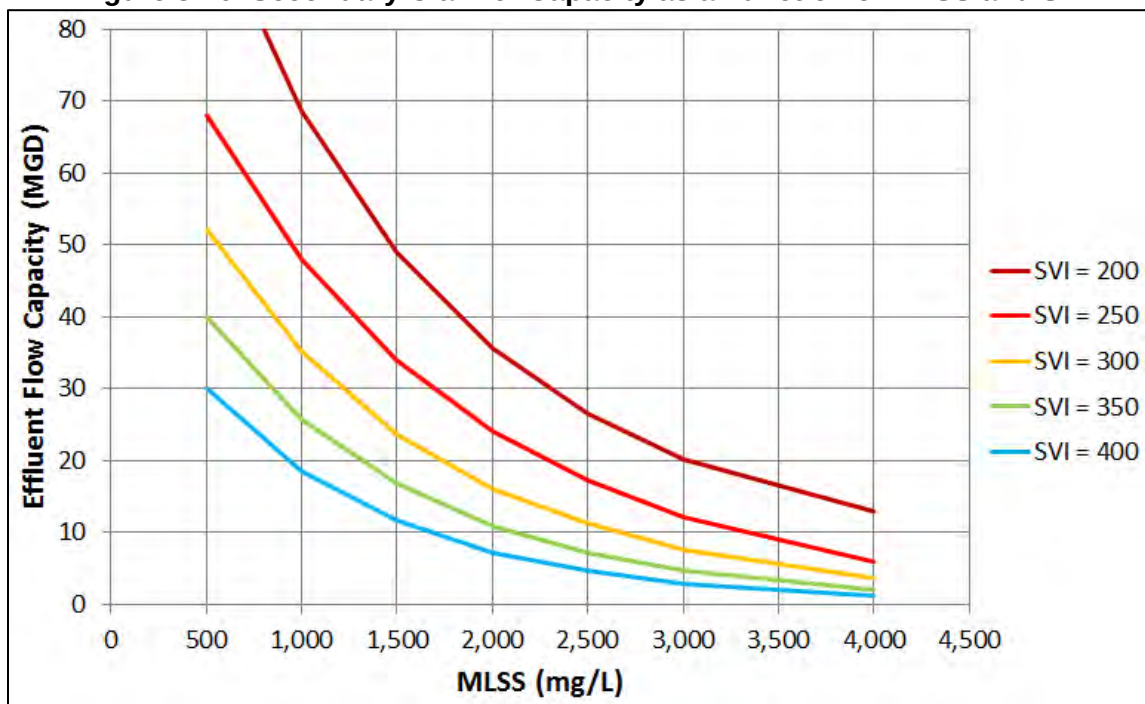
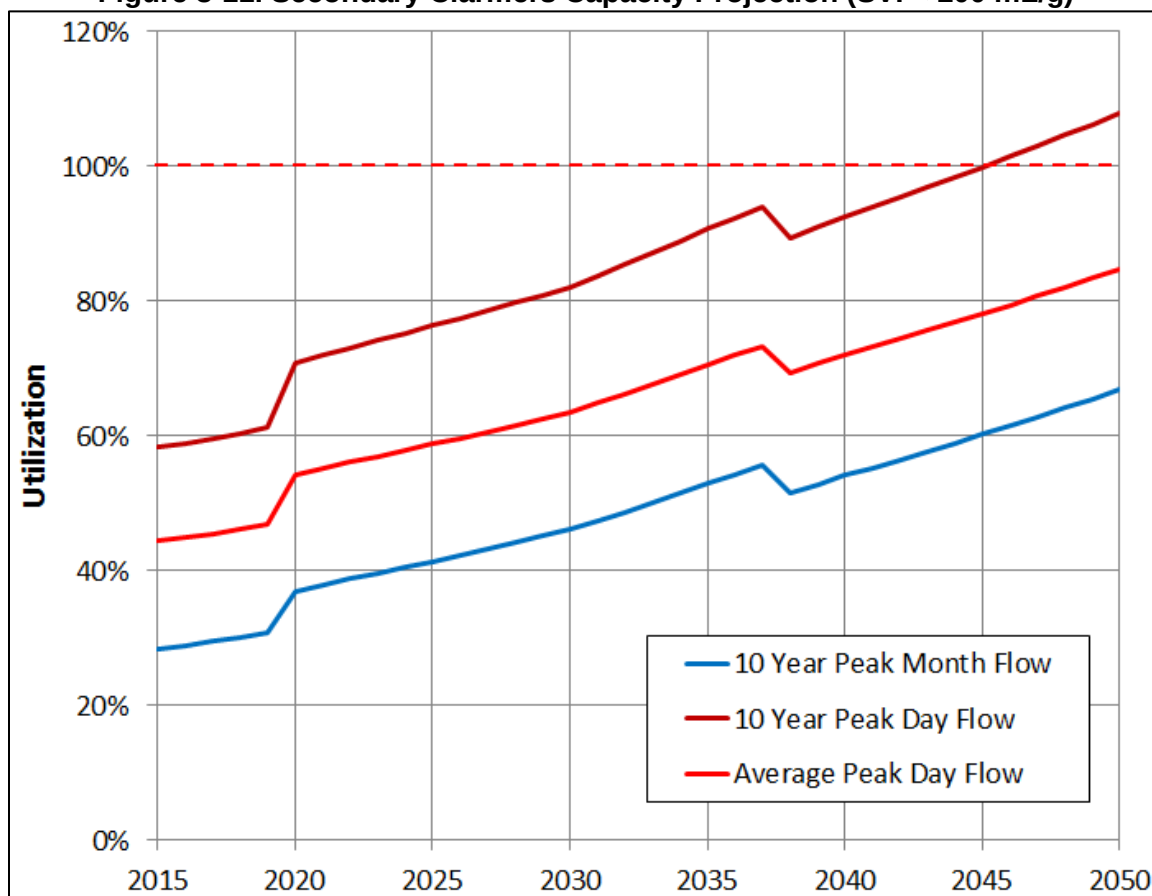


Figure 3-11. Secondary Clarifiers Capacity Projection (SVI < 200 mL/g)



The secondary clarifiers have capacity to treat projected flows and loads at a peak day condition through 2045. It is assumed that peak hour flows are effectively buffered in the Plant's flow equalization basins to avoid clarifier washout. This also assumes operation at an SVI less than 200 mg/L. If the mixed liquor SVI cannot be consistently maintained at this level, the capacity of the secondary clarifiers would be reduced.

Table 3-7 provides a summary of the capacity analysis and assumptions for the secondary clarifiers. Four secondary clarifiers are projected to be sufficient through 2045, assuming the mixed liquor SVI can be maintained under 200 mL/g, and that the full volume of the existing secondary process basins (15.27 mgal) is available for use.

Table 3-7. Secondary Clarifiers Simplified Capacity Summary

		Observed	Projection				
Parameter	Units	2014	2015	2020	2030	2040	2050
Infrastructure Characteristics							
Secondary Clarifiers							
Number		4	4	4	4	4	4
Diameter	ft	120	120	120	120	120	120
Depth	ft	14.5	14.5	14.5	14.5	14.5	14.5
Unit Surface Area	ft ²	11,310	11,310	11,310	11,310	11,310	11,310
Capacity Related Assumptions							
Aeration Basin Volume	Mgal	15.27					
MLSS Settleability		SVI < 200 mL/g					
Projected Loadings							
Aeration Basin MLSS	mg/L	1,300	1,313	1,614	1,788	1,659	1,616
10 Year Peak Day Flow	mgd	41.3	41.4	42.5	45.6	49.3	52.9
Projected Capacity Condition							
Total Clarifier Flow Capacity	mgd	67.3	67.0	57.2	53.1	50.1	46.3
Projected Utilization							
Total Clarifier Flow Capacity		58%	59%	71%	82%	93%	108%

3.3.2 Completed and Planned Projects

Capacity of the clarifiers will need to be reassessed following the upcoming process improvements project. The projected capacity limitation in 2045 may be addressed in a number of ways. For example, chemical addition at the primary clarifiers would reduce solids loading and remove this limitation. Likewise, expansion of treatment at the MWRWP could eliminate this restriction. The \$10 million dollar project is a placeholder to be developed in the future.

Table 3-8. Completed Secondary Clarifier Projects

On-line	Name	Cost/Estimate	Status	Description
2007	Secondary Clarifier Rehabilitation	\$5,819,615	Completed	Replaced sludge collection mechanisms, RAS pumping and WAS pumping systems
2011	Waste Activated Sludge Line Replacement	\$281,027	Completed	Replaced leaking WAS line
2045	Secondary Clarifier Capacity Upgrade	\$10,000,000	Future	Resolve projected secondary clarifier capacity limitation

3.3.3 Asset Management

A variety of mechanical equipment is involved in secondary clarifier operations. Major equipment includes the secondary clarifier sludge collection mechanisms, RAS pumps, and WAS pumps. This equipment is illustrated in Figure 3-9 and is summarized in Table 3-9 below.

Table 3-9. Existing Secondary Clarifiers Equipment

System	Count	Unit Capacity	Motor	Date of Last Upgrade	Risk Score (1-6)
Secondary Clarifier Mechanisms	4	120-ft diameter	NA	2007	3
RAS Pumps	8	2,000 gpm	20 hp	2007	3
WAS Pumps	4	300 gpm	10 hp	2007	3

Equipment replacement costs are tracked as part of LOTT's asset management program. Other replacement activities include periodic replacement of piping, HVAC, electrical, and instrumentation and control equipment.

3.4 Biological Process

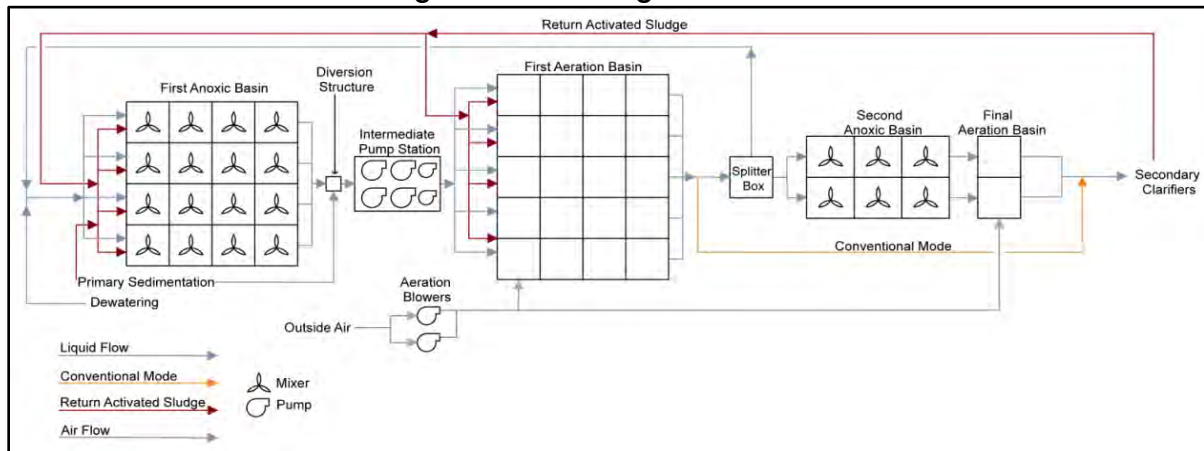
The LOTT biological nutrient removal system operates a modified four-stage Bardenpho process to optimize total inorganic nitrogen removal from the incoming wastewater. Effluent from the primary sedimentation tanks flows through a series of anoxic (low dissolved oxygen) basins and aeration (higher dissolved oxygen concentration) basins. These basins are identified as the first anoxic, first aeration, second anoxic, and final aeration basins. In order to achieve the required nitrogen limits, flows are recycled inside the aeration basin system from the first aeration basin back to the first anoxic basin at a rate up to four times the plant's influent flow.



The first anoxic basin (stage 1) removes nitrate from the wastewater (denitrifies). Each basin is mixed by a mixer mounted on the roof of the basin. Denitrified mixed liquor flows by gravity to the intermediate pump station. The intermediate pump station transfers denitrified mixed liquor to the first aeration basin. The intermediate pump station lifts the mixed liquor and primary effluent flow to allow gravity flow through the remaining elements of the secondary treatment process and ultraviolet disinfection.

In the first aeration basin (stage 2), the wastewater is aerated to provide for BOD removal and nitrification (conversion of ammonia to nitrate). The mixed liquor is aerated with fine bubble diffusers located on the floor of the basins. Air is supplied to the diffusers by a system of blowers. Mixed liquor flows from the first aeration basin to a splitter box that directs flow either back to the first anoxic basin or to the second anoxic basin/final aeration basin.

Figure 3-12: Biological Process



The second anoxic and final aeration basins (stage 3 and 4) provide the final biological denitrification and nitrification steps prior to settling and disinfection. Stages 3 and 4 consist of two trains, each with four cells. The first three cells of each train serve as the second anoxic zone, and the fourth cell as the final aeration zone. In the anoxic cells, additional nitrate removal is achieved. In the final aeration cells the mixed liquor is aerated to further polish the mixed liquor prior to flowing to the secondary clarifiers.

3.4.1 Capacity Analysis

The secondary process tanks comprise of 15.27 million gallons of anoxic and aerobic basin volume. While this process volume is sufficient to provide for BOD and TIN removal through build-out, performance becomes increasingly tied to the mixed liquor suspended solids (MLSS) concentrations. The MLSS concentration is proportional to the BOD loading, which is projected to increase by approximately 80% by 2050 throughout the collection system. The MLSS concentration is inversely proportional to the volume of the secondary process tanks.

A process control evaluation is currently underway to determine the best approach to reconfigure the secondary process tanks. The purpose of the project is to provide for improved control and efficiency. Key outcomes of the project will include reduced energy use, a reduction in foam trapping, improved dissolved oxygen control, and improved mixed liquor settleability. Consolidation of the biological treatment process may also free up valuable space on the plant site for additional future treatment processes. These positive outcomes are balanced against a possible reduction in process volume tied to the elimination of the existing first anoxic basin. The volume reduction would increase the projected MLSS concentration, which in turn increases downstream loading on the secondary clarifiers and reduces secondary clarifier capacity.

LOTT is currently engaged in a planning exercise to determine the optimal combination of satellite plant diversion and actions at the Budd Inlet Treatment Plant to provide the necessary amount of treatment through build-out. The planned upgrades will also relieve existing and projected aeration and blower capacity limitations identified in the 2006 Master Plan.

Table 3-10. Biological Process System Capacity Summary

		Observed	Projection				
	Units	2014	2015	2020	2030	2040	2050
Infrastructure Characteristics							
Aeration Basin		Varies by stage	Varies by stage	TBD	TBD	TBD	TBD
Trains							
Stage Volume							
First Anoxic	Mgal	2.322	2.322	TBD	TBD	TBD	TBD
First Aeration	Mgal	10.794	10.794	TBD	TBD	TBD	TBD
Second Anoxic	Mgal	1.617	1.617	TBD	TBD	TBD	TBD
Final Aeration	Mgal	0.539	0.539	TBD	TBD	TBD	TBD
Total Volume	Mgal	15.273	15.273	TBD	TBD	TBD	TBD
Aeration Blowers							
Multistage Centrifugal							
Units		3	2	2	1	0	0
Unit Capacity	scfm	7,400	7,400	7,400	7,400	7,400	7,400
Turbo							
Units		1	2	2	3	5	6
Unit Capacity	scfm	6,000	6,000	6,000	6,000	6,000	6,000
Controlling Parameters for Capacity							
Aeration Basins		Refer to secondary clarifier capacity					
Turbo Blower Capacity	scfm	6,000	12,000	12,000	18,000	24,000	30,000
Capacity Related Assumptions (Blowers)							
Units held in reserve		3	2	2	1	1	1
Capacity averaging basis		Maximum hour					
Capacity utilization basis		85%					
Projected Capacity Condition							
Aeration demand	scfm	6,000	6,444	8,667	13,111	17,556	22,000
Projected Utilization							
Aeration Blowers		100%	54%	72%	73%	73%	73%

3.4.2 Completed and Planned Projects

The process control improvements project affects operations, maintenance, as well as capacity. The project is scheduled to be completed in 2019. While future phases may be identified during preliminary design, only one phase is considered in this report.

Table 3-11. Completed and Planned Biological Process Projects

On-line	Name	Cost/Estimate	Status	Description
2011	Aeration Blower Upgrade Project	\$787,088	Completed	Added dual-core Turbo Blower
2010	Second Anoxic Mixers	\$200,816	Completed	Replaced aging anoxic basin mixer originally installed in 1995
2019	Process Control Improvements	\$15,553,746	Planning	Upgrades aeration control, instrumentation, and process tank reconfiguration

3.4.3 Asset Management

A variety of mechanical equipment is involved in operation of the aeration basins. Major equipment includes mixers for the anoxic basins and first aeration basin, pumps at the intermediate pumping station, and aeration blowers/diffusers. This equipment is shown on Figure 3-12 and is summarized in Table 3-12 below.

Table 3-12. Existing Aeration Basins Equipment

System	Count	Unit Capacity	Motor	Date of Last Upgrade	Risk Score (1-6)
First Anoxic Basin Mixers	16		10 hp	1980	3
First Aeration Basin Mixers	5		25 hp	1993	3
Second Anoxic Basin Mixers	6		15 hp	2010	2
Intermediate Pumps	2	17 mgd	75 hp	1993	3
	4	33 mgd	150 hp	1993	
Centrifugal Blowers	3	7,400 scfm	500 hp	1993	5
Turbo Blowers	1	6,000 scfm	400 hp	2011	2
Aeration Diffusers	30,000			2012	2

3.5 Ultraviolet Disinfection and Outfalls

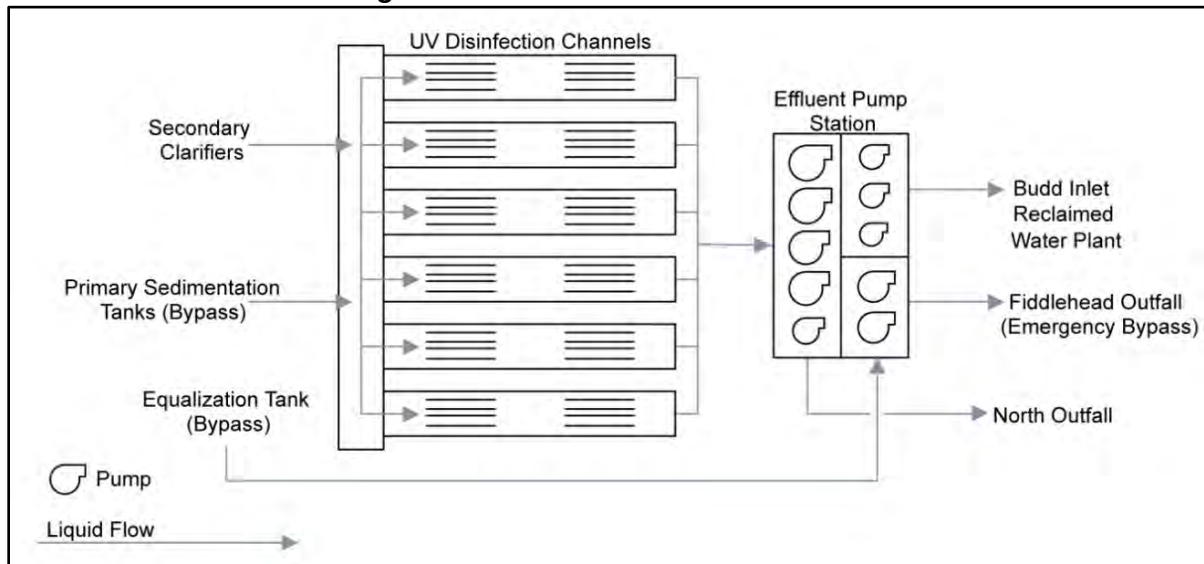
Ultraviolet Disinfection

The ultraviolet (UV) disinfection system is the final liquid stream processing step. Its purpose is to disinfect the effluent from the secondary clarifiers to satisfy NPDES permit requirements for fecal coliform counts in the final effluent.

A UV disinfection system relies upon the bacteria in the effluent being exposed to UV light by flowing past UV bulbs. The UV disinfection system consists of seven channels. Six channels are equipped with horizontal UV bulbs, while the seventh is vacant for future expansion. Each channel can disinfect up to 11 mgd of secondary effluent. UV lamps are arranged in modules across the width of a channel. The spacing of the lamps in the channels provides sufficient UV radiation to ensure destruction of pathogenic microorganisms as effluent flows through the channel. The performance of the UV disinfection system is contingent on the successful performance of the secondary clarifiers, since high suspended solids will block the UV radiation and reduce the amount available for disinfection.



Figure 3-13. UV Disinfection Process



Outfalls

The LOTT treatment plant has two 48-inch outfalls, the North Outfall and the Fiddlehead Outfall. Treated effluent is typically discharged to Budd Inlet out of the North Outfall that extends 953 feet off of the shoreline near the north end of Washington Street. The final 250 feet of the outfall contains a diffuser section approximately 19 feet below the mean lower low water level (MLLW).

The North Outfall is used for all plant flows up to 55 mgd at high tide and approximately 75 mgd at low tide. Peak flows in excess of the North Outfall capacity may be discharged through the Fiddlehead Outfall, in which case LOTT must notify the Department of Ecology that flow was diverted to this pipe.

Most of the North Outfall was upgraded from 30-inch to 48-inch diameter in 1997. A portion of the pipeline, which crosses through a state-regulated dangerous waste site, could not be upgraded to 48-inch. The remaining 1,200 feet of 30-inch diameter pipe, which creates a flow bottleneck, is planned to be replaced in 2041.

3.5.1 Capacity Analysis

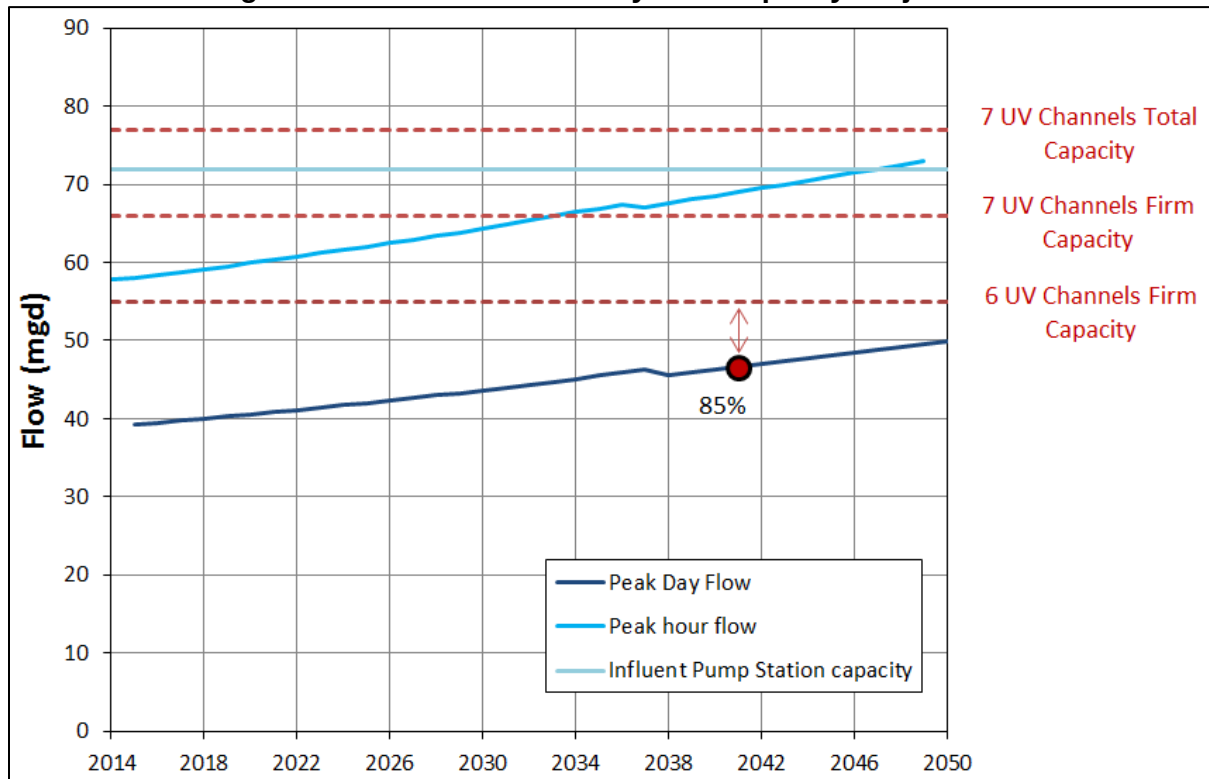
UV Disinfection

The Budd Inlet Treatment Plant currently uses six UV channels for disinfection. A seventh channel is empty and could be brought into service by installing equipment. Each channel has a maximum treatment capacity of 11 mgd. With the capacity of the influent pump station limited to 72 mgd, the existing channel system will have capacity to treat all secondary-treated flows through build-out. The existing treatment capacity (six channels, 66 mgd) is adequate to treat 10-year peak day flows through build-out.

Disinfection systems are rated based upon the Department of Ecology's Class I Reliability requirement, the capacity to treat 50% of the peak design flow with the largest unit out of service. For the Budd Inlet Treatment Plant, this effectively means the existing 6-channel system may treat up to 110 mgd. From a practical standpoint, LOTT prefers to treat 100% of its peak day flow with a margin of safety. The existing six-channel system will operate at

85% of its firm capacity for the projected 10-year peak day flow in 2041 as shown in Figure 3-14. Expansion to a seven-channel system is therefore planned for 2041. The seven-channel system will provide adequate capacity to treat 10-year peak day flows through build-out with one unit out of service.

Figure 3-14. UV Disinfection System Capacity Projection



Outfalls

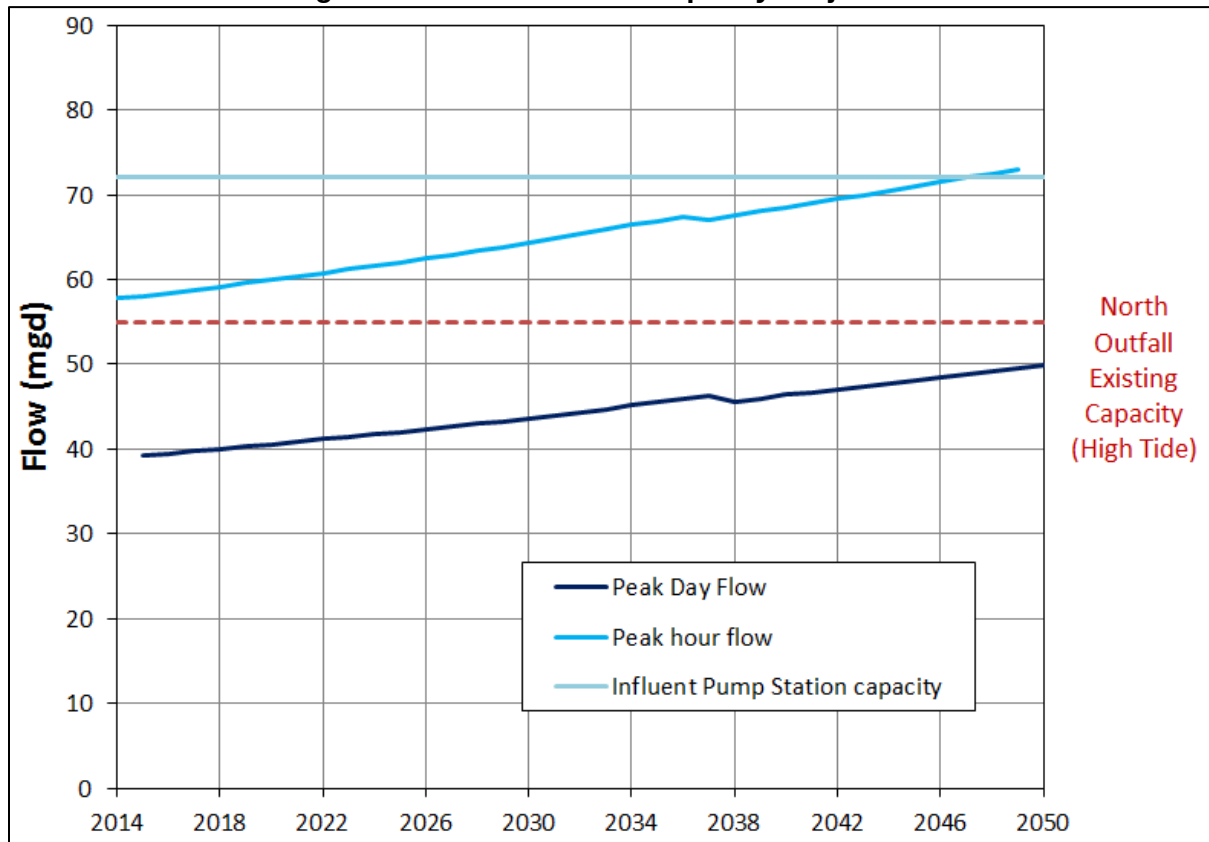
There are four pumps discharging to the North Outfall, each with a nameplate capacity of 16.7 mgd at high tide. However, experience has suggested a real-world pumping capacity of 55 mgd at high tide, and pressure limitations in the outfall pipeline would limit flow increases above this level. Under normal tidal conditions, the outfall can pump up to 75 mgd. Two additional 15 mgd pumps can direct flow to the Fiddlehead Outfall under emergency circumstances, bringing the combined outfall capacity to 85 mgd. LOTT prefers to minimize use of the Fiddlehead Outfall as much as possible. Figure 3-15 shows the existing capacity of the North Outfall, not including Fiddlehead capacity, relative to the projected 10-year peak day flow.

Currently, the North Outfall does not have capacity to discharge peak hour flows under high tide conditions. However, such conditions are rare, and the Plant's influent flow equalization basins typically reduce peak hourly flow through the Plant. Therefore, the plant has very rarely needed to discharge flow to the Fiddlehead Outfall.

A plan is currently being developed to increase the capacity of the North Outfall by replacing the 30-inch section of pipe which is currently limiting pumping capacity, and by upgrading the existing pumps. After those improvements, the North Outfall will have the capacity to match the influent pump station (72 mgd) under all tidal conditions. Project timing is not clearly linked to any single indicator, but is tied to ability to equalize peak hour flows above

55 mgd. The project should happen before 10-year peak day flows reach 55 mgd, which is projected to occur after 2050. A reasonable timeframe would be to take an approach similar to the UV expansion, and set it to occur when 10-year peak day flows reach 85 percent of capacity, or 46.8 mgd. This is projected to occur in 2041.

Figure 3-15. North Outfall Capacity Projection



UV Disinfection System and Outfalls Capacity Summary

Table 3-13 provides a summary of the capacity analysis and assumptions for the UV disinfection system and the North Outfall.

Table 3-13. UV Disinfection System and Outfalls Capacity Summary

Parameter	Units	Observed	Projection				
		2014	2015	2020	2030	2040	2050
Infrastructure Characteristics							
UV Disinfection System							
Number of Channels		6	6	6	7	7	7
Channel Capacity	mgd	11	11	11	11	11	11
Firm Capacity	mgd	55	55	55	66	66	66
Total Capacity	mgd	66	66	66	77	77	77
North Outfall Pumps							
Number		4	4	4	4	TBD	TBD
Unit Capacity (High Tide)	mgd	16.7	16.7	16.7	16.7	TBD	TBD
Total Capacity	mgd	66.8	66.8	66.8	66.8	TBD	TBD
Real Capacity, Firm (High Tide)	mgd	55	55	55	55	72	72
Fiddlehead Outfall Pumps							
Number		2	2	2	2	2	2
Unit Capacity (High Tide)	mgd	15	15	15	15	15	15
Total Capacity	mgd	30	30	30	30	30	30
Controlling Parameters for Capacity							
UV Disinfection System Treatment Capacity	mgd	55	55	55	66	66	66
North Outfall Flow Capacity	mgd	55	55	55	55	72	72
Capacity Related Assumptions							
UV Disinfection System							
Units held in reserve		1	1	1	1	1	1
Capacity averaging basis		Peak One-Day					
Capacity utilization basis		Utilization > 85%					
North Outfall							
Units held in reserve		1	1	1	1	1	1
Capacity averaging basis		Peak One-Hour Flow Through Influent Pump Station					
Capacity utilization basis		Utilization > 85%					
Projected Capacity Condition							
10-year peak hour flow	mgd	57.9	58.1	59.5	63.8	68.0	73.0
10-year peak hour flow through influent pump station	mgd	57.9	58.1	59.5	63.8	68.0	72.0
10 -year peak day flow	mgd	39.3	39.5	40.5	43.6	46.4	49.9
Projected Utilization							
UV Disinfection System							
		71%	72%	74%	66%	70%	76%
North Outfall							
		105%	106%	108%	116%	95%	100%

3.5.2 Completed and Planned Projects

A list of completed and planned projects is included in Table 3-14 below. The support of the existing Trojan UV3000 system will discontinue in 2020. The UV System Control and Power Upgrades upgrade project is planned to be completed by then. The UV equipment installation in the 7th channel, currently planned for 2041, will be triggered when the peak day influent flow reaches approximately 46.8 mgd, 85% utilization of the existing firm UV disinfection capacity. The North Outfall Upgrade, planned for 2041, will address the current pressure limitations in the North Outfall pipeline and will help reduce future use of the Fiddlehead Outfall.

Table 3-14. Completed and Planned Projects

On-line	Name	Cost/Estimate	Status	Description
2013	Effluent Drive and Motor Control Centers Replacement	\$1,692,754	Completed	Replaced effluent pump variable frequency drives and motor control centers
2020	UV System Control and Power Upgrades	\$1,854,142	Future	Upgrades 20-year-old UV system equipment to include lamps, ballasts, control modules, and power supplies
2041	North Outfall Upgrade	\$4,500,000	Future	Remove existing bottleneck from outfall pipe run
2041	UV System/7 th Channel	\$580,200	Future	Add additional channel to UV system to meet projected flows

3.5.3 Asset Management

A variety of mechanical equipment is involved in the operation of the UV disinfection system and the effluent pump station. Major equipment includes the UV disinfection system, North Outfall pumps, Fiddlehead Outfall pumps, and Budd Inlet Reclaimed Water Plant pumps. This equipment is shown on Figure 3-13 and is summarized in Table 3-15 below.

Table 3-15. Existing UV Disinfection and Effluent Pumping Equipment

System	Count	Unit capacity	Motor	Date of last upgrade	Risk Score (1-6)
UV Disinfection System	6	11 mgd	N/A	1993	3
Effluent Pump Station Pumps – North Outfall	3	18 mgd	150 hp	1997	3
	2	12 mgd		2001	3
Effluent Pump Station Pumps – Fiddlehead	2	15 mgd	125 hp	1980	3
Effluent Pump Station Pumps – Budd Inlet Reclaimed Water Plant	3	1 mgd	60 hp	2004	3

3.6 Sludge Thickening

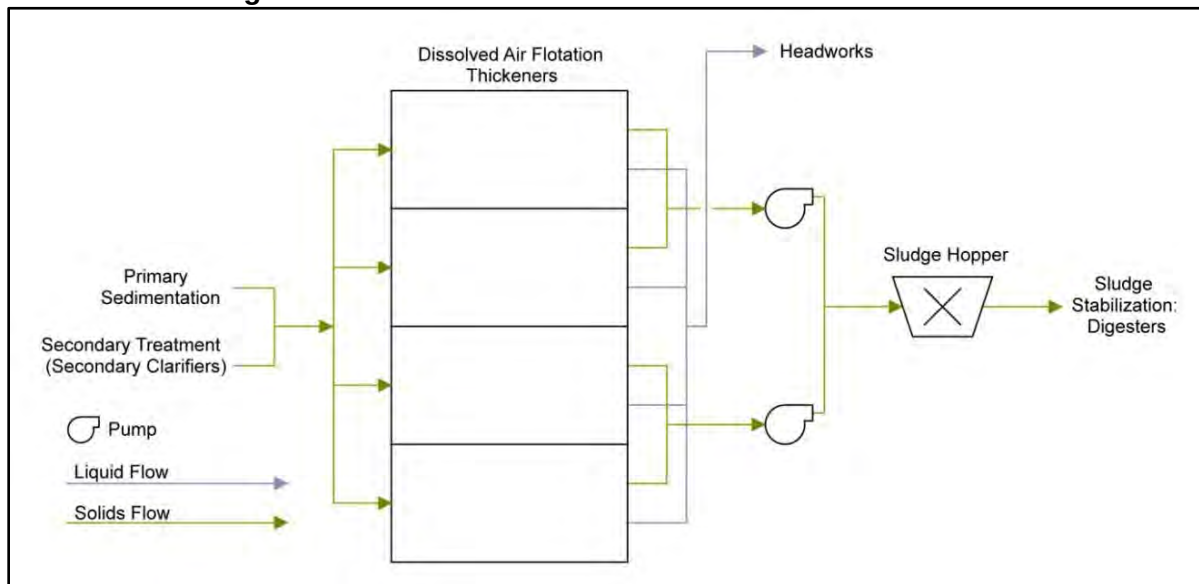
The sludge thickening process removes excess water from the combined primary and waste activated sludge (WAS) flows prior to anaerobic digestion. The Budd Inlet Treatment Plant sludge thickening system consists of four rectangular dissolved air flotation thickener (DAFT) tanks. Polymer is used to enhance sludge thickening and performance of the DAFTs.

Each thickener has a dedicated pressurization system to provide high-pressure air for flotation. A portion of the DAFT effluent is recycled to the pressurization tank, and the pressure is elevated to 40 psig using the plant's high pressure service air. Pressurized flow from the tank is passed through a pressure release valve, where it combines with the sludge feed to the DAFT tanks. The decompressed air bubbles attach to the sludge particles and

thickened sludge floats to the surface. Skimmers collect the thickened sludge and push it to hoppers for transfer to the anaerobic digesters.

Sludge, which falls to the bottom of the DAFT tank, is directed to the thickened sludge pumps. Clarified effluent (supernatant) from the DAFTs drains to the headworks for processing with the plant influent flow.

Figure 3-16. Dissolved Air Flotation Thickeners Process



3.6.1 Capacity Analysis

The thickened sludge from each DAFT unit combines in a common manifold and is carried to the sludge digestion system. The DAFT system was rated to a capacity of 29.7 pounds per square foot per day ($\text{lb/ft}^2/\text{d}$) in the Budd Inlet Treatment Plant Master Plan. However, the system has been operated at a maximum month loading of 52.4 $\text{lb/ft}^2/\text{d}$ and a maximum week loading of 60.3 $\text{lb/ft}^2/\text{d}$ since that time. While DAFT capacity will need to be verified through stress testing, these operational data suggest that system capacity is at least 60 $\text{lb/ft}^2/\text{d}$. This value has been used to assess capacity needs for the sludge thickening system (Figure 3-17).

Based on this solids loading rate capacity, each of the four existing DAFT units has a total solids handling capacity of approximately 36,120 lb/d . The firm and total capacities of the existing DAFT system are approximately 108,360 lb/d and 144,480 lb/d , respectively. Capacity for future sludge loads is assessed based on providing sufficient capacity to thicken projected peak day combined primary sludge and WAS loads with one unit out of service (firm capacity). As shown on Figure 3-17, the existing DAFT units are projected to have adequate capacity through 2050.

Figure 3-17. Sludge Thickening Capacity Projection

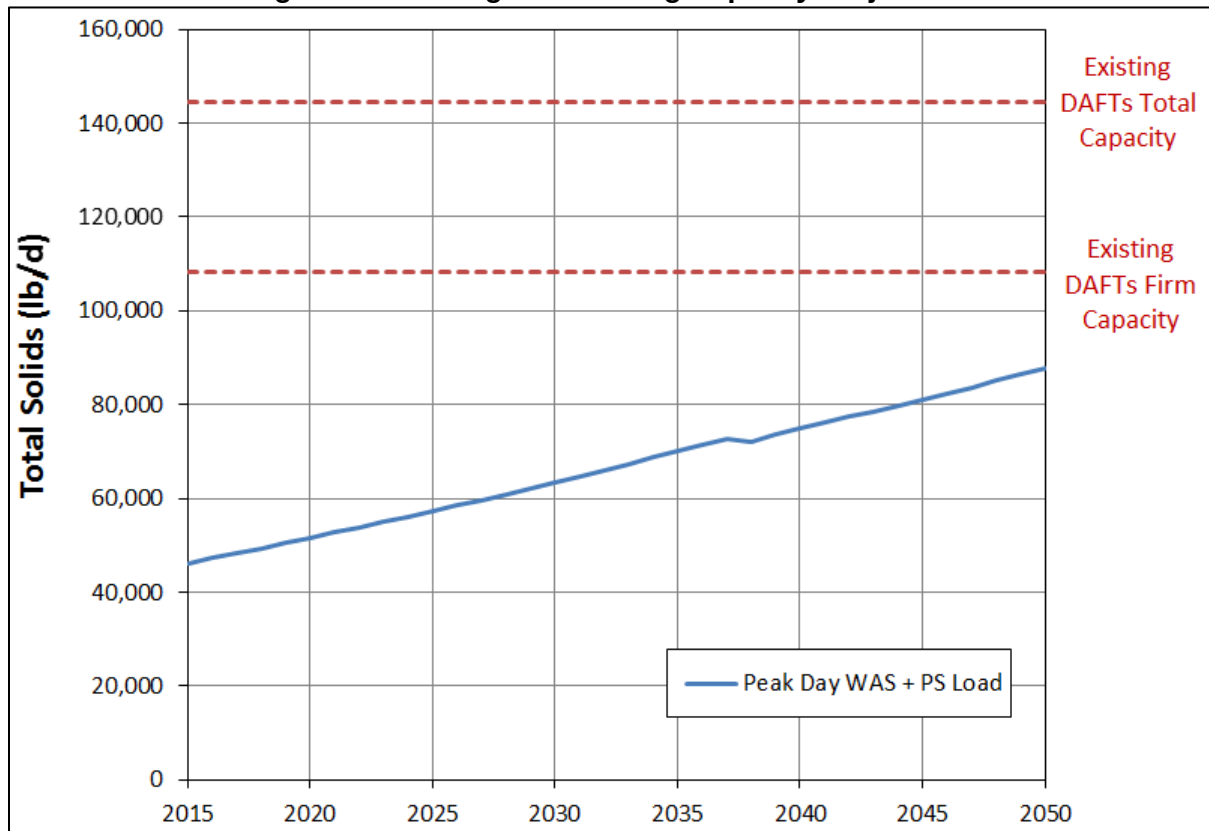


Table 3-17 provides a summary of the capacity analysis and assumptions for the sludge thickening system. Four DAFT units are projected to be sufficient through 2050.

Table 3-16. Sludge Thickening System Capacity Summary

Parameter	Units	Observed	Projection				
		2014	2015	2020	2030	2040	2050
Infrastructure Characteristics							
DAFTs							
Number		4	4	4	4	4	4
Length	ft	43	43	43	43	43	43
Width	ft	14	14	14	14	14	14
Depth	ft	12	12	12	12	12	12
Controlling Parameters for Capacity							
Solids Loading Rate	lb/ft²/d	60	60	60	60	60	60
Capacity Related Assumptions							
Units held in reserve		1	1	1	1	1	1
Capacity averaging basis			Peak Day				
Capacity utilization basis			Utilization > 100%				
DAFT Influent			WAS + PS				
Projected Loadings (Peak One-Day)							
Total Solids	lb/d	44,000	47,206	51,506	63,299	74,867	87,728
Projected Capacity Condition							
Solids Loading Rate	lb/ft²/d	24.4	26.1	28.5	35.0	41.5	48.6
Projected Utilization							
Solids Loading Rate		41%	44%	48%	58%	69%	81%

3.6.2 Completed and Planned Projects

No capacity-related upgrades are projected for this system. Planned and completed projects for the sludge thickening system are listed in Table 3-17.

Table 3-17. Completed and Planned Sludge Thickening Projects

On-line	Name	Cost/Estimate	Status	Description
2011	Thickening System Equipment Replacement	\$478,679	Completed	Included the replacement of the sprocket, chains, collectors, and beaches for each of the 4 tanks
2012	DAFT Cover Replacement	\$218,769	Completed	Replaced tank covers
2014	DAFT Polymer System Upgrade	\$918,128	Completed	Added new polymer mixer and transfer pump and replaced metering pumps and associated controls and electrical
2018	DAFT System and Thickened Sludge Pumping Upgrade	\$2,072,440	Planning	Will replace aging equipment and potentially move to a new thickening technology pending formal business case evaluation

3.6.3 Asset Management

A variety of mechanical equipment is involved in sludge thickening operations. Major equipment includes the DAFT sludge collection flights, as well as the thickened sludge pumps. These equipment are shown on Figure 3-16 and summarized in Table 3-18 below.

Table 3-18. Existing Sludge Thickening Equipment

System	Count	Unit capacity	Motor	Date of last upgrade	Risk Score (1-6)
DAFTs Collection Flights and Sprockets	4	33 lb/ft ² -d	1.5 hp	2005	3
Thickened Sludge Pumps	4	100 gpm	10 hp	2003	5

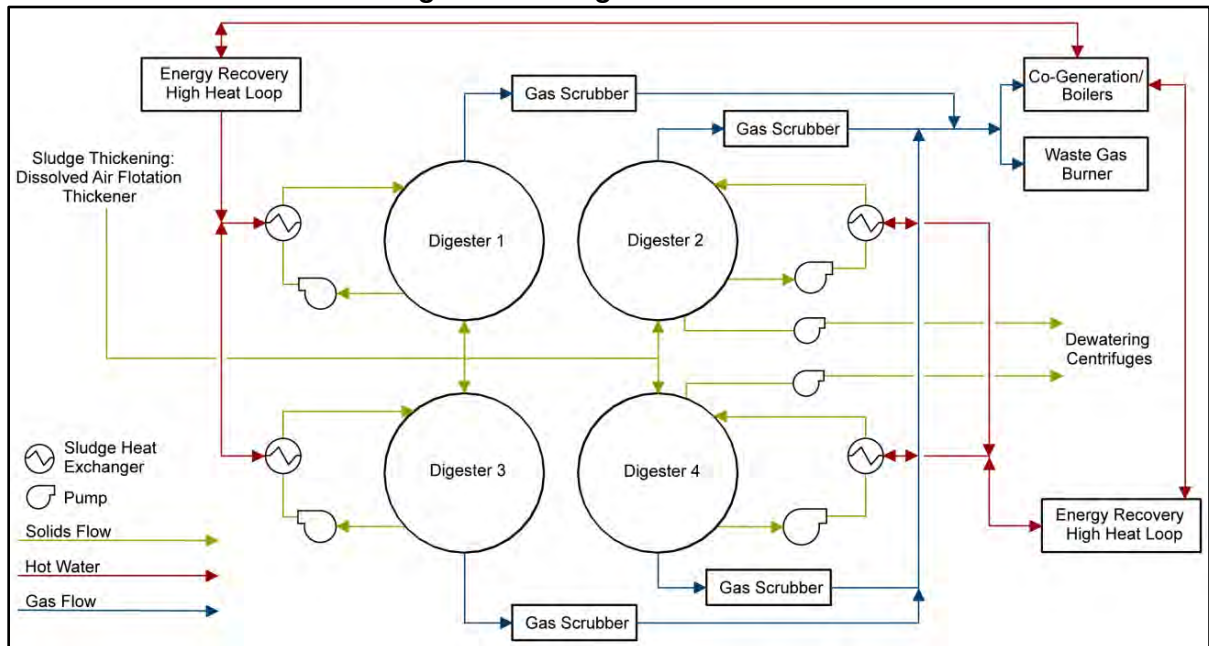
3.7 Digesters (Sludge Stabilization)

The anaerobic digesters biologically stabilize thickened sludge from the DAFTs by converting portions of the sludge to carbon dioxide, methane, and water. Following anaerobic digestion, the residual material (biosolids) is suitable for land application.

Anaerobic sludge digestion facilities include four 70-foot diameter, 30-foot deep, concrete tanks with floating covers. Normal practice is to operate three digesters at a time, with the fourth digester held in reserve.



Figure 3-18. Digesters Process



The anaerobic digester equipment building contains all process mechanical equipment needed to operate the digestion process. Thickened sludge is fed to the bottom of the digesters through the circulating sludge system in the center of the tank. Circulating sludge is withdrawn from each digester and pumped to sludge heat exchangers before being returned to the digesters to assist in keeping them completely mixed. The heat exchangers are used to maintain the temperature in the digester at 95° F, which is a permit requirement in order to meet Class B Biosolids standards.

Methane gas from the digesters is the principle fuel for the high temperature heat loop system. Digested sludge is withdrawn from the bottom of the digesters and pumped to solids dewatering centrifuges. Each digester is equipped with floating gasholder-type covers, which are supported by digester gas pressure. Each digester contains two separate gas-piping systems. The gas utilization system withdraws gas for use as fuel for the high temperature heat loop system. The second system uses digester gas to continuously mix the contents of the digester. A dedicated gas compressor re-circulates digester gas through each digester.

Foul air from the anaerobic digester equipment building is collected and treated in the odor control system prior to release to the atmosphere.

3.7.1 Capacity Analysis

The digesters are rated based upon both loading and hydraulic factors with a target hydraulic retention time of 25 days. This provides a safety factor over the EPA biosolids guideline of a minimum 15-day retention time. The target volatile solids loading rate is 0.15 lbs/ft³/d. This rate is based upon stress testing results at other facilities, and includes a safety factor. Actual loading capacity of the digesters would need to be verified through stress testing. Of the two factors, the hydraulic retention time is more limiting. Utilization is projected to reach 85% capacity in 2037 (at which time an additional digester is planned (Figure 3-19). The capacity rating reflects operation with one digester held in reserve to provide storage and/or secondary digestion.

Figure 3-19. Digester System Capacity Projection

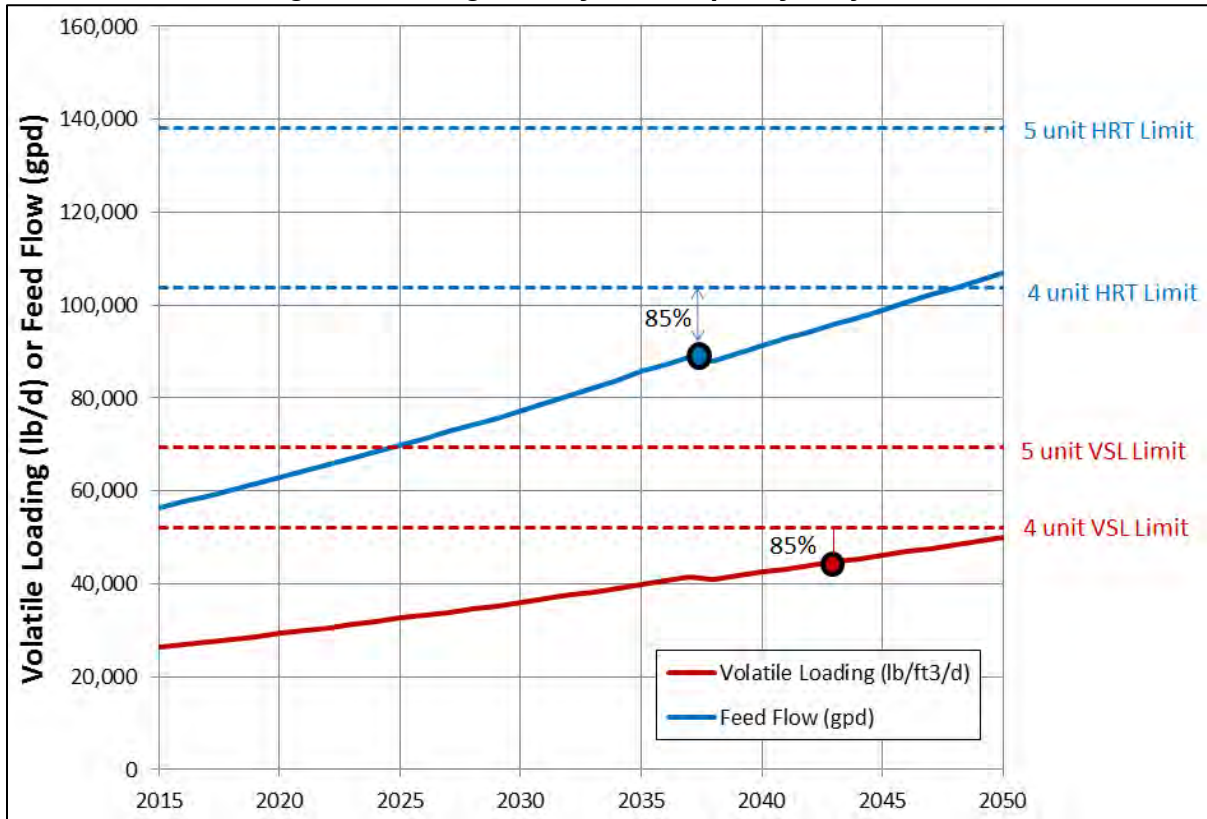


Table 3-19 below summarizes the digester loading projections and capacity.

Table 3-19. Digester System Capacity Summary

Table 3-20: Digester System Capacity Summary							
Parameter	Units	Observed 2014	Projection				
		2015	2020	2030	2040	2050	
Digester Units							
Number		4	4	4	4	5	6
Diameter	ft	70	70	70	70	70	70
Depth	ft	30	30	30	30	30	30
Unit Volume	gal	863,652	863,652	863,652	863,652	863,652	863,652
Controlling Parameters for Capacity							
Hydraulic Retention Time	d	25	25	25	25	25	25
Volatile Solids Loading	lbVS/ft³/d	0.15	0.15	0.15	0.15	0.15	0.15
Capacity Related Assumptions							
Units held in reserve		1	1	1	1	1	1
Capacity averaging basis		Maximum Two-Week					
Capacity utilization basis		Utilization > 85%					
Feed sludge volatile solids ratio		86.7%	85.7%	85.7%	85.7%	85.7%	85.7%
Volatile solids reduction		63.2%	63.1%	63.1%	63.1%	63.1%	63.1%
Digested solids concentration		3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Projected Loadings (Maximum Two-Week)							
Flow	gpd	56,177	56,333	62,784	77,160	91,262	106,939
Total Solids	lb/d	28,000	30,422	33,907	41,670	49,286	57,752
Volatile Solids	lb/d	24,166	26,257	29,264	35,964	42,537	49,844
Projected Capacity Condition							
Hydraulic Retention Time	d	46.1	46.0	41.3	33.6	37.9	40.4
Volatile Solids Loading	lbVS/ft³/d	0.070	0.076	0.084	0.104	0.092	0.086
Projected Utilization							
Hydraulic Retention Time		54%	54%	61%	74%	66%	62%
Volatile Solids Loading		47%	51%	56%	69%	61%	58%

3.7.2 Completed and Planned Projects

The project to add the fifth Digester, estimated to occur in 2037, is triggered when the hydraulic retention time reduces to 29.7 days, representing 85% utilization of the existing digesters. Capacity planning for the digester system will be reevaluated in the future as biosolids disposal demands or requirements may change. A list of projects is included in Table 3-20.

Table 3-20. Completed and Planned Projects

On-line	Name	Cost/Estimate	Status	Description
2008	Digester Cover Repair	\$330,000	Completed	Replaced roofing system on digester covers
2011	Digester Recirculation Improvements	2,069,390	Completed	Replaced digester heating and circulation/mixing pumping systems
2013	Engine Generator Overhaul	\$71,137	Completed	30,000 hour service for the engine generator
2015	Boiler Upgrade	\$2,157,971	Completed	Replace 1980 boiler and upgrade controls
2020	Engine Generator Replacement	\$1,318,081	Future	Replace existing engine generator as it reaches end of useful life
2037	Budd Inlet Treatment Plant 5th Digester	\$17,400,000	Future	Adds a 5 th digester

3.7.3 Asset Management

A variety of mechanical equipment is involved in the operation of the digesters. Major equipment includes sludge transfer and recirculation pumps, gas circulating compressors, and sludge heat exchangers. This equipment is shown on Figure 3-18 and is summarized in Table 3-21.

Table 3-21. Existing Digester Equipment

System	Count	Unit Capacity	Motor	Date of Last Upgrade	Risk Score (1-6)
Sludge Transfer Pumps	3	250 gpm	10 hp	1999	3
Sludge Recirculation Pumps	5	310 gpm	10 hp	2011	2
Gas Circulating Compressors	5	180 scfm at 25 psig	20 hp	2002	3
Sludge Heat Exchangers	5	1,500 mbtu/hr	NA	2011	2
Engine Generator	1	335kW	NA	2013	1

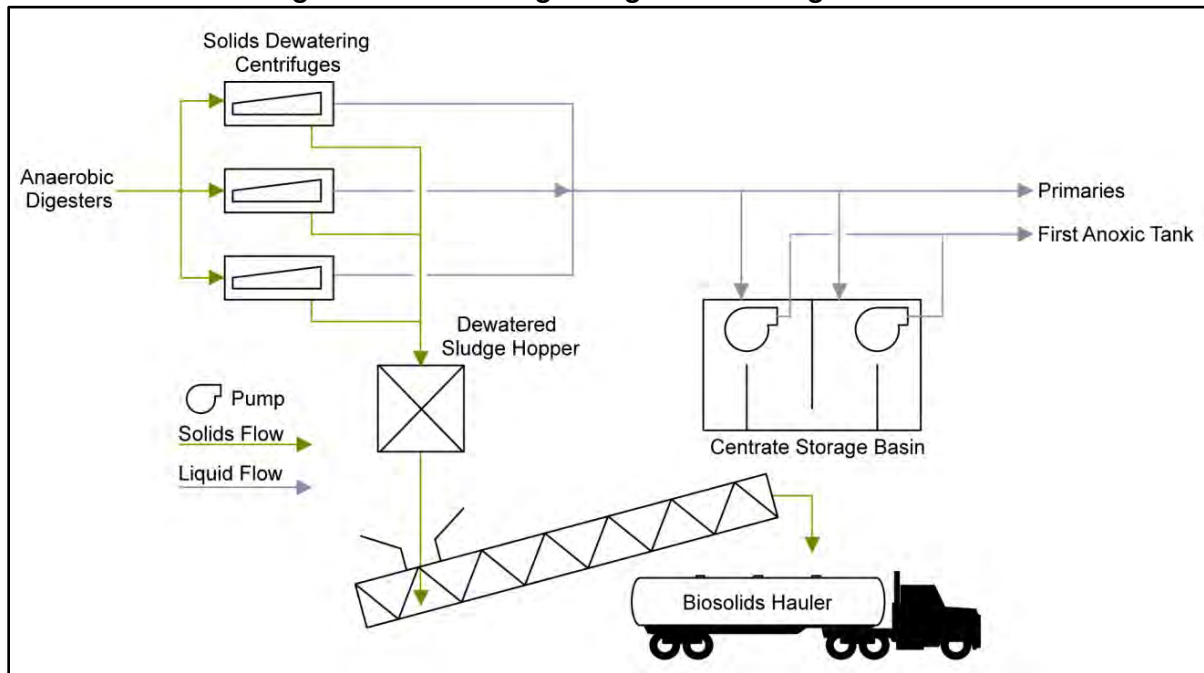
3.8 Sludge Dewatering

The solids dewatering process removes excess moisture from anaerobically digested sludge (2-3% solids) to create biosolids (20-24% solids) and thereby reduces land application hauling costs. Solids dewatering equipment consists of three centrifuges, dewatered sludge conveyance equipment, and loading facilities for sludge hauling trucks. All solids dewatering equipment is contained in the solids handling building. Foul air from the centrifuges and solids handling building is exhausted to the odor control system.



The sludge transfer pumps in the digester equipment building convey anaerobically digested sludge to the centrifuges. LOTT is currently upgrading the dewatering system by installing two new centrifuges. The new units, which operate in duty/standby mode, have a hydraulic capacity of 250 gpm, and a loading capacity of 3,500 lb/hr. The units are typically operated one shift per day, but at the peak loading condition may be operated up to 77 hours per week.

Figure 3-20. Existing Sludge Dewatering Process



Polymer is used to improve dewatering performance. Dewatered biosolids are discharged from the centrifuges into a screw auger conveyor and transferred to the biosolids hauling trucks for land application.

Effluent from the centrifuges (centrate) drains to the headworks, or it can be directed to a centrate storage basin. One of the spare primary sedimentation basins can be used as a centrate storage basin to equalize ammonia loads to the treatment process.

Two truck and trailer combination sets capable of hauling over 30 tons each are alternatively used to transport biosolids to contracted land application sites. One 37-foot end-dump trailer with a capacity of 26 tons is used on a standby basis during times of increased production. The trucks and trailers are all equipped with heavy-duty tarping systems and watertight tailgates to reduce odors and eliminate spillage. Depending on dewatering efficiency, 250 to 350 truckloads of biosolids are delivered for application every year.

3.8.1 Capacity Analysis

The upgraded system has capacity to treat peak loads through 2040. If needed, the system could be operated more than 77 hours per week. Figure 3-21 presents projected system loadings through facility build-out.

Figure 3-21. Sludge Dewatering Capacity Projection

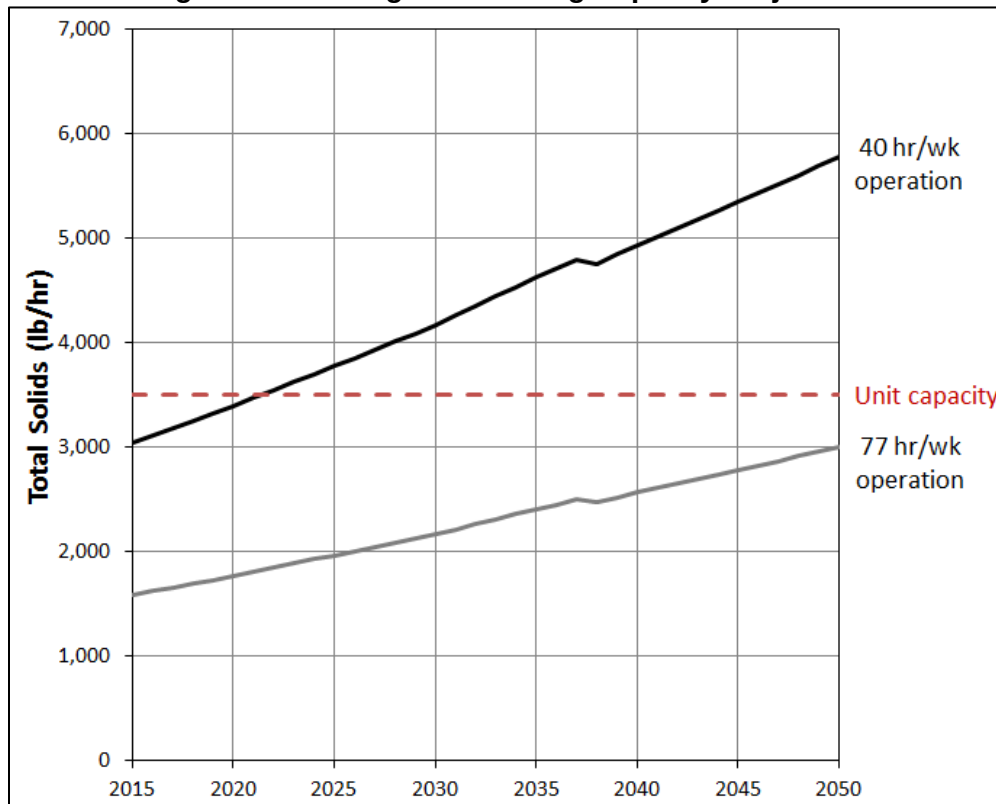


Table 3-22 below provides a summary of the capacity analysis and assumptions for the sludge dewatering system.

Table 3-22. Sludge Dewatering System Capacity Summary

Parameter	Units	Observed 2014	Projection				
			2015	2020	2030	2040	2050
Infrastructure Characteristics							
Centrifuges							
Existing Sharples (backup)		2	0	0	0	0	0
Existing Humboldt (250 gpm)		1	1	1	1	1	1
Planned (333 gpm)		0	1	1	1	1	1
Controlling Parameters for Capacity							
Hydraulic loading	gpm	250	333	333	333	333	333
Capacity Related Assumptions							
Units held in reserve		2	1	1	1	1	1
Capacity averaging basis			Peak Two-Week				
Capacity utilization basis			Utilization > 100%				
Operational schedule			Single-shift (8 hr/d, 7 d/wk)				
Projected Loadings (Peak Two-Week)							
Digested sludge flow	gpm	48	48	53	65	77	91
Projected Utilization							
Hydraulic loading		57%	43%	48%	59%	70%	82%

3.8.2 Completed and Planned Projects

No capital projects are planned after the ongoing upgrade project.

Table 3-23. Completed and Planned Sludge Dewatering Projects

On-line	Name	Cost/Estimate	Status	Description
2017	Sludge Dewatering System Upgrade	\$10,932,502	Design	Project to replace three existing centrifuges with two new units, replace the polymer feed units, screw conveyors, and motor control centers

3.8.3 Asset Management

A variety of mechanical equipment is involved in the operation of the sludge dewatering system. Major equipment includes the sludge transfer pumps, centrifuges, polymer mixing and feed system, and dewatered sludge conveyors. The equipment proposed in the 60% design is summarized in Table 3-24 below.

Table 3-24. Proposed Sludge Dewatering Equipment (60% Design)

System	Count	Unit capacity	Motor	Date of last upgrade	Risk Score (1-6)
Centrifuges	2	3,500 lb-TS/hr	150hp	2015	1
Transfers Conveyors	2	variable	5 hp	2015	1
Inclined Conveyors	2	variable	5 hp	2015	1
Sludge Grider	2	variable	5 hp	2015	1
Polymer Mixing Tank	2	variable	3 hp	2015	1

3.9 Ongoing and Planned Projects Overview

As described in the previous sections, a number of projects are either planned or currently underway to address anticipated capacity limitations. The following highlights some of the major upcoming projects. For a comprehensive list of planned projects, refer to the 2015 Budget and Capital Improvements Plan.

- Secondary clarification limits will be addressed through an expected improvement in mixed liquor settleability to be brought about through the upcoming process improvements project. Projected limitations in 2045 may be addressed through enhanced primary sedimentation using chemicals, expansion of treatment at the Martin Way RWP, or additional clarification at the BITP.
- Sludge dewatering limitations are being addressed with the current sludge dewatering system upgrade project. Once complete, the dewatering system will have capacity through service area build-out.
- A process improvements project is currently being evaluated to redesign the treatment plant's aeration basins and secondary process configuration. This project is envisioned to improve mixed liquor settleability, increase operational flexibility, free-up space at the plant site, reduce power consumption, improve nutrient removal capabilities, and make the plant less susceptible to changes in influent loading. This project should include a blower upgrade, and resolve the aeration system limitations previously noted.

- A North Outfall upgrade project is planned to deal with the hydraulic limitation caused by pressure limitations in the outfall pipeline (2047). Outfall capacity will also be influenced by increased reclaimed water production and uses, including groundwater recharge.
- Disinfection capacity will be addressed by installing ultraviolet equipment in the seventh channel currently scheduled for 2041.
- Projects to investigate digestion processes are planned to coincide with noted limitations in the digesters (2037). Ultimately, LOTT may produce Class A Biosolids at the treatment plant. This will be evaluated in future planning efforts.
- With commercial development planned for the neighborhood surrounding the plant, a project to further reduce odors is planned for 2022. This project would involve replacing the existing north odor scrubber with a new facility.

4. Discharge Capacity

All of the flow generated within the LOTT system must ultimately be discharged or beneficially used. Wastewater discharge/use capacity for the LOTT system is currently available at the Budd Inlet Treatment Plant (marine discharge to Budd Inlet) and the Hawks Prairie Reclaimed Water Ponds/Recharge Basins. LOTT will continue to investigate and purchase land suitable for infiltration to meet build-out condition requirements.

Reclaimed water produced at the Budd Inlet Reclaimed Water Plant and the Martin Way Reclaimed Water Plant is also available for distribution to the cities of Olympia and Lacey, and their water customers. However, for planning purposes, purveyed Class A Reclaimed Water will not be included in the analysis of the LOTT system discharge capacity as it cannot be assumed that these uses will be consistently available.

4.1 Budd Inlet Outfall Permit Limitations

With the issuance of the most recent National Pollutant Discharge Elimination System (NPDES) Permit, discharge limitations to Budd Inlet are now based on both concentration as well as loadings (pounds per day). Primary loading limitations include biological oxygen demand (BOD), total suspended solids (TSS), and total inorganic nitrogen (TIN). Following a one year transition period, the final effluent limitations took effect on October 1, 2011, and extend through September 30, 2016. Table 4-1 lists the loadings-based permit limitations.

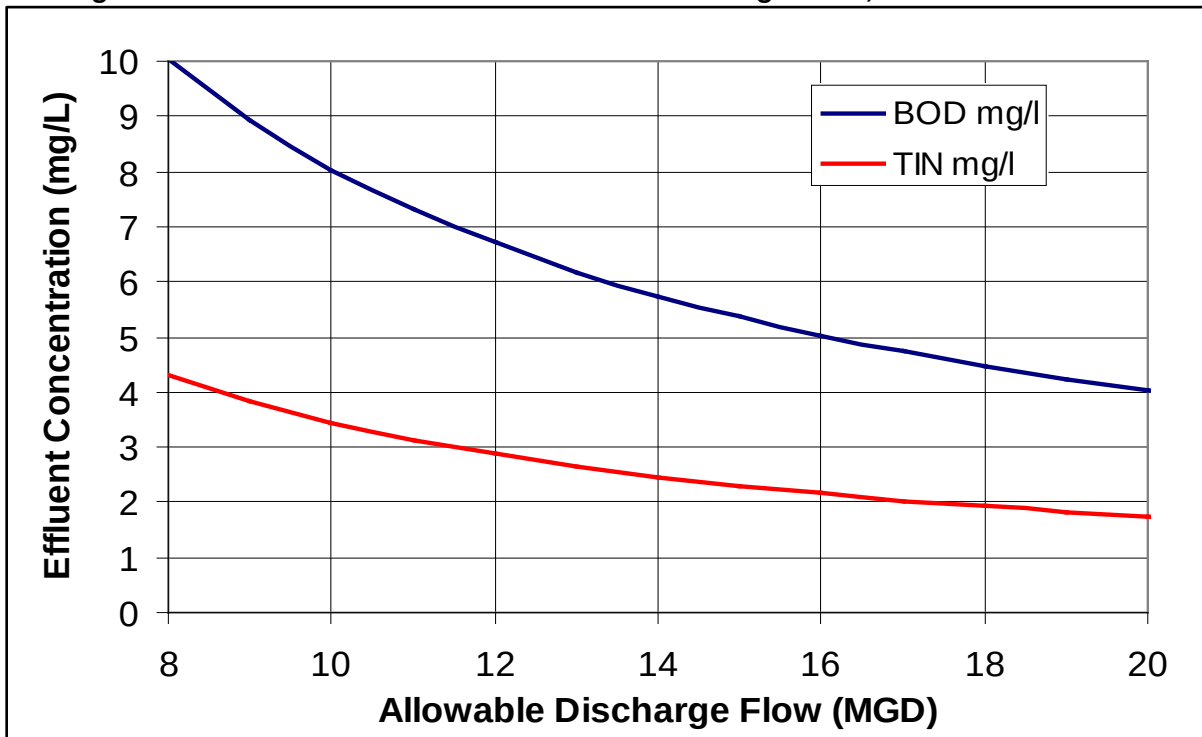
Table 4-1. Budd Inlet Treatment Plant NPDES Discharge Limits (lbs/d)

Parameter	Winter		Shoulder		Summer	
	(November-March)		(April, May, and October)		(June-September)	
	Monthly	Weekly	Monthly	Weekly	Monthly	Weekly
BOD (lbs/day)	5,640	8,460	900	1,350	671	1,006
TSS (lbs/day)	5,265	7,898	5,265	7,898	5,265	7,898
TIN	-	-	3 mg/L, 338 lbs/day		3 mg/L, 288 lbs/day	
Ammonia (as N)	26 mg/L	36 mg/L				

The amount of allowable flow to be discharged to Budd Inlet is now based on the level to which the wastewater is treated. By treating wastewater to lower effluent concentrations of BOD and TIN, greater discharge capacity can be achieved.

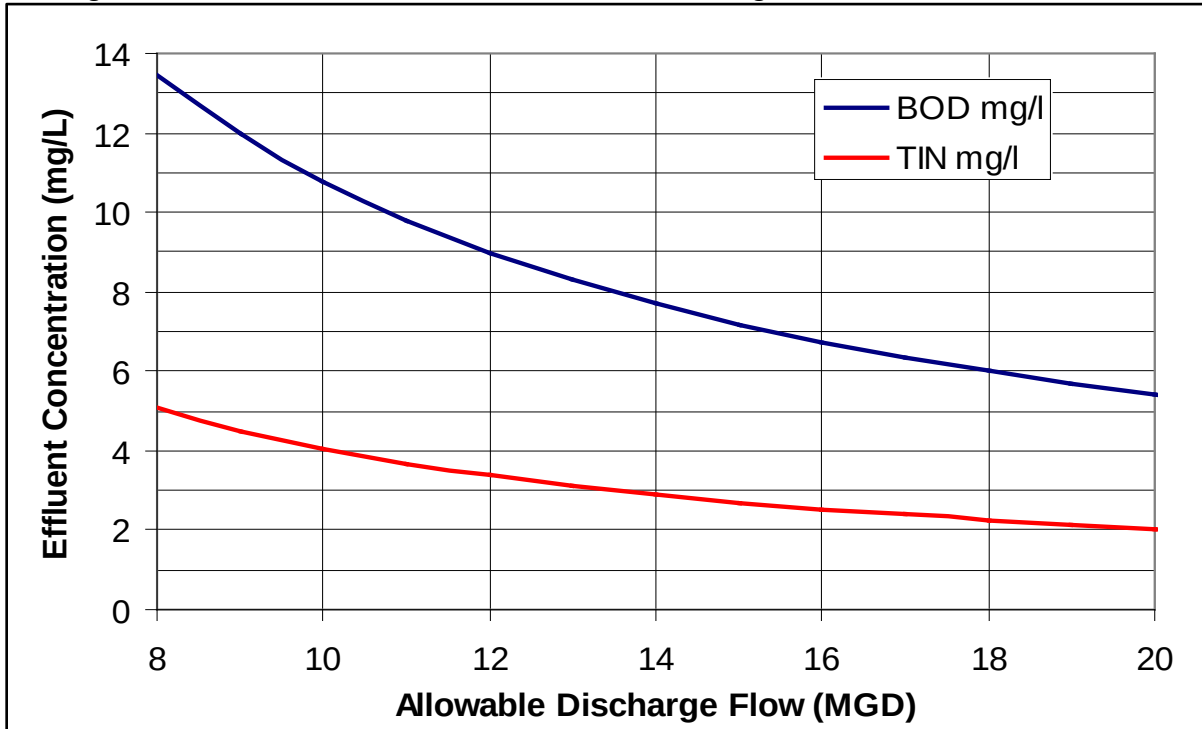
The two primary discharge limitations versus flow for the two seasonal conditions are plotted in Figures 4-1 and 4-2.

Figure 4-1. Effluent Concentration versus Discharge Flow, Summer Condition



The allowable discharge is:
 $\text{mgd} = 671 \text{ lbs/d BOD} \div x \text{ mg/L BOD} \div 8.34$ (based on BOD)
 $\text{mgd} = 288 \text{ lbs/d TIN} \div x \text{ mg/L TIN} \div 8.34$ (based on TIN)

Figure 4-2. Effluent Concentration versus Discharge Flow, Shoulder Condition



The allowable discharge is:
 $\text{mgd} = 900 \text{ lbs/d BOD} \div x \text{ mg/L BOD} \div 8.34$ (based on BOD)
 $\text{mgd} = 338 \text{ lbs/d TIN} \div x \text{ mg/L TIN} \div 8.34$ (based on TIN)

4.2 Budd Inlet Treatment Plant Process Improvements

LOTT is currently evaluating options to upgrade its secondary biological treatment system. The existing biological nutrient removal process requires recirculation of treated water between two process areas in the plant. The proposed improvements could reconfigure the existing process. Potential benefits include reducing recycle-pumping rates, increasing process control, and freeing up valuable space on the plant site for additional treatment processes in the future. LOTT is currently in the predesign phase to solidify the project scope.

Until the design process is completed and a better understanding of the potential impact on the treatment process is established, only a preliminary analysis may be performed on projected discharge capacity at the Budd Inlet Treatment Plant.

The current NPDES permit, issued by the Washington State Department of Ecology in 2011, is based on loadings (pounds per day) of biological oxygen demand (BOD) and nutrients in the form of total inorganic nitrogen (TIN). By increasing the efficiency of the treatment process (lowering the effluent loadings concentration), LOTT could potentially regain discharge capacity to Budd Inlet and/or prepare for potentially more stringent permit limitations as a result of the pending Total Maximum Daily Load process.

For this analysis, performance targets were established for both BOD and TIN in the summer and shoulder compliance periods. These targets are based on past performance, Table 4-2 lists target values reflecting the NPDES permit (concentration-based limits), the average and maximum seasonal values in the year, and projected effluent concentration goals for the process improvements project.

Table 4-2. Budd Inlet Treatment Plant Final Effluent Levels (mg/L)

Parameter/Season	Permit Limits	Average 2014-15	Maximum Month 2014-15	Seasonal Average Goal
TIN mg/L				
Summer	3	1.82	2.14	2.25
Shoulder	3	3.02	7.22	2.25
BOD mg/L				
Summer	7	2.60	3.65	5
Shoulder	8	4.58	12.15	5
Winter	30	4.64	9.88	10
TSS mg/L				
Winter	30	4.76	8.24	10

By achieving the effluent goals, the following Budd Inlet Treatment Plant discharge levels to Budd Inlet could be achieved:

- Summer – 15.34 mgd
- Shoulder – 18.00 mgd
- Winter – 63.09 mgd (superseded by permitted maximum month flow of 28 mgd)

A plot of the 2014 and 2015 monthly average data is provided on Figures 4-3 and 4-4. The plant has met BOD regulations throughout this period, except during the month of April 2014 when the effluent BOD reached 12.15 mg/L, higher than the limit of 8.0 mg/L. Effluent TIN has likewise been lower than permit and target concentrations, with the exception of April and May, 2014. During the spring of 2014, the Plant experienced what appears to have

been a toxic event, which temporarily neutralized the nitrifying community, and may have impaired mixed liquor settleability.

Figure 4-3. Monthly Final Effluent BOD Compared to Target

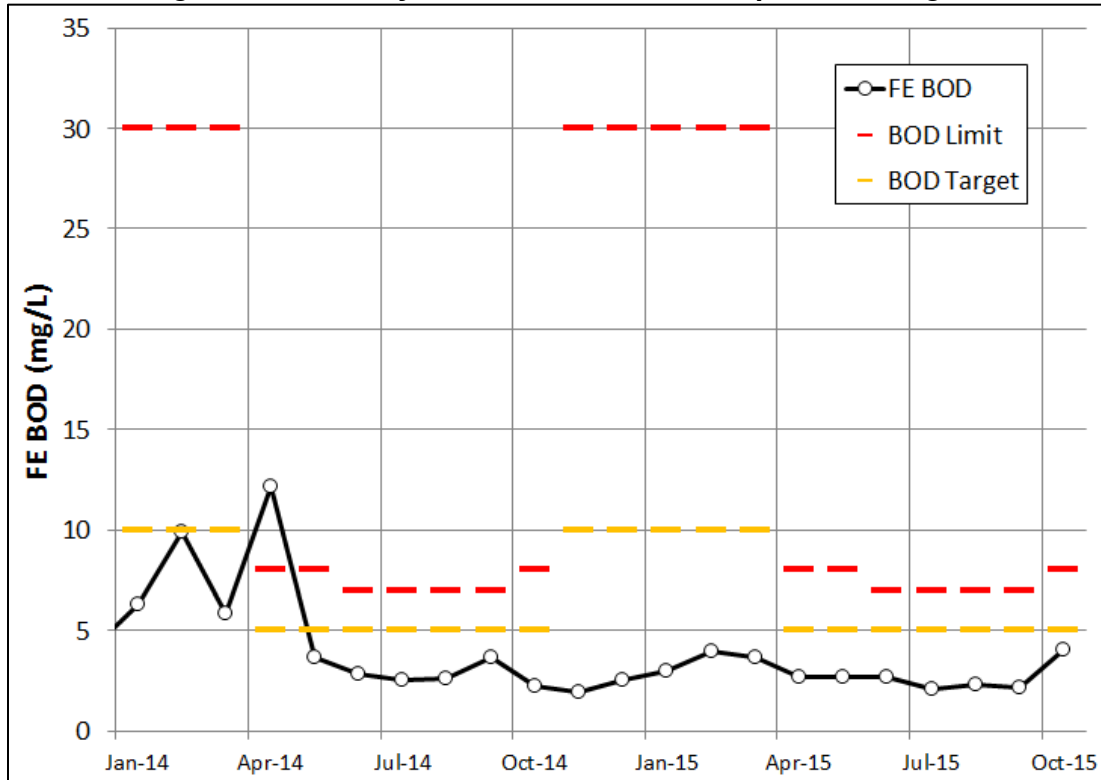
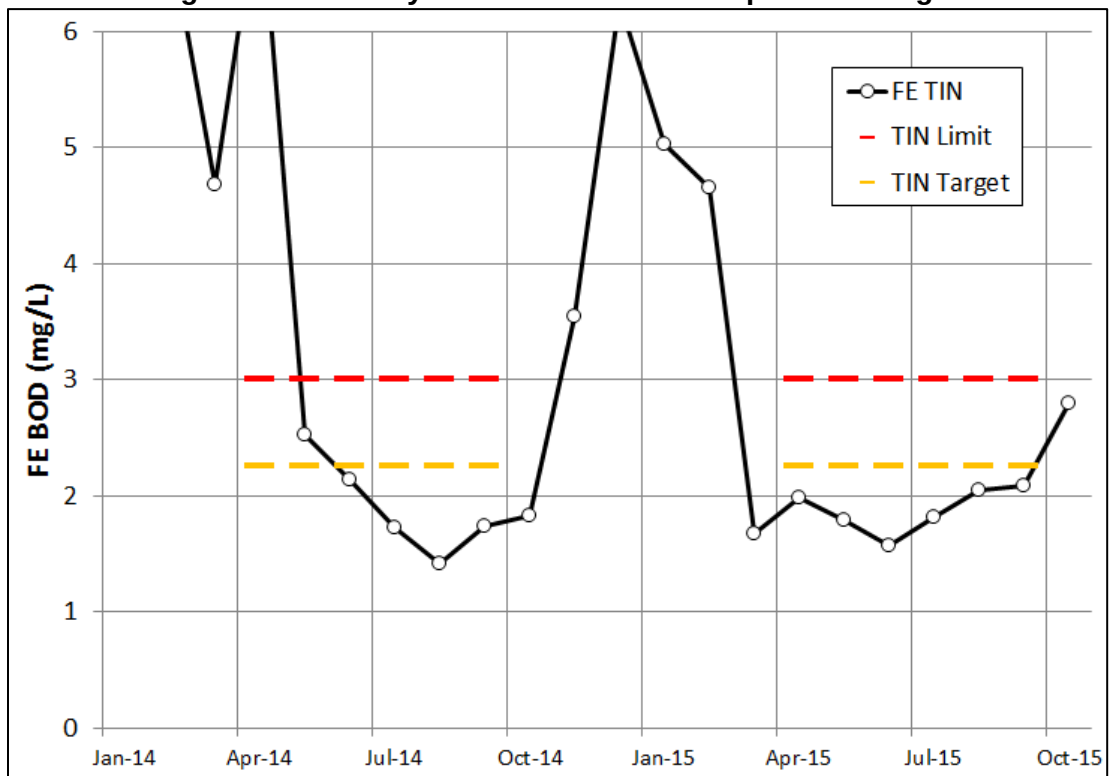


Figure 4-4. Monthly Final Effluent TIN Compared to Target

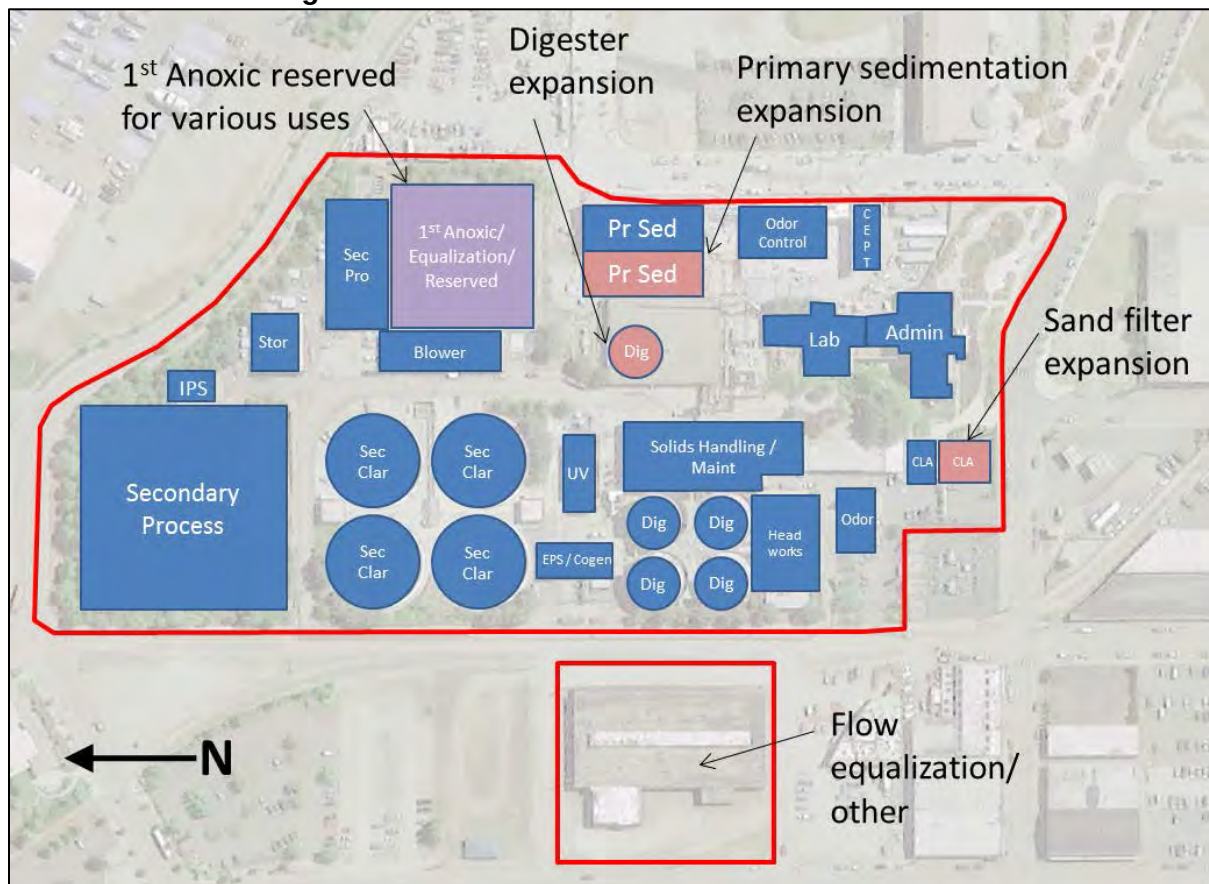


In addition to the NPDES permit limitations, LOTT reserves 1.5 mgd of treatment capacity as an added measure of safety in measuring operational capacity. This serves two purposes: 1) It allows for additional operational flexibility during peak flow events, minimizing the likelihood of a permit violation; and 2) protects the system from unforeseeable rapid population growth and/or delays in the construction of new treatment capacity.

4.3 Budd Inlet Treatment Plant Site Planning

A long term site plan for the plant is presented on Figure 4-5. This figure shows some of the larger projects discussed in the previous section, including an expansion of the digesters, primary sedimentation basins and the Budd Inlet Reclaimed Water Plant.

Figure 4-5. Budd Inlet Treatment Plant Site Plan



LOTT has recently purchased a property to the west of the treatment plant. This parcel could potentially be used for flow equalization, and its proximity to the Plant's headworks, digesters, and effluent pump station offers a number of other potential uses.

4.4 Budd Inlet Discharge Capacity Analysis

Based on the target effluent concentrations for both BOD and TIN (Table 4-2), analysis was performed to determine when the first operational discharge limitation would occur during average flow conditions for each of the compliance periods. This analysis assumes that 1.5 mgd of discharge capacity at the Budd Inlet Treatment Plant has been set aside as reserve

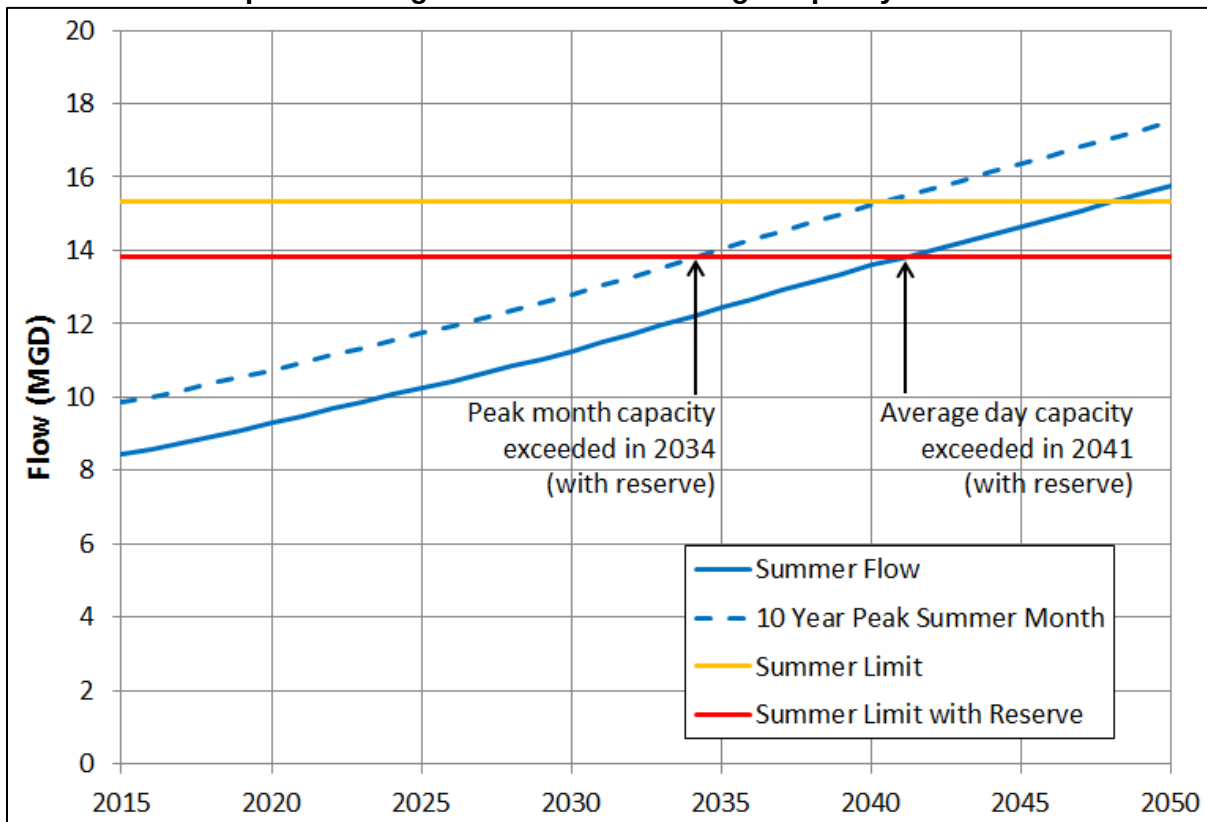
capacity. This analysis also takes into consideration the 2.0 mgd of discharge capacity currently available at the Hawks Prairie Ponds/Recharge Basins.

For the summer seasonal condition, the first limitation is anticipated to occur in 2034, when the 10-year peak summer month flow will exceed the discharge capacity (with reserve) of the BITP (Figure 4-6). This limitation is related to the effluent TIN load. The average summer flow will exceed the discharge capacity in 2041.

During the shoulder season, a TIN-related discharge limitation is projected to occur for peak month flow in 2035, and for average flow in 2044 (Figure 4-7).

This means that LOTT will need to expand its alternative discharge capacity beyond the 2.0 mgd currently used at the Hawks Prairie Ponds and Recharge Basins before 2034 under the most conservative planning approach (considering peak month flows and allowing for reserve capacity beyond peak flows).

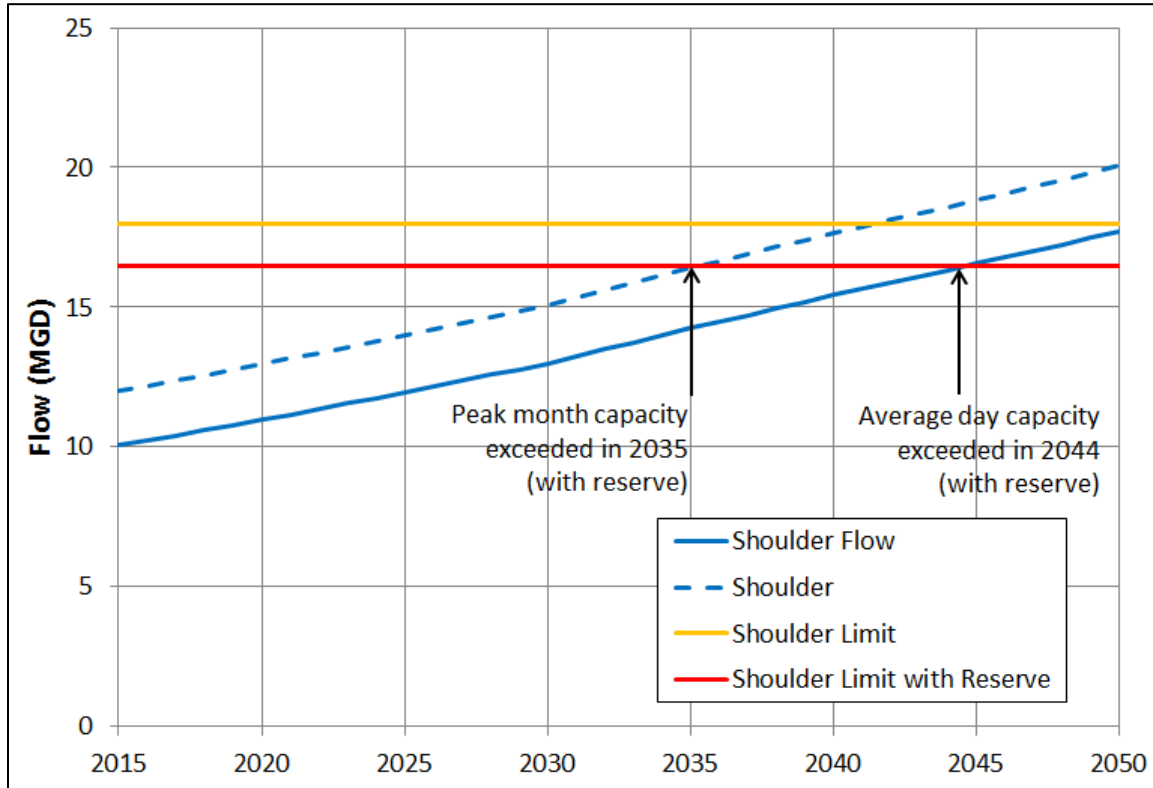
Figure 4-6. Summer Season Average and Peak Flow Projections and Anticipated Timing of Budd Inlet Discharge Capacity Limitation



Note: Assumes 2 mgd of flow treated at Martin Way Reclaimed Water Plant

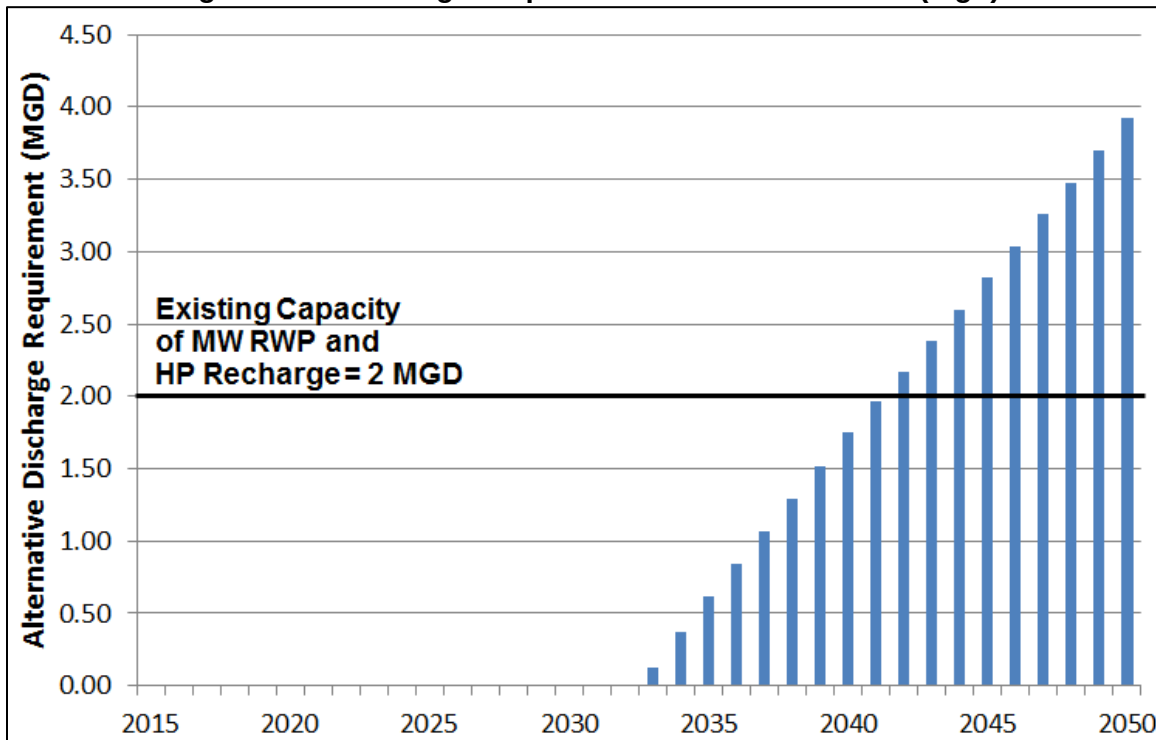
A more practical approach would be to allow the reserve capacity to mitigate the peak events, and project the need for alternative discharge based on average flow. This would shift the need for alternative discharge expansion to 2041. Figure 4-8 illustrates the total discharge capacity required outside of Budd Inlet, assuming the target BOD and TIN treatment concentrations, using the more practical approach.

Figure 4-7. Shoulder Season Average and Peak Flow Projections and Anticipated Timing of Budd Inlet Discharge Capacity Limitation



Note: Assumes 2 mgd of flow treated at Martin Way Reclaimed Water Plant

Figure 4-8. Discharge Required Outside of Budd Inlet (mgd)



Note: Allows for 1.5 mgd reserve capacity at the Budd Inlet Treatment Plant, average flows

4.5 Alternative Discharge Planning

There are several approaches to alternative discharge. These include the following:

- Non-potable reuse (NPR), which includes consumption of reclaimed water by end-users for irrigation or industrial uses
- Environmental uses, which include streamflow or surface water augmentation and wetland enhancement
- Indirect potable reuse (IPR), which includes:
 - o Groundwater recharge through soil percolation
 - o Direct injection to groundwater
- Direct potable reuse (DPR), which involves discharge to a potable water distribution system

Reclaimed water currently generated at the BIRWP and MWRWP is primarily used for irrigation, groundwater recharge, and streamflow augmentation.

In its capital program, LOTT has detailed plans to generate up to 6.0 mgd of alternative discharge by 2050, as required by its current NPDES permit and flow, load, and performance projections (Figure 4-8).

In order to effectively respond to changing regulations or demand, LOTT also has developed conceptual plans to generate up to 35 mgd of product which could be tailored to any of the alternative discharge categories listed above. This section provides a high-level summary of those conceptual plans.

4.5.1 Reclaimed Water Treatment

Existing treatment facilities include the BIRWP and the MWRWP. These sites generate Class A reclaimed water, suitable for NPR, environmental uses, and groundwater recharge.

The BIRWP may supply reclaimed water to the State Capitol Campus and other new end users within the Cities of Olympia and Tumwater. The new T Street Reservoir ensures reliable delivery to such users. Although Figure 4-8 projects that LOTT will not need to develop additional capacity for at least 20 years, anticipated demand for reclaimed water in this area has driven LOTT to push forward expansion of the BIRWP to 2022, when the facility is planned to expand to a total capacity of 3.0 mgd.

The MWRWP treats raw sewage generated in Lacey. Reclaimed water from this facility is primarily used for groundwater recharge at the Hawks Prairie Wetland Ponds and Groundwater Recharge Basins facility, and by the Cities of Lacey and Olympia for water rights mitigation through their Woodland Creek Groundwater Recharge Facility. The Plant is currently able to produce 2.0 mgd of reclaimed water, and the process basins are in place to expand capacity to 3.0 mgd with equipment installation. Further expansion to 5.0 mgd is programmed into the existing facility design. LOTT may ultimately expand the facility to 8.0 mgd if needed. Expansion is limited by flow availability, with the 3rd mgd projected to come online in 2038.

The Deschutes Valley Property (DVP) shown on Figure 2-5 has sufficient space to build a 2.0 mgd raw sewage treatment facility similar to the MWRWP plus a 20.0 mgd facility capable of receiving effluent from the BITP and generating any variety of NPR, IPR, or DPR product.

Table 4-3 summarizes existing, planned, and potential reclaimed water production facilities in the LOTT system.

Table 4-3. Reclaimed Water Production Sites

Facility	Product	Existing Capacity (mgd)	Planned Capacity in 2050 (mgd)	Potential Capacity (mgd)	Next Steps
Budd Inlet Reclaimed Water Plant	Class A	1.5	3.0	5.0	Expand to 3 mgd (2022)
Martin Way Reclaimed Water Plant	Class A	2.0	3.0	8.0	Expand to 3 mgd (2038)
Deschutes Valley Reclaimed Water Plant	Class A	0	0	2.0	Reserve space for future implementation, as needed
Deschutes Valley Advanced Water Plant	Capable of NPR, IPR, DPR, or environmental uses	0	0	20.0	Reserve space for future implementation, as needed
Total		3.5	6.0	35.0	

4.5.2 Alternative Discharge Locations

While LOTT prefers to direct its reclaimed water to end users for environmental or other beneficial uses, such discharge tends to be seasonal, and is subject to the needs of the end users. To ensure the capacity for adequate discharge, LOTT has plans to develop its own groundwater recharge locations. LOTT has purchased a number of properties with soil suitable for infiltration, and has plans to develop the pump stations and distribution network required to deliver product to these locations, as needed. Table 4-4 lists the existing and potential locations for groundwater infiltration of reclaimed water.

Table 4-4. Groundwater Infiltration Sites

Recharge Basin	Site Characterization Status	Current Capacity (mgd)	Planned Capacity in 2050 (mgd)	Potential Capacity (mgd)	Next Steps
Hawks Prairie	Complete	2.0	3.0	8.0	Expand to 3 mgd (2038)
Henderson South	10% Complete	0	0	10.0	Additional site characterization, groundwater modeling, permitting
Henderson North	25% Complete	0	3.0	3.0	Additional site characterization, groundwater modeling, permitting
Rixie Road	75% Complete	0	0	1.0	Additional site characterization, groundwater modeling, permitting
South Deschutes	50% Complete	0	0	10.0	Additional site characterization, groundwater modeling, permitting
Total		2.0	6.0	32.0	

4.5.3 Summary

The upcoming expansion of the BIRWP to 3.0 mgd, and the projected expansion of the MWRWP to 3.0 mgd in 2038 will allow LOTT to generate 6.0 mgd of reclaimed water. This exceeds the 4.0 mgd of alternative discharge capacity required per Figure 4-8, and allows LOTT to stay comfortably ahead of regulatory drivers for reclaimed water production. Figures 4-9 and 4-10 depict the projected treatment and discharge capacity against regulatory demands.

Figure 4-9. Treatment Capacity

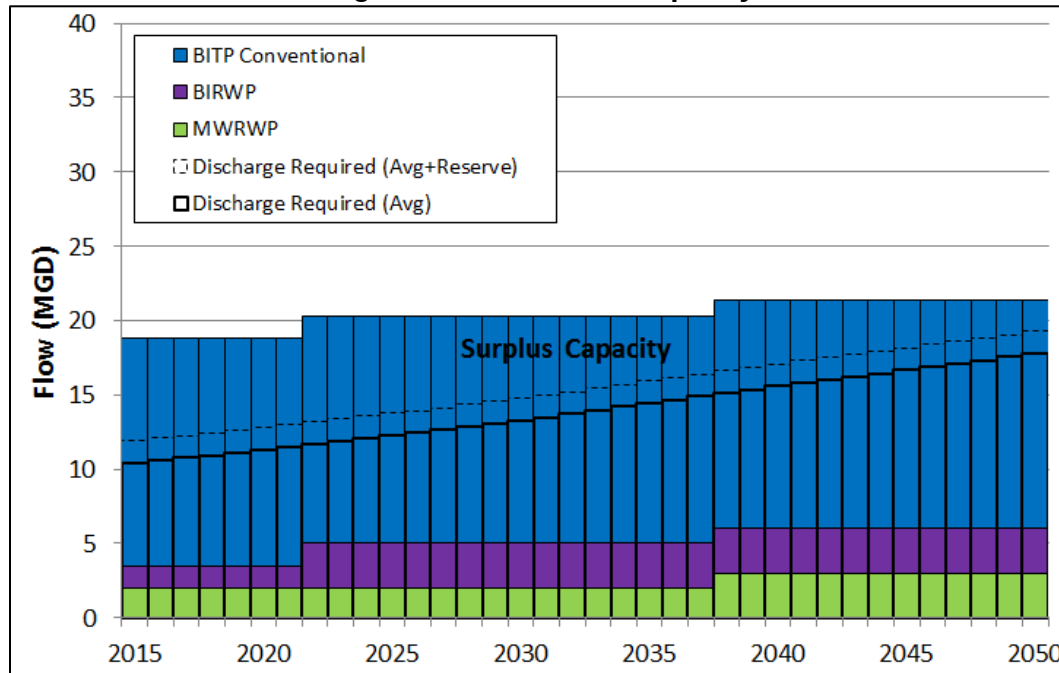
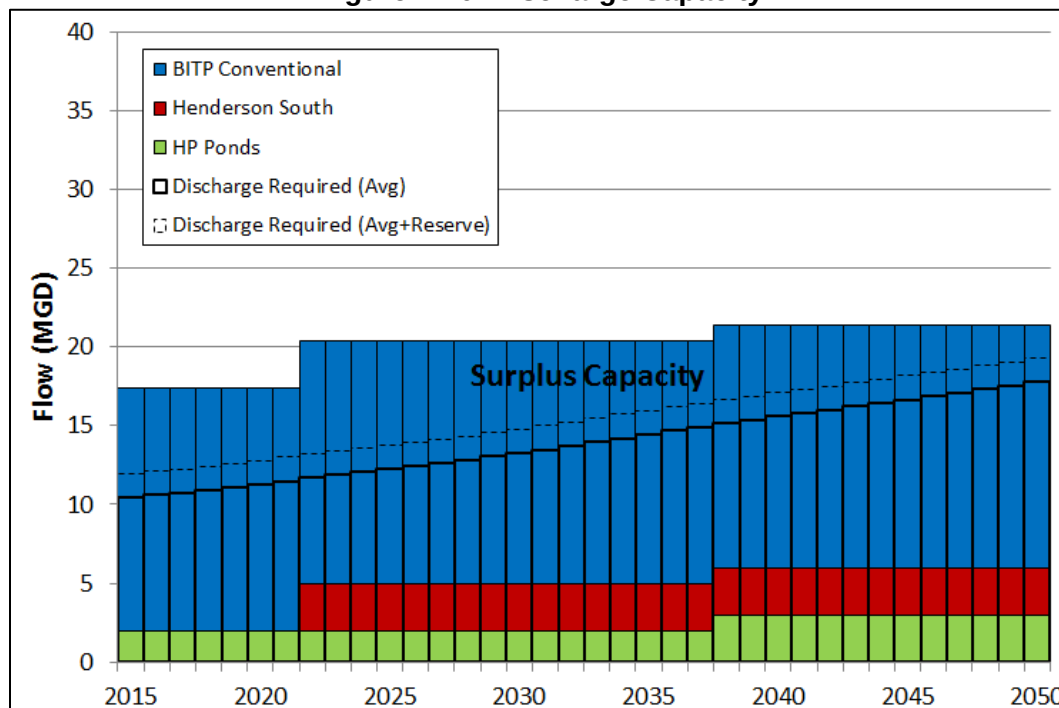


Figure 4-10. Discharge Capacity



Beyond the capacities depicted on Figures 4-9 and 4-10, LOTT has conceptual plans in place that would enable production and discharge of over 30.0 mgd of product water. The development of this capacity will be driven by end user demand, and regulatory changes.

5. Conveyance System Analysis

5.1 Model Description

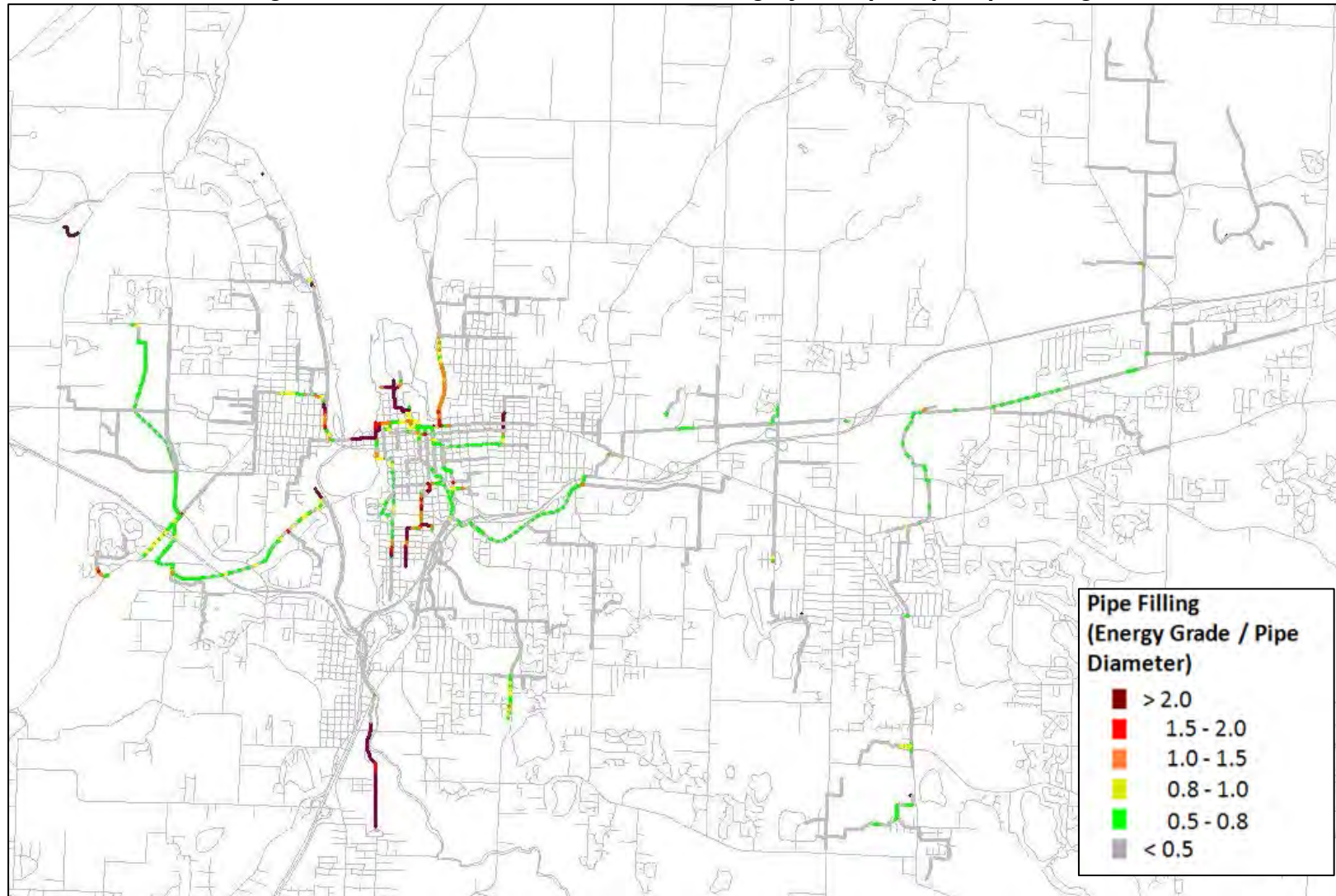
The LOTT sewer model includes all of the Olympia and Lacey pipes greater than 8-inch diameter, a number of key pipes of 8-inch diameter and smaller, and the Tumwater siphon pipeline running from Hixon Street into the LOTT Southern Connection. The model was designed to simulate a 10-year peak hour storm event, and was run at one 5-year and four 10-year time increments from 2015 through 2050. A summary of the model output as it relates to LOTT-owned pipe follows.

5.2 Model Scenarios Summary

The summaries in this section express capacity in terms of pipe filling. Pipe filling is defined as the energy grade level divided by the pipe diameter. A fully surcharged pipe will have a pipe filling ratio of 1.0, meaning it is 100 percent surcharged. A pipe filling ratio of 2.0 means that the pipe is full, and there are x-inches of pressure in the pipe, where x is the pipe diameter. An 8-inch pipe with a pipe filling ratio of 3.0 will flood laterals 16 inches above of the crown of the pipe. Pipe filling is a useful way to gauge the capacity of the sewer system, as surcharged pipes will act as bottlenecks, and will often result in a backwater effect upstream of the restriction. However, a pipe with a ratio of 2.0 or higher may be innocuous. For example, very deep pipes may carry a substantial surcharge, with little risk of flooding laterals due to the main's burial depth. In addition to pipe filling, the sewer model projects manhole depth-to-flooding, and pipeline profiles at maximum water levels will be presented later in this section.

5.2.1 Scenario 1: 2015 Ten Year Peak Hour Flow with 2 mgd of Diversion Flow to the MWRWP

Figure 5-1. 2015 Peak Hour Scenario Existing System (As-Is)—Pipe Filling



The as-is model simulates the current state of affairs as we know it, in regards to flows and pipe sizes that are represented in the geodatabase (Figure 5-1). Major issues identified within the existing system include the following:

- Heavy surcharging of Olympia pipeline along West Bay Drive and Olympic Way near the roundabout
- Surcharging and flooding of manholes along 4th Avenue between the bridge and the Water Street Pump Station
- Pipe surcharging of Olympia downtown pipes
- Surcharging of the Olympia pipes along Capitol Way South
- Heavy surcharging in the Tumwater Hixon Siphon

The surcharging in the Hixon siphon is intentional. This is a siphon pipe and is designed to run full. The identification of flooding on the 4th Avenue Bridge is a new finding, which seems related to a quirk in the I&I model which assigns excess flow to this basin. Actual flooding at this location has not been observed since the new 4th Avenue Bridge was built.

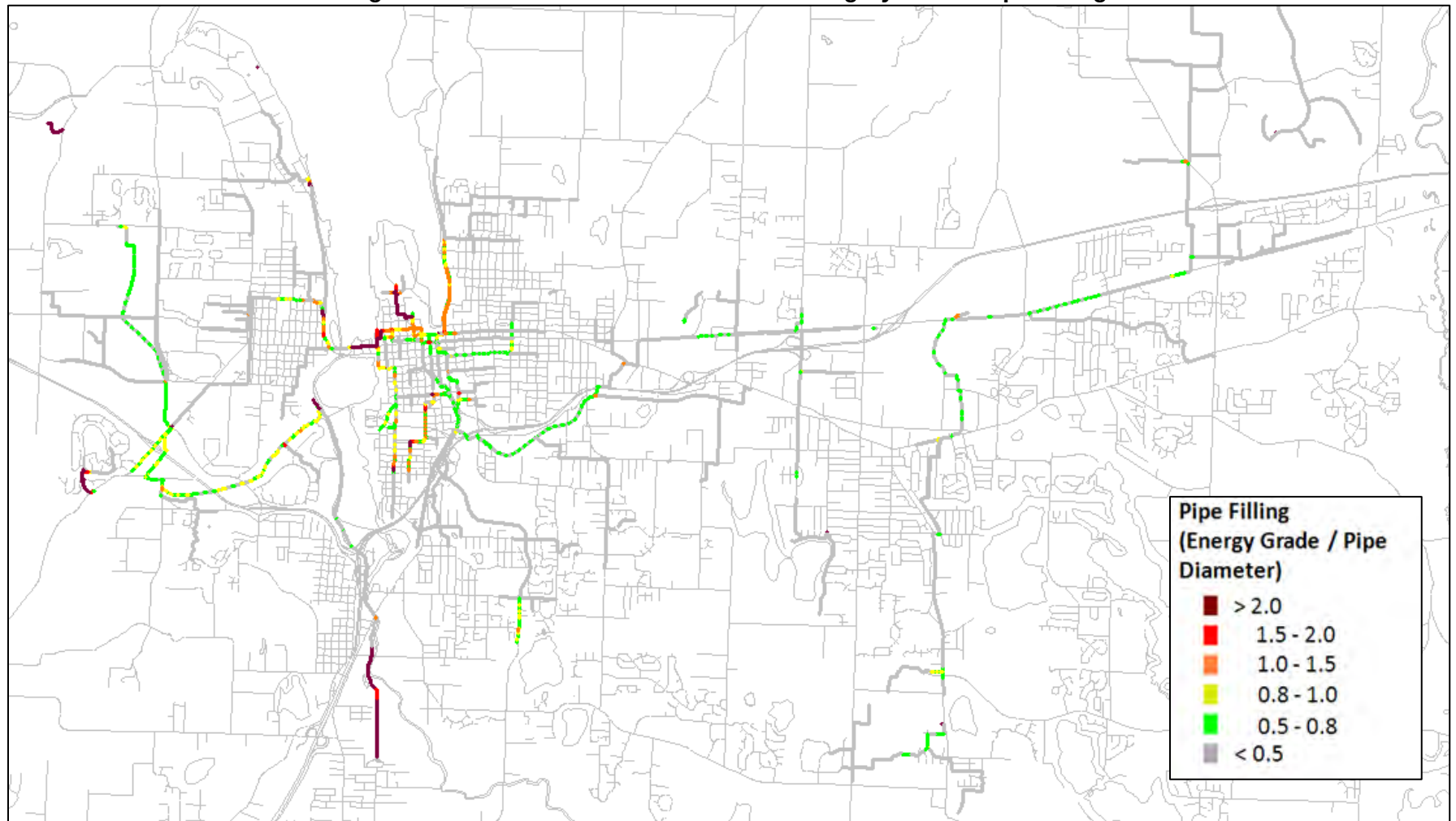
5.2.2 Scenario 2: 2015 Ten Year Peak Hour Flow with 2 mgd of Diversion Flow to MWRWP and West Bay, Downtown and South Olympia Bottlenecks Removed

In order to evaluate pipe capacity in the absence of flow-restricting bottlenecks, the 2015 case was re-run with those bottlenecks removed. Specifically, the following modifications were made to the sewer model:

- To alleviate flooding in the South Olympia area, the diameters of the pipes between manholes 510030 and 510027 along Capitol Way S between 19th and 21st and between manholes 539011 and 530022, parallel to the Capitol Way S bottleneck were increased from 10" to 12"
- To alleviate flooding on West Bay Drive near the roundabouts the diameter of three pipes were increased from 21" to 24", 18" to 21", and from 12" to 18".
- To alleviate the flooding in downtown Olympia, the diameter of the pipes between manholes 011018 and 011014 along Central Street NW between Thurston Avenue and 4th Avenue were increased from 12" to 18".

Figure 5-2 now shows the system with those bottleneck areas cleared.

Figure 5-2. 2015 Peak Hour Scenario Existing System —Pipe Filling

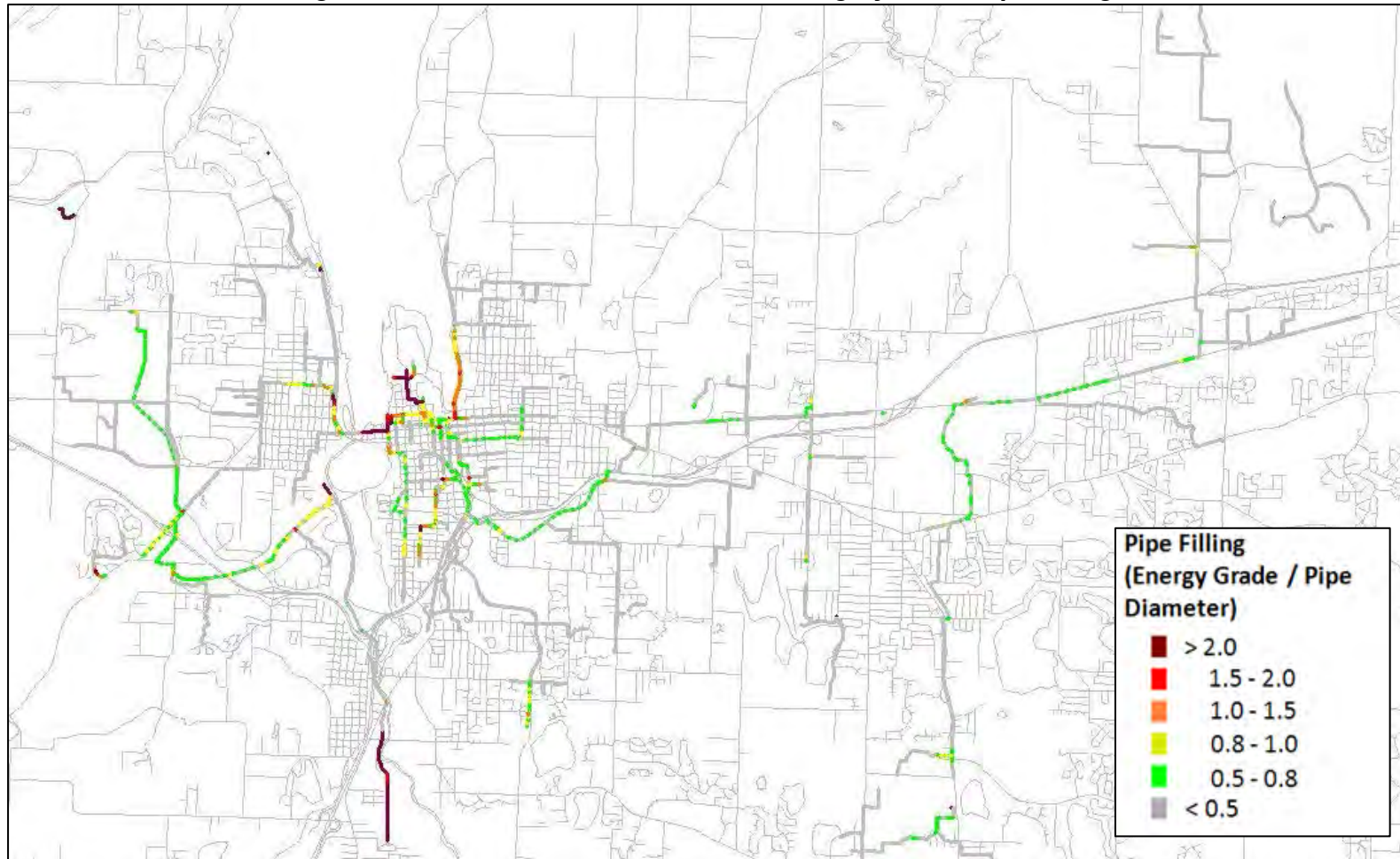


Removal of the bottlenecks has little impact on the capacity condition of downstream pipes.

5.2.3 Scenario 3: 2020 Ten Year Peak Hour Flow with 2 mgd of Diversion Flow to the MWRWP and with West Bay, Downtown and South Olympia Bottlenecks Removed

The 2020 scenario does not show major differences from the 2015 scenario with the bottlenecks removed. There is a slight increase in pipe filling in the eastern portion of the Martin Way Interceptor and in the eastern portion of the Indian Creek Interceptor.

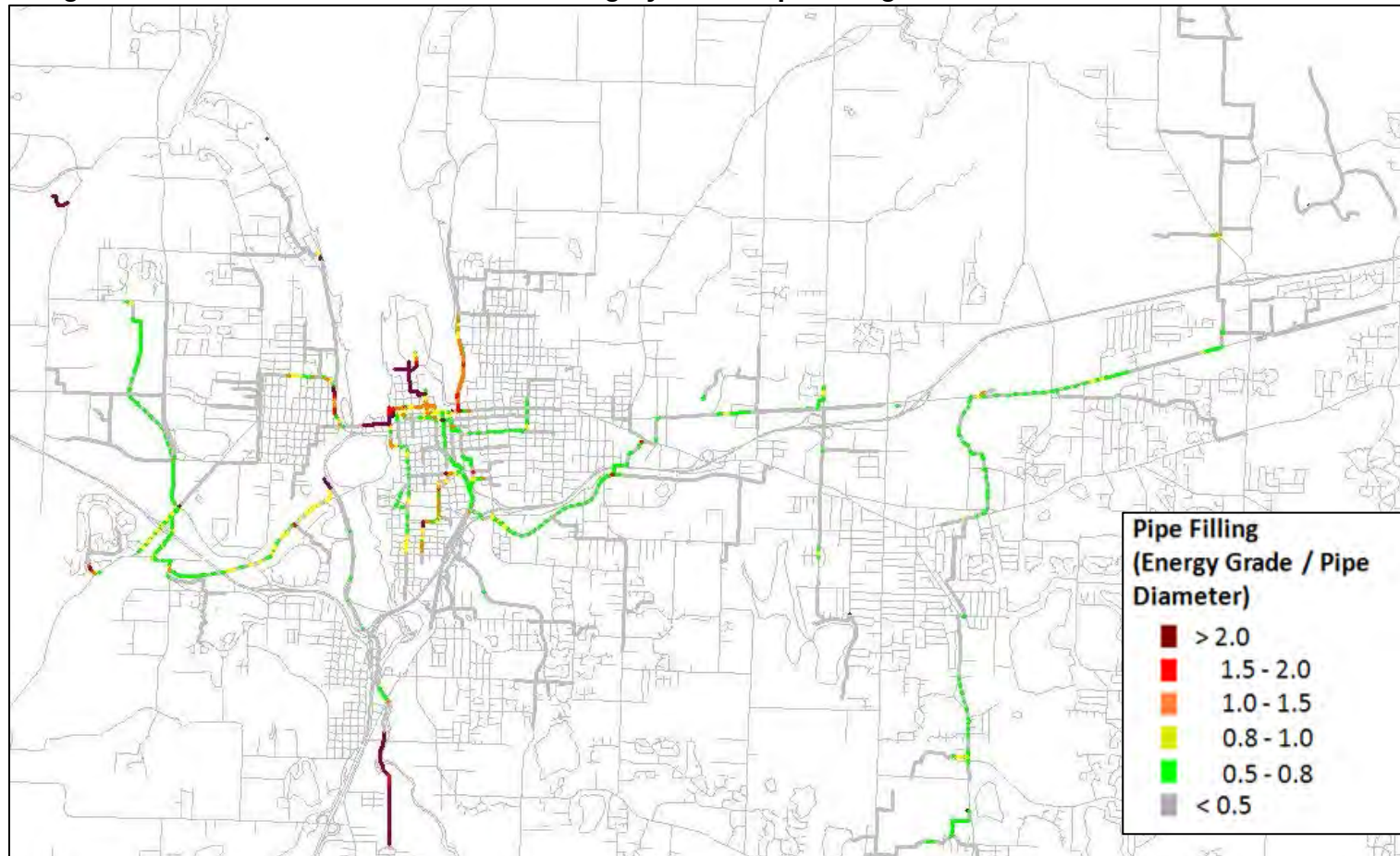
Figure 5-3. 2020 Peak Hour Scenario Existing System—Pipe Filling



5.2.4 Scenario 4: 2030 Ten Year Peak Hour Flow with 2 mgd of Diversion Flow to the MWRWP and West Bay, Downtown and South Olympia, and Henderson Bottlenecks Removed

By 2020 there was significant pipe filling in the Olympia pipes on South Henderson Blvd (Figure 5-4). To mitigate this issue in the 2030 model, the diameters of the pipes between manholes 450009 and 400031 were increased from 10" to 18". There is also pipe filling that exceeds 100% in the Olympia pipes along East Bay Drive.

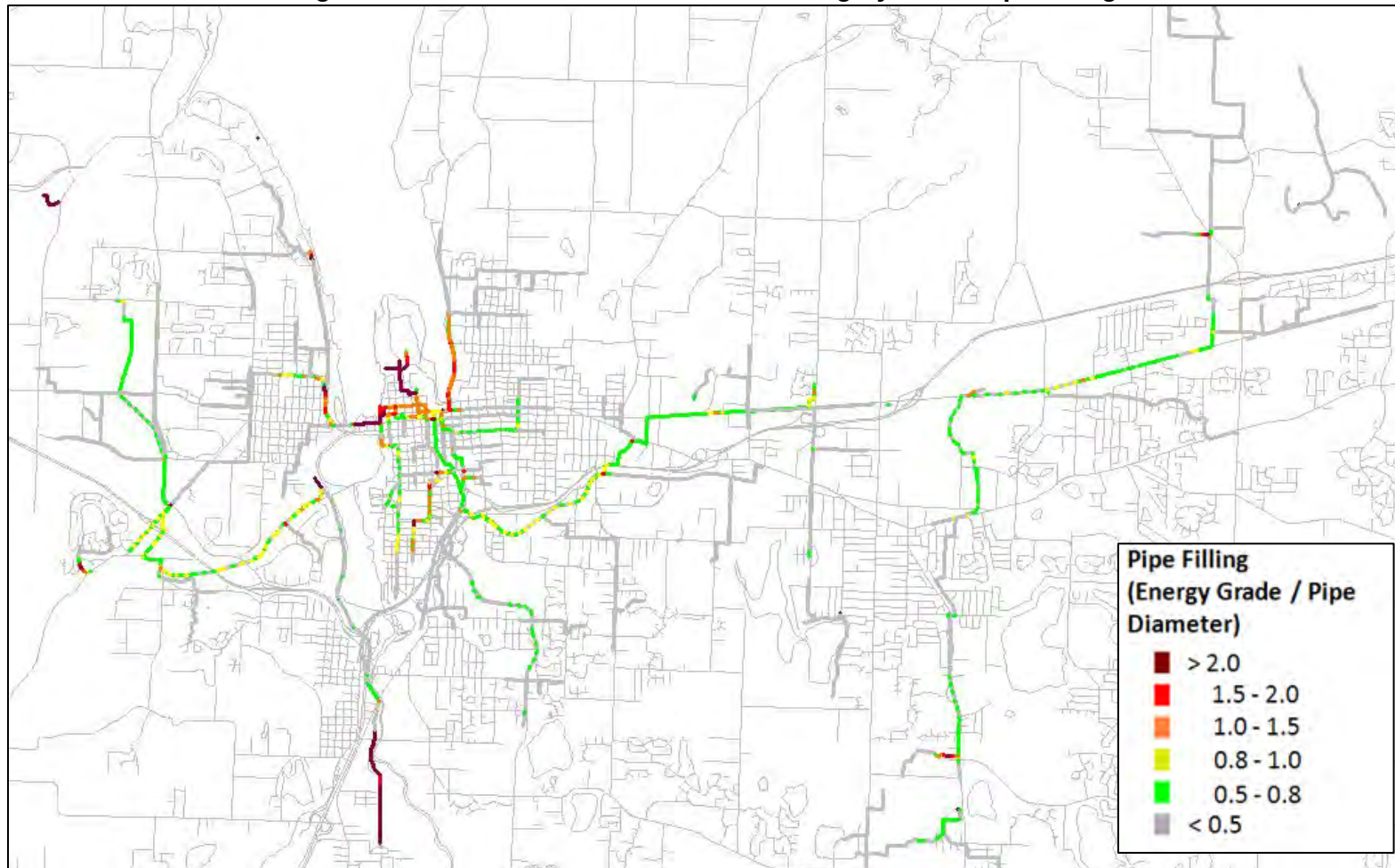
Figure 5-4. 2030 Peak Hour Scenario Existing System—Pipe Filling with Henderson Bottleneck Removed



5.2.5 Scenario 5: 2040 Ten Year Peak Hour Flow with 3 mgd of Diversion Flow to the MWRWP and West Bay, Downtown and South Olympia, and Henderson Bottlenecks Removed

The 2040 scenario does not show significant changes since 2030, other than the Martin Way East and Percival Creek Interceptors showing more pipes approaching the fully surcharged condition.

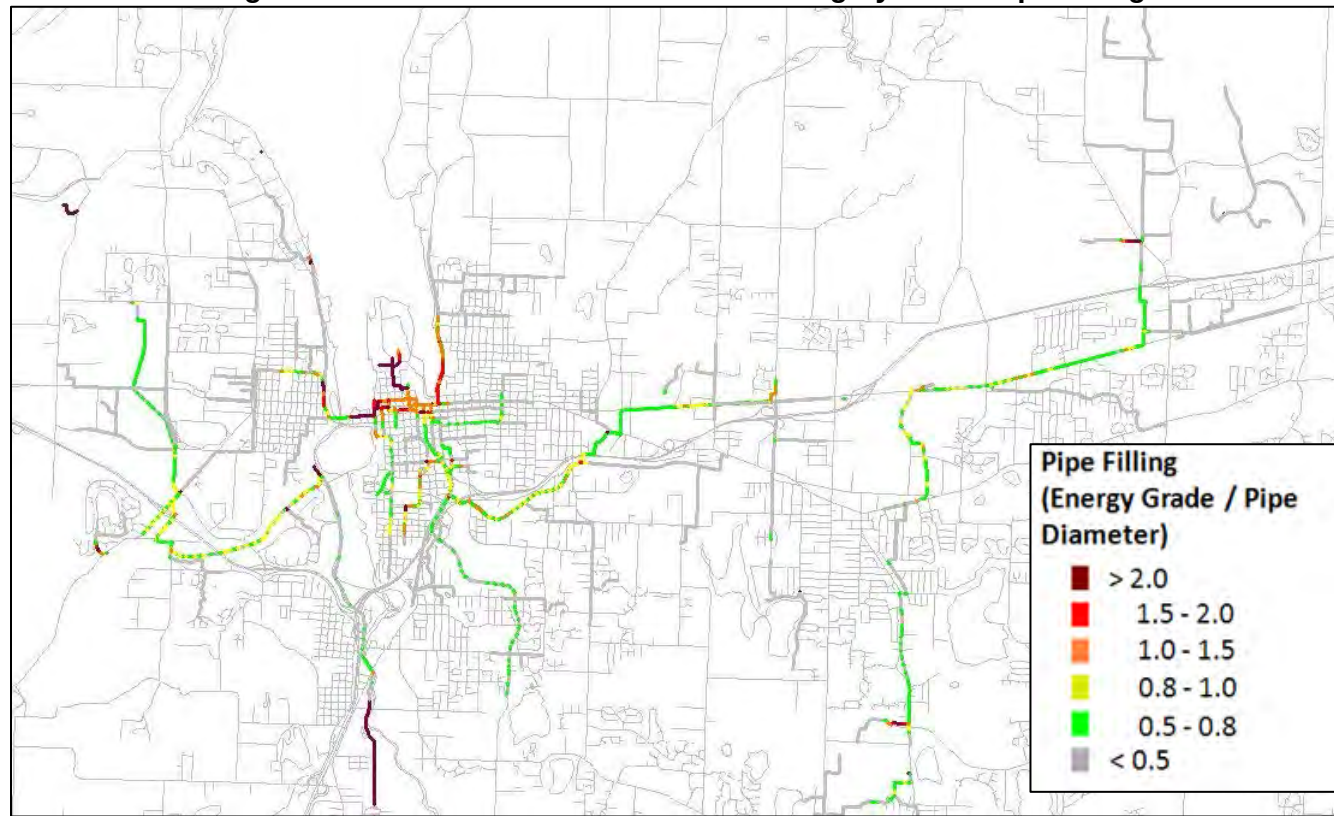
Figure 5-5. 2040 Peak Hour Scenario Existing System—Pipe Filling



5.2.6 Scenario 6: 2050 Ten Year Peak Hour Flow with 3 mgd of Diversion Flow to the MWRWP and West Bay, Downtown and South Olympia, and Henderson Bottlenecks Removed

The 2050 scenario shows increased pipe filling in the City of Lacey gravity line along Ruddell Road SE. The Martin Way, Percival Creek, and Indian Creek Interceptors are also filling beyond 100% in some areas. Pipe profiles of these interceptors are located in the following sections. Manhole 700018 is the shallowest manhole on the Percival Creek Interceptor and comes within roughly one foot of flooding under 2050 peak hour conditions. The increased surcharging in the Martin Way Interceptor will cause backwater effects in the City of Lacey pipes north of I-5. The pipes running east and west down 4th and State Avenues downtown are fully surcharged, with backwater effects extending from East Bay Drive south. Over the simulations, the Cooper Point Interceptor gradually became more surcharged, but never became greater than 80% surcharged.

Figure 5-6. 2050 Peak Hour Scenario Existing System—Pipe Filling



5.3 Existing Capacity Limits

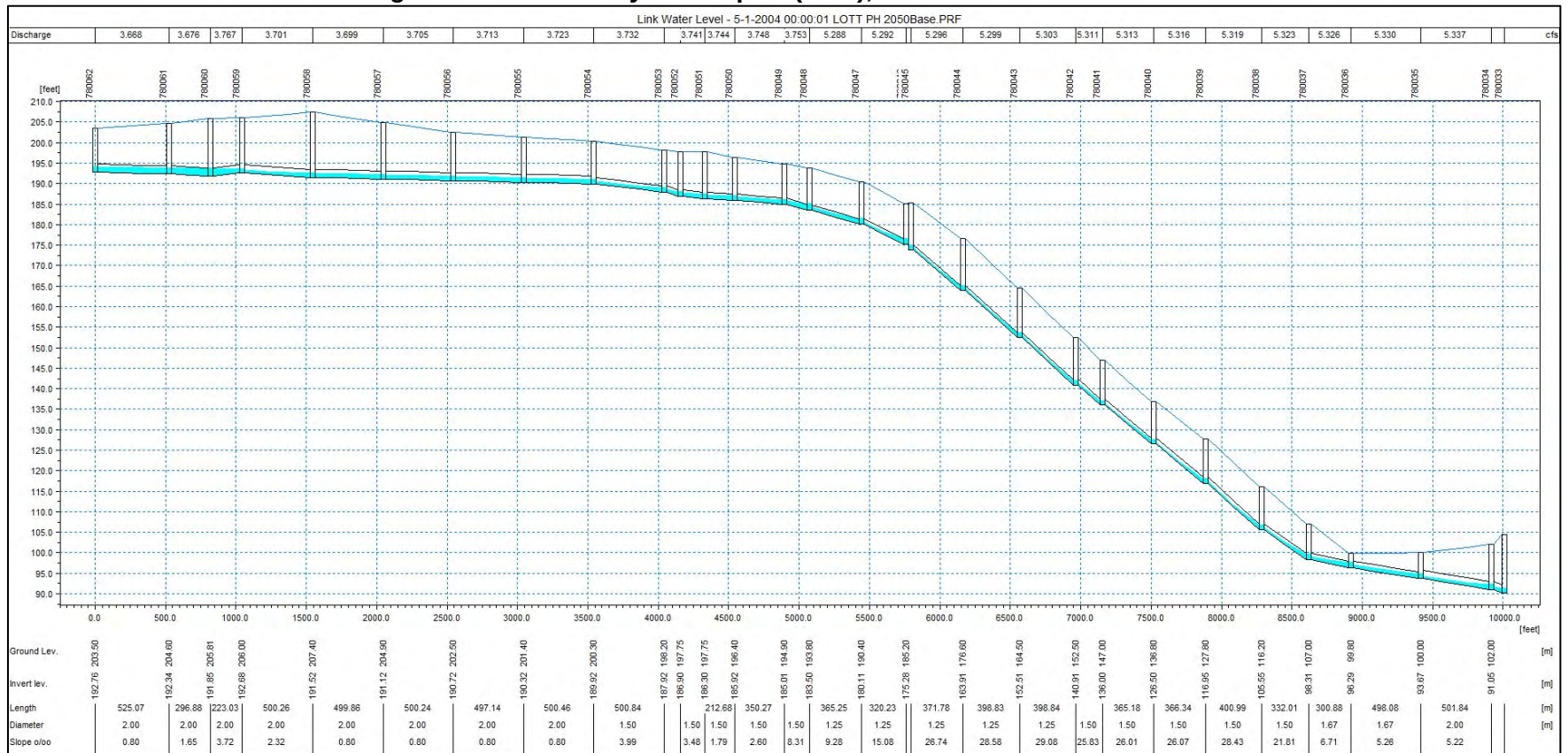
The sewer model identified two capacity limitations in the existing system. These limits are located in pipes owned by the City of Olympia, at Henderson Blvd, south of North Street, and along East Bay Drive. Sewer basin 31 feeds into the East Bay Drive pipes and has recently seen increased flow which could explain the flow limitations on these pipes. More information regarding this basin and increased flow can be found in the Inflow and Infiltration Report. No limitations were noted in LOTT owned pipes at this time.

5.4 LOTT System Analysis

5.4.1 Martin Way Interceptor (East)

This interceptor consists of a relatively flat section of 24-inch pipe flowing into progressively steep portions of 18- and 15-inch pipe. The 15-inch pipe, particularly in a pair of less-steep upstream sections, acts as a flow bottleneck. The sewer model projects a fully surcharged pipe between manholes 780061 and 780059 and the rest of the pipe partially surcharged condition by 2050. Diversion of flow to reclaimed water plants does not affect this interceptor, which is located upstream of the Martin Way Pump Station. Capacity in this pipeline is, however, strongly linked to septic connection in the Tanglewilde and Thompson Place basins. There are no manholes at risk of flooding, even in the fully surcharged portion of pipe. With full connection, this pipe will become capacity-limited and will require an upgrade. This currently projects to happen shortly after 2050. The 2050 condition is displayed in Figure 5-7.

Figure 5-7. Martin Way Interceptor (East), 2050 Peak Hour Condition



5.4.2 Martin Way Interceptor (West)

The Martin Way Interceptor (West) accepts flows from the MWPS Force Main, as well as from the Lacey interceptor running north along Sleater-Kinney Road. A recent failure of the eastern portion of this interceptor due to corrosion resulted in a project to slipline the existing pipeline, and open up a parallel pipeline (North Branch), which had been constructed for just such an eventuality. The pipeline projects some surcharging near manhole 300088, but the depth of the pipe in this location poses little risk of flooding.

Figure 5-8. Martin Way Interceptor (West), 2050 Peak Hour Condition

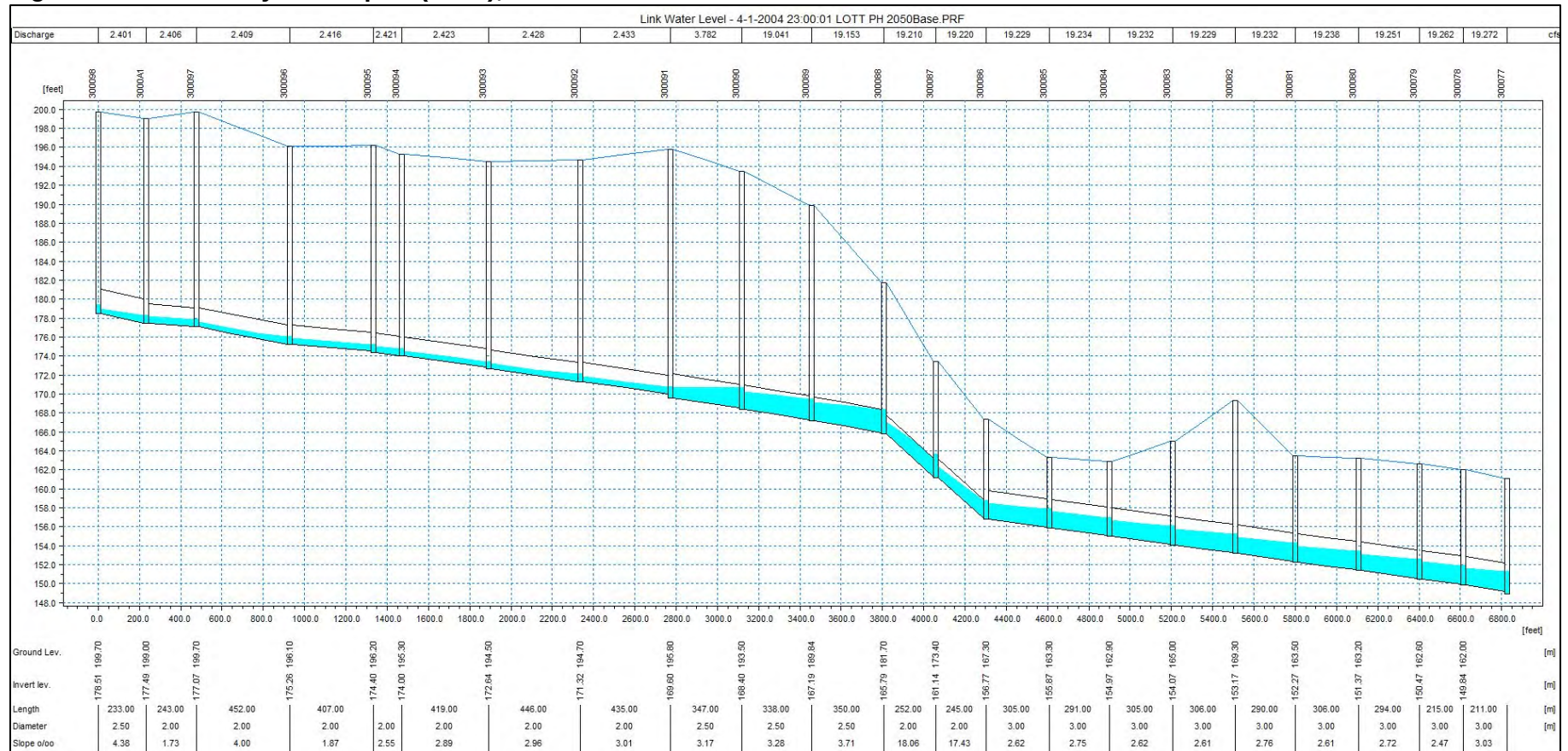
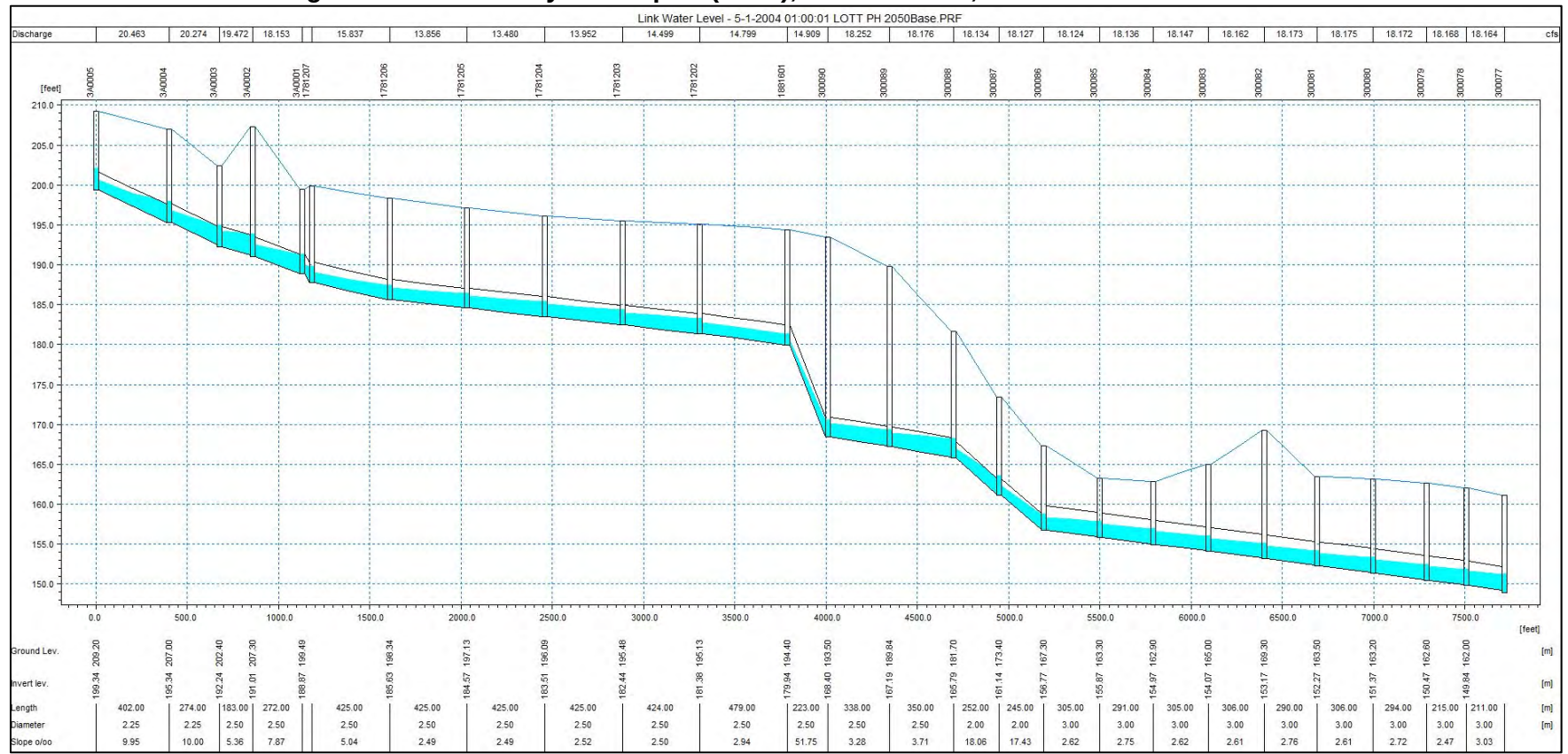


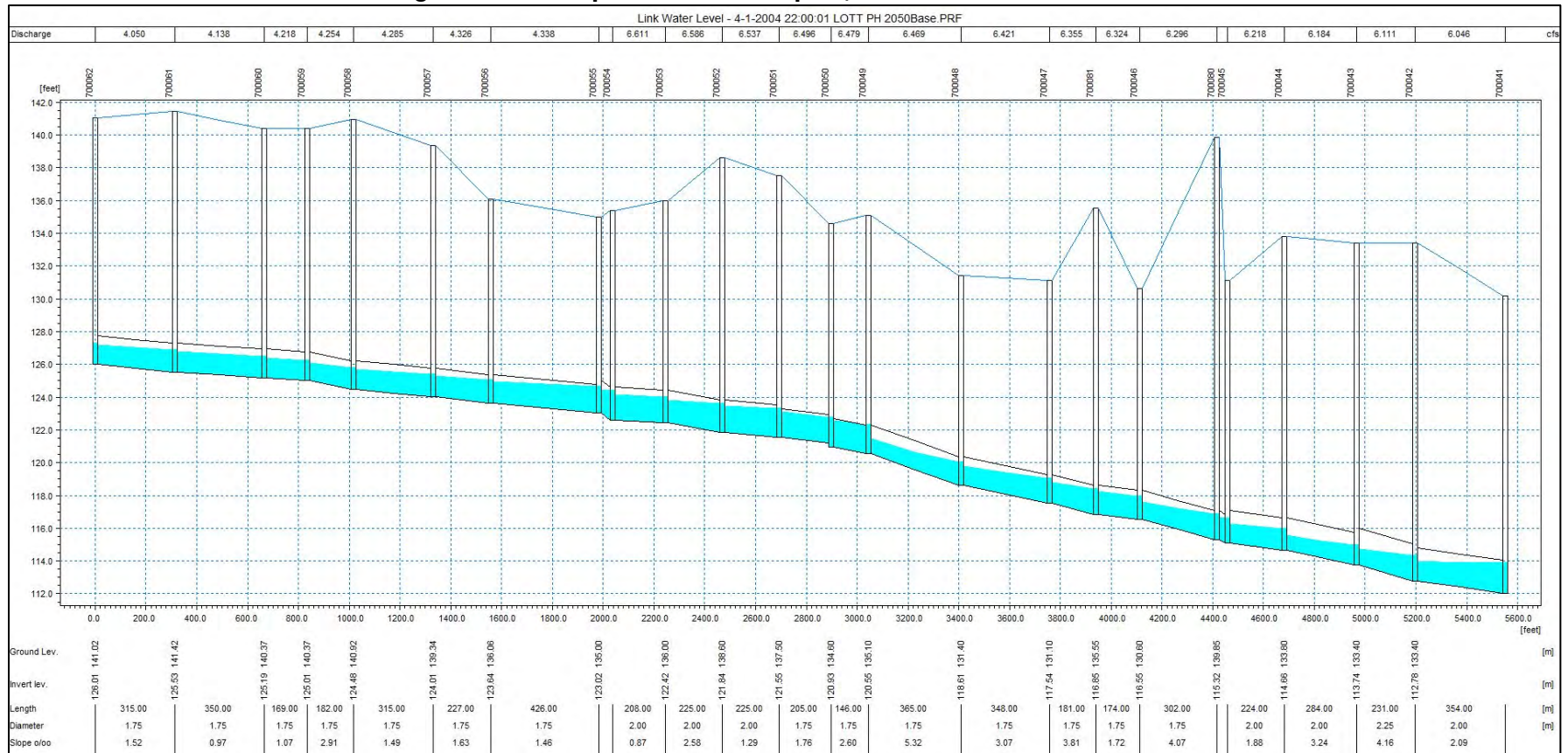
Figure 5-9. Martin Way Interceptor (West), North Branch, 2050 Peak Hour Condition



5.4.3 Cooper Point Interceptor

The Cooper Point Interceptor is not currently limited, and, at an average depth of greater than 10 feet, can deal with some degree of storm-related surcharging. By 2050, this interceptor will be running at full pipe flow between manholes 700056 and 700050 during the peak hour storm. These manholes are located in the less steep upstream portion. Due to its depth, this pipeline poses a low risk of manhole flooding in this area. The 2050 condition is plotted on Figure 5-10.

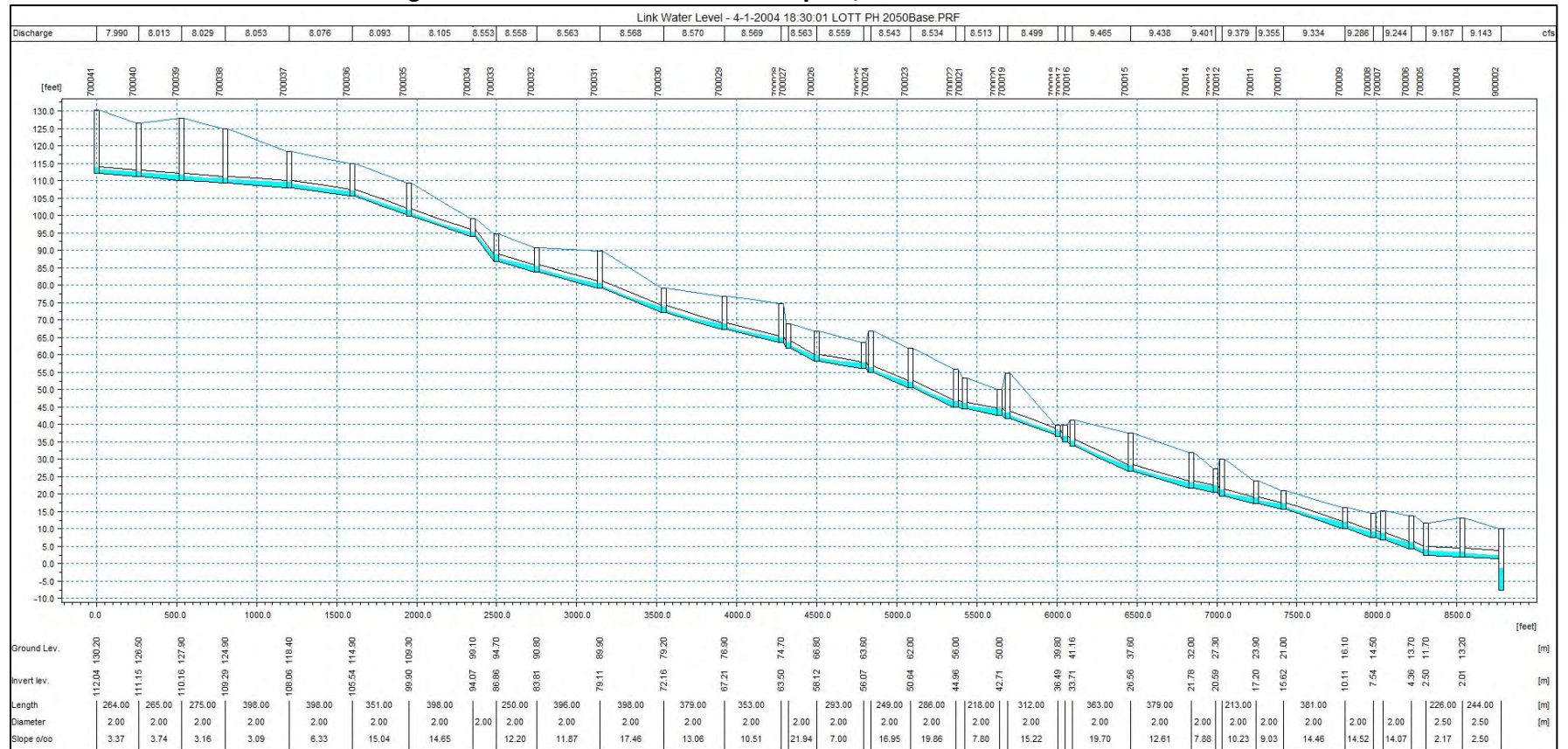
Figure 5-10. Cooper Point Interceptor, 2050 Peak Hour Condition



5.4.4 Percival Creek Interceptor

The Percival Creek Interceptor is comparatively steep, and may experience surcharging in the shallow upstream portion of the interceptor (between manholes 700041 and 700037) in 2050 during peak hour flows (Figure 5-11). Manhole 700018 is the shallowest manhole on the Percival Creek Interceptor and has little headspace to deal with surcharging. This manhole comes within roughly one foot of flooding under 2050 peak hour conditions.

Figure 5-11. Percival Creek Interceptor, 2050 Peak Hour Condition



5.4.5 Indian Creek Interceptor

The Indian Creek Interceptor is heavily influenced by the amount of flow diversion in Lacey. Without increased diversion beyond the existing 2 mgd, the portion of the pipeline with a diameter of 2.5 feet or less would be subject to surcharging by 2050 particularly in the middle and south branches (Figure 5-12 through Figure 5-14). The interceptor is generally shallow, and some of the surcharging comes within 1-2 feet of rim elevation. Flooding is projected in the post-2050 time frame.

Figure 5-12. Indian Creek Interceptor, North, 2050 Peak Hour Condition

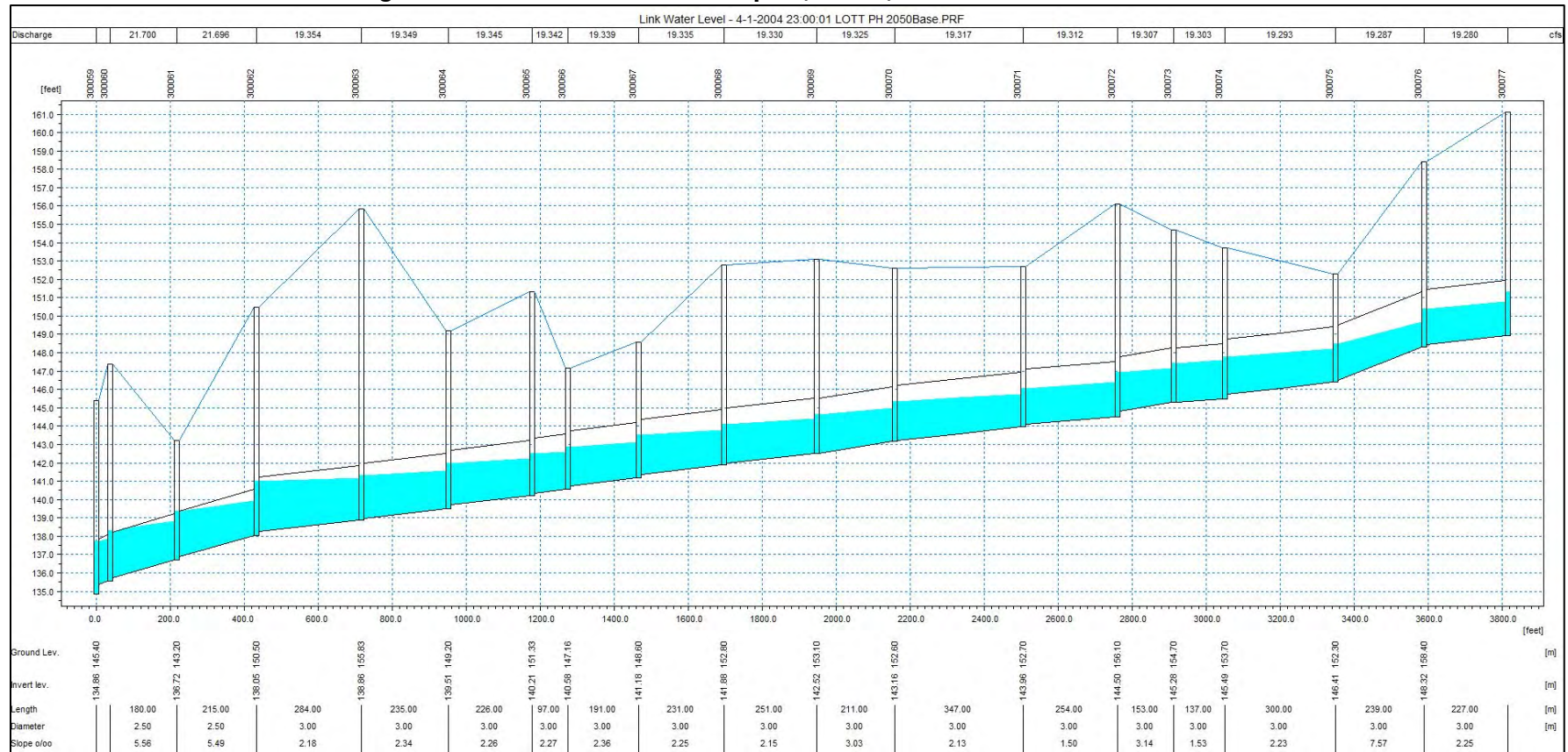


Figure 5-13. Indian Creek Interceptor, Middle, 2050 Peak Hour Condition

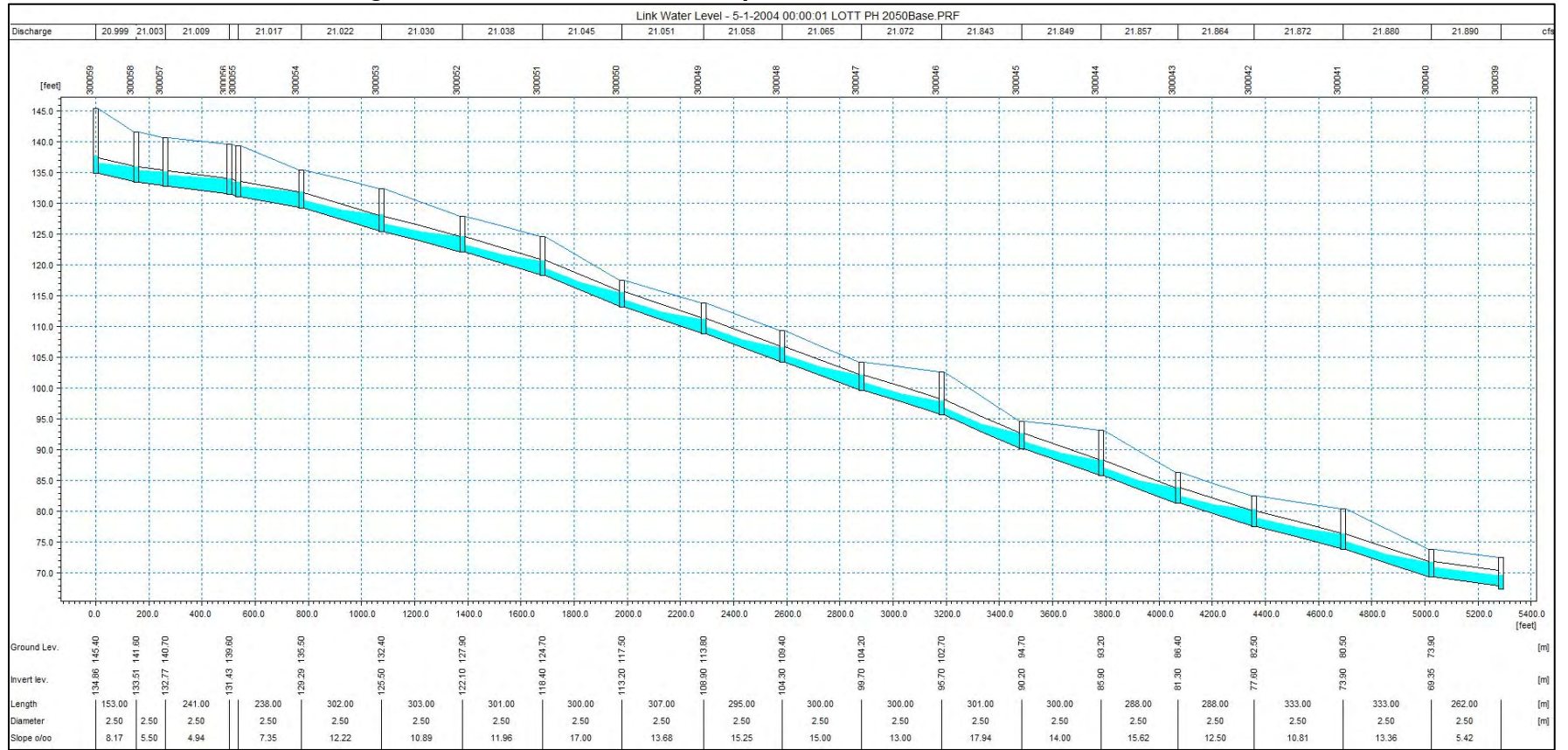
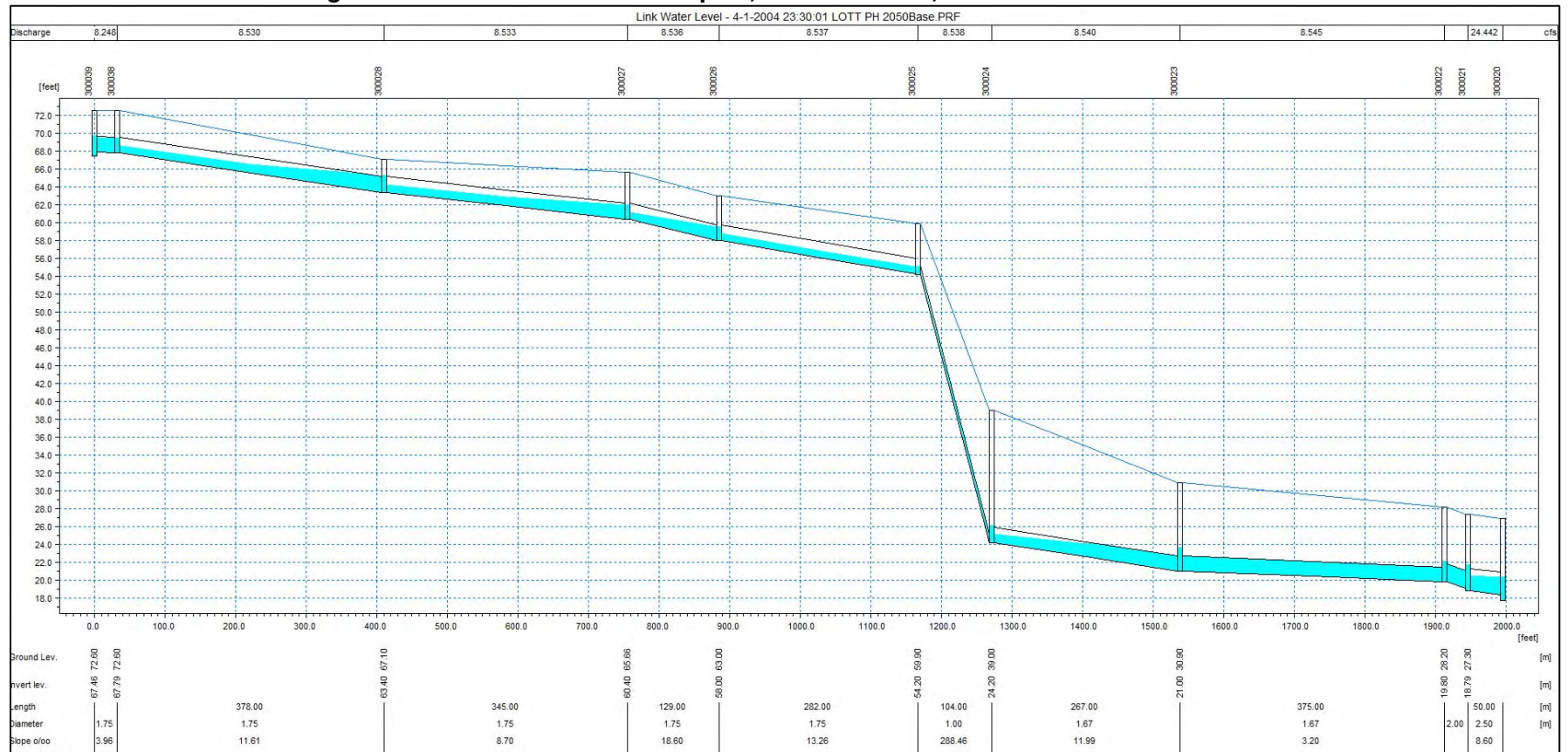


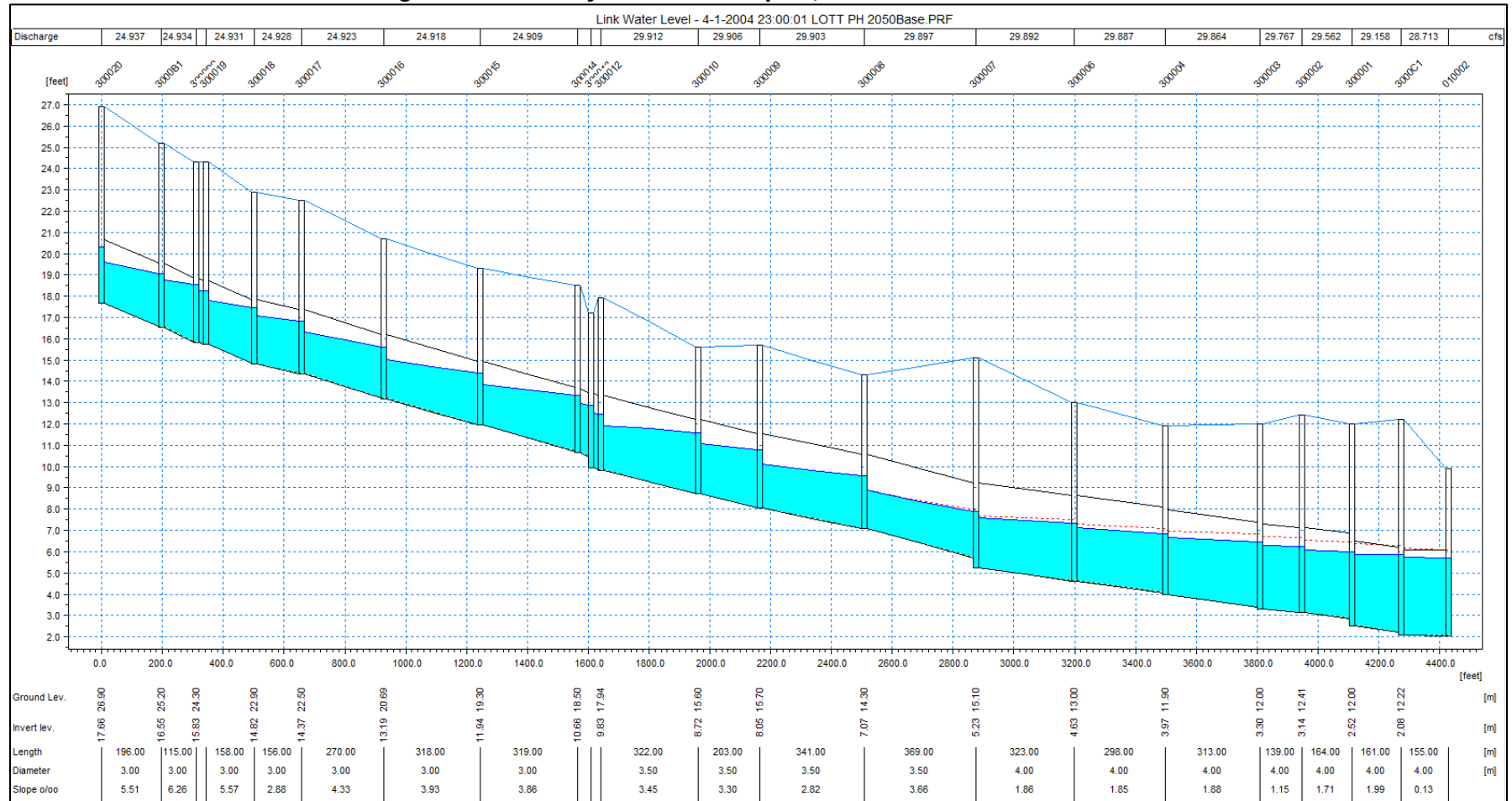
Figure 5-14. Indian Creek Interceptor, South Branch, 2050 Peak Hour Condition



5.4.6 Cherry Street Interceptor

The Cherry Street Interceptor takes most of the flow from the Indian Creek Interceptor and the Henderson Road Interceptor, and picks up combined flows from the City of Olympia at Union Avenue. This interceptor approaches near-surge conditions ahead of the overflow at manhole 300012. Backwater effects from the BITP cause surcharging of this interceptor near State Street.

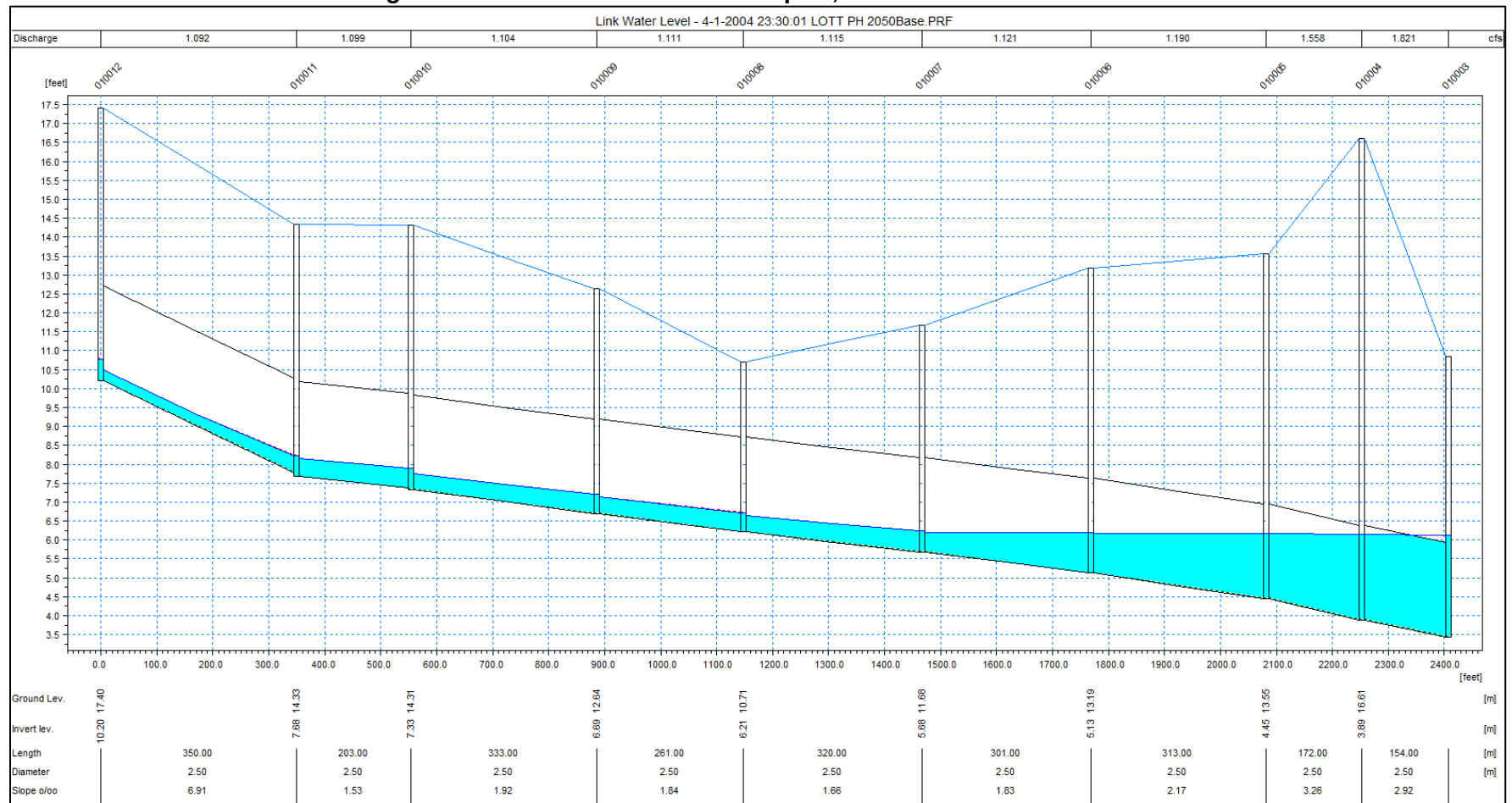
Figure 5-15. Cherry Street Interceptor, 2050 Peak Hour Condition



5.4.7 Chestnut Street Interceptor

The Chestnut Street Interceptor takes overflows from the Cherry Street Interceptor at Union Avenue. This pipeline is projected to convey little flow. By 2050, this pipeline experiences a backwater effect from State Avenue reaching to manhole 010007.

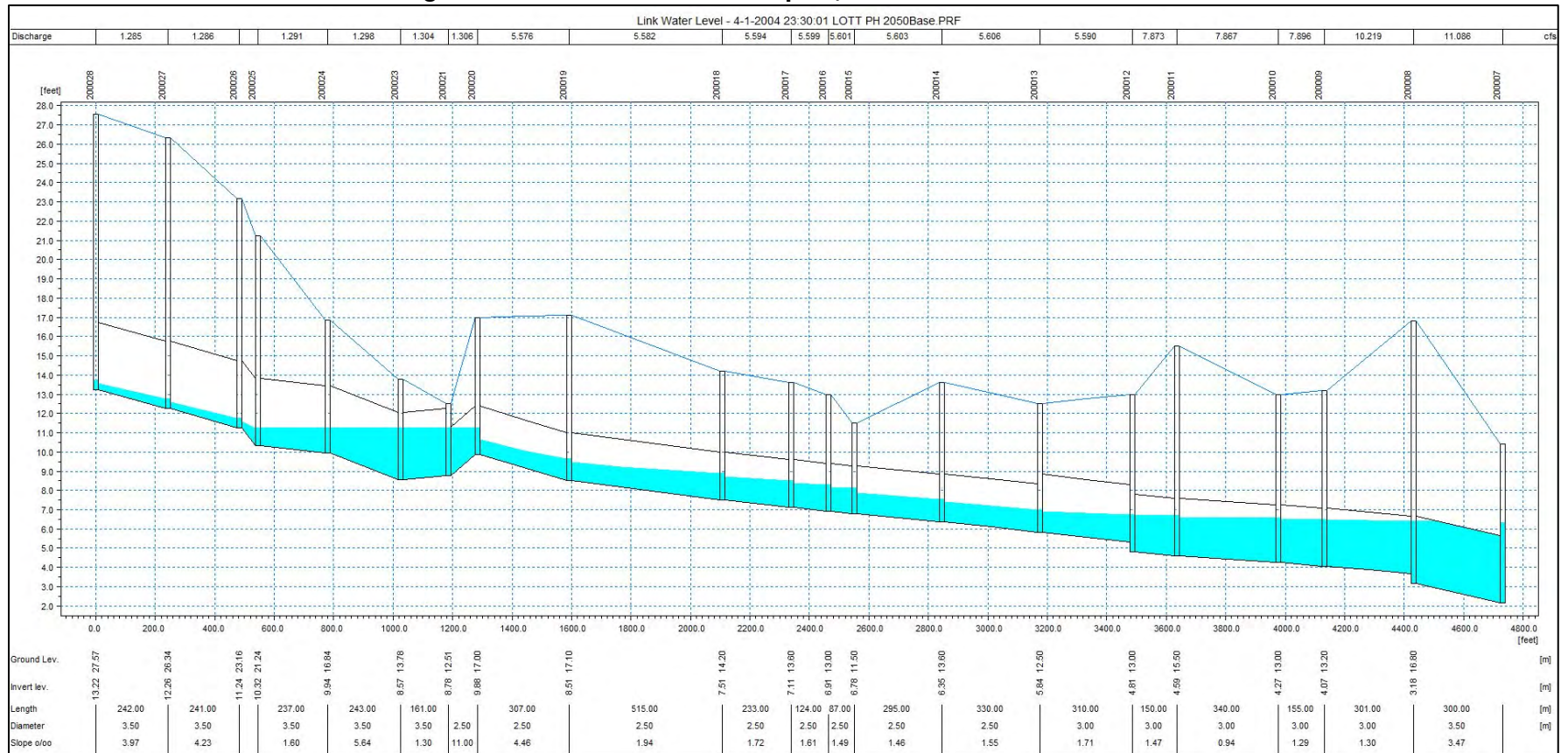
Figure 5-16. Chestnut Street Interceptor, 2050 Peak Hour Condition



5.4.8 Plum Street Interceptor

The Plum Street Interceptor takes flows from Tumwater and Olympia north of North Street. There is a plugged connection which formerly allowed a portion of flow from the Indian Creek Interceptor and Henderson Road to enter this pipeline. A section of negatively sloped pipe near manhole 200021 results in a backwater effect at the upstream end of this interceptor, but no surcharging. A backwater effect from the BITP is observed at the downstream end of the interceptor near State Street.

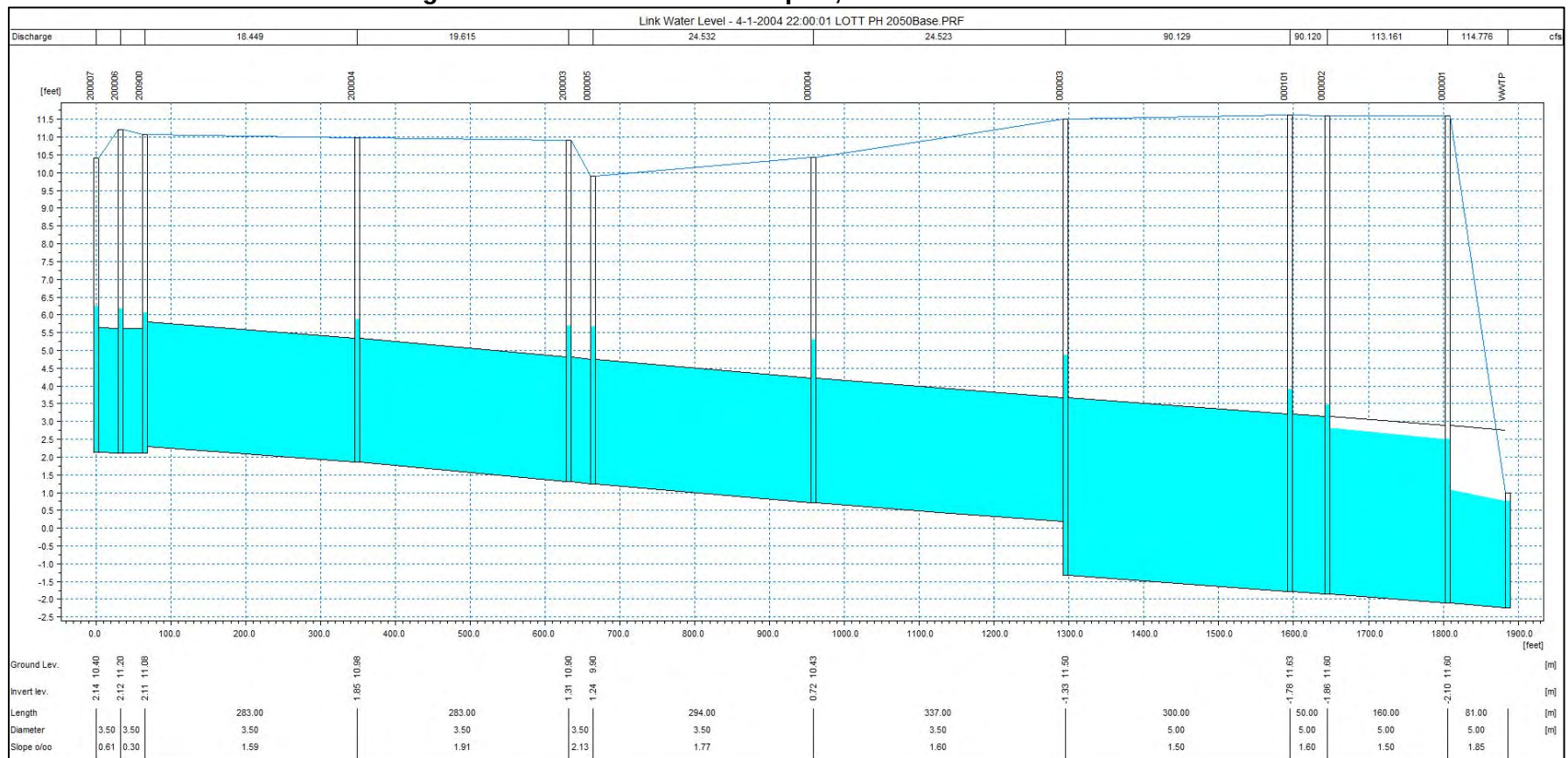
Figure 5-17. Plum Street Interceptor, 2050 Peak Hour Condition



5.4.9 State Street Interceptor

The State Street Interceptor receives flow from the Cherry, Chestnut, and Plum Street Interceptors. It also conveys flow from the two Olympia East Bay Interceptors, and State Street to the west. This interceptor turns north on Adams Street and conveys flow to the BITP. This interceptor has very little slope (less than 0.2%), and currently backwaters regularly. The backwater effect projects to extend down all three LOTT downtown interceptors as far as 8th Street. Because of its depth, and the depth of the downtown LOTT interceptors, none of these pipes are projected to be at high risk of flooding manholes. It is possible that the backwater effects could lead to private residence flooding if basement or other low-elevation side-connections exist in the area. The 2050 condition is plotted on Figure 5-18.

Figure 5-18. State Street Interceptor, 2050 Peak Hour Condition



5.5 Sewer System Modeling Summary

The LOTT sewer system was last modeled in 2010. Since that time, long term flow projections have decreased. This has pushed most projected LOTT capacity limitations past 2050. Capacity limitations in Olympia sewers have been noted in the existing system. Key findings from the current modeling included the following:

- Surcharging in the Martin Way Interceptor (East) and upper portion of the north branch of the Martin Way Interceptor (West) by 2050.
- Surcharging in the Cooper Point Interceptor by 2050, but low risk of flooding due to burial depth.
- Surcharging in the southern portion of the Indian Creek Interceptor by 2050.
- Backwater effects in the downtown interceptors by 2050, but low risk of flooding due to burial depth.

5.5.1 Pressure Mains

Table 5-1 presents the capacity and projected 10-year peak hour utilization of LOTT force mains. Capacity is based on a maximum flow velocity of 7 feet per second.

Table 5-1. LOTT Force main Capacity

Force Main	Size (in)	Capacity (mgd)	2015	2020	2025	2030	2040	2050
Martin Way Forcemain ¹	18	8.0	31%	37%	45%	55%	72%	103%
Capitol Lake Force main (south only)	24	14.2	56%	60%	65%	69%	79%	88%
Capitol Lake Force main (south and north)	20+24	24.1	33%	36%	38%	41%	46%	52%
Southern Connection (22" only)	22	11.9	22%	25%	28%	31%	38%	46%
Southern Connection (both pipes)	20+22	21.8	12%	14%	15%	17%	21%	25%
Kaiser Road Force main	10	2.5	13%	13%	13%	13%	13%	14%

1. Including satellite flow diversion increments for the Martin Way: existing (2 mgd), 2038 (3 mgd)

- The Martin Way Force main will reach 85% capacity by 2046. This assumes 3 mgd of flow diversion to the Martin Way Reclaimed Water Plant.
- The Capitol Lake Pump Station discharges into two force mains, a 24-inch pipeline that runs south of the lake, and a 20-inch pipeline that runs north of the lake. Using just the southern pipeline, the system would reach 85% capacity by 2048. With both force mains in use, the system is not projected to reach 85% capacity by 2050.
- The Southern Connection is a double-barreled force main, which runs from Tumwater to the Capitol Lake Pump Station. The smaller 20-inch pipeline has been converted to a pipeline to convey reclaimed water from the Budd Inlet Treatment Plant to Tumwater. With only the 22-inch pipeline used for wastewater conveyance, the system is not projected to become limited within the planning period.

5.5.2 Pump Stations

Table 5-2 lists the current capacity of the LOTT pump stations in million gallons a day and the percentage of that capacity that will be reached in future years based on updated flow projections. The capacity listed is firm capacity, the capacity of the pump station with one of the largest units out of service.

Table 5-2. LOTT Pump Station Capacity

Pump Station	Pumps	Capacity (mgd)	2015	2020	2025	2030	2040	2050
Martin Way Pump Station ¹	4	18	25%	28%	31%	36%	48%	62%
Capitol Lake Pump Station	5	24	33%	36%	38%	41%	47%	52%
Kaiser Road Pump Station	3	2	16%	16%	16%	16%	17%	17%

1. Including satellite flow diversion increments for the Martin Way: existing (2 mgd), 2015 (2 mgd), 2038 (3 mgd)

- None of the pump stations are projected to become capacity-limited. Even with full sewerage, the pump stations are projected to have capacity.

5.6 Required Capacity Improvements Projects

5.6.1 Martin Way Interceptor (East)

Roughly 1,050 feet of the eastern portion of the Martin Way Interceptor (East) will be surcharged by 2050. LOTT plans to install a parallel pipeline, running from Marvin Road to the Martin Way Pump Station (10,000 ft), in response to further development in western Lacey. The timing of this pipeline expansion is linked closely to septic conversion in the Tanglewilde and Thompson Place basins, but the current projection estimates the project will not be needed until 2050.

Figure 5-19. Martin Way Interceptor (East) Parallel Pipeline

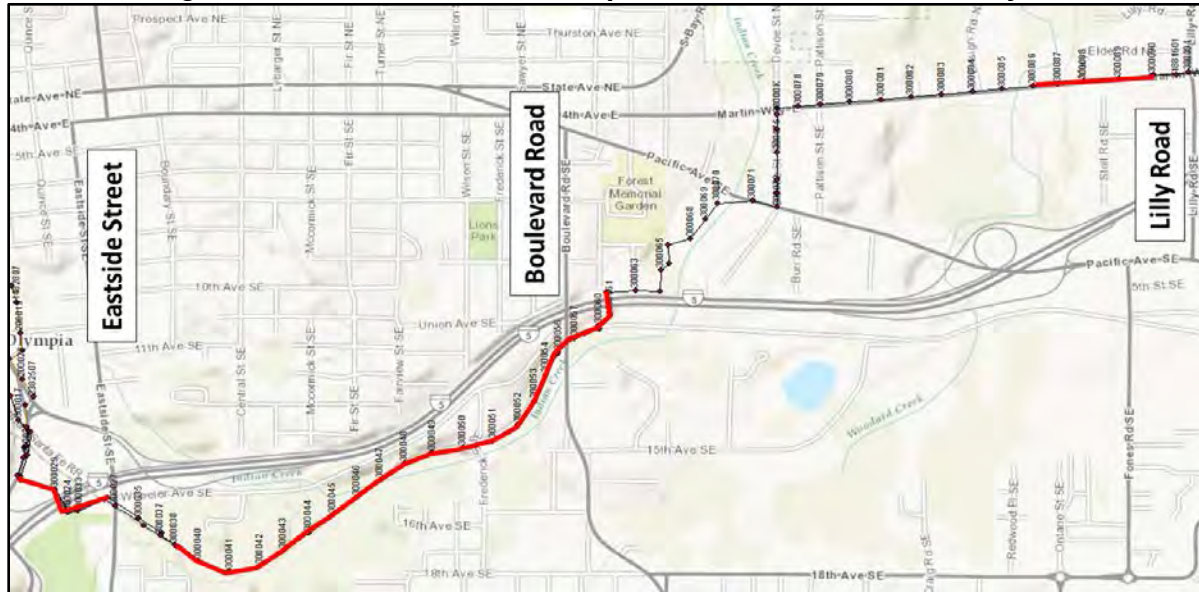


5.6.2 Indian Creek Interceptor

The upstream (east) portion of the Indian Creek Interceptor poses a risk of surcharging in 2050. This risk is highly dependent upon the amount of flow diverted to satellite reclaimed water plants. Accounting for planned diversions, a bottleneck removal project or parallel pipe construction would likely be required in the 2040-2045 timeframe. The project consists of

upgrades to three sections of pipe, illustrated in red on Figure 5-20, totaling 10,600 feet, and includes two crossings of Interstate 5.

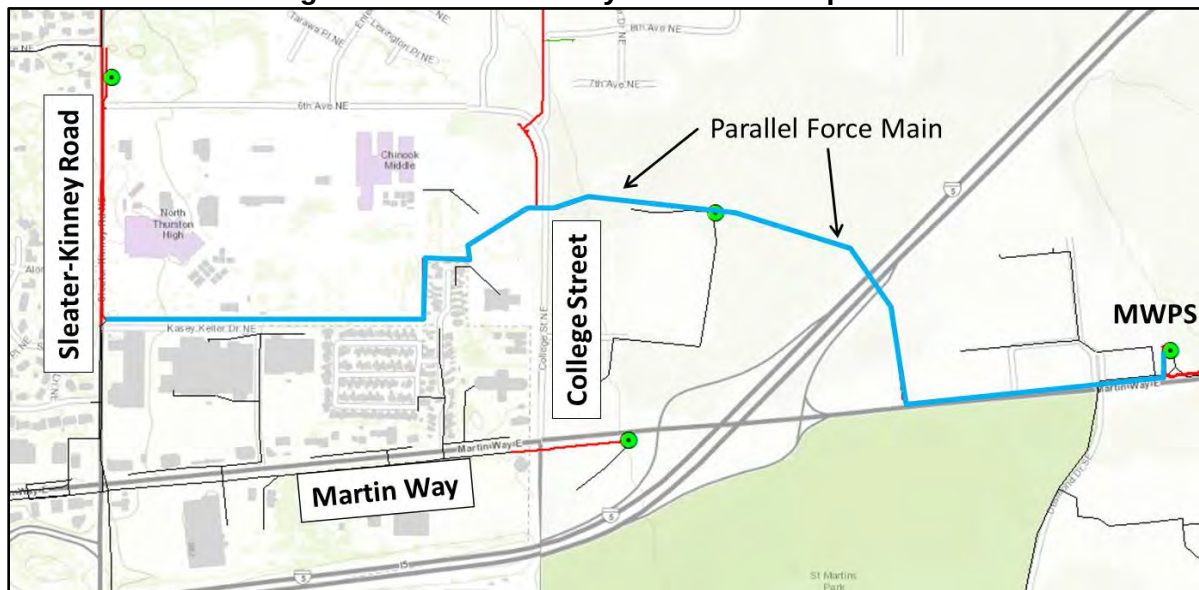
Figure 5-20. Indian Creek Interceptor Bottleneck Removal Project



5.6.3 Martin Way Force main

Like the Indian Creek Interceptor, the Martin Way Force main capacity is highly dependent upon the magnitude and pace of satellite flow diversion in Lacey. According to the current plan, the force main will need to be expanded by 2046. The force main is 7,700 feet along its current alignment, which includes one crossing of Interstate 5.

Figure 56-21. Martin Way Force Main Expansion



5.6.4 Percival Creek / Mottman Road Interceptor

A recent project expanded the capacity of the interceptor near Mottman Road as identified in red on Figure 5-22. The downstream segment, from manhole 700041 to 700040 is projected

to be capacity limiting, but there is some question regarding the relative invert elevations. Even if the segment is capacity-limiting, the pipe's burial depth does not pose a high risk of manhole flooding, or backwater effects, through 2050. If an upgrade is warranted, the most appropriate project would upgrade piping from manhole 700041 through 700037. Budget will be set aside for a potential project, set to occur in 2030. Project drivers will be reassessed in future reports.

Figure 5-22. Percival Creek / Mottman Road Interceptor Project



5.7 Summary of Pipe Capacity Projects

The following table summarizes the sewer pipe capacity projects discussed in this section.

Table 5-3. Planned Pipe Capacity Projects

On-line	Name	Cost/Estimate	Status	Description
2030	Percival Creek/Mottman Road Interceptor	\$894,000	Future	Relieves projected capacity limitations in the Percival Creek Interceptor
2031	Martin Way Parallel Force main	\$3,827,000	Future	Adds parallel force main to meet projected capacity limitations, though affected by pace at which the Martin Way Reclaimed Water Plant is expanded
2045	Indian Creek Interceptor Improvements	\$10,520,000	Future	Removes bottlenecks in the Indian Creek Interceptor

5.8 Reclaimed Water Conveyance Lines

There are currently three reclaimed water conveyance networks in the LOTT system. A 14-inch pipeline conveys reclaimed water from the MWRWP to the Hawks Prairie Wetland Ponds and Groundwater Recharge Basins in Lacey. This pipeline has capacity for 3.0 mgd of flow, and will not need to be expanded through 2050. A 12-inch pipeline was installed in southeast Lacey as a contingency for potential development of a reclaimed water plant in that area. The facility is unlikely to be constructed within the planning horizon. The third network connects the BIRWP to the T Street Reservoir at the Tumwater Municipal Golf Course, serving end users along its route. That system has capacity for 1.5 mgd, and will

need a booster pump station at the reservoir when the facility increases its capacity to 3.0 mgd, scheduled for 2022.

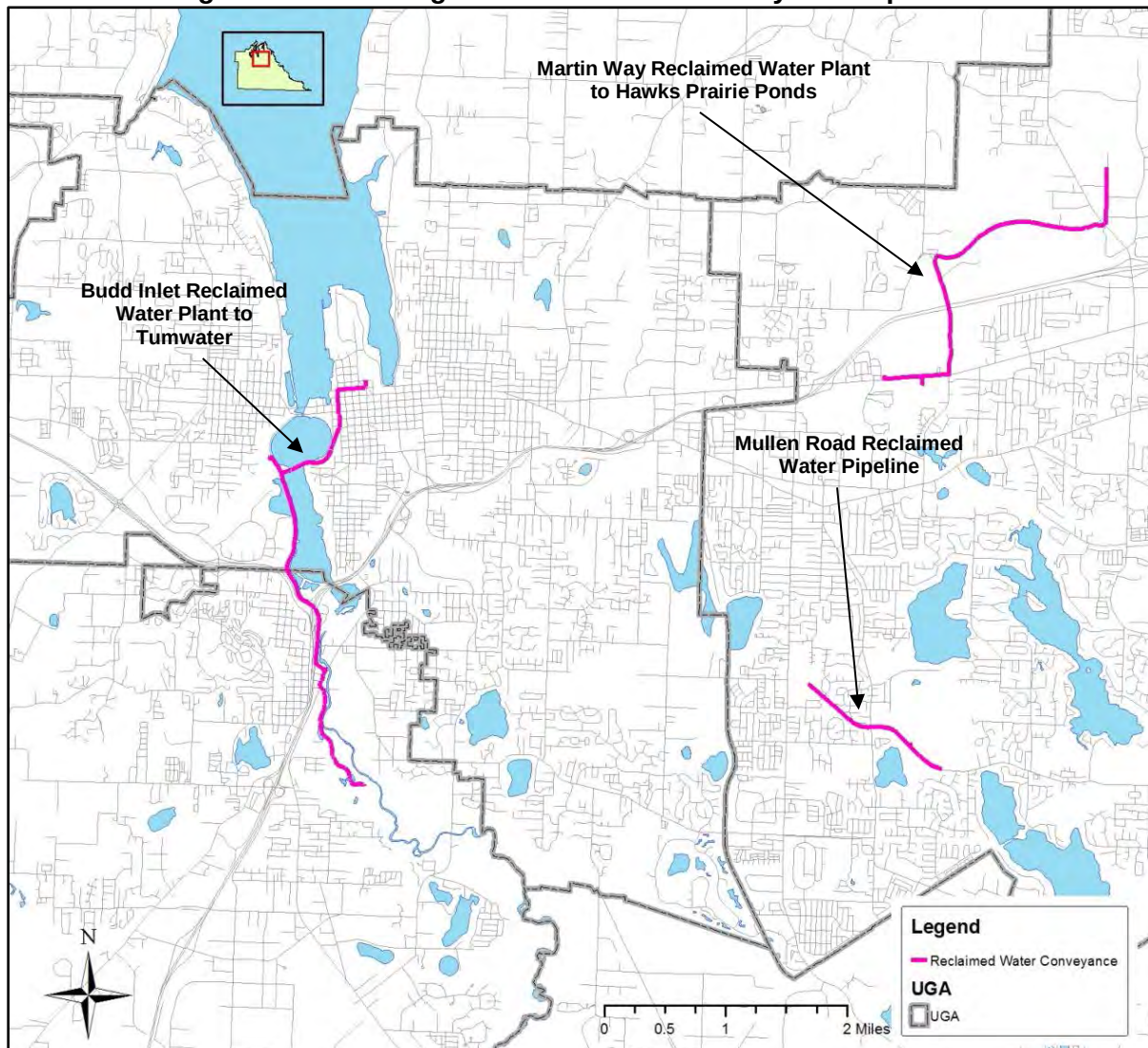
The reclaimed water networks would need to be expanded if demand or regulations drove an increase in water reclamation. As discussed in Section 4.5, LOTT has a conceptual plan to produce up to 35.0 mgd of reclaimed water if needed. Implementation of this plan would require expansion of the reclaimed water networks described above.

Table 5-4 summarizes existing reclaimed water distribution pipes and their related capacities and Figure 5-23 maps the existing pipelines.

Table 5-4. Reclaimed Water Distribution Pipe Capacities

Reclaimed Water Main	Size (in)	Capacity (mgd)	Length (ft)	2015	2020	2025	2030	2040	2050
Martin Way Reclaimed Water Plant to Hawks Prairie Ponds	14	3.0	17,800	2.0	2.0	2.0	2.0	3.0	3.0
Budd Inlet Reclaimed Water Plant to Tumwater Golf Course	12-20	1.5	24,400	1.5	1.5	3.0	3.0	3.0	3.0
Mullen Road	12	3.0	7,250	0	0	0	0	0	0

Figure 5-23. Existing Reclaimed Water Conveyance Pipelines



6. Operational Capacity Analysis Summary

The projects identified in the 2016 Capital Improvements Plan tie together process limitations at the Budd Inlet Treatment Plant, and capacity limitations related to treatment, discharge/use, and conveyance throughout the system. The list is based upon a number of key assumptions, many of which will have to be re-evaluated on an annual basis. In particular, the discharge capacity analysis will have to be re-assessed as the process improvements project moves forward, and the target effluent TIN concentrations are finalized.

LOTT maintains 1.5 mgd of reserve discharge capacity to Budd Inlet in order to manage peak flows and potential delays in the construction of new capacity. LOTT will continue to evaluate and monitor the system requirements and adjust capital improvement projects accordingly to ensure operation capacities are met.

The Reclaimed Water Infiltration Study will provide a better understanding of the community's expectations with regards to the production, water quality, and ultimate disposition of reclaimed water. LOTT will continue to maintain flexibility in its capacity development process, ensuring its ability to meet changing needs and conditions into the future.

2018

CAPACITY REPORTS

*FLOWS & LOADINGS
I&I/FLOW MONITORING
CAPACITY ASSESSMENT*

2018

CAPACITY REPORTS

FLOWS & LOADINGS

I&I/FLOW MONITORING

CAPACITY ASSESSMENT



2018 Flows and Loadings Report

May 2019

Prepared By:

Adam Klein and Hannah McLean, Brown & Caldwell
Tyle Zuchowski, LOTT Clean Water Alliance

PREFACE

The Flows and Loadings Report is one of three related documents that are part of the annual process to monitor and evaluate capacity in the entire LOTT system. The intent, under LOTT's Wastewater Resource Management Plan (also known as the Highly Managed Plan), is to assure that needed new capacity is brought on-line "just in time" to meet system needs. Capacity needs evaluated include wastewater treatment, Budd Inlet discharge, reclaimed water use/recharge, and conveyance capacity in the entire LOTT system. These three reports are prepared annually and are used to help identify capital projects for inclusion in the annual Capital Improvements Plan.

Flows and Loadings Report – analyzes residential and employment population projections within the Urban Growth Area and estimates the impact on wastewater flows and loading within the LOTT wastewater system.

Inflow and Infiltration Report – uses dry and wet weather sewer flow monitoring results to quantify the amount of unwanted surface (inflow) and subsurface (infiltration) water entering the sewer system and to prioritize sewer line rehabilitation projects.

Capacity Assessment Report – uses flows and loadings data and inflow and infiltration evaluation results to analyze system components (i.e. conveyance, treatment, and discharge), determine when limitations will occur, and provide a timeline for new system components and upgrades.

As each report is published, it will be posted in the "Library" on LOTT's website – www.lottcleanwater.org.

Table of Contents

Executive Summary	iii
1. Introduction	1
1.1 Purpose	1
1.2 Data Elements	1
1.3 Modeling Software	1
1.4 Changes from Previous Reports	1
2. Study Area	2
2.1 Service Area	2
2.2 Current Sewered Area	3
2.3 Future Sewered Area	4
2.4 Onsite Septic Systems	7
3. Population and Employment Forecast	8
3.1 Projections	8
3.2 Equivalent Residential Units	10
3.3 New Connections	11
4. Flows and Loadings	13
4.1 Permit Requirements	13
4.2 Drinking Water Analysis	13
4.3 Base Sanitary Flow	15
4.4 Comparison with Historical Wastewater Generation Rates	17
4.5 Flow Projections	18
4.6 Inflow and Infiltration Projections	18
4.7 Loading Projections	21
4.8 Projections Analysis	24
5. Summary	28

Executive Summary

In accordance with the Wastewater Resource Management Plan, also known as the Highly Managed Plan, LOTT is continuously planning to ensure it maintains adequate operational capacity to meet the community needs. The primary goal of the annual Flows and Loadings Report is to define the current and projected wastewater characteristics of the LOTT service area in terms of both wastewater flows and pollutant constituents (loads). The information in this report was used to develop the 2018 Capacity Assessment Report and the 2019-2020 Capital Improvements Plan.

The Thurston Regional Planning Council (TRPC) updates its population and employment projections every five years. The latest update was published in 2018. These projections were used to develop the flows and loadings included in this report. Additional data included flow monitoring data collected as part of LOTT's inflow and infiltration evaluation program, timelines for sewerage of non-sewered areas provided by each of the jurisdictions (Lacey, Olympia, and Tumwater), and updated current sewerage areas.

This report also includes a drinking water evaluation using 2017-2018 drinking water consumption data obtained from the jurisdictions. This analysis was used to recalibrate wastewater generation rate profiles for each of the jurisdictions.

Generally, the projected flows and loadings are slightly reduced from the previous year. This was mainly due to the improved data quality regarding the current customer base received from the partner jurisdictions, resulting in further refinement of the per capita wastewater generation rates.

1. Introduction

1.1 Purpose

Accurate projections of future wastewater flows and loadings are essential in planning for new treatment capacity. In accordance with the Highly Managed Plan, LOTT is continuously monitoring and planning to assure that adequate new wastewater treatment capacity is available “just in time.” The primary goal of the annual Flows and Loadings Report is to define the current and projected wastewater characteristics of the LOTT service area in terms of both wastewater flows and pollutant constituents (loads). Flows and loadings projections cover the 35-year planning cycle (2018-2050) and will be used to evaluate the existing LOTT Capital Improvements Plan and develop recommendations for the timing of capacity-related projects.

1.2 Data Elements

Data used for the development of this report included wastewater flow monitoring data, sewer and non-sewered population projections, existing sewer lines, estimated timelines for sewerage of non-sewered areas within the overall Urban Growth Area (UGA), and 2017 drinking water consumption data. Flow data was collected at the Budd Inlet Treatment Plant and at various flow monitoring locations throughout the collection system. Population projections, updated in 2018, were obtained from the Thurston Regional Planning Council (TRPC) in the form of projected residential and employment populations per parcel. The estimated sewerage timelines, drinking water consumption data, and existing collection system piping information were obtained from each of the partner jurisdictions (Lacey, Olympia, and Tumwater).

1.3 Modeling Software

To develop flows and loadings projections, the drinking water data was combined in Excel, and then uploaded to a map of the parcels in Thurston County in a geographic information system (GIS) database. The drinking water data was allocated to its specific parcel, which contained population data and projections provided by the TRPC. This combined data was exported and extrapolated in Excel.

1.4 Changes from Previous Reports

This year’s projections were developed similarly to those developed in the 2017 Flow and Loadings Report. Drinking water data was collected from each of the partner jurisdictions, along with parcel identification numbers, rate classes, and units per parcel. This drinking water data was sorted, organized, and assigned to their respective parcels in GIS. The GIS map held other pertinent data for each parcel, including its physical location, drinking water basin, sewer basin, future sewer basin, and population projection data from the TRPC. The raw drinking water data from the jurisdictions, along with the population projections from TRPC, were used to project future wastewater and loading production rates.

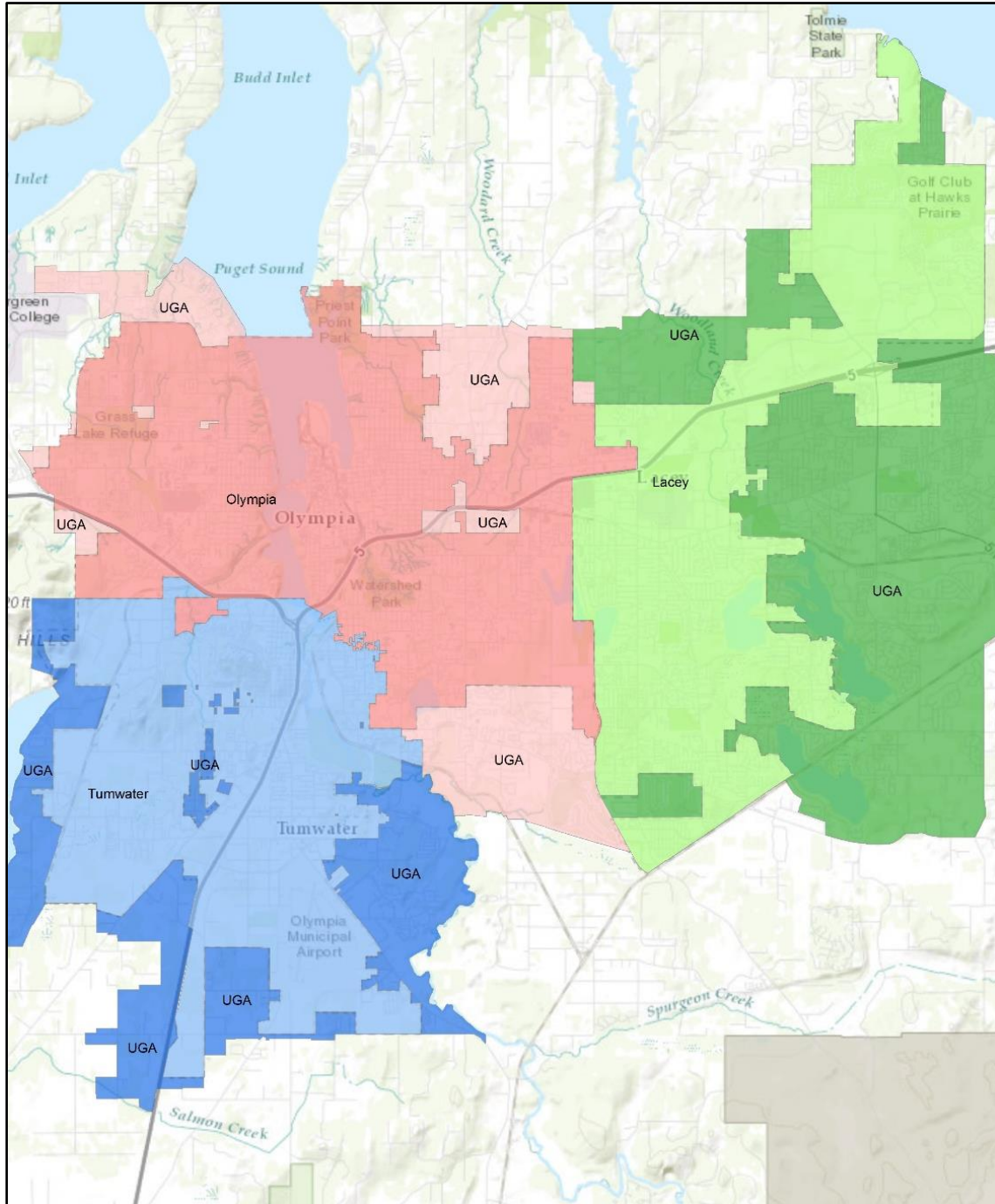
In 2018, TRPC published population projections in the form of a GIS parcel file and included projected residential population for the years 2018, 2020, 2025, 2030, 2035, and 2040. This analysis used previous TRPC projections for employment and maximum density estimate (build out state) that were published in 2013. Population projections are discussed further in Section 3.1.

2. Study Area

2.1 Service Area

The LOTT service area includes the urban growth areas (UGAs) for the cities of Lacey, Olympia, and Tumwater. The current combined UGA encompasses approximately 52,276 acres, with a current residential population of 178,620, and an employment population of 115,737.

Figure 2-1. LOTT Service Area by Jurisdiction

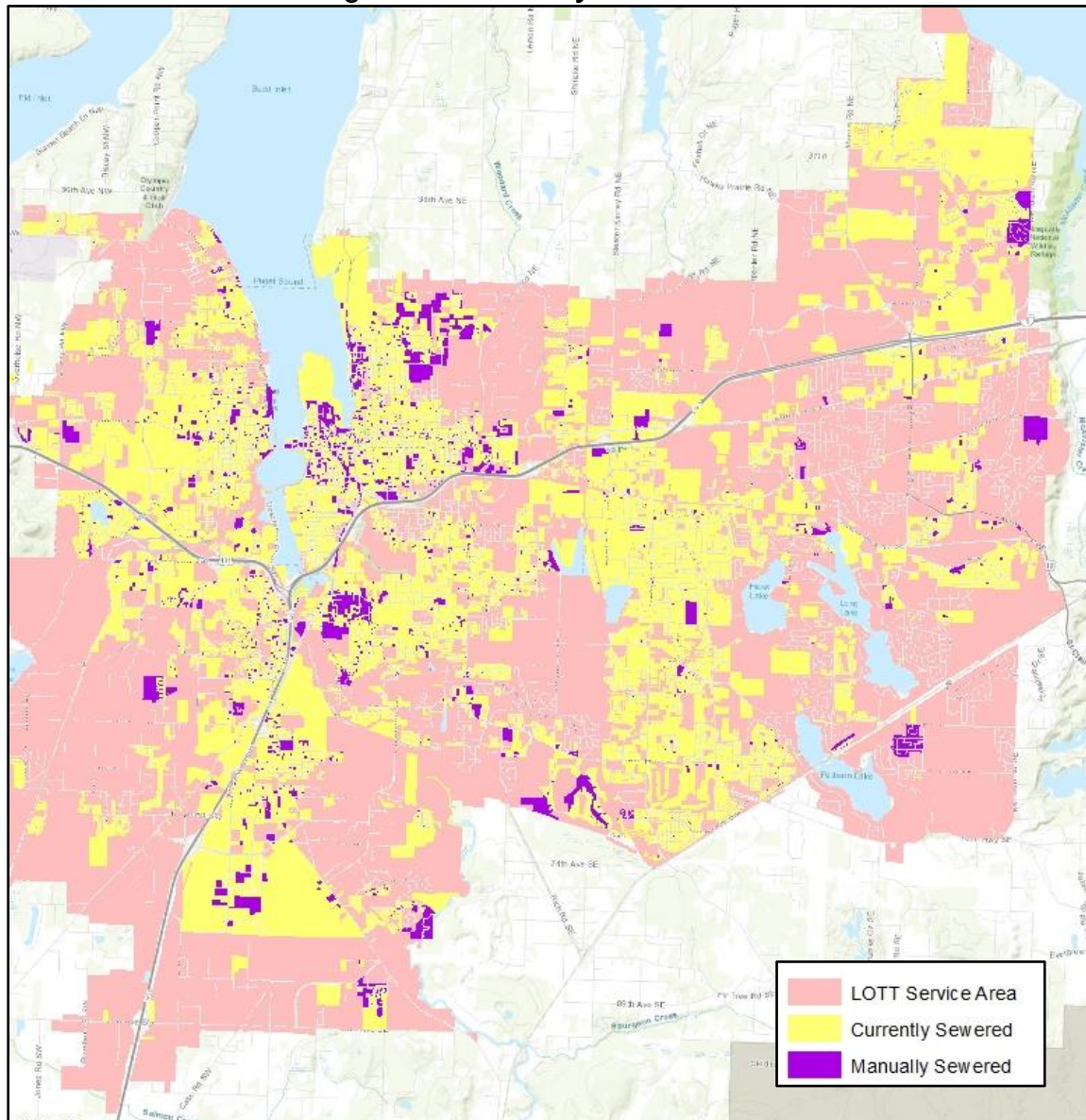


2.2 Current Sewered Area

Within the LOTT service area, approximately 16,516 acres are sewered, serving a residential population of 123,838, and an employment population of 94,109. The currently sewered parcels, shown in yellow on Figure 2-2, indicate parcels that had drinking water consumption in the 2017-18 period and were identified by LOTT's partners as active customers.

The manually sewered parcels, shown in green on Figure 2-2, depict the parcels for which drinking water consumption data was not received or was zero, but the parcels were physically surrounded by sewered parcels, or were otherwise known to be sewered. Some of these parcels may be vacant; others may simply be gaps in the customer database. These parcels have been modeled to become active within the next five years.

Figure 2-2. Currently Sewered Area



2.3 Future Sewered Area

In order to properly project future flows and loadings, future sewered areas must be accounted for. This includes accounting for existing development served by the sewer system, future development served by the sewer system, and development that will be converting from onsite septic systems to the sewer system in the future. The service area has been divided into sewer basins to estimate the rate and timing of sewer connections and future flows and loadings.

In 2014, the three partner cities – Lacey, Olympia, and Tumwater – provided information on when sewer basins in their service area are expected to begin connecting to the sewer system and when the conversions would be complete. Figure 2-3 illustrates the future sewered areas, and Table 2.1 illustrates expected timeline for conversion from septic to sewer.

The build out state, currently projected to occur in 2050 based on a linear regression analysis, is when all parcels within the UGA will have been developed. It should be noted that the build out state does not assume that all parcels will be connected to the sewer system by 2050. It is assumed that a certain percentage of new development within the UGA will include onsite septic systems. The development density is projected by TRPC based on the current zoning and the previous development density corresponding to that zoning.

For this year's analysis, four separate scenarios, or rates, of sewerage were developed – low rate, expected rate, aggressive rate, and full sewerage. Sewer connections were prioritized based on data generated by the interjurisdictional Regional Septic Work Group. This data was obtained from the Thurston Geodata Center in the form of a GIS parcel file, which included an inventory of septic systems and associated risk scores based on environmental and health concerns. Basins with high environmental risk were projected to be connected earlier than those with lower risk.

The low rate of sewerage assumes the majority of sewer basins containing undeveloped parcels without existing septic tanks would begin the connection process by 2020, and that by 2050 about 40% of these parcels would be connected to the sewer system. For the parcels that currently have a septic tank, the start date for the connection process would begin between 2025 and 2030, and only about 23% of the parcels would be connected to the sewer system by 2050.

The expected rate assumes that the undeveloped parcels without existing septic tanks that began connecting to the sewer system before 2020 would be 100% converted to sewer by 2050. The expected rate also assumes that the majority of parcels with an existing septic tank would begin sewer connection in 2030 and would be about 35% converted to sewer by 2050.

The aggressive projection rate assumes that all of the undeveloped parcels without existing septic tanks, regardless of sewer basin, will be fully sewered by 2050. The parcels with an existing septic tank would be roughly 30-58% sewered by 2050 (depending on environmental risk).

The full sewerage rate assumes that by 2050, all parcels with and without septic tanks, regardless of sewer basin, will be connected to the sewer system. The latest start date for any sewer basin is 2030. End sewerage dates are all 2050 (build out) for every sewer

basin. This reflects the assumption made in previous LOTT flows and loadings projections.

The method of calculating future sewerage rates assumed a front-loaded projection. This means that the rate of sewer connection is expected to occur at a faster rate in the next ten years than what is expected to occur in the following 20 to 30 years. The rate of septic conversion is assumed to follow a more linear trend.

The majority of the tables and projections discussed in this report assume the expected sewerage rate. Other projections are occasionally shown for comparison.

Figure 2-3. Future Sewer Basins

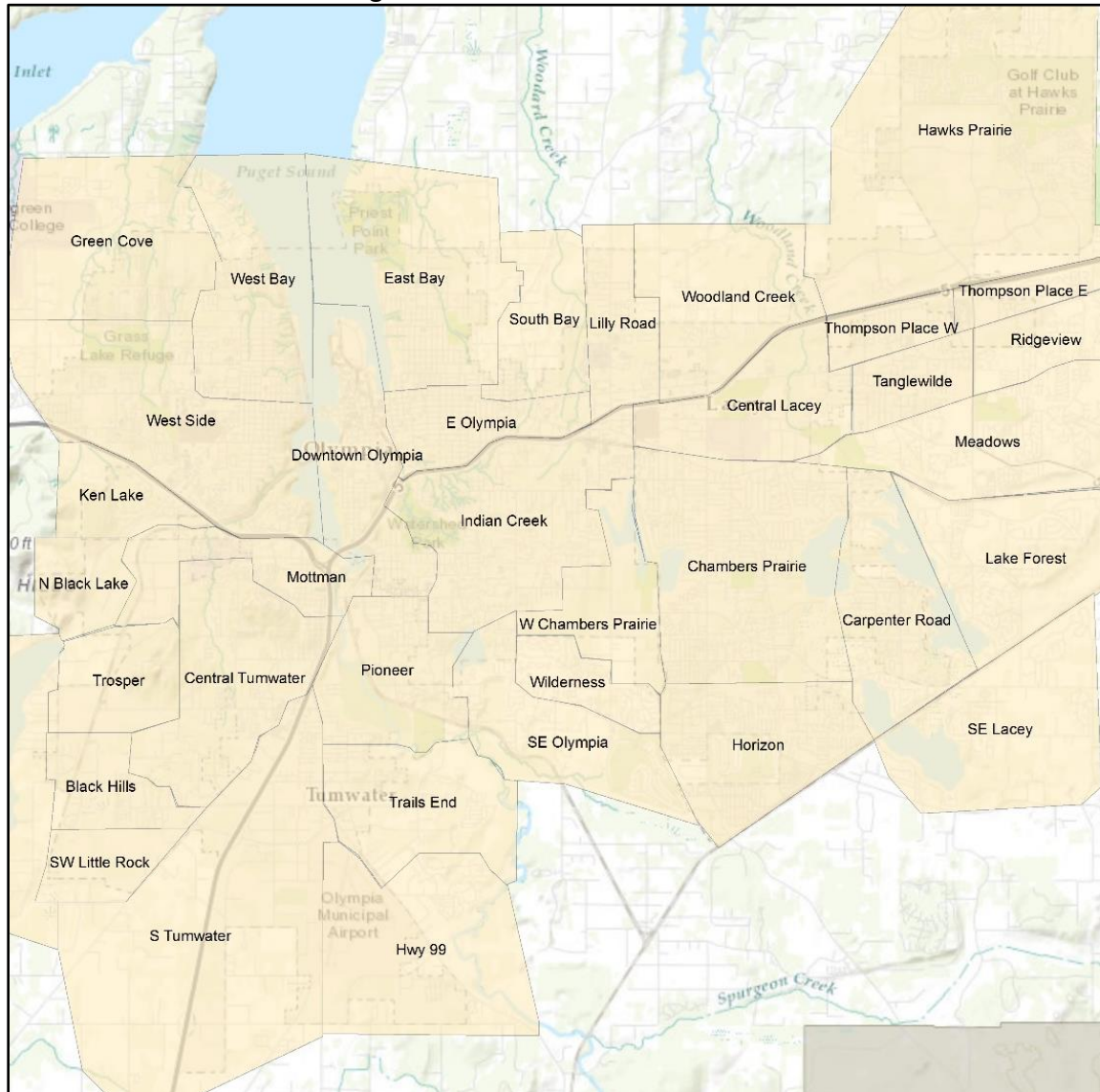


Table 2-1. Expected Future Sewering Schedule

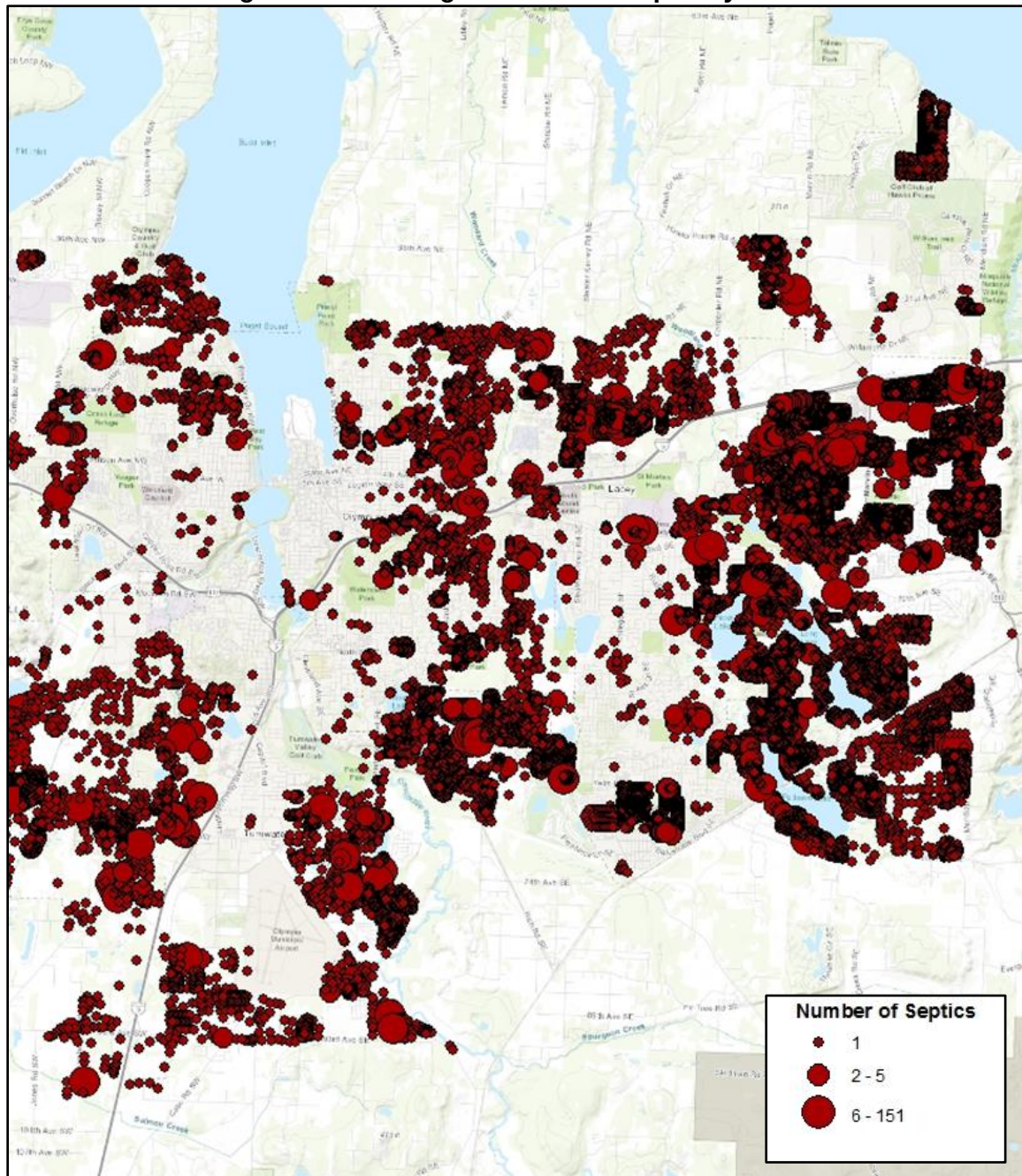
ID	Name	Current Sewer Coverage (0-5, 5=Full)	Septic Conversion Priority (1-3, 3 = High)	Parcels with no existing septic tank			Parcels with existing septic tank		
				Start	End	% Parcels Connected at 2050	Start	End	% Existing Septics Converted at 2050
1	Thompson Place E	3	3	2020	2050	100%	2030	2125	21%
2	Hawks Prairie	2	3	2016	2075	58%	2030	2125	21%
3	Thompson Place W	1	3	2020	2050	100%	2025	2075	50%
4	Woodland Creek	1	3	2015	2050	100%	2012	2075	60%
5	Lilly Road	3	3	2017	2050	100%	2030	2125	21%
6	South Bay	1	3	2020	2080	50%	2030	2125	21%
7	Ridgeview	1	3	2020	2100	38%	2030	2125	21%
8	Tanglewilde	0	1	2020	2060	75%	2025	2060	71%
9	Meadows	2	1	2016	2060	77%	2020	2075	55%
10	Central Lacey	3	1	2016	2050	100%	2020	2075	55%
11	Lake Forest	2	2	2019	2080	51%	2030	2100	29%
12	SE Lacey	1	2	2020	2080	50%	2030	2100	29%
13	Horizon	4	1	2015	2040	100%	2030	2075	44%
14	Carpenter Road	2	1	2017	2050	100%	2030	2075	44%
15	Hwy 99	2	3	2021	2075	54%	2030	2125	21%
16	Trails End	2	3	2020	2075	55%	2030	2125	21%
17	S Tumwater	2	3	2018	2075	56%	2030	2125	21%
18	SW Little Rock	0	1	2025	2060	71%	2025	2075	50%
19	Black Hills	2	3	2021	2075	54%	2030	2125	21%
20	Trosper	0	3	2020	2080	50%	2030	2125	21%
21	Central Tumwater	4	2	2015	2040	100%	2030	2100	29%
22	Pioneer	4	3	2015	2040	100%	2030	2125	21%
23	Black Lake	0	2	2020	2080	50%	2030	2100	29%
24	N Black Lake	0	1	2020	2060	75%	2030	2075	44%
25	Mottman	4	3	2017	2040	100%	2030	2125	21%
26	Ken Lake	4	1	2017	2040	100%	2025	2075	50%
27	West Side	4	3	2015	2040	100%	2030	2125	21%
28	Green Cove	2	3	2020	2075	55%	2030	2125	21%
29	West Bay	4	3	2015	2040	100%	2030	2125	21%
30	East Bay	4	3	2016	2040	100%	2030	2125	21%
31	E Olympia	5	3	2017	2025	100%	2030	2125	21%
32	Indian Creek	4	3	2016	2040	100%	2030	2125	21%
33	W Chambers Prairie	0	2	2022	2080	48%	2030	2100	29%
34	SE Olympia	2	3	2020	2075	55%	2030	2125	21%
35	Wilderness	3	3	2020	2050	100%	2030	2125	21%
36	Chambers Prairie	4	1	2016	2040	100%	2030	2075	44%
37	Downtown Olympia	5	3	2015	2025	100%	2030	2125	21%

2.4 Onsite Septic Systems

As discussed in the previous section, future sewerage considers extension of sewer to new developments, as well as conversion of existing onsite septic systems. Figure 2-4 illustrates the locations of the parcels with septic systems.

The 16,380 existing septic parcels represent a base flow of approximately 3.1 million gallons per day (mgd). The current projection assumes sewerage of 35% of those (5,663) by 2050, which would add a base flow of approximately 1.7 mgd to the system.

Figure 2-4. Existing Parcels with Septic Systems



3. Population and Employment Forecast

3.1 Projections

In 2018, TRPC published population projections in the form of a GIS parcel file and included projected residential population for the years 2018, 2020, 2025, 2030, 2035, and 2040. This analysis used previous TRPC projections for employment and maximum density estimate (build out state) that were published in 2013. Employment projections included the years 2010 and 2035, and build out projections expected to occur in 2050, based on a linear regression analysis.

For each parcel location, the following attributes were assigned: jurisdiction, drinking water basin, sewer basin, future sewer basin, drinking water consumption, whether the parcel was sewer or septic, and whether the parcel was predominately residential or commercial. The parcel data and associated attributes were exported from the GIS file into an Access database for grouping of the attributes. A total of 2,299 unique groups were formed. Each parcel in each group was located in the same jurisdiction, same drinking water, sewer, and future sewer basin; their drinking water consumption data was summed per group, as well as all of the population prediction data.

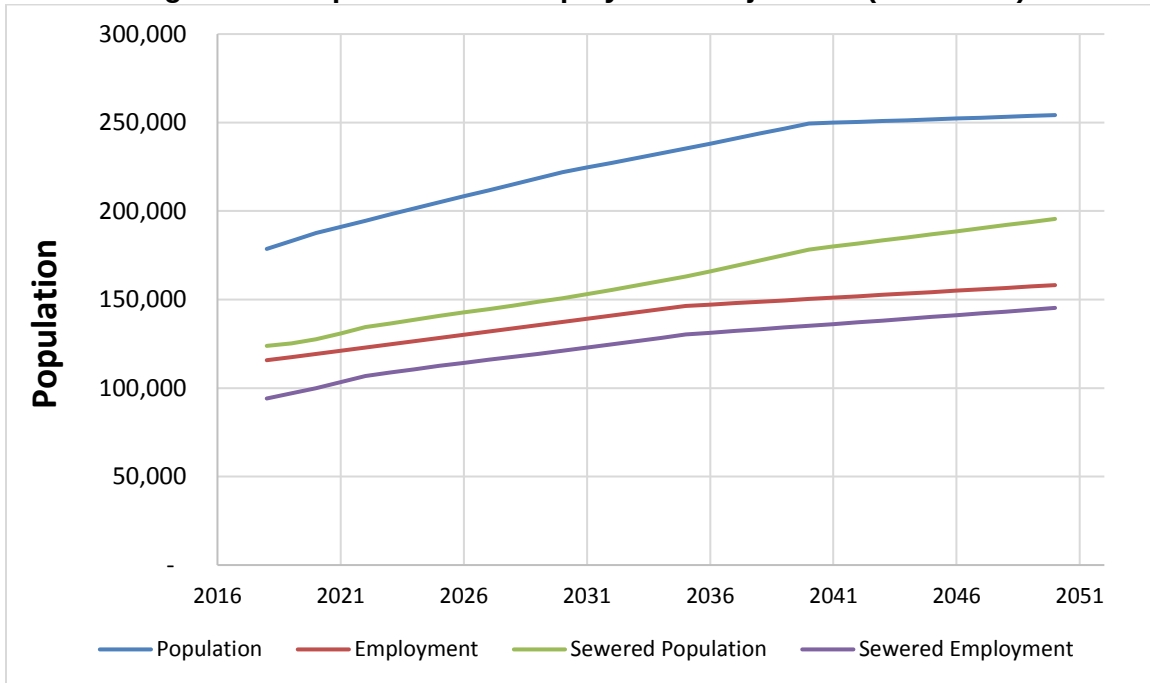
These groups were then exported from the Access database into Excel to perform the forecasting calculations. The future projections, shown in Table 3-1, were calculated through a linear extrapolation of the data provided by the TRPC, and the projected rate at which the sewer areas would expand.

The residential and employment populations include all persons and employees within the UGA. The sewer residential population and sewer employment population include only those contained within the sewer areas. Future expansion of the sewer areas is accounted for in the projections throughout the forecast period. Figure 3-1 displays the projected population and employment forecasts for the 2018-2050 planning period.

Table 3-1. Population and Employment Projections

Year	Residential Population	Employee Population	Sewered Residential Population	Sewered Employee Population
2019	183,117	117,540	125,294	97,011
2020	187,614	119,343	127,524	99,986
2021	191,082	121,146	130,905	103,297
2022	194,551	122,949	134,489	106,749
2023	198,020	124,752	136,510	108,700
2024	201,489	126,555	138,603	110,638
2025	204,958	128,358	140,771	112,577
2026	208,351	130,161	142,682	114,252
2027	211,744	131,964	144,635	115,932
2028	215,137	133,767	146,629	117,618
2029	218,530	135,570	148,663	119,312
2030	221,923	137,373	150,739	121,014
2031	224,599	139,175	153,095	122,841
2032	227,275	140,978	155,506	124,680
2033	229,951	142,781	157,972	126,531
2034	232,627	144,584	160,493	128,394
2035	235,303	146,387	163,067	130,269
2036	238,125	147,172	166,002	131,241
2037	240,947	147,956	168,988	132,218
2038	243,770	148,741	172,025	133,201
2039	246,592	149,525	175,112	134,190
2040	249,415	150,310	178,249	135,184
2041	249,895	151,094	179,961	136,168
2042	250,375	151,879	181,676	137,157
2043	250,856	152,663	183,396	138,152
2044	251,336	153,448	185,120	139,153
2045	251,816	154,232	186,849	140,160
2046	252,297	155,017	188,582	141,173
2047	252,777	155,801	190,321	142,191
2048	253,257	156,586	192,065	143,216
2049	253,738	157,370	193,815	144,246
2050	254,218	158,155	195,570	145,282
Full Sewering	254,218	158,155	254,218	158,155

Figure 3-1. Population and Employment Projections (2019-2050)



3.2 Equivalent Residential Units

For billing purposes, each customer connection to the sewer system is measured in terms of equivalent residential units (ERUs). One ERU is the amount of wastewater presumed to come from an average, sewer-connected single-family household. For multi-family housing (i.e. apartments), each living unit is counted as 7/10 of an ERU. Commercial and industrial dischargers are billed on a volume basis using water consumption data, which is mathematically converted to ERUs.

Established in 1976 as part of the original LOTT Interlocal Agreement, LOTT has defined an ERU as 900 cubic feet of wastewater volume per month (224 gallons per day). Since that time, residential wastewater generation rates have decreased as a result of water conservation efforts. LOTT is currently developing an updated ERU estimate. Estimates of current residents and employees per ERU are provided in Table 3-2.

Table 3-2. Jurisdiction ERU Summary 2018

Jurisdiction	Residents/ERU	Employees/ERU
Lacey	2.45	11.69
Olympia	2.19	9.89
Tumwater	2.27	6.87
Weighted Average	2.31	9.38

Table 3-3 displays the annual average number of ERUs for each jurisdiction over the last 22 years.

Table 3-3. ERU Totals 20-Year Comparison

Year	Lacey	Olympia	Tumwater	Total
1997	10,966	21,430	6,447	38,843
1998	11,363	21,860	6,845	40,068
1999	11,786	22,242	6,962	40,990
2000	13,356	22,398	6,625	42,379
2001	12,362	23,062	6,582	42,006
2002	13,493	23,142	6,667	43,302
2003	13,689	23,445	6,999	44,133
2004	14,206	23,552	7,161	44,919
2005	14,543	23,939	7,572	46,054
2006	15,326	24,575	7,808	47,709
2007	17,647	24,453	8,127	50,227
2008	18,497	24,522	8,441	51,460
2009	19,092	24,333	8,622	52,047
2010	19,463	24,220	8,819	52,502
2011	20,376	24,452	9,131	53,959
2012	20,372	24,324	9,464	54,160
2013	20,789	25,161	10,136	56,086
2014	21,000	25,100	9,600	55,700
2015	21,895	26,502	10,319	58,716
2016	22,545	26,295	10,706	59,546
2017	23,139	27,150	10,761	61,050
2018	23,752	27,452	10,979	62,183

3.3 New Connections

New connections to the system are billed a one-time connection fee, called a Capacity Development Charge (CDC). One CDC is assessed for each ERU connected to the system. Table 3-4 lists the number of CDCs collected over the last 22 years. Table 3-5 lists the projected new connections over the planning period.

Table 3-4. New Connections 22-Year Comparison

Year	Lacey	Olympia	Tumwater	Total
1997	533	381	109	1,023
1998	663	1,361	429	2,453
1999	1,062	882	214	2,159
2000	316	301	144	761
2001	498	306	164	968
2002	489	410	130	1,029
2003	541	296	273	1,110
2004	750	580	414	1,744
2005	942	392	368	1,702
2006	1,888	488	208	2,584
2007	1,129	219	400	1,748
2008	688	201	288	1,178
2009	510	247	119	875
2010	436	346	192	974
2011	462	429	176	1,066
2012	385	336	187	908
2013	384	399	187	970
2014	398	421	163	982
2015	667	332	142	1,141
2016	986	642	243	1,871
2017	455	586	224	1,265
2018	905	266	155	1,325

**Table 3-5. New Connection Projections
Through the Year 2050**

Year	Lacey	Olympia	Tumwater	Total
2019	161	335	632	1,128
2020	147	465	701	1,314
2021	623	775	436	1,834
2022	669	819	449	1,937
2023	377	421	295	1,093
2024	387	431	303	1,121
2025	400	442	311	1,152
2026	460	369	182	1,011
2027	472	375	182	1,029
2028	484	381	182	1,047
2029	496	387	182	1,065
2030	508	392	182	1,083
2031	600	420	196	1,216
2032	614	427	199	1,240
2033	629	434	202	1,264
2034	643	441	205	1,288
2035	657	447	208	1,312
2036	682	432	229	1,343
2037	695	438	232	1,365
2038	708	443	236	1,387
2039	721	448	240	1,408
2040	733	453	243	1,430
2041	472	226	140	838
2042	473	227	141	840
2043	473	228	142	843
2044	474	229	142	845
2045	475	230	143	848
2046	476	231	144	851
2047	477	232	145	854
2048	478	232	146	857
2049	480	233	147	860
2050	481	234	148	863

4. Flows and Loadings

4.1 Permit Requirements

The Department of Ecology issued the National Pollutant Discharge Elimination System (NPDES) permit for the Budd Inlet Treatment Plant, number WA0037061, on February 16, 2018, and it became effective on April 1, 2018. The compliance is based primarily on loadings of biological oxygen demand (BOD), total suspended solids (TSS), and total inorganic nitrogen (TIN), rather than flow. Table 4-1 lists the loadings-based permit limitations.

Table 4-1. NPDES Permit Limitations

	Winter		Shoulder		Summer	
	(November-March)		(April, May, October)		(June-September)	
Parameter	Monthly	Weekly	Monthly	Weekly	Monthly	Weekly
BOD (lbs/day)	5,640	8,460	900	1,350	671	1,006
TSS (lbs/day)	5,265	7,898	5,265	7,898	5,265	7,898
TIN			3 mg/L, 338 lbs/day		3 mg/L, 288 lbs/day	
Ammonia (as N)	26 mg/L	36 mg/L				

4.2 Drinking Water Analysis

For this report, 2017 drinking water consumption data was collected from each of the jurisdictions. Drinking water consumption was reported monthly for each parcel. In order to determine the baseline drinking water consumption rate, and minimize the effect of irrigation, only winter (November, December, January, and February) drinking water consumption data were used for sewered customers. The total consumption was divided by the total number of days to determine the gallons per day per parcel. The wastewater generation rates were then updated using the population and employment data provided by TRPC.

The drinking water basins were created by consolidating sewer basins with similar consumption characteristics into larger basins. Figure 4-1 illustrates the drinking water basins included in this analysis. The wastewater generation rates are organized by drinking water basin in Table 4-2. The variance in drinking water consumption, and therefore wastewater generation, between basins may be attributed to a number of contributing factors, including the predominant type of residential units in the basin (single-family, multi-family, senior housing, etc.), the predominant era of home construction, the average age of the residents, and the various commercial, industrial, or public sector employers present in each basin.

Figure 4-1. 2012 Drinking Water Basins

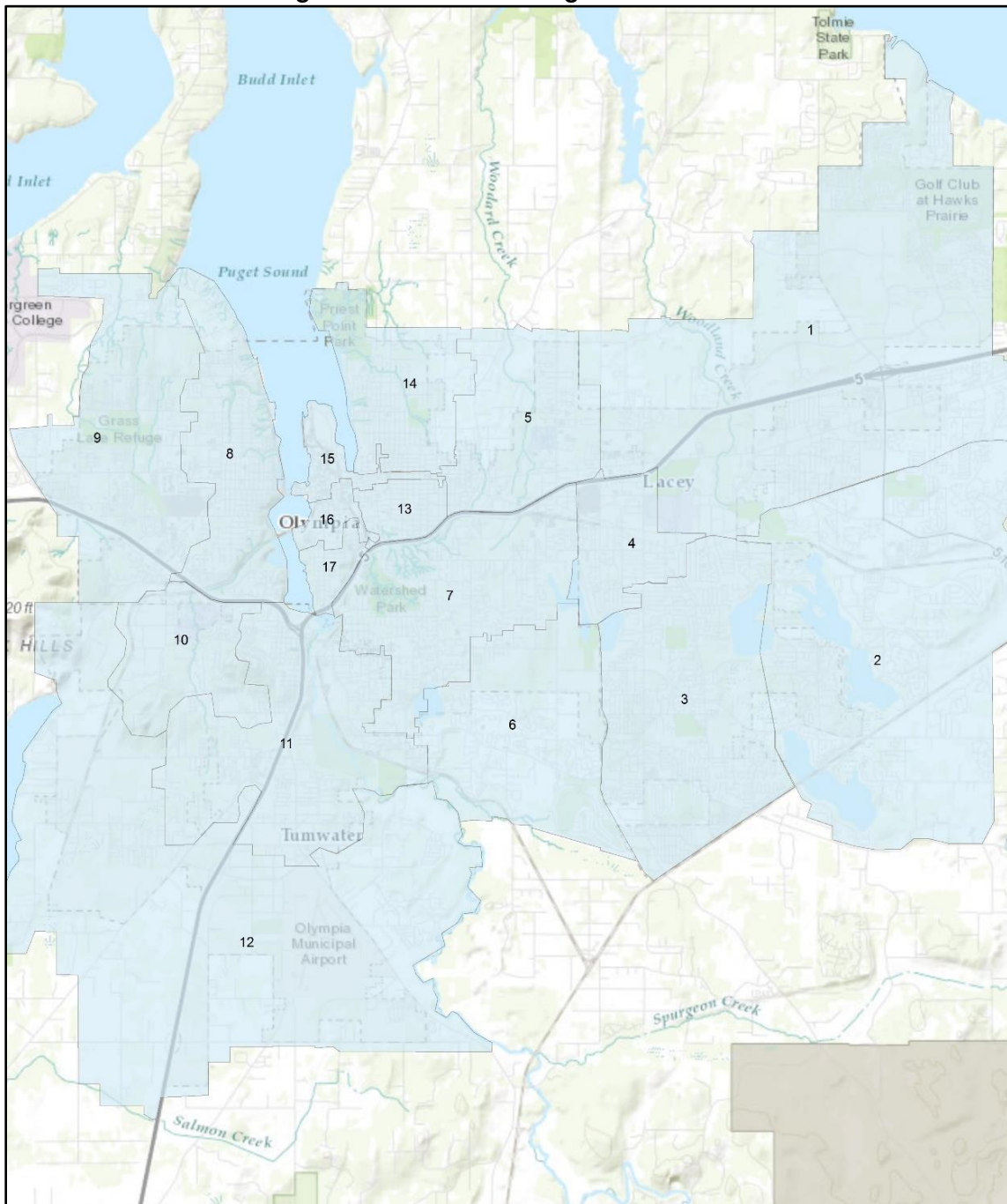


Table 4-2. Wastewater Generation Rate Averages by Drinking Water Basin

Basin	Population		Drinking Water Consumption ¹			Adjusted Wastewater Generation Rate	
	Sewered Residential	Sewered Employee	Total gpd	Residential gpd	Employee gpd	Residential gpcd ²	Employee gpcd ³
1	14,774	12,062	1,438,291	831,607	606,684	49.4	44.2
2	7,550	686	568,435	508,605	59,830	59.2	76.6
3	24,476	4,750	1,727,604	1,489,196	238,408	53.4	44.1
4	6,369	8,890	542,374	384,675	157,699	53.0	15.6
5	4,054	9,018	324,132	194,815	129,318	60.5	18.0
6	3,881	625	205,458	192,531	12,927	62.4	26.0
7	10,082	2,848	680,086	533,705	146,381	66.6	64.7
8	10,602	5,888	643,635	531,438	112,197	63.1	24.0
9	10,680	9,365	800,553	565,424	235,129	66.6	31.6
10	3,536	3,025	324,784	181,750	143,034	55.9	51.4
11	11,243	9,322	800,994	588,355	212,639	56.9	24.8
12	3,147	5,644	277,230	175,073	102,157	60.5	19.7
13	1,966	2,713	124,865	94,891	29,974	60.7	13.9
14	5,363	840	267,036	255,150	11,887	59.9	17.8
15	1,233	5,521	200,634	44,752	155,882	45.7	35.5
16	906	8,892	120,309	34,636	85,674	48.1	12.1
17	1,513	1,114	84,308	74,091	10,217	61.6	11.5
Total	121,542	91,279	9,130,730	6,694,174	2,451,281	57.9	28.5

¹ Raw data, only a portion of total parcels accounted for. Data not adjusted for sewer base flows.

² Gallons per capita per day

³ Gallons per employee per day

4.3 Base Sanitary Flow

In order to accurately forecast flows based on population changes within the service area, a base sanitary flow (BSF) must be established to calibrate residential and employee wastewater generation rates. The base sanitary flow is defined as the minimum average flow generated in the entire collection system, registered over a seven-day period in each year, and assumed to have little to no influence from inflow and infiltration.

Base sanitary flow is measured at the influent of the Budd Inlet Treatment Plant (BITP). Reclaimed water produced by the Martin Way Reclaimed Water Plant, which is diverted to the Hawks Prairie and Woodland Creek infiltration basins, is added to the flow measured at the BITP to ensure that flows of the entire system are accounted for. The BSFs, measured in million gallons per day (mgd), from 2001 to 2018 are provided in Table 4-3 and exclude flows from the Tumwater brewery.

**Table 4-3. Base Sanitary Flow
in LOTT Service Area**

Year	Base Sanitary Flow (mgd)¹
2001	7.94
2002	7.92
2003	8.12
2004	8.79
2005	8.77
2006	8.50
2007	8.40
2008	8.68
2009	8.77
2010	9.29
2011	9.21
2012	8.77
2013	8.94
2014	9.22
2015	9.52
2016	10.06
2017	10.20
2018	10.17

¹Equals the raw dewatered sewage flow at the Budd Inlet Treatment Plant, minus brewery flow, plus flow treated at the Martin Way Reclaimed Water Plant

The current NPDES permit requires that the LOTT Clean Water Alliance conduct an annual infiltration and inflow evaluation such that the entire collection system is evaluated once every seven years. LOTT monitors system flows at seven permanent flow monitoring locations and three pump stations. This, along with flows recorded during previous years, allows for a more detailed analysis of each jurisdiction's base flows. The BSF for each of the jurisdictions is provided in Table 4-4. A more detailed analysis is included in the 2018 Inflow & Infiltration and Flow Monitoring Report.

Table 4-4. Base Sanitary Flow by Jurisdiction (mgd)

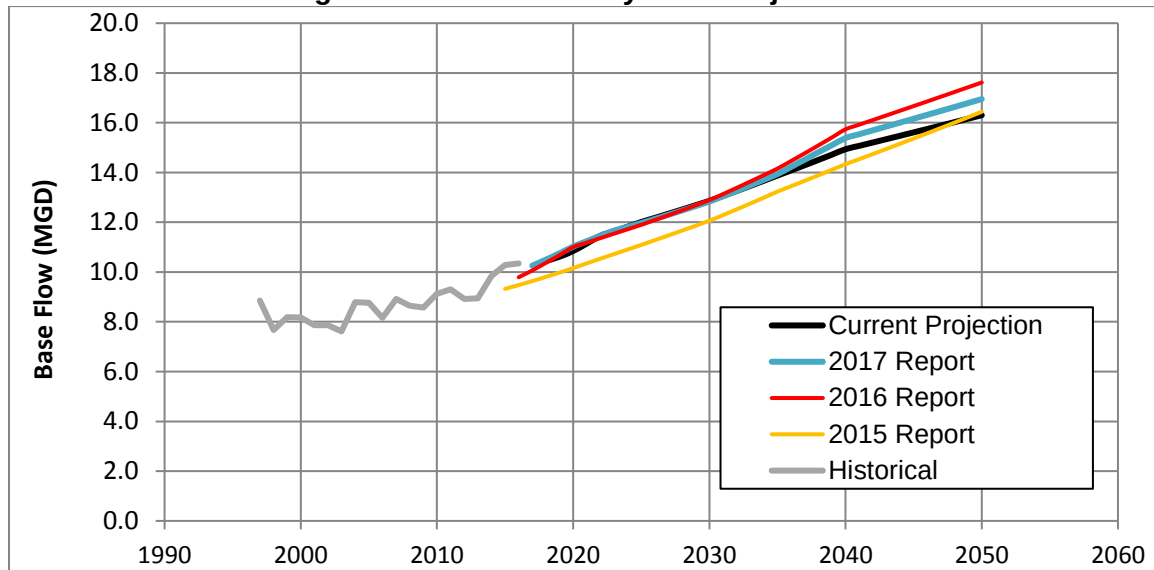
Year	Lacey	Olympia	Tumwater	Point Sources (TESC¹, etc.)	Total
2006	2.63	4.31	1.73	0.05	8.27
2007	2.63	4.32	1.21	0.1	8.26
2008	2.94	4.02	1.14	0.48	8.58
2009	3.09	3.42	1.41	0.54	8.47
2010	3.14	3.56	1.19	0.45	8.34
2012 ²	3.28	4.11	1.37	0.42	9.18
2013	3.10	4.14	1.23	0.41	8.88
2014	3.16	4.31	1.21	0.54	9.22
2015	3.18	4.25	1.54	0.53	9.52
2016	3.56	4.52	1.43	0.58	10.06
2017	3.75	4.34	1.52	0.58	10.20
2018	3.74	4.33	1.52	0.58	10.17

¹ The Evergreen State College (TESC), artesian wells, and Pepsi Bottling Company

² June 2011 – May 2012 average

Figure 4-2 presents the base sanitary flow projections and compares them with those published in the 2017 LOTT Flows and Loadings Report, as well as historical observations since 1997. This year's projections show a decreased rate of growth between 2040 and 2050.

Figure 4-2. Base Sanitary Flow Projections



4.4 Comparison with Historical Wastewater Generation Rates

Historically, wastewater generation rates were developed for each city based upon flow monitoring data. Beginning in 2007, drinking water consumption data has been obtained directly from each of the jurisdictions, enabling a more precise estimation of the wastewater generation rate profiles, as shown in Table 4-2. These profiles have been organized into city-specific profiles for comparison with previous estimates. Table 4-5 summarizes the historical rate profiles, along with the corresponding values developed in this report.

Table 4-5. Wastewater Generation Rate Gallons Per Capita Per Day (gpcd)

Source	Lacey	Olympia	Tumwater	Employment
1995-2002 CIP	66	85	73	40
2003 CIP	64	81	69	39
Budd Inlet Master Plan (2004)	64	75	69	35
2005 CIP	68	62	65	35
2006 Flows and Loadings	71	64	61	34
2007 Flows and Loadings	69	67	74	22
2008 Flows and Loadings	62	66	82	26
2009 Flows and Loadings	66	67	73	20
2010 Flows and Loadings	66	69	69	25
2012 Flows and Loadings	63	67	66	18
2013 Flows and Loadings	66	75	72	20
2014 Flows and Loadings	57	64	58	19
2015 Flows and Loadings	58	58	51	23
2016 Flows and Loadings	57	64	80	24
2017 Flows and Loadings	58	70	61	25
2018 Flows and Loadings	53	63	57	29

These values are extrapolated from the values in Table 4-2, though they were not used in the model. They are presented for the sake of comparison to previous years' profiles.

4.5 Flow Projections

Flow projections are calculated by multiplying the projected sewer populations by the wastewater generation rate. The per capita generation rates are drinking water basin specific. The projected sewer population projections are dependent on whether the parcel is currently sewer, on a septic system, or not sewer and not on septic. The model assumes that these generation rates are constant throughout the simulation period (2019-2050). Each year, these wastewater generation rates will be recalibrated based on ongoing flow monitoring and population estimates. Figure 4-3 displays the projected base flow, annual average, compliance period (winter, summer, shoulder), and peak flows through the year 2050.

4.6 Inflow and Infiltration Projections

The impact of inflow and infiltration on projected flows was also modeled using the projected inflow and infiltration rates as documented in the 2018 Inflow & Infiltration and Flow Monitoring Report. Projections were developed for the following risk-based I&I scenarios: 1) annual average; 2) 10-year peak day; 3) 10-year peak hour; 4) 10-year peak month; 5) summer (June-September); 6) shoulder (April, May, and October); and 7) winter (November-March) time period flows. Flow projections are displayed in Figure 4-3 and listed in Table 4-6.

Figure 4-3. Flow Projections

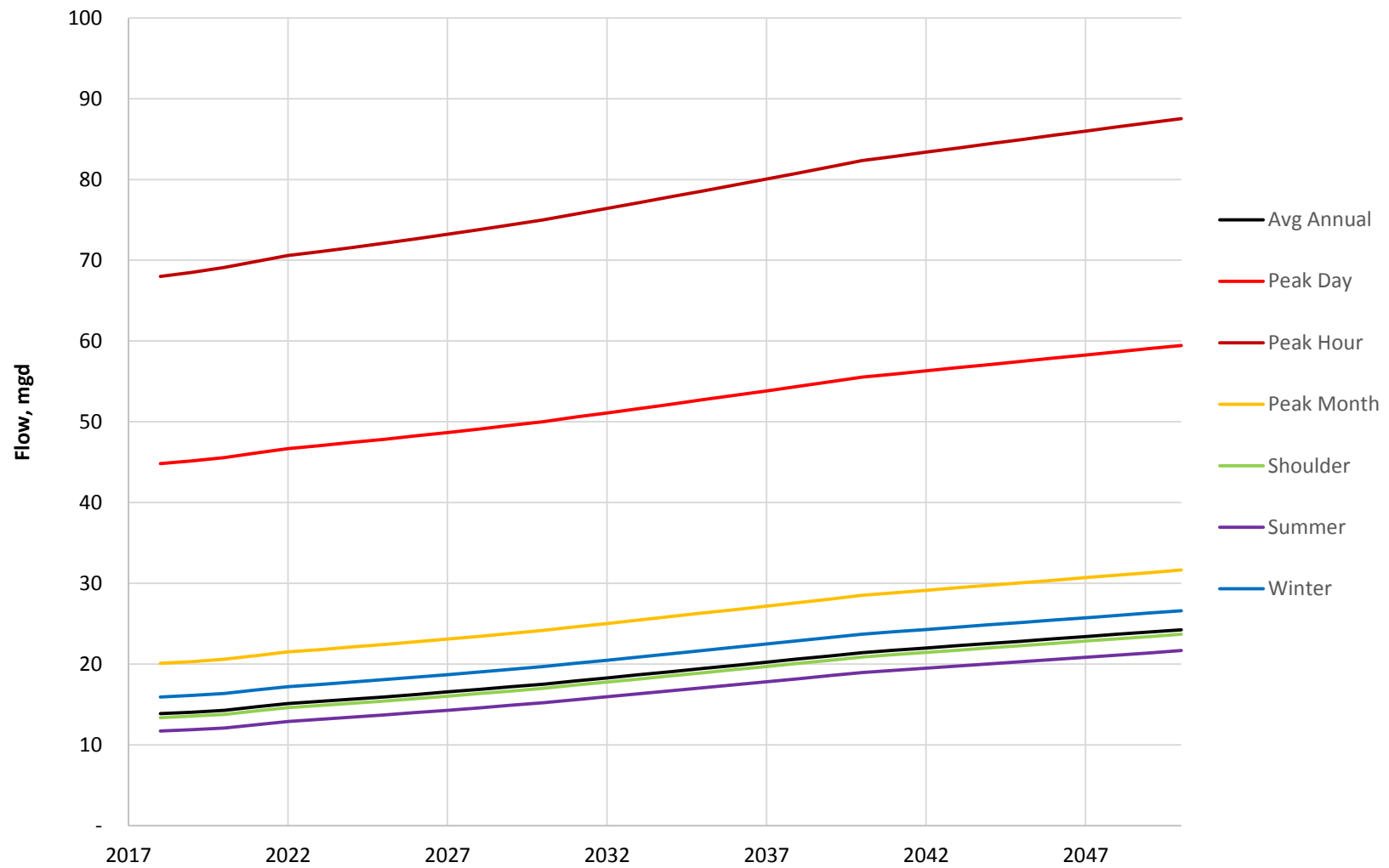


Table 4-6. Flow Projections (mgd)

Year	Base Sanitary Flow	Annual Average	Peak Hour (10-year)	Peak Day (10-year)	Peak Month (10-year)	Shoulder ¹	Summer ²	Winter ³
2019	10.62	14.02	68.32	45.03	20.26	13.54	11.88	16.08
2020	10.85	14.28	68.97	45.47	20.57	13.79	12.11	16.35
2021	11.15	14.60	69.52	45.89	20.91	14.11	12.42	16.68
2022	11.46	14.93	70.09	46.34	21.27	14.44	12.74	17.02
2023	11.64	15.12	70.42	46.59	21.48	14.63	12.92	17.21
2024	11.82	15.31	70.76	46.85	21.69	14.82	13.11	17.41
2025	12.01	15.51	71.11	47.12	21.91	15.02	13.30	17.61
2026	12.18	15.69	71.41	47.36	22.10	15.19	13.47	17.79
2027	12.34	15.86	71.72	47.59	22.30	15.37	13.64	17.97
2028	12.51	16.05	72.04	47.84	22.50	15.55	13.82	18.16
2029	12.69	16.23	72.36	48.09	22.70	15.73	13.99	18.35
2030	12.86	16.42	72.69	48.34	22.90	15.92	14.17	18.54
2031	13.06	16.62	73.06	48.62	23.13	16.12	14.37	18.75
2032	13.26	16.83	73.43	48.91	23.36	16.33	14.58	18.97
2033	13.46	17.05	73.81	49.20	23.60	16.55	14.78	19.19
2034	13.67	17.27	74.20	49.50	23.84	16.76	15.00	19.41
2035	13.88	17.49	74.60	49.80	24.09	16.99	15.21	19.64
2036	14.08	17.71	75.00	50.11	24.33	17.20	15.42	19.87
2037	14.29	17.94	75.42	50.42	24.58	17.43	15.63	20.10
2038	14.50	18.16	75.84	50.74	24.83	17.65	15.85	20.33
2039	14.72	18.39	76.27	51.06	25.08	17.88	16.07	20.57
2040	14.94	18.63	76.71	51.39	25.34	18.11	16.30	20.81
2041	15.07	18.77	76.97	51.58	25.50	18.25	16.43	20.95
2042	15.21	18.91	77.23	51.78	25.66	18.40	16.57	21.10
2043	15.34	19.06	77.48	51.97	25.81	18.54	16.71	21.25
2044	15.48	19.20	77.74	52.17	25.97	18.68	16.85	21.40
2045	15.61	19.34	78.00	52.37	26.13	18.83	16.99	21.54
2046	15.75	19.49	78.26	52.57	26.29	18.97	17.13	21.69
2047	15.89	19.64	78.52	52.76	26.45	19.11	17.27	21.84
2048	16.02	19.78	78.78	52.96	26.61	19.26	17.41	21.99
2049	16.16	19.93	79.04	53.16	26.78	19.41	17.55	22.14
2050	16.30	20.08	79.30	53.37	26.94	19.55	17.69	22.30
Full Sewering	20.18	24.26	87.54	59.45	31.65	23.70	21.68	26.62

1. April, May, and October

2. June, July, August, and September

3. November, December, January, February, and March

4.7 Loading Projections

Loading projections are updated each year based upon observed BOD and TSS loadings at the Budd Inlet Treatment Plant. In 2018, the average monthly BOD and TSS loads to the Budd Inlet Treatment Plant were 25,644 pounds per day (lbs/d) and 25,420 lbs/d, respectively. Load removal at the Martin Way Reclaimed Water Plant (MWRWP) is taken into account when estimating ERU generation rate profiles. In 2018, it is estimated that the MWRWP removed approximately 1,593 lbs/d of BOD and 1,082 lbs/d of TSS.

Projected BOD and TSS loadings for this report are based on a correlation of loadings from 2003-2018, with the 2007 through 2018 values corrected to account for loadings removal at the MWRWP. These values are broken down into blanket residential and employment generation rates based upon the latest population and employment projections. These rates are provided in Table 4-7.

**Table 4-7. Wastewater Load Generation Rate Profiles
(lbs per capita/employee day)**

Residential		Employment	
BOD	TSS	BOD	TSS
0.134	0.127	0.134	0.127

Figure 4-4 displays the historical influent loading characteristics at the Budd Inlet Treatment Plant to include monthly averages for BOD and TSS. After a period of stagnant loadings from 2005 through 2013, loadings in the past four years have been considerably higher.

Figure 4-4. Historical Primary Influent Loads (Monthly Average)

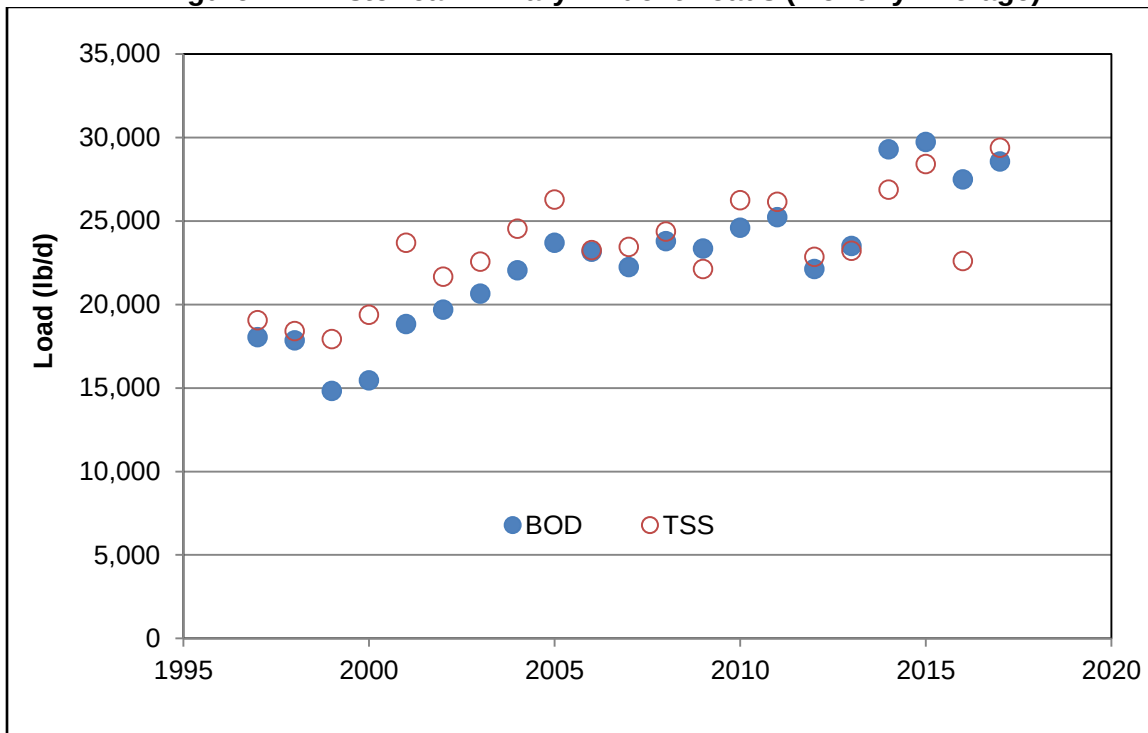


Figure 4-5 and Table 4-8 present the projected BOD and TSS loadings in the LOTT service area through 2050. These loading rates are calculated by multiplying the projected sewer populations by the per capita loading rates detailed in Table 4-7.

Figure 4-5. Projected Loadings

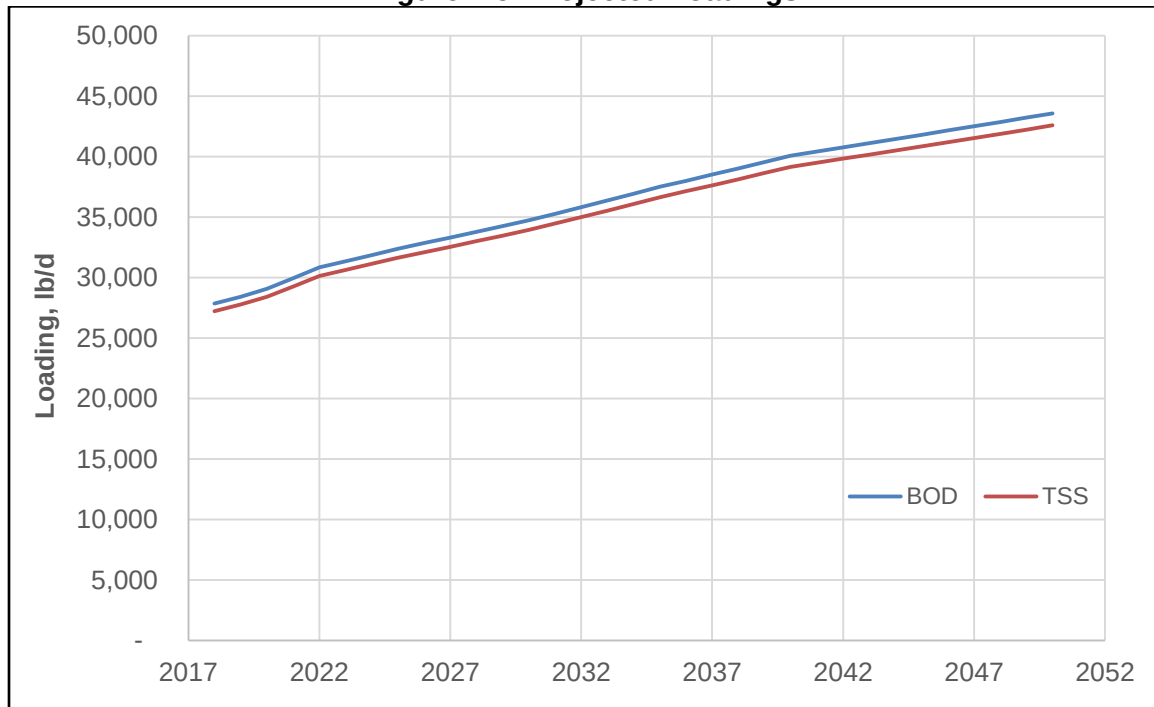


Table 4-8. Projected Flows and Loadings

Year	Average Day BOD (lbs/day)	Average Day TSS (lbs/day)
2019	28,423	27,774
2020	29,089	28,424
2021	29,944	29,260
2022	30,844	30,139
2023	31,352	30,635
2024	31,867	31,139
2025	32,392	31,652
2026	32,851	32,100
2027	33,315	32,554
2028	33,786	33,014
2029	34,262	33,479
2030	34,745	33,951
2031	35,280	34,474
2032	35,824	35,005
2033	36,376	35,544
2034	36,936	36,092
2035	37,505	36,648
2036	38,004	37,136
2037	38,511	37,631
2038	39,025	38,133
2039	39,546	38,642
2040	40,074	39,159
2041	40,419	39,495
2042	40,765	39,833
2043	41,112	40,173
2044	41,460	40,513
2045	41,810	40,855
2046	42,161	41,198
2047	42,514	41,542
2048	42,868	41,888
2049	43,223	42,235
2050	43,580	42,584
Full Sewering	52,724	51,520

4.8 Projections Analysis

The following plots compare the projections summarized in this report with historical trends. This annual recalibration is intended to ensure that projections remain consistent with both projected development within the service area, as well as with historical trends. The plots present the four sets of projections that were defined earlier in section 2.3.

To reiterate, the aggressive rate assumes full sewerage by 2050 and septic conversion by 2075. The full sewerage projection assumes full sewerage and septic conversion by 2050. The low rate assumes that full sewerage of the cities and UGA will not be achieved until after 2150, and that most conversion of parcels with existing septic systems would not begin until 2030. The expected rate assumes 75-80% sewerage within the cities and UGA, and conversion of 35% of existing septic tanks by 2050. These projections are compared against historical flows and loads observed since 1997. The expected rate projection from last year's report is represented by the black dashed line.

Figure 4-6. Comparison of Historical Base Flow and Base Flow Projected from Four Different Projection Models

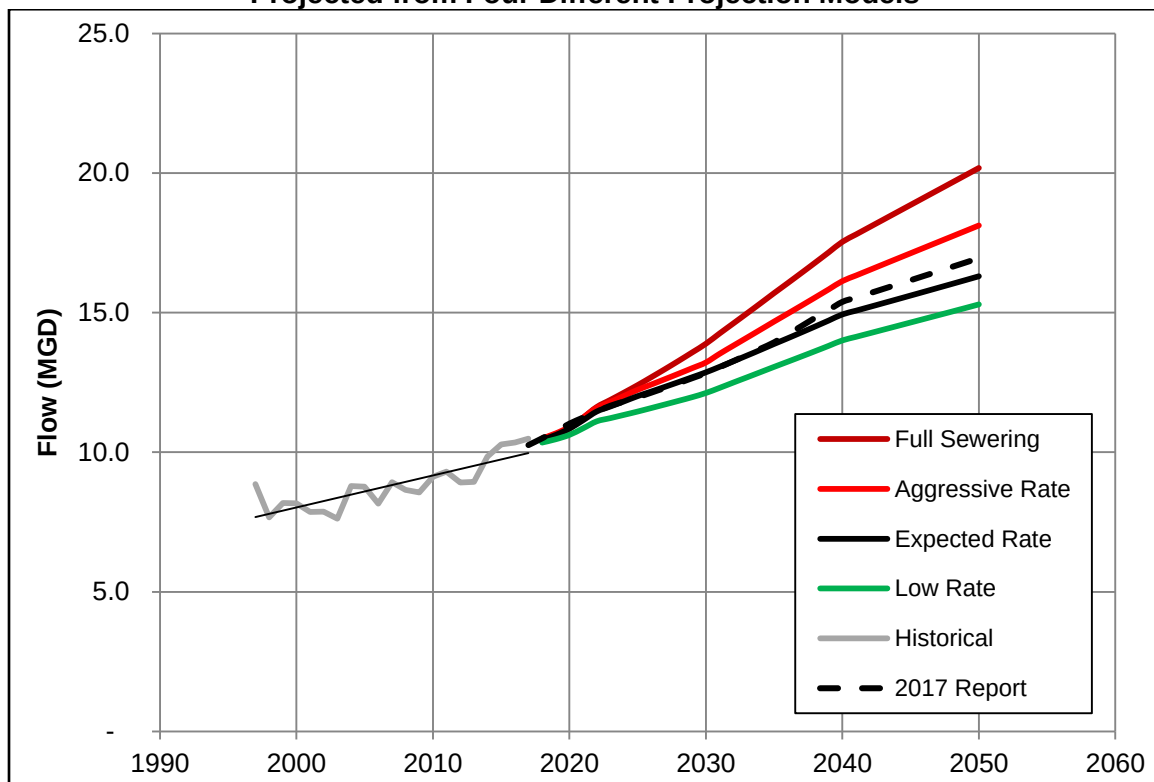


Figure 4-7. Comparison of Historical BOD Loadings and BOD Projected from Four Different Projection Models

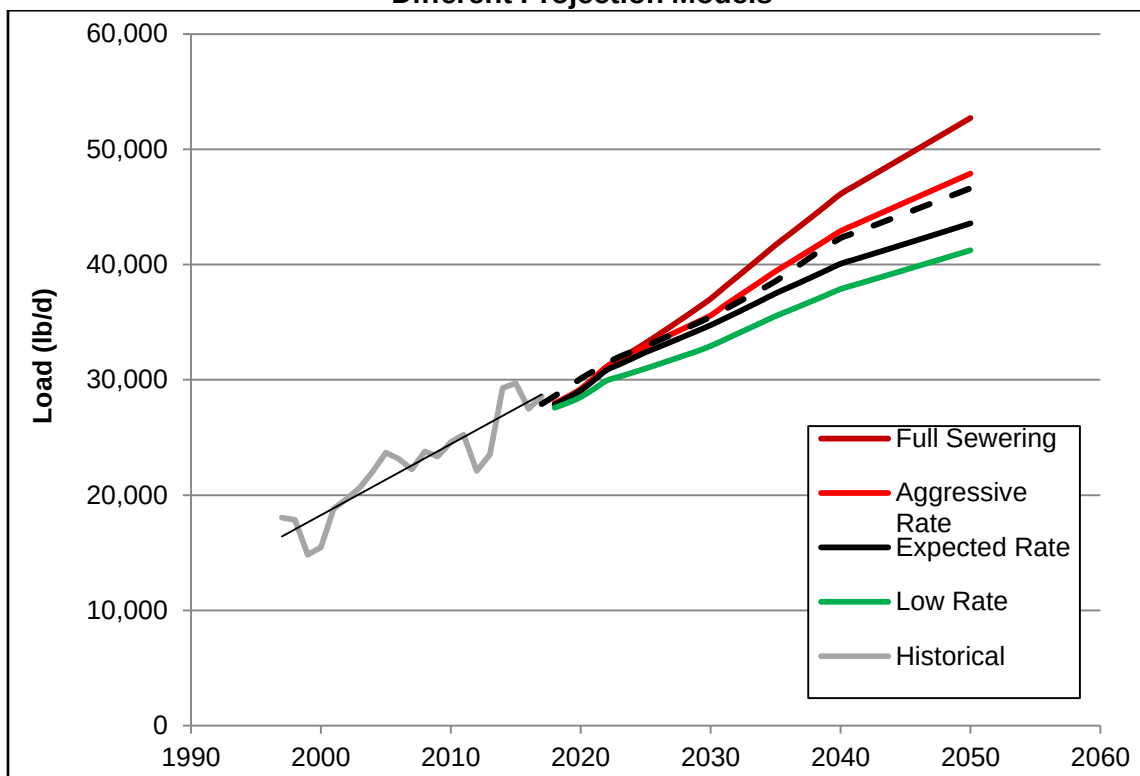


Figure 4-8. Comparison of Historical TSS Loadings and TSS Projected from Four Different Projection Models

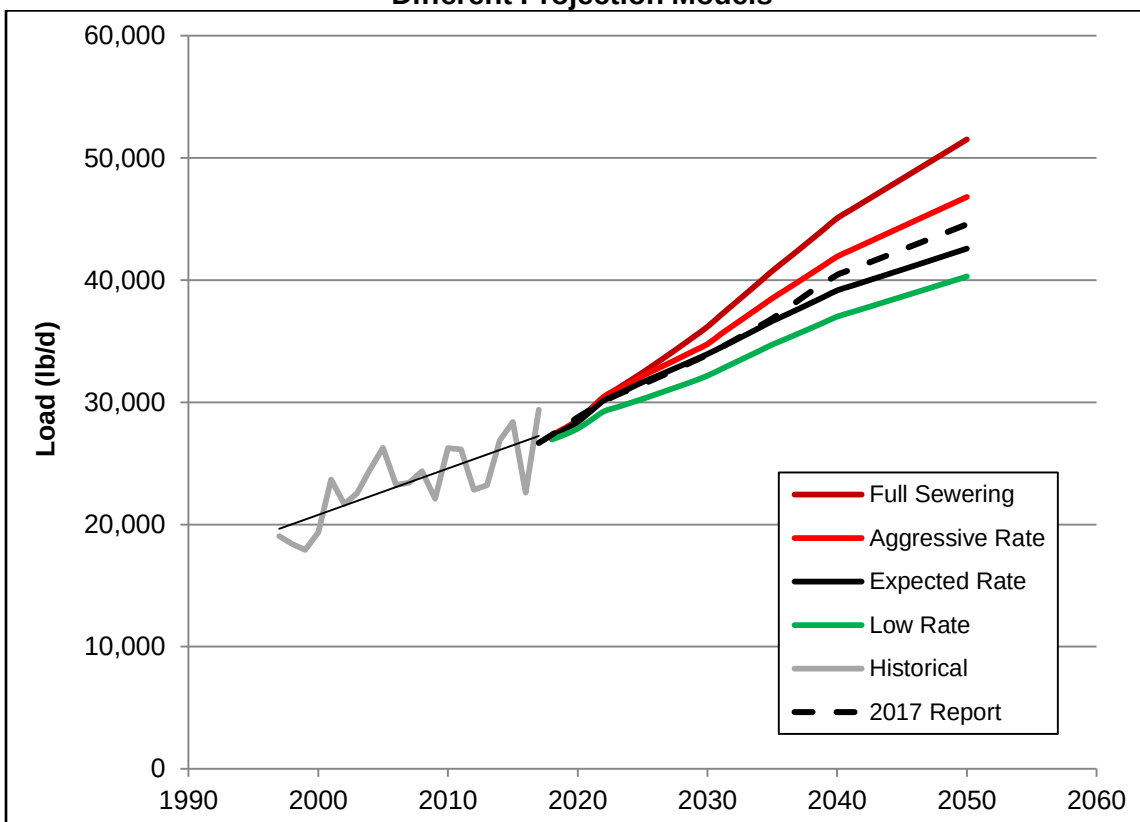
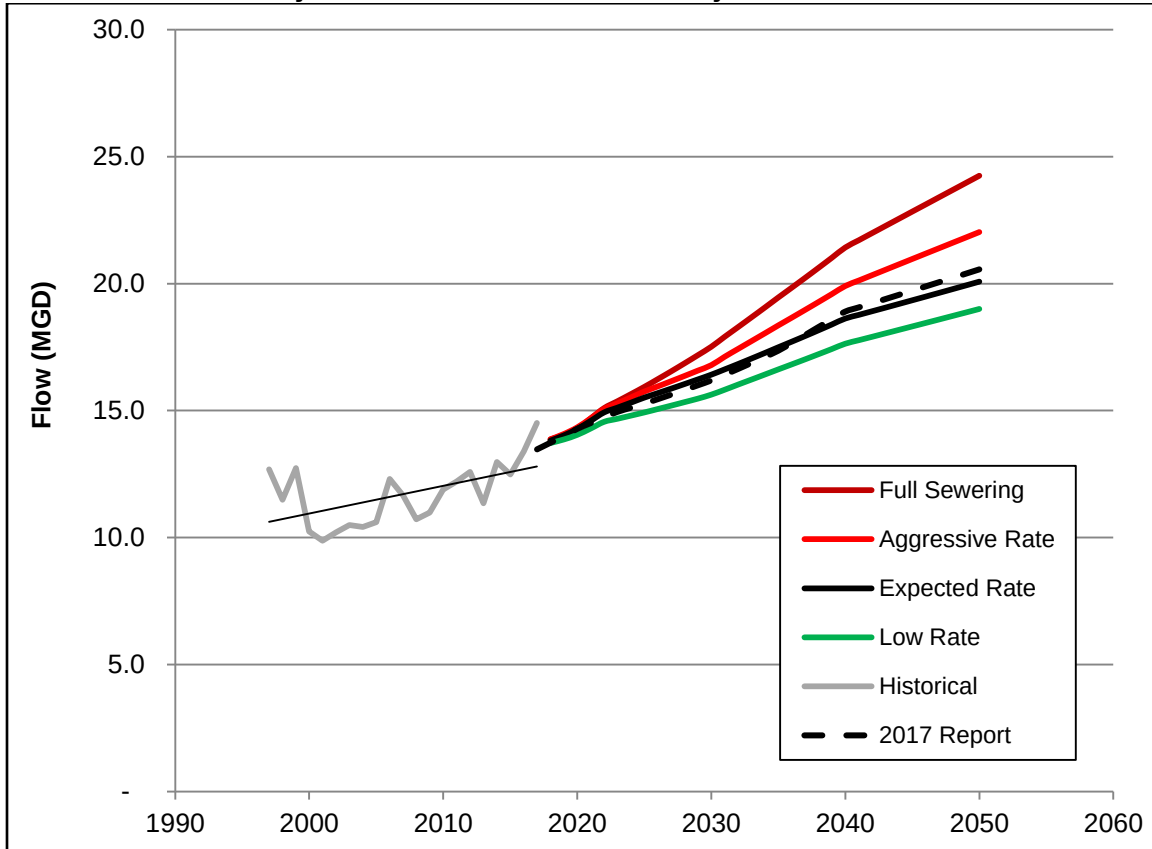


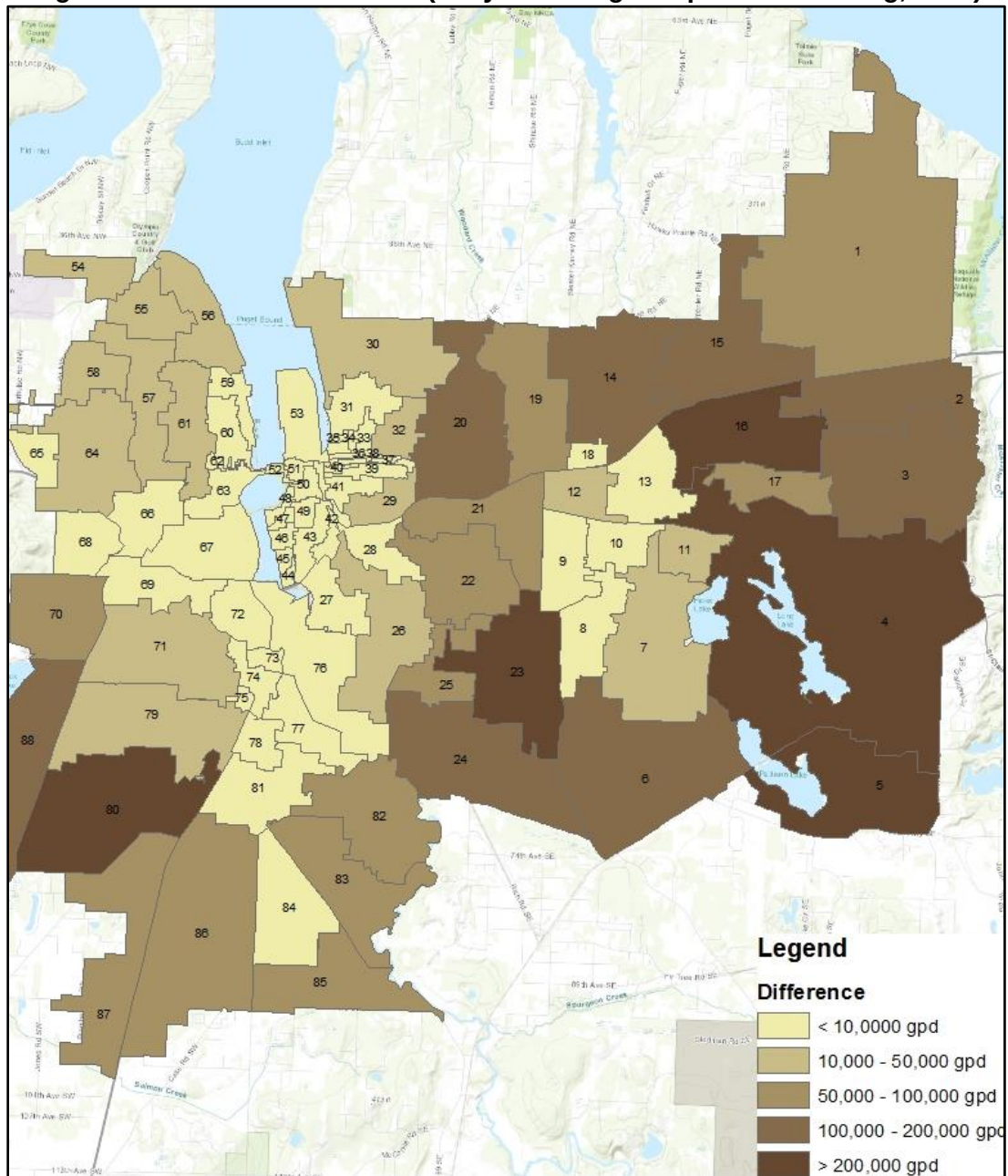
Figure 4-9. Comparison of Historical Average Daily Flow and Average Daily Flow Projected from Four Different Projection Models



In general, the updated projections represent a decrease compared to those in the 2017 Flows and Loadings Report. This is related to the new population projections published by TRPC, which caused future years (2040 to 2050) to show a decrease in growth rate. This decrease is observed in both flows and loadings.

Figure 4-10 shows the difference in projected 2050 base flow in the LOTT sewer basins between the expected sewerage projection and the full sewerage projection. Areas with a large difference are those which are most impacted by the rate of sewerage. These areas, concentrated in southeastern Lacey, are relatively far from the existing sewer network and have a high proportion of parcels with septic tanks. More aggressive sewerage and septic conversion rates would result in higher sewer flows originating in these areas, with impacts to the LOTT Martin Way sewer interceptors, the Indian Creek Interceptor, the Martin Way Pump Station, and the Martin Way Reclaimed Water Plant.

Figure 4-10. Difference in Flow (Fully Sewering – Expected Sewering, 2050)



5. Summary

Generally, flows and loadings projected in 2018 are slightly reduced from the previous year. This was due to the newly published population projections from the TRPC. The information in this report was used to develop the 2018 Capacity Assessment Report and the 2019-2020 Capital Improvements Plan.

2018

CAPACITY REPORTS

*FLOWS & LOADINGS
I&I/FLOW MONITORING
CAPACITY ASSESSMENT*



2018 Inflow & Infiltration and Flow Monitoring Report

**(Data from August 2017-April 2018)
May 2019**

Prepared By:

Adam Klein and Hannah McLean, Brown & Caldwell
Tyle Zuchowski, LOTT Clean Water Alliance

Table of Contents

PREFACE	ii
1. Introduction	1
2. Overview	2
2.1 Program History	2
2.2 Flow Measurement Methodology	6
2.3 Basin Summary	6
2.4 Flow Monitoring Site Summary	6
2.5 Flow Monitoring Data	7
2.6 Inflow and Infiltration Analysis	7
3. Flow Data Analysis	9
3.1 Summary of I&I Statistics for All Flow Monitoring Sites	9
3.2 Analysis of Inflow and Infiltration	10
3.3 Site Assessments	10
3.3.1 Site D6	11
3.3.2 Site D11	13
3.3.3 Site L6	15
3.3.4 Site L7	17
3.3.5 Site OL25	19
3.3.6 Site OL27	21
3.3.7 Site OL33	23
3.3.8 KRPS	25
3.3.9 MWPS	27
3.3.10 CLPS	29
3.3.11 System-Wide	31
3.3.12 Updated I&I Model	32
3.3.13 I&I Benchmarks and Basin Ranking	35
3.3.14 Comparison of base flow and I&I from 2017 to 2018	36
4. Conclusions and Recommendations	40
5. Flow Monitoring Installation Reports	41

PREFACE

The Inflow & Infiltration and Flow Monitoring Report is one of three related documents that are part of the annual process to monitor and evaluate capacity in the entire LOTT system. The intent, under LOTT's Wastewater Resource Management Plan (also known as the Highly Managed Plan), is to assure that needed new capacity is brought on-line "just-in-time" to meet system needs. Capacity needs evaluated include wastewater treatment, Budd Inlet discharge, reclaimed water use/recharge, and conveyance capacity in the entire LOTT system. These three reports are prepared annually, and are used to help identify capital projects for inclusion in the annual Capital Improvements Plan.

Flows and Loadings Report – analyzes residential and employment population projections within the Urban Growth Area and estimates the impact on wastewater flows and loading within the LOTT wastewater system.

Inflow & Infiltration and Flow Monitoring Report– uses dry and wet weather sewer flow monitoring results to quantify the amount of unwanted surface (inflow) and subsurface (infiltration) water entering the sewer system and to prioritize sewer line rehabilitation projects.

Capacity Assessment Report – uses flows and loadings data and inflow and infiltration evaluation results to analyze system components (i.e. conveyance, treatment, and discharge) to determine when limitations will occur, and provide a timeline for new system components and upgrades.

As each report is published, it will be posted in the "Library" on LOTT's website – www.lottcleanwater.org.

1. Introduction

The LOTT Clean Water Alliance flow monitoring program was initiated in 2003. In accordance with National Pollutant Discharge Elimination System (NPDES) Permit WA0037061, an inflow and infiltration (I&I) evaluation for all sub-basins within the LOTT system is required such that the entire system is evaluated once every seven years. The purpose of this program is to ensure permit compliance, characterize flows within the collection system, identify areas of concern for I&I, and aid in the prioritization of rehabilitation projects to reduce I&I. The program is also intended to fulfill requirements of the Intergovernmental Contract for Inflow and Infiltration Management and New Capacity Planning, originally dated March 27, 1995, as presented in Exhibit J to the LOTT Interlocal Cooperation Act Agreement for Wastewater Management by the LOTT Wastewater Alliance. The report includes an overview of the LOTT I&I program as well as the results and analysis of the monitoring program for the 2017/2018 monitoring period. The monitoring program has been in place for fifteen years.

Brown and Caldwell provides data quality assurance and control, and assists in annual I&I analyses. LOTT has contracted with SFE Global NW to install flow monitors throughout the system (Table 1-1) and collect monitoring data. For 2017/2018, flow monitors include seven permanent monitoring sites and four pump station monitors.

This report covers the monitoring year 2017 and spring 2018. The report is arranged as follows:

- Section 2 provides an overview of the program, including a summary monitoring program, and an inventory and assessment of the flow monitoring sites, equipment, and technology
- Section 3 presents the results of the inflow and infiltration analyses
- Section 4 summarizes the data collected in the new program and provides recommendations for the flow monitoring program

2. Overview

Inflow is defined as surface water entering the sewer via manholes, flooded sewer vents, illicitly connected storm drains, basement drains, and by means other than groundwater. Inflow is usually the result of rain and/or snowmelt events. *Infiltration* is defined as groundwater that enters the sewer, usually through leaky sewer pipe joints, manholes, and service connections.

2.1 Program History

When the program was instituted in 2003, information on system-wide I&I was limited. I&I modeling was conducted on flows recorded at the Budd Inlet Treatment Plant (BITP) and then allocated across the system based upon assumptions involving the age of the pipe and a subjective assessment of flows measured at pump stations. A major goal of this program was to more accurately define the spatial distribution of I&I. This would help LOTT with capacity planning for both its collection system, as well as its treatment facilities.

Another goal of this program was to assess changes in I&I over time, which would allow LOTT to highlight areas of concern, and advise the LOTT partners for areas to focus on remediation.

The first 14 years of this program featured rotating flow monitoring stations. Typically, a rotating flow monitoring station was set up for one calendar year, allowing for assessment of base flow during the summer, and I&I during the winter. As part of the program a total of 73 sites were monitored. Some of these sites were less useful than others in the sense that the data they provided were limited, either due to low flows, pump station impacts, or geometrical oddities which compromised the flow measurement. Others were monitored by LOTT partners for specific, short-term purposes. A total of 54 sites, plus the three LOTT pump stations and the Tumwater Hixon Street flow monitoring site are incorporated into LOTT's system-wide I&I model.

Starting this past year, the program has shifted to monitoring 11 permanent locations. The rotating flow monitoring sites served their purpose—allowing for detailed allocation of I&I across the 88 sewer basins. Presently, a smaller number of permanent sites allows for long term tracking of I&I. Periodically, temporary monitoring will be performed at certain locations which have shown marked deterioration over the course of this program, or where the permanent meters suggest that upstream assessment is warranted.

Figure 2-1 shows the locations of the eleven current flow meters, and Figure 2-2 shows their connectivity. Table 2-1 lists the flow monitoring sites included in this program and the associated tributary sewer basins measured by each site.

Figure 2-1. Location of the Permanent Flow Monitoring Sites

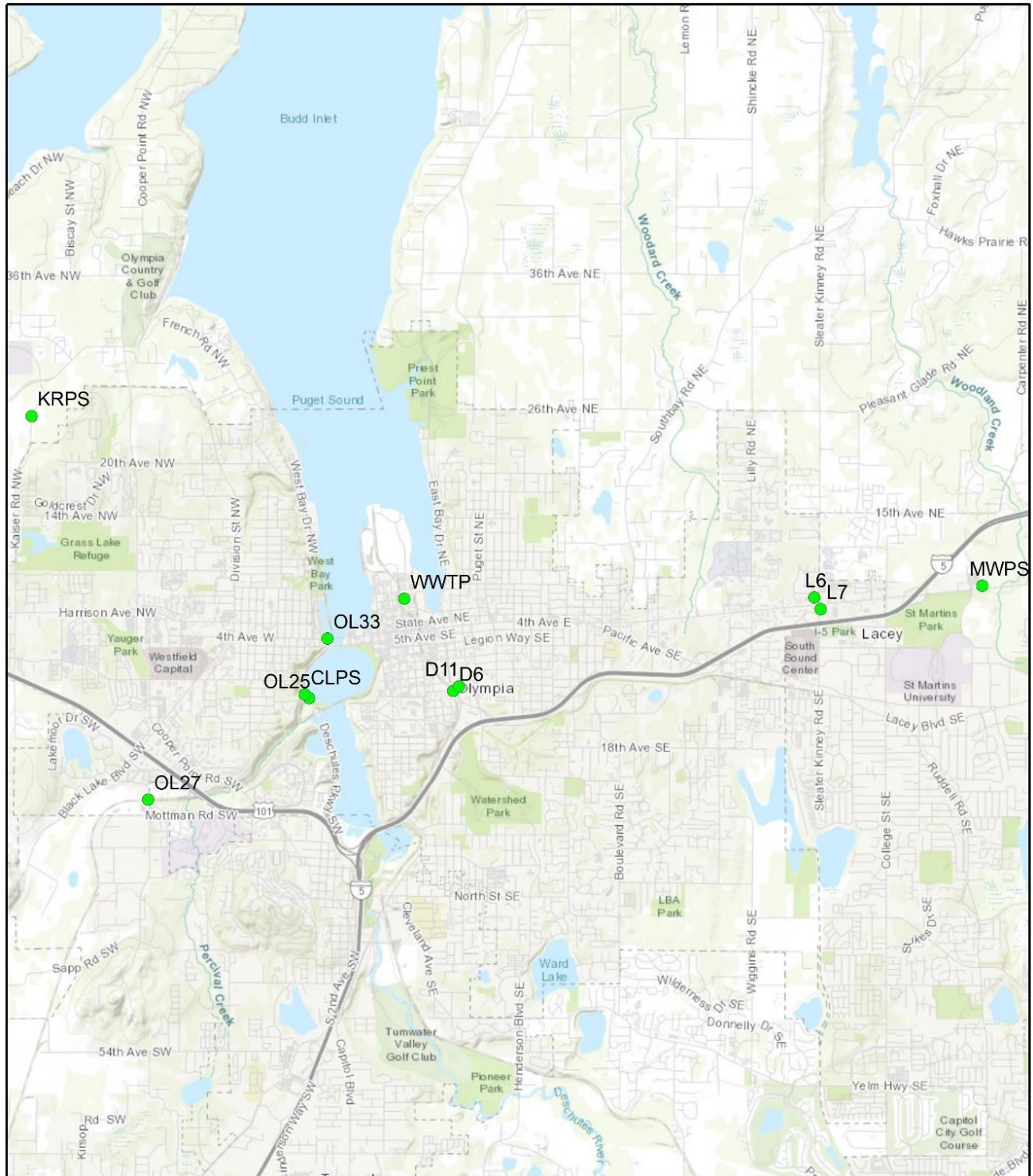
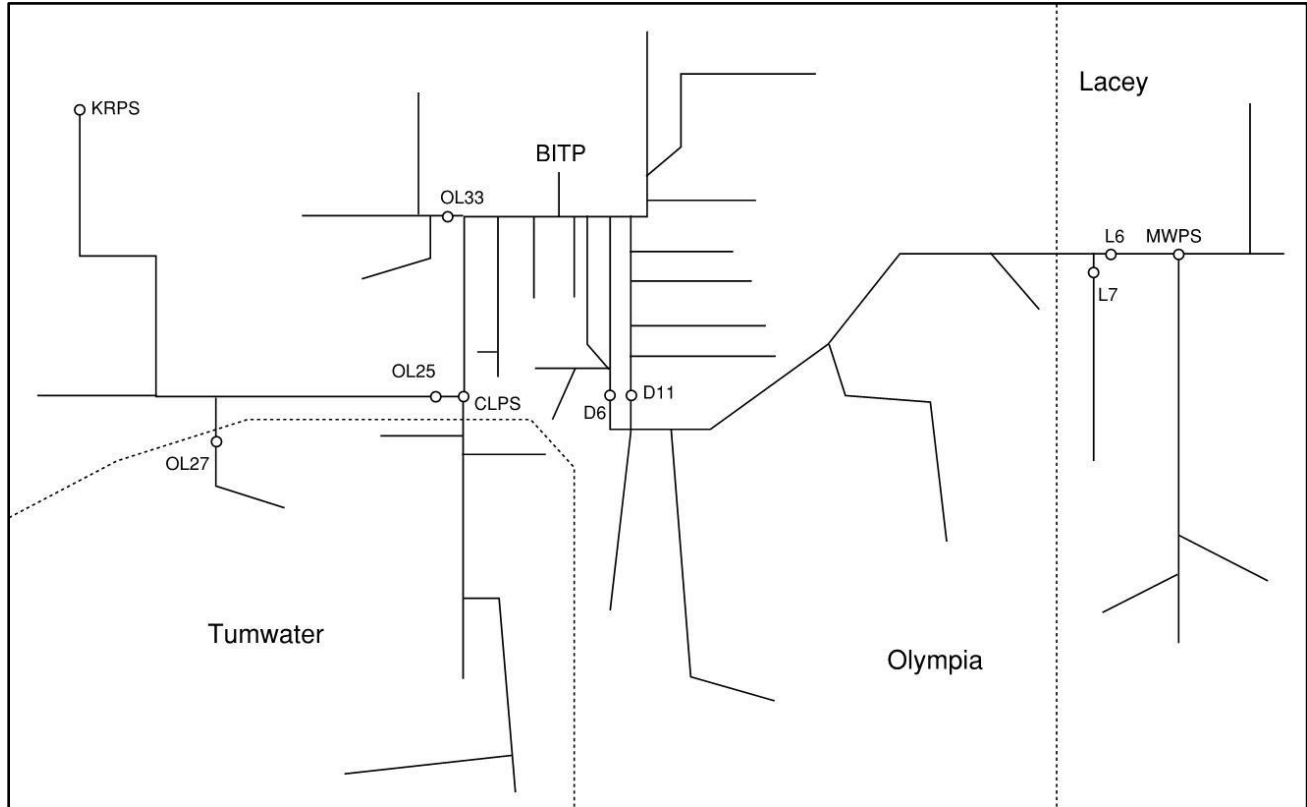


Figure 2-2. Connectivity of the LOTT Flow Monitoring Stations



Flows for each city were calculated using the seven permanent sites and four pump station sites as follows:

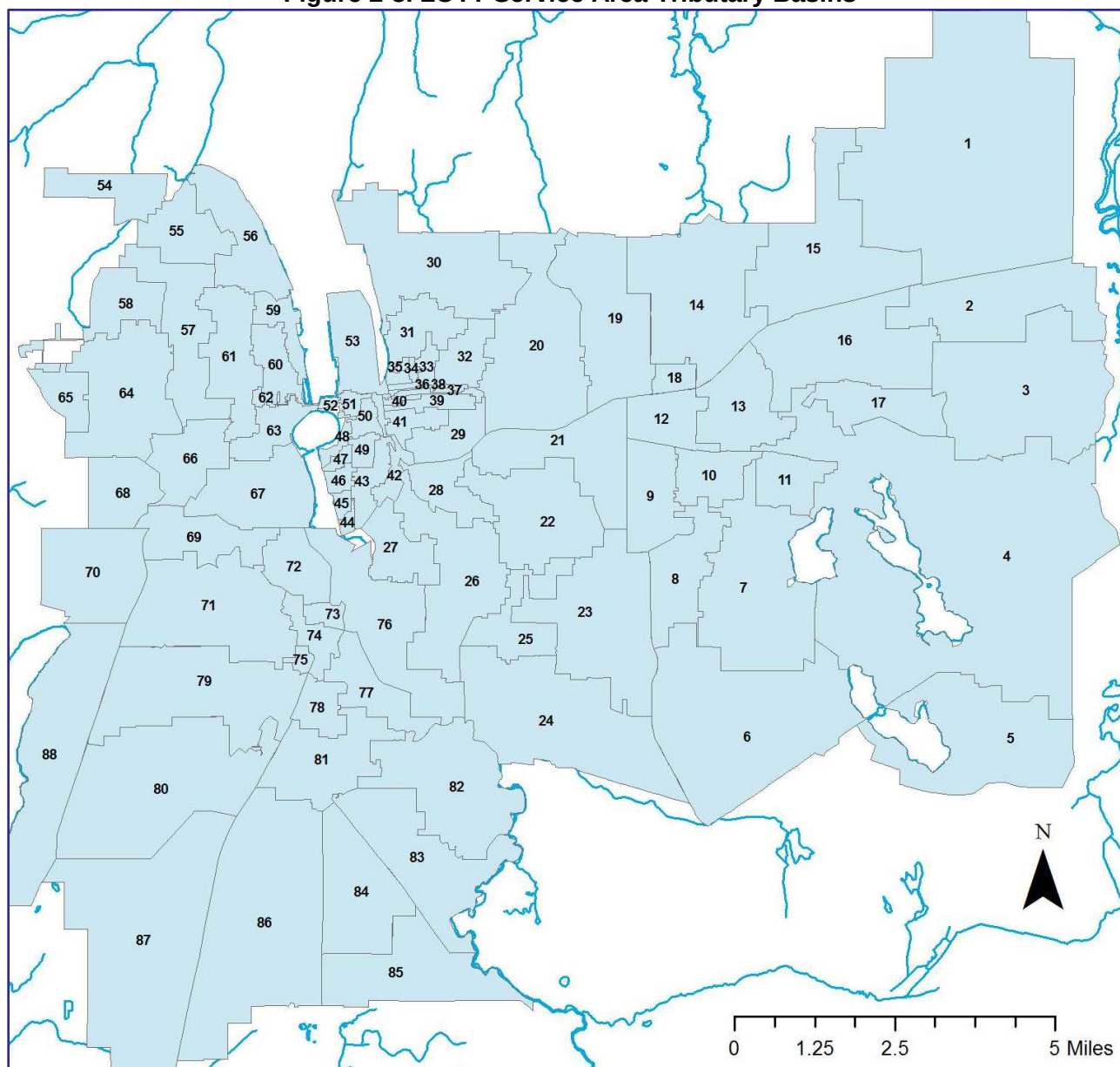
- Olympia = BITP – (OL27 + CLPS + L6 + L7) + OL25
- Tumwater = OL27 + CLPS – OL25
- Lacey = L6 + L7

Table 2-1. Flow Monitoring Sites, with Tributary Basins

Name	Manhole	Pipe Diameter	Location	Basins Served
OL25	MH70-246	30"	Private Drive off of Deschutes Parkway	54,55,57,58,64,65,66,67,68,69,70,71,T ESC
OL33	SSMH9	24"	4th Avenue Bridge	56,59,60,61,62,63,
L6	MH70-200	30"	8468 Martin Way E. (Jack in the Box)	1-7,10-11,13-17
L7	MH70-205	24"	8503 Martin Way E. (Arco Station)	8,9,12
OL27	MH70-290	18"	Access Road East of Mottman Rd	69,70,71
D6	MH70-064	36"	1109 Plum St SE	1- 26,28
D11	MH70-041	36"	Plum and Union Parking Lot	27,42
MWPS			Martin Way Pump Station	1,2,3,4,5,6,7,10,11,13,15,16,17
CLPS			Capitol Lake Pump Station	54,57-58,64-69,71-76,78-83, 85-86, TESC
KRPS			Kaiser Road Pump Station	54, TESC
WWTP			Budd Inlet Treatment Plant	1-22,24-54,56-69,71-76,78-83,85,86, TESC

The LOTT tributary basins are included in Figure 2-3.

Figure 2-3. LOTT Service Area Tributary Basins



2.2 Flow Measurement Methodology

The sewer flow monitoring sites installed by SFE Global consist of SFE Custom Compound Weirs or area-velocity meters. The SFE Weir is a variant of the V-notch type weir. Permanent flow monitoring sites feature a Lexan-bodied weir, while the rotating temporary sites contain weirs constructed of ¾-inch thick plywood. Flow was calculated by measuring the depth of water flowing over the weir, and then applying a rating curve, which was developed individually for each weir during installation and calibration. SFE Global maintains the sites on a monthly basis, during which time data is downloaded from on-site data logging equipment.

LOTT's Budd Inlet Treatment Plant (BITP) has an effluent flow meter. Influent flow is based on flow meters measuring raw degritted flow being discharged from the headworks to the primary sedimentation basins. The Martin Way Pump Station (MWPS), Capitol Lake Pump Station (CLPS), and Kaiser Road Pump Station (KRPS) have Doppler Ultrasonic, strap-on flow meters installed on the discharge piping. These monitoring locations were integrated into the Budd Inlet Treatment Plant SCADA system.

2.3 Basin Summary

The 88 LOTT sewer basins were redefined as part of the 2014 Flows and Loadings Report based upon sewer maps and basin realignments provided by the cities of Olympia, Lacey, and Tumwater. Seven basins are currently unsewered. Previously, of the sewerred 81 basins, 27 were monitored with a single flow monitor located at a point downstream from all inputs into the basin, 32 were monitored by a flow monitor that gathers data from a group of several basins, and six were monitored individually with data gathered on the upstream and downstream ends of the basins, allowing for flow assessment by difference. I&I in the remaining basins was estimated through a system-wide regression model, which incorporated data from 58 temporary flow monitors and the four permanent flow monitors at the pump stations.

The current set of flow monitors is intended to track base flow and I&I in major interceptors. I&I in individual basins is estimating based on system connectivity and observations from the first 14 years of the flow monitoring program.

2.4 Flow Monitoring Site Summary

Table 2-2 lists attributes for the area served by each site monitored including the LOTT pump stations.

The equivalent residential units (ERU) values shown in Table 2-2 are based on 2016-2017 data and the inch-diameter-mile (IDM) values are based on 2016-2017 data.

Table 2-2. Flow Meter Basin Summary

Flow Monitor	Sewered Residents	Sewered Employees	ERU ¹	IDM ²	Acres	% Sewered
D6	67,491	37,182	32,382	2,323	27,743	70%
D11	1,337	1,740	765	165	388	78%
OL25	16,208	15,534	8,601	666	5,815	86%
OL27	3,840	3,511	2,015	163	2,046	78%
OL33	8,036	2,511	3,624	251	1,476	87%
L6	43,394	16,720	25,484	1,447	19,314	60%
L7	6,999	6,980	3,748	188	1,142	91%
CLPS	29,402	29,347	15,747	1,242	13,851	76%
KRPS	1,756	155	743	37	294	85%
WWTP	117,964	86,592	59,334	4,542	45,223	73%
MWPS	42,576	16,016	19,535	1,421	18,156	60%

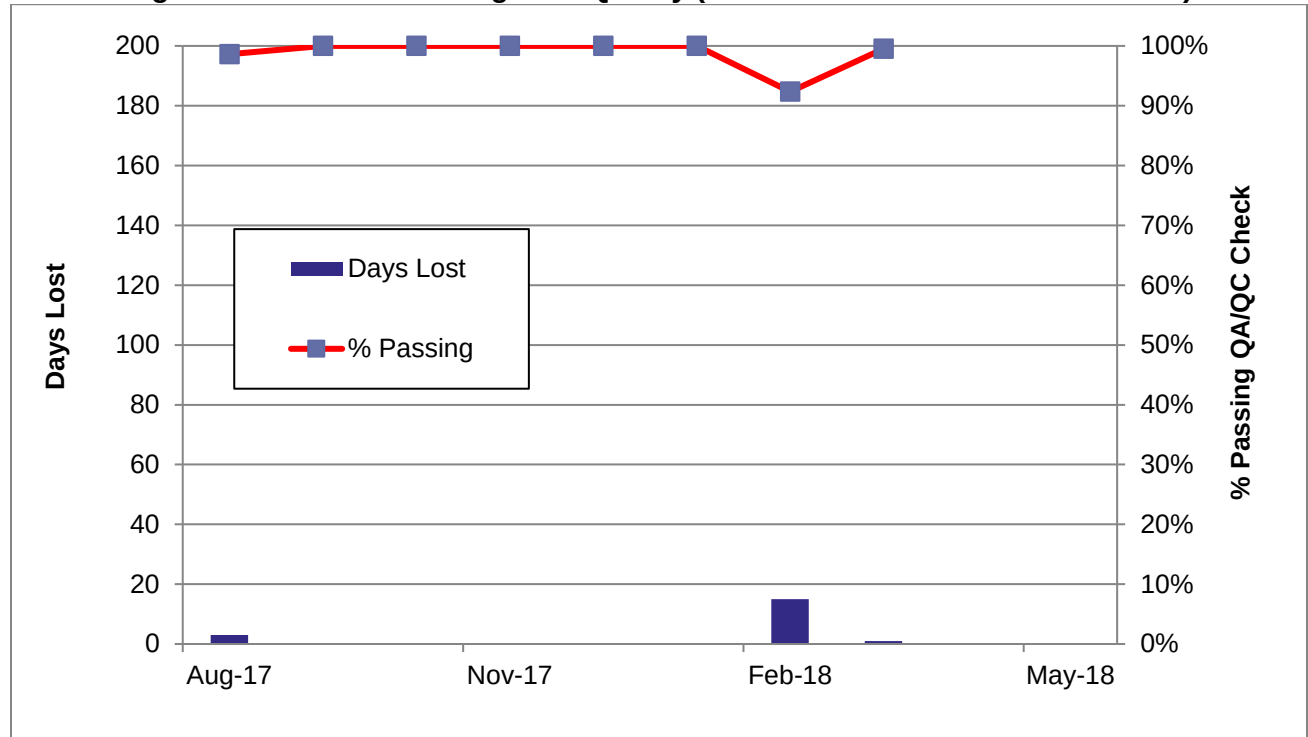
1. ERU: Equivalent Residential Unit (see Flow and Loadings Report for more details)

2. IDM: Inch-diameter-mile of sewer pipe (includes gravity and STEP sewers)

2.5 Flow Monitoring Data

SFE Global's contracted data quality objectives were met over 90% of the time during the 2017-2018 monitoring period. Figure 2-4 summarizes the flow monitoring reliability by showing the portion of flow data that was available and passed quality assurance checks each month.

Figure 2-4. Flow Monitoring Data Quality (All SFE-monitored sites combined)



2.6 Inflow and Infiltration Analysis

An I&I analysis was performed using the Capacity Assessment and Planning Environment (CAPE) modeling software, a wastewater forecasting and management tool provided by Brown and Caldwell. The record of observed flow data was plotted alongside a concurrent record of rainfall data. The model calculates flow based upon rainfall using a variety of hydrologic parameters. These parameters were calibrated until the model flows matched the observed flows over the period of record. Once calibrated, the model was applied to a long-term historical precipitation record (in this case, rainfall observed at the Olympia Regional Airport from 1955 to 2018). The long-term simulation produced risk-based estimates of the I&I flow over the full range of weather conditions contained in the historical rainfall record.

An example of a CAPE calibration plot is presented on Figure 2-5. This plot depicts flow monitored at the BITP (blue), rainfall (green), and modeled flow at the BITP (red). The model has been calibrated such that the modeled and observed flows match very closely.

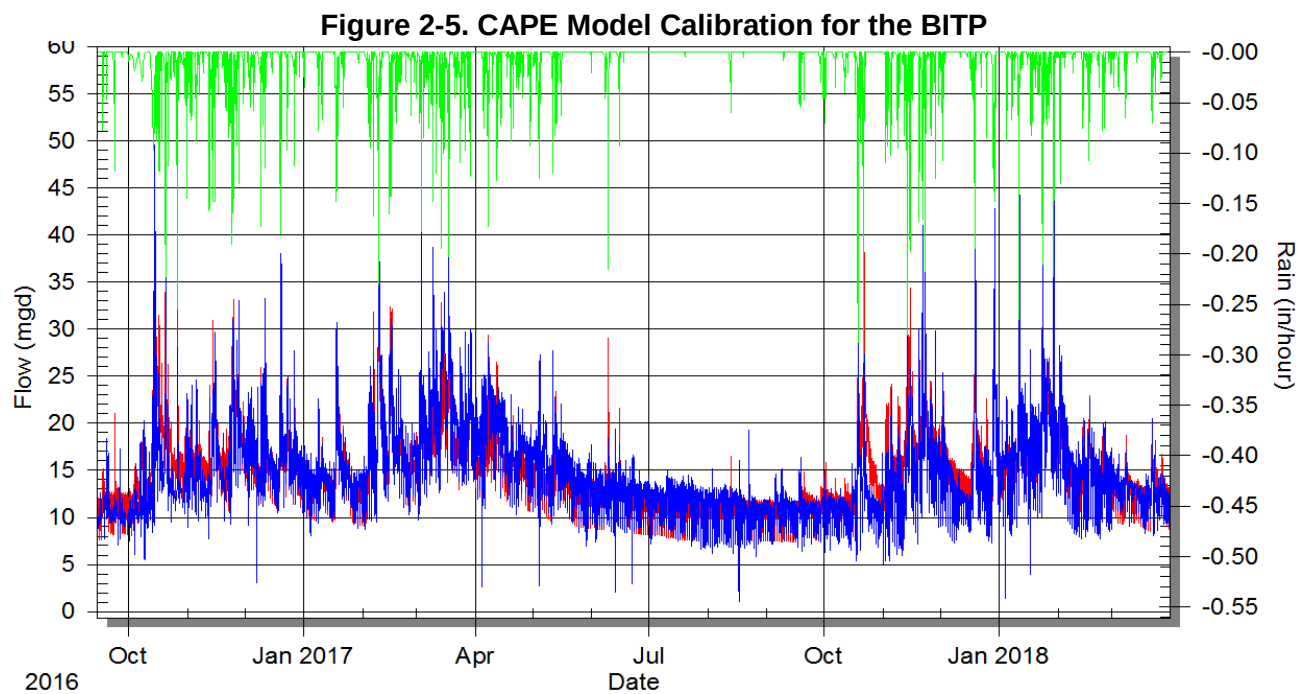
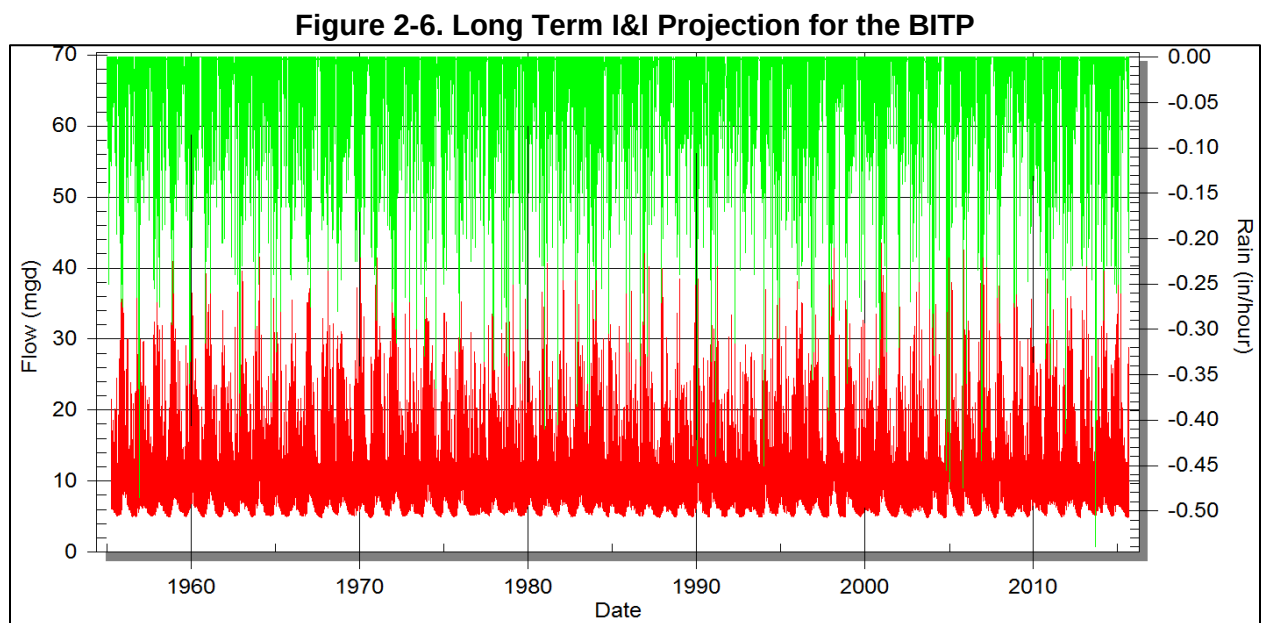


Figure 2-6 presents the model calibration from Figure 2-5 applied to the long-term precipitation record.



The data in Figure 2-5 are used to calculate risk-based I&I. LOTT uses a 10-year return period as the basis of its peak flow projections. A 10-year peak flow carries a 10% risk of being surpassed in any given year.

The CAPE model was used to calculate risk-based I&I for each of the flow monitoring sites and combinations presented in Table 3-1. These data are presented and analyzed in the next section.

3. Flow Data Analysis

This section describes the results of the analysis conducted using the flow data collected during the 2017/2018 monitoring season.

3.1 Summary of I&I Statistics for All Flow Monitoring Sites

A summary of the I&I results for each of the flow monitoring sites is provided in Table 3-1.

Table 3-1. 2017-18 Flow Monitoring Sites Inflow and Infiltration Summary (Total Flow, mgd)

Flow Monitor	Base Sanitary Flow	Average Annual	10-year Peak Month	10-year Peak Day	10-year Peak Hour	Summer	Shoulder	Winter
D6	4.64	0.33	0.90	2.28	3.50	0.12	0.28	0.52
D11	0.07	0.04	0.10	0.35	0.72	0.01	0.03	0.06
L6	2.55	0.58	0.96	2.02	2.65	0.57	0.57	0.59
L7	0.61	0.16	0.44	0.92	1.59	0.07	0.15	0.24
OL25	1.71	0.51	1.47	3.18	3.87	0.18	0.43	0.83
OL27	0.62	0.05	0.22	1.28	1.60	0.02	0.04	0.08
OL33	0.47	0.73	2.59	9.14	12.1	0.22	0.58	1.24
CLPS	2.67	0.78	2.25	5.02	6.28	0.28	0.67	1.27
KRPS	0.09	0.04	0.12	0.22	0.29	0.01	0.04	0.07
MWPS	3.09	0.42	1.11	1.68	2.06	0.16	0.37	0.66
WWTP	10.20	3.39	9.62	34.35	57.52	1.25	2.91	5.45

3.2 Analysis of Inflow and Infiltration

There are a number of ways to assess the quality and integrity of the sewer system. Some of the most commonly used methods involve a calculation of I&I per inch-diameter-mile (IDM) of pipe, I&I per ERU, and the ratio of the peak hour flow to the base flow. Table 3-2 summarizes these statistics for each of the flow monitors. These may be compared with benchmark values, established in the 2007 Inflow & Infiltration and Flow Monitoring Report and listed at the bottom of the table.

Table 3-2. Summary of I&I Statistics

Flow Monitor	Annual Average I&I/ERU (gpd)	Peak Day I&I/ERU (gpd)	Peak Hour I&I/ERU (gpd)	Average Annual I&I/IDM (gpd)	Peak Day I&I/IDM (gpd)	Peak Hour I&I/IDM (gpd)	Peak Hour Flow/Base Flow (mgd)	Benchmark Ratio ¹
D6	10	70	108	140	981	1,506	0.8	0.6
D11	48	609	1363	225	2,827	6,329	5.9	2.7
L6	28	99	130	398	1,395	1,830	1.0	1.0
L7	43	244	422	875	4,900	8,469	2.6	2.7
OL25	61	374	456	778	4,773	5,808	2.3	2.9
OL27	27	635	794	335	7,861	9826	2.6	2.9
OL33	204	2,545	3,370	2,924	36,467	48,277	25.4	16.1
CLPS	50	324	406	632	4,041	5,056	2.3	2.4
KRPS	61	297	392	1,238	5,973	7,873	3.2	3.5
MWPS	21	84	103	293	1,181	1,449	0.7	0.9
WWTP	57	585	980	747	7,562	12,662	5.6	3.8
Benchmark ²	20	150	250	200	1,500	2,400	2.5	1.0

1. The benchmark ratio is the average value of seven ratios, corresponding to the first seven columns of the table (starting with average annual I&I/ERU and ending with the peak hour flow/base flow). The value in this table is divided by the benchmark. For example, the benchmark ratio at site OL25 is the average of the following values: {66/20; 404 /150; 488/250; 867/200; 5,314/1,500; 6,425/2,400; 3.8/2.5} = 3.3.

2. I&I benchmarks established in the 2007 LOTT Inflow and Infiltration Report.

Table 3-3. Summary of I&I Statistics (Cities)

City	Annual Average I&I/ERU (gpd)	Peak Day I&I/ERU (gpd)	Peak Hour I&I/ERU (gpd)	Average Annual I&I/IDM (gpd)	Peak Day I&I/IDM (gpd)	Peak Hour I&I/IDM (gpd)	Peak Hour Flow/Base Flow (mgd)	Benchmark Ratio ¹
Olympia	88	1,069	1,862	1,042	12,640	22,014	9.0	6.4
Tumwater	39	378	485	471	4,574	5,879	2.5	2.3
Lacey	31	122	176	453	1,798	2,593	1.3	1.2
System	58	584	978	745	7,541	12,627	5.6	3.8
Benchmark	20	150	250	200	1,500	2,400	2.5	1.0

For existing pipe, the amount of I&I will vary widely depending on the age of pipe, local maintenance standards, and most importantly, the degree of sewer separation (i.e. whether downspouts are strictly disconnected or whether any sewer to storm pipe cross-connections exist) during the original design of the collection system.

3.3 Site Assessments

The following sections discuss the flow records and I&I model results at each site.

3.3.1 Site D6

Site D6 measures flow generated in Lacey and southeast Olympia (Basins 1 through 28). The flow monitor is located on Plum Street south of downtown Olympia. The flow monitor measures flow through the Cherry Street Interceptor.

Figure 3-1. Flow Meter D6 Tributary Basins



Figure 3-2. Flow Meter D6

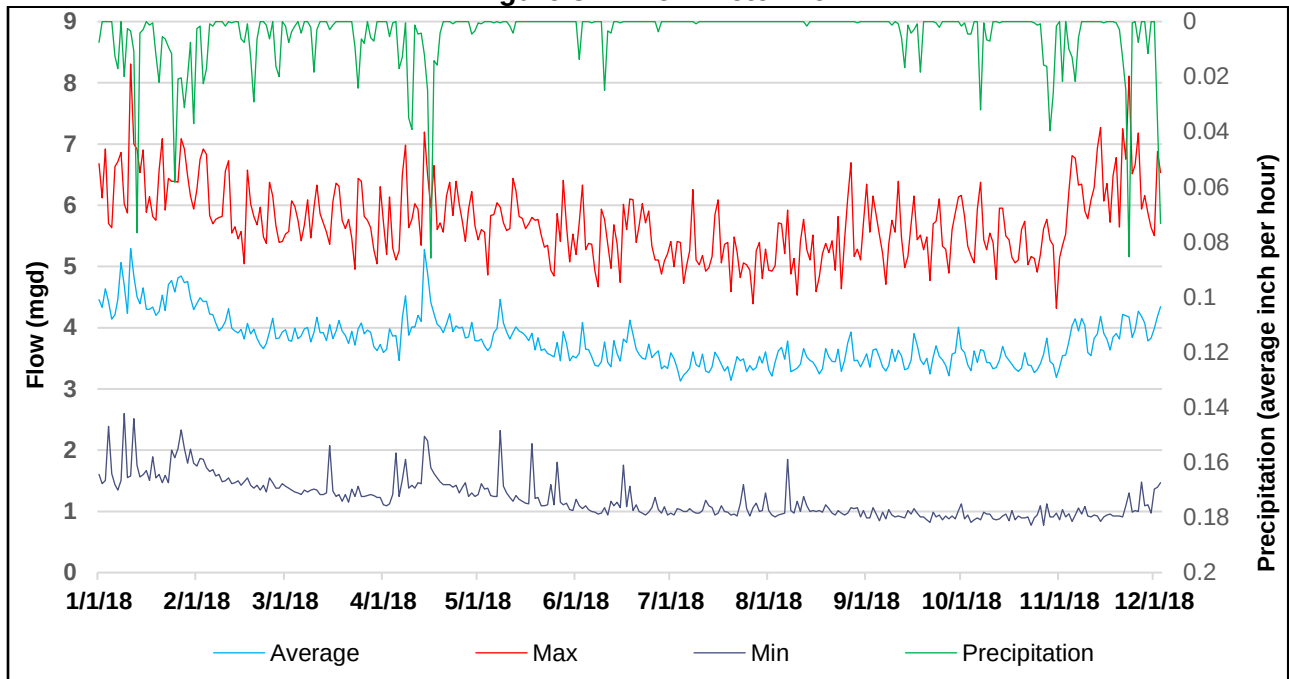


Figure 3-3. D6 Diurnal Flow

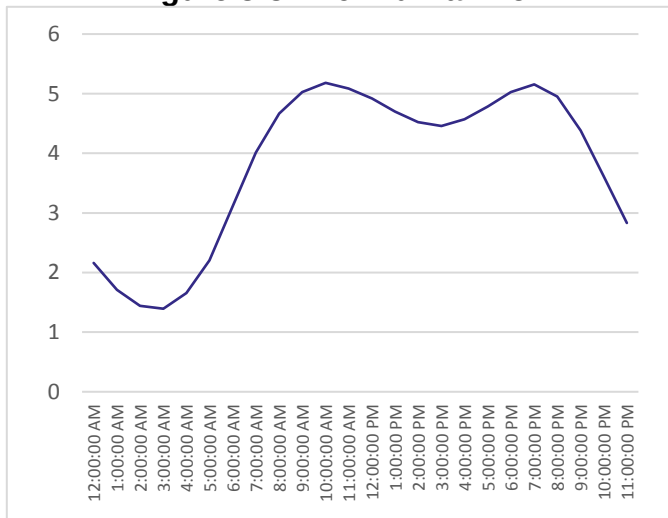


Table 3-4. D6 Flow and I&I Results

Averaging Period	I&I (mgd)	Flow (mgd)
Base Sanitary Flow	0	4.64
Annual Average	0.33	4.97
10-year Peak Month	0.9	5.54
10-year Peak Day	2.28	6.92
10-year Peak Hour	3.5	8.14
Summer	0.12	4.76
Shoulder	0.28	4.92
Winter	0.52	5.16

3.3.2 Site D11

Site D11 measures flow generated in Basins 27 and 42 in Olympia. This meter is located on Plum Street and Union Avenue south of downtown Olympia. D11 was a new site installed in 2014 to measure the flow breakdown between the Plum Street and Cherry Street Interceptors in downtown Olympia. The flow record at site D11 exhibited unusually low flow in the latter part of 2017. The low base flow reported for this site appears to have been an anomaly, and this will be confirmed through further flow monitoring.

Figure 3-4. Flow Meter D11 Tributary Basins

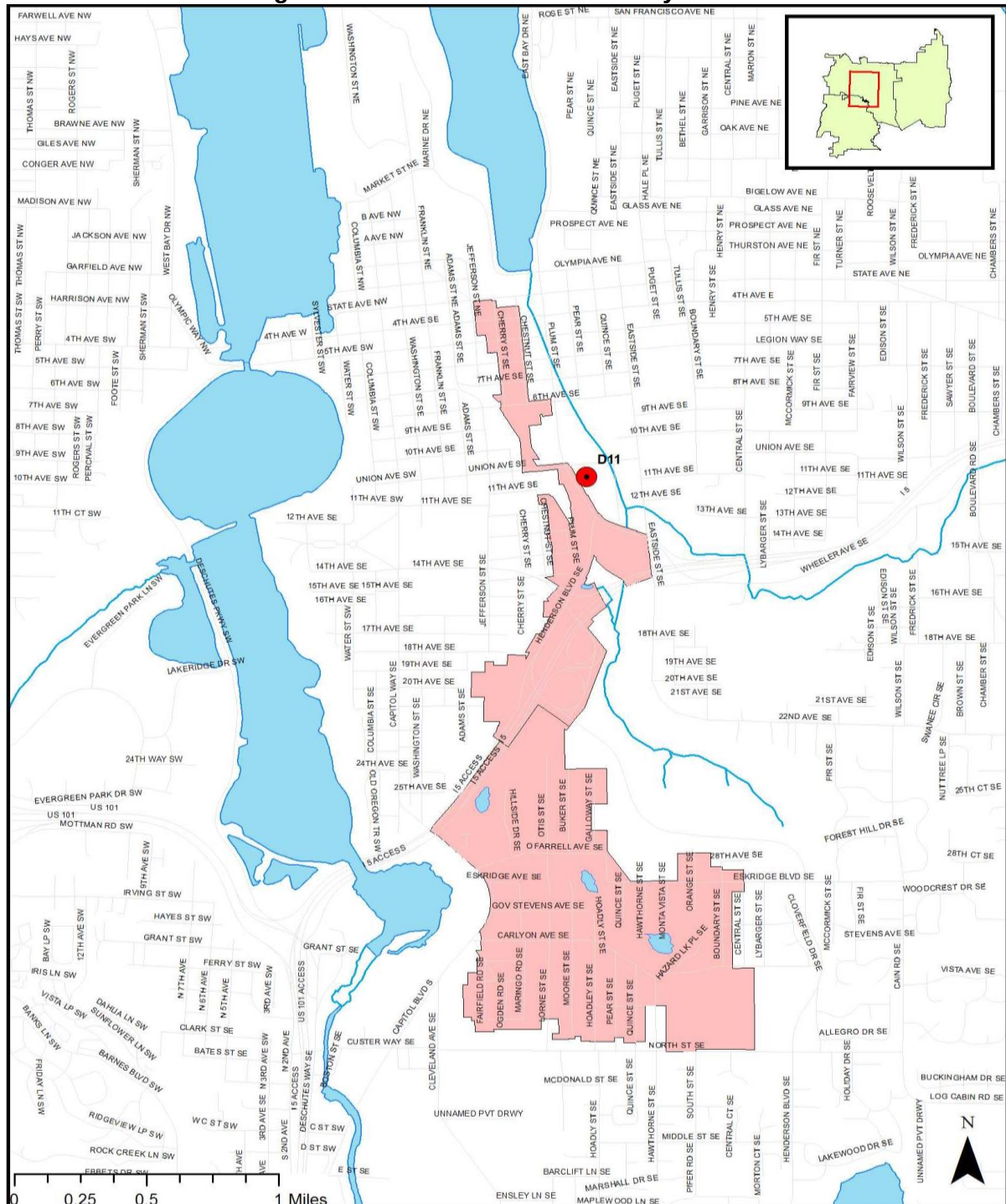


Figure 3-5. Flow Meter D11

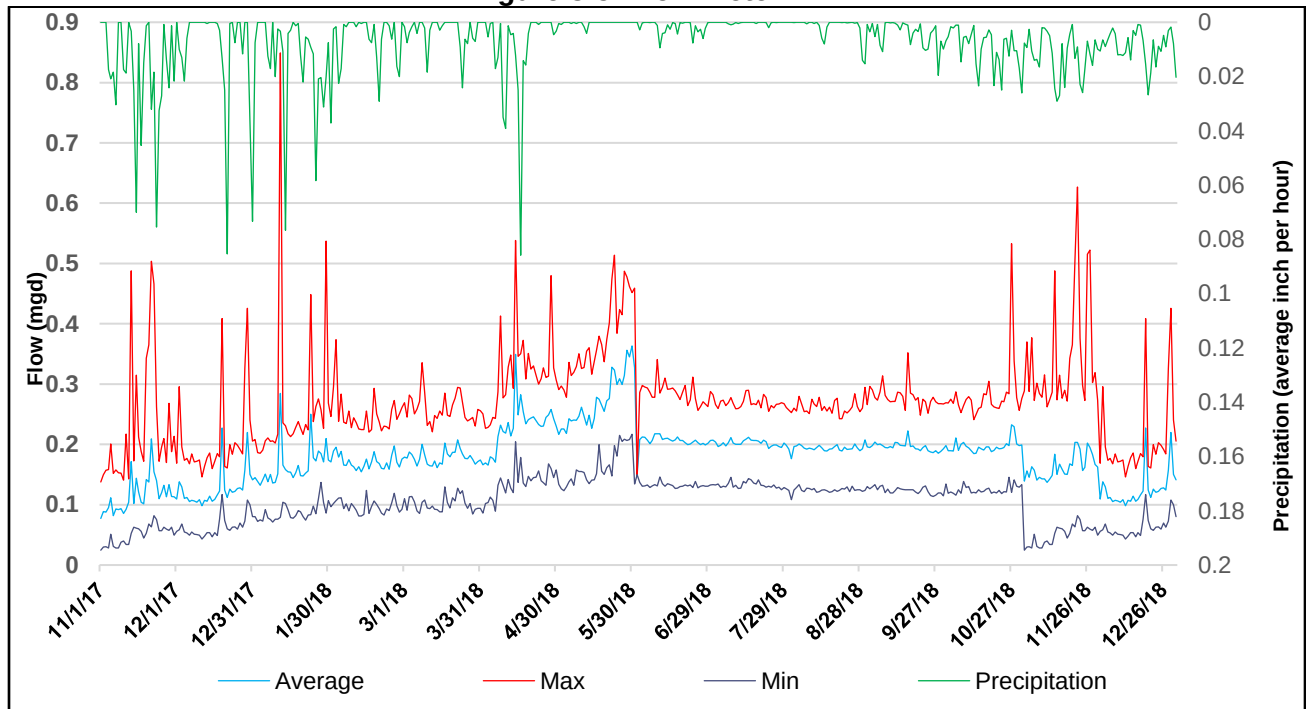


Figure 3-6. D11 Diurnal Flow

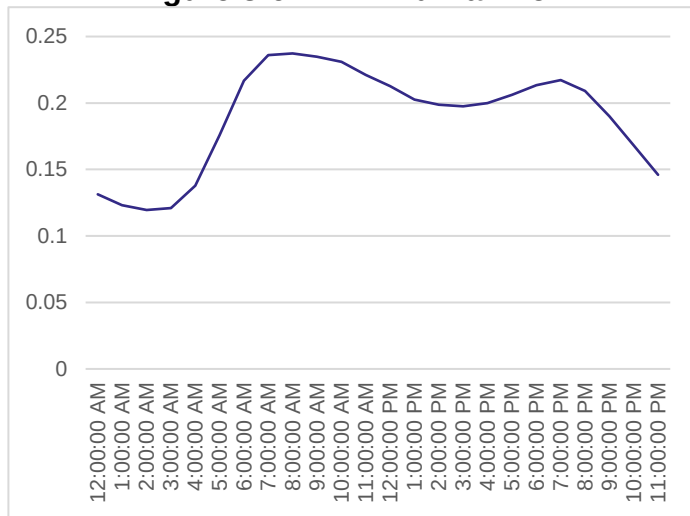


Table 3-5. D11 Flow and I&I Results

Averaging Period	I&I (mgd)	Flow (mgd)
Base Sanitary Flow	0	0.07
Annual Average	0.04	0.11
10-year Peak Month	0.1	0.17
10-year Peak Day	0.35	0.42
10-year Peak Hour	0.72	0.79
Summer	0.01	0.08
Shoulder	0.03	0.1
Winter	0.06	0.13

3.3.3 Site L6

The flow monitor at site L6 measures flows generated in east Lacey. This site's benchmark ratio is 1.0, indicating a tight sewer system with low I&I. A gap in data from mid-February represents a period of time when the flow meter was out of service due to manhole repairs.

Figure 3-7. Flow Meter L6 Tributary Basins

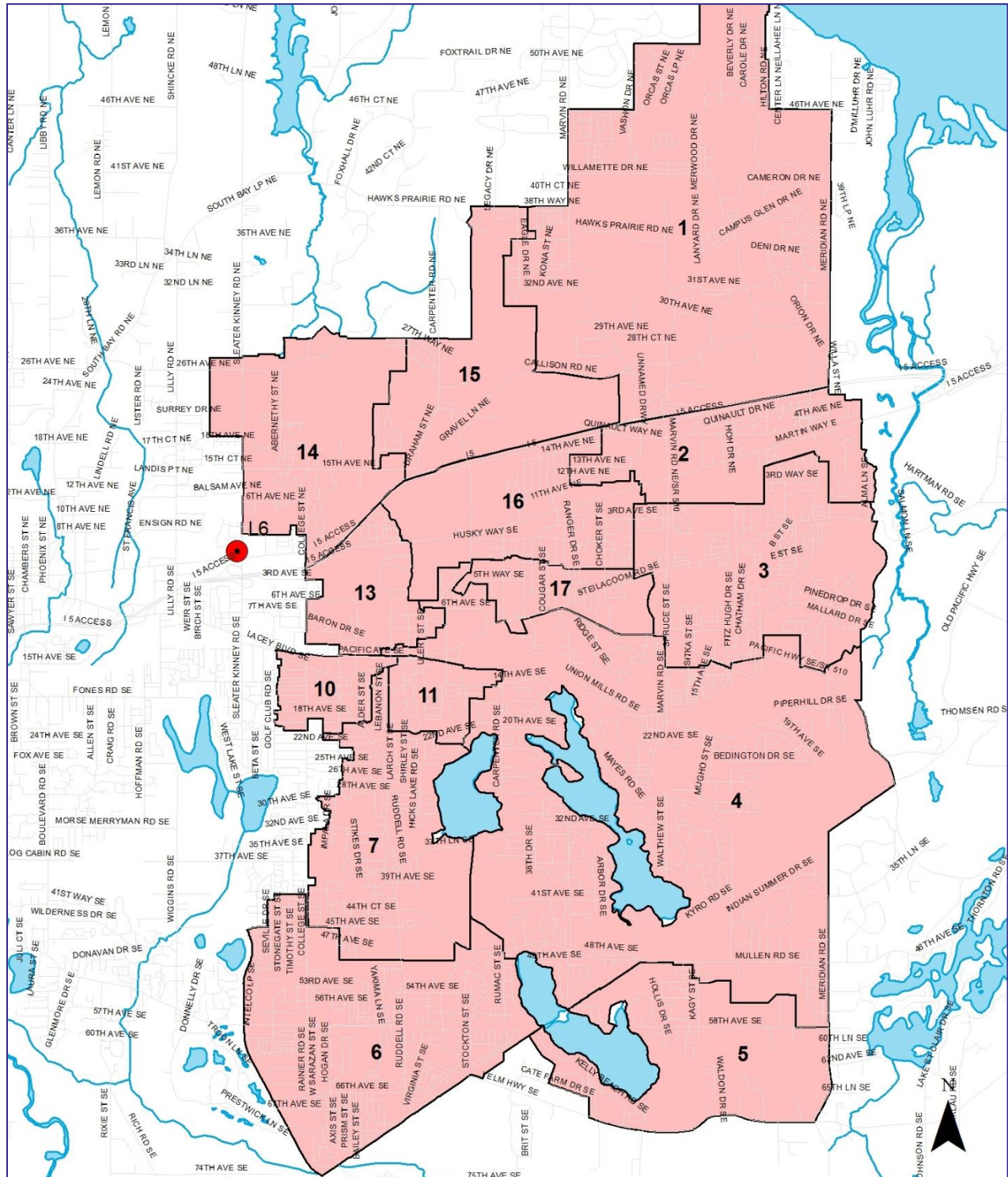


Figure 3-8. Flow Meter L6



Figure 3-9. L6 Diurnal Flow

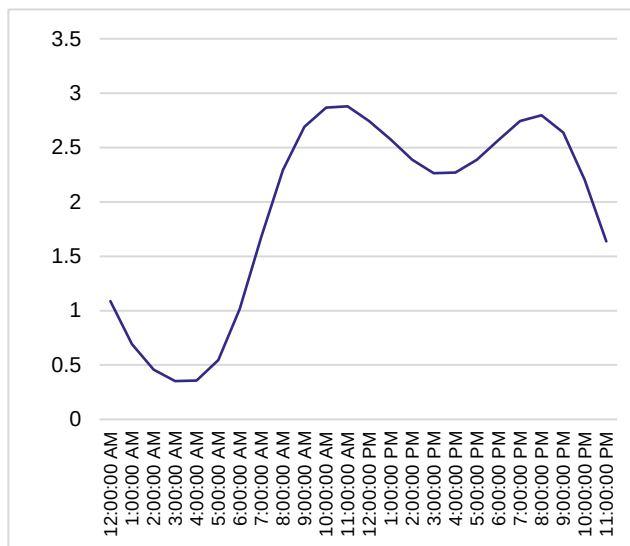


Table 3-6. L6 Flow and I&I Results

Averaging Period	I&I (mgd)	Flow (mgd)
Base Sanitary Flow	0	2.55
Annual Average	0.58	3.13
10-year Peak Month	0.96	3.51
10-year Peak Day	2.02	4.57
10-year Peak Hour	2.65	5.2
Summer	0.57	3.12
Shoulder	0.57	3.12
Winter	0.59	3.14

3.3.4 Site L7

The flow monitor at site L7 measures flow generated in south Lacey. The benchmark ratio for this site is 2.7, higher than L6 but still relatively low compared to the system average of 3.8.

Figure 3-10. Flow Meter L7 Tributary Basins

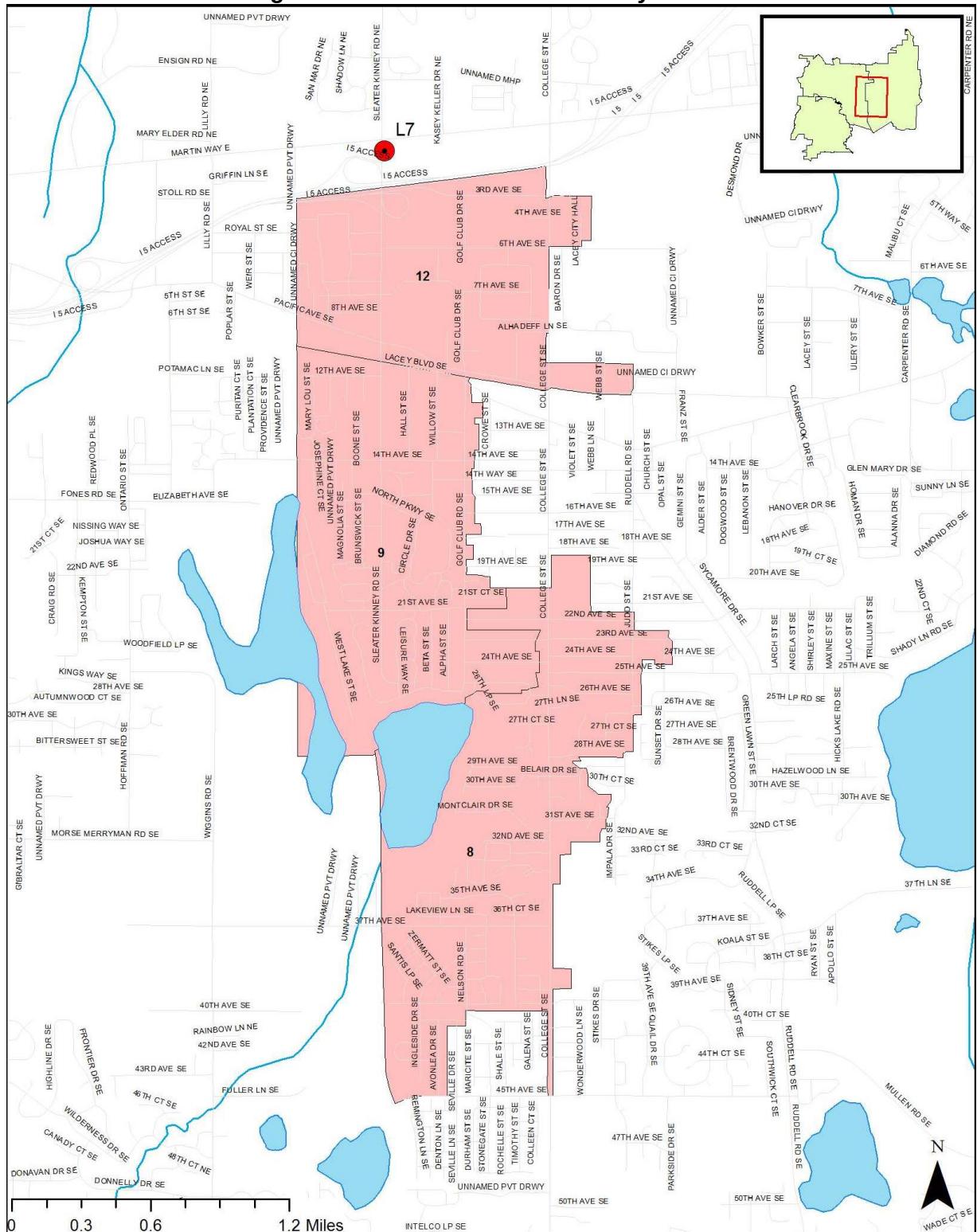


Figure 3-11. Flow Meter L7

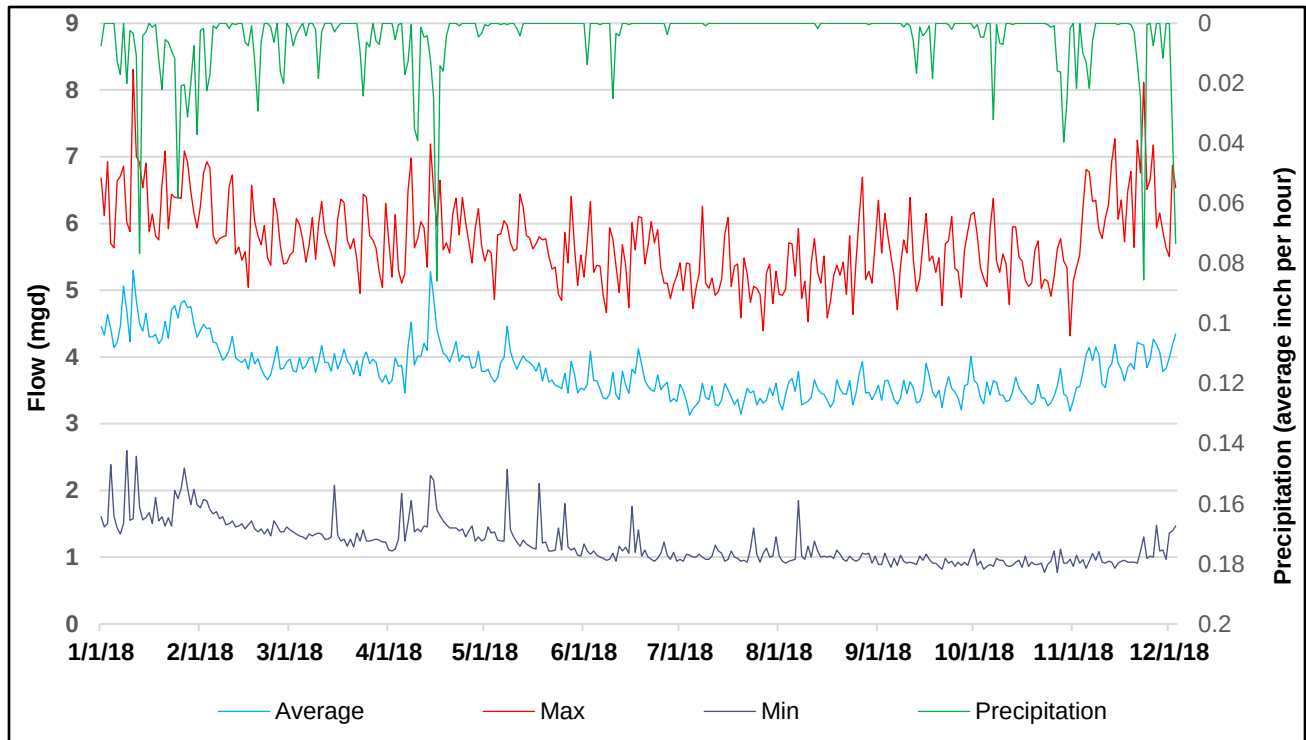


Figure 3-12. L6 Diurnal Flow

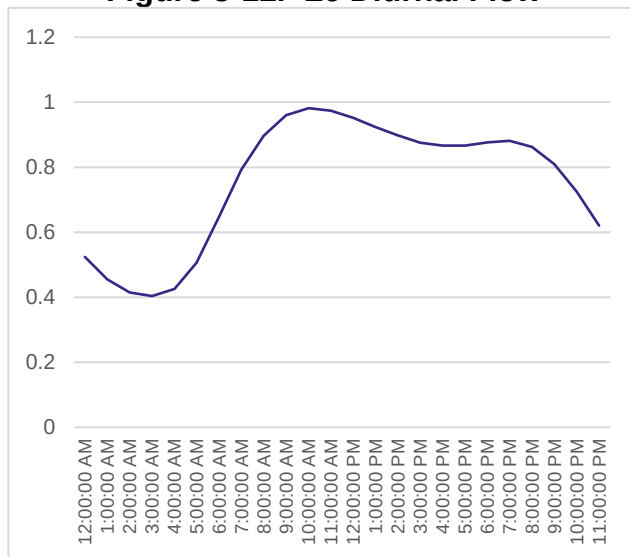


Table 3-7. L6 Flow and I&I Results

Averaging Period	I&I (mgd)	Flow (mgd)
Base Sanitary Flow	0	0.61
Annual Average	0.16	0.77
10-year Peak Month	0.44	1.05
10-year Peak Day	0.92	1.53
10-year Peak Hour	1.59	2.2
Summer	0.07	0.68
Shoulder	0.15	0.76
Winter	0.24	0.85

Site OL25 monitors flow generated in west Olympia and northern Tumwater. The flow monitor is located on the Percival Creek Interceptor downstream of the Capitol Lake Pump Station. The benchmark ratio decreased slightly at this site from 3.3 to 2.9.

The map displays the city of Everett, Washington, with a grid of streets. A red dot is located on the eastern side of the city, near the waterfront. The map includes a scale bar from 0 to 2 miles and a north arrow. An inset map in the top right corner shows the location of Everett within the state of Washington.

Streets shown on the map include: OVERHULSE RD NW, CARDINAL DR NW, CEDRONA DR NW, 3RD WAY NW, 4TH AVE NW, DRIFTWOOD RD NW, EVERGREEN PKWY NW, MCCANN PLAZA DR NW, 17TH AVE NW, 11TH AVE NW, 9TH AVE NW, 8TH AVE NW, 5TH AVE NW, 4TH AVE NW, 3RD AVE NW, 2ND AVE NW, 1ST AVE NW, DELPHI RD NW, EVERGREEN PKWY SW, UNNAMED PVT DRWY, ROSEWOOD DR SW, MUD BAY RD NW, 7TH AVE SW, 6TH AVE SW, 5TH AVE SW, 4TH AVE SW, 3RD AVE SW, 2ND AVE SW, 1ST AVE SW, KAISER RD SW, LAKEWOOD DR SW, PARK DR SW, UNNAMED PVT DRWY, 40TH LN SW, 49TH AVE SW, 48TH LN SW, 47TH AVE SW, 46TH LN SW, 45TH LN SW, 44TH AVE SW, 43RD AVE SW, 42ND AVE SW, 41ST AVE SW, 40TH AVE SW, 39TH AVE SW, 38TH AVE SW, 37TH AVE SW, 36TH AVE SW, 35TH AVE SW, 34TH AVE SW, 33RD AVE SW, 32ND AVE SW, 31ST AVE SW, 30TH AVE SW, 29TH AVE SW, 28TH AVE SW, 27TH AVE SW, 26TH AVE SW, 25TH AVE SW, 24TH AVE SW, 23RD AVE SW, 22ND AVE SW, 21ST AVE SW, 20TH AVE SW, 19TH AVE SW, 18TH AVE SW, 17TH AVE SW, 16TH AVE SW, 15TH AVE SW, 14TH AVE SW, 13TH AVE SW, 12TH AVE SW, 11TH AVE SW, 10TH AVE SW, 9TH AVE SW, 8TH AVE SW, 7TH AVE SW, 6TH AVE SW, 5TH AVE SW, 4TH AVE SW, 3RD AVE SW, 2ND AVE SW, 1ST AVE SW, 0TH AVE SW, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100.

Figure 3-15. Flow Meter OL25

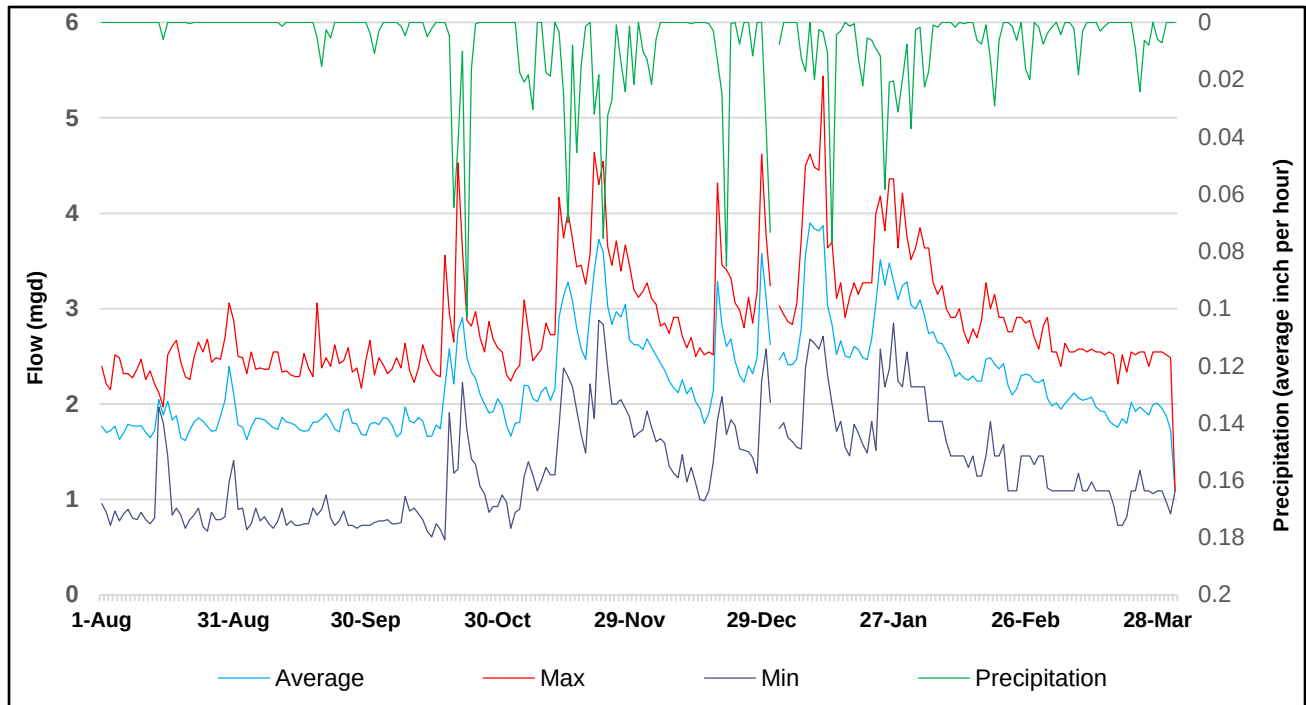


Figure 3-16. OL25 Diurnal Flow

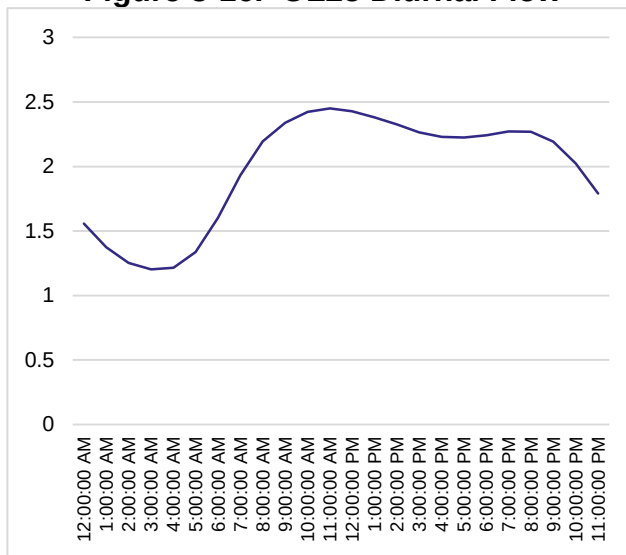


Table 3-8. OL25 Flow and I&I Results

Averaging Period	I&I (mgd)	Flow (mgd)
Base Sanitary Flow	1.71	1.71
Annual Average	0.51	2.22
10-year Peak Month	1.47	3.18
10-year Peak Day	3.18	4.89
10-year Peak Hour	3.87	5.58
Summer	0.18	1.89
Shoulder	0.43	2.14
Winter	0.83	2.54

3.3.6 Site OL27

Site OL27 was last monitored in 2011 and has been added as a permanent flow meter. OL27 measures flow from Tumwater on the downstream end of the Mottman Road Interceptor. Site OL27 benchmark ratio of 2.9 is lower than the 2011 benchmark ratio of 6.2. Given that this site monitors flow generated in the Mottman Industrial Zone, it is likely that much of what is being classified as I&I is actually point source flow from local industry. Seasonal contributions from South Puget Sound Community College also complicate the I&I calculation in this basin. The reduction in benchmark may be related to recent repair work of an interceptor in this area.

Figure 3-17. Flow Meter OL27 Tributary Basins

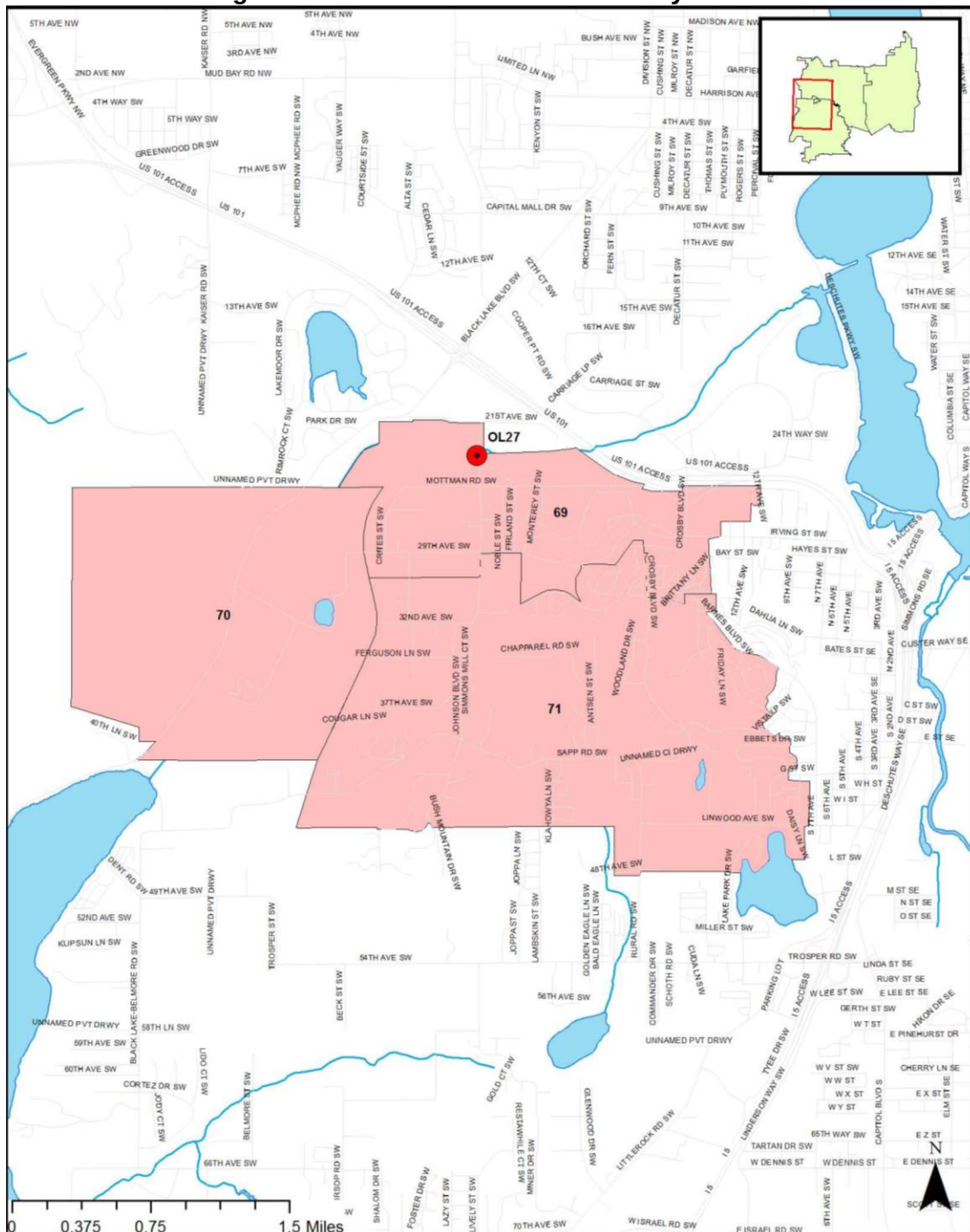


Figure 3-18. Flow Meter OL27

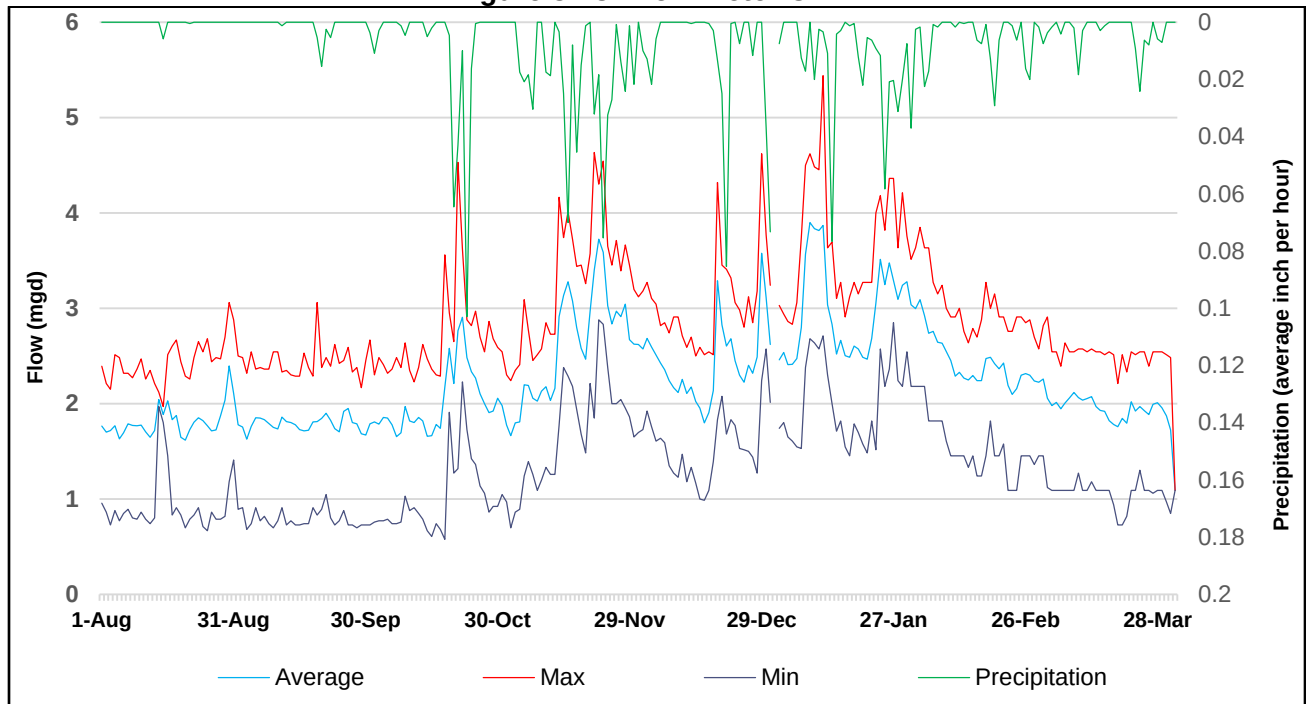


Figure 3-19. OL27 Diurnal Flow

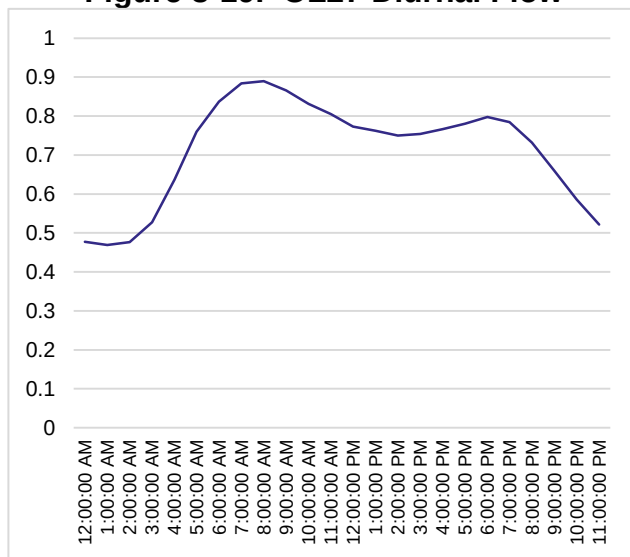


Table 3-9. OL27 Flow and I&I Results

Averaging Period	I&I (mgd)	Flow (mgd)
Base Sanitary Flow	0.62	0.62
Annual Average	0.05	0.67
10-year Peak Month	0.22	0.84
10-year Peak Day	1.28	1.9
10-year Peak Hour	1.6	2.22
Summer	0.02	0.64
Shoulder	0.04	0.66
Winter	0.08	0.7

3.3.7 Site OL33

The OL33 flow meter is located at the 4th Avenue Bridge and measures flow from northwest Olympia. The benchmark ratio at this site did not change from last year and remained 16.1.

Figure 3-20. Flow Meter OL33 Tributary Basins

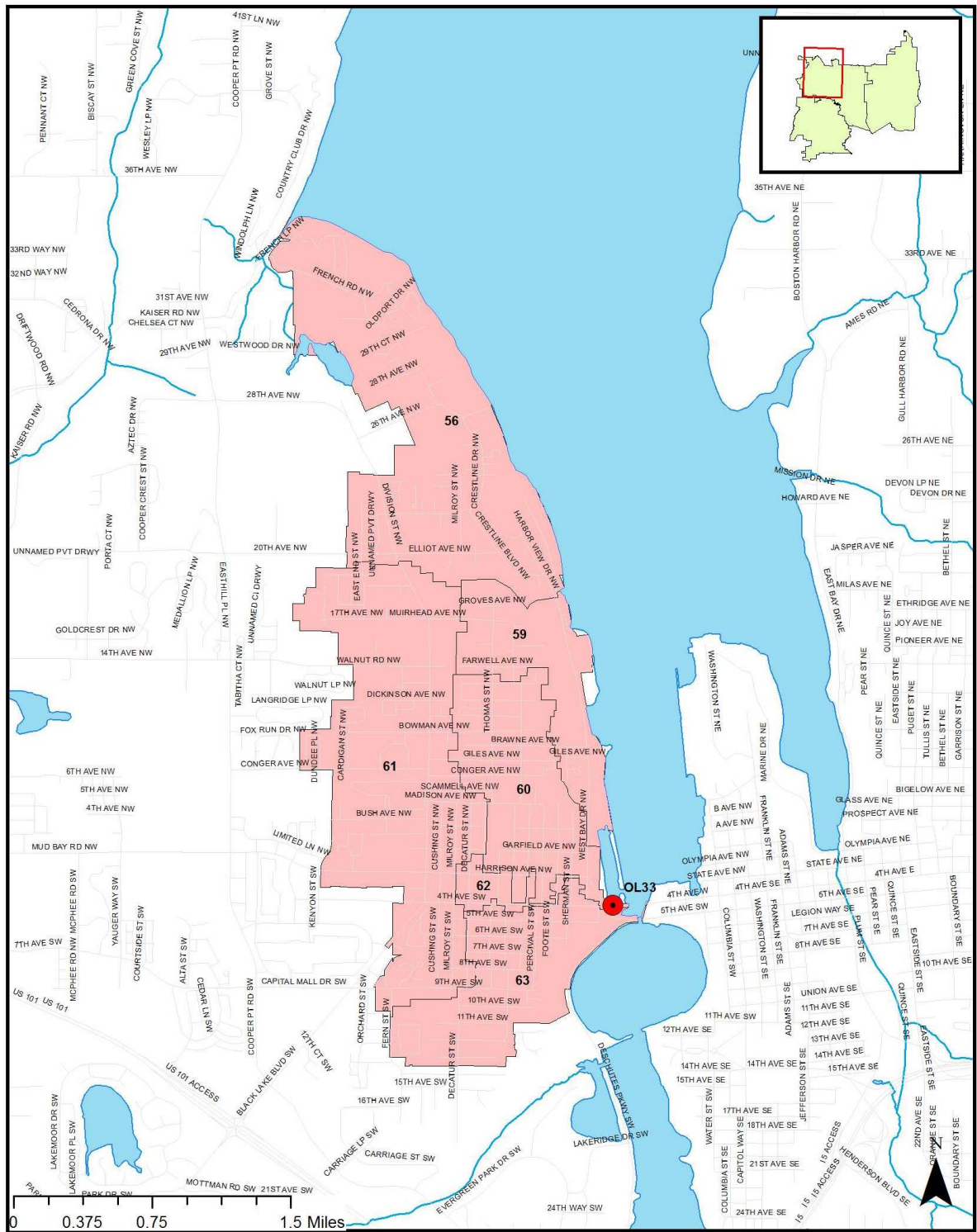


Figure 3-21. Flow Meter OL33

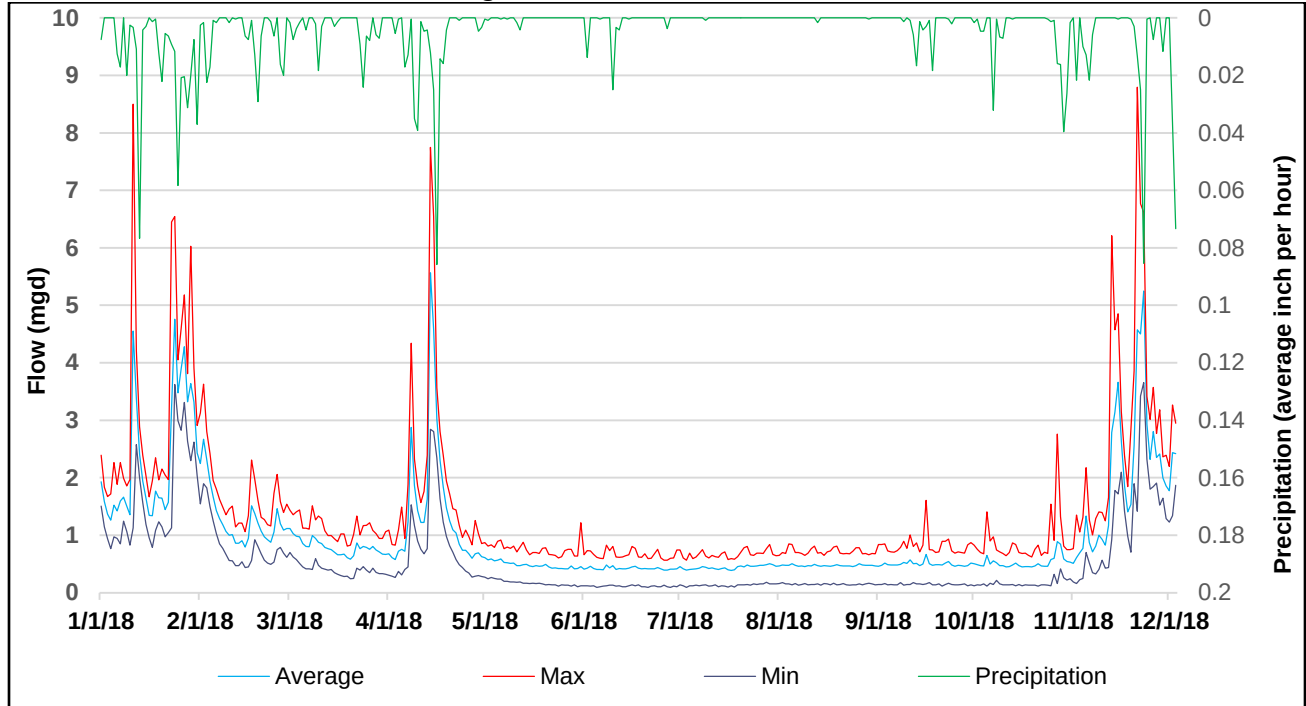


Figure 3-22. OL33 Diurnal Flow

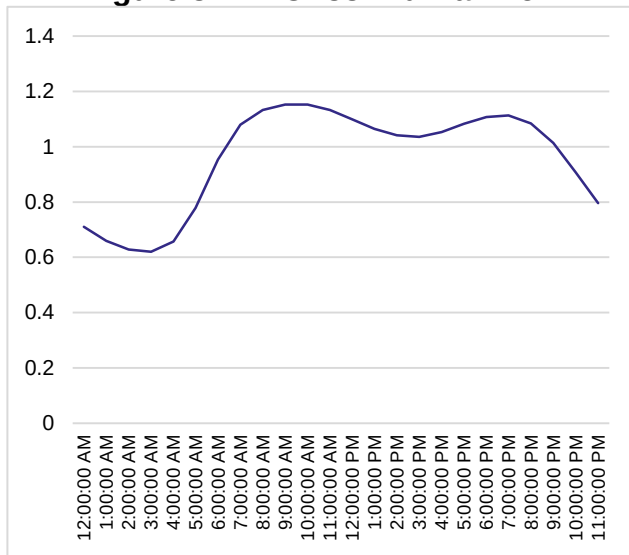


Table 3-10. OL33 Flow and I&I Results

Averaging Period	I&I (mgd)	Flow (mgd)
Base Sanitary Flow	0	0.47
Annual Average	0.73	1.2
10-year Peak Month	2.59	3.06
10-year Peak Day	9.14	9.61
10-year Peak Hour	12.1	12.57
Summer	0.22	0.69
Shoulder	0.58	1.05
Winter	1.24	1.71

The meter at KRPS was found to be out of calibration after last year's Report, and was repaired in late 2017. The flows at KRPS typically show large variations year to year and throughout the year due to the influx of students at The Evergreen State College (TESC). Figure 3-12 shows how widely the flow at KRPS varies, from 60,000 gpd in the summer to over 200,000 gpd in the winter. The large change from the previous year reflects the faulty meter readings from 2017.

[illegible]

Figure 3-24. KRPS Flow Pattern

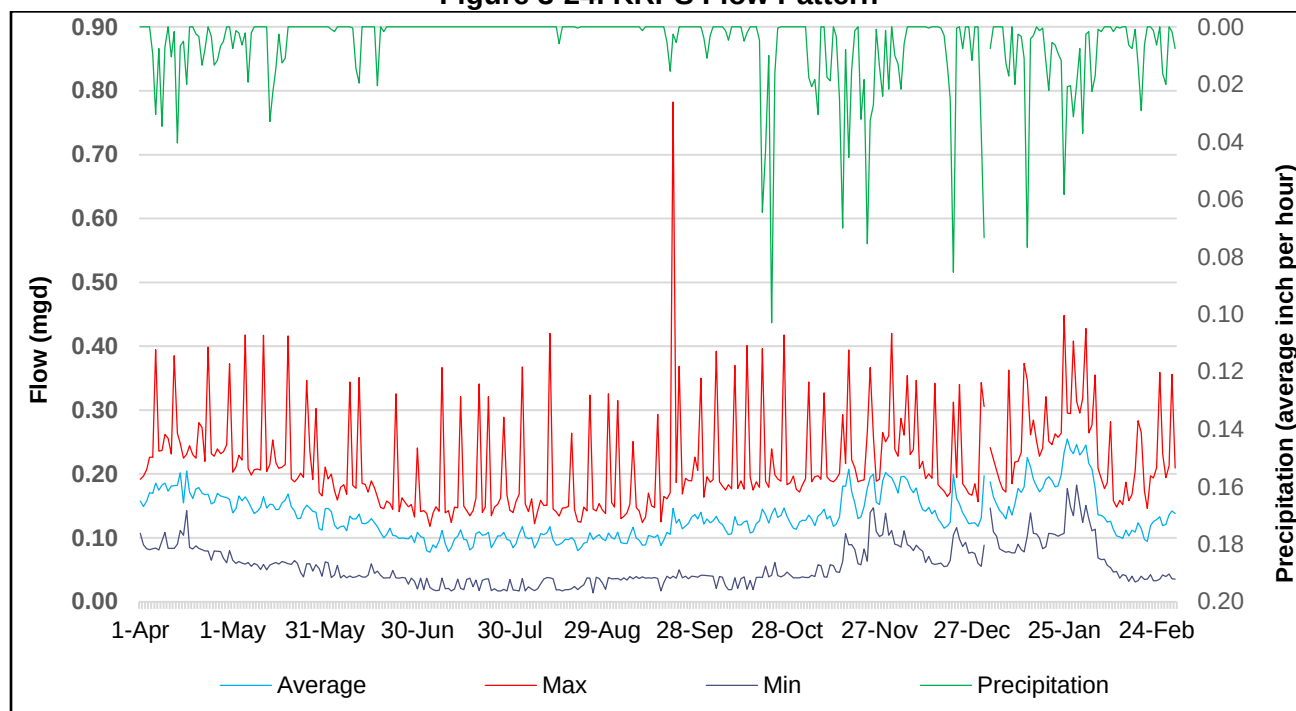


Figure 3-24. KRPS Diurnal Flow

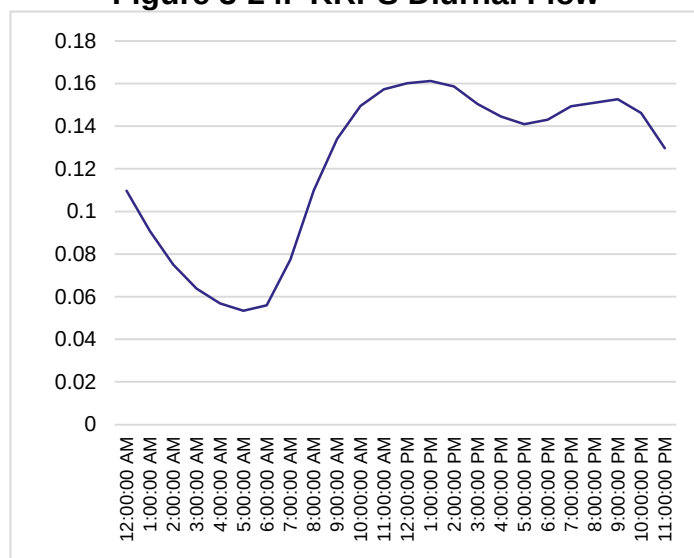


Table 3-11. KRPS Flow and I&I Results

Averaging Period	I&I (mgd)	Flow (mgd)
Base Sanitary Flow	0	0.09
Annual Average	0.04	0.13
10-year Peak Month	0.12	0.21
10-year Peak Day	0.22	0.31
10-year Peak Hour	0.29	0.38
Summer	0.01	0.1
Shoulder	0.04	0.13
Winter	0.07	0.16

3.3.9 MWPS

The meter at MWPS measures flow entering the Martin Way Pump Station. This flow is pumped either to the BITP or to the MWRWP. Most of the I&I parameters at this site tracked higher this year than in previous years. The MWPS flow meter is historically difficult to model, and typically exhibits higher than average year to year variability.

Figure 3-25. MWPS Tributary Basins

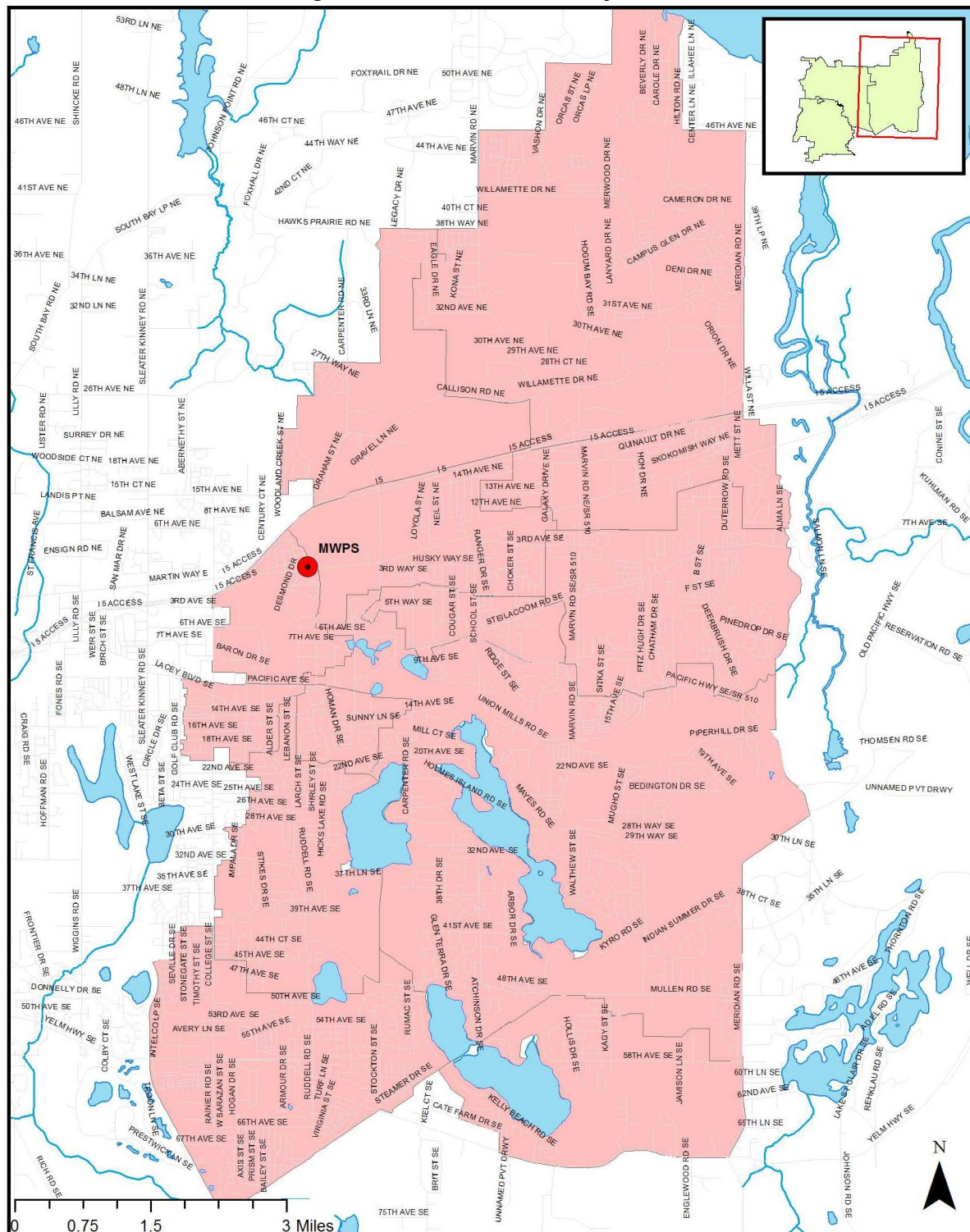


Figure 3-26. MWPS Flow Pattern

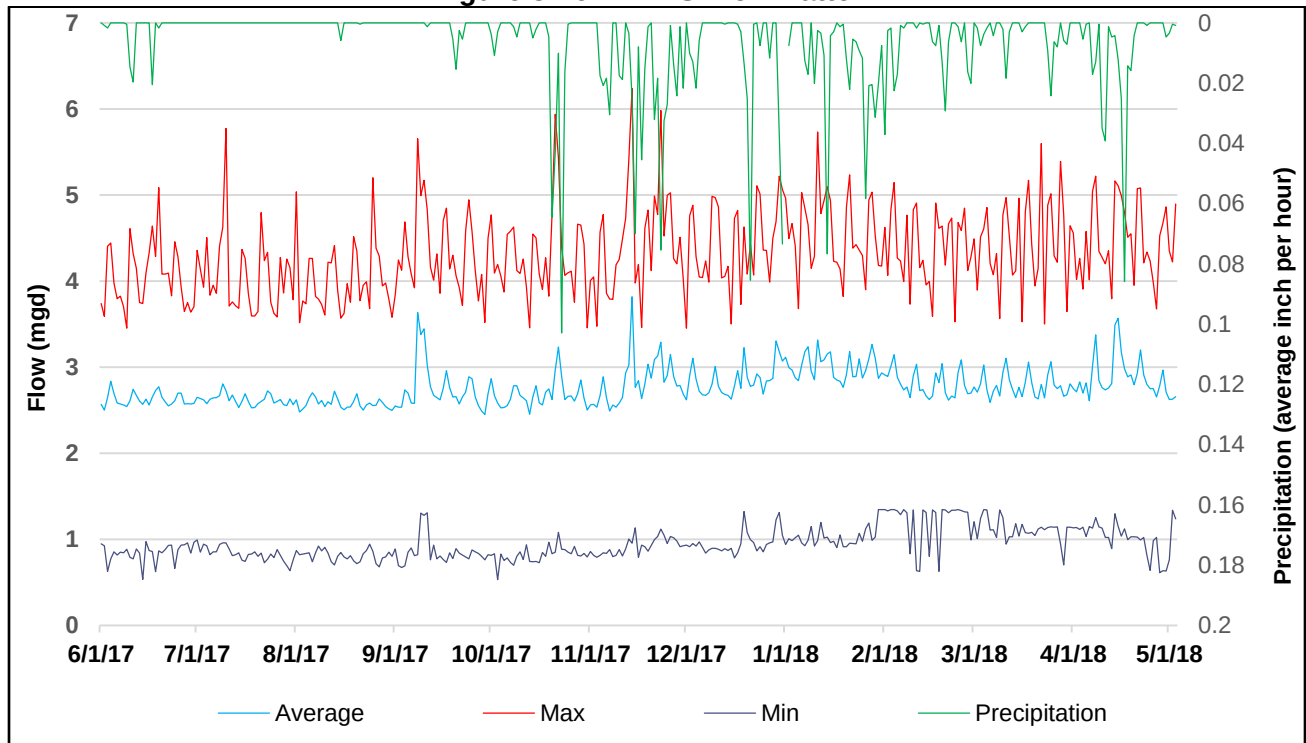


Figure 3-27. MWPS Diurnal Flow

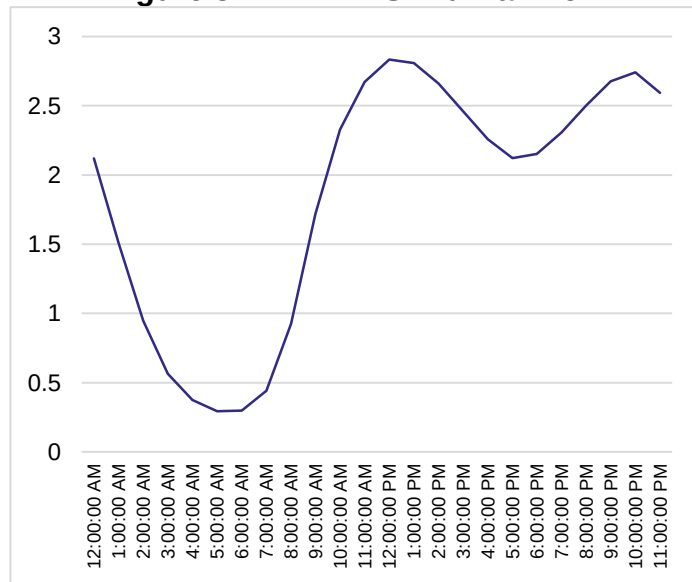


Table 3-12. D6 Flow and I&I Results

Averaging Period	I&I (mgd)	Flow (mgd)
Base Sanitary Flow	0	3.09
Annual Average	0.42	3.51
10-year Peak Month	1.11	4.2
10-year Peak Day	1.68	4.77
10-year Peak Hour	2.06	5.15
Summer	0.16	3.25
Shoulder	0.37	3.46
Winter	0.66	3.75

The Capitol Lake Pump Station collects flows from West Olympia via the Percival Creek Interceptor plus flow from Tumwater via the LOTT Southern Connection. The Tumwater flows include basically everything west of the Deschutes River.

Figure 3-29. CLPS Flow Pattern

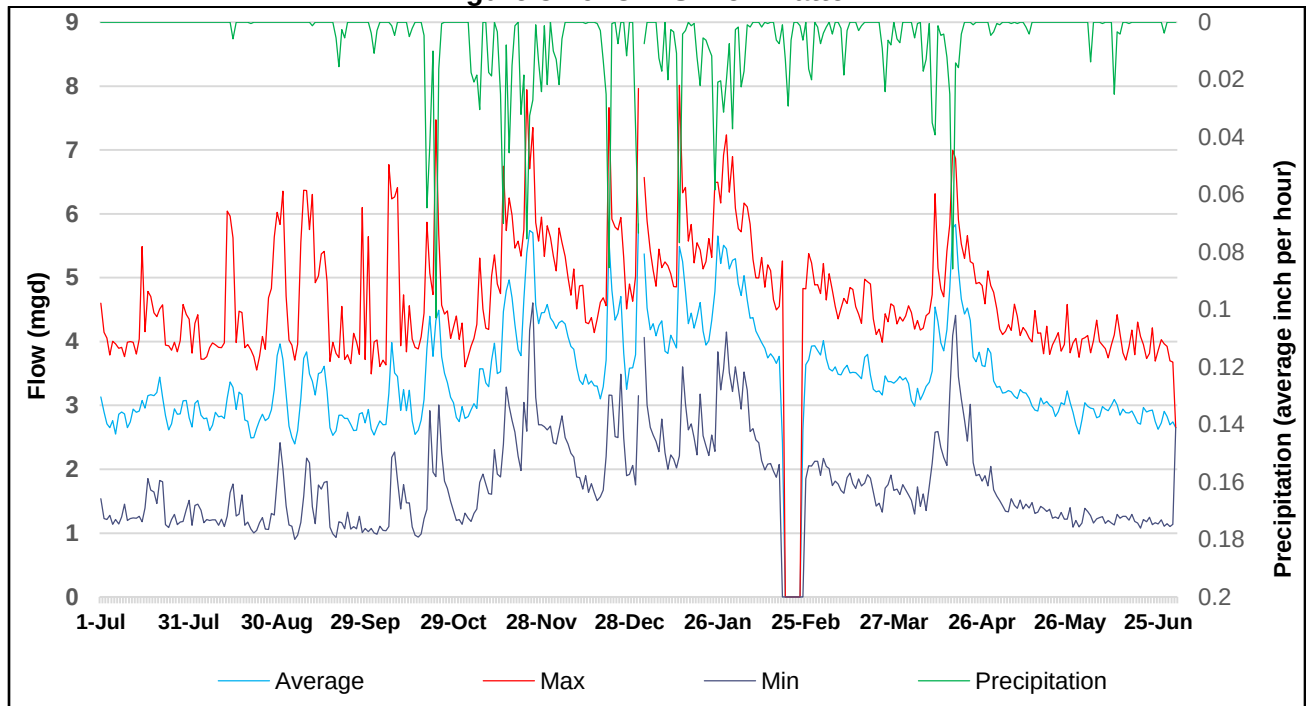


Figure 3-30. CLPS Diurnal Flow

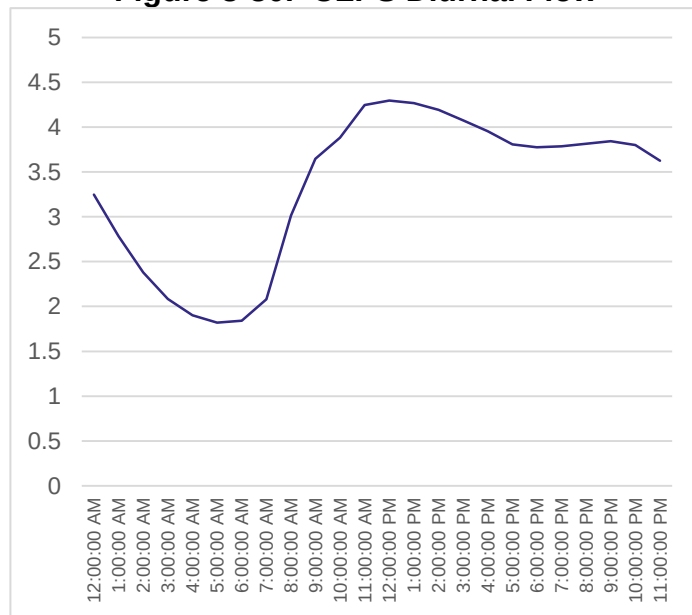


Table 3-13. CLP Flow and I&I Results

Averaging Period	I&I (mgd)	Flow (mgd)
Base Sanitary Flow	0	3.09
Annual Average	0.78	3.87
10-year Peak Month	2.25	5.34
10-year Peak Day	5.02	8.11
10-year Peak Hour	6.28	9.37
Summer	0.28	3.37
Shoulder	0.67	3.76
Winter	1.27	4.36

3.3.11 System-Wide

The system-wide I&I is largely a known quantity. Projections tend to vary slightly from year to year, which reflects some of the sensitivity of the model to variables such as groundwater level which vary independently, or at least on a larger time scale, from I&I. In the big picture, system-wide I&I appears to be trending slightly upward, which is what one would expect as the service area expands and infrastructure ages. Figures 3-31 and 3-32 plot the system-wide I&I over the last 15 years.

Figure 3-31. System-wide I&I Trends

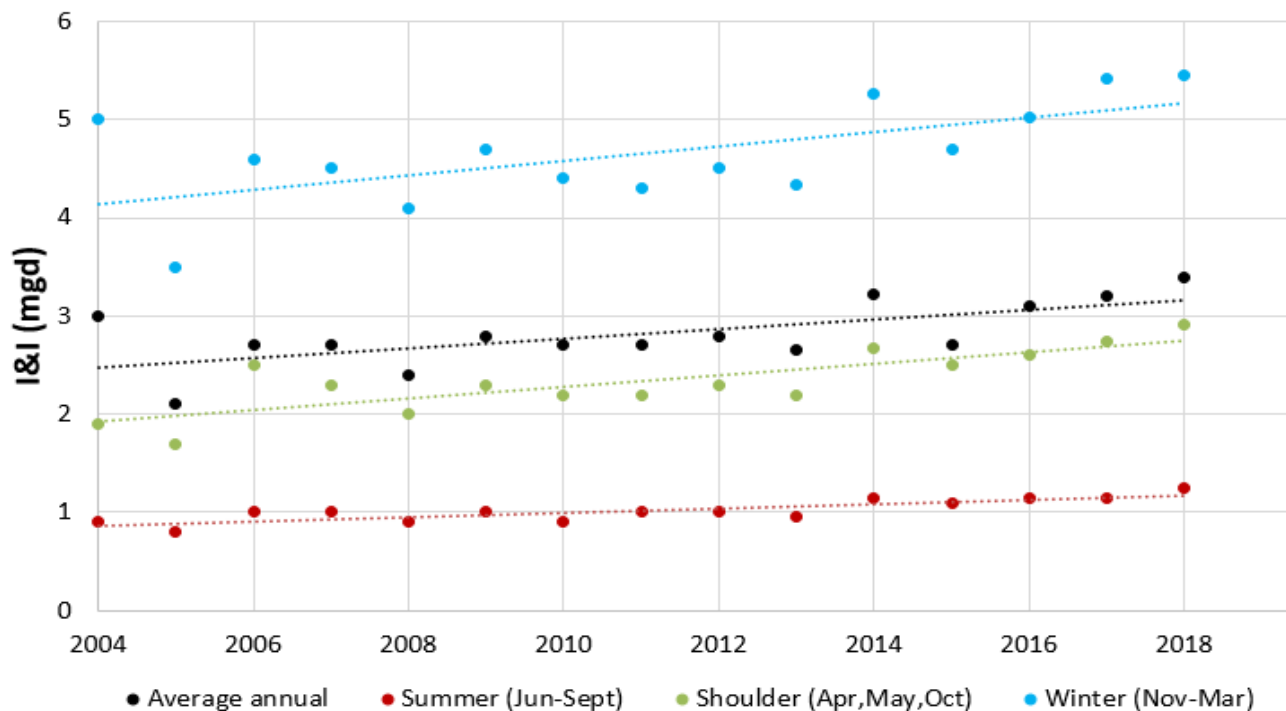
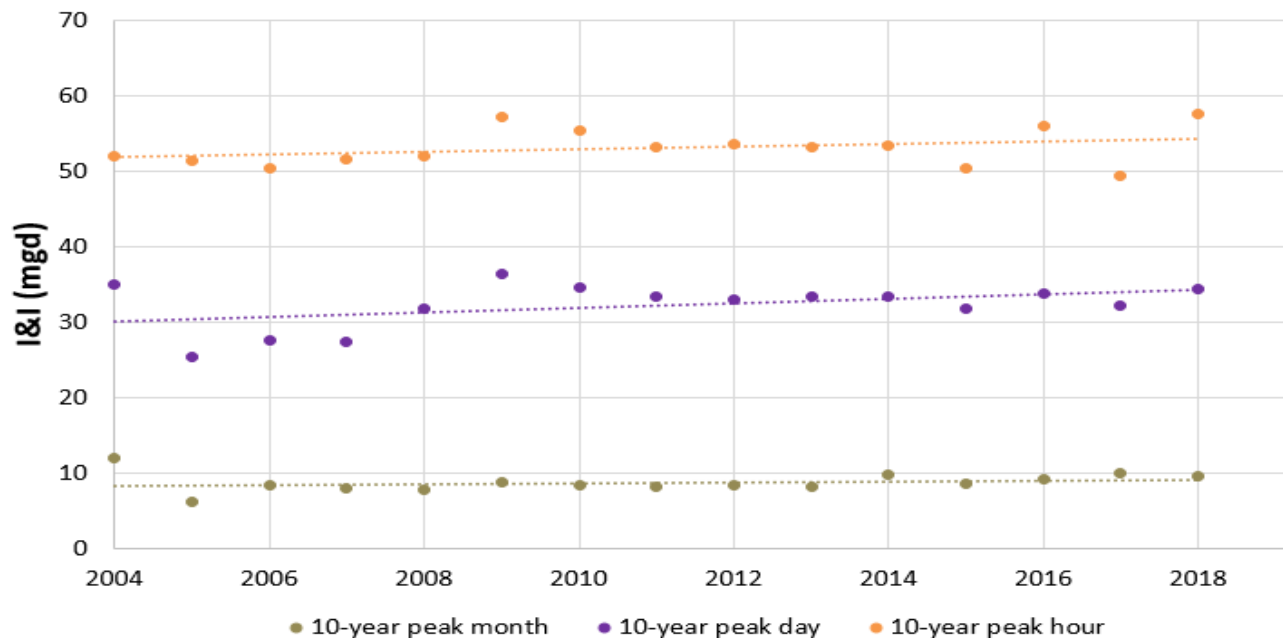


Figure 3-32. System-wide I&I Trends



3.3.12 Updated I&I Model

The previous 14 years of rotating flow meters established a breakdown of how much I&I each sewer basin contributed to the whole city. The current position of flow meters strategically measures flow from each city. Using the previous modeling efforts and I&I approximations, individual basin I&I can be estimated from the total city I&I. Inflow and infiltration estimates for each flow meter are translated to basin I&I estimates by first calculating the percentage of I&I each basin contributes to each city. This percentage is then applied to this year's flow measurements resulting in an estimate of I&I from each basin. Table 3-14 summarizes the basin I&I statistics.

Table 3-14. Basin I&I (gpd)

Basin	City	Location	Average Annual	Peak Month	Peak Day	Peak Hour	Summer (6,7,8,9)	Shoulder (4,5,10)	Winter (Nov-Mar)
1	L	Hawks Prairie	195,643	353,645	817,615	983,878	183,560	221,311	234,450
2	L	Meridian	35,042	78,811	166,327	229,381	43,392	47,829	45,742
3	L	Meadows	22,188	21,962	29,339	52,071	8,872	14,301	18,776
4	L	Lacey STEP	22,188	20,422	29,339	52,071	14,047	21,524	18,776
5	L	SE Corner	22,188	20,315	29,339	52,071	7,886	8,090	17,502
6	L	Horizon View	5,487	37,856	128,668	344,320	11,000	7,865	9,983
7	L	Ruddell	5,487	52,135	128,668	221,321	9,263	12,049	9,983
8	L	S Chambers Lake	30,077	94,073	226,262	355,528	17,843	22,053	37,323
9	L	N Chambers Lake	51,644	81,982	190,678	356,141	47,957	46,085	51,372
10	L	Lacey Blvd	27,887	60,805	245,630	385,961	21,502	24,723	30,824
11	L	Lacey Confluence	36,908	69,860	106,640	165,640	33,725	35,377	38,395
12	L	South Sound Center	170,776	334,074	448,929	513,757	148,629	150,287	190,254
13	L	St. Martins	22,188	22,142	29,339	52,071	19,222	21,380	18,776
14	L	Chinook	19,821	18,808	26,825	44,186	20,810	15,701	13,736
15	L	Britton Pkwy.	24,583	55,599	112,134	138,190	27,724	30,813	32,561
16	L	N Tanglewilde	24,583	38,041	112,134	128,705	17,061	14,790	32,561
17	L	S Tanglewilde	24,583	39,469	112,134	164,707	14,928	29,991	32,561
18	O	Motel 8	18,069	53,177	77,173	120,281	3,281	13,933	33,731
19	O	Lilly Rd.	18,069	53,177	77,173	120,281	3,281	13,933	33,731
20	O	South Bay Rd.	869	1,188	1,375	1,564	608	1,155	1,229
21	O	Fones	83,403	251,515	552,793	751,143	20,289	76,722	156,895
22	O	Boulevard	20,473	60,806	84,342	95,025	7,389	25,342	45,371
23	O	Wiggins	-	-	-	-	-	-	-

Basin	City	Location	Average Annual	Peak Month	Peak Day	Peak Hour	Summer (6,7,8,9)	Shoulder (4,5,10)	Winter (Nov-Mar)
24	O	Indian Summer	8,805	19,195	100,616	190,538	2,879	8,808	16,105
25	O	South Boulevard	19,319	55,977	90,843	130,251	5,199	18,138	35,890
26	O	Henderson	8,805	32,297	100,616	158,943	2,094	8,378	16,105
27	O	North St.	27,802	83,940	368,401	717,921	6,769	25,250	51,467
28	O	Indian Creek	8,397	26,829	73,936	118,971	1,961	7,588	16,093
29	O	SE Downtown	99,689	264,491	394,498	614,865	20,582	77,627	159,785
30	O	Priest Point	217,403	380,672	867,885	1,352,686	29,623	111,726	229,973
31	O	San Francisco	153,171	506,166	1,551,714	2,307,409	34,907	135,706	293,041
32	O	NE Downtown	7,927	40,073	428,738	2,176,701	1,683	3,864	15,788
33	O	Bigelow	28,331	78,281	226,258	331,887	7,787	26,965	50,401
34	O	Puget St.	6,030	17,194	157,481	331,793	1,180	4,198	8,656
35	O	Bigelow Springs	6,030	17,194	157,481	331,793	1,180	4,198	8,656
36	O	State Ave.	6,030	17,279	158,695	334,300	1,242	4,290	8,745
37	O	Lybarger	7,927	29,319	410,407	645,363	1,359	8,265	15,788
38	O	4 th Ave. E	11,459	37,834	178,799	369,329	2,651	10,205	21,849
39	O	5 th Ave. E	7,927	47,175	499,443	782,995	1,747	7,621	15,788
40	O	Pear	13,620	38,815	355,270	748,539	2,733	9,583	19,631
41	O	Plum	140,528	477,173	1,661,811	2,577,822	31,825	121,704	263,359
42	O	I-5 Interchange	7,025	24,527	144,619	445,921	1,727	7,540	16,220
43	O	Stevens Field	61,466	222,209	1,625,110	4,325,774	13,847	54,426	115,822
44	O	S Capitol 24th	14,351	42,234	265,742	635,050	2,047	23,974	29,543
45	O	S Capitol 22nd	8,168	58,440	460,629	1,402,183	584	5,122	18,223
46	O	S Capitol 17th	16,678	31,980	298,986	680,652	5,877	12,148	19,320
47	O	State Capitol	15,806	57,666	298,986	622,172	6,075	13,331	29,322
48	O	N Capitol Campus	15,903	48,224	272,054	367,455	2,311	9,568	27,551
49	O	State Offices	22,681	77,153	457,452	992,448	5,372	20,524	43,251
50	O	Central Downtown	101,247	321,161	1,764,256	4,003,493	24,360	91,262	188,521
51	O	Sylvester	128,062	415,812	2,875,660	5,324,376	32,585	120,121	241,632
52	O	Heritage Park	124,230	482,717	2,750,582	3,351,294	7,248	53,870	280,105
53	O	Port Peninsula	13,620	38,815	355,270	748,539	2,733	9,583	19,631

Basin	City	Location	Average Annual	Peak Month	Peak Day	Peak Hour	Summer (6,7,8,9)	Shoulder (4,5,10)	Winter (Nov-Mar)
54	O	Cedrona	9,666	19,800	37,370	64,087	3,575	8,061	12,767
55	O	Westwood	-	-	-	-	-	-	-
56	O	Old Port	79,546	255,448	757,884	1,023,808	19,825	74,817	154,415
57	O	Cooper Point	58,282	177,388	308,558	449,066	6,100	48,420	112,208
58	O	Goldcrest	42,115	119,956	274,122	436,743	3,181	22,758	55,346
59	O	West Bay	16,722	60,656	142,703	222,418	2,070	12,788	35,647
60	O	West Side	52,661	161,573	719,806	1,121,889	9,923	56,796	76,725
61	O	Jefferson	241,313	824,101	2,519,600	3,343,023	64,522	226,743	438,775
62	O	Harrison	18,014	81,027	479,611	747,522	3,722	14,749	35,717
63	O	Decatur Woods	52,562	172,189	528,049	723,934	12,416	47,280	100,766
64	O	Grass Lake	39,014	43,314	151,591	236,269	3,371	12,713	26,167
65	O	West Olympia	2,760	7,319	13,571	25,984	734	2,122	4,375
66	O	Capital Mall	37,200	139,681	429,197	537,789	5,010	28,233	57,137
67	O	Percival Creek	15,185	69,507	206,219	274,106	2,531	16,104	30,144
68	O	Ken Lake	108,190	336,681	783,176	858,617	26,630	96,204	206,649
69	O	Mottman	92,637	292,134	669,568	801,912	15,000	74,113	172,369
70	T	N Black Lake	-	-	-	-	-	-	-
71	T	Sapp	126,933	359,748	899,648	1,056,687	58,923	120,284	214,318
72	T	Tumwater Hill	74,107	248,984	878,658	1,054,303	23,639	61,518	120,675
73	T	E Street	4,774	15,525	45,379	50,456	1,743	3,808	8,456
74	T	H Street	3,839	13,843	37,463	49,312	1,496	3,007	6,865
75	T	Barnes Lake	10,209	36,361	92,242	123,841	3,834	8,564	16,726
76	T	NE Tumwater	19,306	59,132	163,285	257,049	6,741	16,605	30,411
77	T	Tumwater Valley	98	328	1,053	1,469	31	82	159
78	T	Southgate	55,073	159,914	570,680	856,395	18,913	48,410	84,428
79	T	Trosper	2,153	7,205	34,509	44,642	1,563	1,805	3,495
80	T	Littlerock	4,426	14,286	47,888	87,455	1,556	3,793	7,282
81	T	Tumwater City Hall	4,087	16,935	69,839	85,678	1,120	3,115	6,706
82	T	Trails End	4,087	16,935	69,839	85,678	1,120	3,115	6,706
83	T	Hwy 99	4,087	16,935	69,839	85,678	1,120	3,115	6,706

Basin	City	Location	Average Annual	Peak Month	Peak Day	Peak Hour	Summer (6,7,8,9)	Shoulder (4,5,10)	Winter (Nov-Mar)
84	T	Airport	-	-	-	-	-	-	-
85	T	S Airport	4,087	16,935	69,839	85,678	1,120	3,115	6,706
86	T	Kimmie	4,087	16,935	69,839	85,678	1,120	3,115	6,706
87	T	Salmon Creek	-	-	-	-	-	-	-
88	T	Black Lake	-	-	-	-	-	-	-
TESC		The Evergreen State College	16,086	48,520	123,878	193,076	2,616	9,612	25,650

3.3.13 I&I Benchmarks and Basin Ranking

The intergovernmental agreement which established the LOTT I&I program includes a non-degradation clause. Based upon this clause, LOTT will annually evaluate I&I in each of its sewer basins. If the amount of I&I in a basin is found to be significantly increasing, LOTT and its partners will prioritize work in that basin to remedy the situation. In order to provide a measure which can be tracked on an annual basis, the I&I benchmarks listed in Table 3-15 have been selected. These benchmarks are drawn from a statistical analysis of the LOTT basins. They represent the top 33rd percentile of I&I measures across all of the basins when the benchmark was established in 2007. That is, two-thirds of the LOTT basins exhibited I&I parameters worse than these benchmarks at that time.

Table 3-15. LOTT Sewer Basin I&I Benchmarks

Average Annual I&I per ERU	20	gpd/ERU
Peak Month I&I per ERU	50	gpd/ERU
Peak Day I&I per ERU	150	gpd/ERU
Peak Hour I&I per ERU	250	gpd/ ERU
Average Annual I&I per IDM	200	gpd/idm
Peak Month I&I per IDM	500	gpd/idm
Peak Day I&I per IDM	1,500	gpd/idm
Peak Hour I&I per IDM	2,400	gpd/idm
Peak Hour Flow to Base Flow Ratio	2.5	

Each LOTT city is compared with the benchmark in each of the nine categories. A benchmark average is then calculated, which provides a representation of how each city compares to the benchmark. Table 3-16 compares the last three years of benchmarks for Olympia, Tumwater, Lacey, and the System as a whole.

Table 3-16. City Benchmarks

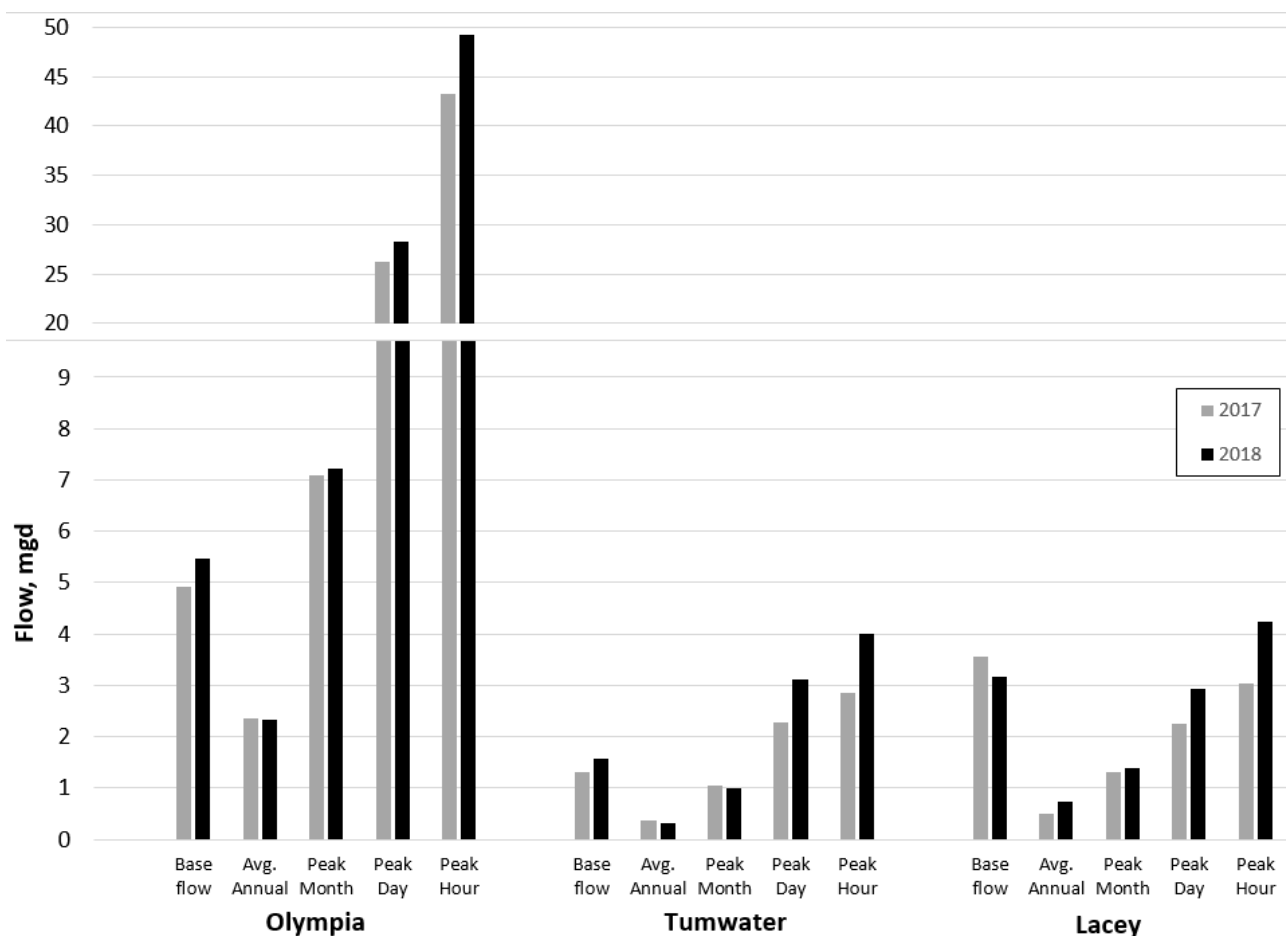
Flow Monitor	2015	2016	2017
Olympia	5.9	6.0	6.4
Tumwater	2.2	2.1	2.3
Lacey	0.9	1.0	1.2
System	3.5	3.5	3.8

Overall, the system benchmark ratio was 3.8, which is slightly higher than the previous year's average (3.54).

3.3.14 Comparison of base flow and I&I from 2017 to 2018

Figure 3-33 compares the city-wide flows and I&I projections.

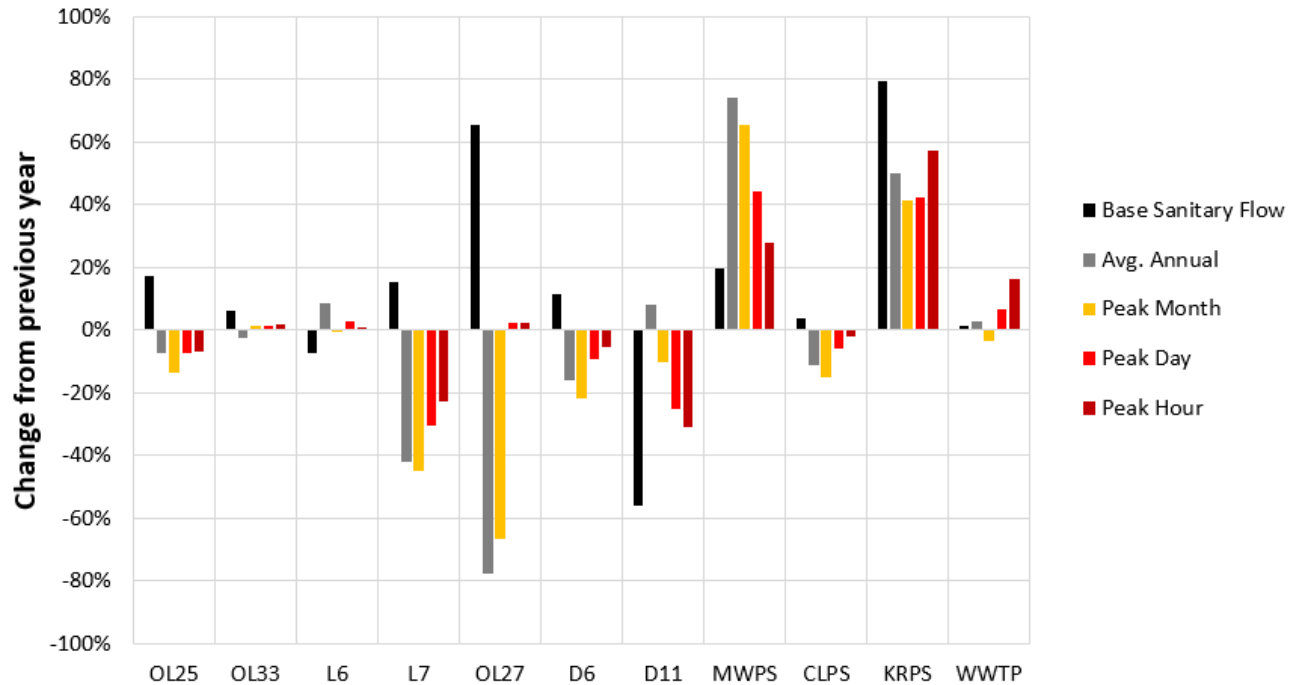
Figure 3-33. City-wide base flow and I&I comparison, 2017 to 2018



The year-to-year changes from City to City were relatively small. Base flow appeared to increase slightly in Olympia and Tumwater, and decrease in Lacey. These projections are based on winter season water consumption, and may reflect changes in occupancy, as well as environmental factors which can impact outdoor uses in the winter period. Peak period I&I increased in all three cities, reflecting similar observations at the BITP.

Figure 3-34 presents the change in flows between the 11 specifically monitored sites between 2017 and 2018.

Figure 3-34. Change in I&I, 2018 versus 2017

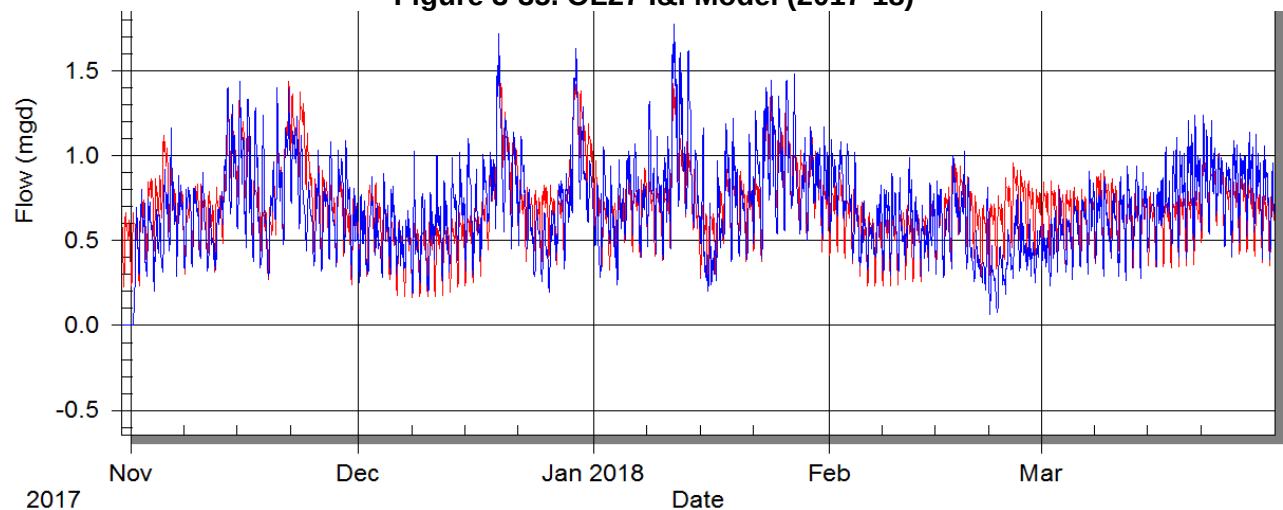


I&I parameters were largely unchanged from previous years at sites OL25, OL33, L6, D6, and CLPS. Notable changes at the other sites will be discussed in the subsequent sections.

OL27

OL27 is located on the Olympia/Tumwater border measuring flow from the Mottman industrial area. This site had a 66% increase in base flow, with large reductions in both average and peak month I&I. The changes are likely related. The base flow at this site is irregular, due to the large influence of industrial users. A high base flow in the model will cause the long-time-frame I&I projections to appear smaller. Peak day and peak hour I&I at this site were similar to previous years.

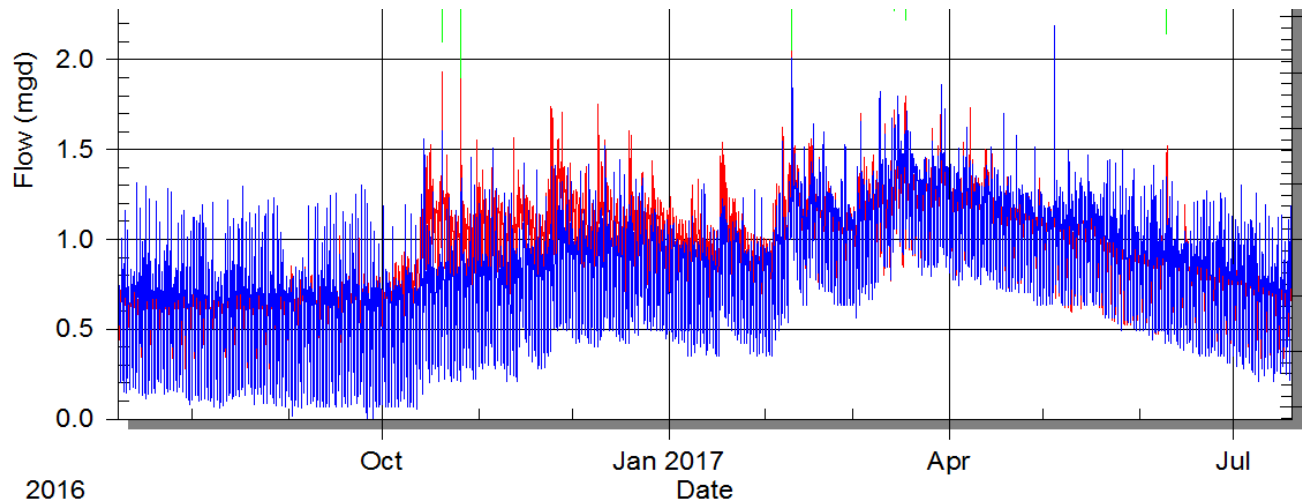
Figure 3-35. OL27 I&I Model (2017-18)



L7

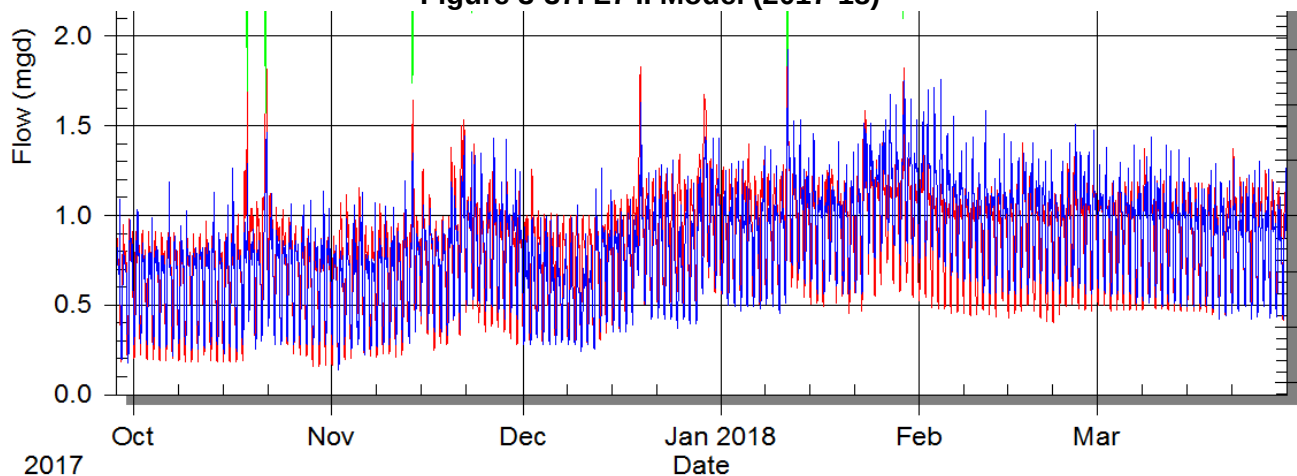
The I&I projections at site L7 decreased from last year by 20-40 percent. The flow monitor appears to have had some calibration issues in the latter half of 2016, which appears to have impacted last year's model. Figure 3-36 shows how the observed and model flows diverged in late 2017.

Figure 3-36. L7 I&I Model (2016-17)



The recalibrated model, shown in Figure 3-37, has a much better fit.

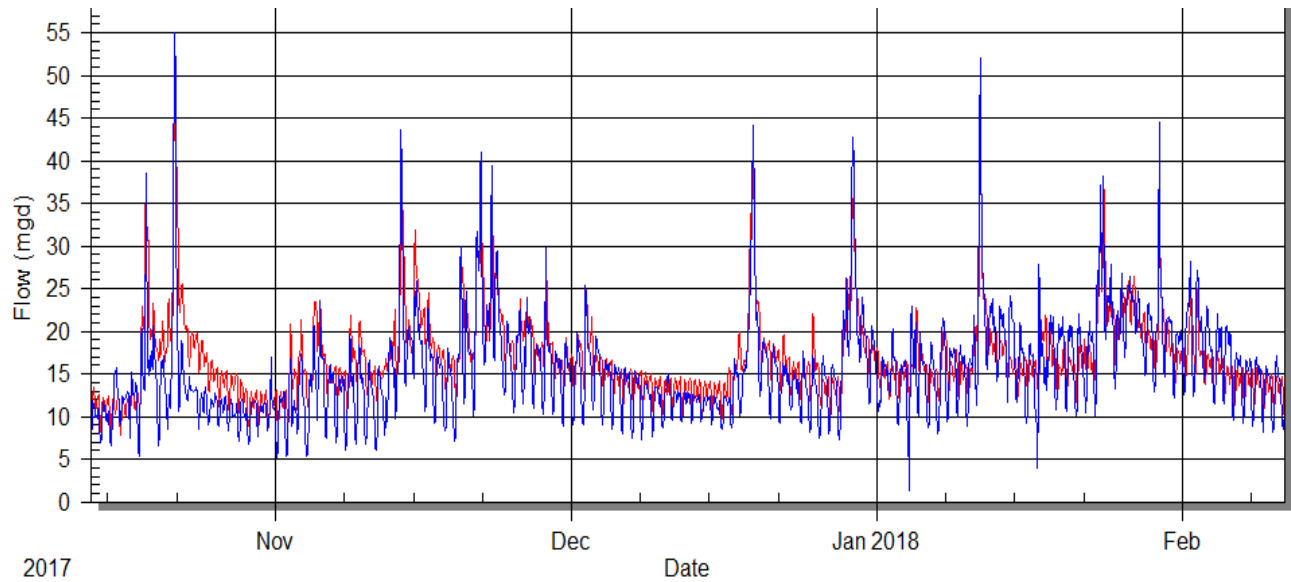
Figure 3-37. L7 II Model (2017-18)



WWTP

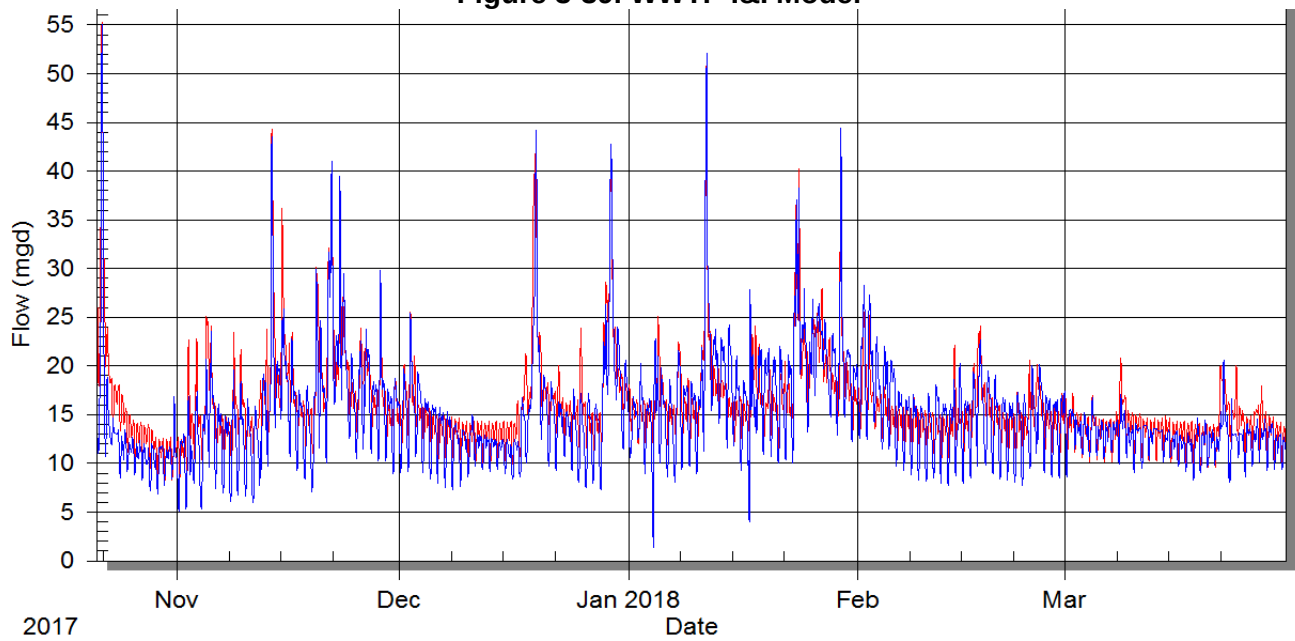
The I&I pattern at the BITP tends not to vary much from year to year. However, in recent years, the model has struggled to match peak hour flows. This year, the peak hour I&I had to be increased considerably to achieve a good fit. Specifically, the model peak hour I&I was 17% higher than last year. Figure 3-38 shows the model from 2017 applied to 2017-18 flows. Notice how the red model peaks fail to match the height of the blue observed peaks, indicating the model is not adequately projecting peak hour flows.

Figure 3-38. WWTP I&I Model from Previous Year



The I&I model coefficients were adjusted to match the higher peaks resulting in a more conservative model as shown in Figure 3-39.

Figure 3-39. WWTP I&I Model



4. Conclusions and Recommendations

1. Peak hour I&I has been increasing system-wide for the past few years, and this was the first year that the model was thoroughly adjusted to account for that trend. This resulted in a 17 percent increase in the modeled peak hour I&I. This increase does not appear to be directly linked to any single meter or partner jurisdiction, but rather appears to be a system-wide condition.
2. City-specific I&I parameters were generally in agreement with previous years observations. No more detailed assessment is recommended at this time.
3. Base flow at side D11 appeared to normalize in 2018 after being very low in 2017. Base flow at this site should continue to be tracked to confirm that the 2017 flows were an anomaly.

5. Flow Monitoring Installation Reports



Site Assessment Sheet

CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA

SFE PROJECT #: U18-119
SFE SITE #: D11

Project Specific Information

Client Name: LOTT
End User Name: LOTT
Project Name: Sanitary Sewer Flow Monitoring
Client Contact: Tyle Zuchowski
Field Contact: Tyle Zuchowski
SFE PM Contact: Adrian Marshall
Site Maintenance: bi-weekly

Site Equipment

Install / Removal Date:	<u>11/01/17</u>	<u>Permanent</u>
Meter Make & Model:	<u>ISCO 2150</u>	
Meter I.D. - #1 and #2	<u>207K01083</u>	<u>na</u>
Wireless I.D # / Cell #:	<u>na</u>	<u>na</u>
Level / Velocity Type:	<u>Pressure Probe</u>	<u>AV Sensor</u>
Sensor Mounting:	<u>other</u>	
Primary Device:	<u>Weir w/ AV</u>	
Logging Rate / Call out:	<u>5 minute</u>	<u>n/a</u>

Site Location Information

Client Manhole #: Mh 20020
Address (Location): 1116 Plum St.
City, Province: Olympia, Wa
GPS (North - West): N47.03963 W122.89166
Landmarks: 1/4 mile south down tracks
Traffic Control Req's: no traffic control
Additional Information: na

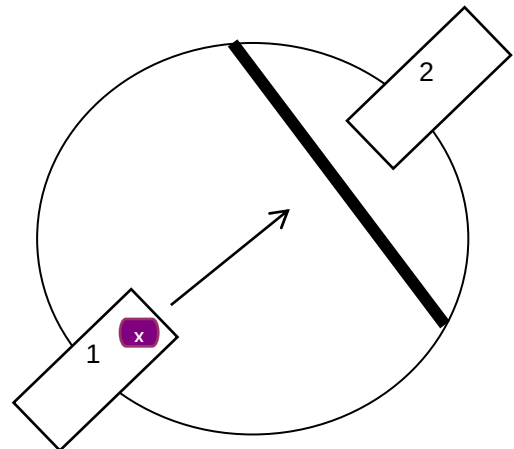
Site Profile

Manhole Depth (in):	<u>74.875</u>	Rungs?	<u>yes</u>
Overall Site Condition:	<u>good</u>		
Pipe Size #1	<u>30in</u>	#2	<u>30in</u>
(in): #3	<u>n/a</u>	#4	<u> </u>
Location of Sensor (which pipe?):	<u>x</u>	=	<u>1</u>
Overall Pipe Condition:	<u>good</u>		
Additional Information:	<u>na</u>		

Map of Area



Manhole Layout



Additional Notes

- This is an offset man hole
-
-

-
-
-



Site Pictures

CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA

SFE PROJECT #: U18-119
SFE SITE #: D11



Notes

- 1 area outside the manhole
- 2 inside manhole
- 3

4
5
6



Weir Install Sheet

CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA

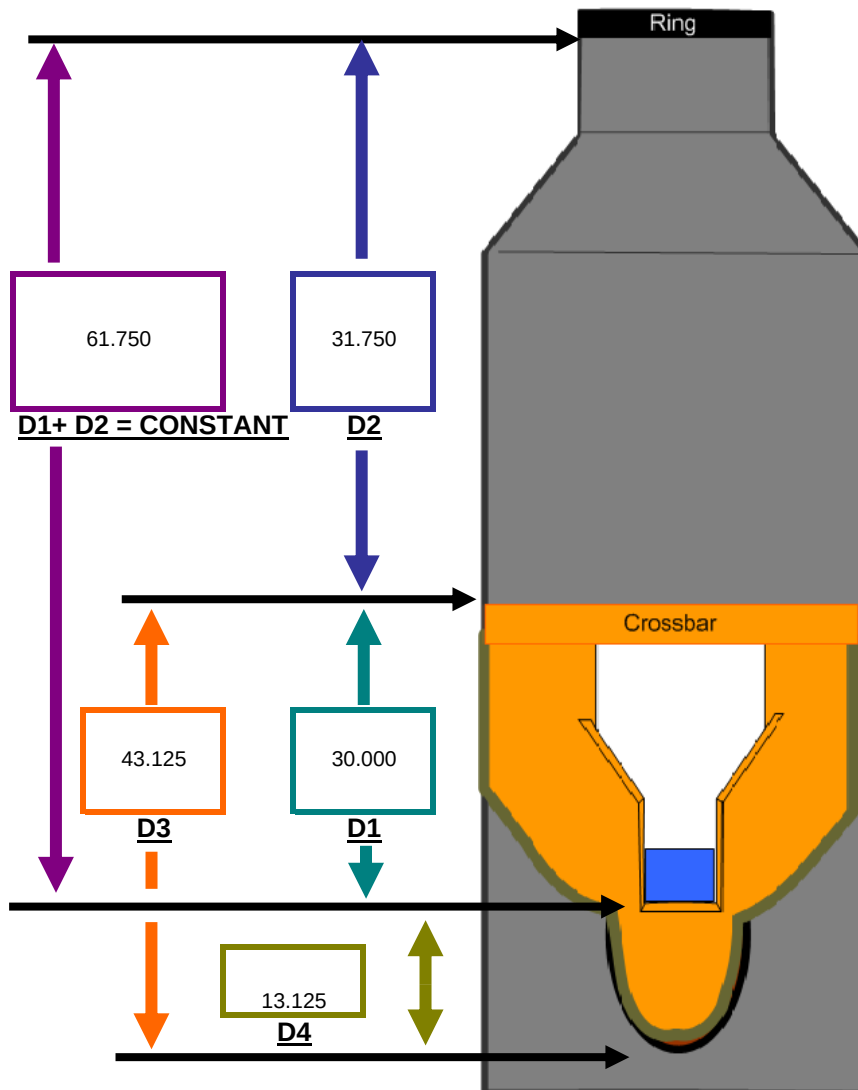
SFE PROJECT #: U18-119
SFE SITE #: D11
Technician 1: DC
Technician 2: CC

Meter Depth vs.. Field Depth Calibration / Verification

Reading Number	Date (m/d/yyyy)	Time (hh:mm)	Field Meas (in)	Meter Depth (in)	Comments (Zero Meter Level before Installation)
Initial	01/11/2017	19:18	-3.50	-2.16	600mm weir with AV set to weir depth
1		19:38	0.00	-0.11	sensor is at 9 oclock
2		19:43	0.25	0.34	
3		19:47	0.75	0.79	
Average			0.33	0.34	

* Three Continuous Measurements Within 1 inch

* Average Meter vs (WL1 and WL2) Within 5%



Weir Measurements

Weir Size (mm)

600mm

Raw Weir Level

0.339 (in)

CONSTANT

61.750 (in)

D1 CONSTANT

30.000 (in)



CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA
Date / Time: Nov 1 2017 19:20

SFE PROJECT #: U18-119
SFE SITE #: D11
Technician 1: Dylan Carver
Technician 2: Colton Chandler

Flow Meter Information

Meter Make & Model: ISCO 2150
Meter I.D. #:

<u>207K01083</u>	<u>na</u>
------------------	-----------

Wireless I.D. / Cell #:

<u>na</u>	<u>na</u>
-----------	-----------

Level / Velocity Type:

<u>Pressure Probe</u>	<u>AV Sensor</u>
-----------------------	------------------

Primary Device: Weir w/ AV
Battery Old / New:

	<u>12.8V</u>
--	--------------

Logging Rate/Call out:

<u>5 minute</u>	<u>n/a</u>
-----------------	------------

Flow Units: cfs
Velocity Units: fps
Depth Units: in
Surcharge Meter (Y/N): Y

Site Physical Information

Silt Level: 0
Slope: N/A
Uniform Flow (Y/N): Yes
Debris in Flow (Y/N): Yes (sanitary)
Pipe Material: Concrete

Weather: sunny
Weir Size: 600mm
Depth Only(DO) or Look up Table(LT): LT
Comments: _____

Check Off List

	Yes	No
Time Set:	☒	☐
Depth Calibrated:	☒	☐
Velocity Profile:	☐	☒
Download Data:	☒	☐
Meter Running:	☒	☐
Pipe Size Verified:	☒	☐
Photograph Taken:	☒	☐
Site Cleaned:	☒	☐
Site Secured:	☒	☐



Site Assessment Sheet

CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA

SFE PROJECT #: U18-119
SFE SITE #: L6

Project Specific Information

Client Name: LOTT
End User Name: LOTT
Project Name: Sanitary Sewer Flow Monitoring
Client Contact: Tyle Zuchowski
Field Contact: Tyle Zuchowski
SFE PM Contact: Adrian Marshall
Site Maintenance: bi-weekly

Site Equipment

Install / Removal Date:	<u>01/01/04</u>	<u>Permanent</u>
Meter Make & Model:	<u>ISCO 2150</u>	
Meter I.D. - #1 and #2	<u>207B01097</u>	<u>na</u>
Wireless I.D # / Cell #:	<u>na</u>	<u>na</u>
Level / Velocity Type:	<u>Pressure Probe</u>	<u>AV Sensor</u>
Sensor Mounting:	<u>Compression</u>	
Primary Device:	<u>Weir w/ AV</u>	
Logging Rate / Call out:	<u>5 minute</u>	<u>n/a</u>

Site Location Information

Client Manhole #: MH 701200
Address (Location): 4040 Sleater Kinney rd NE
City, Province: Olympia, Wa
GPS (North - West): N47.04866 W122.83449
Landmarks: Jack In Box
Traffic Control Req's: no traffic control
Additional Information: n/a

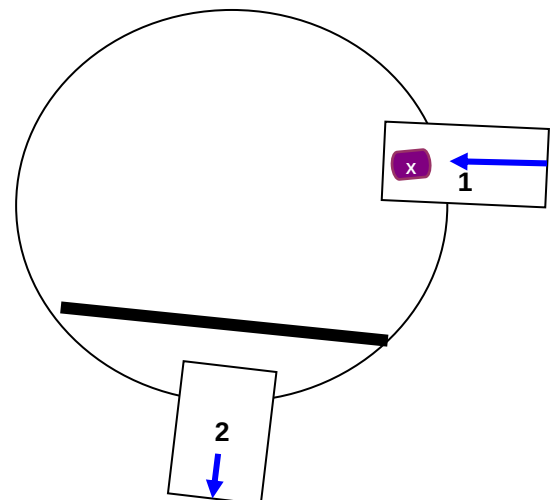
Site Profile

Manhole Depth (in): 195.75 Rungs? yes
Overall Site Condition: Deterioration
Pipe Size #1 30 #2 30
(in): #3 na #4 na
Location of Sensor (which pipe?): x =
Overall Pipe Condition: good
Additional Information: manhole is deteriorated badly

Map of Area



Manhole Layout



Additional Notes

-
-
-



Site Pictures

CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA

SFE PROJECT #: U18-119
SFE SITE #: L6



Notes

- 1 area outside the manhole
- 2 inside manhole
- 3

4
5
6



Weir Install Sheet

CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA

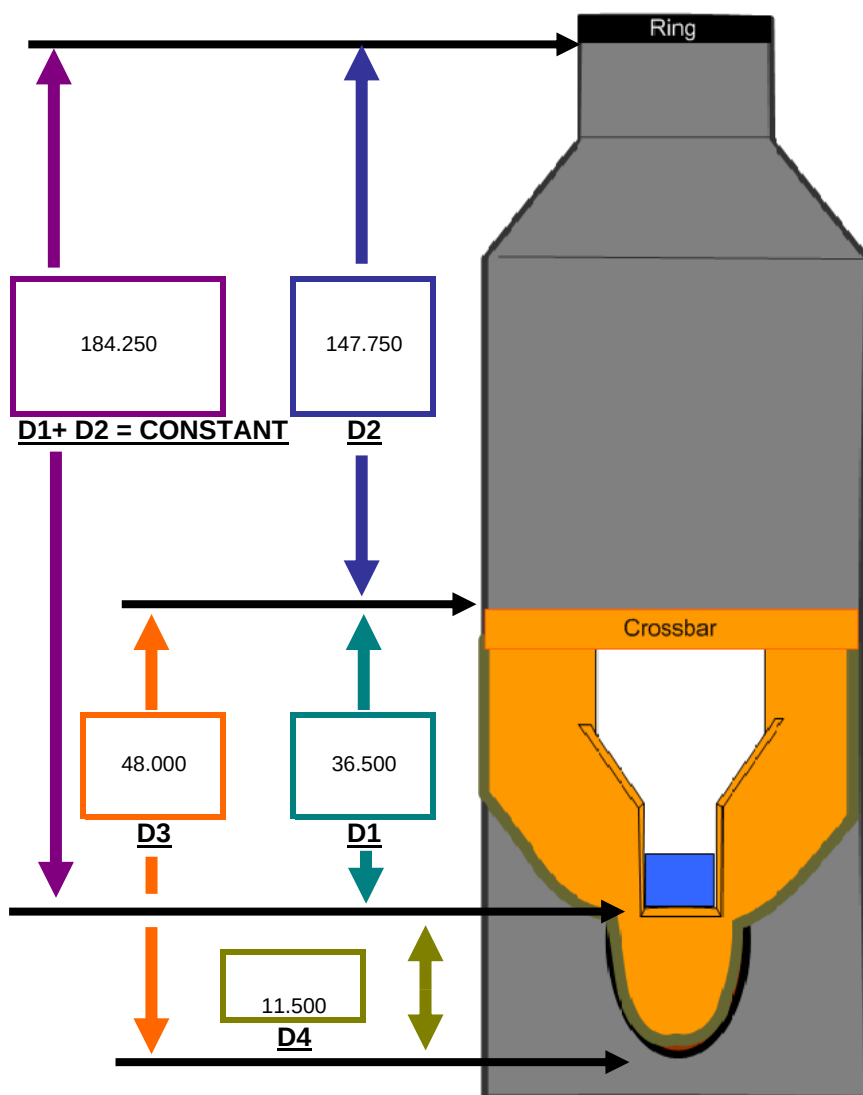
SFE PROJECT #: U18-119
SFE SITE #: L6
Technician 1: DC
Technician 2: CC

Meter Depth vs.. Field Depth Calibration / Verification

Reading Number	Date (m/d/yyyy)	Time (hh:mm)	Field Meas (in)	Meter Depth (in)	Comments (Zero Meter Level before Installation)
Initial	01/11/2017	18:06	13.375	13.600	
1			13.375	13.600	sensor is at 7 o'clock
2			13.375	13.600	900mm-2 weir
3			13.375	13.600	
Average			13.375	13.600	

* Three Continuous Measurements Within 1 inch

* Average Meter vs (WL1 and WL2) Within 5%



Weir Measurements

Weir Size (mm)

900mm-2

Raw Weir Level

13.600 (in)

CONSTANT

184.250 (in)

D1 CONSTANT

36.500 (in)



CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA
Date / Time: Nov 1 2017 18:06

SFE PROJECT #: U18-119
SFE SITE #: L6
Technician 1: Dylan Carver
Technician 2: Colton Chandler

Flow Meter Information

Meter Make & Model: ISCO 2150
Meter I.D. #: 207B01097 na
Wireless I.D. / Cell #: na na
Level / Velocity Type: Pressure Probe AV Sensor
Primary Device: Weir w/ AV
Battery Old / New: 12.8V

Logging Rate/Call out: 5 minute | n/a
Flow Units: cfs
Velocity Units: fps
Depth Units: in
Surcharge Meter (Y/N): Y

Site Physical Information

Silt Level: 0
Slope: N/A
Uniform Flow (Y/N): Yes
Debris in Flow (Y/N): Yes (sanitary)
Pipe Material: Concrete

Weather: Coud +50F
Weir Size: 900mm-2
Depth Only(DO)
or Look up Table(LT) LT
Comments manhole deteriorated

Check Off List

	Yes	No
Time Set:	☒	☐
Depth Calibrated:	☒	☐
Velocity Profile:	☐	☒
Download Data:	☒	☐
Meter Running:	☒	☐
Pipe Size Verified:	☒	☐
Photograph Taken:	☒	☐
Site Cleaned:	☒	☐
Site Secured:	☒	☐



Site Assessment Sheet

CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA

SFE PROJECT #: U18-119
SFE SITE #: L7

Project Specific Information

Client Name: LOTT
End User Name: LOTT
Project Name: Sanitary Sewer Flow Monitoring
Client Contact: Tyle Zuchowski
Field Contact: Tyle Zuchowski
SFE PM Contact: Adrian Marshall
Site Maintenance: bi-weekly

Site Equipment

Install / Removal Date:	<u>01/01/04</u>	<u>Permanent</u>
Meter Make & Model:	<u>ISCO 2150</u>	
Meter I.D. - #1 and #2	<u>207F00783</u>	<u>na</u>
Wireless I.D # / Cell #:	<u>na</u>	<u>na</u>
Level / Velocity Type:	<u>Pressure Probe</u>	<u>AV Sensor</u>
Sensor Mounting:	<u>Compression</u>	
Primary Device:	<u>Weir w/ AV</u>	
Logging Rate / Call out:	<u>5 minute</u>	<u>n/a</u>

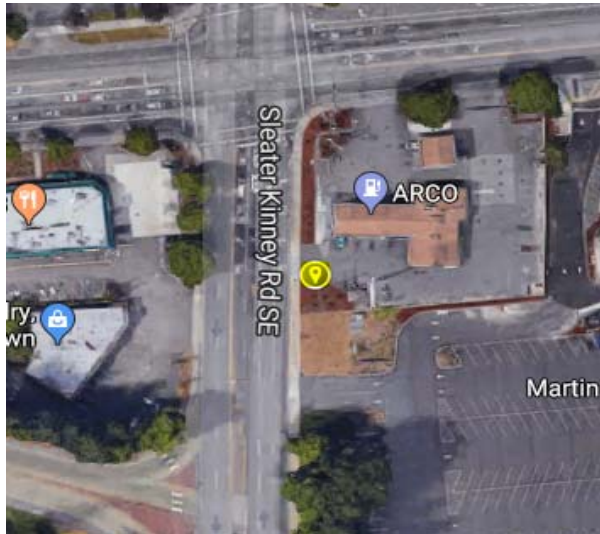
Site Location Information

Client Manhole #: MH 70-205
Address (Location): 410 Sleater Kenney Rd SE
City, Province: Olympia, Wa
GPS (North - West): N47.04744 W122.83382
Landmarks: Next to ARCO gas
Traffic Control Req's: no traffic
Additional Information: n/a

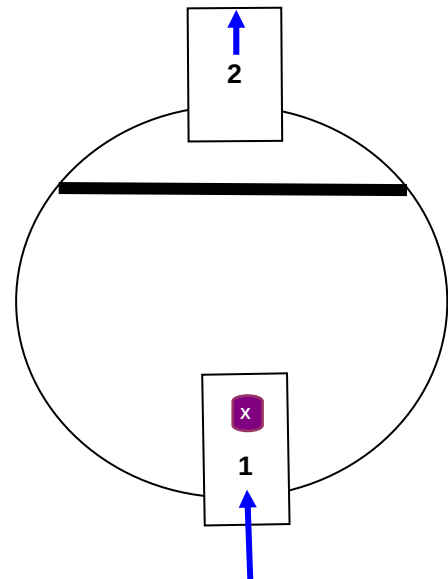
Site Profile

Manhole Depth (in):	<u>244</u>	Rungs?	<u>yes</u>
Overall Site Condition:	<u>good</u>		
Pipe Size #1	<u>24</u>	#2	<u>26</u>
(in): #3	<u>n/a</u>	#4	<u></u>
Location of Sensor (which pipe?):	<u>x</u>	=	<u>1</u>
Overall Pipe Condition:	<u>good</u>		
Additional Information:	<u>n/a</u>		

Map of Area



Manhole Layout



Additional Notes

- | | |
|---|---|
| - | - |
| - | - |
| - | - |



Site Pictures

CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA

SFE PROJECT #: U18-119
SFE SITE #: L7



Notes

- 1 area outside the manhole
- 2 inside Manhole
- 3

4
5
6



Weir Install Sheet

CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA

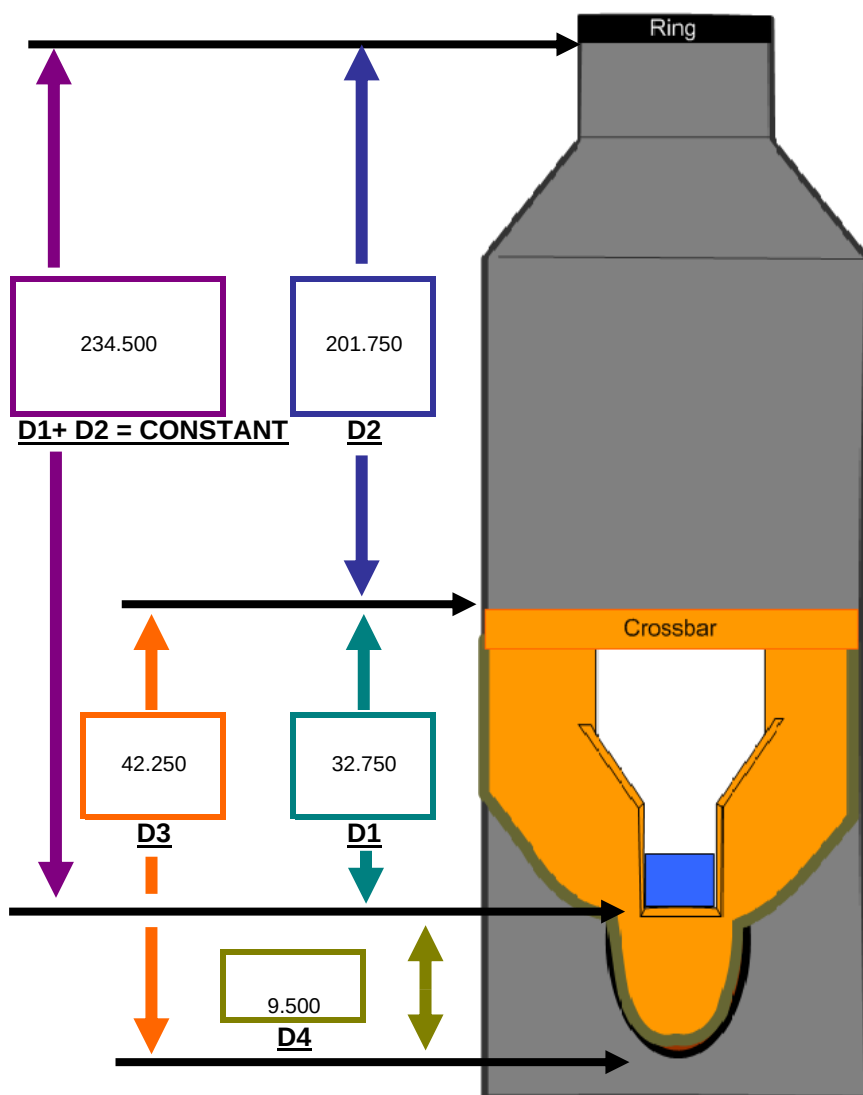
SFE PROJECT #: U18-119
SFE SITE #: L7
Technician 1: DC
Technician 2: CC

Meter Depth vs.. Field Depth Calibration / Verification

Reading Number	Date (m/d/yyyy)	Time (hh:mm)	Field Meas (in)	Meter Depth (in)	Comments (Zero Meter Level before Installation)
Initial	01/11/2017	19:33	5.500	5.800	900mm-2 weir with AV set to weir depth
1		*	5.500	5.800	sensor is at 9 oclock
2		*	5.500	5.800	
3		*	5.500	5.800	
Average			5.500	5.800	

* Three Continuous Measurements Within 1 inch

* Average Meter vs (WL1 and WL2) Within 5%



Weir Measurements

Weir Size (mm)

900mm-2

Raw Weir Level

5.800 (in)

CONSTANT

234.500 (in)

D1 CONSTANT

32.750 (in)



CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA
Date / Time: Nov 1 2017 19:33

SFE PROJECT #: U18-119
SFE SITE #: L7
Technician 1: Dylan Carver
Technician 2: Colton Chandler

Flow Meter Information

Meter Make & Model: ISCO 2150
Meter I.D. #: 207F00783 na
Wireless I.D. / Cell #: na na
Level / Velocity Type: Pressure Probe AV Sensor
Primary Device: Weir w/ AV
Battery Old / New: 12.8V

Logging Rate/Call out: 5 minute | n/a
Flow Units: cfs
Velocity Units: fps
Depth Units: in
Surcharge Meter (Y/N): Y

Site Physical Information

Silt Level: 0
Slope: N/A
Uniform Flow (Y/N): Yes
Debris in Flow (Y/N): Yes (sanitary)
Pipe Material: Concrete

Weather: Cloud +50F
Weir Size: 900mm-2
Depth Only(DO) or Look up Table(LT): LT
Comments:

Check Off List

	Yes	No
Time Set:	☒	☐
Depth Calibrated:	☒	☐
Velocity Profile:	☐	☒
Download Data:	☒	☐
Meter Running:	☒	☐
Pipe Size Verified:	☒	☐
Photograph Taken:	☒	☐
Site Cleaned:	☒	☐
Site Secured:	☒	☐



Site Assessment Sheet

CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA

SFE PROJECT #: U18-119
SFE SITE #: OL25

Project Specific Information

Client Name: LOTT
End User Name: LOTT
Project Name: Sanitary Sewer Flow Monitoring
Client Contact: Tyle Zuchowski
Field Contact: Tyle Zuchowski
SFE PM Contact: Adrian Marshall
Site Maintenance: bi-weekly

Site Equipment

Install / Removal Date:	<u>11/01/17</u>	<u>Permanent</u>
Meter Make & Model:	<u>ISCO 2150</u>	
Meter I.D. - #1 and #2	<u>AV207K01044</u>	<u>na</u>
Wireless I.D # / Cell #:	<u>na</u>	<u>na</u>
Level / Velocity Type:	<u>Pressure Probe</u>	<u>AV Sensor</u>
Sensor Mounting:	<u>other</u>	
Primary Device:	<u>Weir w/ AV</u>	
Logging Rate / Call out:	<u>5 minute</u>	<u>n/a</u>

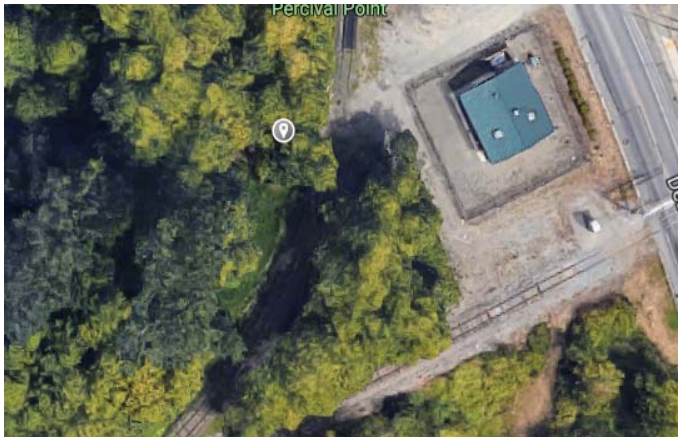
Site Location Information

Client Manhole #: MH 70-249
Address (Location): 1122 Deschutes
City, Province: Olympia, Wa
GPS (North - West): N47.03651 W122.91348
Landmarks: next to gate
Traffic Control Req's: no traffic control
Additional Information: n/a

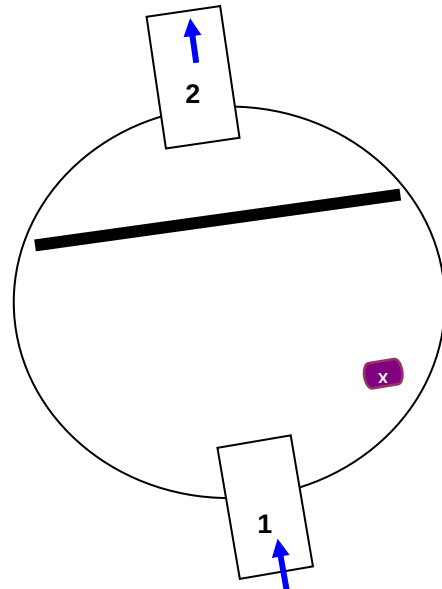
Site Profile

Manhole Depth (in): 95 Rungs? yes
Overall Site Condition: good
Pipe Size #1 24 #2 24
(in): #3 n/a #4
Location of Sensor (which pipe?): x = 1
Overall Pipe Condition: good
Additional Information: sensor in wet well

Map of Area



Manhole Layout



Additional Notes

- -
 -
- -
 -



Site Pictures

CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA

SFE PROJECT #: U18-119
SFE SITE #: OL25



Notes

- 1 area outside the manhole
- 2 inside the manhole
- 3

- 4
- 5
- 6



Weir Install Sheet

CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA

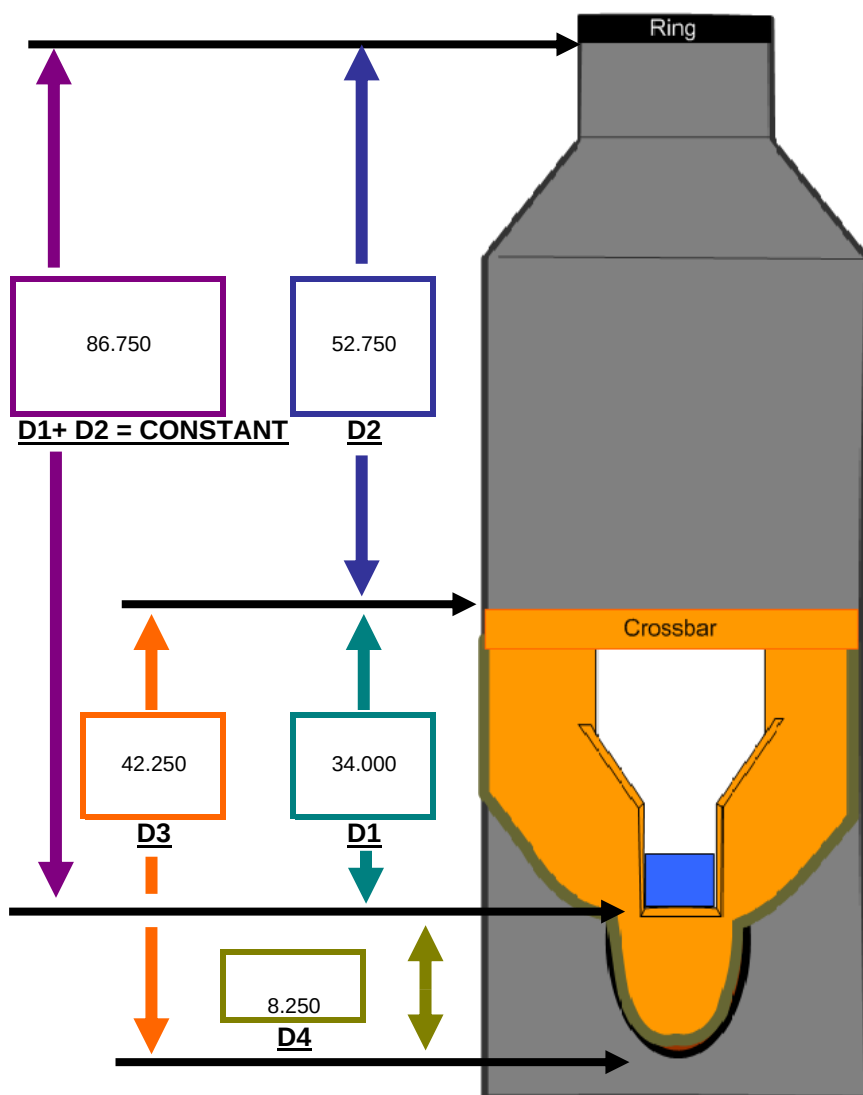
SFE PROJECT #: U18-119
SFE SITE #: OL25
Technician 1: DC
Technician 2: CC

Meter Depth vs.. Field Depth Calibration / Verification

Reading Number	Date (m/d/yyyy)	Time (hh:mm)	Field Meas (in)	Meter Depth (in)	Comments (Zero Meter Level before Installation)
Initial	01/11/2017	14:59	13.500	13.750	
1		*	13.500	13.750	
2		*	13.500	13.750	
3		*	13.500	13.750	
Average			13.500	13.750	

* Three Continuous Measurements Within 1 inch

* Average Meter vs (WL1 and WL2) Within 5%



Weir Measurements

Weir Size (mm)

TQI Design

Raw Weir Level

13.750 (in)

CONSTANT

86.750 (in)

D1 CONSTANT

34.000 (in)



CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA
Date / Time: Nov 1 2017 14:49

SFE PROJECT #: U18-119
SFE SITE #: OL25
Technician 1: Dylan Carver
Technician 2: Colton Chandler

Flow Meter Information

Meter Make & Model: ISCO 2150
Meter I.D. #:

AV207K01044	na
-------------	----

Wireless I.D. / Cell #:

na	na
----	----

Level / Velocity Type:

Pressure Probe	AV Sensor
----------------	-----------

Primary Device: Weir w/ AV
Battery Old / New:

	12.8V
--	-------

Logging Rate/Call out:

5 minute	n/a
----------	-----

Flow Units: cfs
Velocity Units: fps
Depth Units: in
Surcharge Meter (Y/N): Y

Site Physical Information

Silt Level: 0
Slope: N/A
Uniform Flow (Y/N): Yes
Debris in Flow (Y/N): Yes (sanitary)
Pipe Material: Concrete

Weather: Cloud +50F
Weir Size: TQI Design
Depth Only(DO) or Look up Table(LT): LT
Comments: na

Check Off List

	Yes	No
Time Set:	☒	☐
Depth Calibrated:	☒	☐
Velocity Profile:	☐	☒
Download Data:	☒	☐
Meter Running:	☒	☐
Pipe Size Verified:	☒	☐
Photograph Taken:	☒	☐
Site Cleaned:	☒	☐
Site Secured:	☒	☐



Site Assessment Sheet

CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA

SFE PROJECT #: U18-119
SFE SITE #: OL27

Project Specific Information

Client Name: LOTT
End User Name: LOTT
Project Name: Sanitary Sewer Flow Monitoring
Client Contact: Tyle Zuchowski
Field Contact: Tyle Zuchowski
SFE PM Contact: Adrian Marshall
Site Maintenance: bi-weekly

Site Equipment

Install / Removal Date:	<u>10/18/17</u>	<u>Permanent</u>
Meter Make & Model:	<u>ISCO 2150</u>	
Meter I.D. - #1 and #2	<u>216B00953</u>	<u>na</u>
Wireless I.D # / Cell #:	<u>na</u>	<u>na</u>
Level / Velocity Type:	<u>Pressure Probe</u>	<u>AV Sensor</u>
Sensor Mounting:	<u>other</u>	
Primary Device:	<u>Weir w/ AV</u>	
Logging Rate / Call out:	<u>5 minute</u>	<u>n/a</u>

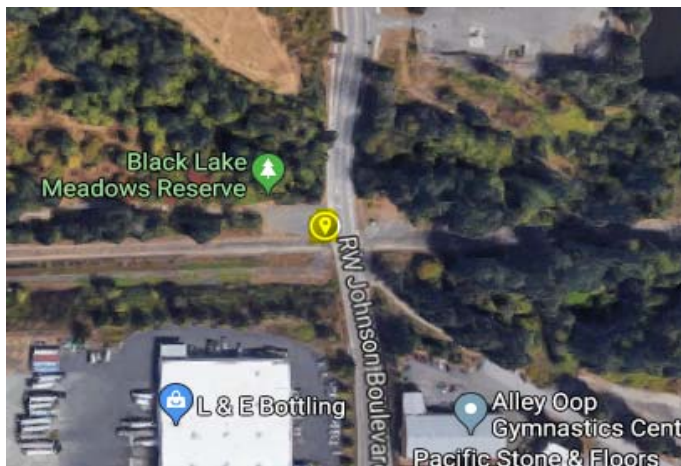
Site Location Information

Client Manhole #: Unknown
Address (Location): 2290 RW Jonhson Blvd SW
City, Province: Olympia, Wa
GPS (North - West): N47.02695 W12093962
Landmarks: next to RR tracks
Traffic Control Req's: no traffic control
Additional Information: n/a

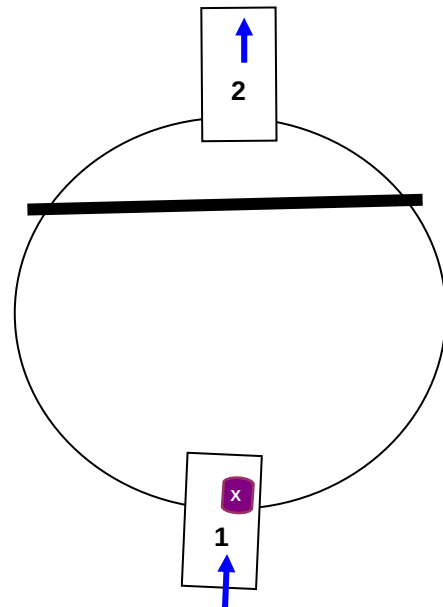
Site Profile

Manhole Depth (in):	<u>139.375</u>	Rungs?	<u>yes</u>
Overall Site Condition:	<u>good</u>		
Pipe Size #1	<u>18</u>	#2	<u>24</u>
(in): #3	<u>n/a</u>	#4	<u></u>
Location of Sensor (which pipe?):	<u>x</u>	=	<u>1</u>
Overall Pipe Condition:	<u>good</u>		
Additional Information:	<u>next RR tracks</u>		

Map of Area



Manhole Layout



Additional Notes

-
-
-



Site Pictures

CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA

SFE PROJECT #: U18-119
SFE SITE #: OL27



Notes

- | | |
|--|---|
| 1 area outside the manhole | 4 |
| 2 inside the manhole prior to weir install | 5 |
| 3 inside the manhole after to weir install | 6 |



Weir Install Sheet

CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA

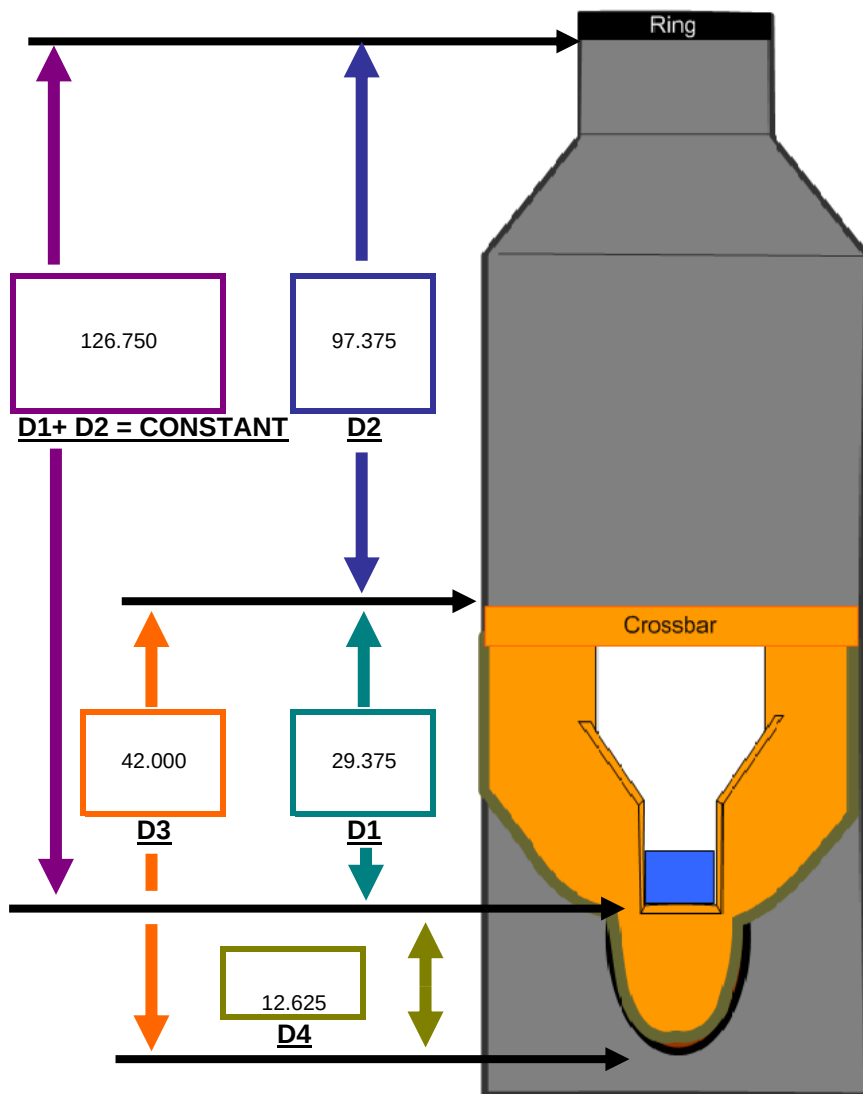
SFE PROJECT #: U18-119
SFE SITE #: OL27
Technician 1: DC
Technician 2: CC

Meter Depth vs.. Field Depth Calibration / Verification

Reading Number	Date (m/d/yyyy)	Time (hh:mm)	Field Meas (in)	Meter Depth (in)	Comments (Zero Meter Level before Installation)
Initial	10/18/2017	14:52	5.32	15.77	600mm weir with AV set to weir depth
1		*	6.50	6.35	sensor is at 9 oclock
2		*	5.75	5.61	
3		*	5.75	5.62	
Average			6.00	5.86	

* Three Continuous Measurements Within 1 inch

* Average Meter vs (WL1 and WL2) Within 5%



Weir Measurements

Weir Size (mm)

600mm

Raw Weir Level

5.858 (in)

CONSTANT

126.750 (in)

D1 CONSTANT

29.375 (in)



CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA
Date / Time: Oct 18 2017 15:00

SFE PROJECT #: U18-119
SFE SITE #: OL27
Technician 1: Dylan Carver
Technician 2: Colton Chandler

Flow Meter Information

Meter Make & Model: ISCO 2150
Meter I.D. #: 216B00953 na
Wireless I.D. / Cell #: na na
Level / Velocity Type: Pressure Probe AV Sensor
Primary Device: Weir w/ AV
Battery Old / New: 12.8V

Logging Rate/Call out: 5 minute | n/a
Flow Units: cfs
Velocity Units: fps
Depth Units: in
Surcharge Meter (Y/N): Y

Site Physical Information

Silt Level: 0
Slope: N/A
Uniform Flow (Y/N): Yes
Debris in Flow (Y/N): Yes (sanitary)
Pipe Material: Concrete

Weather: Rain +50F
Weir Size: 600mm
Depth Only(DO)
or Look up Table(LT) LT
Comments new installation

Check Off List

	Yes	No
Time Set:	☒	☐
Depth Calibrated:	☒	☐
Velocity Profile:	☐	☒
Download Data:	☒	☐
Meter Running:	☒	☐
Pipe Size Verified:	☒	☐
Photograph Taken:	☒	☐
Site Cleaned:	☒	☐
Site Secured:	☒	☐



Site Assessment Sheet

CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA

SFE PROJECT #: U18-119
SFE SITE #: OL33

Project Specific Information

Client Name: LOTT
End User Name: LOTT
Project Name: Sanitary Sewer Flow Monitoring
Client Contact: Tyle Zuchowski
Field Contact: Tyle Zuchowski
SFE PM Contact: Adrian Marshall
Site Maintenance: bi-weekly

Site Equipment

Install / Removal Date:	<u>01/01/04</u>	<u>Permanent</u>
Meter Make & Model:	<u>ISCO 2150</u>	
Meter I.D. - #1 and #2	<u>207K01068</u>	<u>na</u>
Wireless I.D # / Cell #:	<u>na</u>	<u>na</u>
Level / Velocity Type:	<u>Pressure Probe</u>	<u>AV Sensor</u>
Sensor Mounting:	<u>other</u>	
Primary Device:	<u>Weir w/ AV</u>	
Logging Rate / Call out:	<u>5 minute</u>	<u>n/a</u>

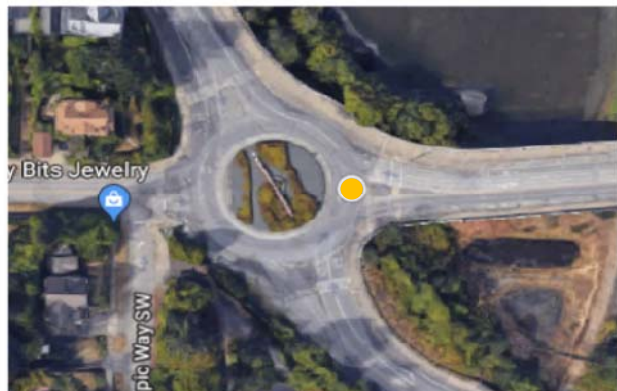
Site Location Information

Client Manhole #: MH 70-249
Address (Location): 731 4th Ave W
City, Province: Olympia, Wa
GPS (North - West): N47.04425 W122.91161
Landmarks: outer lane east side of roundabout
Traffic Control Req's: full traffic control
Additional Information: n/a

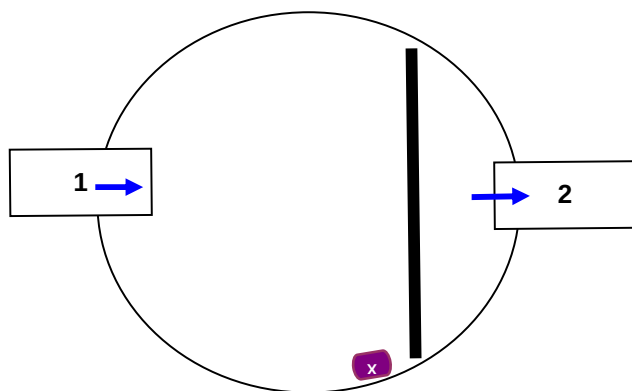
Site Profile

Manhole Depth (in):	<u>54</u>	Rungs? <u>yes</u>
Overall Site Condition:	<u>good</u>	
Pipe Size #1	<u>22.5</u>	#2 <u>18</u>
(in): #3	<u>n/a</u>	#4 <u>n/a</u>
Location of Sensor (which pipe?):	<u>x</u>	<u>wet well</u>
Overall Pipe Condition:	<u>good</u>	
Additional Information:	<u>sensor in wet well</u>	

Map of Area



Manhole Layout



Additional Notes

-
-
-



Site Pictures

CLIENT FLOW MONITORING #: U18-119

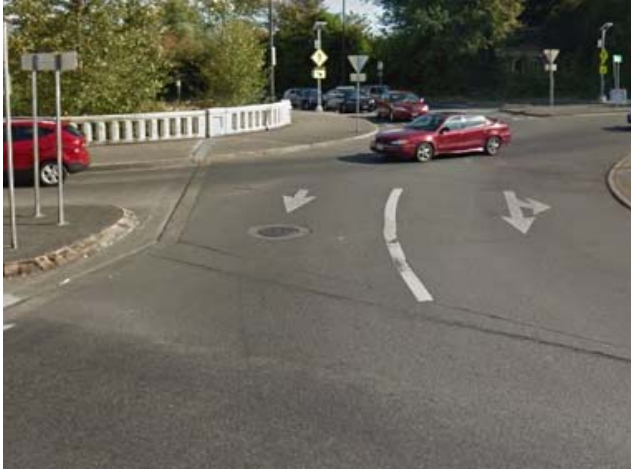
SFE PROJECT #:

U18-119

NAME: City of Olympia, WA

SFE SITE #:

OL33



Notes

- 1 area outside the manhole
- 2 inside Manhole
- 3

- 4
- 5
- 6



Weir Install Sheet

CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA

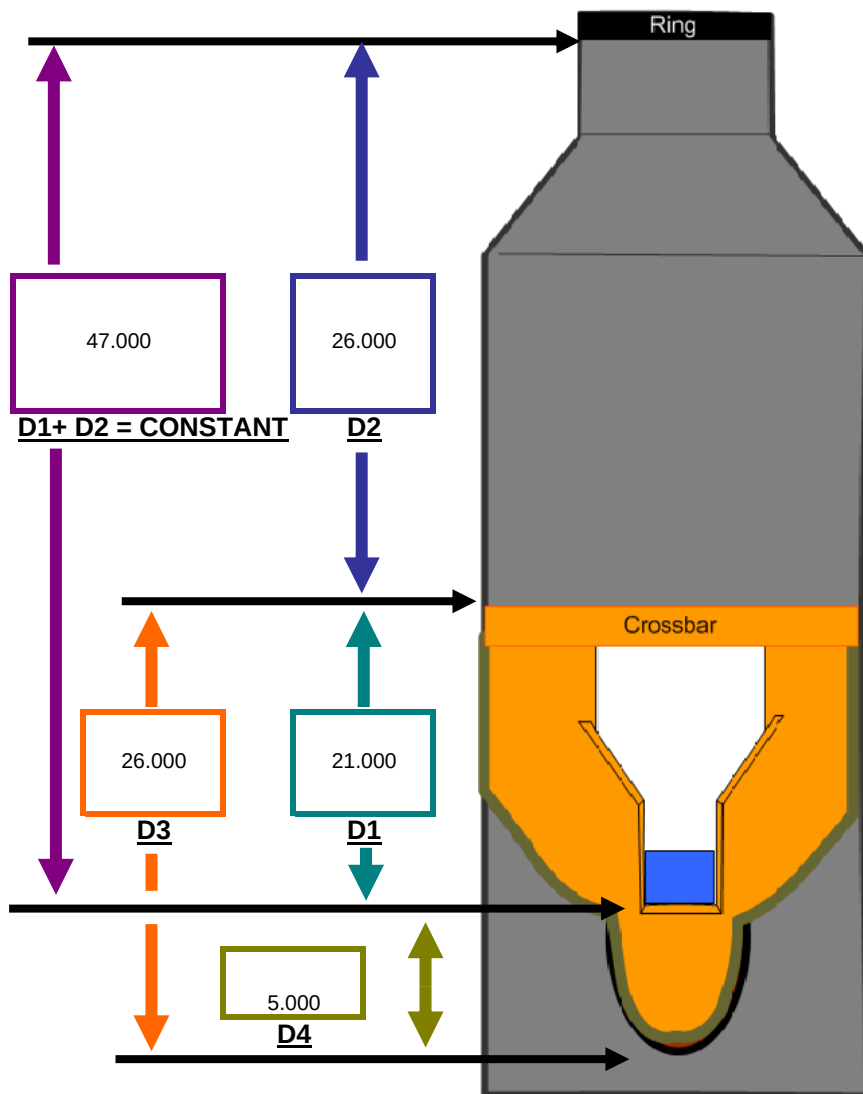
SFE PROJECT #: U18-119
SFE SITE #: OL33
Technician 1: DC
Technician 2: CC

Meter Depth vs.. Field Depth Calibration / Verification

Reading Number	Date (m/d/yyyy)	Time (hh:mm)	Field Meas (in)	Meter Depth (in)	Comments (Zero Meter Level before Installation)
Initial	11/18/17	16:43	6.19	6.13	
1			6.19	6.13	Sensor in wetwell
2			6.19	6.13	
3			6.19	6.13	
Average			6.19	6.13	

* Three Continuous Measurements Within 1 inch

* Average Meter vs (WL1 and WL2) Within 5%



Weir Measurements

Weir Size (mm)

600mm

Raw Weir Level

6.250 (in)

CONSTANT

47.000 (in)

D1 CONSTANT

21.000 (in)



CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA
Date / Time: Nov 18 2016 16:40

SFE PROJECT #: U18-119
SFE SITE #: OL33
Technician 1: Dylan Carver
Technician 2: Colton Chandler

Flow Meter Information

Meter Make & Model: ISCO 2150
Meter I.D. #: 207K01068 na
Wireless I.D. / Cell #: na na
Level / Velocity Type: Pressure Probe AV Sensor
Primary Device: Weir w/ AV
Battery Old / New: 12.8V

Logging Rate/Call out: 5 minute | n/a
Flow Units: cfs
Velocity Units: fps
Depth Units: in
Surcharge Meter (Y/N): Y

Site Physical Information

Silt Level: 0
Slope: N/A
Uniform Flow (Y/N): Yes
Debris in Flow (Y/N): Yes (sanitary)
Pipe Material: Concrete

Weather: light rain
Weir Size: 600mm
Depth Only(DO)
or Look up Table(LT) LT
Comments na

Check Off List

	Yes	No
Time Set:	☒	☐
Depth Calibrated:	☒	☐
Velocity Profile:	☐	☒
Download Data:	☒	☐
Meter Running:	☒	☐
Pipe Size Verified:	☒	☐
Photograph Taken:	☒	☐
Site Cleaned:	☒	☐
Site Secured:	☒	☐



Site Assessment Sheet

CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA

SFE PROJECT #: U18-119
SFE SITE #: D6

Project Specific Information

Client Name: LOTT
End User Name: LOTT
Project Name: Sanitary Sewer Flow Monitoring
Client Contact: Tyle Zuchowski
Field Contact: Tyle Zuchowski
SFE PM Contact: Adrian Marshall
Site Maintenance: bi-weekly

Site Equipment

Install / Removal Date:	<u>10/18/17</u>	<u>Permanent</u>
Meter Make & Model:	<u>ISCO 2150</u>	
Meter I.D. - #1 and #2	<u>207H01719</u>	<u>n/a</u>
Wireless I.D # / Cell #:	<u>n/a</u>	<u>n/a</u>
Level / Velocity Type:	<u>Pressure Probe</u>	<u>AV Sensor</u>
Sensor Mounting:	<u>Compression</u>	
Primary Device:	<u>Area Velocity</u>	
Logging Rate / Call out:	<u>5 minute</u>	<u>n/a</u>

Site Location Information

Client Manhole #: MH 70-064
Address (Location): 1100 Plum St.
City, Province: Olympia ,Wa
GPS (North - West): N47.03869 W122.89140
Landmarks: across street next to Rrtracks
Traffic Control Req's: n/a
Additional Information: n/a

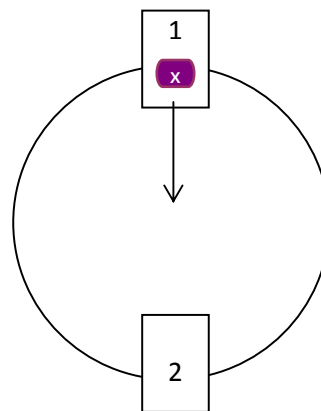
Site Profile

Manhole Depth (in):	<u>80.75</u>	Rungs? <u>yes</u>
Overall Site Condition:	<u>good</u>	
Pipe Size #1	<u>36</u>	#2 <u>36</u>
(in): #3	<u>n/a</u>	#4 <u>n/a</u>
Location of Sensor (which pipe?):	<u>x</u>	= <u>1</u>
Overall Pipe Condition:	<u>good</u>	
Additional Information:	<u>n/a</u>	

Map of Area



Manhole Layout



Additional Notes

- see photo of install
-
-

-
-
-



Site Pictures

CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA

SFE PROJECT #: U18-119
SFE SITE #: D6



Notes

- 1 manhole location
- 2 manhole
- 3 meter installed

- 4
- 5
- 6



Area Velocity Install Sheet

CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA

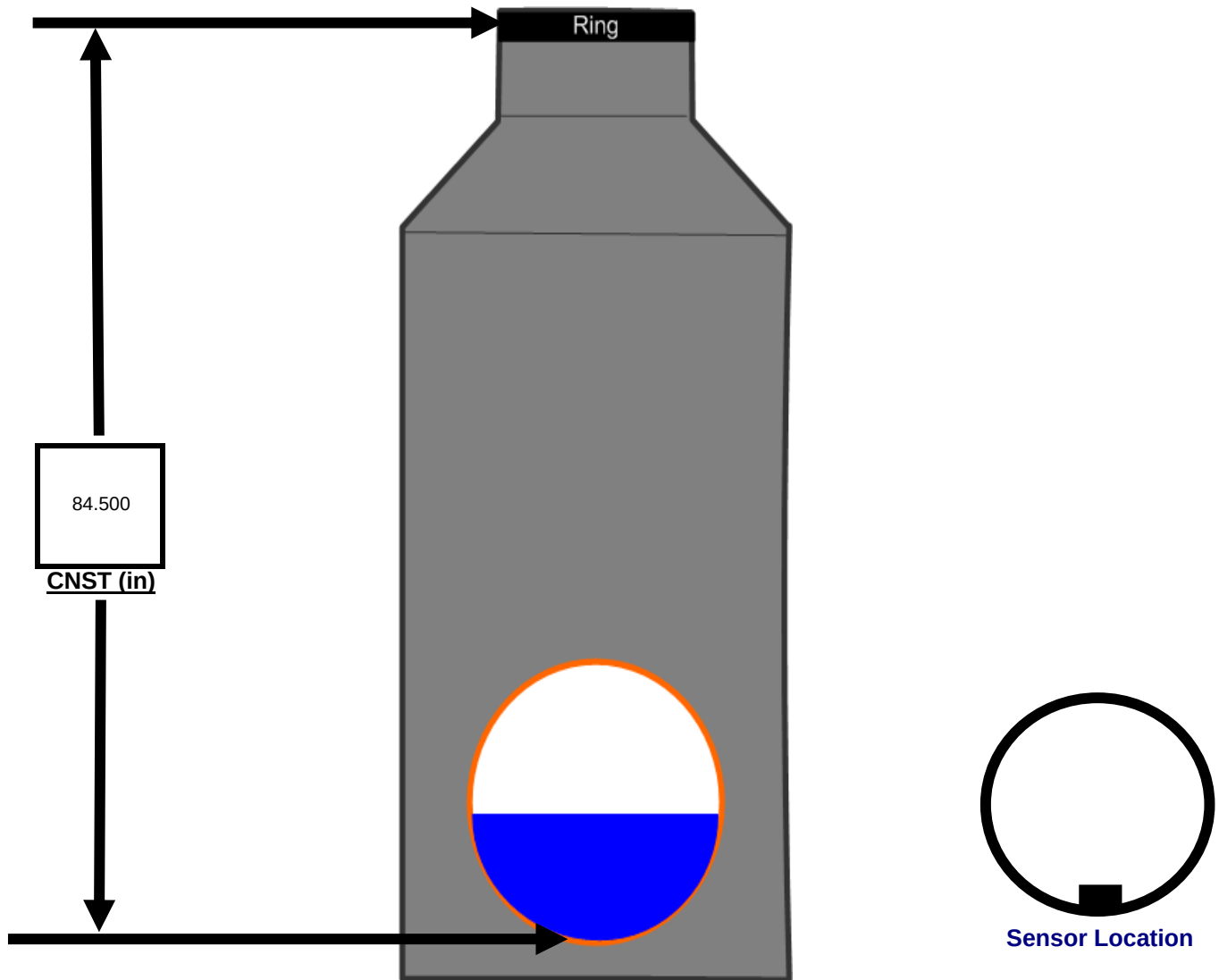
SFE PROJECT #: U18-119
SFE SITE #: D6
Technician 1: Dylan Carvin
Technician 2: Colton Chandler

Meter Depth vs.. Field Depth Calibration / Verification

Reading Number	Date (m/d/yyyy)	Time (hh:mm)	Field Meas (in)	Meter Depth (in)	Comments (Zero Meter Level before Installation)
Initial	10/18/2017	9:15	13.50	9.86	new installation - 36" AV
1		9:39	12.50	12.86	
2		9:38	12.25	12.20	
3		9:41	11.75	11.75	
Average			12.2	12.3	

* Three Continuous Measurements Within 0.5"

* Average Meter vs (WL1 and WL2) Within 5%





CLIENT FLOW MONITORING #: U18-119
NAME: City of Olympia, WA
Date / Time: 18-Oct-17 1330

SFE PROJECT #: U18-119
SFE SITE #: D6
Technician 1: Adrian Marshall
Technician 2: Dylan Carbin

Flow Meter Information

Meter Make & Model: ISCO 2150
Meter I.D. #: 207H01719 n/a
Wireless I.D. / Cell #: n/a n/a
Level / Velocity Type: Pressure Probe AV Sensor
Primary Device: Area Velocity
Battery Old / New: 12.8V

Logging Rate/Call out: 5 minute | n/a
Flow Units: cfs
Velocity Units: fps
Depth Units: in
Surcharge Meter (Y/N): Y

Site Physical Information

Silt Level: 0
Slope: N/A
Uniform Flow (Y/N): Yes
Debris in Flow (Y/N): Yes (sanitary)
Pipe Material: Concrete

Weather: Overcast 50F
Weir Size: na
Depth Only(DO)
or Look up Table(LT)
Comments: AV meter
8" diameter

Check Off List

	Yes	No
Time Set:	☒	☐
Depth Calibrated:	☒	☐
Velocity Profile:	☒	☐
Download Data:	☒	☐
Meter Running:	☒	☐
Pipe Size Verified:	☒	☐
Photograph Taken:	☒	☐
Site Cleaned:	☐	☒
Site Secured:	☒	☐

2018

CAPACITY REPORTS

*FLOWS & LOADINGS
I&I/FLOW MONITORING
CAPACITY ASSESSMENT*



2018 Capacity Assessment Report

May 2019

Prepared by:

Adam Klein and Hannah McLean, Brown and Caldwell
Tyle Zuchowski, LOTT Alliance

PREFACE

The Capacity Assessment Report is one of three related documents that are part of the annual process to monitor and evaluate capacity in the entire LOTT system. The intent, under LOTT's Wastewater Resource Management Plan (also known as the Highly Managed Plan), is to assure that needed new capacity is brought on-line "just in time" to meet system needs. Capacity needs evaluated include wastewater treatment, Budd Inlet discharge, reclaimed water use/recharge, and conveyance capacity in the entire LOTT system. These three reports are prepared annually and are used to help identify capital projects for inclusion in the Capital Improvements Plan.

Flows and Loadings Report – analyzes residential and employment population projections within the Urban Growth Area and estimates the impact on wastewater flows and loading within the LOTT wastewater system.

Inflow & Infiltration and Flow Monitoring Report– uses dry and wet weather sewer flow monitoring results to quantify the amount of unwanted surface (inflow) and subsurface (infiltration) water entering the sewer system and to prioritize sewer line rehabilitation projects.

Capacity Assessment Report – uses flows and loadings data and inflow and infiltration evaluation results to analyze system components (i.e. conveyance, treatment, and discharge) to determine when limitations will occur, and provide a timeline for new system components and upgrades.

As each report is published, it will be posted in the "Library" on LOTT's website – www.lottcleanwater.org.

Table of Contents

PREFACE	i
Executive Summary	iv
1. Introduction	1
1.1 Purpose	1
1.2 Current and Projected Flows and Loadings	1
1.3 Operational Capacity	3
2. Budd Inlet Treatment Plant Capacity	4
2.1 Headworks	5
2.1.1 Capacity Analysis	6
2.1.2 Completed and Planned Projects	9
2.1.3 Asset Management	10
2.1.4 Operations and Maintenance	10
2.2 Primary Treatment	11
2.2.1 Capacity Analysis	12
2.2.2 Completed and Planned Projects	13
2.2.3 Asset Management	13
2.2.4 Operations and Maintenance	14
2.3 Secondary Clarifiers	15
2.3.1 Capacity Analysis	16
2.3.2 Completed and Planned Projects	17
2.3.3 Asset Management	17
2.3.4 Operations and Maintenance	17
2.4 Biological Process	18
2.4.1 Capacity Analysis	19
2.4.2 Completed and Planned Projects	19
2.4.3 Asset Management	20
2.4.1 Operations and Maintenance	20
2.5 Ultraviolet Disinfection and Effluent Pumping	21
2.5.1 Capacity Analysis	22
2.5.2 Completed and Planned Projects	24
2.5.3 Asset Management	24
2.5.4 Operations and Maintenance	25
2.6 Sludge Thickening (DAFTs)	26
2.6.1 Capacity Analysis	26
2.6.2 Completed and Planned Projects	27
2.6.1 Asset Management	28
2.6.2 Operations and Maintenance	28
2.7 Digesters (Sludge Stabilization)	29
2.7.1 Capacity Analysis	30
2.7.2 Completed and Planned Projects	31
2.7.3 Asset Management	32
2.7.4 Operations and Maintenance	32
2.8 Sludge Dewatering	33
2.8.1 Capacity Analysis	34
2.8.2 Completed and Planned Projects	35
2.8.3 Asset Management	35
2.8.4 Operations and Maintenance	35
2.9 Centrate Management	36
2.9.1 Capacity Analysis	36
2.9.2 Completed and Planned Projects	37
2.9.3 Asset Management	37
2.9.4 Operations and Maintenance	37
2.10 Ongoing and Planned Projects Overview	39

3. Reclaimed Water Production Capacity	40
3.1 Budd Inlet Reclaimed Water Plant	40
3.2 Martin Way Reclaimed Water Plant	41
3.3 Mullen Road Reclaimed Water Plant	45
3.4 Deschutes Valley Reclaimed Water Plant	45
4. Discharge Capacity	47
4.1 Budd Inlet Outfall Permit Limitations	47
4.2 Budd Inlet Treatment Plant Biological Process Improvements	49
4.3 Budd Inlet Treatment Plant Site Planning	52
4.4 Budd Inlet Discharge Capacity Analysis	52
4.5 Alternative Discharge Planning	54
4.5.1 Reclaimed Water Treatment.....	54
4.5.2 Alternative Discharge Location	56
4.5.3 Summary.....	56
5. Conveyance System Analysis	57
5.1 Model Description	57
5.2 Sewer Capacity Definition	57
5.3 Existing Condition	58
5.4 Existing Capacity Limits	59
5.5 LOTT Interceptor Analysis	60
5.5.1 Martin Way Interceptor (East).....	60
5.5.2 Martin Way Interceptor (West).....	62
5.5.3 Cooper Point Interceptor.....	66
5.5.4 Percival Creek Interceptor	68
5.5.5 Indian Creek Interceptor	70
5.5.6 Cherry Street Interceptor	76
5.5.7 Chestnut Street Interceptor.....	78
5.5.8 Plum Street Interceptor	79
5.5.9 State Street Interceptor.....	80
5.5.10 Downtown Interceptor Capacity.....	81
5.6 Sewer System Modeling Summary	84
5.6.1 Pressure Mains	85
5.6.2 Pump Stations.....	86
5.7 Required Capacity Improvements Projects	86
5.7.1 Martin Way Interceptor (East).....	86
5.7.2 Indian Creek Interceptor	87
5.7.3 Martin Way Forcemain.....	87
5.7.4 Percival Creek/Mottman Road Interceptor	88
5.7.5 Downtown Interceptors	88
5.8 Summary of Pipe Capacity Projects	90
5.9 Reclaimed Water Conveyance Lines	90
6. Operational Capacity Analysis Summary	92

Executive Summary

For the 2018 Capacity Assessment Report, updated flows and loadings projections, along with inflow and infiltration and flow monitoring data, were used to evaluate the current and projected capacity limitations within the LOTT system. Projected flows and loadings are slightly decreased from last year, reflecting updated Thurston Regional Planning Council (TRPC) population projections.

Much of the capacity discussion is centered on the Budd Inlet Treatment Plant's (BITP) National Pollutant Discharge Elimination System (NPDES) Permit, which limits discharge to a fixed load of biological oxygen demand (BOD) and total inorganic nitrogen (TIN) in pounds per day. The more the treatment plant can reduce its effluent concentration of BOD and TIN, the more flow it can discharge to Budd Inlet. Design is currently underway for the Biological Process Improvements project, which is intended to improve LOTT's ability to consistently attain target effluent BOD and TIN levels.

Effective operational capacity equals the minimum combination of treatment, discharge, and conveyance capacity. Discharge capacity analysis considers two modeled flow projections – average flows and 10-year-return peak flows. All three seasonal conditions (summer, shoulder, and winter) were taken into account, with the summer and shoulder conditions being the most limiting. The first limitations are projected to occur in summer, in 2038, based on assumptions that include: 2 million gallons a day (mgd) of treatment capacity at the Martin Way Reclaimed Water Plant, 1.5 mgd of reserve capacity, and highly efficient operation of the biological process at the BITP. This report discusses how LOTT aims to meet those capacity limitations.

LOTT maintains a 1.5 mgd reserve of treatment/discharge capacity at the Budd Inlet Treatment Plant. This allows for additional operational flexibility during peak flow events, minimizing the likelihood of a permit violation, and protects the system from unanticipated rapid population growth and/or delays in the construction of new capacity.

LOTT's Reclaimed Water Infiltration Study will continue into 2020. The goal of the study is to provide local scientific data and community perspectives to help policymakers make informed decisions about future reclaimed water treatment and uses. LOTT will continue to maintain flexibility in its capacity planning process to respond to community expectations and future regulatory requirements.

Based on the updated projections, it is estimated that LOTT will need a total of 4 million gallons a day (mgd) of discharge capacity outside of the marine discharge to Budd Inlet by 2050. This capacity will be added through expansion of the Martin Way Reclaimed Water Plant and/or expansion of reclaimed water production at the Budd Inlet Treatment Plant, with re-use and recharge applications reducing the discharge to Budd Inlet.

1. Introduction

1.1 Purpose

In accordance with the Wastewater Resource Management Plan, LOTT is continuously monitoring system demands and planning for future capacity on a “just in time” basis. The primary purpose of this document is to evaluate system capacity requirements based on projected demands and identify and evaluate capital improvement projects to meet these requirements.

1.2 Current and Projected Flows and Loadings

The Thurston Regional Planning Council (TRPC) updated its county-wide population projections in 2013. In 2018, TRPC released new residential population estimates for the years 2018, 2020, 2025, 2030, 2035, and 2040, which were incorporated into the forecast model used to update the flows and loadings projections. LOTT’s service area includes the urban growth areas (UGAs) of Lacey, Olympia, and Tumwater and is shown in Figure 1-1.

Figure 1-1. LOTT Service Area by Jurisdiction

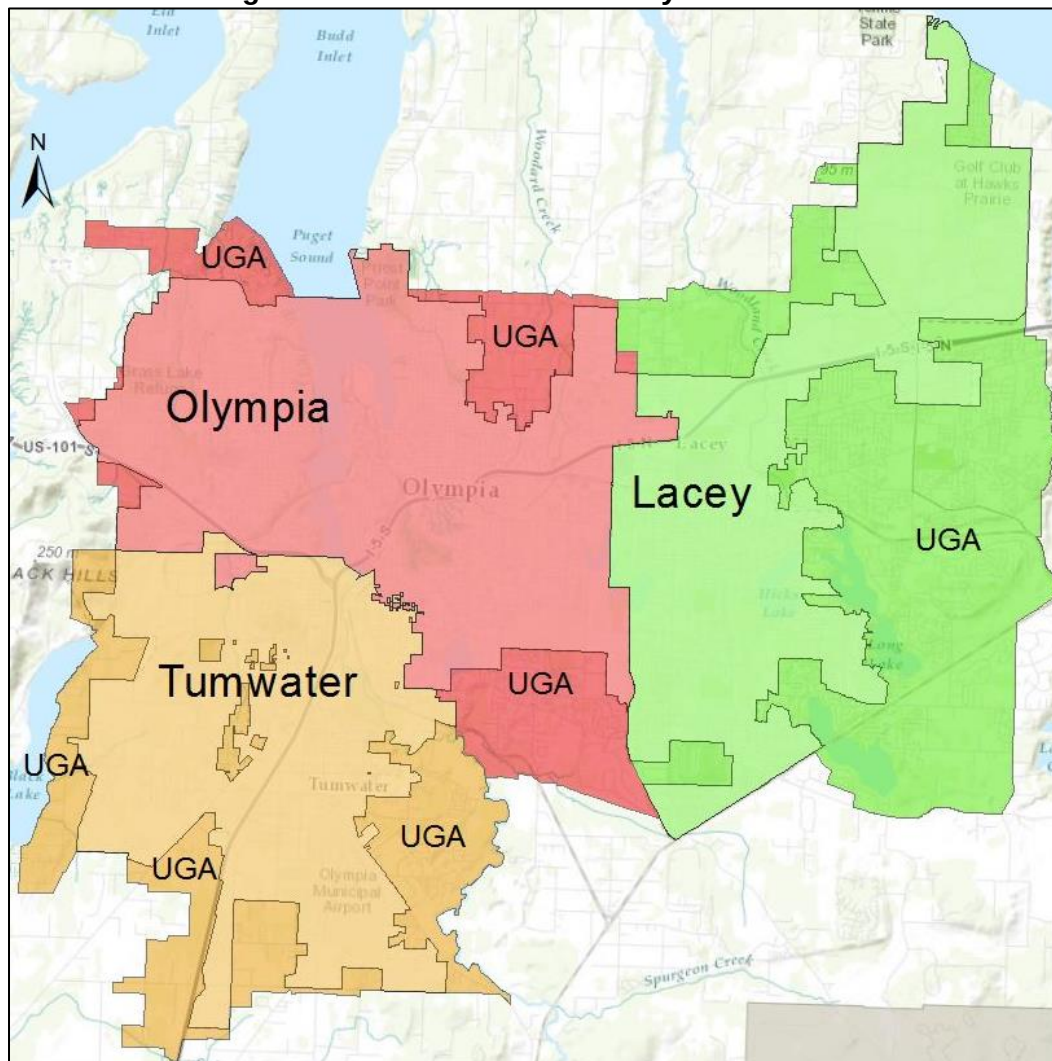


Figure 1-2 compares the projected base sanitary flows against projections from the past few years. The base sanitary flow is defined as the minimum average flow registered over a 7-day period in each year and is assumed to have little influence from inflow and infiltration. For additional details on per capita wastewater generation rates, refer to the 2018 Flows and Loadings Report.

Figure 1-2. Base Sanitary Flow Projection Comparison

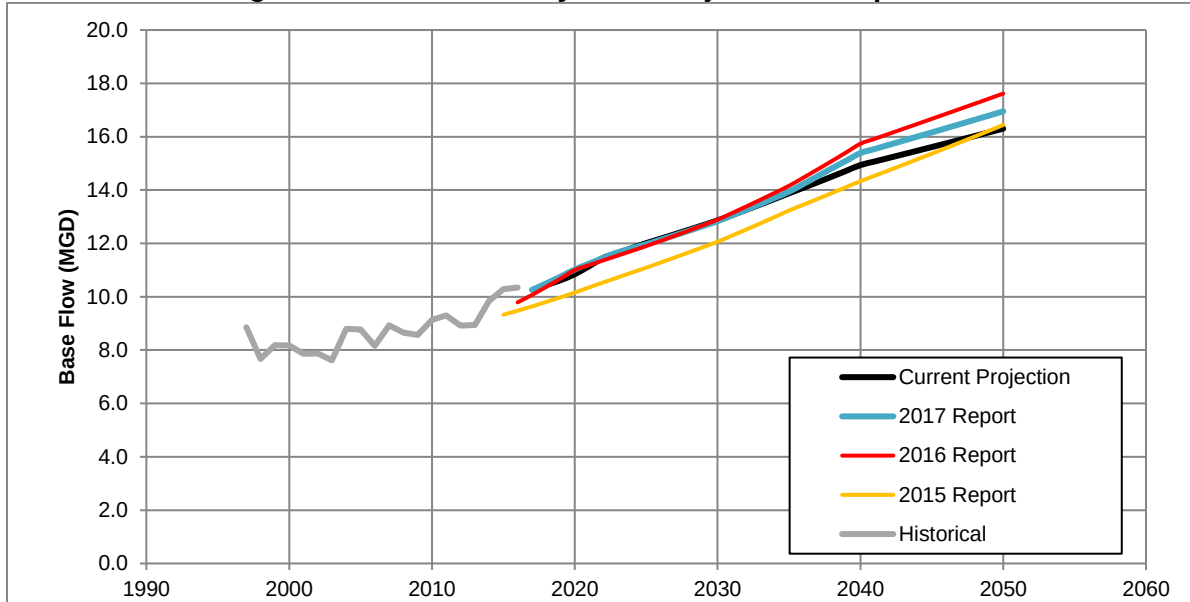


Figure 1-3 presents the projected biological oxygen demand (BOD) and total suspended solids (TSS) loadings in the LOTT service area through 2050. These loading rates are calculated by multiplying the projected sewer populations by the per capita loading rates.

Figure 1-3. Projected Loadings

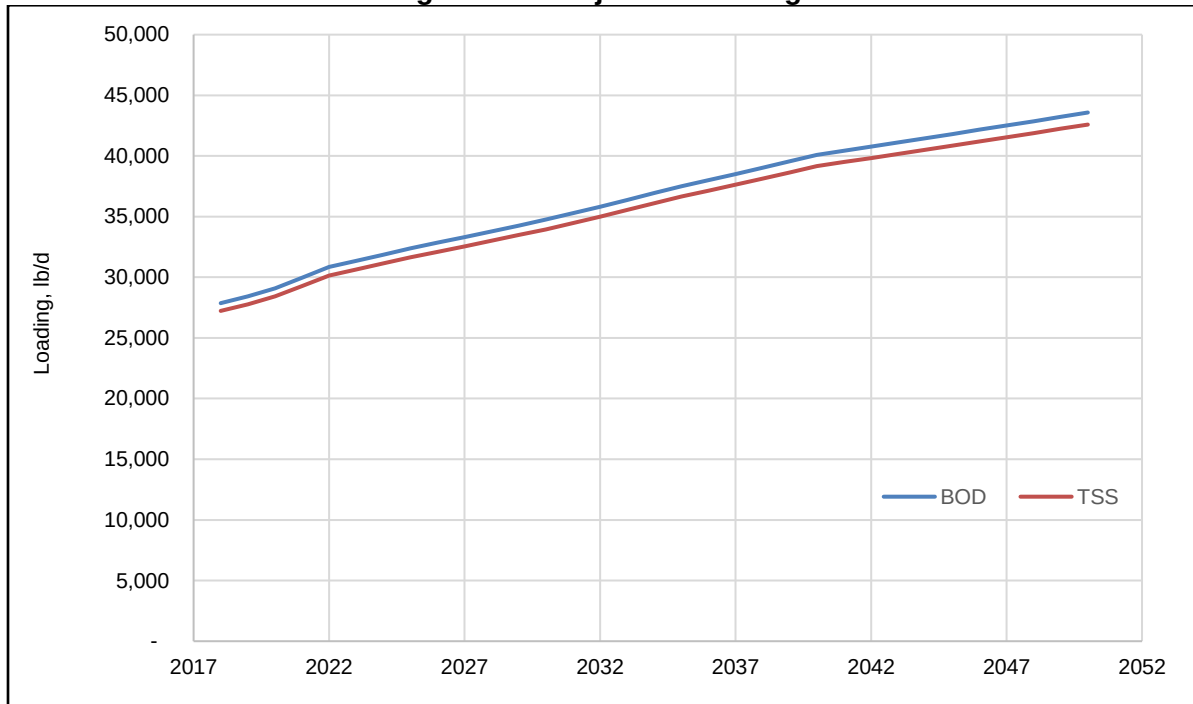


Table 1-1 lists the projected flows generated in the LOTT service area in millions of gallons per day (mgd). The summer and shoulder compliance periods represent the average monthly values. The 10-year peak values are based on the 10-year return period flows. In any given year, there would be a 10% chance of averaging the projected flow for each period.

Table 1-1. LOTT Service Area Projected Flows (mgd)

Year	Base Flow	Summer ¹	Shoulder ²	Winter ³	10-Year Peak Month	10-Year Peak Day	10-Year Peak Hour
2018	10.44	11.69	13.34	15.87	20.01	44.67	67.77
2019	10.62	11.88	13.54	16.08	20.26	45.03	68.32
2020	10.85	12.11	13.79	16.35	20.57	45.47	68.97
2021	11.15	12.42	14.11	16.68	20.91	45.89	69.52
2022	11.46	12.74	14.44	17.02	21.27	46.34	70.09
2023	11.64	12.92	14.63	17.21	21.48	46.59	70.42
2024	11.82	13.11	14.82	17.41	21.69	46.85	70.76
2025	12.01	13.30	15.02	17.61	21.91	47.12	71.11
2026	12.18	13.47	15.19	17.79	22.10	47.36	71.41
2027	12.34	13.64	15.37	17.97	22.30	47.59	71.72
2028	12.51	13.82	15.55	18.16	22.50	47.84	72.04
2029	12.69	13.99	15.73	18.35	22.70	48.09	72.36
2030	12.86	14.17	15.92	18.54	22.90	48.34	72.69
2031	13.06	14.37	16.12	18.75	23.13	48.62	73.06
2032	13.26	14.58	16.33	18.97	23.36	48.91	73.43
2033	13.46	14.78	16.55	19.19	23.60	49.20	73.81
2034	13.67	15.00	16.76	19.41	23.84	49.50	74.20
2035	13.88	15.21	16.99	19.64	24.09	49.80	74.60
2036	14.08	15.42	17.20	19.87	24.33	50.11	75.00
2037	14.29	15.63	17.43	20.10	24.58	50.42	75.42
2038	14.50	15.85	17.65	20.33	24.83	50.74	75.84
2039	14.72	16.07	17.88	20.57	25.08	51.06	76.27
2040	14.94	16.30	18.11	20.81	25.34	51.39	76.71
2041	15.07	16.43	18.25	20.95	25.50	51.58	76.97
2042	15.21	16.57	18.40	21.10	25.66	51.78	77.23
2043	15.34	16.71	18.54	21.25	25.81	51.97	77.48
2044	15.48	16.85	18.68	21.40	25.97	52.17	77.74
2045	15.61	16.99	18.83	21.54	26.13	52.37	78.00
2046	15.75	17.13	18.97	21.69	26.29	52.57	78.26
2047	15.89	17.27	19.11	21.84	26.45	52.76	78.52
2048	16.02	17.41	19.26	21.99	26.61	52.96	78.78
2049	16.16	17.55	19.41	22.14	26.78	53.16	79.04
2050	16.30	17.69	19.55	22.30	26.94	53.37	79.30

1. June, July, August, and September

2. April, May, and October

3. November, December, January, February, and March

1.3 Operational Capacity

LOTT considers three types of capacity when describing operational capacity – treatment capacity, discharge/use capacity, and conveyance capacity. Treatment capacity is defined as the amount of wastewater that can be treated within permit limitations. Discharge/use capacity is a combination of the amount of treated wastewater that can be discharged into the environment within permit limitations (i.e. Budd Inlet outfall), the amount of Class A Reclaimed Water that can be infiltrated into the ground (i.e. Hawks Prairie Ponds and Recharge Basins), and the amount of Class A Reclaimed Water that can be utilized for other beneficial uses (i.e. reclaimed water customers). Conveyance capacity represents the hydraulic capacity of both: 1) sewer lines to convey wastewater from the point of collection to the point of treatment; and 2) reclaimed water lines to convey Class A Reclaimed Water from the point of treatment to the point of discharge/use.

2. Budd Inlet Treatment Plant Capacity

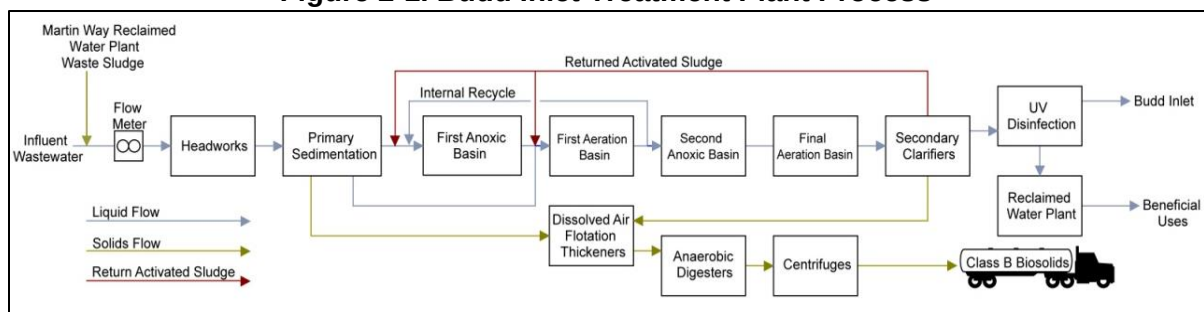
The rated capacity of the Budd Inlet Treatment Plant was established as part of the last major facility upgrade, which occurred in the mid-1990s. Although that rated capacity serves as the basis for this capacity assessment, it should be acknowledged that many systems have been upgraded since the mid-1990s and the plant capacity has likely increased. However, LOTT does not plan to request a re-rate of the plant until the Biological Process Improvements project has been completed and sufficient operational data has been collected.

The treatment capacity of the Budd Inlet Treatment Plant is also tied to the capacity of each individual system within the plant. These capacities are assessed annually based on updated flows and loadings projections. The following sections are included in the overview of each system unit:

- **System Profile** – General description of the system and its purpose.
- **System Schematic** – Schematic depicting the various components and flow paths.
- **Capacity Analysis** – Discussion of the various capacities as they relate to projected flows and loadings.
- **Completed and Planned Improvements** – List of completed and planned improvement projects.
- **Asset Management** – List of major equipment to include its capacity, date of last upgrade, and risk score (based on a score of 1 through 6, with 1 being the highest risk and 6 being the lowest).
- **Operations and Maintenance** – Description of the various activities associated with the operation and maintenance of the system and a review of historical costs. Costs are broken down into materials, labor, and contracted services. These historical costs are shown primarily to illustrate the improvements to LOTT's business practices in capturing costs through its computerized maintenance management system.

Figure 2-1 provides an overview of the Budd Inlet Treatment Plant and the various supporting systems.

Figure 2-1. Budd Inlet Treatment Plant Process



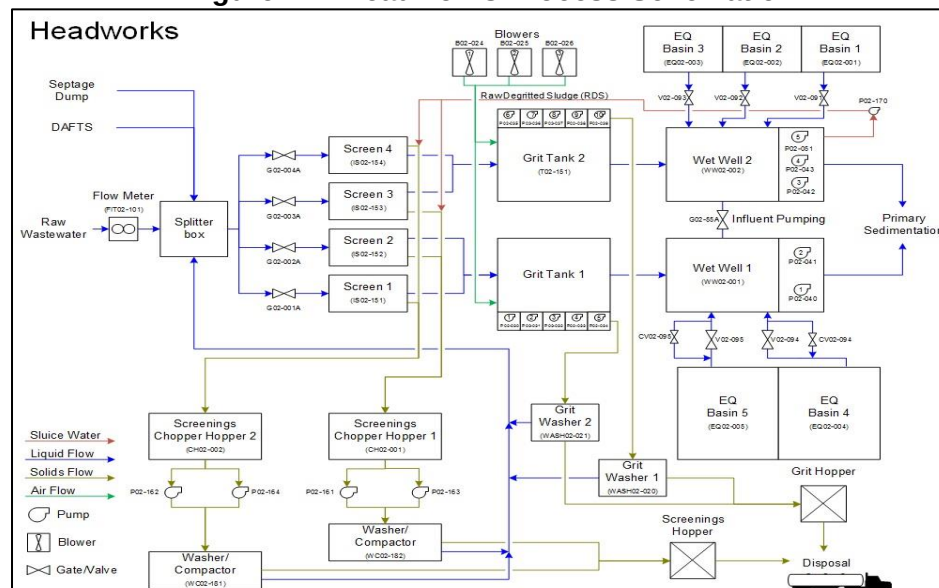
2.1 Headworks

The headworks facility consists of preliminary treatment (screens and grit removal) and influent pumping. Flow enters the plant via a 60-inch plant influent pipe. A splitter box directs flow through four influent channels. Motor-operated sluice gates at the head of each channel control the flow to four mechanically cleaned screens that remove large debris from the influent wastewater. Screenings are conveyed to two screenings pits where chopper pumps convey ground-up screenings to two washer/compactor units. Dewatered screenings are collected and hauled to the Thurston County Waste and Recovery Center for disposal.



After screening, wastewater enters two aerated grit channels that remove large inorganic and organic particles. Grit collects in hoppers at the bottom of each tank and is removed by 10 grit pumps. Grit is conveyed to the grit screening/handling room where the grit is processed through two cyclone separators and grit washer/classifiers to remove organic material and return it to the process via the influent splitter box. Washed grit is stored in hoppers and then hauled to the Waste and Recovery Center for disposal. Liquid supernatant from the separator and classifier is recycled to the plant influent splitter box. De-gritted sewage overflows from the grit tanks into two influent wetwells. Four variable speed 200-horsepower (hp) pumps and one variable speed 50-hp pump provide the influent pumping capacity. The influent pumping system conveys raw de-gritted sewage to the primary sedimentation tanks.

Figure 2-2. Headworks Process Schematic



Five equalization basins (EQs) provide up to 2.5 million gallons of storage. As the water level rises in the wetwells during peak flows, the tanks fill in series as determined by elevation of the internal weirs. After the headworks upgrade of 2012, the addition of control valves on the lines to the north EQs allows the option of filling from the bottom of the wetwells rather than over the weirs. This change adds flexibility to flow pace during the summer months, reducing the impact of fluctuating flows on the biological treatment process.

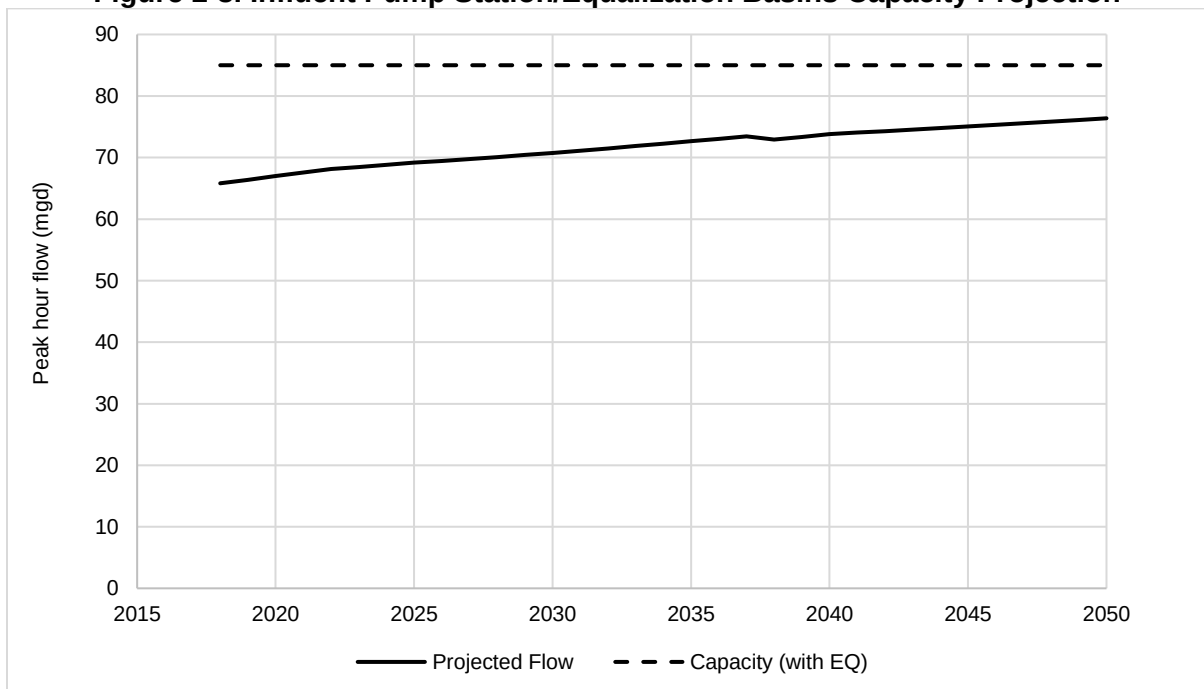
2.1.1 Capacity Analysis

Influent Pump Station/Equalization Basins

The influent pump station has an operational capacity of 72 mgd, and a firm capacity (one pump out of service) of 54 mgd. A hydraulic analysis was conducted to determine the impact of the existing 2.5-million-gallon equalization basins on flow through the influent pump station. This analysis projected that the EQ basins could buffer approximately 13 mgd of peak hour flow, meaning that the equalized capacity of the influent pump station is approximately 85 mgd. Restrictions in the 60-inch influent sewer arise at flows between 60-70 mgd, and those sewers may currently pass only 80-90 mgd depending on the pressure condition.

Figure 2-3 plots the peak hour influent flow against the estimated capacity of the influent pump station and equalization basins. Currently, influent pumping capacity is projected to reach 85% capacity in 2034. Based on the recommendations of the Equalization Basin Cost and Feasibility Assessment, completed in 2014, a project is planned to expand the two forcemains feeding the primary sedimentation basins from 30-inches to 36-inches, with no modification to the influent pumps, and no expansion of equalization volume. LOTT is currently developing a comprehensive wet weather plan which will also assess capacity limitations in the influent piping to the BITP.

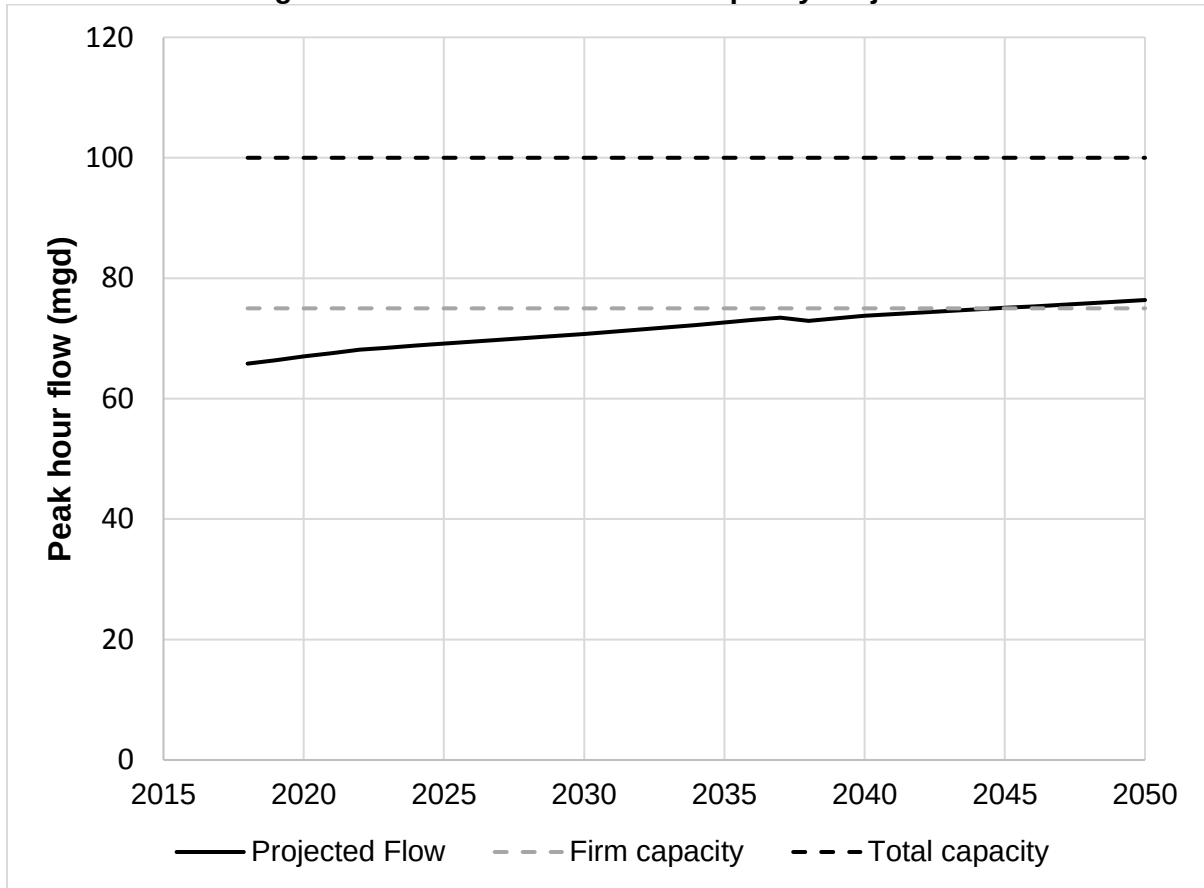
Figure 2-3. Influent Pump Station/Equalization Basins Capacity Projection



Headworks Screens

Each of the existing headworks screens has a rated peak hour influent flow capacity of 25 mgd. With four screens, the operational capacity of the screening facility is 100 mgd and the firm capacity is 75 mgd. Figure 2-4 shows the existing firm and total screening capacities relative to the projected peak hour influent flow. Because the plant has the ability to bypass excessive peak flows around the screens, the screening system is evaluated based upon the total, rather than the firm capacity. No capacity-related projects are planned for the headworks screens.

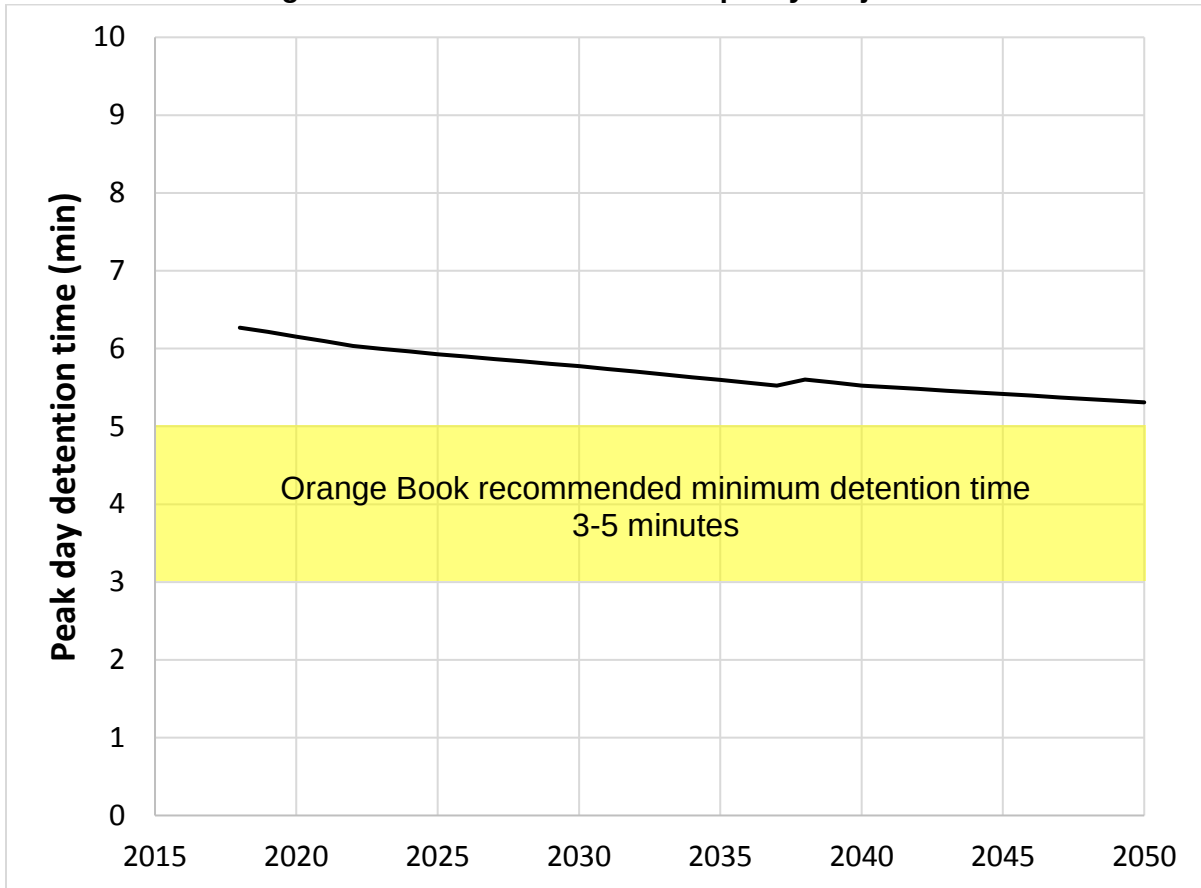
Figure 2-4. Headworks Screens Capacity Projection



Aerated Grit Tanks

The capacity of the aerated grit tanks is expressed relative to the hydraulic retention time (HRT) at peak day flow. Ecology's Orange Book recommends that aerated grit tanks be designed to maintain a minimum hydraulic retention time of three to five minutes in order to effectively remove grit during peak wet weather events. The retention time with both aerated grit tanks in service is projected to remain above this range through 2050. Therefore, no capacity-related projects are planned for the aerated grit tanks.

Figure 2-5. Aerated Grit Tanks Capacity Projection



Headworks System Capacity Summary

Table 2-1 provides a summary of the capacity analysis and assumptions for the headworks system. This includes the influent pump station and equalization basins, the headworks screens, and the aerated grit tanks.

Table 2-1. Headworks System Capacity Summary

Unit Process	Capacity basis	Units	Redundancy Basis	Capacity	Condition		Utilization	
					Current	2050	Current	2050
Influent pump station	Peak hour flow with equalization	mgd	Total	85	65.8	76.4	77%	90%
Headworks screens	Peak hour flow	mgd	Total	100	65.8	76.4	66%	76%
Aerated grit tanks	Peak day HRT	min	Total	4	6.3	5.3	64%	75%

2.1.2 Completed and Planned Projects

Planned future capital projects include expanding the capacity of the two influent pumping forcemains, currently planned for 2034. Additional flow equalization is not projected to be needed prior to 2050. However, given changing weather patterns and potential impacts related to climate change and sea level rise, LOTT maintains the flexibility to expand equalization capacity as needed. In 2013, LOTT purchased a 1.44-acre property adjacent to the Budd Inlet Treatment Plant formerly owned by the Washington State Department of Fish and Wildlife. This property could be used for an equalization basin expansion or other beneficial uses, if needed in the future. The building is scheduled to be demolished in the summer of 2019. The site will be paved, fenced, and used on an interim basis as a contractor staging area for upcoming capital projects. Completed and planned projects for the headworks system are listed in Table 2-2.

Figure 2-6. Potential Future Equalization Basin Site



Table 2-2. Completed and Planned Project Summary

On-line	Name	Cost/Estimate	Status	Description
2013	Screenings Pumps	\$270,513	Completed	Additional screening pumps to ensure process redundancy and reliability
2013	Grit Blower Replacement	\$183,509	Completed	Two new grit channel blowers
2014	Headworks Improvements	\$1,024,025	Completed	Includes replacement of the grit channel diffusers, influent wetwell transfer gates, EQ valves, and basin and channel coatings
2016	Influent Screen #1 Refurbishment	\$51,082	Completed	Included refurbishment of the #1 influent screen
2019	Washington Street Property Improvements	\$1,585,000	Construction	Demolish building, pave and fence site, and use for contractor staging
2019	Influent Pump Station Valve and Piping Improvements	\$548,221.56	Construction	Replace suction and discharge isolation gates, and check valves for four influent pumps
2025	Headworks Solids Handling Improvements	\$1,200,000	Future	Replace grit washer/separators
2034	Influent Pumping Capacity Expansion	\$4,400,000	Future	Expand capacity to reduce risk of storm-related overflows

2.1.3 Asset Management

Major equipment includes the influent pumps, headworks screens, and associated screenings handling equipment, and the equipment associated with grit removal. This equipment is shown in Figure 2-2 and is summarized in Table 2-3.

Table 2-3. Existing Headworks Equipment

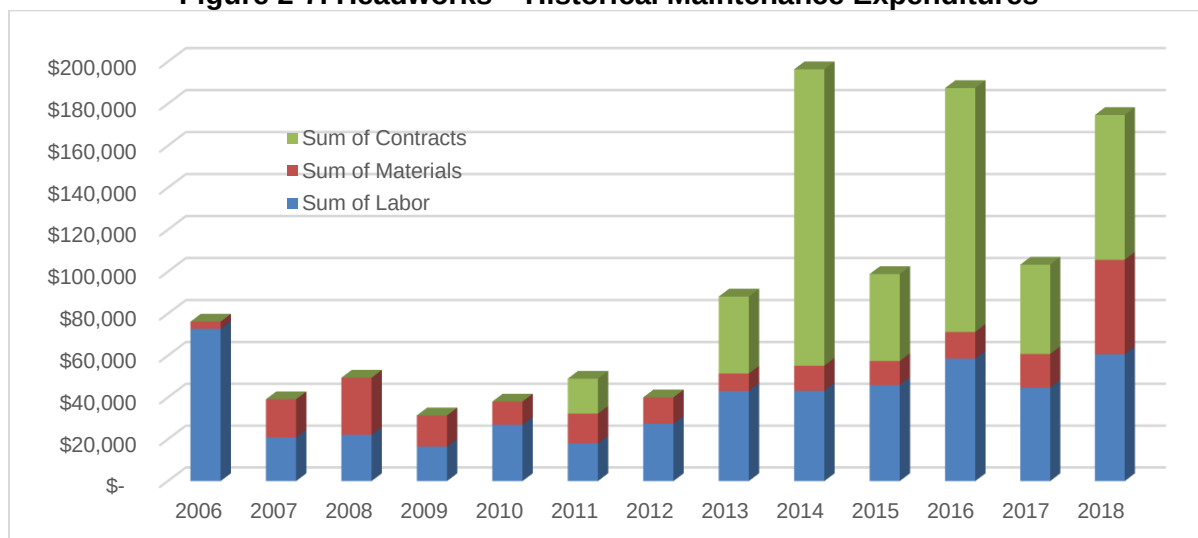
System	Count	Unit Capacity	Motor	Date of Last Upgrade	Risk Score (1-6)
Influent Pumps	4	18 mgd	200 hp	1994	3
	1	5 mgd	50 hp	1993	3
Headworks Screens	4	25 mgd	2 hp	2016	2
Screenings Pumps	2	200 gpm	20 hp	2012	2
Screenings Compactors	2	45 ft ³ /hr	7.5 hp	2003	3
Grit Pumps	10	150 gpm	25 hp	1980	3
Grit Separators	2	200 gpm	20 hp	2004	3
Grit Washer	2	1.5 ton/hr	0.5 hp	2004	3
Grit Chamber Blowers	3	263 cfm/11.6 psi	20 hp	2013	2

2.1.4 Operations and Maintenance

Headworks system operational costs include labor, energy, and disposal fees. Labor costs are associated with operations staffing requirements for the influent pump station, equalization basins, screens/screenings handling equipment, and the grit removal system. This also includes labor requirements for the collection, hauling, and disposal of dewatered screenings and grit. The major energy cost for the headworks system is the electrical power required for operation of the influent pumps, screens, and grit blowers.

Disposal costs have to do with the hauling and disposal of screenings and grit. Maintenance of the headworks system includes maintaining the major equipment, as well as associated instruments, gates, and piping systems. This may also include periodic draining and removal of any accumulated grit/sediment in the influent screens channels and grit tanks. Maintenance costs tracked in LOTT's computerized maintenance management system (CMMS) are shown in Figure 2-7.

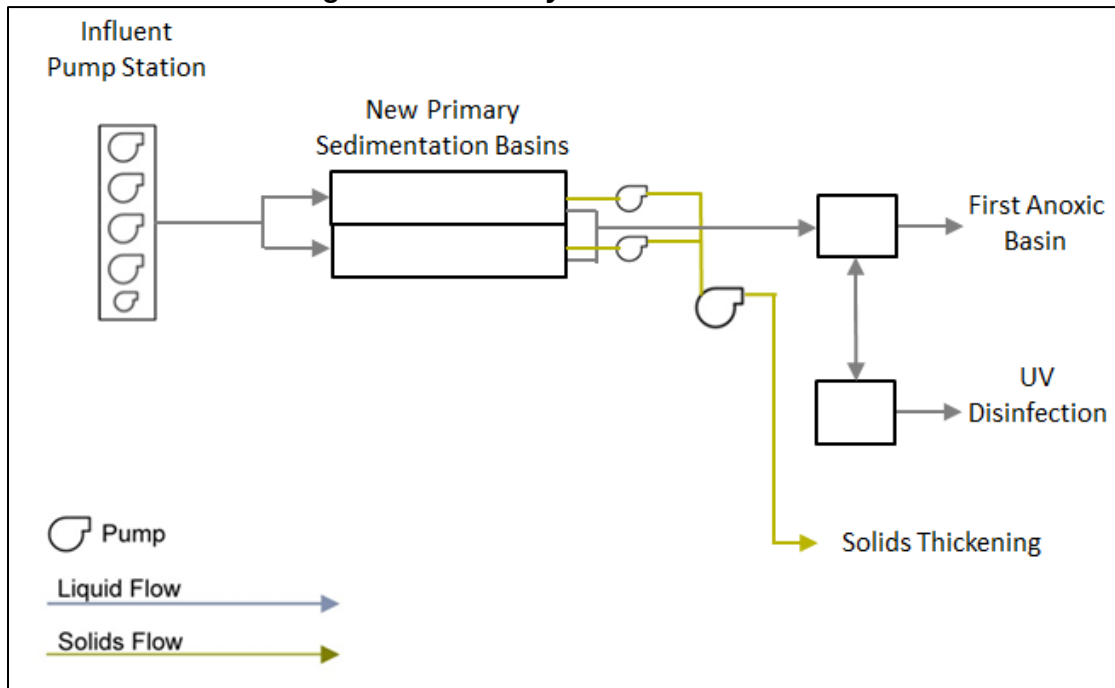
Figure 2-7. Headworks – Historical Maintenance Expenditures



2.2 Primary Treatment

The primary treatment process removes easily settleable material from the screened and de-gritted wastewater. The system includes two sets of primary clarifiers totaling four basins, brought into service after an upgrade in 2013. The primary treatment system includes magnetic flow meters, which provide an estimate of primary influent flow. This flow measurement is used to control influent gates and the pump speed for influent pumping, return activated sludge, waste activated sludge, and internal mixed liquor recycle pumping.

Figure 2-8. Primary Treatment Process



All of the primary clarifiers include scum collectors, surface return flight sludge collectors, and primary sludge pumps. Primary scum is sent to an aerated tank where, under controlled conditions, a proprietary mixture of biomass prepares the scum for anaerobic digestion. Primary sludge removed from the primary sedimentation tanks is pumped to the dissolved air flotation thickeners.



Primary effluent is routed from the clarifiers to an effluent diversion structure. This structure can feed the first anoxic basin via a 60-inch pipeline. Under emergency conditions, the effluent diversion structure can send flow through a 48-inch pipeline to either first aeration or the ultraviolet disinfection system.

The primary clarifiers include an odor control facility and chemical building, which have been sized to accommodate a potential primary sedimentation basins expansion. The primary odor control facility receives foul air from the new primary clarifiers and treats it with a chemical (sodium hydroxide) scrubber, followed by a set of carbon scrubbers. The chemical building includes space and conduit for chemically enhanced primary treatment in the event that LOTT elects to augment solids removal in the future.

2.2.1 Capacity Analysis

The capacity of the primary treatment system may be defined as either hydraulic capacity or treatment capacity. The primary clarifiers can hydraulically pass up to 60 mgd of flow without flooding, though they are designed to treat flows up to 37.5 mgd. The latter condition corresponds to a surface overflow rate of 4,716 gpd/ft², with all four basins in service. While higher than Orange Book recommendations, five years of operational data supports operation to this flow rate. At a high surface overflow rate (SOR), the performance of the primary clarifiers will degrade, and total suspended solids (TSS) and biochemical oxygen demand (BOD) removal rates will decrease. This will increase loadings to the secondary biological process and secondary clarifiers and will have a cascading effect on the capacity of downstream systems. The relationship between SOR and performance will be monitored, and the overall BITP capacity model is based upon that relationship.

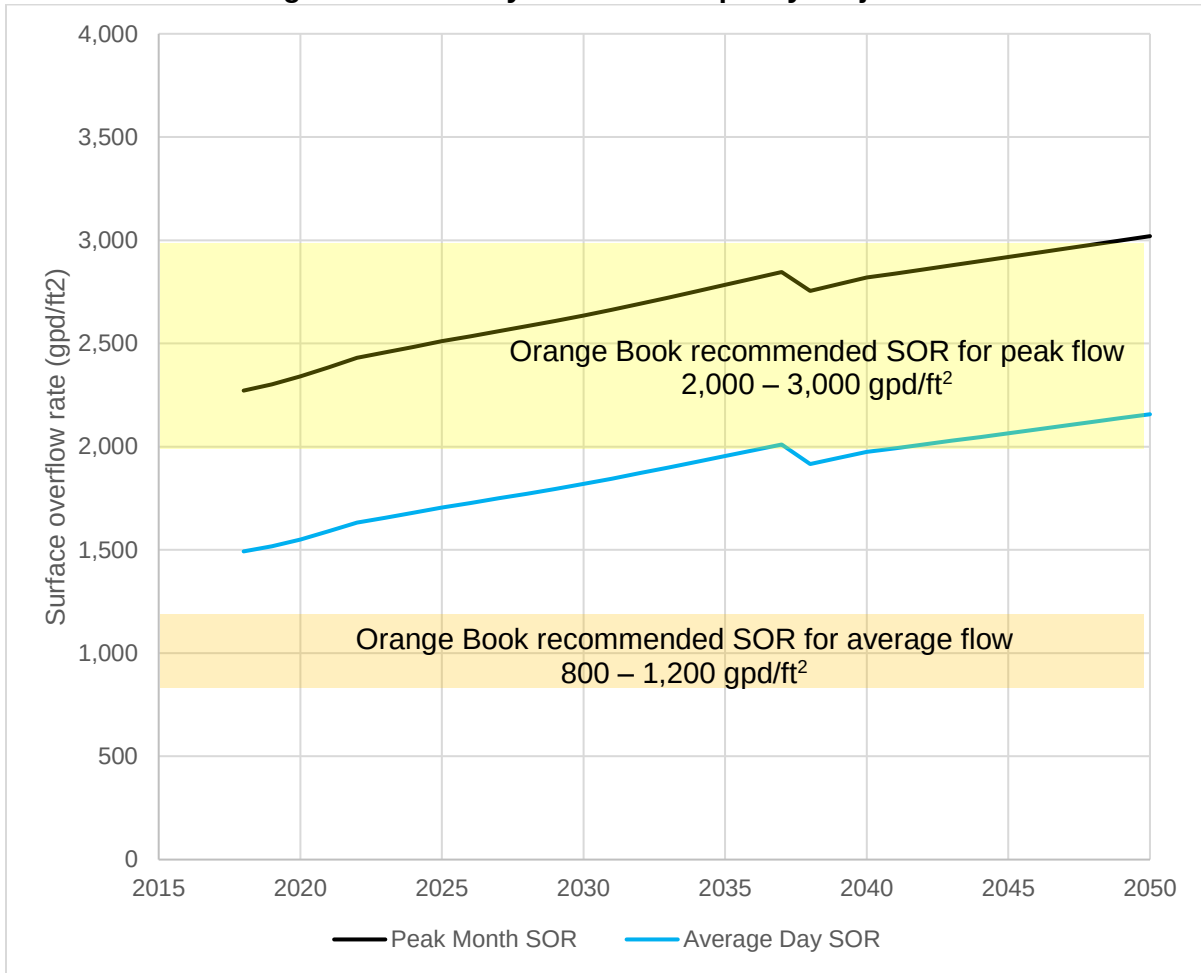
For the purpose of this capacity assessment, the capacity of the primary clarifier will be judged on the Orange Book recommended peak overflow rate of 3,000 gpd/ft². This criterion will be applied to a maximum month flow condition, as single day exceedances of the criterion would not be expected to impact permit compliance. Table 2-4 includes a summary of the various capacity parameters assessed and the related assumptions.

Table 2-4. Primary Clarifiers Capacity Summary

Unit Process	Capacity basis	Units	Redundancy Basis	Capacity	Condition		Utilization	
					Current	2050	Current	2050
Primary clarifiers	Peak month SOR	gpd/ft ²	Total	3,000	2,272	3,020	76%	101%

While the average day SORs are higher than Orange Book standards, the system has performed well since its construction. The average TSS removal rate in 2018 was 60.5%.

Figure 2-9. Primary Treatment Capacity Projection



2.2.2 Completed and Planned Projects

Construction of the primary clarifiers was completed in 2013 and included new odor control and chemical storage facilities sized to meet build out conditions. Phase II will add a second set of clarifiers adjacent to the existing clarifiers. The timing of this project is currently planned for 2034, however the timing may be adjusted based on performance. This project will likely include a dedicated centrate management facility.

Table 2-5. Primary Treatment Completed and Planned Project Summary

On-line	Name	Cost/Estimate	Status	Description
2010	Port of Olympia Land Purchase	\$2,156,297	Completed	Purchased property to locate the new primaries
2013	Primary Sedimentation Basins	\$58,957,736	Completed	Project added new primary clarifiers, odor control, and chemical feed and storage facilities
2034	Primary Sedimentation Basins, Phase II	\$35,863,743	Future	Project will add a second set of primary clarifiers and new centrate handling facility

2.2.3 Asset Management

A variety of mechanical equipment is involved in the operation of the primary treatment system. Major equipment includes the influent flow meters, the chain and flight sludge and

scum collectors, and the primary sludge pumps. This equipment is shown in Figure 2-8 above and is summarized in Table 2-6 below.

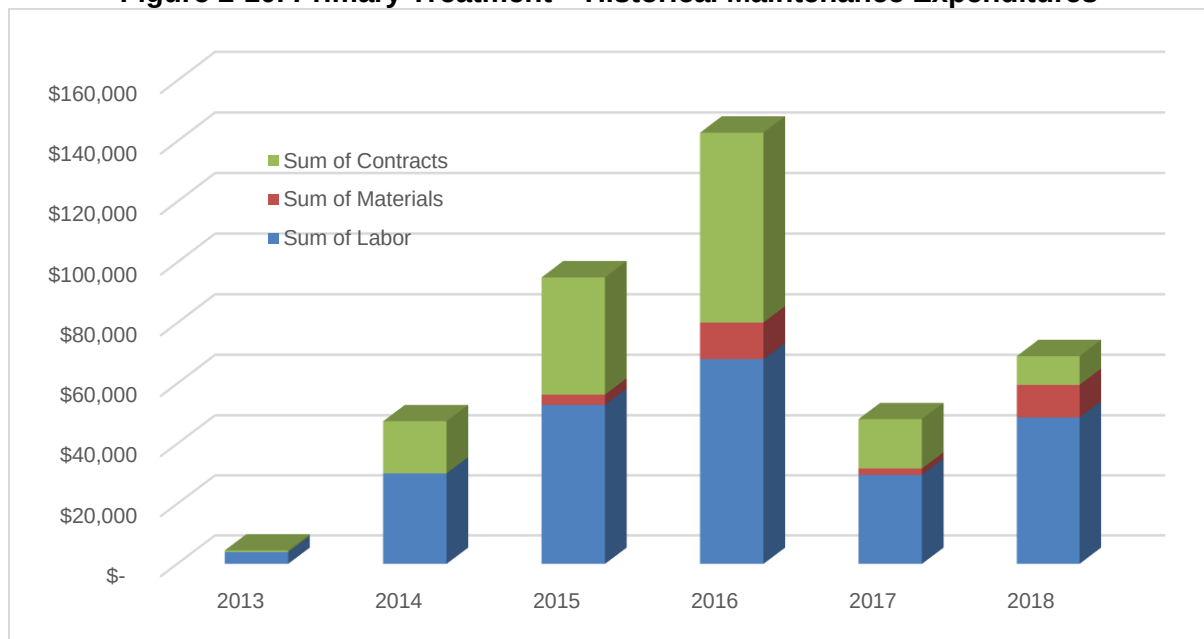
Table 2-6. Existing Primary Treatment Equipment

System	Count	Unit Capacity	Motor	Date of Last Upgrade	Risk Score (1-6)
Influent flow meters	2	NA	NA	2013	2
Clarifier chain and flight collectors	8	NA	0.5 hp	2013	2
Sludge pumps	2	230 gpm	15 hp	2013	2
Scum pumps	2	100 gpm	5 hp	2013	2

2.2.4 Operations and Maintenance

Primary treatment operational costs include labor and energy. Labor costs are associated with operations staffing requirements for the clarifiers, sludge pumps, and scum system. Energy costs are related to sludge pumping, operation of the chains and flights, and the odor control system fans. Chemical costs associated with scum digestion are small and are not tracked on a facility level. Maintenance of the primary treatment system includes maintaining the major equipment as well as associated instruments, gates, and piping systems.

Figure 2-10. Primary Treatment – Historical Maintenance Expenditures



2.3 Secondary Clarifiers

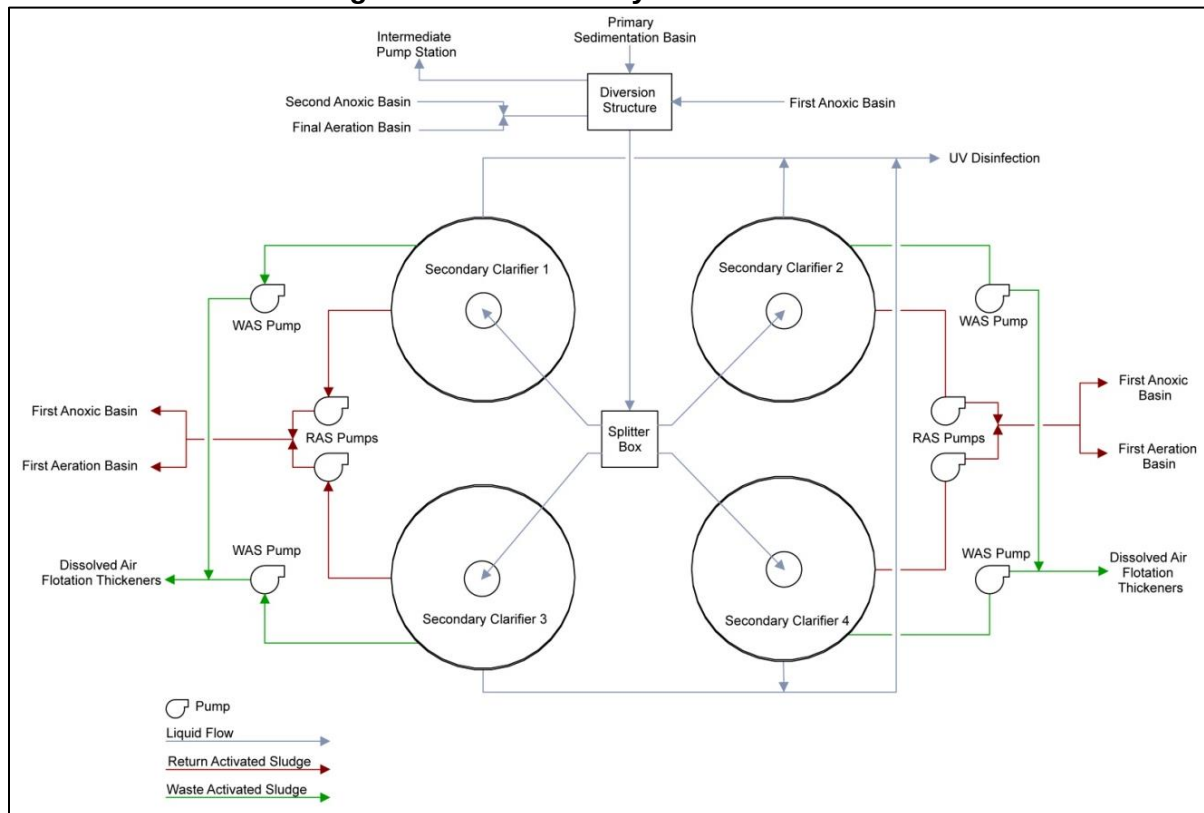
The purpose of the secondary clarifiers is to retain the activated sludge bacteria within the secondary process, and discharge clean effluent to the disinfection system. The clarifiers receive flow from the final aeration basin and clarified effluent from the clarifiers flows to the ultraviolet disinfection system. There are four clarifiers at the plant with a diameter of 120 feet and a 14.5-foot side water depth. A project to upgrade the secondary clarifiers was completed in 2007. The project included the replacement of the clarifier mechanisms, and both the waste activated sludge (WAS) and return activated sludge (RAS) pumping systems.



Each clarifier is equipped with two RAS pumps and one WAS pump. Settled sludge is withdrawn from each clarifier through dedicated RAS pumps that are connected to a manifold of pipes located on the clarifier's rotating sludge collector rake arms.

A magnetic flow meter measures the flow from each pair of pumps. RAS is recycled back to the first anoxic basin or to the first aeration basin. The pumping rate is adjusted to maintain a blanket of settled sludge in the clarifier.

Figure 2-11: Secondary Clarifier Process

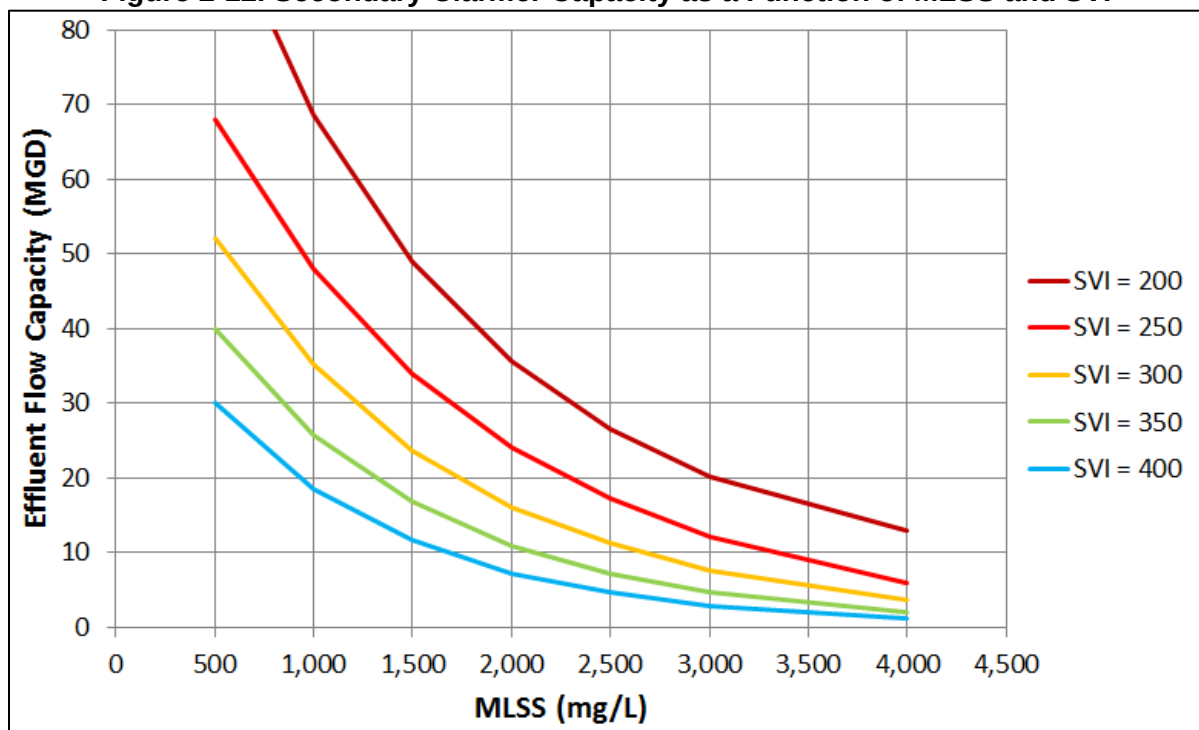


WAS is withdrawn from each RAS wetwell and directed to the dissolved air flotation thickeners for solids processing. The WAS pumps are used to maintain the solids inventory in the system and the solids retention time in the secondary treatment process to allow the biological treatment process to operate correctly. The WAS pumps are operated continuously to even out the load to the dissolved air flotation thickeners.

2.3.1 Capacity Analysis

The capacity of the secondary clarifiers was established through stress testing and fluid dynamic modeling in late 2008. Unit capacity is a function of the mixed liquor suspended solids (MLSS) concentration in the aeration basins and the mixed liquor sludge volume index (SVI) (Figure 2-12). MLSS is a function of the BOD loading to the aeration basins and the total aeration basin volume. In addition, the BOD loading to the aeration basins is itself a function of both satellite plant diversion and primary sedimentation performance.

Figure 2-12. Secondary Clarifier Capacity as a Function of MLSS and SVI



As noted above, secondary clarifier capacity is a function of several factors and is linked to the influent flows and loads to the plant, primary sedimentation performance, and operation of the aeration basins as it relates to MLSS concentration. LOTT is currently engaged in a process improvements project which will reconfigure the aeration basins and biological process. The relationship between influent loadings, MLSS concentration, and clarifier capacity will need to be re-evaluated after the conclusion of this project.

Table 2-7 provides a summary of the capacity analysis and assumptions for the secondary clarifiers. Much of table is currently undefined pending the ongoing process improvements project. In previous years reports, secondary clarifier capacity was not projected to become limiting within the next 20 years.

Table 2-7. Secondary Clarifiers Simplified Capacity Summary

Unit Process	Capacity basis	Units	Redundancy Basis	Capacity	Condition		Utilization	
					Current	2050	Current	2050
Secondary clarifiers	Peak day solids loading rate	lb/d/ft ²	Total	TBD	20.1	TBD	TBD	TBD
RAS Pumps	Flow	mgd	Total	23	N/A	N/A	N/A	N/A

2.3.2 Completed and Planned Projects

Long range planning for the footprint of the Budd Inlet Treatment Plant will include an assessment of future expansion of this system. No projects are currently planned.

2.3.3 Asset Management

Major equipment involved in secondary clarifier operation includes secondary clarifier sludge collection mechanisms, RAS pumps, and WAS pumps. This equipment is illustrated in Figure 2-11 and is summarized in Table 2-8 below.

Table 2-8. Existing Secondary Clarifiers Equipment

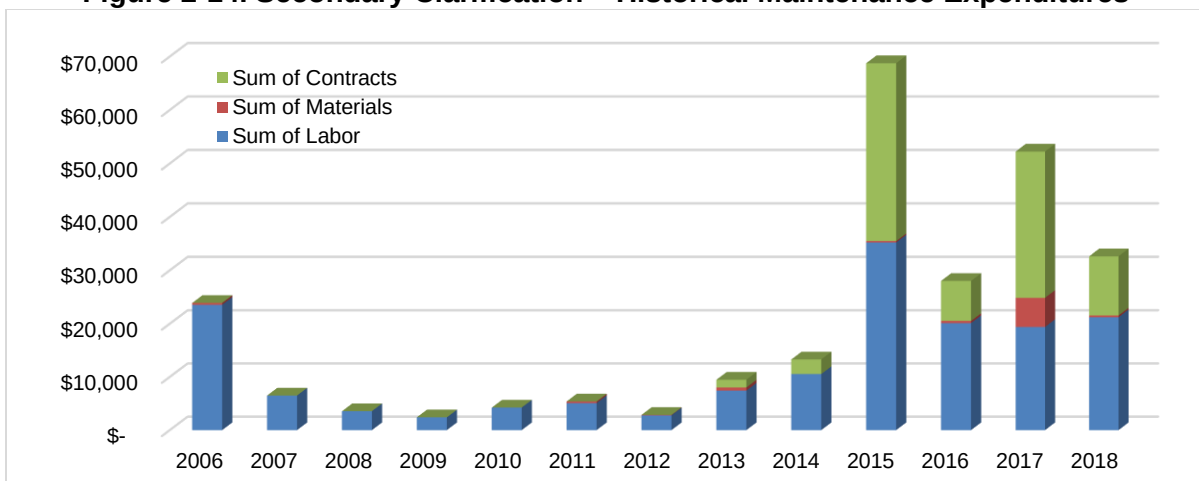
System	Count	Unit Capacity	Motor	Date of Last Upgrade	Risk Score (1-6)
Secondary Clarifier Mechanisms	4	120-ft diameter	N/A	2007	3
RAS Pumps	8	2,000 gpm	20 hp	2007	3
WAS Pumps	4	300 gpm	10 hp	2007	3

Maintenance costs to include labor, materials, and contracted services captured in LOTT's CMMS are included in Figure 3-14.

2.3.4 Operations and Maintenance

Operational costs for the secondary clarifiers include labor and energy. Labor costs are associated with operations staffing requirements for the secondary clarifiers. Electrical energy is required to operate the secondary clarifier mechanisms and the RAS/WAS pumps.

Maintenance of the secondary clarifier system includes maintaining the major equipment, as well as associated instruments and piping systems.

Figure 2-14. Secondary Clarification – Historical Maintenance Expenditures

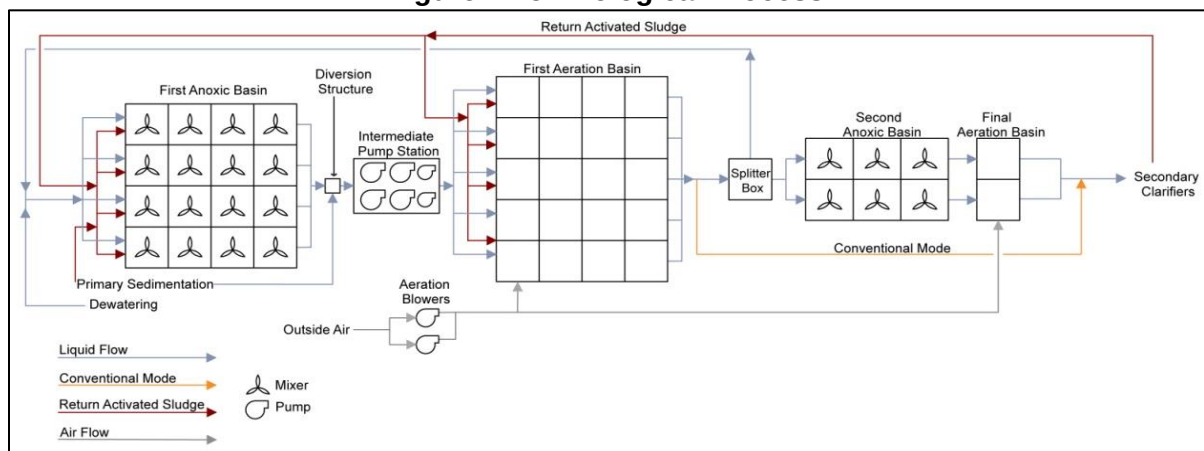
2.4 Biological Process

LOTT's biological nutrient removal system operates a modified four-stage Bardenpho process to optimize total inorganic nitrogen removal from the incoming wastewater. Effluent from the primary sedimentation tanks flows through a series of anoxic (low dissolved oxygen) basins and aeration (higher dissolved oxygen concentration) basins. These basins are identified as the first anoxic, first aeration, second anoxic, and final aeration basins. In order to achieve the required nitrogen limits, flows are recycled inside the aeration basin system from the first aeration basin back to the first anoxic basin at a rate up to four times the plant's influent flow.



The first anoxic basin (stage 1) removes nitrate from the wastewater (denitrifies). Each basin is mixed by a mixer mounted on the roof of the basin. Denitrified mixed liquor flows by gravity to the intermediate pump station, which transfers it to the first aeration basin. The intermediate pump station lifts the mixed liquor and primary effluent flow to allow gravity flow through the remaining elements of the secondary treatment process and ultraviolet disinfection.

Figure 2-15: Biological Process



In the first aeration basin (stage 2), the wastewater is aerated to provide for BOD removal and nitrification (conversion of ammonia to nitrate). The mixed liquor is aerated with fine bubble diffusers located on the floor of the basins. Air is supplied to the diffusers by a system of blowers. Mixed liquor flows from the first aeration basin to a splitter box that directs flow either back to the first anoxic basin or to the second anoxic basin/final aeration basin.

The second anoxic and final aeration basins (stage 3 and 4) provide the final biological denitrification and nitrification steps prior to settling and disinfection. Stages 3 and 4 consist of two trains, each with four cells. The first three cells of each train serve as the second anoxic zone, and the fourth cell as the final aeration zone. In the anoxic cells, additional nitrate removal is achieved. In the final aeration cells the mixed liquor is aerated to further polish the mixed liquor prior to flowing to the secondary clarifiers.

2.4.1 Capacity Analysis

The secondary process tanks comprise of 15.27 million gallons of anoxic and aerobic basin volume. While this process volume is sufficient to provide for BOD and TIN removal through build out, performance becomes increasingly tied to the mixed liquor suspended solids (MLSS) concentrations. The MLSS concentration is proportional to the BOD loading, which is projected to increase by approximately 200% by build out. The MLSS concentration is inversely proportional to the volume of the secondary process tanks.

The Biological Process Improvements project is currently underway, which will reconfigure the secondary process tanks to provide for improved control and efficiency. Key outcomes of the project include reduced energy use, a reduction in foam trapping, improved dissolved oxygen control, and improved mixed liquor settleability. Consolidation of the biological treatment process may also free up valuable space on the plant site for additional future treatment processes. These positive outcomes are balanced against a possible reduction in process volume tied to the elimination of the existing first anoxic basin. The volume reduction would increase the projected MLSS concentration, which in turn increases downstream loading on the secondary clarifiers and reduces secondary clarifier capacity.

Table 2-9. Biological Process System Capacity Summary

					Condition		Utilization	
Unit Process	Capacity basis	Units	Redundancy Basis	Capacity	Current	2050	Current	2050
Aeration basins	Capacity is driven by secondary clarifier solids loading							
Aeration blowers	Peak day air flow	scfm	Firm	20,800	14,000	21,132	67%	102%

The capacity of the aeration basins is linked to the secondary clarifiers via the relationship between MLSS concentration and solids loading. This relationship will need to be revisited after the reconfiguration of the aeration basins. The Biological Process Improvements project will also address aeration blower capacity.

2.4.2 Completed and Planned Projects

In 2011, a new Neuros high-speed dual-core turbo blower was installed to add more control and redundancy to the process aeration system. The total project cost was \$767,803, though the project qualified for a Puget Sound Energy rebate in the amount of \$374,772, resulting in a total project cost of \$344,264.

The Biological Process Improvements project is currently in the design phase and is scheduled to be completed in 2022. The purpose of this project is to optimize the current biological treatment process at the Budd Inlet Treatment Plant. The project will reconfigure the existing first aeration basins, as well as reduce the energy required to accomplish biological nutrient removal. The improvements include replacing oversized blowers and minimizing recycle pumping, which will reduce power consumption. The project will also optimize methanol addition to the secondary process.

Table 2-10. Completed and Planned Biological Process Projects

On-line	Name	Cost/Estimate	Status	Description
2011	Aeration Blower Upgrade	\$344,264	Completed	Added Neuros high-speed turbo blower
2022	Biological Process Improvements	\$31,175,969	In Process	Upgrades aeration control, instrumentation, and process tank reconfiguration

2.4.3 Asset Management

A variety of mechanical equipment is involved in operation of the aeration basins. Major equipment includes mixers for the anoxic basins and first aeration basin, pumps at the intermediate pumping station, and aeration blowers/diffusers. This equipment is shown on Figure 2-12 and is summarized in Table 2-11 below.

Table 2-11. Existing Aeration Basins Equipment

System	Count	Unit Capacity	Motor	Date of Last Upgrade	Risk Score (1-6)
First Anoxic Basin Mixers	16		10 hp	1980	4
First Aeration Basin Mixers	5		25 hp	1993	3
Second Anoxic Basin Mixers	6		15 hp	2010	2
Intermediate Pumps	2	17 mgd	75 hp	1993	3
	4	33 mgd	150 hp	1993	
Centrifugal Blowers	3	7,400 scfm	500 hp	1993	5
Turbo Blowers	1	6,000 scfm	400 hp	2011	2
Aeration Diffusers	30,000			2012	2

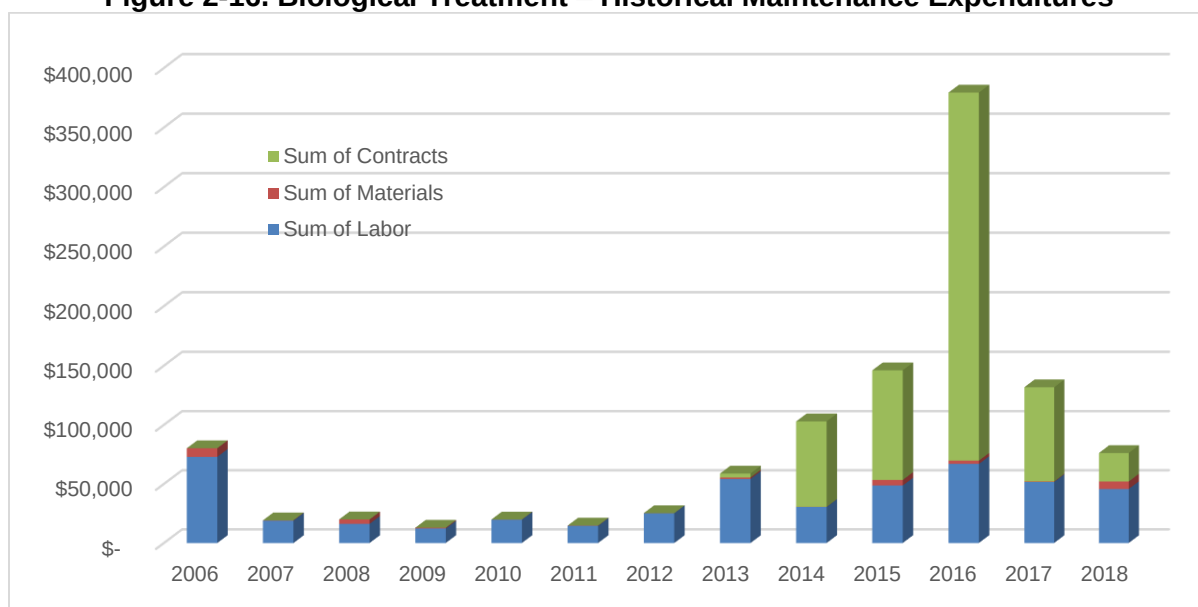
2.4.1 Operations and Maintenance

Aeration basin operational costs include labor, energy, and chemicals. Energy is primarily required for operation of the aeration blowers, recycle pumping, and operation of the anoxic and aeration basin mixers when in use.

Chemical costs include supplemental carbon to drive denitrification, and polyaluminum chloride (PAX) to reduce biological foaming. The plant typically uses methanol as a supplemental carbon source, and doses during the summer and shoulder permit seasons. PAX is typically dosed during the winter, to limit the growth of foaming filaments.

Maintenance of the aeration basins includes maintaining the major equipment, as well as associated instruments and piping systems. The aeration diffusers require periodic cleaning, which involves taking a basin out of service and manually cleaning the membranes.

Figure 2-16. Biological Treatment – Historical Maintenance Expenditures



2.5 Ultraviolet Disinfection and Effluent Pumping

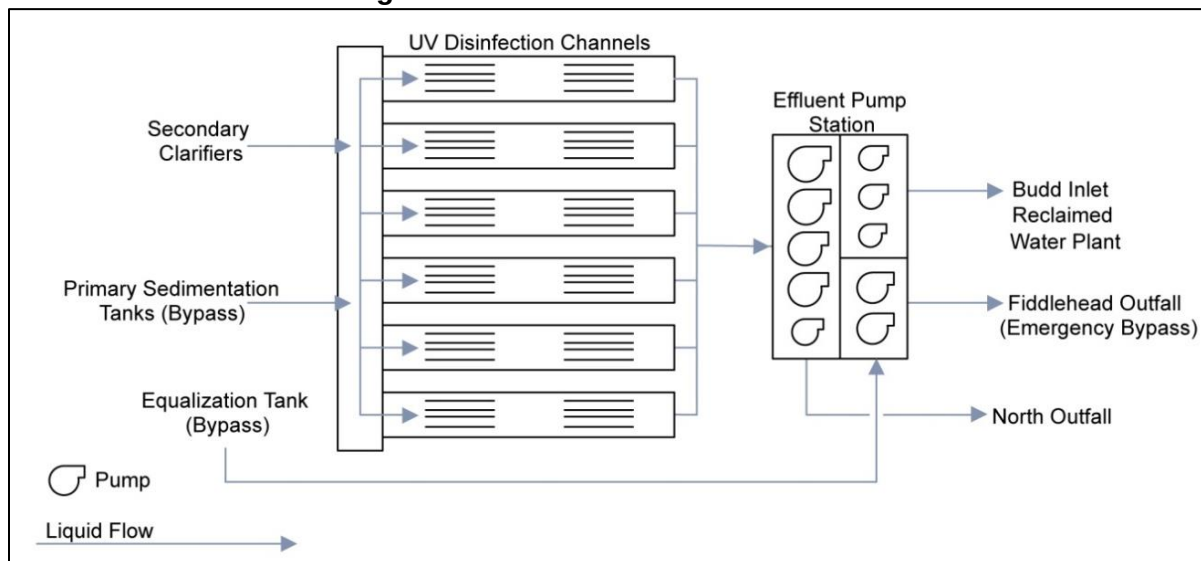
Ultraviolet Disinfection

The ultraviolet (UV) disinfection system is the final liquid stream processing step. Its purpose is to disinfect the effluent from the secondary clarifiers to satisfy NPDES permit requirements for fecal coliform counts in the final effluent.

A UV disinfection system exposes bacteria in the effluent to UV light by flowing past UV bulbs. The UV disinfection system consists of channels equipped with horizontal UV bulbs arranged in modules across the width of a channel. The spacing of the lamps in the channels provides sufficient UV radiation to ensure destruction of pathogenic microorganisms as effluent flows through the channel. The performance of the UV disinfection system is contingent on the successful performance of the secondary clarifiers, since high suspended solids will block the UV radiation and reduce the amount available for disinfection.



Figure 2-17. UV Disinfection Process



Effluent Pumping

The LOTT treatment plant has two 48-inch outfalls, the North Outfall and the Fiddlehead Outfall. Treated effluent is typically discharged to Budd Inlet out of the North Outfall that extends 953 feet off the shoreline near the north end of Washington Street. The final 250 feet of the outfall contains a diffuser section approximately 19 feet below the mean lower low water level (MLLW).

The effluent pump station for the North Outfall includes five pumps, three rated at 18 mgd and two rated at 12 mgd. The North Outfall is used for all plant flows up to 55 mgd at high tide and approximately 75 mgd at low tide. Most of the North Outfall was upgraded from 30- to 48-inch diameter in 1997. A portion of the pipeline, which crosses through a state-regulated dangerous waste site, could not be upgraded to 48-inch. The remaining 1,200 feet of 30-inch diameter pipe, which creates a flow bottleneck, is planned to be replaced in 2036.

Peak flows in excess of the North Outfall capacity can be discharged through the Fiddlehead Outfall, utilizing two pumps rated at 15 mgd each. In the event that the Fiddlehead Outfall is utilized, LOTT must notify the Department of Ecology that flow was diverted to this pipe.

2.5.1 Capacity Analysis

UV Disinfection

The existing TrojanUV3000™ ultraviolet disinfection system utilizes 6 channels for disinfection, with an empty seventh channel which could be brought into service by installing additional equipment. Each channel currently has a maximum treatment capacity of 11 mgd. With the capacity of the influent pump station limited to 72 mgd, the existing channel system will have capacity to treat all secondary-treated flows through build out. The existing treatment capacity (six channels, 66 mgd) is adequate to treat 10-year peak day flows through build out, and 10-year peak hour flows through 2020.

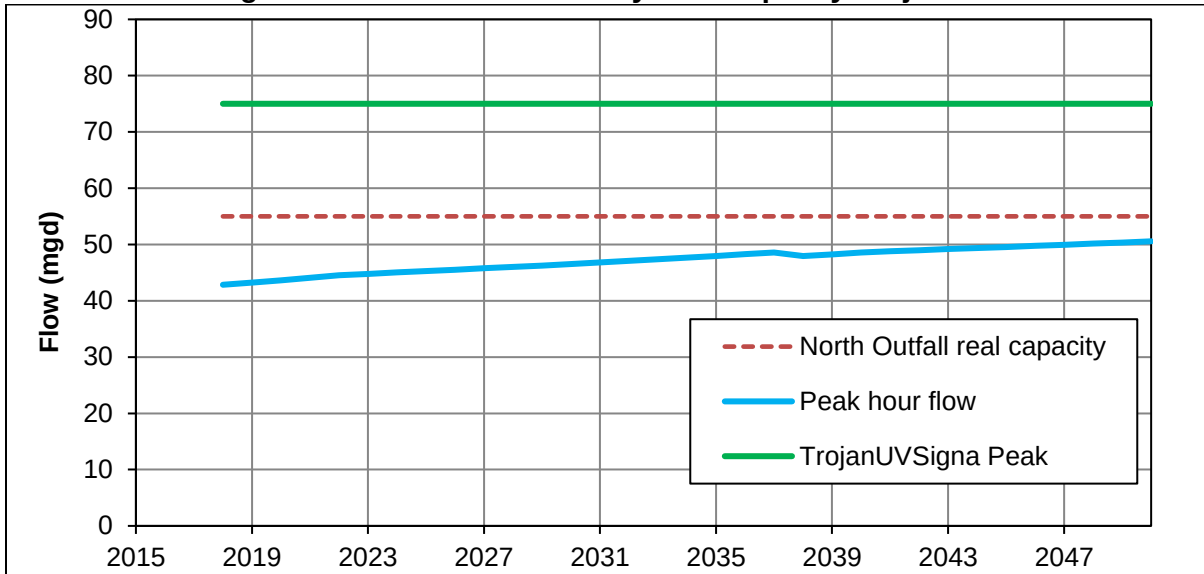
Disinfection systems are rated based upon the Department of Ecology's Class I Reliability requirement, the capacity to treat 50% of the peak design flow with the largest unit out of service. This effectively means that, as long as there are more than two equally-sized units, rating can be based on total, rather than firm, capacity. From a practical standpoint, LOTT prefers to treat 100% of its peak day flow with a margin of safety. The existing six-channel system will operate at 85% of its firm capacity for the projected 10-year peak day flow in 2031 as shown in Figure 2-18.

A project is underway to upgrade the system to the new TrojanUVSigna™. It is anticipated that this project will be complete by the beginning of 2020. The new system configuration includes UV lights installed at a 45-degree angle and will require deepening of the existing UV channels, thus increasing each channel's overall capacity. The new system layout will utilize four duty channels with one redundant channel. Each channel will contain two banks of UV lamps. Each bank contains 18 lamps, for a total of 180 lamps in the system. The design criteria is included in Table 2.12.

Table 2.12 TrojanUVSigna™ Design Criteria

Parameter	Capacity
Peak Design Flow	75 MGD
Average Daily Flow	23.3 MGD
UV Transmission	63% minimum
Total Suspended Solids (TSS)	30 mg/l (30 Day Average, grab sample)
Minimum Dose	24 mJ/cm ²
Discharge Limit	200 Fecal Coliforms, 30 Day Geometric Mean

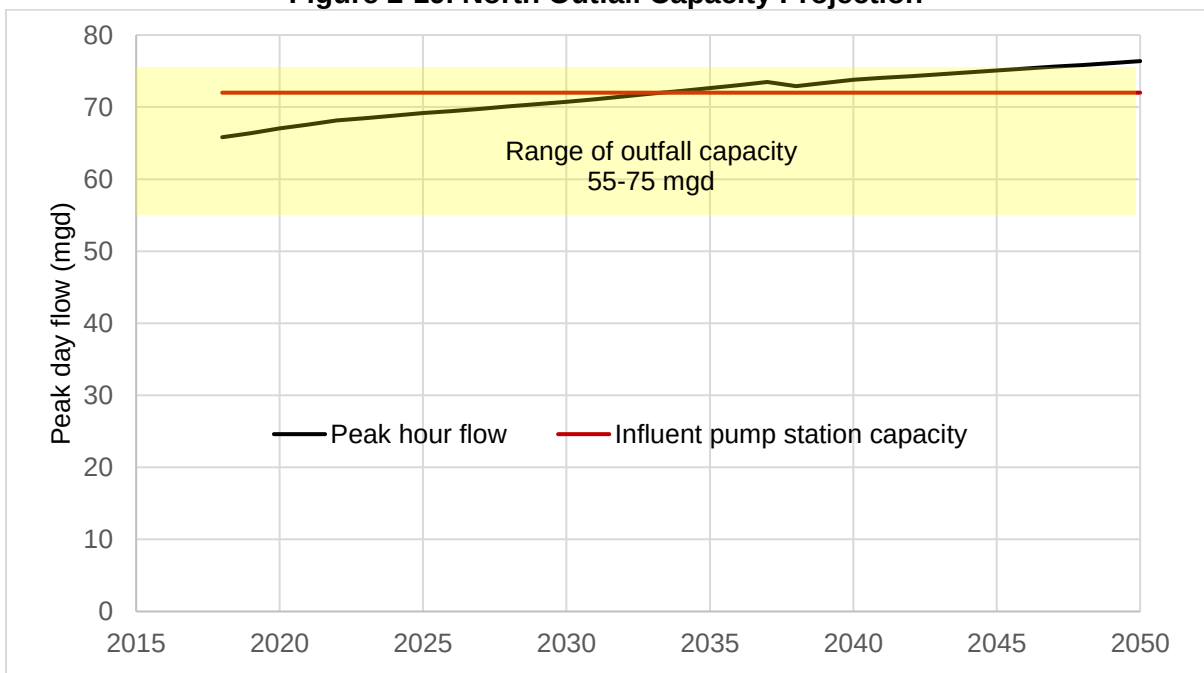
Figure 2-18. UV Disinfection System Capacity Projection



Effluent Pumping

There are four pumps discharging to the North Outfall, each with a nameplate capacity of 16.7 mgd at high tide. However, experience has suggested a real-world combined pumping capacity of 55 mgd at high tide, and pressure limitations in the outfall pipeline would limit flow increases above this level. Under normal tidal conditions, the outfall can pump up to 75 mgd. Two additional 15 mgd pumps can direct flow to the Fiddlehead Outfall under emergency circumstances, bringing the combined outfall capacity to 85 mgd. LOTT prefers to minimize use of the Fiddlehead Outfall as much as possible. Figure 2-19 shows the existing capacity of the North Outfall, not including Fiddlehead capacity, relative to the projected 10-year peak day flow.

Figure 2-19. North Outfall Capacity Projection



Currently, the North Outfall does not have capacity to discharge peak hour flows under high tide conditions. However, such conditions are rare, and the plant's influent flow equalization basins typically reduce peak hourly flow through the plant. Therefore, the plant has very rarely needed to discharge flow to the Fiddlehead outfall.

A plan is currently being developed to increase the capacity of the North Outfall by replacing the 30-inch section of pipe, which is currently limiting pumping capacity, and by upgrading the existing pumps. After those improvements, the North Outfall will have the capacity to match the influent pump station (72 mgd) under all tidal conditions. This project is currently planned for 2036.

UV Disinfection System and Outfalls Capacity Summary

Table 2-13 provides a summary of the capacity analysis and assumptions for the UV disinfection system and the North Outfall.

Table 2-13. UV Disinfection System and Outfalls Capacity Summary

Unit Process	Capacity basis	Units	Redundancy Basis	Capacity	Condition		Utilization	
					Current	2050	Current	2050
UV Disinfection	Peak day flow	mgd	Firm	55	42.7	50.4	78%	92%
North Outfall pumps	Peak hour flow	mgd	Firm	55	65.8	76.4	120% ¹	139% ¹
Fiddlehead Outfall pumps	Peak hour flow	mgd	Firm	30	N/A	N/A	N/A	N/A

1. Capacity rating is based on flow capacity at maximum tide conditions

2.5.2 Completed and Planned Projects

The existing Trojan UV3000™ Disinfection System, installed in 1993, has been discontinued and spare parts will no longer be manufactured. The Ultraviolet Disinfection Upgrades project is currently underway to replace the obsolete system.

A list of planned projects is included in Table 2-14 below. The UV equipment installation in the seventh channel, currently planned for 2031, will be triggered when the peak day influent flow reaches approximately 46.8 mgd, 85% utilization of the existing firm UV disinfection capacity. The North Outfall Upgrade, planned for 2036, will address the current pressure limitations in the North Outfall pipeline and will help reduce future use of the Fiddlehead Outfall.

Table 2-14. Completed and Planned Projects

On-line	Name	Cost/Estimate	Status	Description
2013	Effluent Drive and Motor Control Centers Replacement	\$1,692,754	Completed	Replaced effluent pump variable frequency drives and motor control centers
2020	Ultraviolet Disinfection Upgrades	\$8,407,815	Active	Upgrades 20-year-old TrojanUV3000™ system to new TrojanUVSigna™
2036	North Outfall Upgrade	\$15,200,000	Future	Remove existing bottleneck from outfall pipe run

2.5.3 Asset Management

A variety of mechanical equipment is involved in the operation of the UV disinfection system and the effluent pump station. Major equipment includes the UV disinfection system, North Outfall pumps, Fiddlehead Outfall pumps, and Budd Inlet Reclaimed Water Plant pumps. This equipment is shown in Figure 2-17 and is summarized in Table 2-15 below.

Table 2-15. Existing UV Disinfection and Effluent Pumping Equipment

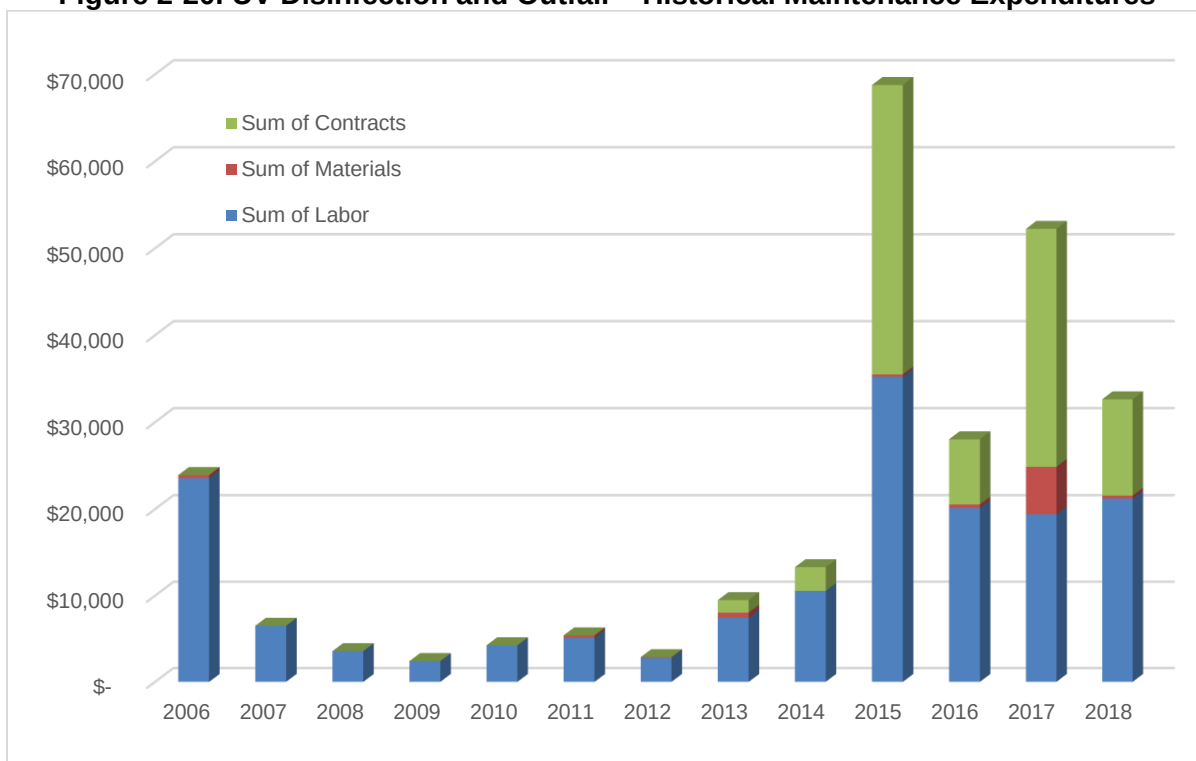
System	Count	Unit capacity	Motor	Date of last upgrade	Risk Score (1-6)
TrojanUV3000™ Disinfection System	6	11 mgd	N/A	1993	5
Effluent Pump Station Pumps – North Outfall	3	18 mgd	150 hp	1997	3
	2	12 mgd		2001	3
Effluent Pump Station Pumps – Fiddlehead	2	15 mgd	125 hp	1980	3
Effluent Pump Station Pumps – Budd Inlet Reclaimed Water Plant	3	1 mgd	60 hp	2004	3

2.5.4 Operations and Maintenance

Operational costs for the UV disinfection system and outfalls include labor and energy. Labor costs are associated with operations staffing requirements for both systems. The major energy cost for the UV disinfection system is associated with the electrical energy needed to power the UV lamps. The outfalls also require electrical energy to operate the effluent pumps.

Maintenance of the UV disinfection system and outfalls includes maintaining the major equipment, as well as associated instruments, gates, and piping systems. Maintenance costs have increased in recent years due to the system approaching the end of its useful life.

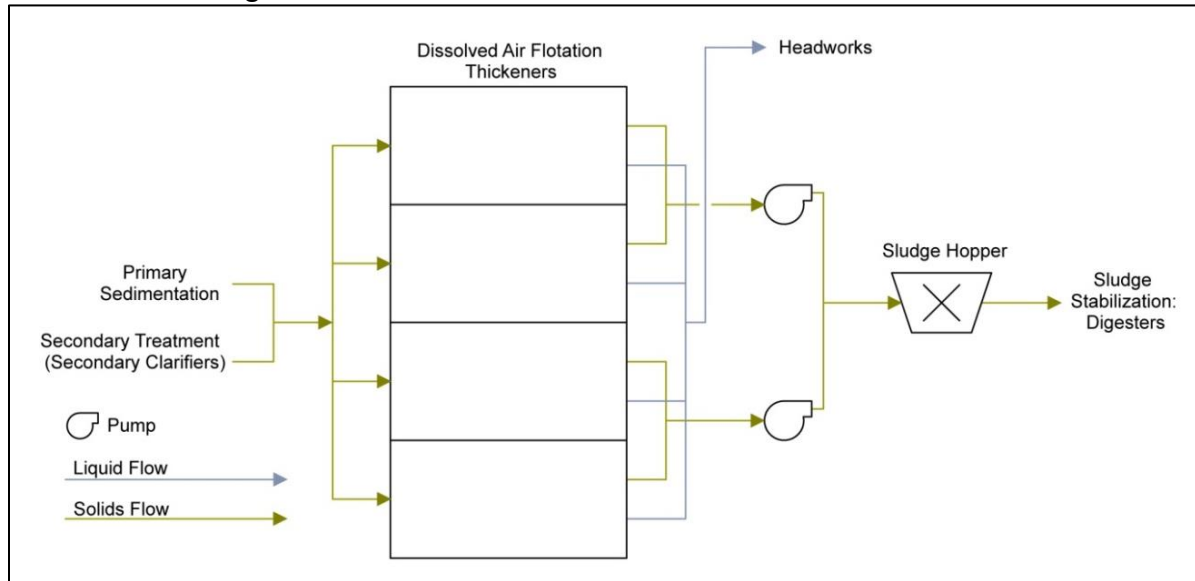
Figure 2-20. UV Disinfection and Outfall – Historical Maintenance Expenditures



2.6 Sludge Thickening (DAFTs)

The sludge thickening process removes excess water from the combined primary and waste activated sludge (WAS) flows prior to anaerobic digestion. The Budd Inlet Treatment Plant sludge thickening system consists of four rectangular dissolved air flotation thickener (DAFT) tanks. Polymer is used to enhance sludge thickening and performance of the DAFTs.

Figure 2-21. Dissolved Air Flotation Thickeners Process



Three of the DAFT tanks use a dedicated pressurization system to provide high-pressure air for flotation. A portion of the DAFT effluent is recycled to the pressurization tank, and the pressure is elevated to 40 pounds per square inch gauge (psig) using the plant's high-pressure service air. Pressurized flow from the tank passes through a pressure release valve, where it combines with the sludge and polymer feeds to the DAFT tanks. The decompressed air bubbles attach to the sludge and polymer particles floating them to the surface. Skimmers collect the thickened sludge and push it to hoppers for transfer to the anaerobic digesters. Sludge that settles to the bottom of the DAFT tanks is drained back to headworks once each day. Overflow from the DAFTs drains back to headworks for re-processing with the plant influent flow. The fourth DAFT tank recently replaced its air pressurization system with a self-aspirating pump. The new system saves energy and is easier to maintain. The relative capacities of the two types of DAFT are currently being tested.

2.6.1 Capacity Analysis

Common hoppers are shared between DAFT tanks 1 and 2 and between DAFT tanks 3 and 4. The thickened sludge then combines in a common manifold and is carried to the sludge digestion system. The DAFT system was rated to a capacity of 29.7 pounds per square foot per day (lb/ft²/d) in the 2006 Budd Inlet Treatment Plant Master Plan. However, the system has been operated at much higher loadings since that time. Historically, the system has been operated up to 60 lb/ft²/d, although recently the system has struggled to perform under such loadings, and a more conservative estimate of capacity may be closer to 45 lb/ft²/d. The DAFT system is currently undergoing stress testing to determine its capacity. The value of 45 lb/ft²/d has been used to assess capacity needs for the sludge thickening system.

Figure 3-22 depicts the capacity of the DAFT system assuming three tanks in service. The system is projected to reach capacity in 2044.

Figure 2-22. Sludge Thickening Capacity Projection

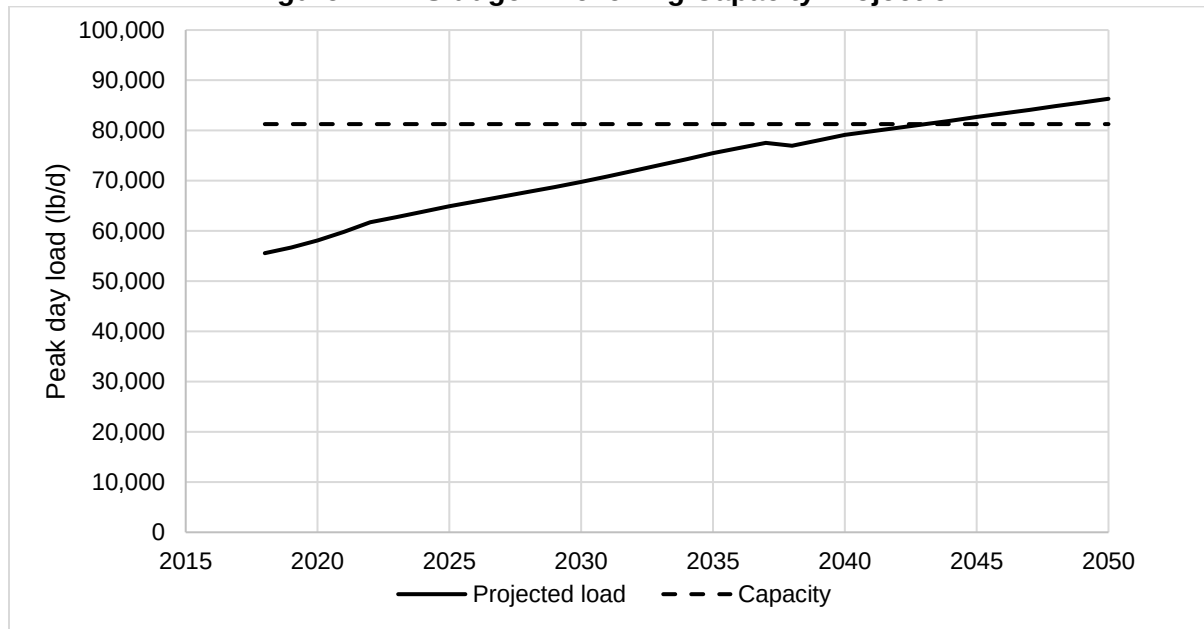


Table 2-16 provides a summary of the capacity analysis and assumptions for the sludge thickening system. Three DAFT units are projected to meet firm capacity needs through 2044. The system is currently undergoing stress testing to verify the capacity rating, and alternatives for future expansion are being evaluated as part of long-range planning for the Budd Inlet Treatment Plant.

Table 2-16. Sludge Thickening System Capacity Summary

Unit Process	Capacity basis	Units	Redundancy Basis	Capacity	Condition		Utilization	
					Current	2050	Current	2050
DAF Thickening	Peak day solids load	lb/d/ft ²	Firm	45	30.8	47.8	68%	106%

2.6.2 Completed and Planned Projects

LOTT, with assistance from HDR Engineering, conducted a comprehensive evaluation of the DAFT system in 2016. Much of the equipment, originally installed in 1982, is reaching the end of its useful life. A list of near-term improvements, with the goal to extend the useful life of the existing DAFT system by ten years, was developed to ensure operational reliability and redundancy to include the following:

- Install self-aspirating pumps to replace the existing pressurization system, which are inefficient and reaching the end of their useful lives
- Upgrade thickened sludge (THS) pumping
- Replace bottom collectors in tanks 1, 2 and 3

A complete system upgrade is currently planned for 2030 and may include a new thickening technology such as rotary drum thickeners.

Table 2-17. Completed and Planned Sludge Thickening Projects

On-line	Name	Cost/Estimate	Status	Description
2011	Thickening System Equipment Replacement	\$372,196	Completed	Included the replacement of the sprocket, chains, collectors, and beaches for the top collectors for each of the 4 tanks
2012	DAFT Cover Replacement	\$223,516	Completed	Replaced tank covers
2014	DAFT Polymer System Upgrade	\$918,128	Completed	Added new polymer mixer and transfer pump and replaced metering pumps and associated controls and electrical
2015	DAFT Ventilation Fan Replacement	\$42,764	Completed	DAFT ventilation fan replacement
2020	DAFT System and Thickened Sludge Pumping Upgrade	\$2,920,000	In Process	Includes upgrading the DAFT system with new bottom collectors, aspirating pumps, thickened sludge pumps, and process piping
2030	Sludge Thickening Upgrade	\$3,450,000	Future	Will include a complete upgrade of the system based on the results of the business case evaluation

2.6.1 Asset Management

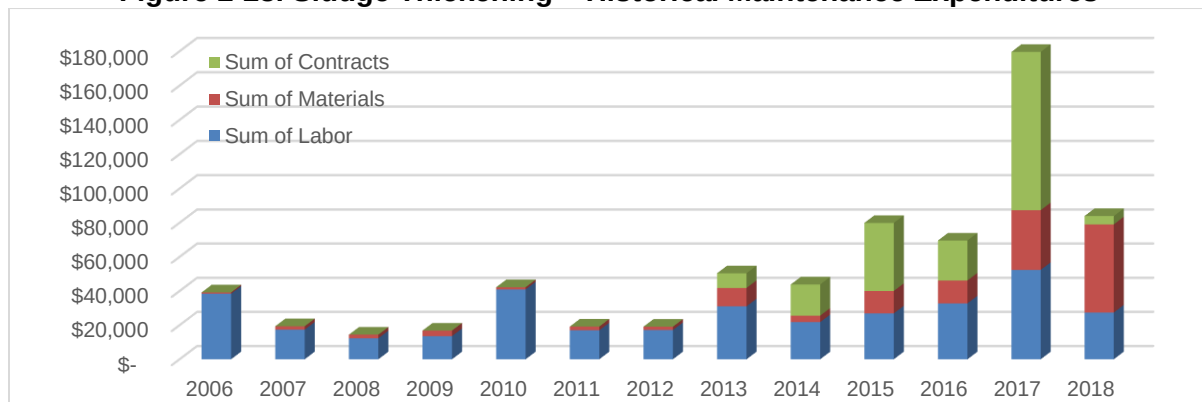
For the existing DAFT system, there is a variety of mechanical equipment involved in sludge thickening operations. Major equipment includes the DAFT sludge collection flights, scum collection flights, as well as the thickened sludge pumps and pressurization system. This equipment is shown in Figure 2-16 and summarized in Table 2-18.

Table 2-18. Existing Sludge Thickening Equipment

System	Count	Unit capacity	Motor	Date of last upgrade	Risk Score (1-6)
Top Collectors	4	33 lb/ft ² -d	1.5 hp	2005	3
Bottom and Cross Collectors	4	33 lb/ft ² -d		1982	5
Pressurization System	4			1982	4
Polymer Metering Pumps	4	4 gpm	0.75	2014	2
Thickened Sludge Pumps	4	100 gpm	10 hp	2003	3

2.6.2 Operations and Maintenance

Sludge thickening operational costs includes labor, energy, and chemicals. Labor costs are associated with operations staffing requirements for the DAFTs and associated polymer supply system. Electrical energy is required to operate the DAFTs, polymer equipment, thickened sludge pumps, and odor control. Chemical costs are related to thickening polymer. The current cost of polymer for sludge thickening is approximately \$80,000 per year.

Figure 2-23. Sludge Thickening – Historical Maintenance Expenditures

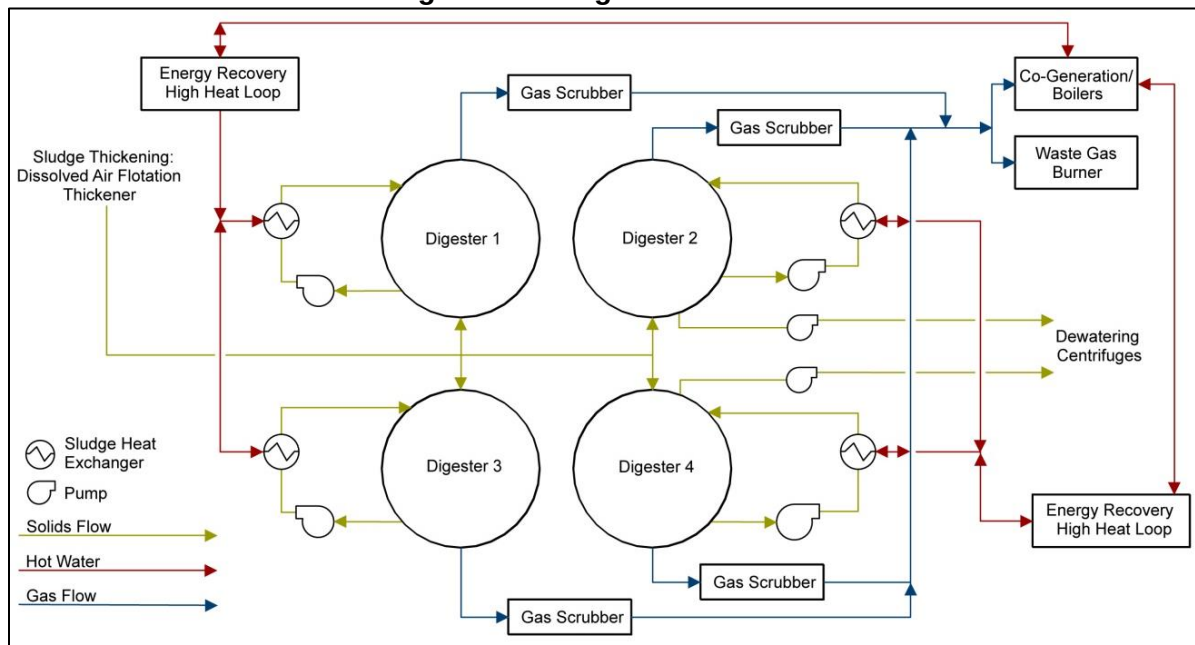
2.7 Digesters (Sludge Stabilization)

The anaerobic digesters biologically stabilize thickened sludge from the DAFTs by converting portions of the sludge to carbon dioxide, methane, and water. Following anaerobic digestion, the residual material (biosolids) is suitable for land application.

Anaerobic sludge digestion facilities include four 70-foot diameter, 30-foot deep concrete tanks with floating covers. Normal practice is to operate three digesters at a time, with the fourth digester held in reserve.



Figure 2-24. Digesters Process



The anaerobic digester equipment building contains all process mechanical equipment needed to operate the digestion process. Thickened sludge is fed to the bottom of the digesters through the circulating sludge system in the center of the tank. Circulating sludge is withdrawn from each digester and pumped to sludge heat exchangers before being returned to the digesters to assist in keeping them completely mixed. The heat exchangers are used to maintain the temperature in the digester at 95° F, which is a permit requirement in order to meet Class B Biosolids standards.

Methane gas from the digesters is the principle fuel for the high temperature heat loop system. Digested sludge is withdrawn from the bottom of the digesters and pumped to solids dewatering centrifuges. Each digester is equipped with floating gasholder-type covers, which are supported by digester gas pressure. Each digester contains two separate gas-piping systems. The gas utilization system withdraws gas for use as fuel for the high temperature heat loop system. The second system uses digester gas to continuously mix the contents of the digester. A dedicated gas compressor recirculates digester gas through each digester.

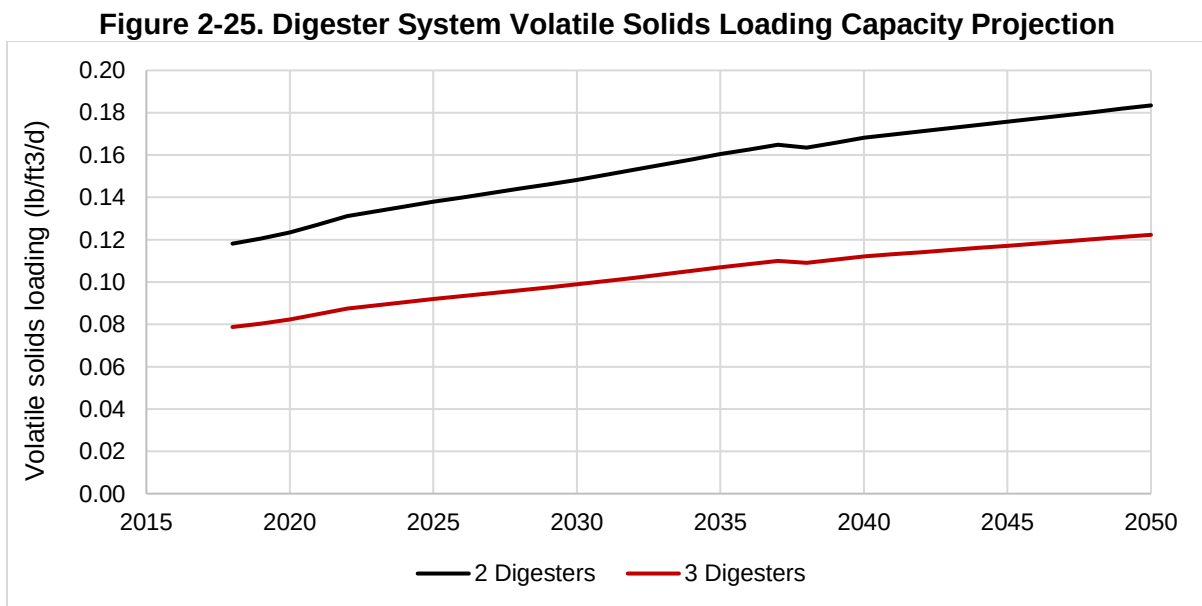
Foul air from the anaerobic digester equipment building is collected and treated in the odor control system prior to release to the atmosphere.

2.7.1 Capacity Analysis

Digester capacity is typically evaluated in terms of the hydraulic retention time and the volatile solids loading rate. The Environmental Protection Agency (EPA) biosolids rule requires a minimum detention time of 15 days. Historically, the plant has aimed to maintain an HRT of at least 25 days in order to allow stable operation. Most mesophilic digesters can operate at volatile solids loadings rate of 0.150 to 0.200 lb/ft³/d. However, digesters with limited or inefficient mixing, such as the gas mixing employed at the plant, may have much lower loading capacities. Operations staff prefer to limit digester loading to 0.08 lb/ft³/d.

Although the plant has four digesters, one unit is reserved for secondary digestion or solids holding, while another unit is reserved as a standby unit. This effectively limits primary digestion to two units.

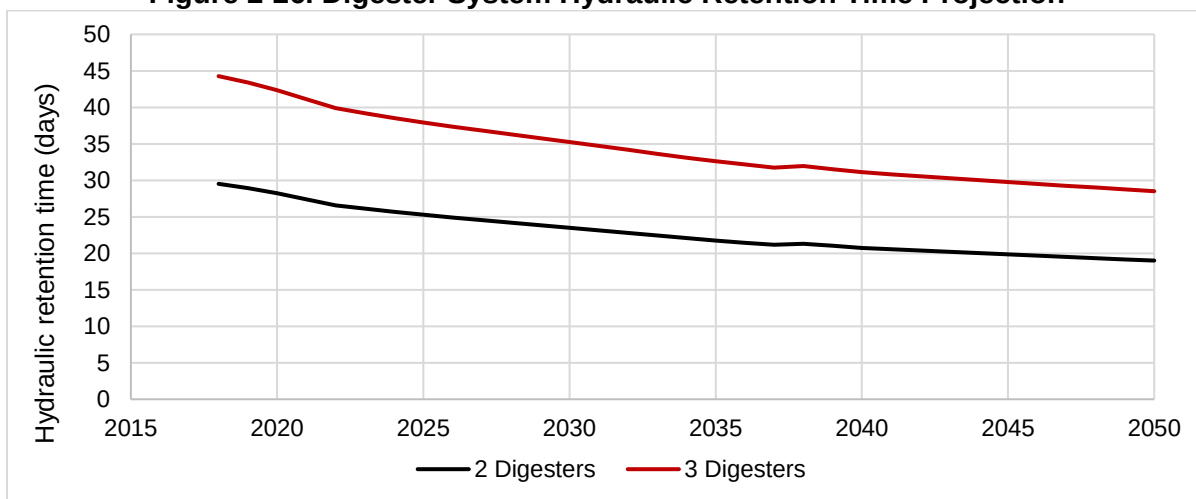
Of the two capacity criteria, volatile solids loading is more critical. Figure 2-25 plots projected volatile solids loading for 2 and 3 primary digesters.



The system is currently operating at higher than preferred loading rate of 0.08 lb/ft³/d with either two or three digesters in service. The more traditional planning guideline of 0.150 lb/ft³/d would be reached in 2030 with two digesters in service.

Neither the two- or three-digester system is projected to come close to the regulatory limit of 15 days. However, the two-digester system would have an HRT of less than the preferred 25 days in 2025. Figure 2-26 plots the projected hydraulic retention time in the digester system.

Figure 2-26. Digester System Hydraulic Retention Time Projection



Clearly, the digester system is currently limited when evaluated in terms of staff's preferred operating conditions. A study is currently underway to determine a long range approach to solids stabilization. At minimum, the result could be improved mixing and cover modifications, which should extend volatile solids loading capacity to more conventional ranges. Beyond that, the study will assess options such as thermophilic digestion and thermal hydrolysis to expand both capacity and energy recovery.

Table 2-19 below summarizes the digester loading projections and capacity.

Table 2-19. Digester System Capacity Summary

Unit Process	Capacity basis	Units	Redundancy Basis	Capacity	Condition		Utilization	
					Current	2050	Current	2050
Anaerobic digestion	Peak 14-day volatile solids loading	lb/ft ³ /d	2 digesters	0.08	0.12	0.18	148%	229%
Anaerobic digestion	Minimum 14-day hydraulic retention time	days	2 digesters	25	29.5	19.0	85%	132%

2.7.2 Completed and Planned Projects

A project to add digestion capacity has been added to the Capital Improvements Plan, scheduled for 2030. A list of projects is included in Table 2-20.

Table 2-20. Completed and Planned Projects

On-line	Name	Cost/Estimate	Status	Description
2014	Boiler Upgrade	\$2,205,675	Complete	Replace 1980 boiler and upgrade controls
2016	Digester Concrete Support Repair	\$192,084	Complete	Repair degraded concrete supports
2018	Engine Generator Replacement	\$401,299	Complete	Replace engine generator at 60,000 hours
2018	Digester Building Drain Replacement	\$286,580	Complete	Replace failing drain lines in the digester building
2024	Digester Refurbishments	\$9,402,042	Ongoing	Refurbishment of aging components
2025	Biogas Utilization Upgrades	\$1,290,467	Future	Complete alternatives assessment prior to engine generator reaching end of useful life to
2030	Digestion Capacity Expansion	\$18,700,000	Future	Adds a fifth digester

2.7.3 Asset Management

A variety of mechanical equipment is involved in the operation of the digesters. Major equipment includes sludge transfer and recirculation pumps, gas circulating compressors, and sludge heat exchangers. This equipment is shown on Figure 3-24 and is summarized in Table 3-21.

Table 2-21. Existing Digester Equipment

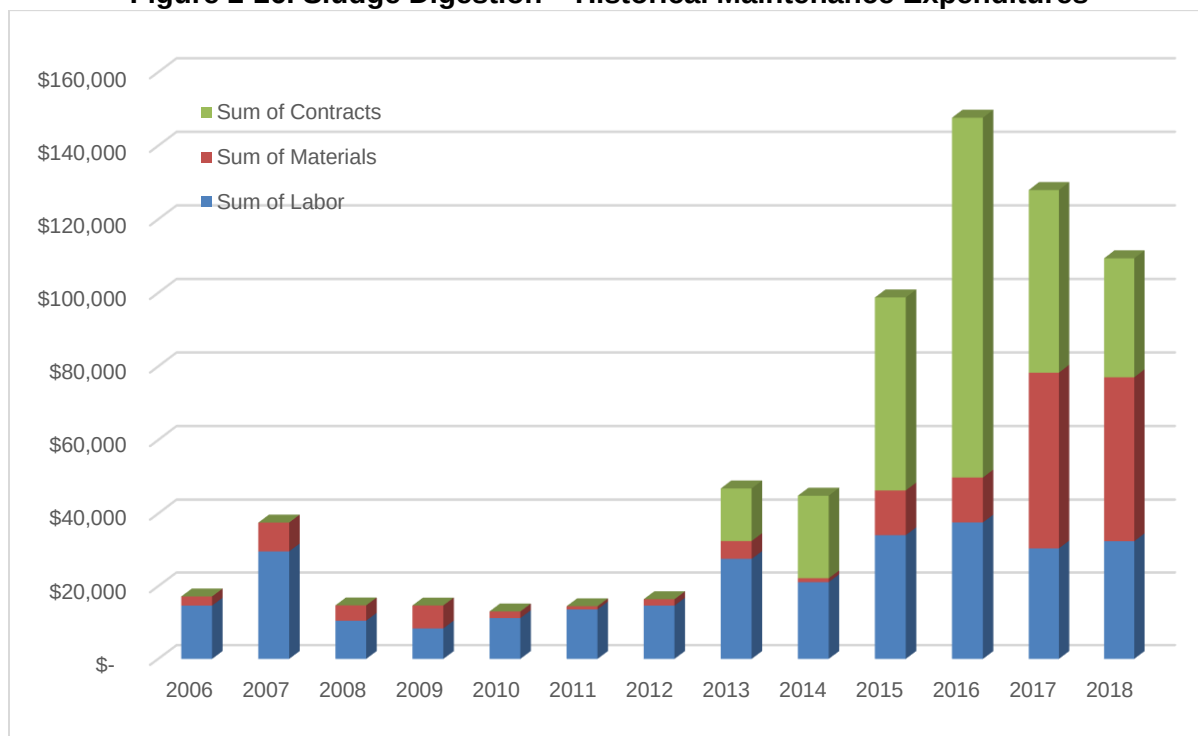
System	Count	Unit Capacity	Motor	Date of Last Upgrade	Risk Score (1-6)
Sludge Transfer Pumps	3	250 gpm	10 hp	1999	3
Sludge Recirculation Pumps	5	310 gpm	10 hp	2011	2
Gas Circulating Compressors	5	180 scfm at 25 psig	20 hp	2002	3
Sludge Heat Exchangers	5	1,500 mbtu/hr	N/A	2011	2
Engine Generator	1	335kW	N/A	2013	1

2.7.4 Operations and Maintenance

Maintenance of the anaerobic digestion system includes maintaining the major equipment, as well as associated instruments and piping systems. The digester units themselves require periodic cleaning, which involves taking a unit out of service, pumping out the sludge, and removing grit and other debris that accumulates at the bottom. Such cleaning is required once every five years at a cost of \$10,000 per event.

Digester operational costs include labor and energy. While energy to heat the digester is provided by the plant's cogeneration system, pumping and facility HVAC energy represents an annual cost.

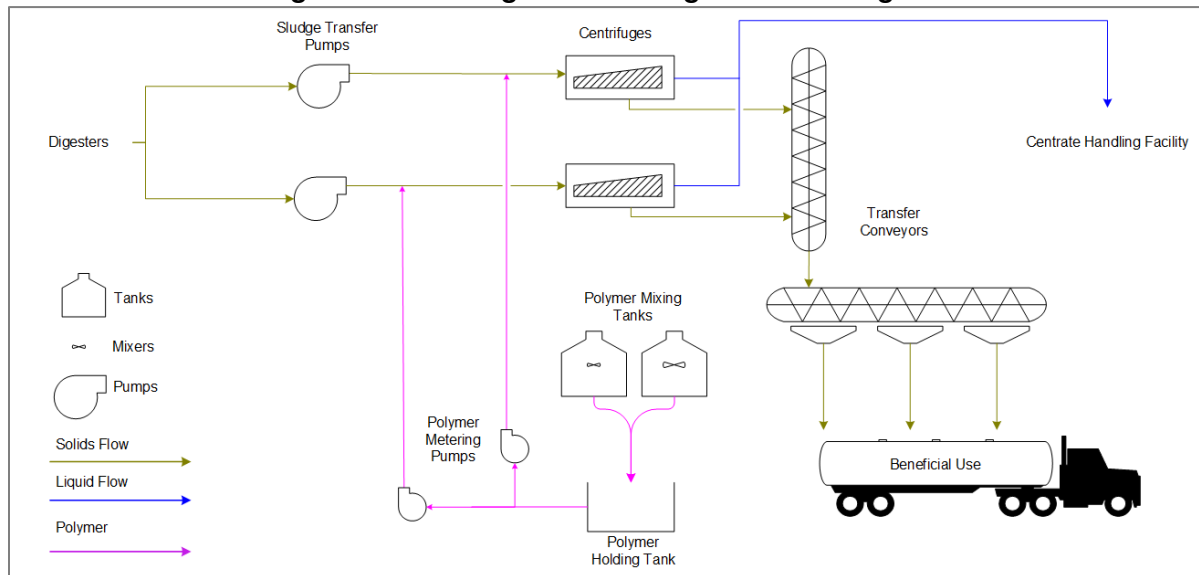
Figure 2-26. Sludge Digestion – Historical Maintenance Expenditures



2.8 Sludge Dewatering

The solids dewatering process removes excess moisture from anaerobically digested sludge (2-3% solids) to create biosolids (20-24% solids), thereby reducing land application hauling costs. Solids dewatering equipment consists of two centrifuges, dewatered sludge conveyance equipment, and loading facilities for sludge hauling trucks. All solids dewatering equipment is contained in the solids handling building. Foul air from the centrifuges and solids handling building is exhausted to the north odor scrubber.

Figure 2-27. Sludge Dewatering Process Diagram



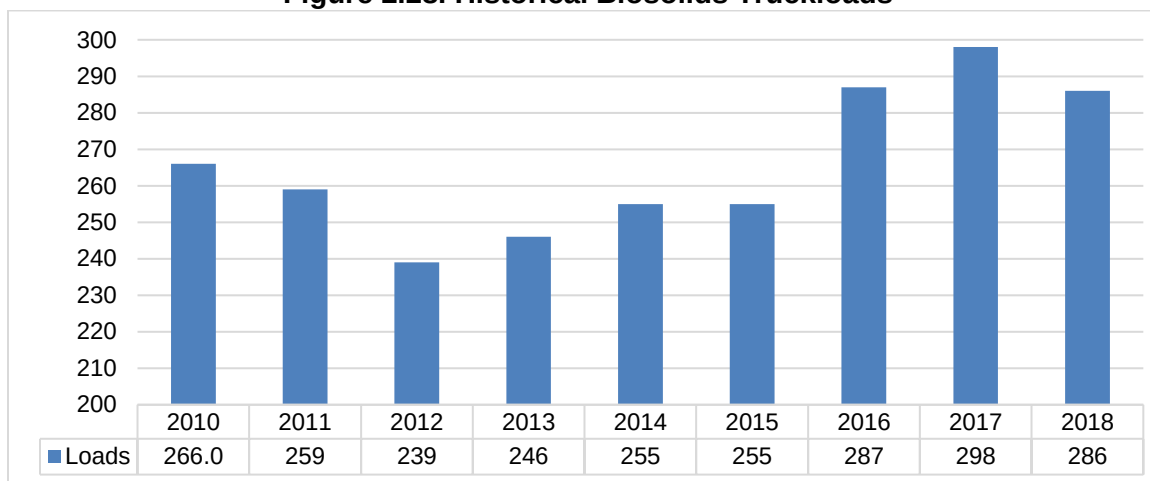
The 1979 facility was completely overhauled in 2018 to include two new Andritz D6LX centrifuges, each with a maximum capacity of 3,500 dry pounds per hour. It is assumed that the units will have a minimum 20-year life, at which time a new project will be initiated to upgrade the system. Firm capacity assumes one unit to remain as a standby to provide full redundancy.

The established level of service requires a truckload to be dewatered in no longer than 12 hours per day, 7 days per week (including centrifuge flushing). For optimum performance, the manufacturer's recommendation is to operate the centrifuges in an approximate range of 60-80% of the design capacity. The system will allow both centrifuges to run simultaneously if needed.

Polymer is added to improve dewatering performance. Dewatered biosolids are discharged from the centrifuges into a screw auger conveyor and transferred to the biosolids hauling trucks for land application. Effluent from the centrifuges (centrate) is drained to a centrate handling facility. Centrate is then metered into the secondary treatment process to control the ammonia loading.

Truck and trailer combination sets are alternatively used to transport biosolids to contracted land application sites in Eastern Washington. The trucks and trailers are all equipped with heavy-duty tarping systems and watertight tailgates to reduce odors and eliminate spillage. Depending on dewatering efficiency, 250 to 350 truckloads of biosolids are delivered for land application every year. The number of loads over the past six years is shown in Figure 2-28.

Figure 2.28. Historical Biosolids Truckloads



2.8.1 Capacity Analysis

With a single unit capacity of 3,500 lb/hr, the system can operate up to 20,000 lb/d for a 40-hour work week, or up to 42,000 lb/d when operated for 12 hours per day. System capacity is projected on Figure 2.29.

Figure 2.28. Dewatering System Capacity Projection

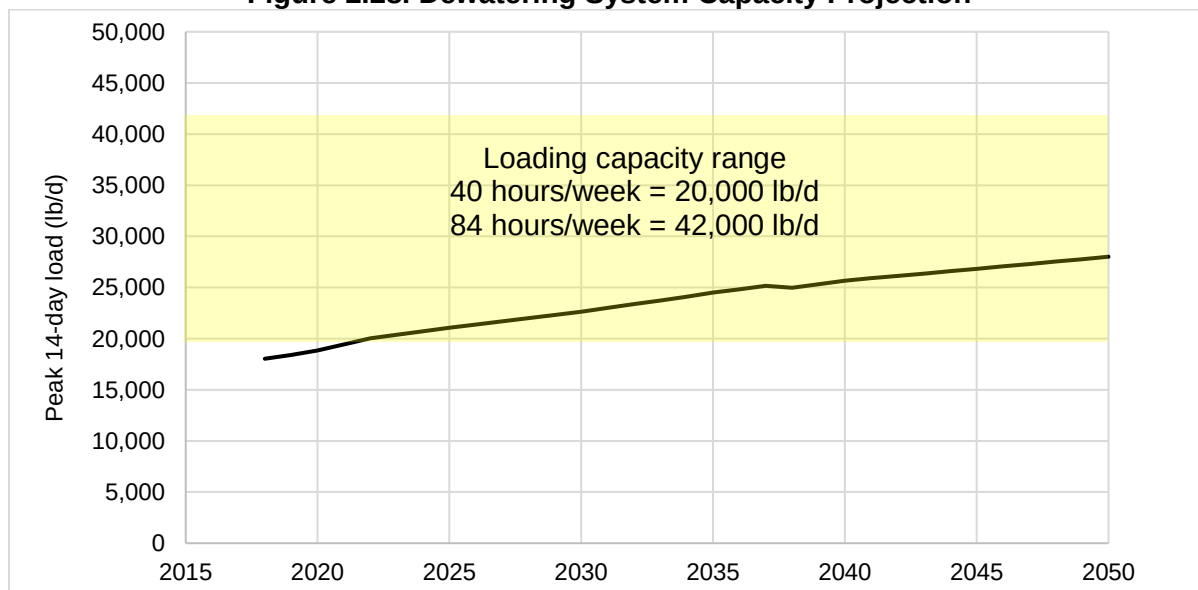


Table 2-22 below provides a summary of the capacity analysis and assumptions for the sludge dewatering system.

Table 2-22. Sludge Dewatering System Capacity Summary

					Condition		Utilization	
Unit Process	Capacity basis	Units	Redundancy Basis	Capacity	Current	2050	Current	2050
Dewatering	Peak 14-day solids loading	lb/hr	Firm	3,500	1,503	2,334	43%	67%

2.8.2 Completed and Planned Projects

Having just completed an overhaul of this system, no future projects are currently planned.

Table 2-23. Completed and Planned Sludge Dewatering Projects

On-line	Name	Cost/Estimate	Status	Description
2018	Sludge Dewatering System Upgrade	\$12,972,813	Completed	Replace existing centrifuges and polymer addition system

2.8.3 Asset Management

A variety of mechanical equipment is involved in the operation of the sludge dewatering system. Major equipment includes the polymer system, sludge transfer pumps, centrifuges, and dewatered sludge conveyors. Table 2-24 lists the current equipment. At the completion of the Sludge Dewatering System Upgrade project, this information will be updated to reflect the new equipment.

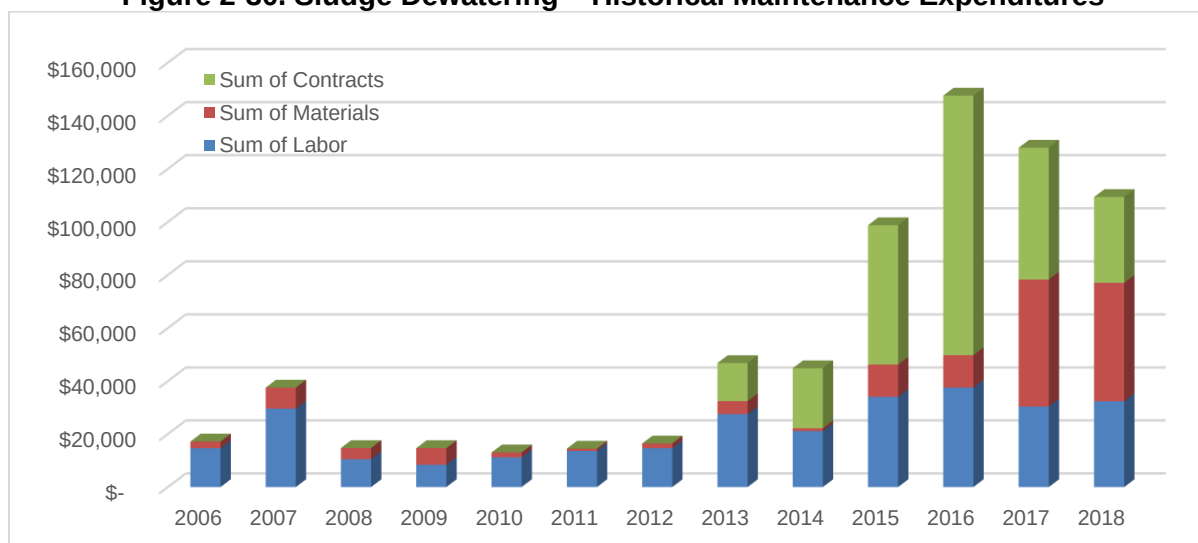
Table 2-24. Existing Sludge Dewatering Equipment

System	Count	Unit capacity	Motor	Date of last upgrade	Risk Score (1-6)
Centrifuges	2	3,500 lb-TS/hr	150 hp	2018	2
Polymer feed pumps	3	50 gpm	5 hp	2018	2
Dewatered Sludge Conveyors	1	variable	10 hp	2018	3

2.8.4 Operations and Maintenance

Sludge dewatering operational costs include labor, energy, chemicals, and disposal. Labor costs are associated with operations staffing requirements for the centrifuges and the associated polymer supply system. Detailed operations and maintenance labor costs are not available at this time. The centrifuges represent the main electrical energy consumer for the sludge dewatering system. Electrical energy is also required to pump the sludge from the digesters to the centrifuges, as well as for operation of the polymer equipment and dewatered sludge conveyance equipment. In addition, sludge dewatering also requires chemicals to enhance performance. LOTT current spends approximately \$180,000 per year on dewatering polymer.

Figure 2-30. Sludge Dewatering – Historical Maintenance Expenditures



2.9 Centrate Management

The centrate handling process removes easily settleable material from the centrate and provides storage for equalizing the ammonia load sent to the biological treatment process. LOTT now uses the original primary sedimentation basins as a dedicated centrate handling facility. This process includes flow measurement, ammonia concentration monitoring, seven rectangular sedimentation tanks modified to provide settling and storage of centrate, three centrate discharge pumps and two centrate sludge pumps as illustrated in Figure 2-31.

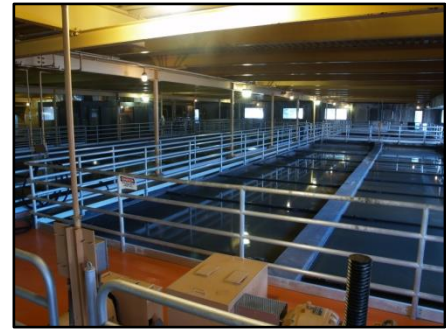
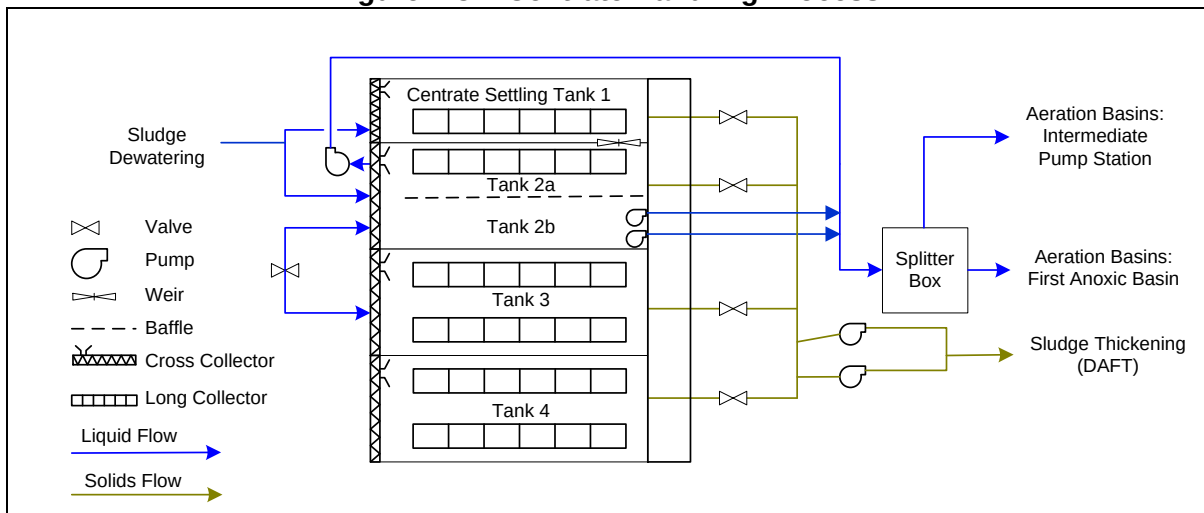


Figure 2-31: Centrate Handling Process



Centrate from the solids dewatering process enters the centrate handling facility through a 12-inch HDPE line. Centrate can be sent to either Centrate Tank 1 or 2a, though during normal operation, flow is directed to Tank 1, where any remaining solids are allowed to settle. Longitudinal collectors move the settled sludge to the sludge hoppers where it is pumped to the dissolved air floatation thickeners (DAFT) via two positive displacement, progressing cavity pumps.

Clarified centrate overflows from tank 1 to tank 2a via a weir at the north end and then flows south through tank 2a and back north through tank 2b. Centrate is metered into either the first aeration or first anoxic basins via the diversion structure via two self-priming centrifugal pumps.

2.9.1 Capacity Analysis

Capacity related to the centrate handling facility is dependent on a variety of factors to include solids dewatering (centrifuging) duration and performance, centrate dilution, the amount and concentration of centrate that can be sent secondary treatment process due to performance issues or compliance periods (i.e. permit discharge limitations).

There are seven tanks, each with a volume of 100,000 gallons, totally 700,000 gallons of storage capacity. The plant produces an average of 50,000 gallons per day of centrate, which is diluted at a ratio of 3:1 to minimize struvite formation. Up to 270,000 gallons of

diluted centrate may be sent to this system on a peak day. During normal operation, only tanks 1,2a and 2b are used. Sufficient pumping and storage capacity is available until a new facility is constructed.

2.9.2 Completed and Planned Projects

A project is scheduled for 2023 to replace the roof structure and odor control system, as well as add covers to the tanks, and make upgrades to the electrical systems.

Future centrate handling or treatment alternative are being evaluated as part of the Budd Inlet Treatment Plant long range planning effort. The timing of this project is arbitrarily linked to expansion of the primary clarifiers, scheduled for 2034.

Table 2-25. Completed and Planned Centrate Handling Projects

On-line	Name	Cost/Estimate	Status	Description
2009	Centrate Metering Pump	\$30,000	Completed	Replace centrate metering pump
2017	Centrate Handling Improvements	\$942,106	Completed	Upgrades the centrate pumping system to include adding two new pumps, instrumentation, and baffles
2023	Centrate Building Rehabilitation	\$4,012,573	Future	Replace roof structure, odor control system, electrical upgrades, and add covers to the tanks
2034	Centrate Handling and Treatment	\$5,000,000	Future	Install new centrate treatment system

2.9.3 Asset Management

Major equipment involved in centrate handling includes: centrate pumps, longitudinal collectors, cross collectors, odor control system, and sludge withdrawal pumps, which are included in Figure 2-31 and summarized in Table 2-26 below.

Table 2-26. Existing Centrate Handling Equipment

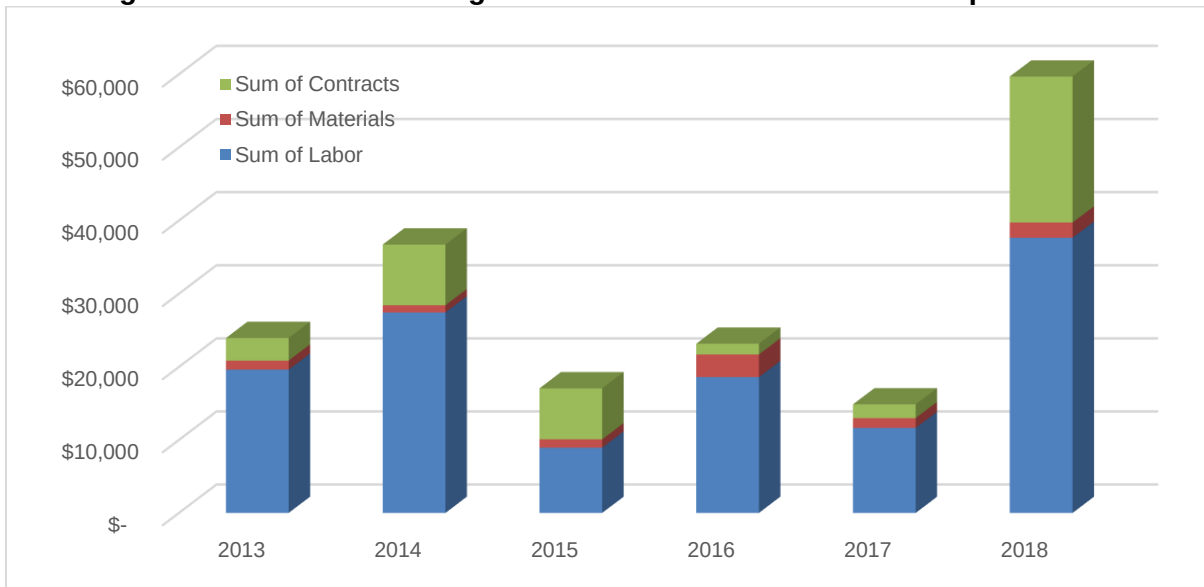
System	Count	Unit Capacity	Motor	Date of Last Upgrade	Risk Score (1-6)
Tanks	7	100,000 gal	NA	1955	3
Cross Collectors	6		0.5 hp	2017	2
Longitudinal Collectors	6		0.75 hp	2009	3
Centrate Pumps	1	250 gpm	7.5 hp	2009	3
Centrate Pumps	2	130-425 gpm	10 hp	2017	1
Sludge Pumps	2	5-90 gpm	5 hp	2017	3

Maintenance costs to include labor, materials, and contracted services captured in LOTT's CMMS are included in Figure 2-31.

2.9.4 Operations and Maintenance

Operational costs for the centrate handling facility include labor and energy. Labor costs are associated with operations staffing requirements for the metering centrate to the secondary process. Electrical energy is required to operate the odor control fans, bottom flights, cross collectors, sludge pumps, and centrate metering pumps. Figure 3-32 includes the maintenance costs from the time it was operated solely for centrate management.

Figure 2-32. Centrate Management – Historical Maintenance Expenditures



2.10 Ongoing and Planned Projects Overview

As described in the previous sections, a number of projects are either planned or currently underway to address anticipated capacity limitations. The following highlights some of the major upcoming projects. For a comprehensive list of planned projects, refer to the 2019-2020 Budget and Capital Improvements Plan.

- The Biological Process Improvements project is currently in the design phase and will optimize the current biological treatment processes at the Budd Inlet Treatment Plant by reconfiguring the existing first aeration basins, as well as reduce the energy required to accomplish nitrogen removal. The improvements include replacing oversized blowers and minimizing recycle pumping, which will reduce power consumption. The project will also optimize methanol addition to the secondary process. Capacity projections for the aeration basins and secondary clarifiers will be reassessed once this project is complete.
- Hydraulic limitations at the influent pump station will be addressed by upsizing the influent pumping forcemain that feeds the primary sedimentation basins. The project is planned for 2036 and will reduce the 2050 risk of bypass to the Fiddlehead Outfall to less than once in ten years.
- With commercial development planned for the neighborhood surrounding the plant, a project to further reduce odors is planned for 2024. This project will involve replacing the old north odor scrubber with new technology that will be more effective in eliminating odiferous constituents and more efficient in balancing airflows. The project will also include improvements to the headworks, solids, and maintenance building air handling capacities.
- Projected limitations in the anaerobic digesters have resulted in an evaluation of long range alternatives. Refurbishment of the existing digesters is planned to be completed by 2024. A project to expand capacity of this system with an additional digester is planned beyond 2039.
- A project to upgrade the UV disinfection system is under construction and is anticipated to be online in December of 2019. The upgrade will provide capacity through 2050.
- The solids thickening process is currently being tested to determine capacity. A conservative estimate projects a capacity limitation in 2044. A study is underway to determine the best long range approach to solids thickening capacity.

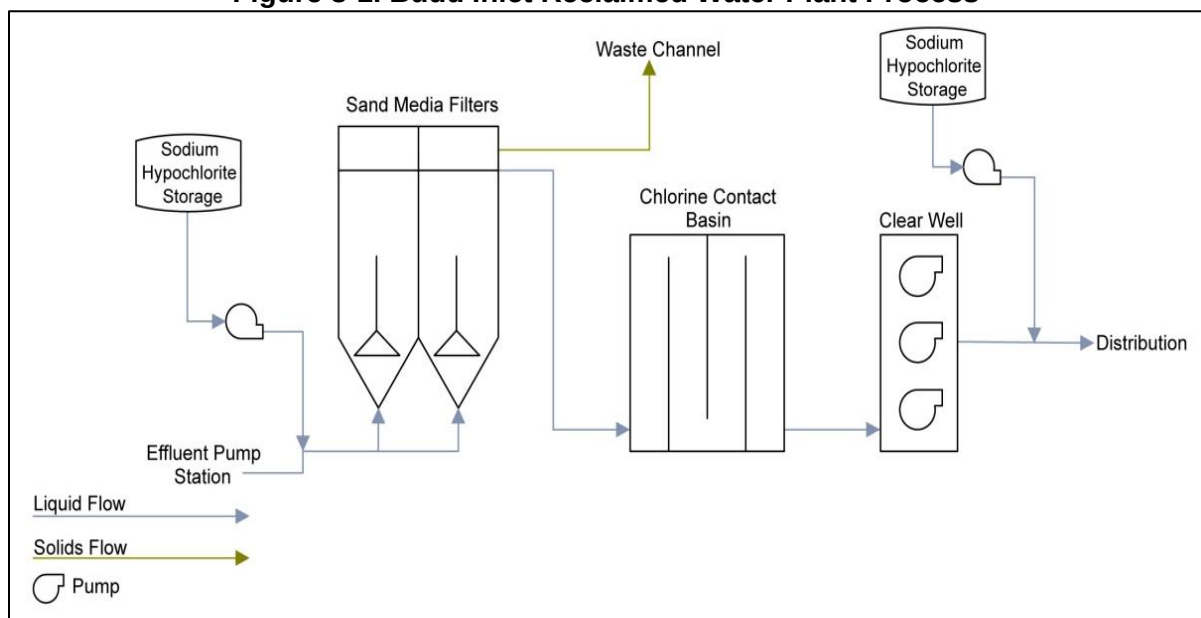
3. Reclaimed Water Production Capacity

Reclaimed water production capacity is an essential component of LOTT's overall treatment program. In response to community questions about residual chemicals from pharmaceuticals and personal care products, LOTT has initiated the multi-year Reclaimed Water Infiltration Study. The study is designed to identify the risks from infiltrating reclaimed water into groundwater because of chemicals that may remain in the water from products people use every day, and determine what can be done to reduce those risks. The study is expected to continue through 2020. The study will provide LOTT and the Board of Directors with data and community perspectives to guide future decisions regarding reclaimed water treatment technologies and uses.

3.1 Budd Inlet Reclaimed Water Plant

The Budd Inlet Reclaimed Water Plant (BIRWP), commissioned in 2004, produces Class A Reclaimed Water using sand media and sodium hypochlorite to filter and disinfect secondary effluent. The facility is capable of treating up to a maximum of 1.5 mgd in the form of three bays of sand filters (0.5 mgd each). Some water is used for internal processes at the Budd Inlet Treatment Plant and the Capitol Lake Pump Station. The City of Olympia also has various customers in the downtown and Port Peninsula area that irrigate using reclaimed water. With the completion of the Tumwater Reclaimed Water Storage Tank in 2015, the City of Tumwater also uses reclaimed water to irrigate the Tumwater Valley Municipal Golf Course. Approximately 206.5 million gallons of reclaimed water were produced and put to beneficial use in 2018.

Figure 3-1. Budd Inlet Reclaimed Water Plant Process



Completed and Planned Projects

In 2015, HDR Engineering was contracted to update the 2010 Budd Inlet Reclaimed Water Plant Reclaimed Water Demand and Supply Analysis report. The update concluded that LOTT is currently able to meet the instantaneous demands of its existing customers. The report also identified potential future users of reclaimed water, which could include the State

Capitol Campus. Expansion of production capacity may be driven by demand for the resource.

A project exists in the capital improvements plan (CIP) to add 1.5 mgd of capacity to this system, allowing for up to 3 mgd of treatment. This project is scheduled for 2040, but may be moved forward as driven by demand for the product.

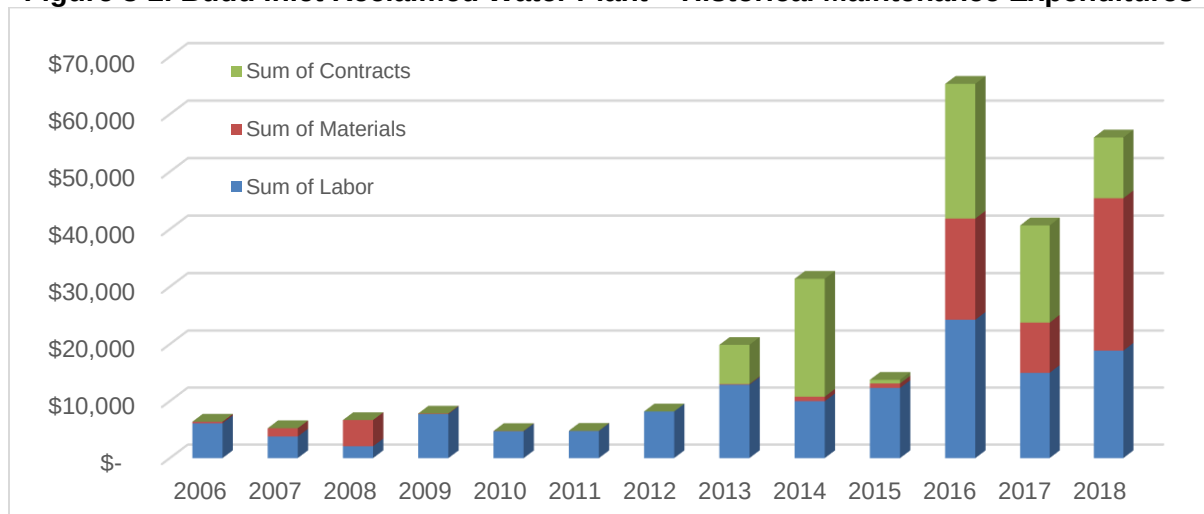
In 2015, a project was completed to replace deteriorating pipes, valves, seals, and flow meters, and upgrade the hypochlorite disinfection system.

Table 3-1. Completed and Planned Project Summary

On-line	Name	Cost/Estimate	Status	Description
2015	BIRWP Improvements	\$425,990	Completed	Upgrades to the existing facility
2040	BIRWP Expansion to 3 mgd	\$8,000,000	Future	Add 1.5 mgd of capacity to existing facility

Historical maintenance costs for the BIRWP are included in Figure 3-2.

Figure 3-2. Budd Inlet Reclaimed Water Plant – Historical Maintenance Expenditures

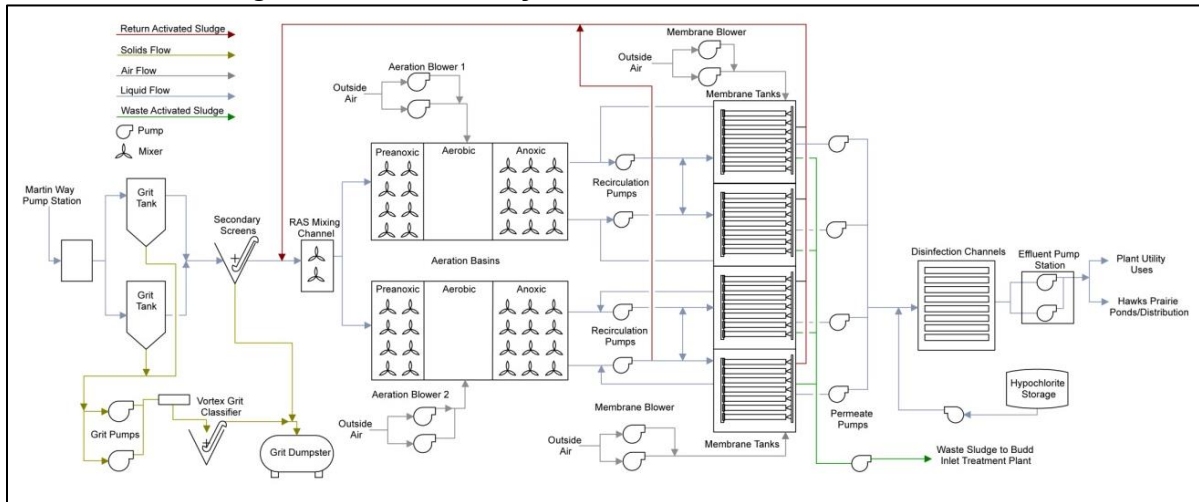


3.2 Martin Way Reclaimed Water Plant

The Martin Way Reclaimed Water Plant (MWRWP) is a membrane bioreactor, treating raw wastewater to Class A Reclaimed Water. The Martin Way Pump Station performs preliminary screening of the raw wastewater, which is pumped to the plant for treatment. The plant has a current treatment capacity of 2 mgd. Reclaimed water produced at the plant is pumped to LOTT's Hawks Prairie Ponds and Recharge Basins for groundwater infiltration. Reclaimed water is also utilized at the Woodland Creek Groundwater Recharge Facility, a water rights mitigation project developed by the Cities of Lacey and Olympia.

In 2018, the MWRWP produced 447 million gallons of reclaimed water, of which 336 million gallons was diverted to the Hawks Prairie Ponds, 117 million gallons to the Woodland Creek Groundwater Recharge Facility, and the remainder was used for internal processes at the Martin Way treatment plant and pump station.

Figure 3-3. Martin Way Reclaimed Water Plant Process



The MWRWP is designed to be expandable up to 5 mgd of treatment capacity with additional construction at the site. Process tanks for the 3rd mgd of treatment capacity were included as part of the original construction project. Additional property adjacent to the site shown in Figure 3-4 was secured from the City of Lacey through a perpetual easement and provides enough space to expand the capacity to 8 mgd if needed.

Figure 3-4. Martin Way Reclaimed Water Plant Expansion Easement



The current plan is to expand the plant as soon as there are sufficient raw wastewater flows at the Martin Way Pump Station. Based on the updated flows and loadings projections this may not occur until 2038.

Flow availability is largely dependent on the septic conversion schedule for the City of Lacey. There are roughly 24,800 parcels within the service boundary of the Martin Way Pump Station, which feeds the MWRWP. Of those parcels, 12,700 are sewered, 9,400 have on-site septic systems, 700 are vacant, and 2,000 are undeveloped. In terms of flow, there

is 2.2 mgd of base flow currently discharging to on-site septic systems within this basin. The current model projects that 3,600 septic parcels in this basin will be sewered by 2050 (38% of total). At that point, approximately 2 mgd of base flow will discharge to on-site systems. The City of Lacey assumes 2% a year will be connected to the system in their 2015 Sewer Comprehensive Plan update.

Table 3-2 lists the timing of flow availability to the MWRWP. These projections are based on the assumption that parcels with existing septic tanks in the Tanglewilde and Thompson Place areas will be 60-70% connected to sewer by 2050. Projections also include 500,000 gallons a day reserved as base flow in the system to ensure sufficient flow remains in the sewers to convey waste activated sludge from the reclaimed water plant to the Budd Inlet Treatment Plant.

Table 3-2. Flow Availability for the Martin Way Plant¹

Flow (mgd)	Year	
	Without Flow Equalization	With Flow Equalization
1	Existing	Existing
2	Existing	Existing
3	2038	2023
4	--	2035
5	--	2047

1. Allows for 500,000 gpd of base flow remaining in the system.

Production capacity at the MWRWP could potentially be increased with the addition of flow equalization capacity at the plant. Excess flow during the day could be sequestered for treatment at night, resulting in a relatively constant flow to the membranes. Flow equalization would therefore eliminate the constraint of overnight low flows. Figure 3-5 demonstrates the extreme amount of variability, as overnight flow reaches as low as 40 percent of the daily average.

Figure 3-5. Diurnal Flow at the Martin Way Pump Station

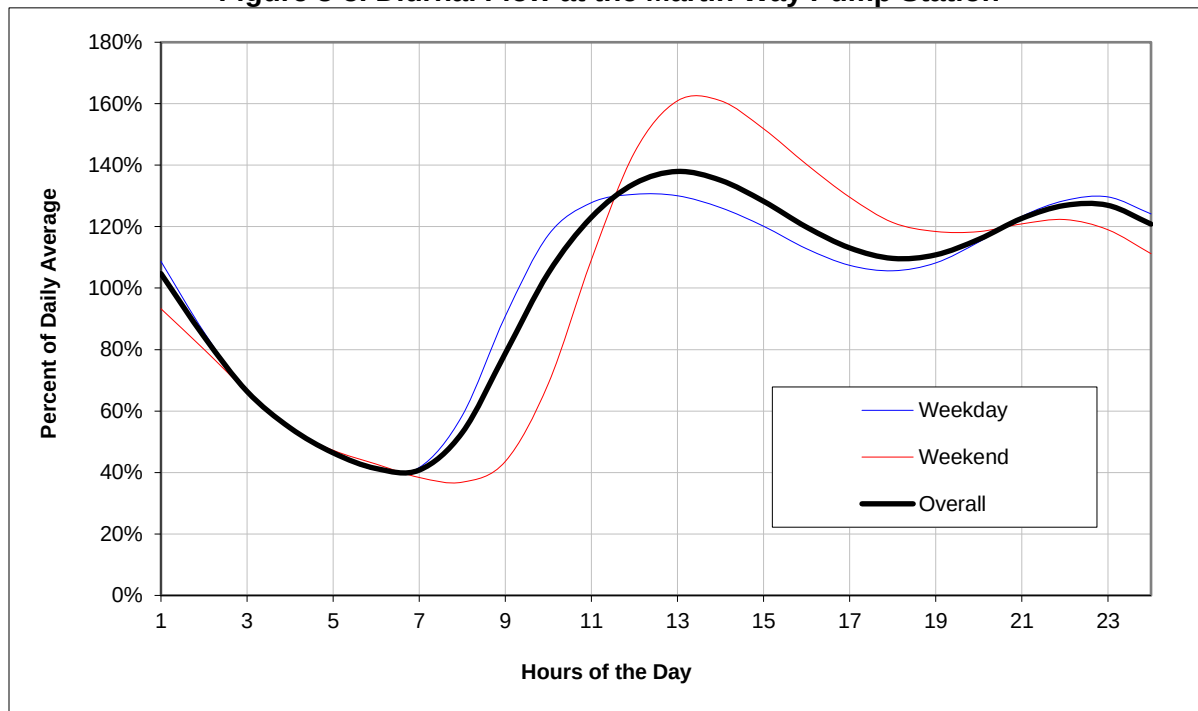
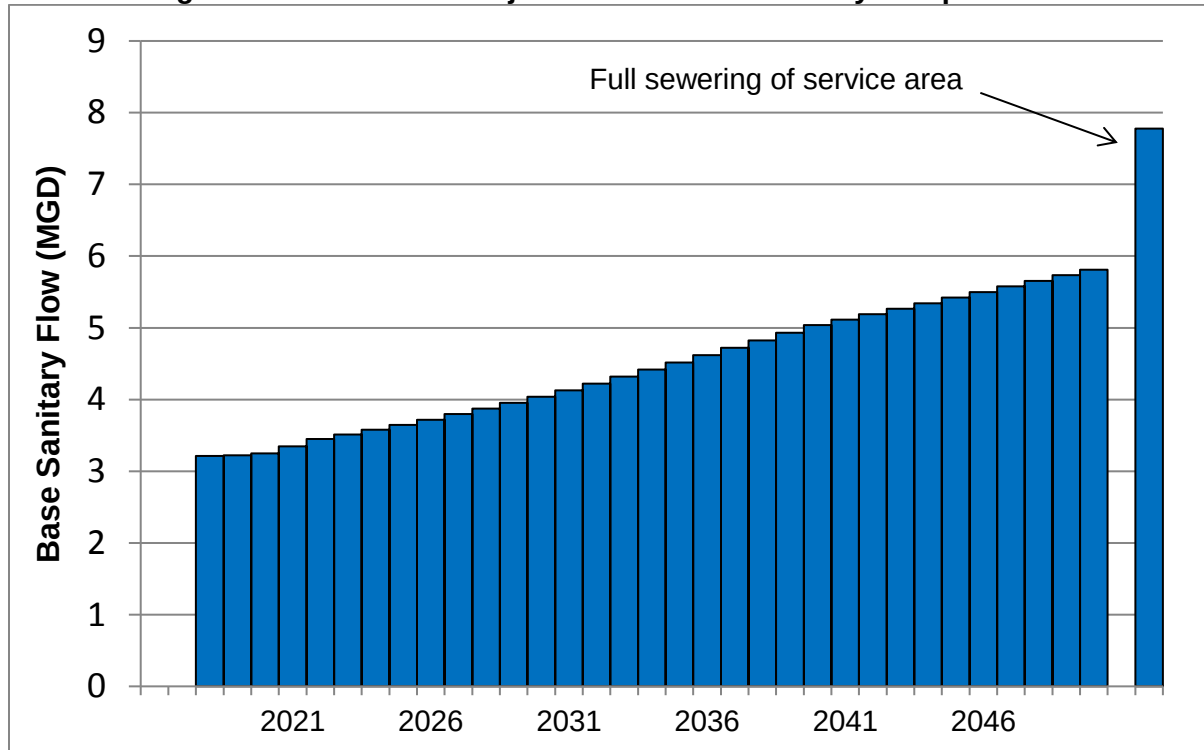


Figure 3-6 depicts the base sanitary flow projection at the Martin Way Pump Station. Up to 5 mgd will be available at this location by 2050, with another 2 mgd added with full septic system conversion. Even during the summer, there is likely to be some component of inflow and infiltration, meaning that actual average daily flows should be slightly higher than those included in this evaluation.

Figure 3-6. Base Flow Projections at the Martin Way Pump Station



Completed and Planned Projects

Consistent and reliable operation of the facility is increasingly important now that the Woodland Creek Groundwater Recharge Facility is on-line. The Martin Way Reclaimed Water Plant Improvements project will include additional blower and screenings capacity and replacement of aging process valves and equipment to improve reliability and process control. The project is scheduled to be completed in 2023.

It is anticipated that replacement of the existing membranes will also be included in the project as they will be due for replacement in 2023 based on the original estimated useful life. The membrane performance has been good and may last longer than originally expected. LOTT will continue to monitor efficiency and update the timing of replacement as necessary.

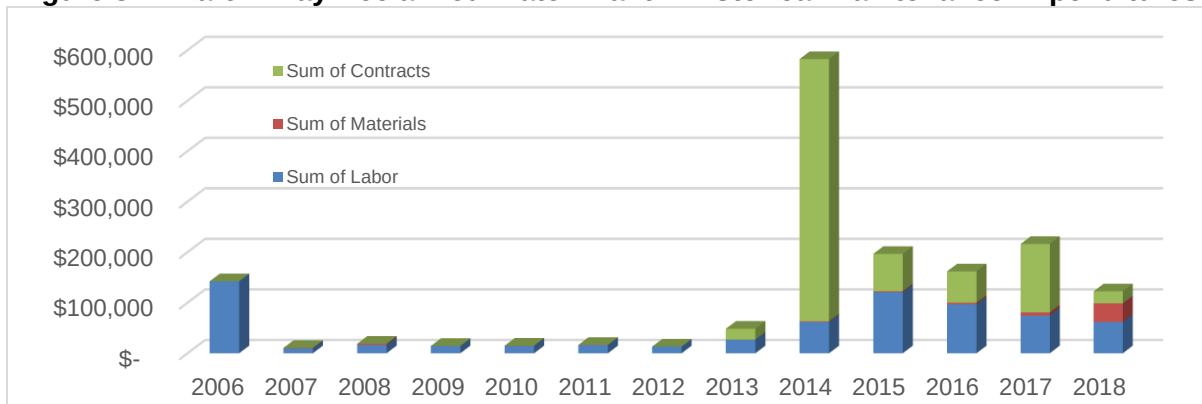
Expansion to the 3rd mgd of treatment capacity is currently scheduled for 2038. Whether this expansion includes flow equalization has yet to be determined, and this decision may impact the timing of the project.

A project to add the 4th and 5th mgd is included in the CIP for planning purposes, however expansion could be driven by reclaimed water demand or by changes to the regulatory environment.

Table 3-3. Completed and Planned Project Summary

On-line	Name	Cost/Estimate	Status	Description
2006	2 mgd Plant	\$25,798,818	Complete	Original plant construction
2010	Huber Drum Screen	\$720,000	Complete	Added secondary fine screens
2014	MWRWP Membrane Upgrade	\$2,674,297	Complete	Upgrades to the existing facility
2018	Waste Activated Sludge (WAS) Pump upgrades	\$462,372	Complete	Replaced two WAS pumps and associated controls
2023	MWRWP Improvements	\$8,478,244	Future	Upgrades to the existing facility
2023	MWRWP Membrane Filter Replacement	\$2,094,657	Future	Replace the membrane filters at the end of their service life
2038	MWRWP 3rd mgd Equipment	\$6,600,000	Future	Add equipment to bring facility capacity to 3 mgd.
2045	Martin Way to Hawks Prairie Pipeline Expansion	\$11,100,000	Future	Expand conveyance capacity
2047	MWRWP 4th and 5th mgd	\$33,300,000	Future	Expand facility to 5 mgd

Historical maintenance costs are included in Figure 3-7.

Figure 3-7. Martin Way Reclaimed Water Plant – Historical Maintenance Expenditures

3.3 Mullen Road Reclaimed Water Plant

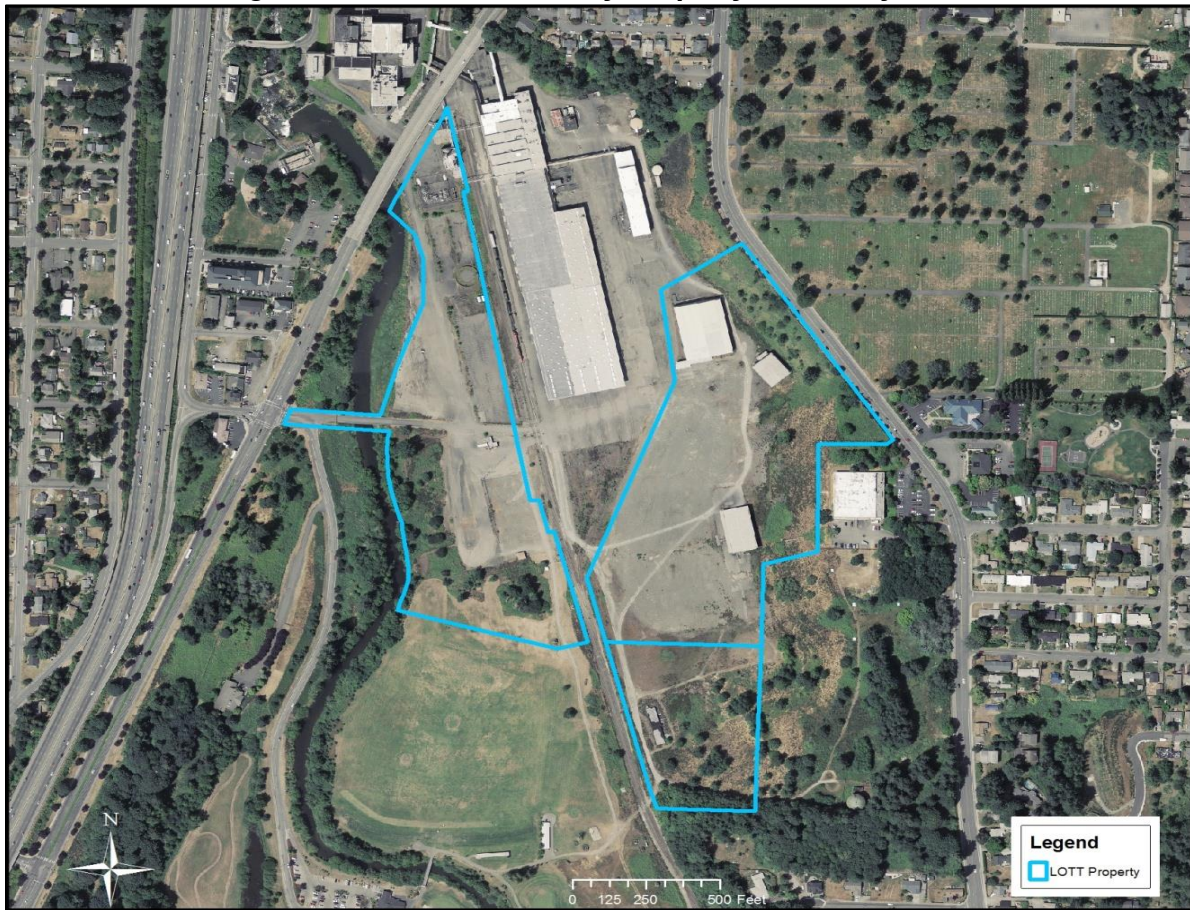
Based on the updated flows and loadings projections, it was determined that the Mullen Road Reclaimed Water Plant will not be needed. LOTT is thus far retaining the property in the event that projections change.

3.4 Deschutes Valley Reclaimed Water Plant

LOTT owns approximately 45 acres of the former brewery property in the Deschutes River Valley as a location for a potential future reclaimed water plant (Figure 3-8). The facility could draw raw sewage from Tumwater and portions of southeast Olympia or treat secondary effluent from the Budd Inlet Treatment Plant. Depending on regulatory constraints and/or demand, product quality could range from Class A Reclaimed Water to water suitable for direct potable reuse.

LOTT initiated a Deschutes Valley master planning effort in 2014 to guide the use and ultimate development of the property. The first phase of the effort involved coordination with ongoing planning efforts with the City of Tumwater and local stakeholders, evaluation of existing infrastructure, completion of an environmental and hydraulic site characterization, and development of plant layout alternatives.

Figure 3-8. Deschutes Valley Property Owned by LOTT



Several near-term site improvements, including removal of several degraded structures, were recommended as part of the first phase of the plan. Further work on the property master plan has been postponed due to uncertainties related to future capacity projections and site development. Plans for the site may change as a result of the long-term system-wide planning effort initiated in 2018. For example, if it is determined that there is adequate space within the Budd Inlet Treatment Plant footprint to accommodate future expansion of reclaimed water production, a separate reclaimed water facility at the Deschutes Valley site may not be necessary. LOTT is thus far retaining the property to maintain flexibility in meeting future system capacity needs.

Table 3-4 includes planned projects at the Deschutes Valley property. Work in 2018-2020 includes removal of several buildings to limit liability while the property remains undeveloped.

Table 3-4. Completed and Planned Project Summary

On-line	Name	Cost/Estimate	Status	Description
2015	Deschutes Valley Master Planning	\$400,000	Suspended	Develop master plan for Tumwater property reserved for future treatment facilities
2018-2020	Demolition of Select Structures	\$224,000	Active	Demolish several buildings to limit liability while site remains undeveloped
2019	Hazardous Materials Assessments for Remaining Buildings	\$22,000	Active	Complete assessments and develop cost estimates for potential demolition of additional high-risk buildings

4. Discharge Capacity

All of the flow generated within the LOTT system must ultimately be discharged or beneficially used. At the BITP, final effluent is discharged to Budd Inlet. Reclaimed water is reused at LOTT facilities and distributed to LOTT partner cities for beneficial reuse by a variety of users. Reclaimed water is also used to replenish groundwater at LOTT's Hawks Prairie Ponds and Recharge Basins and Lacey/Olympia's Woodland Creek Groundwater Recharge Facility. LOTT will continue to identify and evaluate potential properties for purchase that are suitable for additional infiltration/disposition facilities to meet build out condition requirements.

Reclaimed water produced at the Budd Inlet Reclaimed Water Plant and the Martin Way Reclaimed Water Plant is also available for distribution to the partner jurisdictions and their reclaimed water customers. However, for planning purposes, purveyed Class A Reclaimed Water will not be included in the analysis of the LOTT system discharge capacity, as it cannot be assumed that these uses will be consistently available.

4.1 Budd Inlet Outfall Permit Limitations

Based on LOTT's existing National Pollutant Discharge Elimination System (NPDES) Permit, discharge limitations to Budd Inlet are based on both concentration as well as loadings (pounds per day). Primary loading limitations include biological oxygen demand (BOD), total suspended solids (TSS), and total inorganic nitrogen (TIN). The existing permit was issued on February 16, 2018 with an expiration date of March 31, 2023. Table 4-1 lists the loadings-based permit limitations.

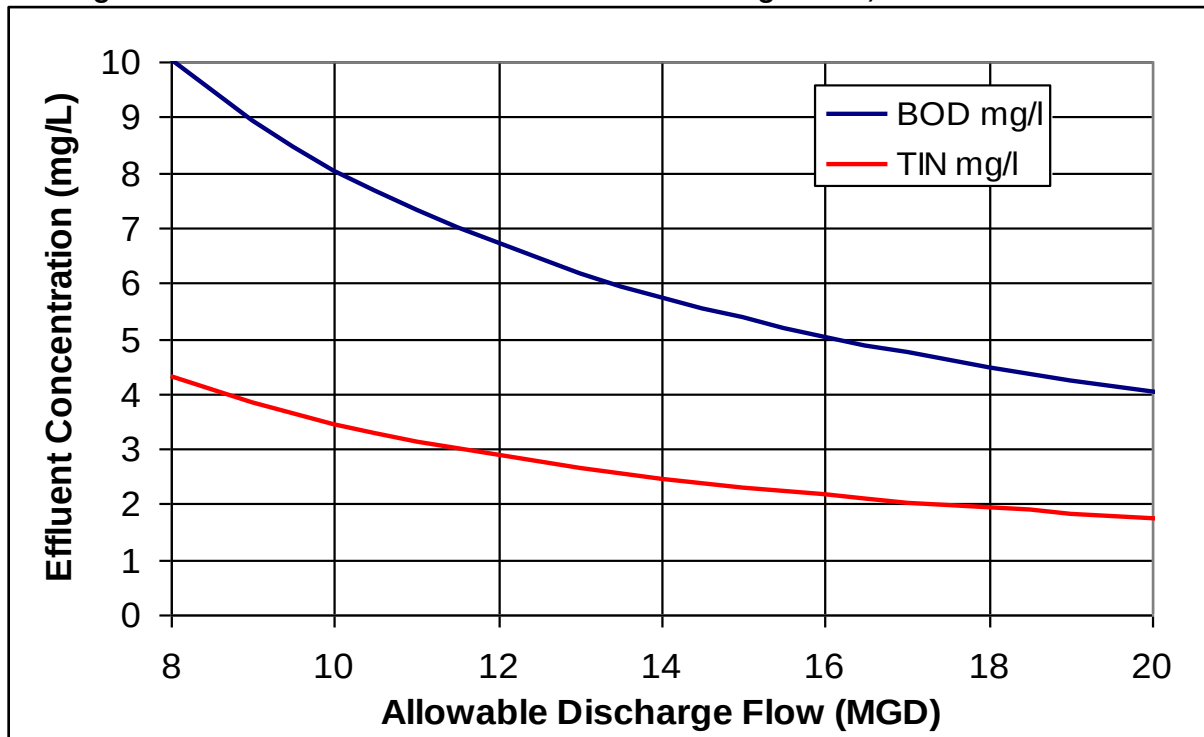
Table 4-1. Budd Inlet Treatment Plant NPDES Discharge Limits (lbs/d)

Parameter	Winter		Shoulder		Summer	
	(November-March)		(April, May, and October)		(June-September)	
	Monthly	Weekly	Monthly	Weekly	Monthly	Weekly
BOD (lbs/day)	5,640	8,460	900	1,350	671	1,006
TSS (lbs/day)	5,265	7,898	5,265	7,898	5,265	7,898
TIN	-	-	3 mg/L, 338 lbs/day		3 mg/L, 288 lbs/day	
Ammonia (as N)	26 mg/L	36 mg/L				

The amount of allowable flow to be discharged to Budd Inlet is based on the level to which the wastewater is treated. By treating wastewater to lower effluent concentrations of BOD and TIN, greater discharge capacity can be achieved.

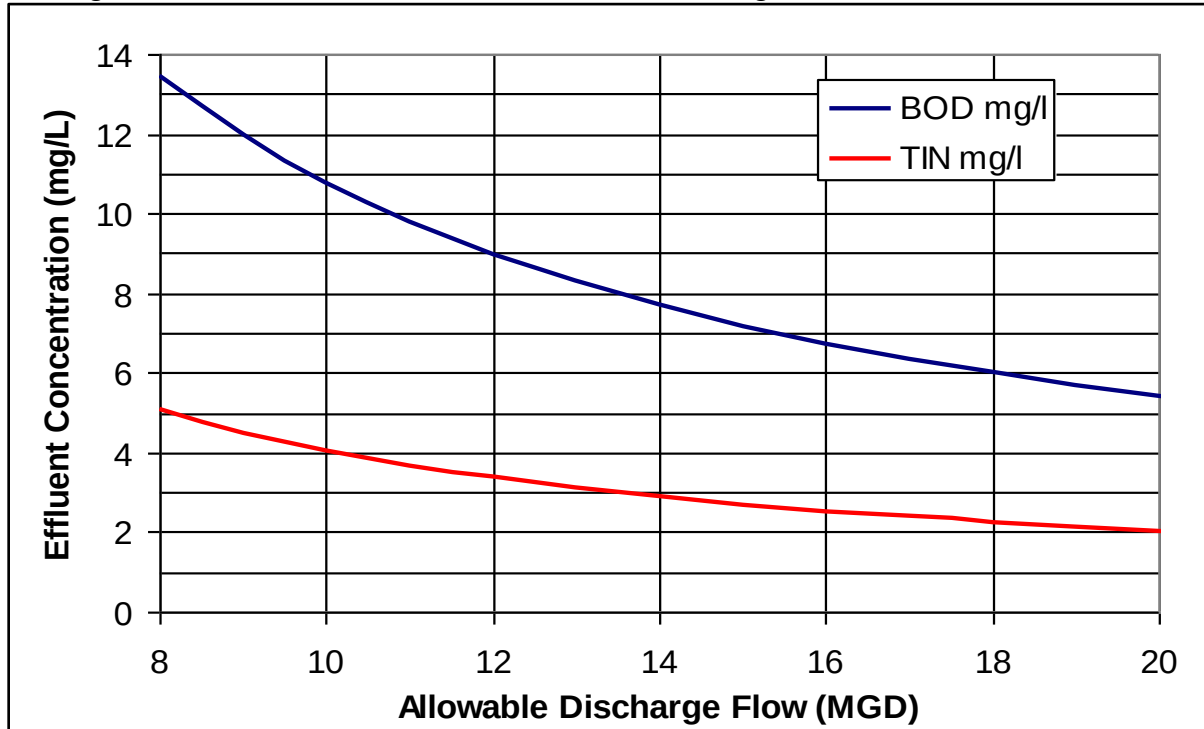
The two primary discharge limitations versus flow for the two seasonal conditions, summer and shoulder, are plotted in Figures 4-1 and 4-2.

Figure 4-1. Effluent Concentration versus Discharge Flow, Summer Condition



The allowable discharge is:
 $\text{mgd} = 671 \text{ lbs/d BOD} \div x \text{ mg/L BOD} \div 8.34$ (based on BOD)
 $\text{mgd} = 288 \text{ lbs/d TIN} \div x \text{ mg/L TIN} \div 8.34$ (based on TIN)

Figure 4-2. Effluent Concentration versus Discharge Flow, Shoulder Condition



The allowable discharge is:
 $\text{mgd} = 900 \text{ lbs/d BOD} \div x \text{ mg/L BOD} \div 8.34$ (based on BOD)
 $\text{mgd} = 338 \text{ lbs/d TIN} \div x \text{ mg/L TIN} \div 8.34$ (based on TIN)

4.2 Budd Inlet Treatment Plant Biological Process Improvements

LOTT is currently in the design phase of a project to upgrade its secondary biological treatment system. The existing biological nutrient removal process requires recirculation of treated water between two process areas in the plant. The proposed improvements will reconfigure the existing process. The benefits include reducing recycle-pumping rates, increasing process control with additional instrumentation, and freeing up valuable space on the plant site for additional treatment processes in the future.

A better understanding of the potential effect on LOTT's treatment capacity will not be available until the project is completed and has been in operation for several years. However, it is anticipated that the project will improve performance and efficiency.

The current NPDES permit is based on loadings (pounds per day) of biological oxygen demand (BOD) and nutrients in the form of total inorganic nitrogen (TIN). By increasing the efficiency of the treatment process (lowering the effluent loadings concentration), LOTT could potentially regain discharge capacity to Budd Inlet.

Table 4-2 summarizes the plant's current performance relative to its existing NPDES permit.

Table 4-2. Budd Inlet Treatment Plant Final Effluent Levels (mg/L)

Parameter/Season	NPDES Permit Limits	Average 2018	Maximum Month 2018
TIN (mg/L)			
Summer	3.0	2.45	2.70
Shoulder	3.0	1.73	1.93
BOD (mg/L)			
Summer	7.0	4.05	5.86
Shoulder	8.0	4.15	5.61
Winter	30	5.64	7.78
TSS (mg/L)			
Winter	30	6.31	6.70

In addition to the NPDES permit limitations, LOTT reserves 1.5 mgd of treatment capacity as an added measure of safety in measuring operational capacity. This serves two purposes: 1) allows for additional operational flexibility during peak flow events, minimizing the likelihood of a permit violation; and 2) protects the system from unanticipated rapid population growth and/or delays in the construction of new treatment capacity.

Figures 4-3 through 4-6 show the plant's BOD and TIN performance in terms of both concentration and loading for 2018. The plant has met BOD and TIN regulations throughout this period. While LOTT strives to perform at discharge levels well below those required by permit, it is important to note that:

- Operational conditions and performance vary considerably due to factors outside of LOTT's control, such as temperature. Therefore, the existing buffer between permit limits and performance levels is necessary to ensure continued permit compliance.
- LOTT is responsible for management of wastewater from our partner jurisdictions, and they in turn are responsible for accommodating growth. By enhancing the performance of the Budd Inlet Treatment Plant, LOTT gains capacity in the system that will be necessary to responsibly manage community growth in the future.

Figure 4-3. Monthly Final Effluent BOD Compared to Permit

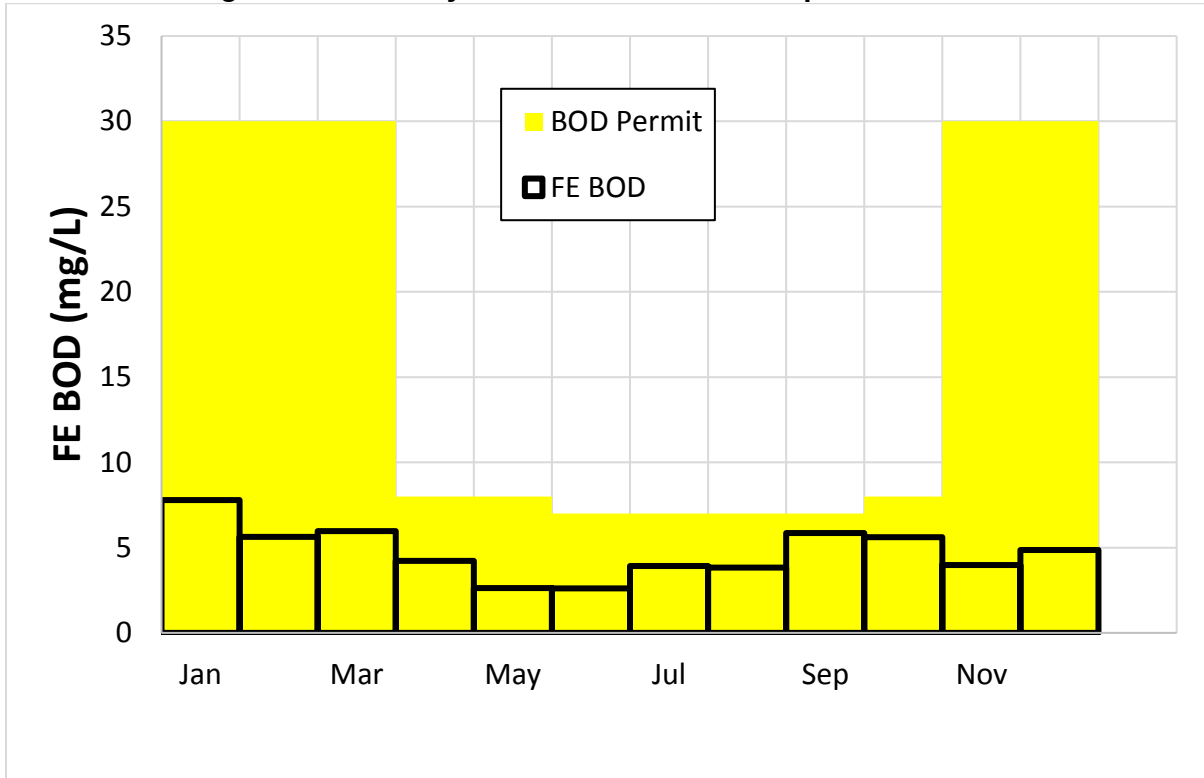


Figure 4-4. Monthly Final Effluent TIN Compared to Permit

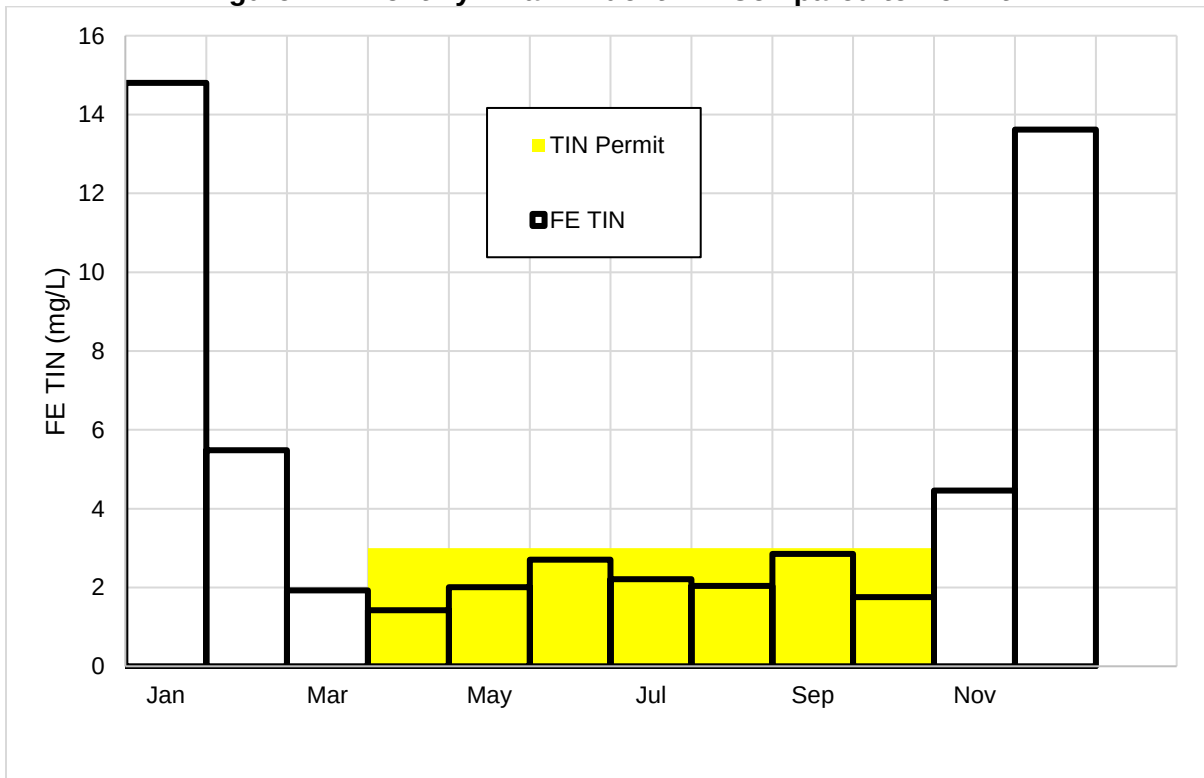


Figure 4-5. Monthly Final Effluent BOD Load Compared to Permit

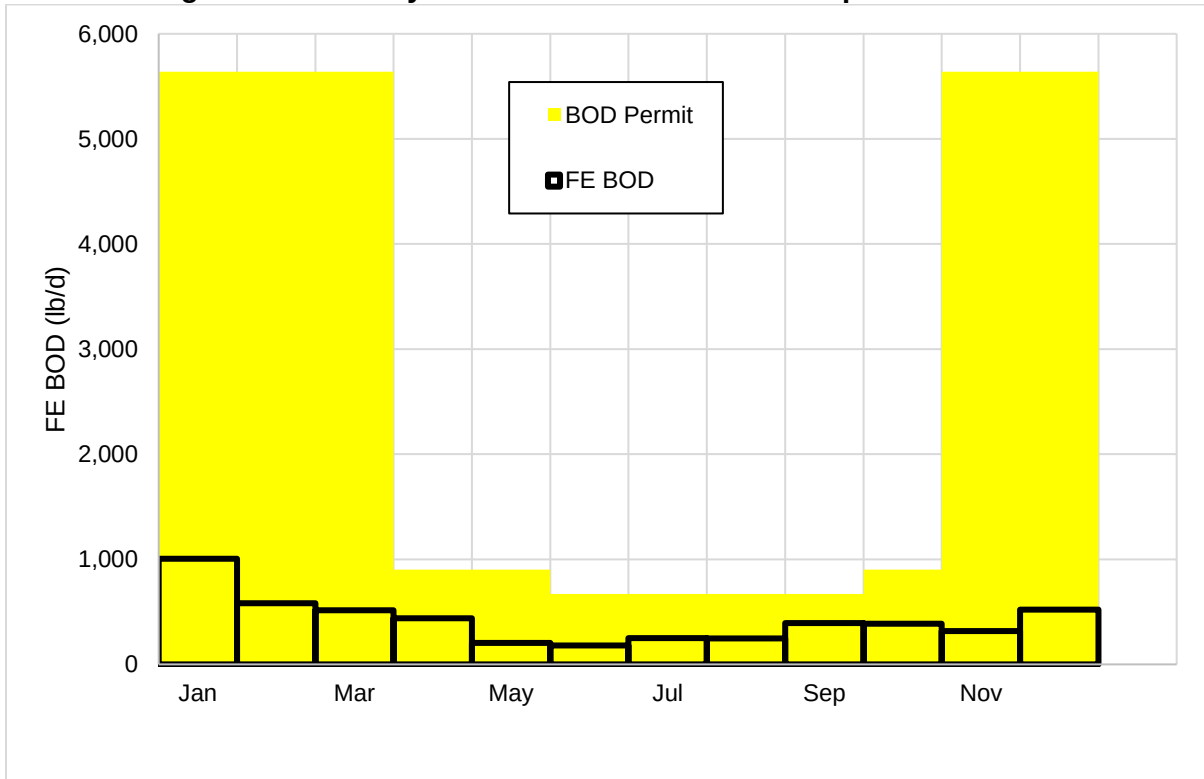
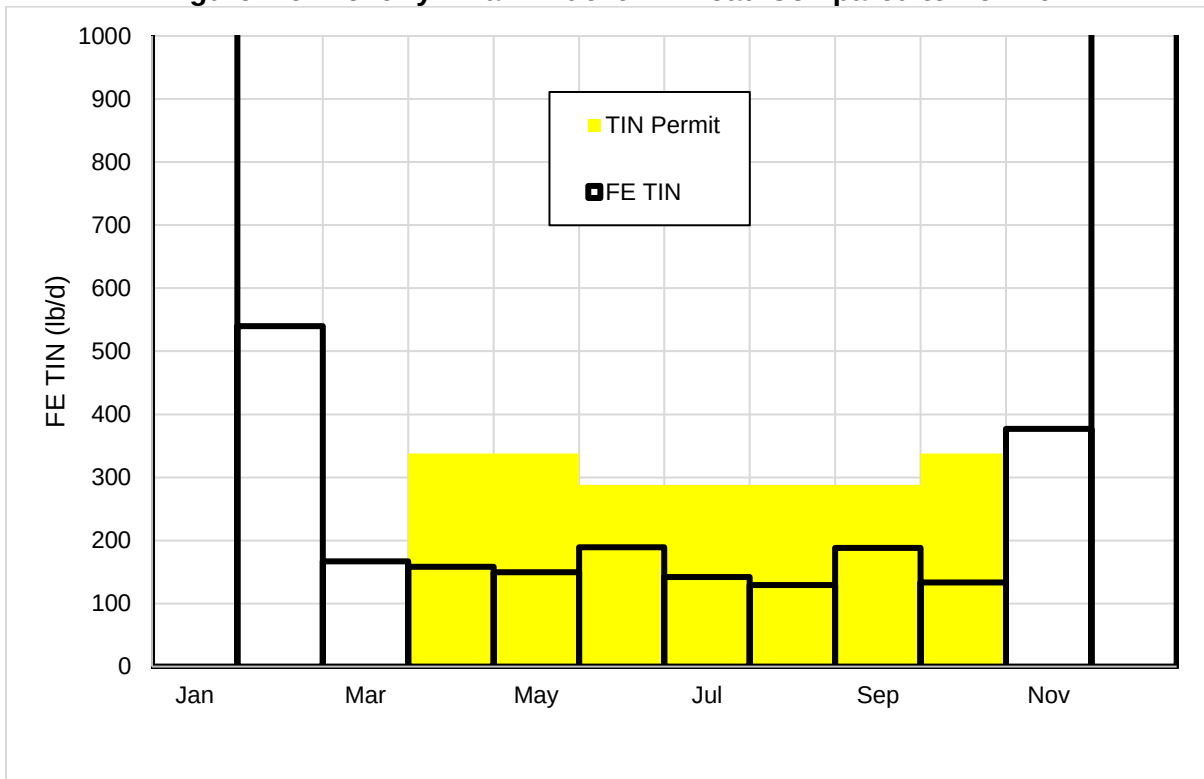


Figure 4-6. Monthly Final Effluent TIN Load Compared to Permit

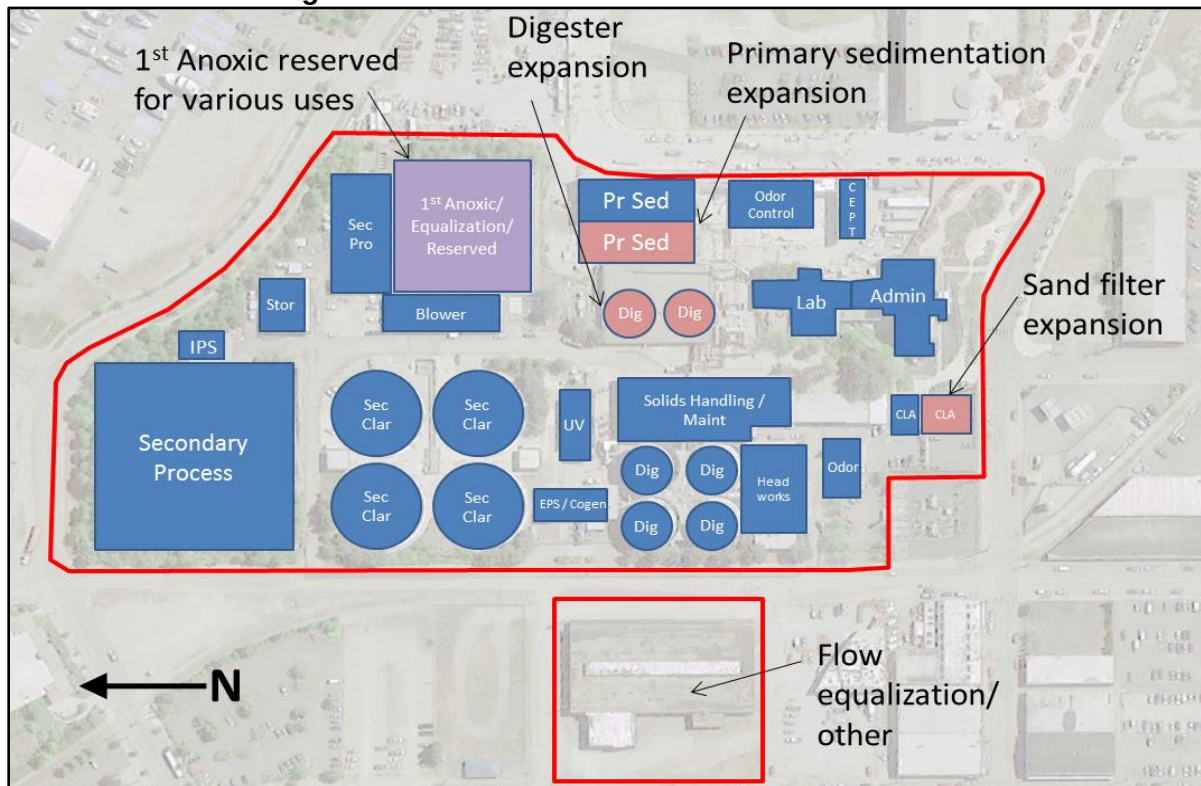


4.3 Budd Inlet Treatment Plant Site Planning

LOTT has begun initial work on a long-term master planning effort which will be conducted in two phases. The first phase will evaluate the Budd Inlet Treatment Plant footprint and update the site plan, locating various treatment processes. An example site plan for the plant is presented in Figure 4-7.

The second phase will reevaluate LOTT's reclaimed water production, distribution, and disposition program. This planning takes into account that system capacity requirements have decreased, and that community use and demand for reclaimed water has increased since LOTT's original Wastewater Resource Management Plan (1999) and Budd Inlet Treatment Plant Master Plan (2006) were completed.

Figure 4-7. Budd Inlet Treatment Plant Site Plan



4.4 Budd Inlet Discharge Capacity Analysis

Discharge capacity planning involves projecting a reasonable level of performance to allow compliance with the load-based BOD and TIN limits. Operation at the permitted concentrations would restrict the amount of discharge to Budd Inlet to 11.5 mgd in the summer (from Figures 4-1 and 4-2). In 2018, the average summer flow generated in the LOTT system was 10.9 mgd. However, Budd Inlet discharge was held well below permit levels as shown on Figures 4-5 and 4-6. This was due to three factors:

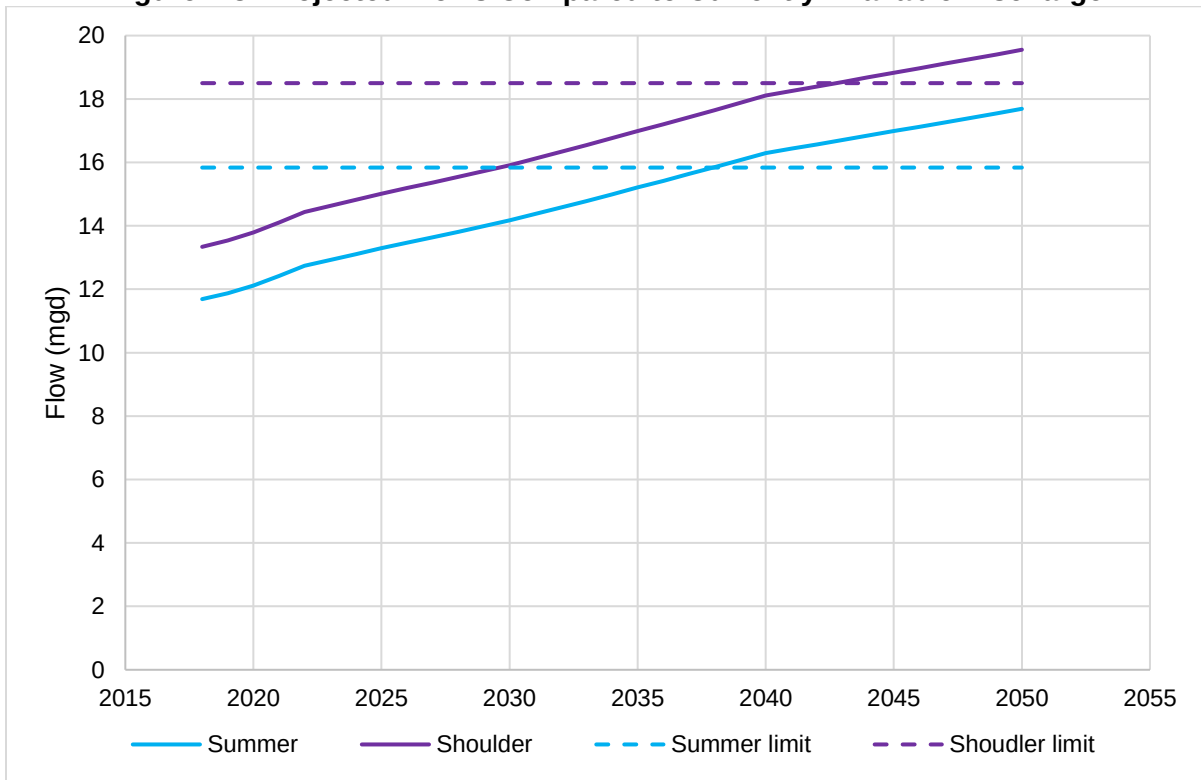
1. Reclaimed water production at the MWRWP and end uses in Lacey
2. Reclaimed water production at the BIRWP and end uses in Olympia and Tumwater
3. Effluent concentrations lower than permit regulation (Figures 4-3 and 4-4)

LOTT's approach to planning includes a number of assumptions—some conservative, some expedient. These assumptions include the following:

- A reserve of 1.5 mgd capacity is maintained, year-round.
- Credit for reclaimed water production is only applied where groundwater recharge is available. Other end-uses are not assumed to be guaranteed, and are therefore not considered.
- Effluent concentrations at the Budd Inlet treatment plant may average 5 mg/L for BOD and 2.25 mg/L for TIN during summer and shoulder seasons. While these values are used for this analysis, the plant is not expected to always perform at these target levels, due to the inherent variability in operational conditions.

With these assumptions in hand, an analysis was performed to determine when the first operational discharge limitation would occur during average flow conditions for each of the compliance periods. Figure 4-8 depicts the projected system-wide summer and shoulder season flow, plotted against the amount of discharge currently available in the system. This includes 2 mgd of discharge at the Hawks Prairie Ponds/Recharge Basins, and 1.5 mgd of reserve capacity, and assumed BITP discharge at the concentrations assumed above.

Figure 4-8. Projected Flows Compared to Currently Available Discharge

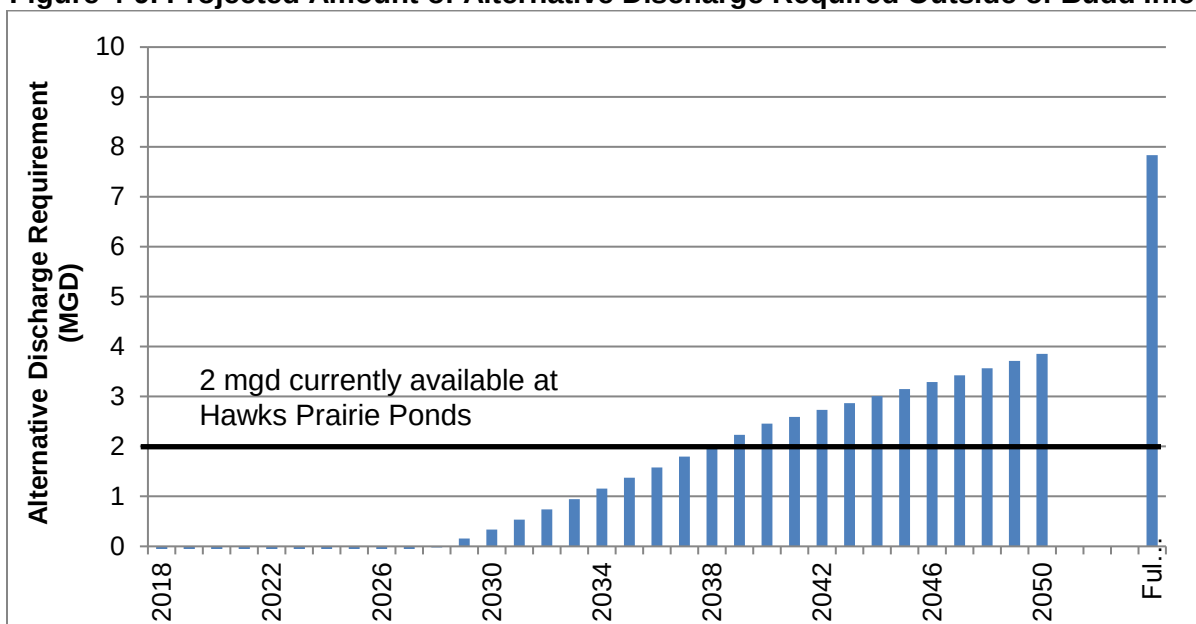


Note: assumes 2 mgd of discharge at Hawks Prairie Ponds and 1.5 mgd of reserve capacity

The figure shows that the system will become limited in 2038. This limitation is driven by the summer TIN regulation. The shoulder season limitation is not projected until 2043.

For discharge planning, Figure 4-8 may be translated into a plot showing the amount of alternative discharge required, based on the assumptions listed above. This is plotted on Figure 4-9.

Figure 4-9. Projected Amount of Alternative Discharge Required Outside of Budd Inlet



Note: maintains 1.5 mgd of reserve capacity

This figure also shows the limitation arising in 2038, and estimates that a total of 4 mgd of discharge capacity will need to be in place by 2050, and up to 8 mgd for the full connection scenario.

4.5 Alternative Discharge Planning

There are several approaches to alternative discharge. These include the following:

- Non-potable reuse (NPR), which includes consumption of reclaimed water by end-users for irrigation or industrial uses
- Environmental uses, which include streamflow or surface water augmentation and wetland enhancement
- Indirect potable reuse (IPR), which includes:
 - Groundwater recharge through soil percolation
 - Direct injection to groundwater
- Direct potable reuse (DRP), which involves discharge to a potable water distribution system

Reclaimed water currently generated at the BIRWP and MWRWP is primarily used for irrigation, process water at LOTT facilities, and groundwater recharge.

In its capital program, LOTT has general plans to generate up to 8.0 mgd of alternative discharge by 2050, which is more than the projected requirement per Figure 4-9. The purpose of additional generation is to reduce risk, and to satisfy end-user demand.

4.5.1 Reclaimed Water Treatment

Existing treatment facilities include the BIRWP and the MWRWP. These sites generate Class A Reclaimed Water, suitable for NPR, environmental uses, and groundwater recharge.

The BIRWP has a current treatment capacity of 1.5 mgd, which is sufficient to meet the demand of existing reclaimed water customers. Construction of the Tumwater Reclaimed Water Tank has allowed LOTT to meet instantaneous demands and allows for more reliable delivery to LOTT existing users. Community demand for reclaimed water in the area may drive expansion of the BIRWP. Potential users may include the State Capitol Campus. In 2016, Gray and Osborne Consulting Engineers completed the Capitol Campus Reclaimed Water Assessment. The estimated cost was \$2,427,000 to construct the necessary infrastructure to provide service to the campus.

The MWRWP treats raw sewage generated in Lacey. Reclaimed water from this facility is primarily used for groundwater recharge at LOTT's Hawks Prairie Ponds and Recharge Basins, and by the Cities of Lacey and Olympia for water rights mitigation through their Woodland Creek Groundwater Recharge Facility. The plant is currently able to treat up to 2.0 mgd of reclaimed water, and the process basins are in place to expand capacity to 3.0 mgd with equipment installation. Further expansion to 5.0 mgd is programmed into the existing facility design. LOTT may ultimately expand the facility to 8.0 mgd if needed. Expansion is limited by flow availability, with the 3rd mgd not projected to become available until 2038. With influent flow equalization, this could be moved forward to 2023.

The Deschutes Valley Property (DVP) shown in Figure 2-8 has sufficient space to build a 2.0 mgd raw sewage treatment facility similar to the MWRWP plus a 20.0 mgd facility capable of receiving effluent from the BITP and generating any variety of NPR, IRP, or DPR product. Based on current capacity projections, these facilities are not needed in the foreseeable future, and LOTT currently has no plans to construct these facilities.

Table 4-3 summarizes previous assumptions about existing, planned, and potential reclaimed water production facilities in the LOTT system. The second phase of LOTT's current long-term planning effort will explore options for reclaimed water production and disposition, and may result in changes to the dates and locations of reclaimed water production shown here.

Table 4-3. Reclaimed Water Production Sites

Facility	Product	Existing Capacity (mgd)	Planned Capacity in 2050 (mgd)	Potential Capacity (mgd)	Next Steps
Budd Inlet Reclaimed Water Plant	Class A	1.5	3.0	5.0	Expand to 3 mgd (demand-driven)
Martin Way Reclaimed Water Plant	Class A	2.0	5.0	8.0	Expand to 3 mgd (2038)
Deschutes Valley Reclaimed Water Plant	Class A	0	0	2.0	Reserve space for future implementation, as needed
Deschutes Valley Advanced Water Plant	Capable of NPR, IPR, DPR, or environmental uses	0	0	20.0	Reserve space for future implementation, as needed
Total		3.5	8.0	35.0	

4.5.2 Alternative Discharge Location

While LOTT prefers to direct its reclaimed water to end users for environmental or other beneficial uses, such discharge tends to be seasonal, and is subject to the needs of the end users. To ensure the capacity for adequate discharge, LOTT has plans to develop its own groundwater recharge locations. LOTT has purchased a number of properties with soil suitable for infiltration and has plans to develop the pump stations and distribution network required to deliver product to these locations, as needed. Table 4-4 lists the existing and potential locations for groundwater infiltration of reclaimed water.

Table 4-3. Groundwater Infiltration Sites

Recharge Basin	Site Characterization Status	Current Capacity (mgd)	Planned Capacity in 2050 (mgd)	Potential Capacity (mgd)	Next Steps
Hawks Prairie	Complete	2.0	5.0	8.0	Expand to 3 mgd (2038)
Henderson South	50% Complete	0	0	1.5	Additional site characterization, groundwater modeling
Henderson North	75% Complete	0	0	1.0-1.3	Additional site characterization, groundwater modeling
Rixie Road	75% Complete	0	0	1.0	Additional site characterization, groundwater modeling
South Deschutes	50% Complete	0	0	10.0	Additional site characterization, groundwater modeling
Total		2.0	8.0	25.5	

4.5.3 Summary

Expansion of the BIRWP to 3.0 mgd and the MWRWP to 3.0 mgd will allow LOTT to generate 6.0 mgd of reclaimed water by 2038. This provides more discharge capacity than strictly required per Figure 4-8 and allows LOTT to stay comfortably ahead of regulatory drivers for reclaimed water production.

The timing of additional increments of treatment and discharge capacity may change based on community desire for increased availability of reclaimed water. LOTT's Reclaimed Water Infiltration Study will also provide valuable information to assist policymakers in developing a strategy to meet the community's long-term wastewater treatment needs.

5. Conveyance System Analysis

LOTT has instituted a program to inspect all of its collection system manholes and pipes on a regular schedule. This program keeps track of the condition of collection system assets and prioritizes projects to repair or replace pipes and manholes.

The following section summarizes a capacity analysis of the conveyance systems. The projects listed at the end of this section involve capacity expansion and are separate from the repair and replacement projects developed as part of the inspection program.

5.1 Model Description

The LOTT sewer model includes all of the Olympia and Lacey pipes greater than 8-inch diameter, a number of key pipes of 8-inch diameter and smaller, and the Tumwater siphon pipeline running from Hixon Street into the LOTT Southern Connection. The model was designed to simulate a 10-year peak hour storm event and was run at one 5-year and four 10-year time increments from 2018 through 2050. A summary of the model output as it relates to LOTT-owned pipe follows. The model assumes 2 mgd of flow diversion to the MWRWP for all scenarios.

5.2 Sewer Capacity Definition

The capacity of the collection system may be assessed in several ways. In this report, capacity is assessed using three measures:

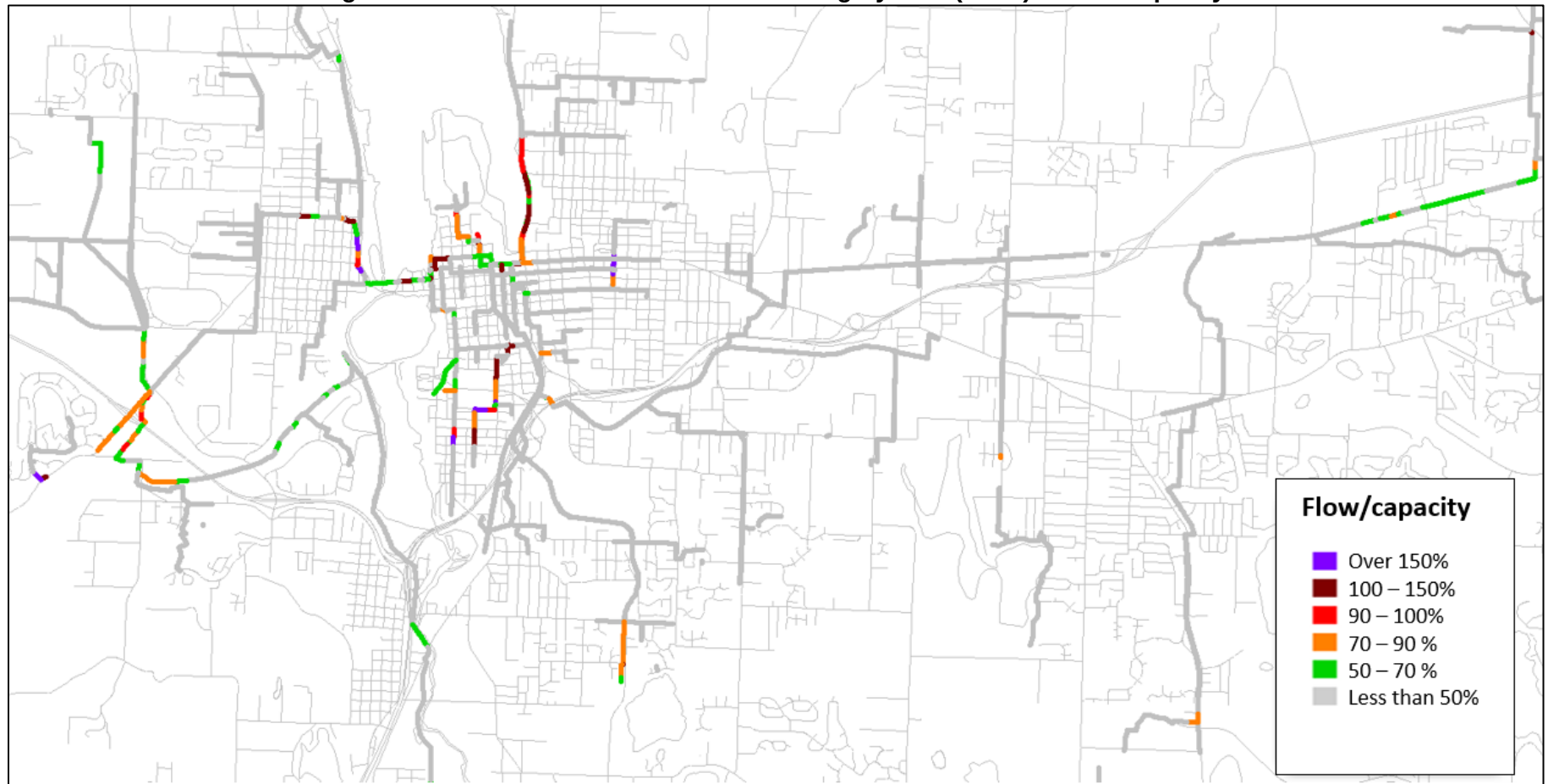
1. **Depth to flood:** The most obvious measure of capacity is whether a pipeline is projected to flood. Manholes are shown with maximum projected water levels as they compare to rim elevations. A conservative capacity trigger would be a water elevation which comes within 5-feet of rim elevation at peak flows. Other communities have set capacity triggers anywhere from 1.5 to 7.0 feet of rim. The capacity trigger depends upon many factors, including the consequence of flooding (pipelines near sensitive areas may require a more conservative trigger), as well as the likelihood of secondary flooding (flow five feet below the manhole rim elevation may be enough to flood private laterals and customer basements).
2. **Pipe filling or surcharge ratio:** Pipe filling is defined as the energy grade level divided by the pipe diameter. A fully surcharged pipe will have a pipe filling ratio of 1.0. A pipe filling ratio of 2.0 means that the pipe is full, and there are x-inches of pressure in the pipe, where x is the pipe diameter. An 8-inch pipe with a pipe filling ratio of 3.0 will flood laterals 16 inches above the crown of the pipe. Pipe filling is a useful way to gauge the capacity of the sewer system, as surcharged pipes will act as bottlenecks, and will often result in a backwater effect upstream of the restriction. However, a pipe with a ratio of 2.0 or higher may be innocuous. For example, very deep pipes may carry a substantial surcharge, with little risk of flooding laterals due to the main's burial depth.
3. **Pipe flow capacity:** The capacity of a gravity sewer may be estimated by its diameter and slope. The model compares the projected flow in each pipe segment to its theoretical capacity and reports the ratio. Pipes which are flowing at or above capacity act as bottlenecks, and cause flow to back up into upstream pipes.

The summaries in this section express capacity in terms of all three measures.

5.3 Existing Condition

Figure 5-1 presents the current peak hour flow condition for the existing system. The figure is showing the peak hour flow divided by the theoretical capacity of each segment. The purpose of this figure is to summarize existing capacity limitations in the system. These limitations are currently restricting flow to downstream pipes, making it difficult to assess capacity of downstream segments.

Figure 5-1. 2018 Peak Hour Scenario Existing System (As-Is) – Flow Capacity



The as-is model simulates the current state of affairs as we know it in regards to flows and pipe sizes that are represented in the geodatabase (Figure 5-1). Major issues identified within the existing system include the following:

- Heavy surcharging with flooding of Olympia pipeline along West Bay Road near the roundabouts
- Flooding at the 4th Avenue Bridge area
- Pipe surcharging of Olympia downtown pipes
- Surcharging of Olympia pipeline along East Bay Road
- Surcharging with flooding of the Olympia pipes along Capitol Way South

Based on this scenario, most of the major existing issues affect Olympia pipes. Olympia is aware of these limitations, and each jurisdiction is developing strategies to meet these capacity related issues. For the following scenarios, the bottlenecks causing surcharging in south and downtown Olympia and along West Bay Drive were removed to allow effective modeling of downstream pipes.

To alleviate flooding in the South Olympia area, the diameters of the pipes between manholes 510030 and 510027 along Capitol Way S between 19th and 21st and between manholes 539011 and 530022, parallel to the Capitol Way S bottleneck were increased from 10" to 12". To alleviate flooding on West Bay Drive near the roundabouts the diameter of three pipes were increased from 21" to 24", 18" to 21", and from 12" to 18". To alleviate the flooding in downtown Olympia, the diameter of the pipes between manholes 011018 and 011014 along Central Street NW between Thurston Avenue and 4th Avenue were increased from 12" to 18".

5.4 Existing Capacity Limits

LOTT conducted a comprehensive condition assessment inspection of their gravity interceptors and manholes in the summer of 2017. The inspection discovered high flows in the downstream portion of the Indian Creek Interceptor at low flow times (midnight to 2 am). The high flows and blockages encountered near the point where the interceptor crosses I-5. Roots were encountered in the south branch of the interceptor and could not be inspected. The pipes with high flows were also not inspected. None of the other LOTT pipes exhibited similarly high flows or flow restrictions. Further discussion of the Indian Creek Interceptor is included in the next section.

5.5 LOTT Interceptor Analysis

5.5.1 Martin Way Interceptor (East)

This interceptor consists of a relatively flat section of 24-inch pipe flowing into progressively steep portions of 18- and 15-inch pipe. The 15-inch pipe, particularly in a pair of less-steep upstream sections, acts as a flow bottleneck. Figure 5-8 presents the pipe profile, along with water depth at the 2050 peak hour condition. Figure 5-9 presents the capacity assessment for this same condition.

Figure 5-8. Martin Way Interceptor (East) 2050 Peak Hour Flow Profile

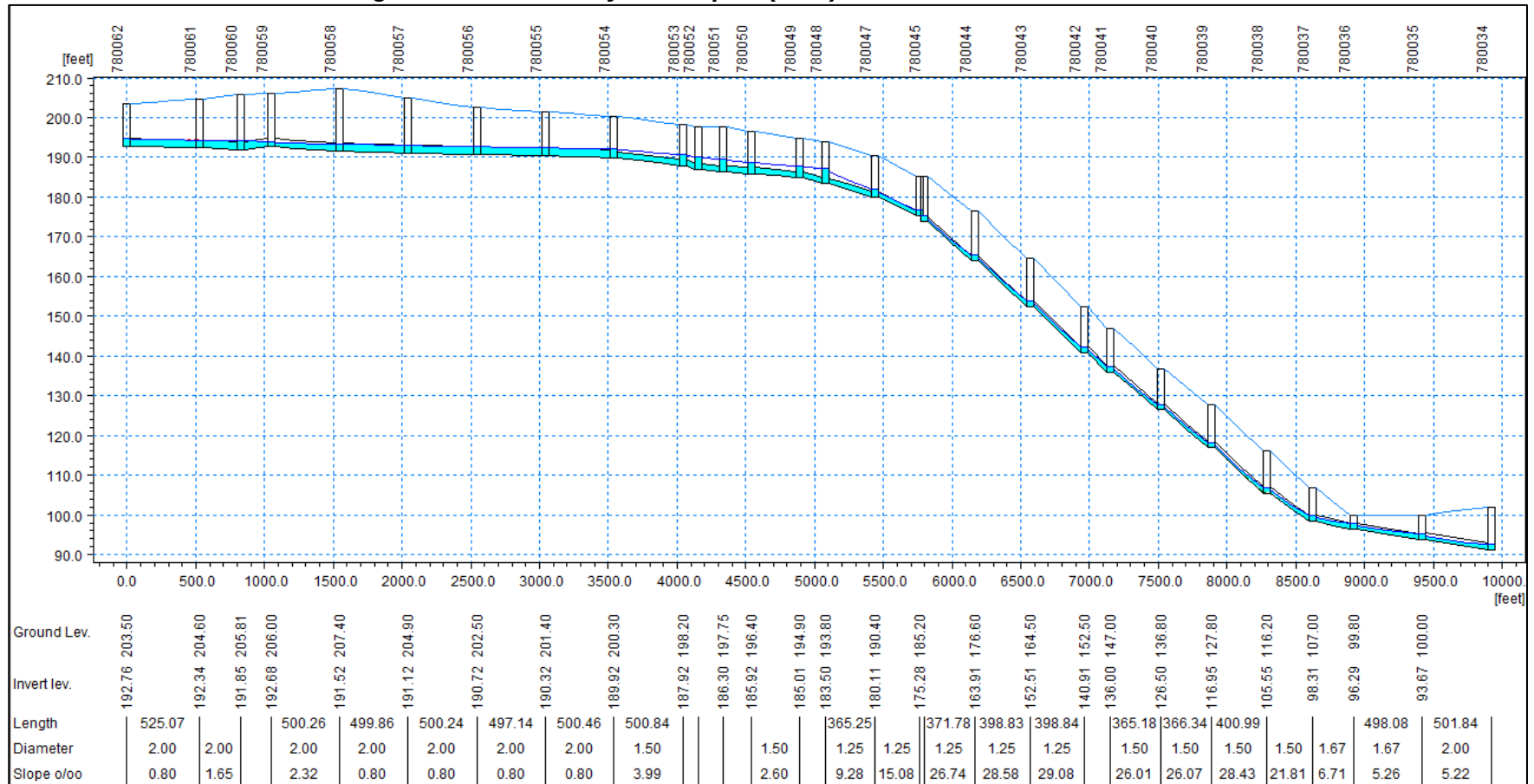
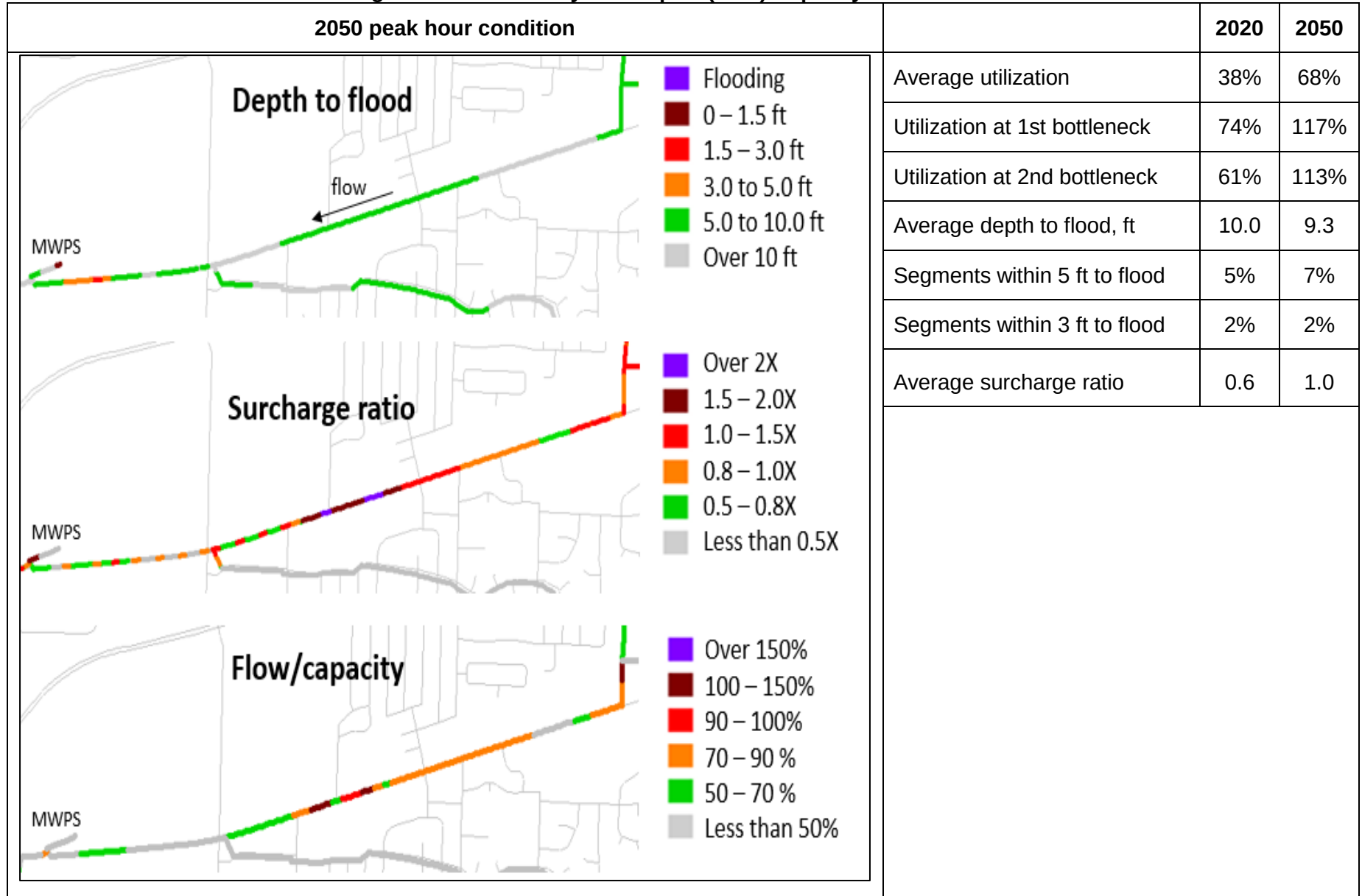


Figure 5-9. Martin Way Interceptor (East) Capacity Assessment



The pipe is deep for most of its length, and only a small section near the downstream end poses a risk of flooding. At that location, the pipeline comes within 3 feet of flooding.

The pipe projects to be fully surcharged for most of its length. A surcharge ratio over 2.0 is projected for the middle section of this pipeline. The surcharging appears to be related to flow restrictions in the middle section of the pipeline, where the pipe diameter is only 15 inches.

The depth to flood is related to the depth of the pipeline at that position. As shown in Figure 5-8, one of the downstream manholes has only 2 feet of burial depth. This manhole will always be within 3 feet of flooding. Therefore, depth to flood should not be a capacity-limiting consideration at this location.

The most critical capacity-limiting feature of this pipeline is the flow restriction in the 15-inch diameter pipes. This restricts flow and causes upstream surcharging of over 2X the pipe diameter. The capacity restriction arises between 2030 and 2040.

5.5.2 Martin Way Interceptor (West)

The Martin Way Interceptor (West) accepts flows from the MWPS Force Main, as well as from the Lacey interceptor running north along Sleater-Kinney Road. Flow splits between a northern and southern branch for the upstream portion of this pipeline—the north branch taking flow from the MWPS Force Main, and the southern branch taking flow from Lacey. Figures 5-10 and 5-11 present the profile of the interceptor in the 2050 peak hour flow condition, and Figure 5-12 summarizes capacity.

Figure 5-10. Martin Way Interceptor (West), 2050 Peak Hour Condition

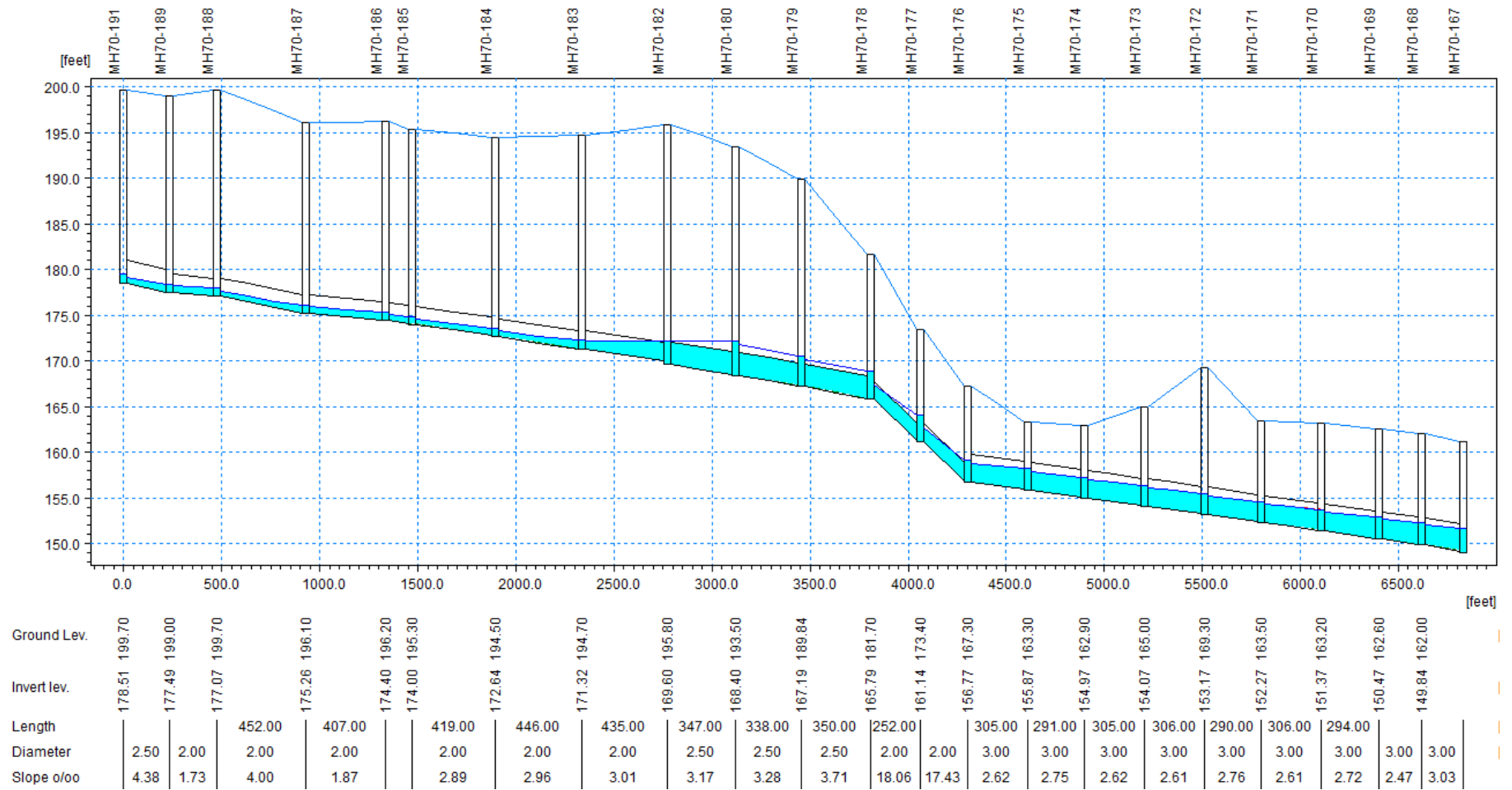


Figure 5-11. Martin Way Interceptor (West), North Branch, 2050 Peak Hour Condition

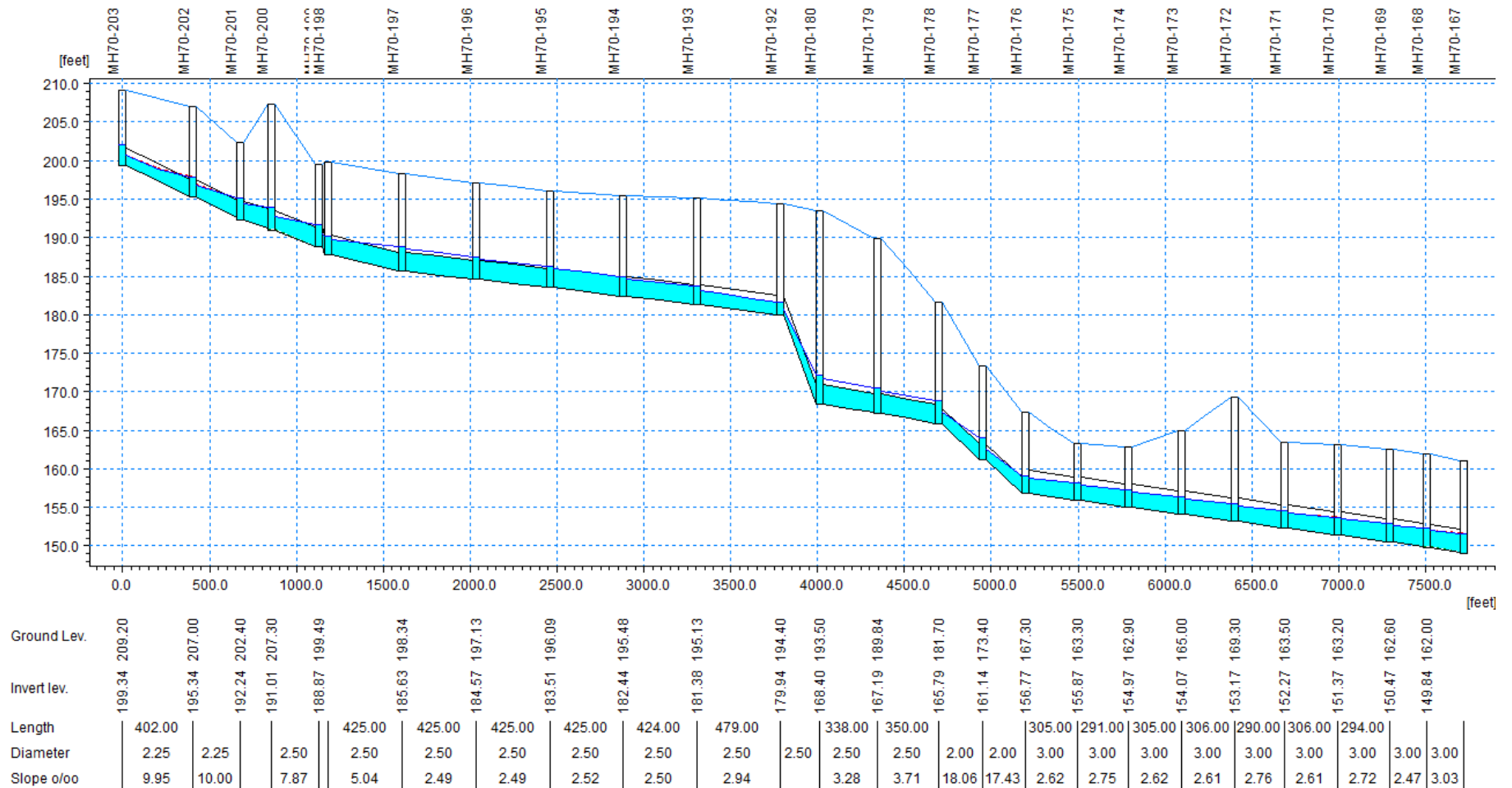
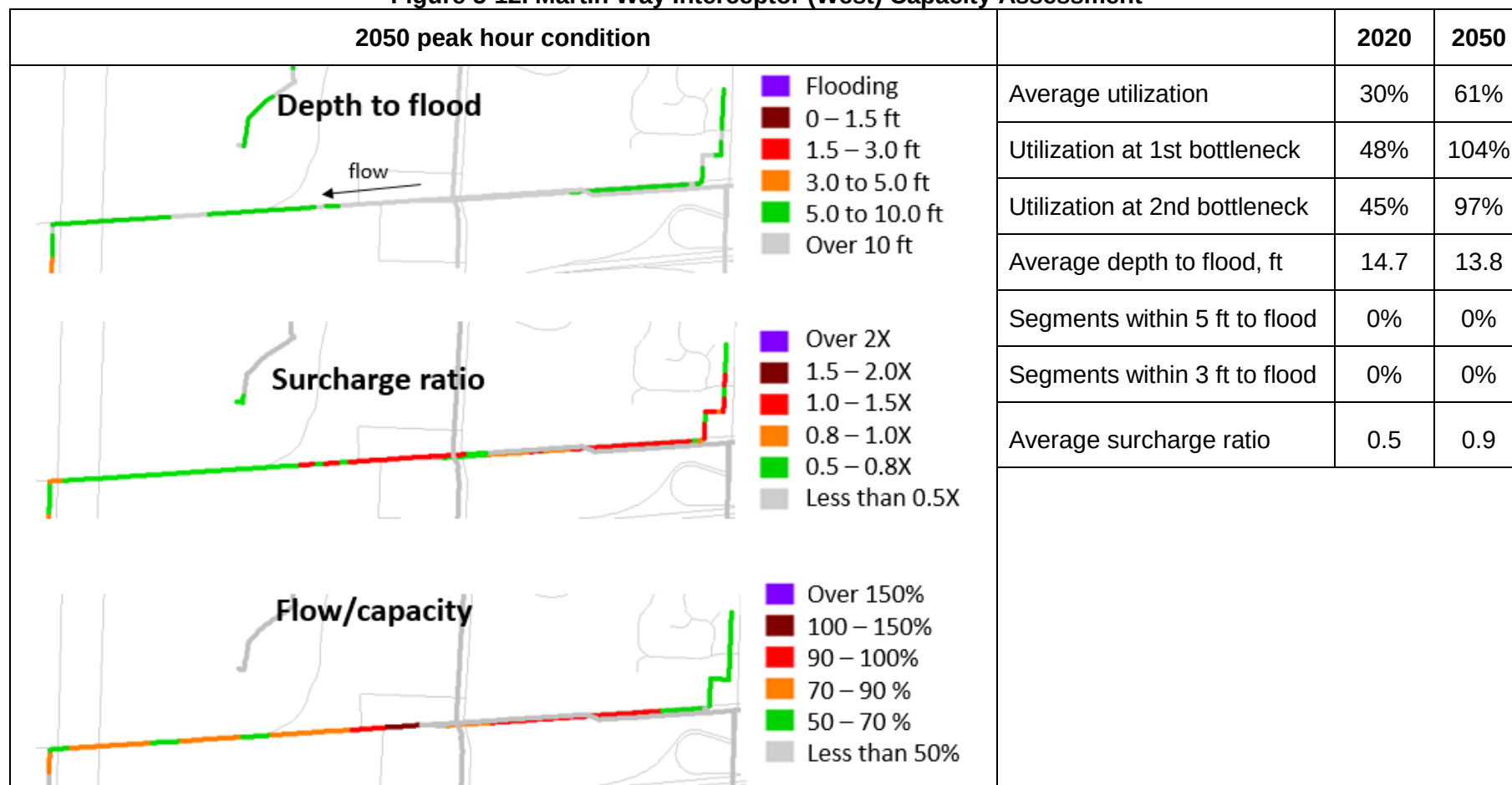


Figure 5-12. Martin Way Interceptor (West) Capacity Assessment



This pipeline poses a low risk of flooding, with no segments or manholes projected to flow within 5 feet of the ground elevation. The pipeline projects to be fully surcharged, though, particularly in the northern branch and just downstream of where the two branches come together. Surcharging appears to be related to a capacity restriction in the relatively flat 30-inch section of pipe between manholes MH70-180 and MH70-179. The flat section of 36-inch pipe downstream of that bottleneck appears to be a secondary bottleneck.

Capacity in this pipeline is related to the flow restriction. This restriction arises between 2040 and 2050. Additional flow diversion beyond 2 mgd to the MWRWP will push back the capacity limitations beyond 2050.

5.5.3 Cooper Point Interceptor

The Cooper Point Interceptor is a deep pipeline, averaging over 10 feet of burial depth. Figure 5-13 presents its 2050 peak hour flow profile, while Figure 5-14 presents its capacity summary at the same condition.

Figure 5-13. Cooper Point Interceptor, 2050 Peak Hour Condition

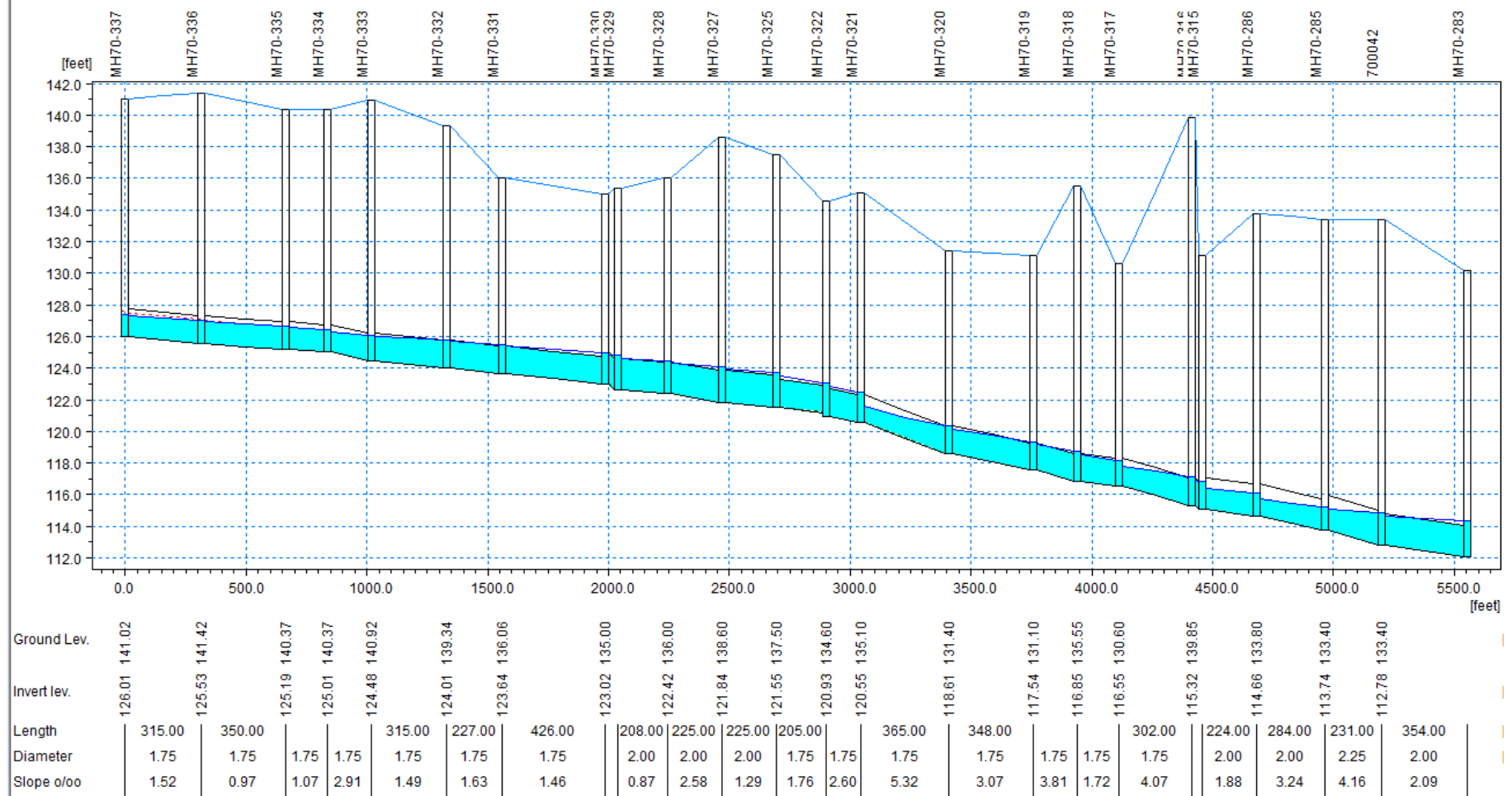
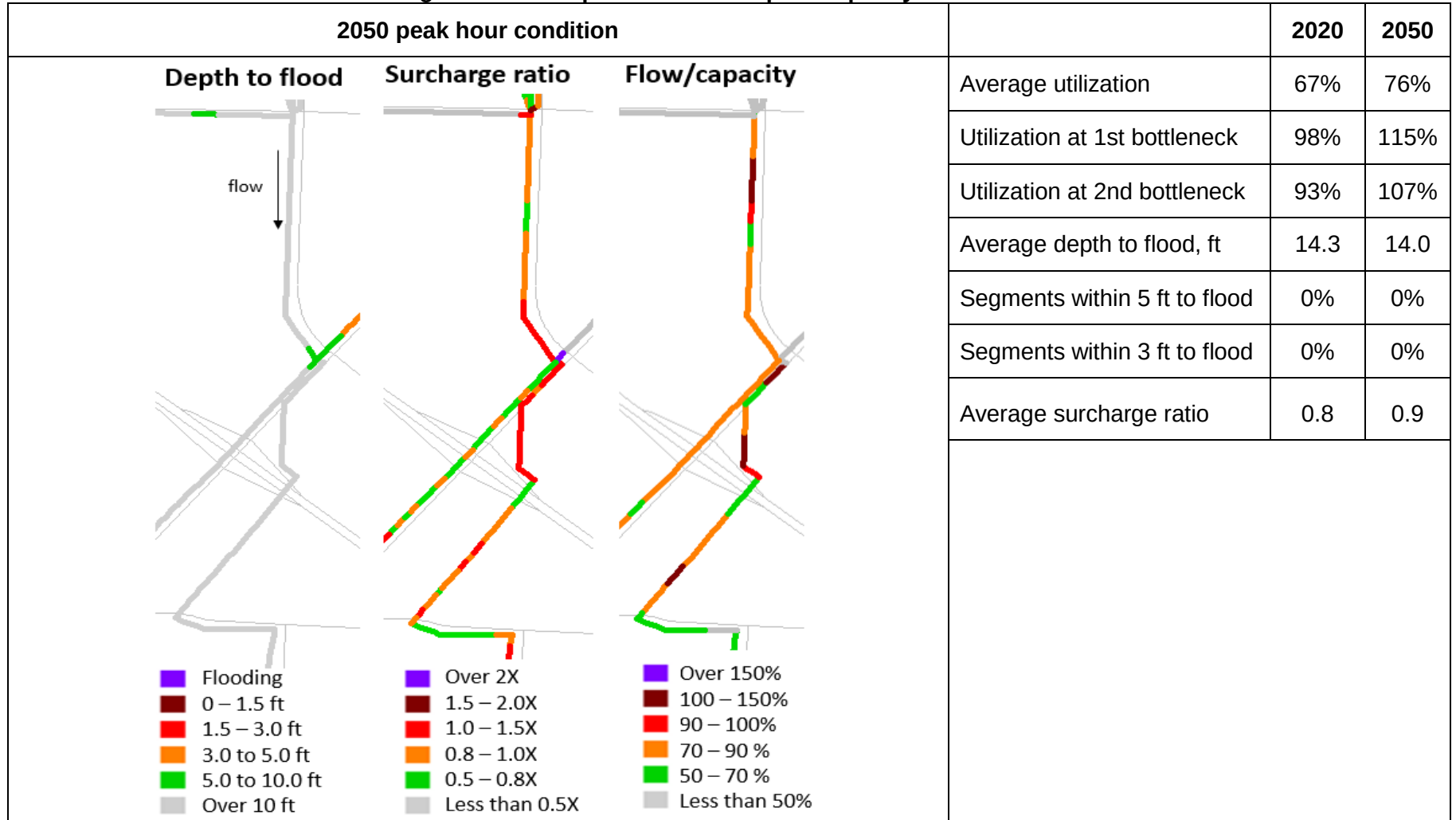


Figure 5-14. Cooper Point Interceptor Capacity Assessment



Given its depth, the Cooper Point Interceptor has very low risk of flooding. The pipe projects to be fully surcharged for most of its length. Surcharging is due to capacity limitations which are projected at several points along its length, wherever the slope of pipeline levels off compared to adjacent lengths. These capacity limitations are projected to appear between 2020 and 2030.

Although capacity limitations are projected, those limitations do not give rise to excessive surcharging. By 2050, the maximum projected surcharge ratio is just over 1.1.

5.5.4 Percival Creek Interceptor

The Percival Creek Interceptor is a long and comparatively steep pipeline, with areas under minimal cover. The 2050 peak hour profile is plotted on Figure 5-15, and a capacity summary is provided on Figure 5-16.

Figure 5-15. Percival Creek Interceptor, 2050 Peak Hour Condition

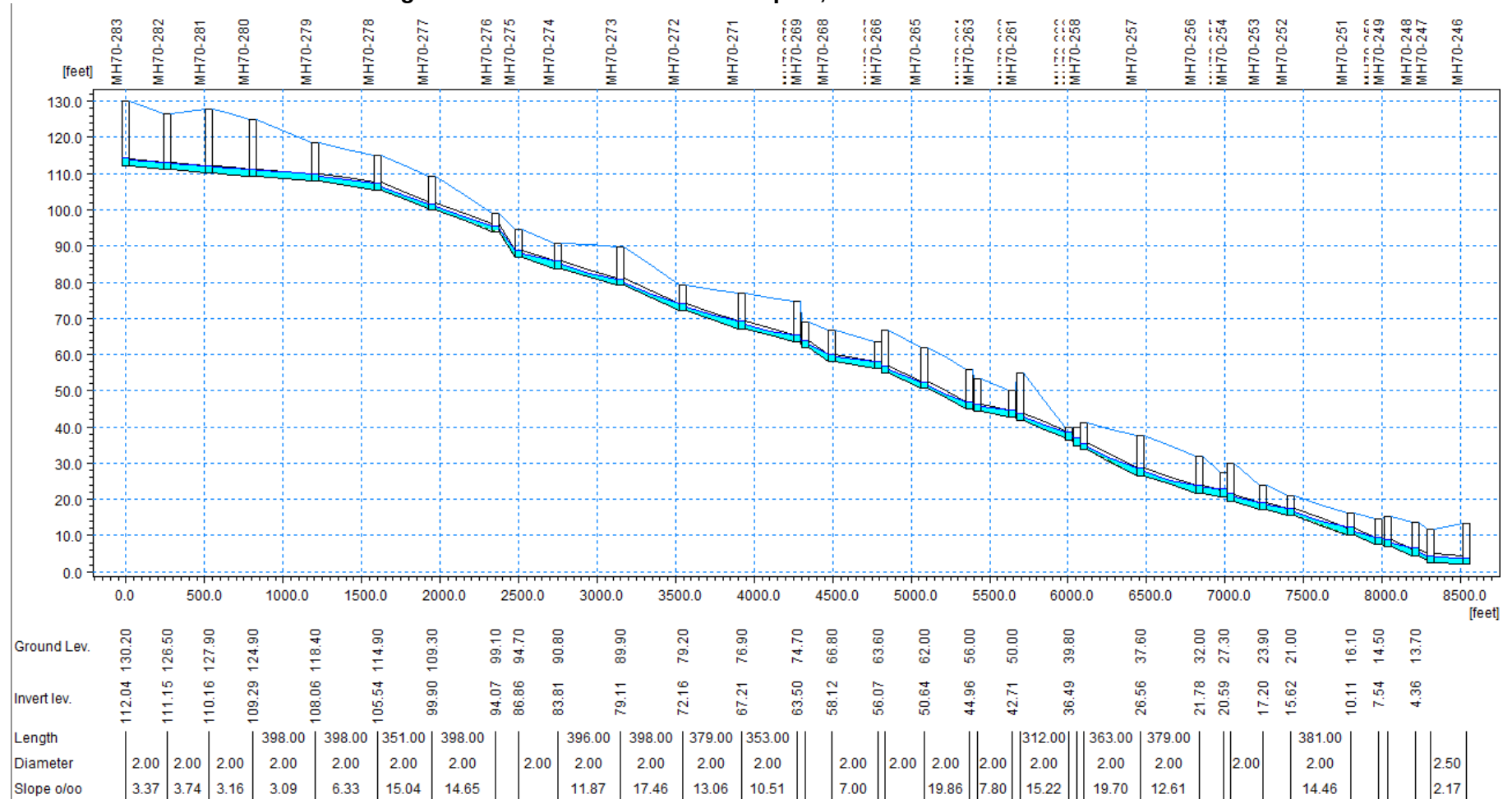
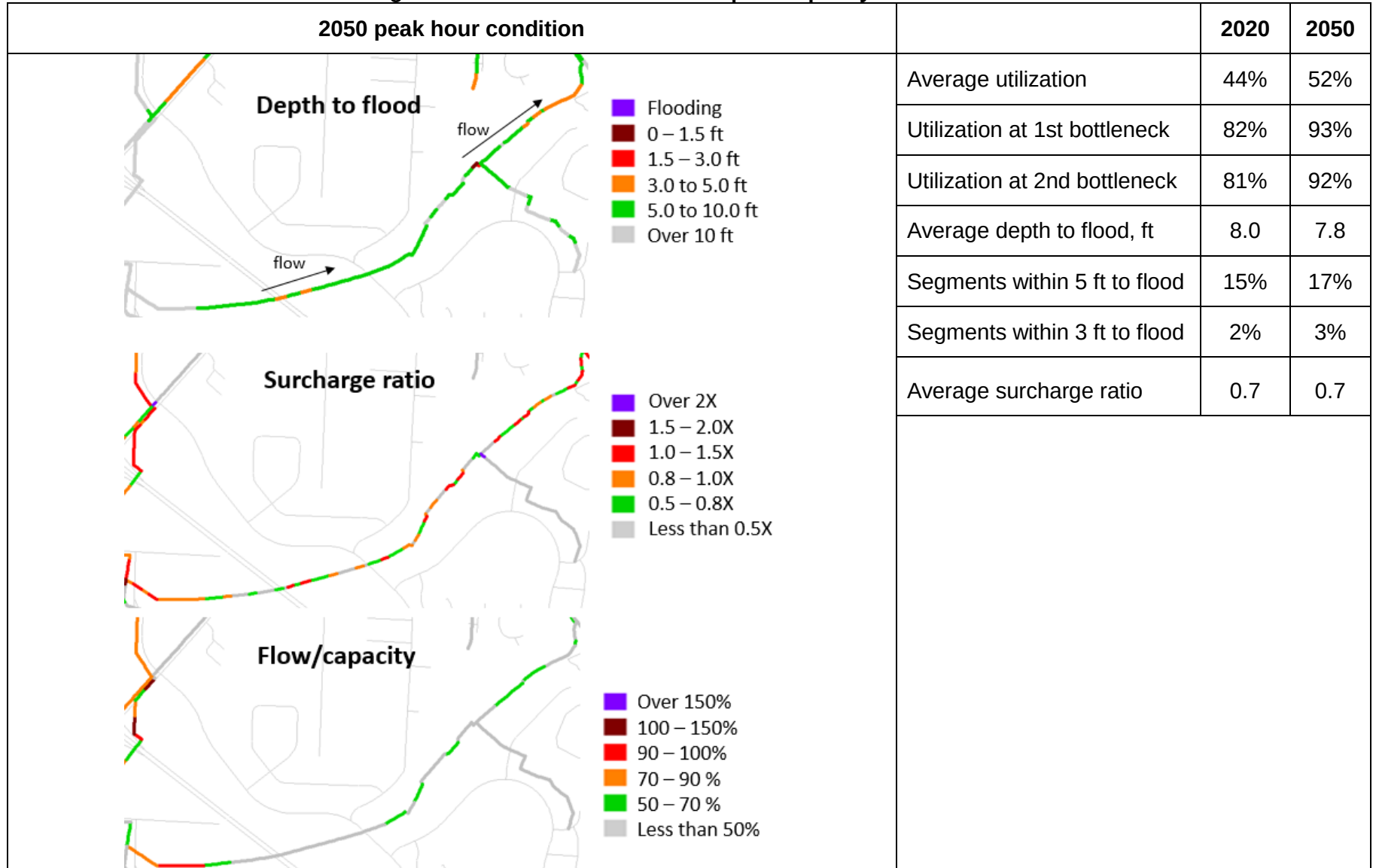


Figure 5-16. Percival Creek Interceptor Capacity Assessment



By 2050, several segments of the Percival Creek Interceptor are projected to come within 5 feet of flooding. However, as was the case with the Martin Way Interceptor, this simply reflects the shallow depth of portions of this pipeline. Most of these segments are only buried under 3-5 feet of cover, so the depth-to-flood assessment does not necessarily indicate a capacity limitation.

As depicted on Figure 5-16, most of the pipeline will be fully surcharged in the 2050 peak hour condition, but the surcharge ratio is typically quite low. The maximum surcharge ratio for the 2050 peak hour condition is 1.1.

The pipeline does not project to have any flow restrictions through 2050, although a flat section of pipe in the upstream portion of the interceptor (between manholes MH70-283 and MH70-279) averages over 90 percent utilized by 2050. Further development in western Olympia could drive an upgrade project in this section.

5.5.5 Indian Creek Interceptor

The Indian Creek Interceptor consists of three segments. The upstream segment of mostly 36-inch pipe runs from Martin Way down to I-5. The middle segment, more steeply-sloped, is mostly 30-inch pipe running along the Indian Creek Trail. The final segment splits into two parallel pipes which cross back under I-5. Profiles of each segment at the 2050 peak hour flow condition are presented on Figures 5-17 to 5-20, with Figure 5-21 summarizing the pipeline capacity.

Figure 5-17. Indian Creek Interceptor, North, 2050 Peak Hour Condition

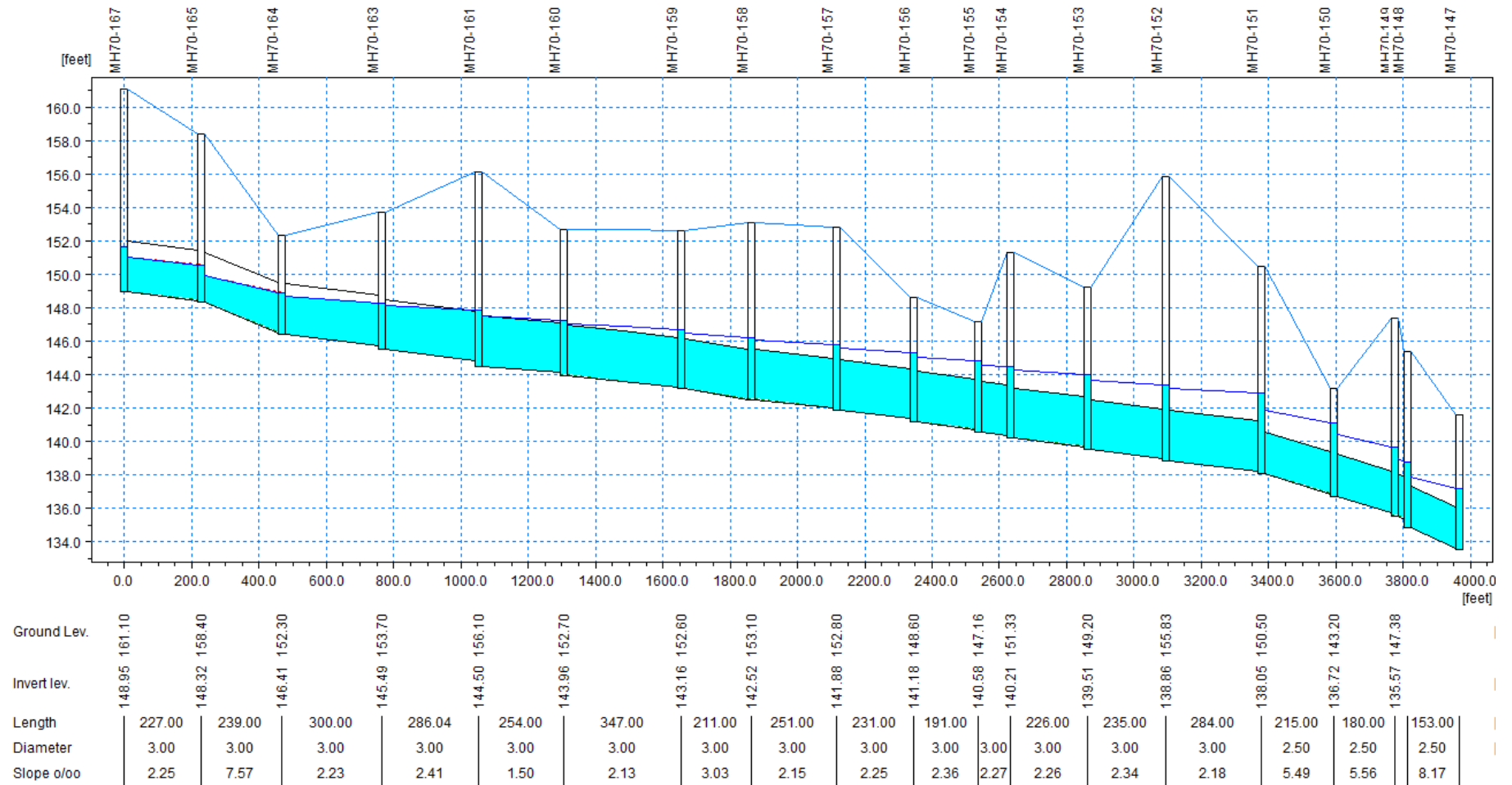


Figure 5-18. Indian Creek Interceptor, Middle, 2050 Peak Hour Condition

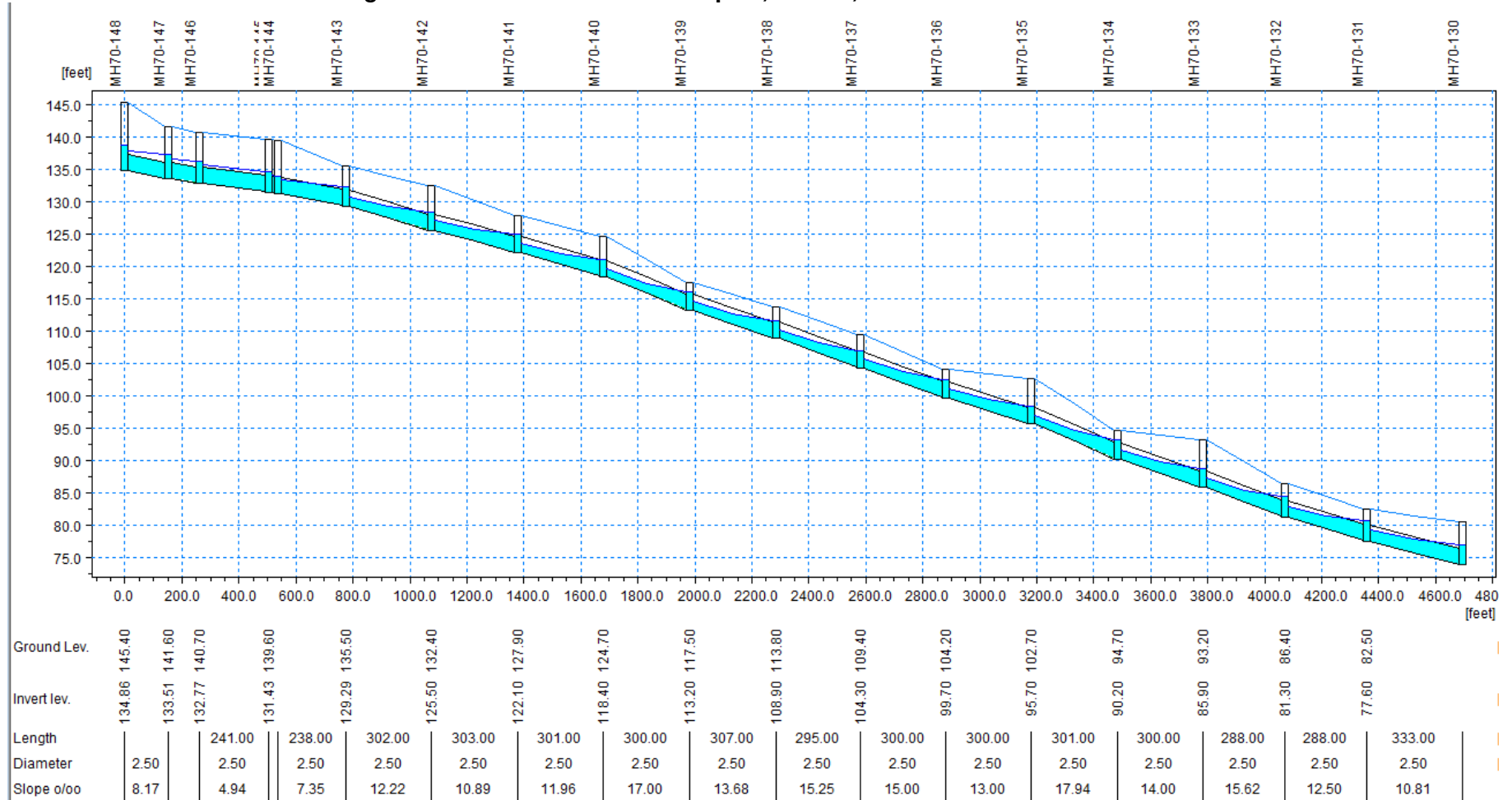


Figure 5-19. Indian Creek Interceptor, South (North Branch), 2050 Peak Hour Condition

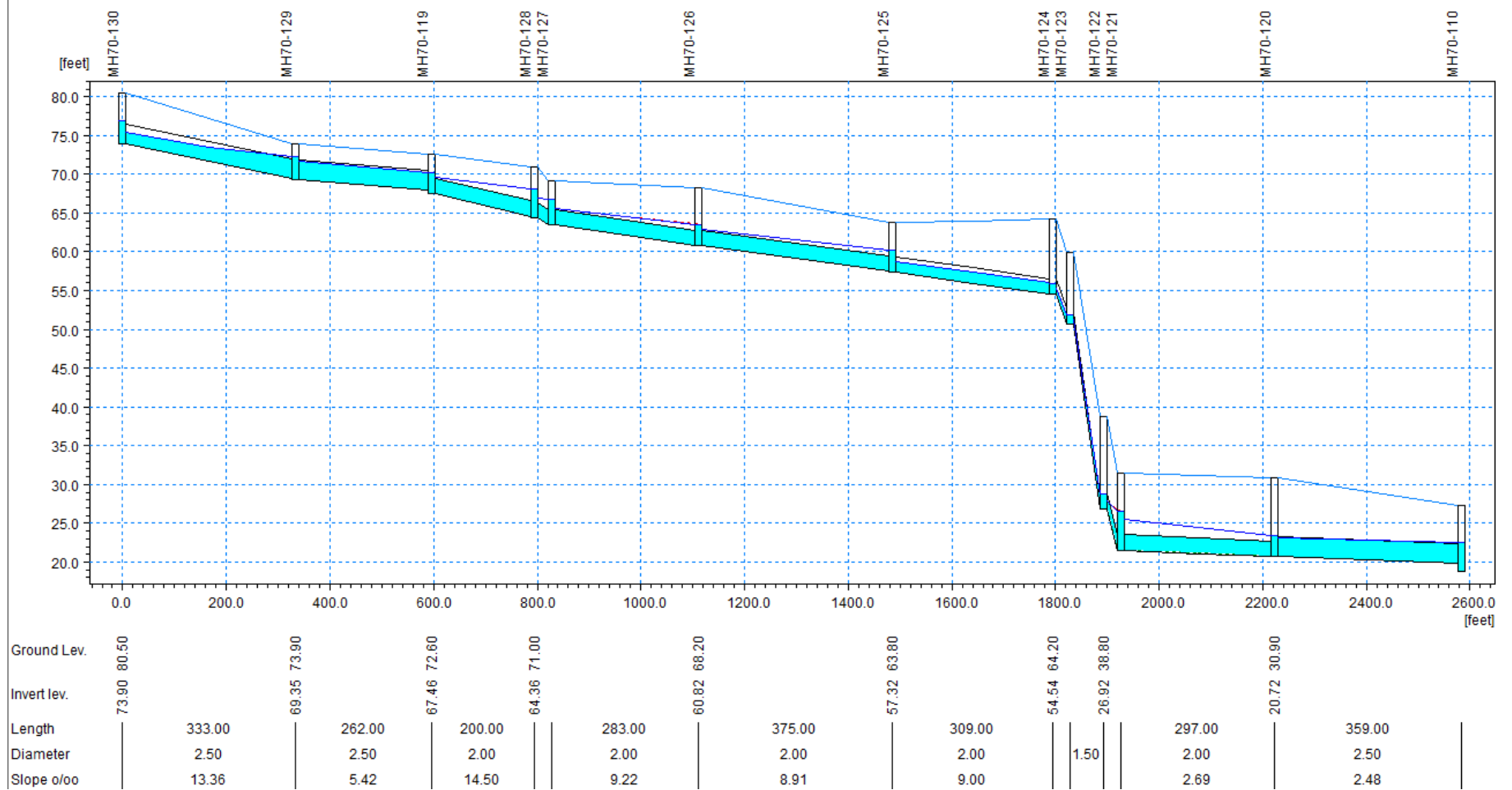


Figure 5-20. Indian Creek Interceptor, South (South Branch), 2050 Peak Hour Condition

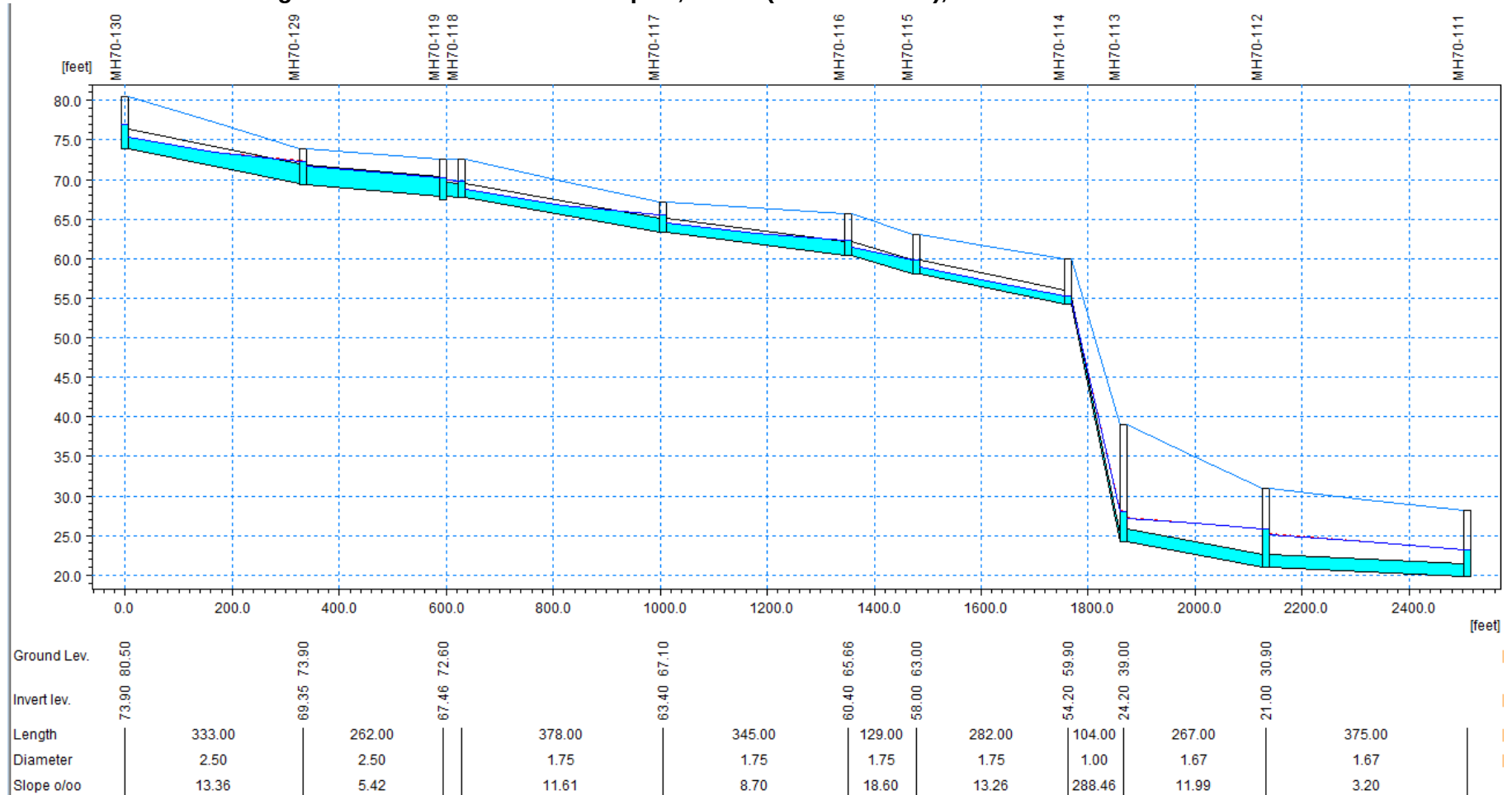
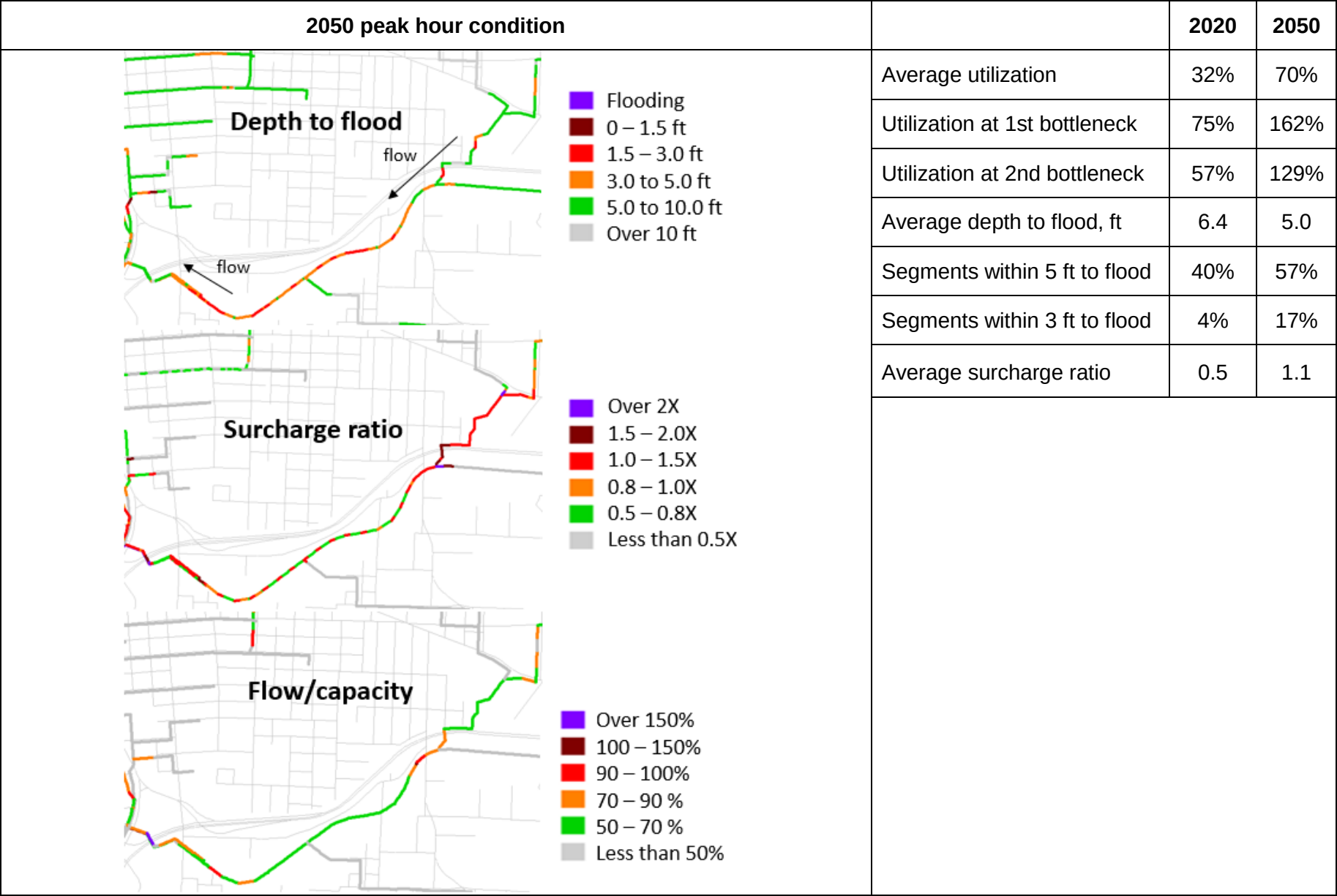


Figure 5-21. Indian Creek Interceptor Capacity Assessment



In the 2050 peak hour flow condition, most of the interceptor is fully surcharged. Capacity bottlenecks exist at five locations:

- 30" pipe between manholes MH70-146 and MH70-144
- 30" pipe between manholes MH70-129 and MH70-119
- 24" pipe between manholes MH70-121 and MH70-120
- 21" pipe between manholes MH70-119 and MH70-118
- 20" pipe between manholes MH70-112 and MH70-111

The capacity bottlenecks lead to surcharging, which puts the pipeline at risk of flooding. Depth of flood is projected to be less than 5-ft over most of the interceptor length, and less than 3-ft for over 10 segments. Seven manholes are projected to come within 2-ft of flooding. Much of the pipeline is quite shallow, though, so the depth-to-flood is not entirely a product of high flows.

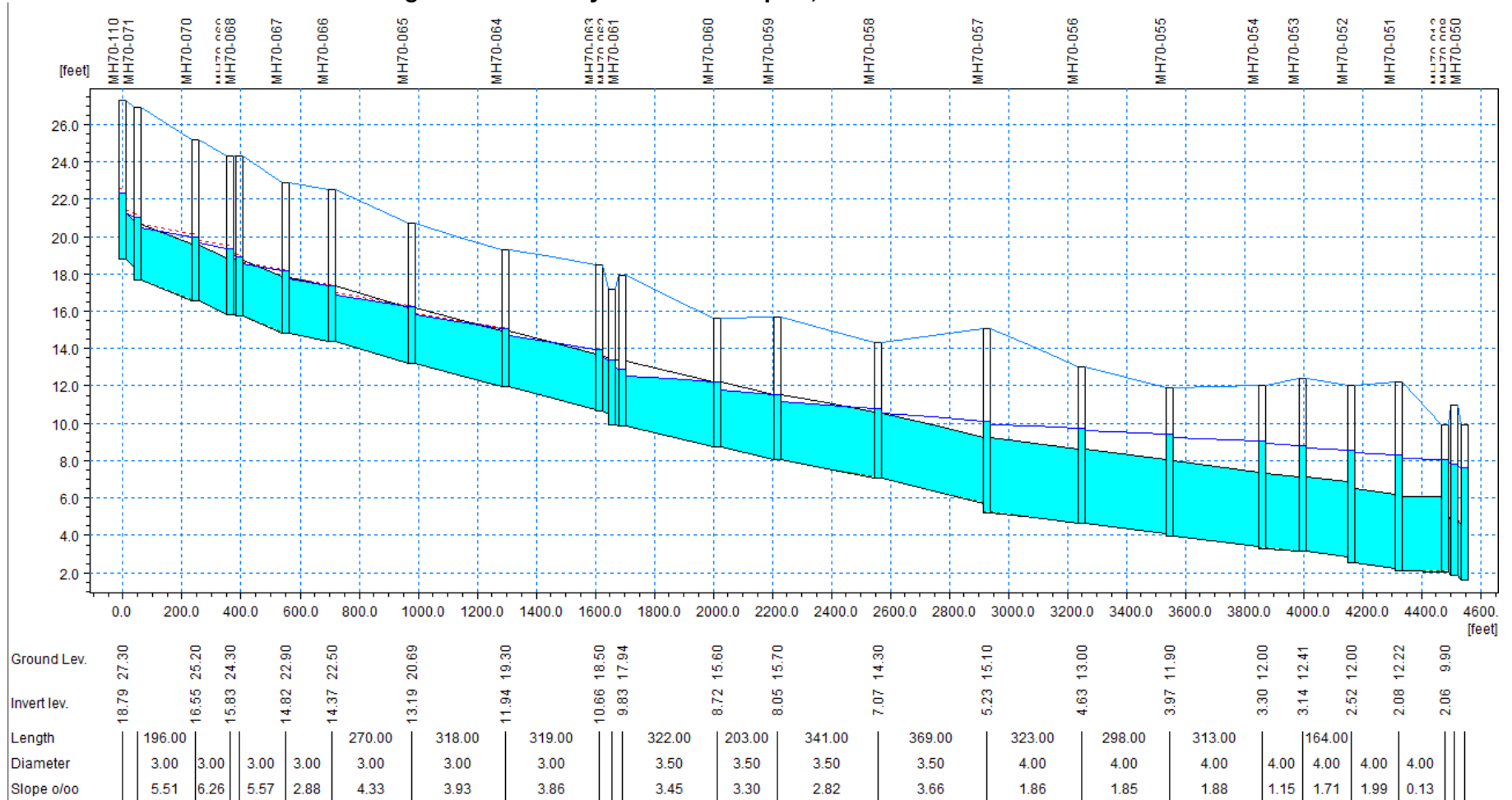
The first capacity bottleneck arises between 2020 and 2030 at manhole MH70-121. By 2040, the next bottleneck at manhole MH70-112 is observed. Both of these capacity bottlenecks are in the parallel segments of pipe crossing under I-5.

Capacity limitations in the Indian Creek Interceptor are strongly linked to flow diversion at the MWRWP. Increased flow diversion beyond the existing 2 mgd would delay limitations.

5.5.6 Cherry Street Interceptor

The Cherry Street Interceptor takes most of the flow from the Indian Creek Interceptor and the Henderson Road Interceptor and picks up combined flows from the City of Olympia at Union Avenue. Figure 5-22 presents the 2050 peak hour profile, and capacity is summarized at the end of this section in Figure 5-26.

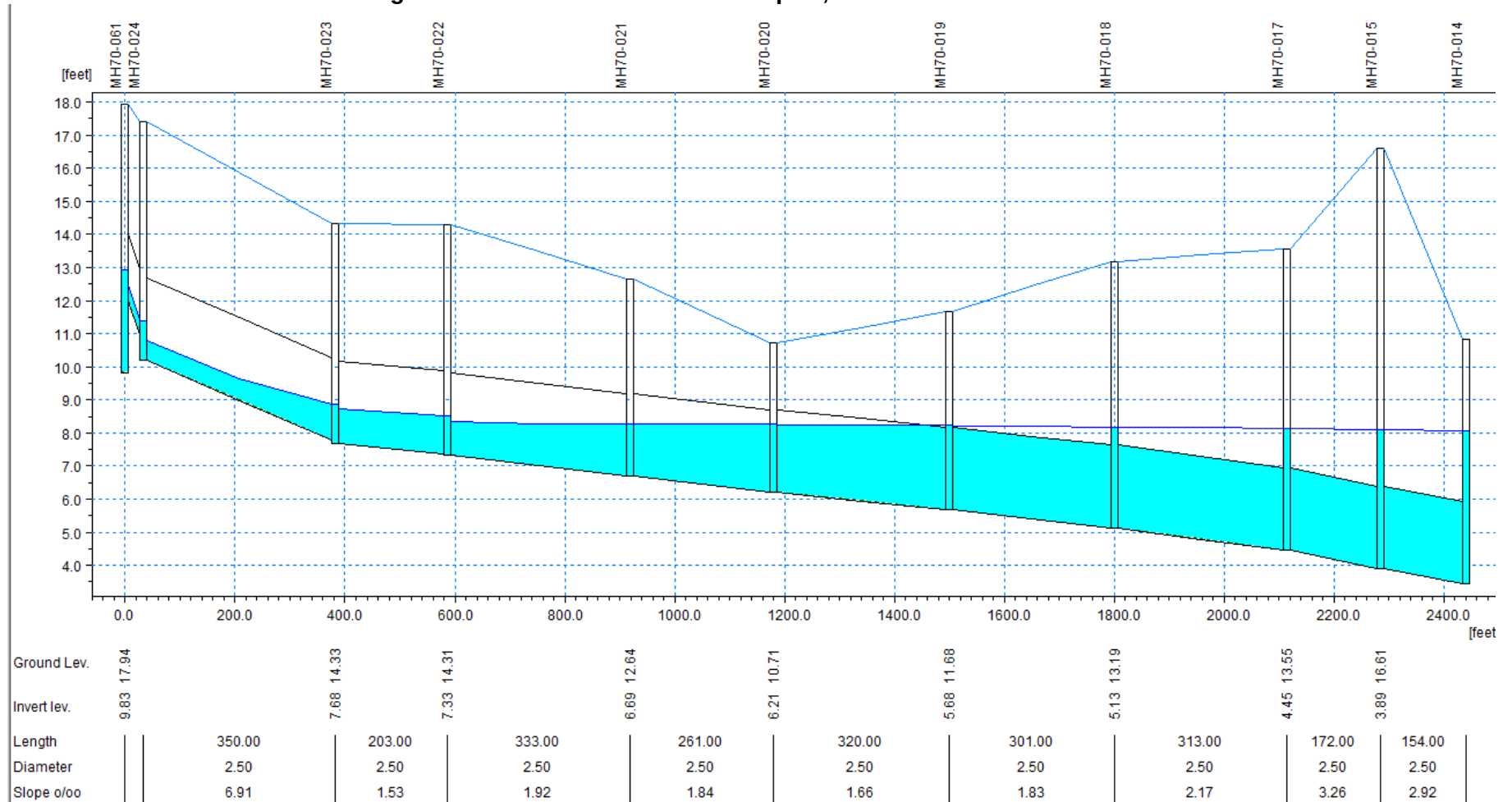
Figure 5-22. Cherry Street Interceptor, 2050 Peak Hour Condition



5.5.7 Chestnut Street Interceptor

The Chestnut Street Interceptor takes overflows from the Cherry Street Interceptor at Union Avenue. Figure 5-23 presents the 2050 peak hour profile, and capacity is summarized at the end of this section in Figure 5-26.

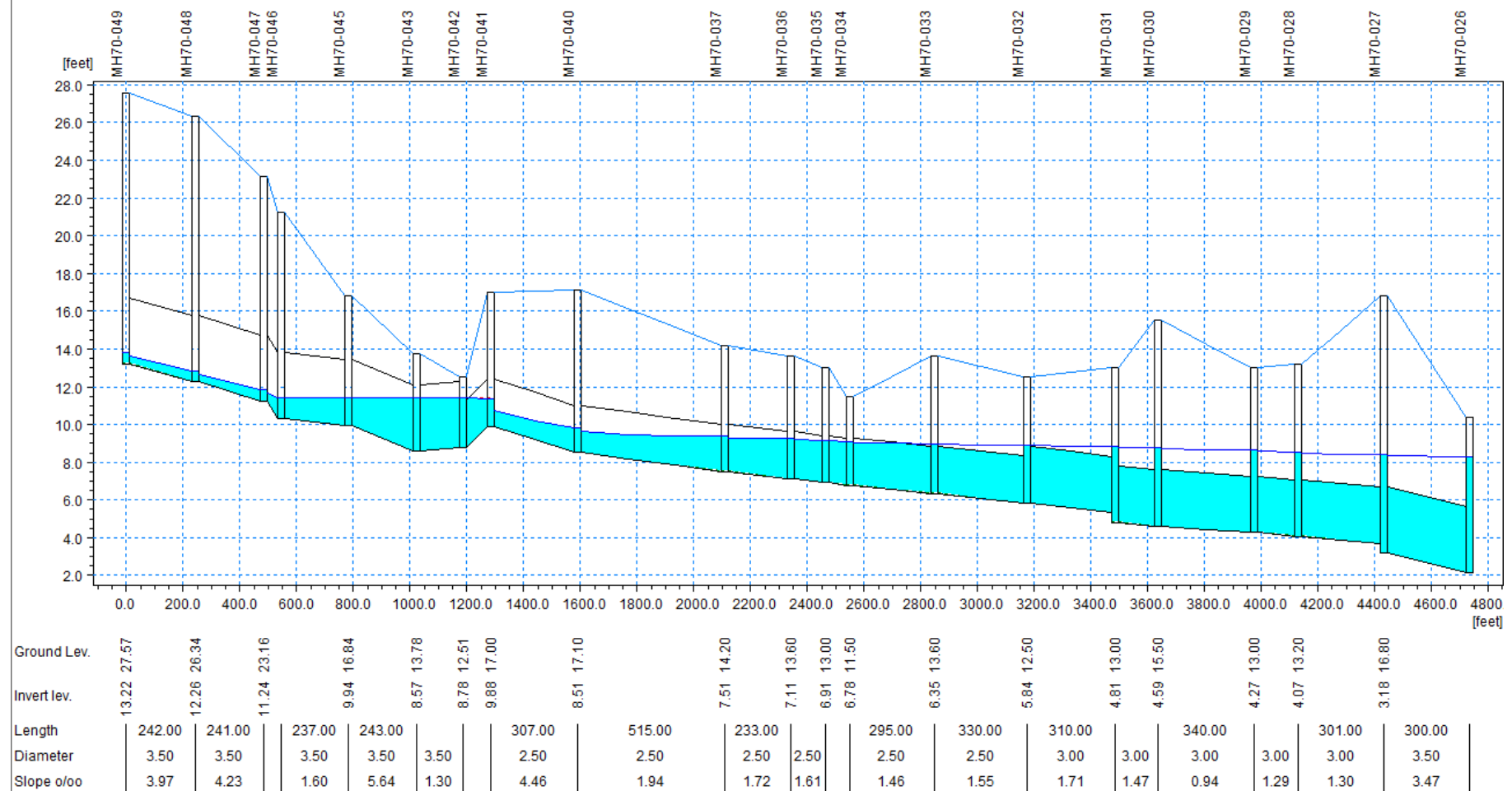
Figure 5-23. Chestnut Street Interceptor, 2050 Peak Hour Condition



5.5.8 Plum Street Interceptor

The Plum Street Interceptor takes flows from Tumwater and Olympia north of North Avenue. There is a plugged connection, which formerly allowed a portion of flow from the Indian Creek Interceptor and Henderson Road to enter this pipeline. Figure 5-24 presents the 2050 peak hour profile, and capacity is summarized at the end of this section in Figure 5-26.

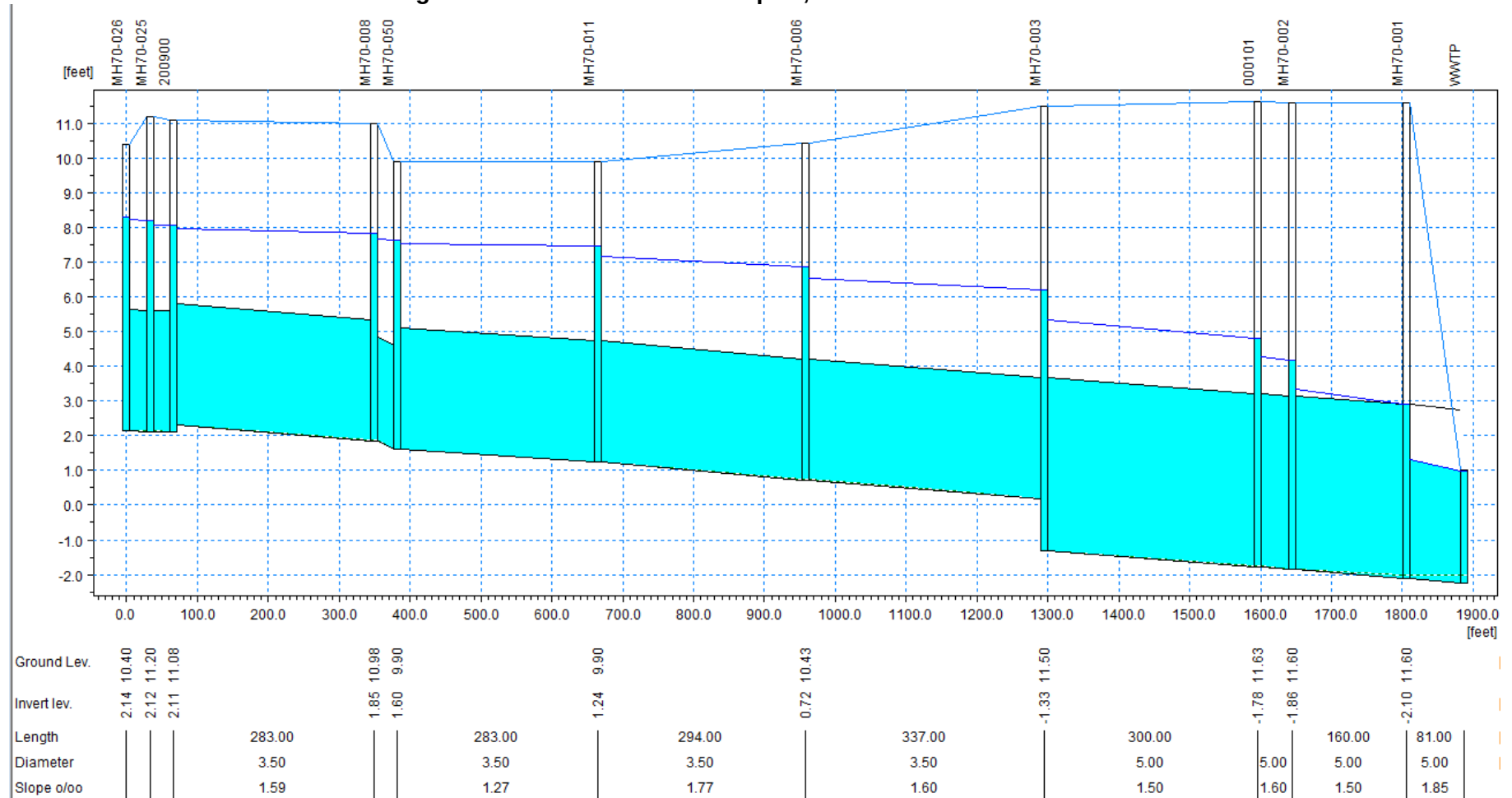
Figure 5-24. Plum Street Interceptor, 2050 Peak Hour Condition



5.5.9 State Street Interceptor

The State Street Interceptor receives flow from the Cherry, Chestnut, and Plum Street Interceptors. It also conveys flow from the two Olympia East Bay Interceptors, and State Avenue to the west. This interceptor turns north on Adams Street and conveys flow to the BITP. Figure 5-25 presents the 2050 peak hour profile, and capacity is summarized at the end of this section in Figure 5-26.

Figure 5-25. State Street Interceptor, 2050 Peak Hour Condition



5.5.10 Downtown Interceptor Capacity

Figure 5-26 presents an overview of capacity of the downtown interceptors in the 2050 peak hour flow condition.

Figure 5-26. Downtown Interceptor Capacity Assessment

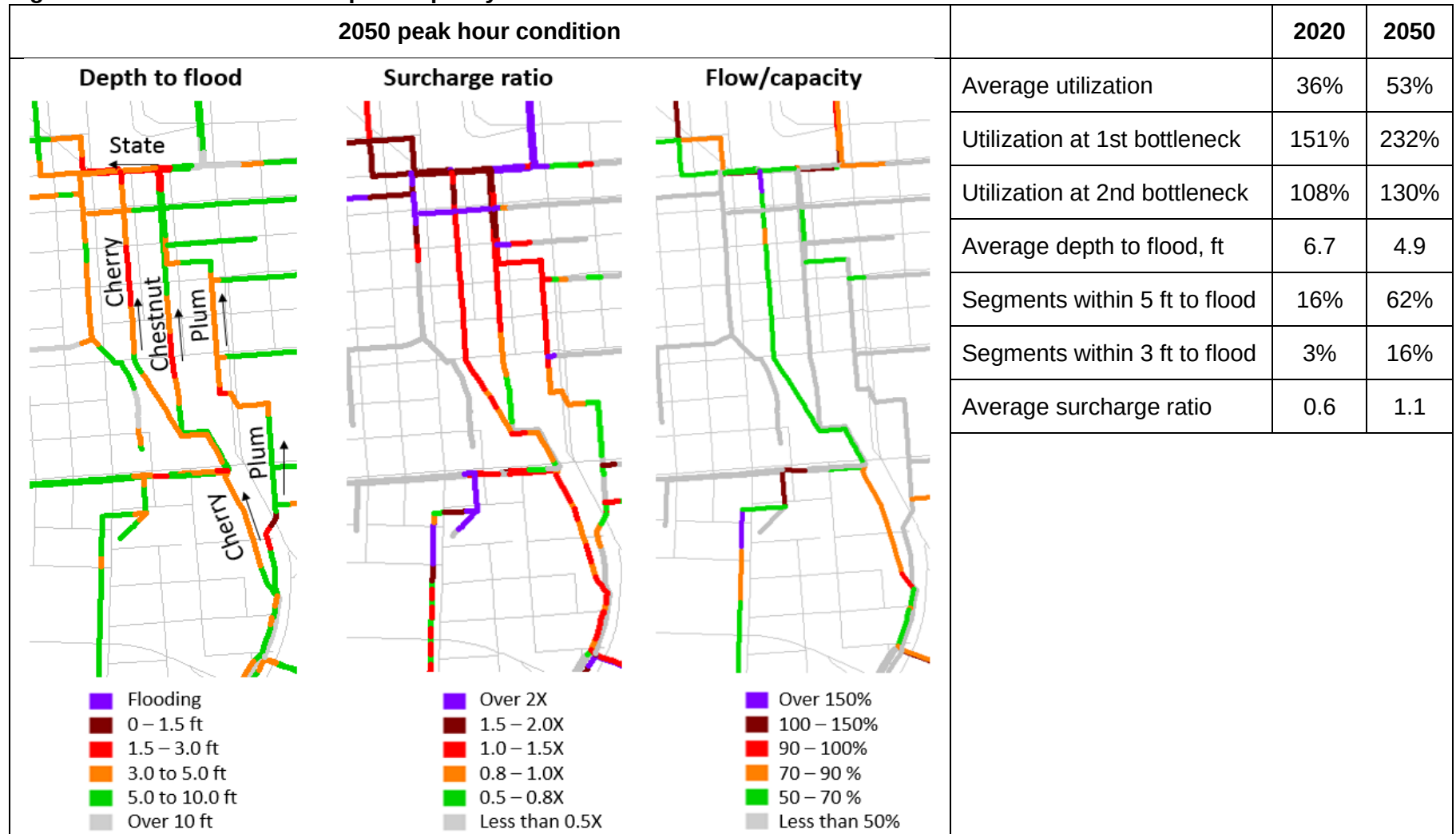
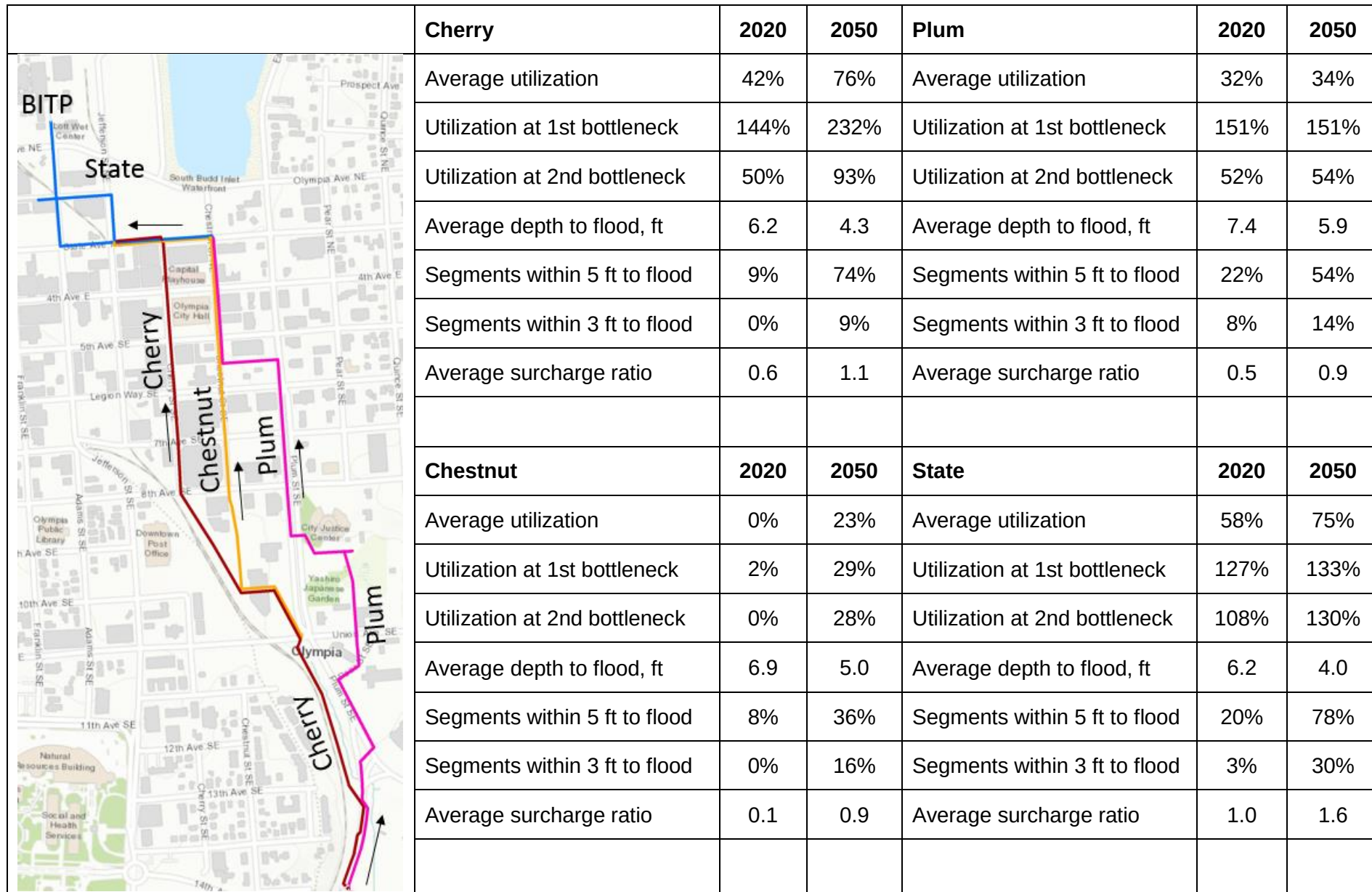


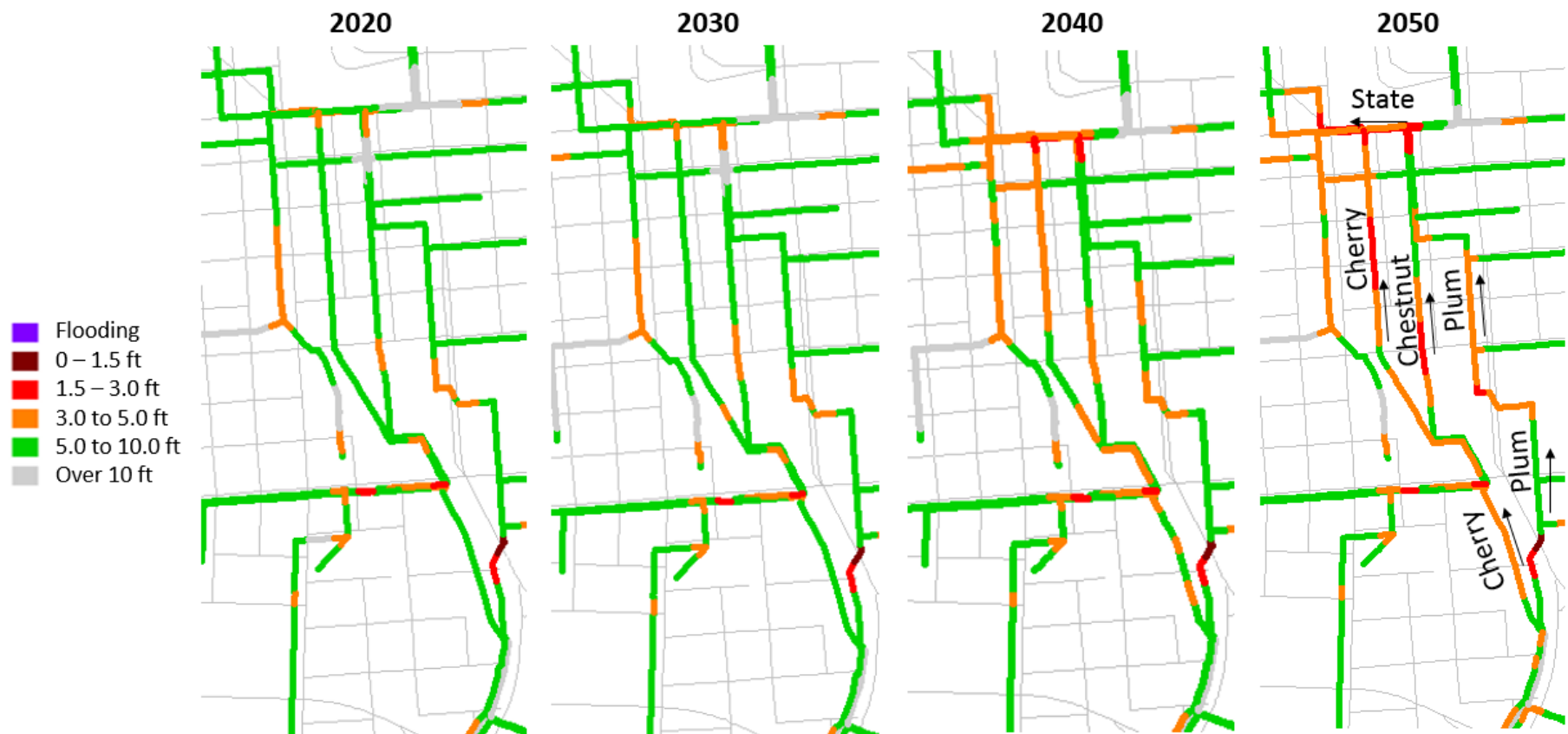
Figure 5-26. Downtown Interceptor Capacity Detail



Capacity bottlenecks exist near the upstream end of the Cherry Street Interceptor (manhole MH70-067 to MH70-066), at the downstream end of the Cherry Street Interceptor (manhole MH70-051 to MH70-013), along the State Street Interceptor (manhole MH70-013 to MH70-012), as well as along the outlet to the BITP (manhole MH70-003 to the BITP). These limitations cause a large amount of surcharging and backwater effects. All four of the downtown interceptors are projected to have segments within 3-ft of flooding, and the Plum Street Interceptor is projected to come within 1.1-ft of flooding at MH70-042.

Most of these capacity issues are related to existing levels of inflow and infiltration in the downtown Olympia system. Figure 5-27 shows the depth-to-flood maps for 2020 through 2050.

Figure 5-27. Depth-to-Flood for the Downtown Interceptors, Peak Hour Conditions



The shallow pipe depth near MH70-042 means that the depth-to-flood issue at that location is not capacity-driven, but rather driven by topography. The downtown interceptors show a marked increase in flow depth between 2030 and 2040, with several segments coming within 3-ft of flooding. High water depths and surcharge conditions increases the risk of private property flooding via laterals.

As with the Indian Creek Interceptor, capacity limitations in these pipes is related to flow diversion at the MWRWP. Increased diversion beyond the existing 2 mgd will postpone projected limitations.

5.6 Sewer System Modeling Summary

Key findings from the updated sewer modeling include the following:

- A number of pipes in Olympia and Lacey are either capacity-limited or projected to become capacity-limited in the near future. These pipes are currently acting as bottlenecks, and restricting flow to downstream pipes under peak flow conditions. These include:
 - The pipe between manholes 510030 and 510027 on Capital Blvd
 - The pipe between manholes 539011 and 530044 on Franklin and Jefferson St.
 - Piping along Madison Ave and West Bay Road
 - Piping along Central Street in downtown Olympia
 - Both of the pipelines along East Bay Road, but particularly the one originating on San Francisco Ave.
- 15-inch capacity bottlenecks in the Martin Way Interceptor (East), commencing between 2030 and 2040, which give rise to excessive surcharging.
- 30-inch and 36-inch bottlenecks in the Martin Way Interceptor (West), commencing between 2040 and 2050, which give rise to excessive surcharging.
- Marginal capacity limitations and low-level surcharging in both the Cooper Point and Percival Creek Interceptors, but with limited risk of flooding due to pipe depth and/or slope.
- Capacity limitations in at least five segments of pipe in the Indian Creek Interceptor, commencing between 2020 and 2030, which give rise to excessive surcharging with risk of flooding.
- Capacity limitations and excessive surcharging of downtown interceptors, particularly notable between 2030 and 2040, with increased risk of flooding.

Because most of the LOTT pipelines are deep interceptors, none of the LOTT manholes are projected to flood, or to even come within 1 foot of flooding, by 2050. The LOTT manholes which come closest to flooding are:

- MH70-042 in the Plum St. Interceptor (within 1.1 ft of flooding)
- MH70-260 in the Percival Creek Interceptor (within 1.3 feet of flooding)
- MH70-134 in the Indian Creek Interceptor (1.5 ft)
- MH70-139 in the Indian Creek Interceptor (1.5 ft)

- MH70-129 in the Indian Creek Interceptor (1.5 ft)
- MH70-117 in the Indian Creek Interceptor (1.6 ft)
- MH70-136 in the Indian Creek Interceptor (1.6 ft)
- MH70-131 in the Indian Creek Interceptor (1.7 ft)
- MH70-013 in the State St. Interceptor (1.8 ft)
- MH70-132 in the Indian Creek Interceptor (1.9 ft)

5.6.1 Pressure Mains

The existing LOTT forcemain capacities and projected capacity reached in future years is listed in millions of gallons a day in Table 5-1 assuming a flow velocity of 7 feet per second.

Table 5-1. LOTT Forcemain Capacity

Force Main	Size (in)	Capacity (mgd)	2015	2020	2025	2030	2040	2050
Martin Way Forcemain ¹	18	8.0	52%	55%	64%	72%	81%	97%
Capitol Lake Forcemain (south only)	24	14.2	78%	83%	88%	91%	97%	100%
Capitol Lake Forcemain (south and north)	20+24	24.1	46%	49%	52%	53%	57%	59%
Southern Connection	22	11.9	35%	39%	43%	44%	49%	52%
Kaiser Road Forcemain	10	2.5	8%	8%	8%	8%	8%	8%

1. Including satellite flow diversion increments for the Martin Way: existing (2 mgd), 2038 (3 mgd)

- The Martin Way Forcemain would reach 85% capacity in 2023 with no flow to MWRWP. With flow to MWRWP as planned, the force main will not reach 85% of capacity.
- The Capitol Lake Pump Station discharges into two forcemains, a 24-inch pipeline that runs south of the lake, and a 20-inch pipeline that runs north of the lake. Using just the southern pipeline, the system would reach 85% capacity by 2022. With both forcemains in use, the system is not projected to reach 85% capacity within the planning period.
- The Southern Connection is a double-barreled forcemain, which runs from Tumwater to the Capitol Lake Pump Station. The smaller 20-inch pipeline has been converted to a pipeline to convey reclaimed water from the Budd Inlet Treatment Plant to Tumwater. With only the 22-inch pipeline used for wastewater conveyance, the system is not projected to become limited within the planning period.
- The Kaiser Road Force Main is not projected to become limited at any point in the planning period.

5.6.2 Pump Stations

Table 5-2 lists the current capacity of the LOTT pump stations in million gallons a day and the percentage of that capacity that will be reached in future years based on updated flow projections. The capacity listed is firm capacity, the capacity of the pump station with one of the largest units out of service.

Table 5-2. LOTT Pump Station Capacity

Pump Station	Pumps	Capacity (mgd)	2015	2020	2025	2030	2040	2050
Martin Way Pump Station ¹	4	18	34%	36%	39%	43%	53%	60%
Capitol Lake Pump Station	5	24	46%	49%	52%	54%	57%	59%
Kaiser Road Pump Station	3	2	10%	9%	9%	9%	10%	10%

1. Including satellite flow diversion increments for the Martin Way: existing (2 mgd), 2015 (2 mgd), 2038 (3 mgd)

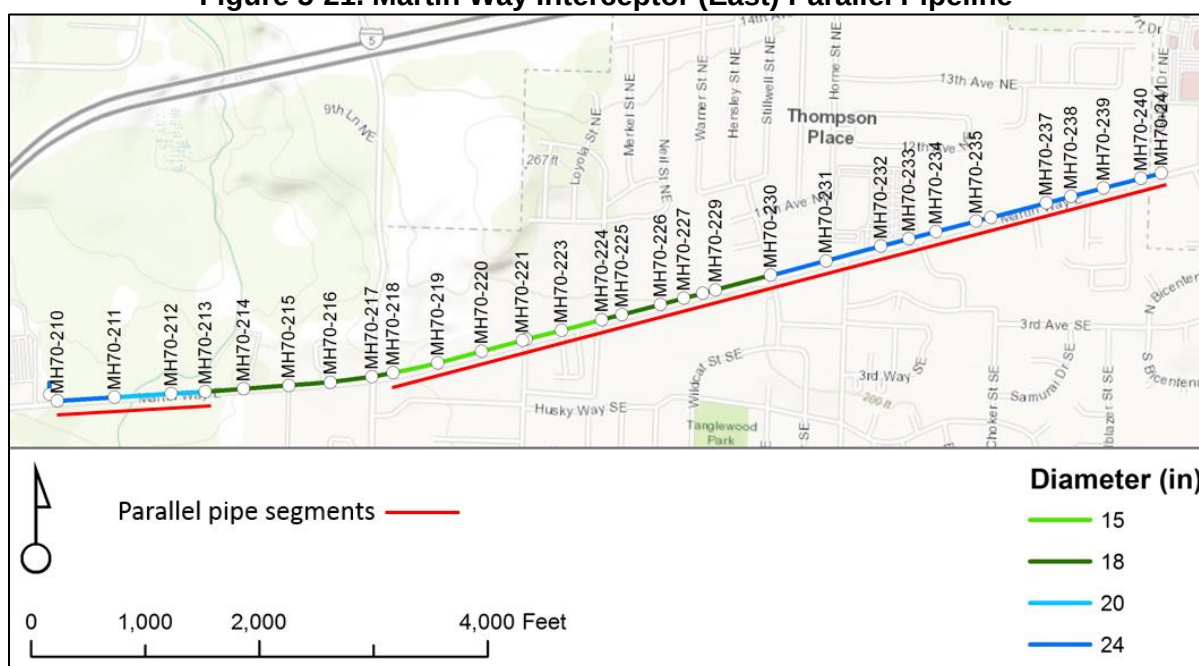
- None of the pump stations are projected to reach 85% capacity by 2050. Even with full build out and sewer connection, MWPS would only reach 79% of its full capacity

5.7 Required Capacity Improvements Projects

5.7.1 Martin Way Interceptor (East)

Up to 40 percent of the Martin Way Interceptor (East) will be surcharged by 2050, however the risk of flooding will remain low until after 2050. LOTT plans to install a parallel pipeline, running from Marvin Road to the Martin Way Pump Station (10,000 feet), in response to further development in western Lacey. The parallel pipeline will not become necessary until the 2040-2050 time frame, unless development and/or septic conversion in Lacey accelerates beyond the current projection.

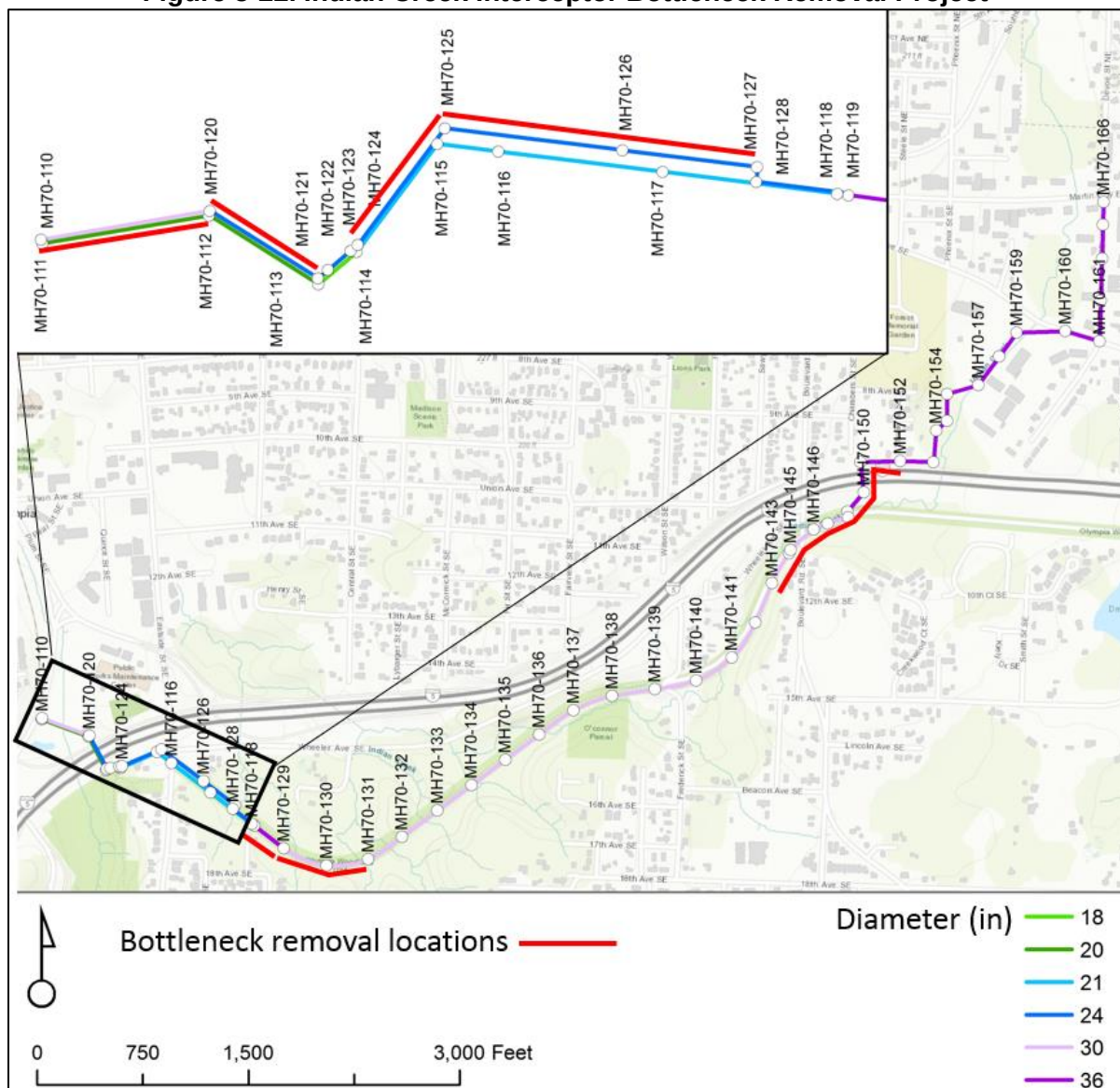
Figure 5-21. Martin Way Interceptor (East) Parallel Pipeline



5.7.2 Indian Creek Interceptor

The Indian Creek Interceptor is projected to become capacity limited at several locations, most notably in the two sections of pipe which cross under I-5 near its outlet. A bottleneck removal project would include several sections of pipe replacement. The project consists of upgrades to three sections of pipe, illustrated in red in Figure 5-22, and includes two crossings of Interstate 5. This project is scheduled to occur in 2035, but may be delayed if the MWRWP is expanded before 2038.

Figure 5-22. Indian Creek Interceptor Bottleneck Removal Project



5.7.3 Martin Way Forcemain

Like the Indian Creek Interceptor, the Martin Way Forcemain capacity is highly dependent upon the magnitude and pace of satellite flow diversion in Lacey. According to the current plan, the forcemain will not need to be expanded before 2050. The forcemain is 7,700 feet along its current alignment, which includes one crossing of Interstate 5.

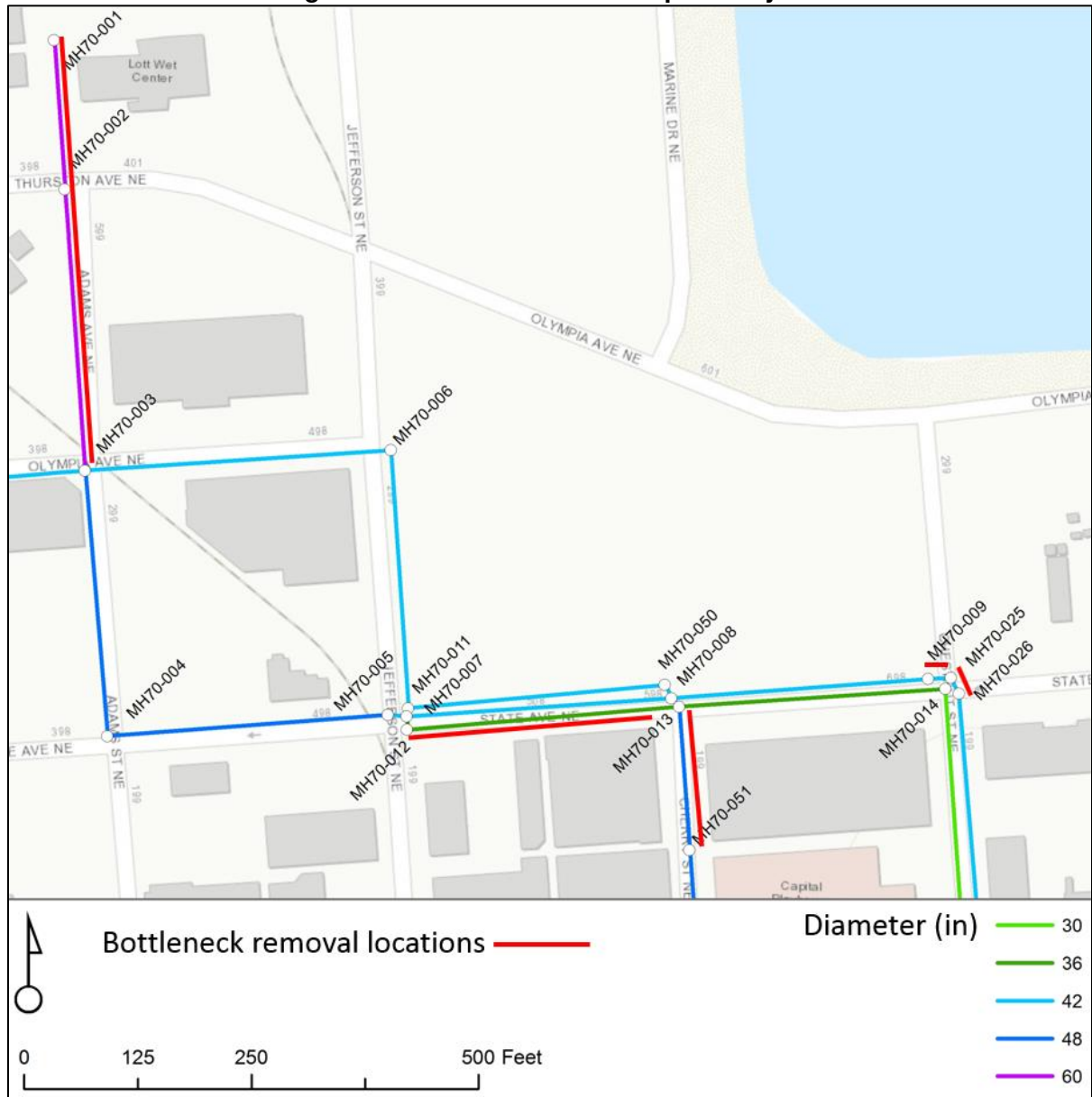
The map illustrates the proposed Parallel Force Main route in the Sleater-Kinney area. The route is highlighted in blue and follows a path that starts on the west side, passes north of North Thurston High and Chinook Middle, then continues east along Martin Way East, and finally turns south to connect to the MWPS. Key landmarks and streets shown include Sleater-Kinney, North Thurston High, Chinook Middle, Martin Way East, College Street, 6th Ave NE, 7th Ave NE, and Highway 5. The map also indicates the location of the MWPS (Main Water Pump Station) and the proposed route for the Parallel Force Main.

A recent project expanded the capacity of the interceptor near Mottman Road as identified in red in Figure 5-24. The downstream segment, from manhole MH70-283 to MH70-282 is projected to be capacity limited just after 2050. Even if the segment is capacity limited, the pipe's burial depth does not pose a high risk of manhole flooding, or backwater effects. If an upgrade is warranted, the most appropriate project would upgrade piping from manhole MH70-283 through MH70-279. A budget will be set aside for a potential project, set to occur in 2038. Project drivers will be evaluated in future reports.

The downtown interceptors projected to be heavily surcharged and capacity-limited by 2040, although this improvements could be pushed back with additional treatment beyond 2 mgd at the MWRWP. Regardless, capacity restrictions in this area will need to be addressed as the service population expands. Most of the issues in the downtown system stem from capacity restrictions in the State Street interceptors and the 60-inch diameter pipeline

entering the BITP. Figure 5-24 envisions a comprehensive project to remove bottlenecks in the downtown sector. Modeling suggests that resolution of the limitations along Adams Avenue alone may allow ample flow capacity through 2050.

Figure 5-24. Downtown Interceptor Project



5.8 Summary of Pipe Capacity Projects

The following table summarizes the sewer pipe capacity projects discussed in this section.

Table 5-3. Planned Pipe Capacity Projects

On-line	Name	Cost/Estimate	Status	Description
2035	Martin Way Interceptor (East)	\$11,400,000	Future	Increases capacity from Marvin to Carpenter
2036	Indian Creek Interceptor Improvements	\$16,000,000	Future	Removes bottlenecks in the Indian Creek Interceptor
2037	Downtown Interceptors	\$5,000,000	Future	Relieve capacity limitations at Adams Ave and State
post-2050	Percival Creek/Mottman Road Interceptor	\$4,500,000	Future	Relieves projected capacity limitations in the Percival Creek Interceptor

5.9 Reclaimed Water Conveyance Lines

Table 5-4 summarizes existing reclaimed water distribution pipes and their related capacities and Figure 5-25 maps the existing pipelines. The system includes a one-million-gallon Reclaimed Water Storage Tank to manage reclaimed water supply to the Tumwater Valley Golf Course and other end-users in Olympia and Tumwater.

Table 5-4. Reclaimed Water Distribution Pipe Capacities

Reclaimed Water Main	Size (in)	Capacity (mgd)	Length (ft)	2020	2025	2030	2040	2050
Martin Way Reclaimed Water Plant to Hawks Prairie Ponds	14	4	16,600	2	2	2	3	5 ¹
Budd Inlet Reclaimed Water Plant to Marathon Park	12	3.5	7,160	1.5	3	3	3	3
Marathon Park to Southern Connection A	20	10	230	1.5	3	3	3	3
Marathon Park to Southern Connection B	18	8	180	1.5	3	3	3	3
Marathon Park to Southern Connection C	20	10	8,900	1.5	3	3	3	3
Southern Connection to Deschutes Valley	18	8	1,110	1.5	3	3	3	3
Deschutes Valley to Tumwater Golf Course	20	10	5,110	1.5	3	3	3	3
Mullen Road	12	3	7,250	0	0	0	0	0

1. Capacity to be increased by adding an 18" pipeline

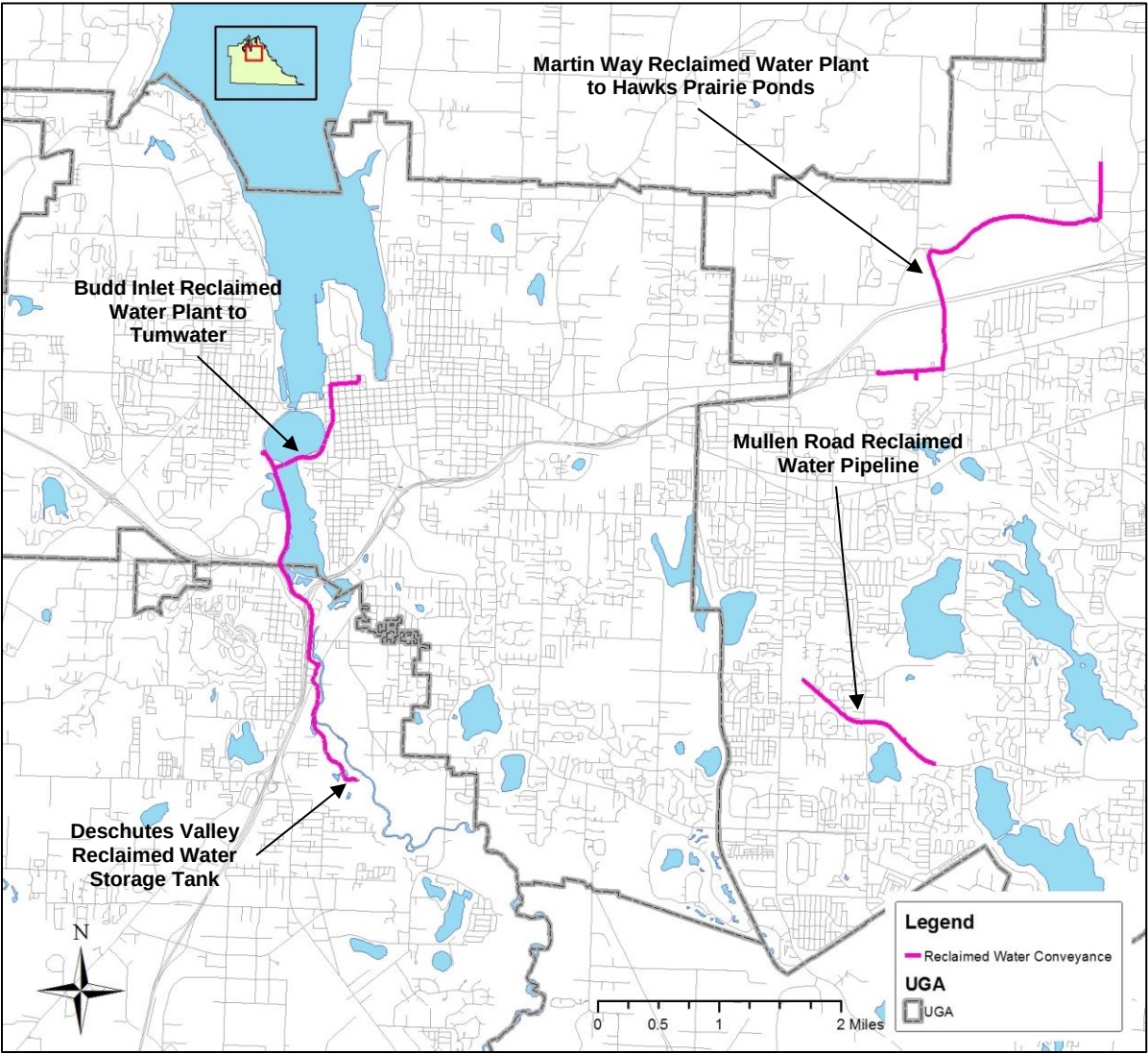
Planned Projects

A portion of the pipeline from the Tumwater Reclaimed Water Storage Tank to the planned Henderson North infiltration basins has been budgeted to enable collaboration with the City of Tumwater's project to extend their trail system to connect Pioneer Park.

Table 5-5. Planned Reclaimed Water Pipe Projects

On-line	Name	Cost/Estimate	Status	Description
2023	Tumwater Golf Course to Henderson North: Phase I	\$924,476	Future	Constructs line to Pioneer Park in collaboration with City of Tumwater Trail project
2039	Tumwater Golf Course to Henderson North: Phase II	\$7,200,300	Future	Extends line from Pioneer Park to the Henderson North Groundwater Infiltration site
2046	Martin Way to Hawks Prairie Pipeline Expansion	\$8,855,543	Future	Adds parallel forcemain to meet projected capacity limitations, though affected by pace at which the Martin Way Reclaimed Water Plant is expanded

Figure 5-25. Existing Reclaimed Water Conveyance Pipelines



6. Operational Capacity Analysis Summary

The projects identified in the 2019-2020 Capital Improvements Plan tie together process limitations at the Budd Inlet Treatment Plant, and capacity limitations related to treatment, discharge/use, and conveyance throughout the system. The list is based upon a number of key assumptions, many of which will have to be re-evaluated on an annual basis. In particular, the discharge capacity analysis will have to be re-assessed as the biological process improvements project moves forward, and the target effluent TIN concentrations are finalized.

LOTT maintains 1.5 mgd of reserve discharge capacity to Budd Inlet in order to manage peak flows and potential delays in the construction of new capacity. LOTT will continue to evaluate and monitor the system requirements and adjust capital improvement projects accordingly to ensure operational capacities are met.

The Reclaimed Water Infiltration Study will provide scientific data and community perspectives that will inform future decisions about reclaimed water levels of treatment and options for ultimate disposition of reclaimed water. LOTT will continue to maintain flexibility in its capacity development process, ensuring its ability to meet changing needs and conditions into the future.

In 2018, LOTT initiated a two phased long-term planning effort to evaluate alternatives for meeting future capacity needs. The first phase will focus on the Budd Inlet Treatment Plant foot print, evaluating alternatives for locating treatment processes. The second phase will focus on LOTT's reclaimed water production, conveyance and disposition program.

**WOODLAND CREEK RECLAIMED WATER
INFILTRATION FACILITY ANALYSES
FINAL REPORT**

September, 2010

**WOODLAND CREEK RECLAIMED WATER
INFILTRATION FACILITY ANALYSES
FINAL REPORT**

Prepared for:

**City of Lacey
420 College St SE
Lacey, WA 98509-3400
And
City of Olympia
PO Box 1967
Olympia, WA 98507-1967**

Prepared by:

**Pacific Groundwater Group
2377 Eastlake Avenue East, Suite 200
Seattle, Washington 98102
206.329.0141
www.pgwg.com**

September 2010

JE0909

final report v8

TABLE OF CONTENTS

1.0	EXECUTIVE SUMMARY	1
2.0	INTRODUCTION	2
3.0	PRIOR STUDIES	3
4.0	HYDROGEOLOGY	3
4.1	Hydrostratigraphy	3
4.2	Qvr Hydraulic Conductivity	4
4.3	Groundwater and Surface Water Flow	5
4.3.1	<i>Low-Water Season Synoptic Measurement Round</i>	<i>5</i>
4.3.2	<i>High-Water Season Synoptic Measurement Round</i>	<i>6</i>
4.3.3	<i>Groundwater and Stream Hydrographs</i>	<i>7</i>
4.3.4	<i>Historic Maximum Groundwater Level</i>	<i>8</i>
4.3.5	<i>Lake Lois Water Levels</i>	<i>9</i>
5.0	INFILTRATION SIMULATIONS	9
5.1	Simulated Infiltration Basins	10
5.2	Modeling to Assess Site Capacity and the NLD Rate	10
5.2.1	<i>Low-Water Season</i>	<i>10</i>
5.2.2	<i>High-Water Season</i>	<i>11</i>
5.3	Modeling to Assess Groundwater and Surface Water Effects	12
5.3.1	<i>Base-flow Effects in General</i>	<i>12</i>
5.3.2	<i>Effects with Basin 2 Infiltrating 1.3 mgd (low-water season site capacity)</i>	<i>13</i>
5.3.3	<i>Effects with Basin 2 Infiltrating 0.8 mgd (low-water season NLD rate)</i>	<i>14</i>
5.3.4	<i>Effects with Basin 2 Infiltrating 1.0 mgd (1 mgd rate)</i>	<i>14</i>
5.3.5	<i>Effects with Basin 2 Infiltrating 0.3 mgd (high-water season site capacity and NLD rates)</i>	<i>14</i>
5.3.6	<i>Effects from Infiltration at NLD rate if K_h is 100 ft/day (low-water season NLD rate sensitivity analysis)</i>	<i>15</i>
5.4	Flow Paths and Time of Travel	15
5.4.1	<i>Method of Analysis</i>	<i>16</i>
5.4.2	<i>Low-water Season Site Capacity (basin 2 infiltrating 1.3 mgd)</i>	<i>17</i>
5.4.3	<i>Low-water Season NLD rate (basin 2 infiltrating 0.8 mgd)</i>	<i>17</i>
5.4.4	<i>1 mgd rate (basin 2 infiltrating 1.0 mgd)</i>	<i>17</i>
5.4.5	<i>High-water Season NLD rate (basin 2 infiltrating 0.3 mgd)</i>	<i>18</i>
5.4.6	<i>Ambient Groundwater Flow Paths</i>	<i>18</i>
6.0	ANNUAL VOLUME	18
7.0	SUMMARY OF FINDINGS	19
	REFERENCES	21

TABLES

Table 1:	Generalized Hydrostratigraphy
Table 2:	Piezometer and Staff Gage Construction and Survey Data
Table 3:	Hydraulic Conductivity Data
Table 4:	Synoptic Water Level Data
Table 5:	Synoptic Streamflow Data
Table 6:	Low-Water Season Site Capacity and NLD Rate Modeling Results
Table 7:	Comparison of Modeled Recharge Rates
Table 8:	High-Water Season Site Capacity and NLD Rate Modeling Results
Table 9:	Low-Water Season Modeled Regional Flux Changes for Basin 2
Table 10:	High-Water Season Modeled Regional Flux Changes for Basin 2
Table 11:	Travel Time Estimates

FIGURES

Figure 1:	Vicinity and Geologic Map
Figure 2:	Conceptual Hydrogeologic Cross Section A-A'
Figure 3:	MW-1D Boring Log
Figure 4:	Groundwater and Surface Water Elevations 10/19/09
Figure 5:	Groundwater and Surface Water Elevations 3/10/10
Figure 6:	Well and Stream Hydrographs
Figure 7:	UWC Model Domain and TMR Calibration Target Locations
Figure 8:	UWC Model Infiltration Recharge Zones
Figure 9:	Low-Water Season Estimated Groundwater Mound and Reclaimed Water Time of Travel, Site Capacity
Figure 10:	Low-Water Season Estimated Groundwater Mound and Reclaimed Water Time of Travel, NLD Rate
Figure 11:	Low-Water Season Estimated Groundwater Mound and Reclaimed Water Time of Travel, 1 mgd Rate
Figure 12:	High-Water Season Estimated Groundwater Mound and Reclaimed Water Time of Travel, Site Capacity and NLD Rate
Figure 13:	Low-Water Season Groundwater Flow Paths Without Reclaimed Water Infiltration
Figure 14:	High-Water Season Groundwater Flow Paths Without Reclaimed Water Infiltration
Figure 15:	Variation of NLD Rate as a Function of Daily Ambient Groundwater Elevation

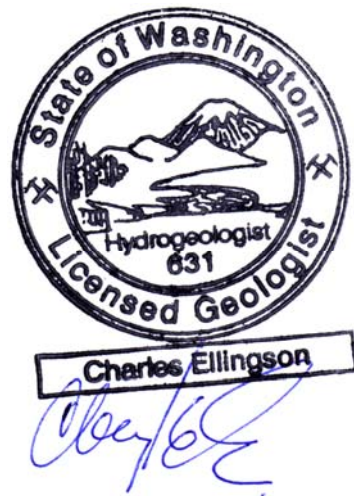
APPENDICES

Appendix A: Upper Woodland Creek Model Documentation

Appendix B: Variable Infiltration Rate Calculator

SIGNATURE

This report, and Pacific Groundwater Group's work contributing to this report, were reviewed by the undersigned and approved for release.



Charles Ellingson
Principal Hydrogeologist
Washington State Hydrogeologist No. 631

1.0 EXECUTIVE SUMMARY

To assess the feasibility of large-scale reclaimed water infiltration at Woodland Creek Community Park, field work was conducted to measure hydrogeologic properties, and a numerical groundwater model was adapted to simulate infiltration.

Measurements of low- and high-water conditions indicated that the elevation of Woodland Creek was consistently higher than local groundwater near the Park, suggesting that surface water flows out of the creek into the aquifer under natural conditions. Loss of creek water to the aquifer accounts for the creek going dry downstream of Lake Lois during a typical dry season.

To simulate infiltration of reclaimed water, a sub-regional model (the UWC or Upper Woodland Creek model) was adapted from the regional McAllister Model. The McAllister Model is an established groundwater model that has been used by the cities of Olympia, Lacey, and Yelm for water rights mitigation design. The UWC model was used to estimate feasible infiltration rates for reclaimed water during low-water and high-water seasons.

Our best estimate of the range of low-water season *site capacity*, which is the maximum infiltration rate which does not result in flooding, is 0.9 to 1.4 million gallons per day (mgd). Our best estimate of the range of the low-water season *no-local-discharge* (NLD) infiltration rate, which is the maximum rate that does not result in flooding or local discharge of reclaimed water at Woodland Creek, was found to be 0.8 to 0.9 mgd.

For high-water season simulations, the estimated site capacity and NLD rates are equal for each simulated basin, and vary from 0.4 to 0.2 mgd between basins.

The model was also used to evaluate the effect of infiltration on nearby surface-water bodies and wells. Increased groundwater-fed base flow

in the Woodland Creek basin was equal to 56 to 85 percent of the reclaimed water infiltration rate, depending on season and infiltration rate. Increases to base flows in the creek occur when infiltrating at the NLD rates (even though reclaimed water does not enter the local creek) because the lakes and creek lose less water to the aquifer when reclaimed water is infiltrated, and because the addition of reclaimed water forces more natural groundwater into the creek in gaining reaches and springs.

Under the NLD infiltration rate, reclaimed water is predicted to first appear in Woodland Creek at Beatty Springs after a travel time of about three years. However, within about three months travel time the reclaimed water will flow with groundwater through Goose Pond¹ (a small closed surface-water feature not connected to Woodland Creek). When low-water season infiltration rates exceed the NLD rate, local discharge to Woodland Creek is predicted within three months of infiltration.

One local well (the Lamplighter Well) is likely to capture some reclaimed water under all simulated infiltration rates, with a travel time exceeding three years. The model predicted that City of Lacey's Well No. 7 and the non-municipal Jackson, Lake Lois, and Sprout wells would not capture any reclaimed water. The Jackson and Sprout wells are close to the infiltration basins but are screened deeper than the simulated reclaimed water flow paths.

To estimate the annual volume of water that can be infiltrated using a seasonally variable infiltration rate, PGG generated a spreadsheet calculator. Using the low-water and high-water NLD rates predicted in this report, the calculator indi-

¹Goose Pond has existed since at least 1923, when it was included on a surveyed plat map of Fleetwood Acres. Based on the glacial history of the area, Goose Pond is most likely a natural kettle created thousands of years ago. However, its absence on a map from 1854 indicates it could be a man-made feature that post-dates 1854. If not entirely man-made, it may have been deepened to create the pond.

cates that about 550 acre-feet of water can be infiltrated during the average precipitation year. Operational infiltration rates may vary from predicted values, and therefore annual volumes would also vary.

Since site capacity and NLD rates both vary seasonally, maximizing the volume of infiltrated water requires a method to vary the operational infiltration rate throughout the year. Monitoring of the groundwater and creek is recommended to adjust the operational infiltration rate to match either the site capacity rate or NLD rate, whichever is chosen as the basis for design and permitting. In addition to seasonal variations, operational infiltration rates and the annual volume may vary from predicted values because of limitations in our knowledge and simulation of actual field conditions, as discussed below. Prior to final design, a large-scale pilot test could be performed to improve knowledge of achievable infiltration rates.

The accuracy of the site capacity, NLD rate, annual volumes and travel-time estimates, are subject to model limitations and knowledge of field conditions, including the following factors:

- Averaging of elevations and aquifer properties across model cells (minimum size 50 x 50 ft).
- Limited knowledge of the variation in aquifer and aquitard properties.
- Limitations of model calibration.
- Simplified representation of the relationship between the creek and groundwater.
- Approximations of the annual groundwater hydrograph and NLD rate/groundwater level relationship in the spreadsheet calculator.
- Extreme precipitation events are not considered and will affect facility operations.

2.0 INTRODUCTION

This report summarizes field conditions at the proposed reclaimed water infiltration site at

Woodland Creek Community Park in Lacey, Washington (**Figure 1**) and modeling performed to estimate the site infiltration capacity. The work was authorized in October 2009 by the City of Lacey under project number PW 2009-21. HDR Inc. was a subconsultant to Pacific Groundwater Group. The following field work was conducted between October 2009 and March 2010:

- Observing and interpreting surface soils
- Drilling 12 borings and constructing piezometers
- Constructing three staff gages in Woodland Creek and one in Goose Lake
- Measuring groundwater levels, surface-water levels and streamflow on the same day – once on October 19, 2009, and once on March 10, 2010
- Measuring the vertical hydraulic conductivity of soils in the presumed infiltration horizon at six locations using double-ring infiltrometers
- Estimating aquifer hydraulic conductivity using slug tests in each piezometer and interference injection tests in two sets of paired piezometers
- Installing transducers in piezometers and the stream

An Upper Woodland Creek (UWC) numerical groundwater model was adapted from the regional McAllister Model to simulate infiltration at the site and thus estimate site capacity, hydraulic effects, and travel times. The McAllister Model is an established groundwater model that has been used by the cities of Olympia, Lacey, and Yelm for water rights mitigation design. The UWC model was calibrated to the low-water season synoptic data set and used to simulate low-water-season infiltration. The model recharge was then altered so that model head better reflected high-water-season groundwater levels, but aquifer parameters were not changed at that point. The high-water season model was used to estimate a high-water season site capacity.

The work was performed, and this report prepared, using generally accepted hydrogeologic practices used at this time and place, for exclusive use of the City of Lacey, and for specific application to the project site. This in lieu of other warranties, express or implied.

3.0 PRIOR STUDIES

Geology and hydrology of the project region is described by the following primary references:

- *Hydrology and quality of ground water in Northern Thurston County, Washington, 1998, US Geological Survey.* This report provides a regional scale hydrogeologic interpretation to the area. The US Geological Survey's (USGS) numerical groundwater model of the vicinity is based on the conceptual model presented in this report, but significant simplifications were made in the numerical model compared to the hydrogeologic conceptual model. The "McAllister" Groundwater Model (CDM, 2002) is based on the USGS model, and in the Woodland Creek area several simplifications in addition to those retained from the USGS model were made.
- *Geologic Map of the Lacey 7.5-minute Quadrangle, Thurston County, Washington by Robert L. Logan, Timothy J. Walsh, Henry W. Schasse, and Michael Polenz, 2003.* This is the latest surficial geologic map and it provides a brief geologic history which is used as the basis for channel incision; however, we have relied more on the soil survey to indicate shallow geologic strata, and on the aforementioned USGS report for deeper geologic interpretations.
- *Soil Survey of Thurston County, Russell F. Pringle, 1990. NRCS/US Soil Conservation Service.*
- *Current Conditions Report, Woodland Creek Pollutant Load Reduction Project, 2007, Pacific Groundwater Group.* This report interprets hydrogeology near and downstream

of the proposed reclaimed water infiltration site.

- *Henderson Inlet Watershed Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Temperature Total Maximum Daily Load Study. Washington State Department of Ecology, March 2006, Publication No. 06-03-012.* This report provides creek flow data and general hydrologic conceptual model information.
- *Geotechnical Engineering Report, Carpenter Road SE, Pacific Ave. to Martin Way, September 10, 2009, Amec Earth and Environmental, Inc.* This report provides groundwater levels below Lake Lois.
- Information on the depth of Lake Lois in February 2002 was provided by City of Lacey survey data.

In addition to the references above, test pits were excavated on-site by HDR Engineering in 2007 to provide a preliminary opinion on infiltration feasibility (Woodland Creek Park Test Pit Explorations, May 2007).

4.0 HYDROGEOLOGY

Our conceptual hydrogeologic understanding of the Woodland Creek Community Park area is based on the references listed above and PGG's field activities. The conceptual model presented below is the basis from which the numerical groundwater model refinements (Section 5) were made.

4.1 Hydrostratigraphy

Figure 1 shows a map of shallow geology based on the soil survey of Thurston County and regional geologic mapping by the US Geological Survey. On **Figure 1**, areas expected to be underlain by glacial till were differentiated by PGG from areas where shallow glacial till is not anticipated. Though the figure shows an area where till was modeled that includes the Tri-Lakes, based on USGS data PGG does not believe that till is present in much of the Tri-Lakes (till was

modeled at the Tri-Lakes to maintain continuity with the modeling approach used in the McAllister Model for the Tri-Lakes (**Appendix A**)).

PGG locally favored the soil survey data for identifying areas underlain by till because of its higher resolution. Soils in the western portion of the site are mapped as Cagey and Everett series, consisting of loamy sand, and gravelly, sandy loam, respectively (Pringle, 1990) that developed on glacial outwash. Both soils are well drained, but the Cagey soil is noted for a seasonal high water table. The eastern portion the site and adjacent areas generally east of the site are mapped as Bellingham silt-clay loam and Alderwood soils, which (respectively) developed in depressions and on glacial till. For the purpose of this study, we have assumed that the Bellingham soils are also underlain by till.

Soils and geology encountered in on-site test pits and borings were generally consistent with the regional geologic mapping presented on **Figure 1**. Test pits and borings indicate glacial till and sediments with appreciable fines at shallow depths on the eastern end of the area explored, with sandy soils in the remainder of the area (except for extensive shallow silt at TP-16). Shallow silt overlies the area with thicknesses generally varying from 3 to 4 feet (but up to 14 feet at TP-16), and will likely require removal and replacement under the designed infiltration feature.

The data suggest the site is located near the headwaters of a channel that was eroded through Vashon glacial till (and probably into the advance outwash deposits) during a period when sea level was substantially lower than at present. The channel was later filled with the sandy soils encountered by the test pits and borings. **Table 1** summarizes our interpretation of the stratigraphy in areas where the till was eroded away (at the site and downstream to the north/northwest). It also shows where the more complete sequence of Vashon strata is present (which is generally upstream, to the southwest and southeast of the site). **Figure 2** is a conceptual cross section through the site and backfilled erosional channel, extending east into an area underlain by till

(note that the presence of till on the east end of the section is confirmed by only a single test pit).

Boring MW-1D was the only boring geologically logged at the site. Other borings were used to construct piezometers but were not logged (piezometer completion data are in **Table 2**). Soils encountered in boring MW-1D (**Figures 2 and 3**) consist of organic-rich topsoil and clayey silt to 4 feet depth (possibly Lake Russell lake sediment), then medium to fine sand with scattered gravel and cobbles to 33 feet depth, then fine sand with varying silt content to 91 feet, then 2.5 feet of silt and clay underlain by more fine sand to the total drilled depth of 100 feet. We interpret the upper 100 feet to be the combined thickness of Vashon recessional (Qvr) deposits, predominantly sand, deposited in a recessional lake which occupied the channel eroded through the till. We call this the “upper aquifer,” although the bottom portion is not highly permeable. The bottom of boring MW-1D is at the approximate elevation of the top of the Qf aquitard as mapped by the US Geological Survey. The Qf aquitard underlies the upper aquifer according to the conceptual model used for this project.

4.2 Qvr Hydraulic Conductivity

Field hydraulic conductivity tests were conducted on sediments of the upper aquifer (Qvr). Six double-ring infiltrometer tests were conducted in test pits at depths of 3 to 4 feet (**Table 3**). The pits were located adjacent to (but not within) former test pits excavated by HDR (2007). Vertical hydraulic conductivities interpreted from tests on sandy soils ranged from 1 to 164 ft/day with a geometric mean of 48 ft/day or 24 in/hr. One test in silt indicated a value of 0.1 ft/day (0.05 in/hr). Based on the distribution of sandy soils, slope, and distance from Woodland Creek, a “favorable infiltration zone” was mapped (**Figure 1**).

Slug tests were conducted in each piezometer by quickly injecting a volume of water. The test

data varied greatly in quality, and in general yielded hydraulic conductivity values below what was reasonable for the soil and compared to the infiltrometer data (range of results 1 to 127 ft/day with a geometric mean of 12 ft/day, **Table 3**). The piezometers were installed with the direct-push method, except for MW-1D (**Figures 2 and 4**) which was drilled using the sonic method. A low-permeability skin may have developed around the piezometers, particularly those installed in direct-push borings. Therefore multiple-well injection tests were performed on the two available piezometer pairs (MW-2S/2D and MW-3S/3D).

Injection tests were performed by injecting water at a constant rate into piezometers MW-3D and MW-2S, with mounding measured in both the injection and observation (MW-3S and MW-2D) piezometers. Hydraulic conductivity was estimated using Aqtesolve™ (HydroSOLVE Inc., version 3.81.000) and the methods of Moench, Cooper-Jacob, and Theis. The Moench method allowed consideration of partial penetration and the vertical screen off-sets between the D (deep) and S (shallow) completions. The injection tests indicated higher hydraulic conductivities than the slug tests did, suggesting that a low permeability skin may indeed exist around the piezometers. The geometric means of various injection test analysis methods were 82 to 236 ft/day for the four piezometers involved (**Table 3**). This range is in good agreement with the USGS who modeled the Qvr at a hydraulic conductivity of 150 ft/day.

The only piezometer installed at the bottom of the upper aquifer is MW-1D. Therefore only the slug test is available to measure hydraulic conductivity at that horizon. The hydraulic conductivity is relatively low, at 2 ft/day. Our conceptual model thus divides the upper aquifer into two horizons, with the upper being more conductive and the lower less conductive.

Hydraulic conductivities of hydrostratigraphic units below the upper aquifer were not tested on site and are generally assumed equal to those used in the McAllister Model (CDM, 2002; Golder, 2006). However, properties of the Qf

aquitard were modified based on local model calibration for this project (**Appendix A**).

4.3 Groundwater and Surface Water Flow

The following work was performed to characterize groundwater and surface-water flow:

- A low-water season synoptic measurement round
- A high-water season synoptic measurement round
- High-frequency water level measurements using transducers between the low-water and high-water synoptic measurement rounds
- At-time-of-drilling groundwater levels and survey data from Lake Lois were reviewed

The following subsections present these field data and interpretations.

4.3.1 Low-Water Season Synoptic Measurement Round

Groundwater level, surface water level, and surface water flow measurements were made on October 19, 2009². Groundwater and surface-water level measurement locations are shown on **Figure 1**. The water table occurred at a depth of 23.7 feet below ground surface below the favorable infiltration zone (MW-1S, **Figure 2**, and **Table 4**). Depth to water near the creek varied from 5 to 6 feet below ground surface. Right below the creek, the water table was more than 5 feet below the creek water surface at the upstream staff-gage/piezometer pair (SG-2/SG-2P, **Figure 4**). The water table was at least 5 feet below the stream water surface at the downstream stream-gage/piezometer pair (SG-1/SG-1P); data from nearby MW-3S suggest the water table was about 9 feet below the stream water surface. The relative elevation of the groundwa-

² Streamflow measurements were conducted by subcontractor River Measurement, a division of West Consultants, Inc.

ter and surface water indicates that the stream was losing water to the ground in October 2009. Groundwater levels are typically at their lowest seasonal elevation in September or October.

Groundwater flow was generally northwest, with a component parallel to Woodland Creek flow (**Figure 4**). Groundwater elevation varied about 10.5 feet spatially across the site on the date of measurement; however, 5 feet of that variation occurs between upgradient piezometers MW-6/MW-7 and the rest of the piezometer network. The abrupt change in groundwater gradient near MW-6/MW-7 is likely the result of a change in aquifer transmissivity, which may be caused by a gradational contact or glacial till present at MW-6 and MW-7 (those borings were not logged). That interpretation is reflected in the change in slope of the water table on the cross section of **Figure 2**.

To further assess the relationship between the creek and groundwater, streamflow measurements were made at four locations between Martin Way and Long Lake on the date of water level measurements (**Table 5**). Flow in the channel to Goose Lake was also measured on that day (it had flow in preceding weeks but no measurable flow on the date of measurement). Flow in Woodland Creek was 1.62 cfs at the railroad bridge downstream of Long Lake, 0.98 cfs at Pacific Avenue, and was dry at the footbridge over the creek downstream of Lake Lois and Carpenter Road. Thus the creek lost at least 0.64 cfs between Long Lake and Pacific Avenue (which includes the reach through the site), and it lost another 0.98 cfs between Pacific Avenue and the outlet of Lake Lois (lake storage is assumed constant).

Stream loss to groundwater theoretically causes a mound in the water table to form below the creek (and divergent flow away from the creek). A small mound (0.15 ft) was observable at the downstream piezometer transect³, while no

mound was discernable from the data at the upstream transect. The observed mound height is smaller than that expected given the measured hydraulic conductivity of the soils. A small mound height may be explained by a stringer of higher permeability sediments below the creek that acts as a drain on groundwater in the vicinity. A small mound could also be explained by lower leakage from the creek in the area monitored and higher leakage in unmonitored areas.

The water elevation in Goose Lake in October 2009 was about five feet lower than the upstream staff gage SP-2 (**Figure 4**). There was no surface water flow into the lake from the channel that connects to Woodland Creek, although flow was observed in the preceding weeks. A groundwater piezometer was not installed at Goose Lake and that surface water body is likely substantially above the nearby water table – therefore groundwater contours were not drawn from the piezometer network to the lake (**Figure 4**). Water elevations at Goose Pond were not measured as both property owners controlling access to the pond denied access.

4.3.2 High-Water Season Synoptic Measurement Round

Another set of groundwater level, surface water level, and surface water flow measurements were made on March 10, 2010. Groundwater levels and base flows are commonly near their annual peak in March; however, in water year 2010, maxima occurred in January 2010. Antecedent precipitation within the 2010 water year (beginning October 1, 2009) leading up to March 10, 2010, was 38.23 inches at Olympia Airport compared to average precipitation of 38.55 inches for that portion of the year.

The water table occurred at a depth of 17.5 feet below ground surface at the favorable infiltration zone (MW-1S, **Table 4**). That is 6.2 feet shallower than on the date of the low-water season synoptic measurement. Right below the creek, the water table was 3.69 feet below the

³ The downstream transect consists of piezometers MW-1 through MW-5 and SG-1P, plus staff gage SG-1. The upstream transect consists of piezometers

MW-6 through MW-9 and SG-2P, plus staff gage SG-2. See Figure 4.

creek water surface at the upstream staff-gage/piezometer pair (SG-2/SG-2P), and at the lower gage/piezometer pair (SG-1/SG-1P) it was 1.81 feet below the stream water surface. The relative elevation of the groundwater and surface water in March indicates that the stream was losing water to the ground in March 2010. We conclude that the stream loses water to the ground throughout the typical year based on the fact that it was losing during the low- and high-water season synoptic events.

Groundwater flow was northwest, generally parallel to Woodland Creek flow (**Figure 5**). Groundwater elevation varied only 2.35 ft between wells MW-9 and MW-5 on the date of measurement. That spatial variation is smaller than the value measured in October 2009. The lower average gradient measured when *more* groundwater was moving through the aquifer during the wet season suggests heterogeneities in aquifer properties and stream loss.

Streamflow measurements were made at five locations between Martin Way and Long Lake on March 10, 2010 (**Table 5**). There was only 0.02 inch of precipitation on the 10th, and a total of 0.24 inch in the preceding 10 days. Thus the streamflow data represent high-water season base flow. Flow in Woodland Creek was 13.8 cfs at the railroad bridge downstream of Long Lake compared to 1.62 cfs at that location in October 2009. At Pacific Avenue flow was 12.7 cfs in March 2010 compared to 0.98 cfs in October 2009, and at the footbridge over the creek downstream of Lake Lois and Carpenter Road flow was 8.43 cfs in March 2010 and zero in October 2009. Thus the creek lost 5.37 cfs between Long Lake and the outlet of Lake Lois (which includes the reach through the site) in March 2010 compared to 1.62 cfs in October 2009.

Flow at Martin Way, upstream of Beatty Springs, was 7.02 cfs in March 2010 compared to zero in October 2009. Thus additional stream loss occurred in the reach between Lake Lois and Martin Way in March 2010 whereas that reach was dry in October 2009. Other calcu-

lated streamflow losses to groundwater were as follows:

- Long Lake to Pacific Avenue: 1.1 cfs loss in March 2010 compared to 0.64 cfs loss in October 2009 – a modest difference of 0.46 cfs (1.72-times greater in the high-water season)
- Pacific Avenue to Lake Lois outlet: 4.27 cfs loss in March 2010 compared to 0.98 cfs loss in October 2009 – a large difference of 3.29 cfs (4.35-times greater in the high-water season)
- Lake Lois outlet to Martin Way: 1.41 cfs loss in March 2010 compared to 0 cfs in October 2009 – a modest difference in absolute terms

These calculations indicate that the largest stream loss to groundwater occurs in the reach between Pacific Avenue and Lake Lois outlet – a reach which is downstream of the site. Stream loss to groundwater theoretically causes a mound in the water table to form below the creek (and divergent flow away from the creek). The contours of **Figure 5** have been drawn to reflect a mound where appropriate. A small mound (as high as possibly ~1 ft) was observable at the downstream piezometer transect by comparing heads in SG-1P and MW-4 to MW-3S, MW-2S, and MW-5; however, the fact that MW-3S has relatively low head (near the creek) is not consistent with the presence of a mound. During October 2009, the downstream transect suggested a minimal mound of ~0.15 ft. Similar to October 2009, no mound was discernable at the upstream transect.

Flow occurred from the creek to Goose Lake (estimated 0.05 cfs) on March 10, 2010 when the lake water elevation was 149.12 ft. Goose Lake was 1.77 feet lower than the upstream staff gage SP-2 on that date (**Figure 5**). The water elevation at Goose Pond was not measured.

4.3.3 Groundwater and Stream Hydrographs

Transducers were installed in five piezometers and one Woodland Creek staff gage on Novem-

ber 23, 2009. This report provides water level data from the piezometers through the second synoptic measurement round of March 10, 2010.

Water levels rose substantially between the October 2009 synoptic data set and transducer installation (**Figure 6**) on November 23, 2009. All wells except MW-6 rose significantly between those dates whereas MW-6 had similar water levels. Based on hand-measurements, MW-6 responded to the onset of precipitation just prior to October 19, 2009, whereas the other wells' responses were relatively delayed.

Water levels rose rapidly after transducer installation in response to precipitation between early and mid-November. Delayed water-level change similarly occurs in response to precipitation in late December to early January. In that event, stream and groundwater levels built up over 19 days of precipitation, but did not reach maxima until a couple of days after the cessation of precipitation. The slow build-up and delay of the surface water level is likely caused by the large tortuous surface water basin (the Tri-Lakes) upstream of the gage and the fact that the upstream lakes are dominated by groundwater discharge. The similarly slow buildup and delay of on-site shallow groundwater levels may result from the significant role that stream loss has on groundwater recharge near the piezometer network.

Water levels reached maxima on or about January 18, 2010. At that time, groundwater levels in the downstream piezometer transect were 1.3 ft above the elevations recorded during the wet season synoptic event of March 10, 2010, and the stream was 0.1 to 0.2 ft higher than the date of the synoptic event⁴. Based on the differences between measured groundwater and stream levels between the synoptic event and dates of maximum groundwater levels, it appears that the stream was losing to the ground even during the

extreme groundwater high⁵. The water table was likely as high as the bottom of the creek bed at the lower transect, but the surface water elevation in the creek was higher than the adjacent water table.

4.3.4 Historic Maximum Groundwater Level

The natural historic maximum groundwater level was not estimated for the site because methods typically used for estimating historic extreme groundwater elevations were not likely to be accurate at this site. Approaches considered include linear regression to a long-term groundwater elevation dataset and a statistical correlation to a long-term precipitation record. A local groundwater model using transient precipitation data was not within the scope and would have been hampered by lack of calibration data in any case.

Long-term groundwater level records in northern Thurston County exist at Hawks Prairie Landfill and within the Salmon Creek Basin. The hydrogeologic conditions at those sites differ in important ways from the project site. In particular, on-site groundwater levels are affected by Woodland Creek, which loses water to the ground under all observed conditions, but may gain during extreme groundwater highs. Under those conditions correlations are likely to be inaccurate for the extreme events of interest.

The antecedent precipitation index for head (APIH, outlined in **Appendix B**) used to predict the annual average hydrograph was found to be unreliable at predicting maximum historic groundwater elevations. APIHs assume that groundwater elevations are a function of precipitation and that the functionality does not change over the range of data. If actual extreme groundwater levels are damped by nearby groundwater flooding, gaining streams, or other

⁴ The only staff gage with a transducer was SG-4 at Pacific Ave. The water elevation in that downstream location is 2 to 2.5 ft lower than at the lower transect gage (SG-2). See Table 4 for tabular water level data.

⁵ The fact that the SG-4 elevation was lower than onsite groundwater elevations on Figure 6 does not mean the stream was gaining, as the SG-4 gage is substantially downstream and down-gradient of the piezometers.

boundaries, the predicted groundwater elevations for extreme events will be over-predicted.

Although the historic maximum groundwater elevation could not be reliably quantified at this time, extreme groundwater highs may cause Woodland Creek to gain water from the aquifer at the site. Under those conditions, a reclaimed water infiltration facility may not be able to operate continuously without discharging reclaimed water to the local creek.

4.3.5 Lake Lois Water Levels

Depth to groundwater was measured by Amec in several auger borings drilled for construction of a pumping station along Carpenter Road SE at Lake Lois (Amec, 2002). Wells and piezometers were not installed, and thus all water levels were collected inside the augers at the time of drilling. From this work we interpret that water leaking into the ground from Lake Lois saturates shallow low-permeability soil layers (up to about 5 ft depth below the western retaining wall). The perched shallow water is separated from the regional water table that occurs at depth of 10 to 15 ft below the west retaining wall in higher-permeability sands and gravels indicated on the boring logs.

The depth of Lake Lois was surveyed by a City of Lacey survey crew in February 2002. The surveyed portions of the lake were less than 5 feet deep on that date. The invert elevation of the culverts under Carpenter Rd are about 139 ft above City datum compared to the lake water elevation of about 140 feet on that date.

These data provide the best information on lake elevation, lake depth, groundwater elevations, and soil properties in that vicinity. The data are thus important contributors to our understanding of hydrology downstream of the Park.

5.0 INFILTRATION SIMULATIONS

To assess the feasibility of large-scale reclaimed water infiltration at Woodland Creek Communi-

ty Park, a numerical groundwater model was adapted from the regional McAllister Model. The McAllister Model is an established groundwater model that has been used by the cities of Olympia, Lacey, and Yelm for water rights mitigation design. The UWC model is a sub-regional model that was calibrated to local conditions in the Upper Woodland Creek basin between Long Lake and Beatty Springs (**Figure 7 and Appendix A**).

Major local refinements to the McAllister Model made in the UWC model include:

- A finer model grid was used for greater spatial accuracy.
- Recharge rates were revised to simulate steady-state representations of seasonal low and high groundwater levels.
- Land surface elevations were updated to allow for a more accurate evaluation of flooding.
- Local water bodies (Goose Lake and Goose Pond) near Woodland Creek Community Park were added and the representation of Lake Lois was refined.
- Beatty and St Martin's springs were added.
- Woodland Creek was re-delineated and model representation of the creek was revised.
- Model layers were added to the shallow Vashon units (Qvr and Qvt) to allow for greater vertical resolution to better simulate the proposed reclaimed water infiltration, groundwater mounding, and local geology.
- An erosional window through the Vashon till (Qvt) was added in the Woodland Creek vicinity, with aquifer parameters in the window modified to reflect local conditions.
- Local wells that were not previously simulated in the McAllister model were added to the UWC model.

PGG used the model to estimate infiltration rate under several operational conditions. Specifically, the *site capacity, no-local-discharge (NLD) rate, and 1 mgd rates* are defined as:

- “Site capacity” is the range of maximum infiltration rates which should maintain groundwater elevations below the bottom of the infiltration pond and not result in local flooding. Site capacity is expressed as a range because three infiltration basins are simulated in adjacent, but different, locations.
- “NLD rate” is the infiltration rate range that meets the “site capacity” constraints defined above, and should not result in local discharge of reclaimed water to Woodland Creek (local discharge is defined as discharge to the creek at or above Lake Lois (Upper Woodland Creek)).
- “1 mgd rate” is the 1 mgd infiltration rate identified in Lacey’s and Olympia’s Water Right Mitigation Plans.

The site capacity and NLD rates were estimated using best estimates of aquifer properties. A sensitivity analysis was then performed by estimating the NLD rate using lower aquifer transmissivity.

5.1 Simulated Infiltration Basins

Three infiltration basins were simulated (**Figure 8**) assuming that redundant infiltration area will be required to allow drying and maintenance of the basins. The modeled infiltration was spread as a constant recharge rate across a single active infiltration basin. It was assumed that for all infiltration basins, approximately 4 feet of topsoil will be removed, and that the shallow clay layer identified by HDR (2007) and PGG (2010) is removed. Modeled infiltration rates were constrained so that groundwater elevations beneath the basins remained at least four feet below current land surface, which is the assumed depth of the basins.

The areas of simulated basins 1, 2, and 3 were 60,000, 47,500, and 45,000 square feet respectively. The differences in sizes resulted from fitting three basins into the irregular favorable infiltration area and limitations imposed by the

numerical model grid (**Figure 8**). The largest basin (1) is furthest from the creek and the smallest basin (3) is closest to the creek. Smaller size, the equidimensional shape, and closer proximity to the creek all contribute to a slightly reduced site capacity for basin 3 (**Table 6**). Most modeling was performed using basin 2 which is of an intermediate size and distance from the creek.

Degree of redundancy, maintenance, size, and shape of the basins are issues that should be reviewed during site design. At sites limited by groundwater mound height right below the basin, a site design using numerous, narrow, inter-fingered sub-basins or gallery pipes may increase site capacity for a given area, relative to the relatively equidimensional separated basins assumed for this analysis. Infiltration rates at this site are limited by effects at the creek or in nearby low areas (not right below the basins – **Table 6**) – and site capacity and NLD rates are likely to be less sensitive to basin geometry.

5.2 Modeling to Assess Site Capacity and the NLD Rate

Site capacities and the NLD rates were estimated for both the low-water season and high-water season since differing depths to ambient groundwater will result in different maximum infiltration rates. Detailed description of the modeling analysis used to generate these estimates is found in **Appendix A**.

5.2.1 Low-Water Season

Depending on the basin modeled, the best estimate of steady-state site capacity in the low-water season ranged from 0.9 to 1.4 mgd while best estimates of the NLD rates ranged from 0.8 to 0.9 mgd (**Table 6**). The NLD rates and site capacity rates are ranges because different infiltration basins have different sizes and spatial relationships to the creek and to low-lying areas (which are eventually predicted to flood with increased infiltration rate and growth of the groundwater mound).

Estimated NLD rates decrease from 0.8 to 0.6, 0.8 to 0.5, and 0.9 to 0.6 mgd for basins 1, 2, and 3 if aquifer hydraulic conductivity of model layers 1 through 6 is assumed to be 100 ft/day instead of 200 ft/day at the infiltration site. The lower hydraulic conductivity is within the range of measured values.

Because the actual performance of the basins will remain somewhat uncertain until they are operated, we recommend a phased and flexible facility development approach. Such an approach would ideally include gradual increase in the rate of infiltration, performance monitoring to improve understanding, and design contingencies for extra infiltration area in case a fixed performance is necessary and not realized. If that approach is not possible, a large scale pilot infiltration test should be considered prior to final design.

5.2.2 High-Water Season

The high-water season model was created by modifying the low-water season model to approximate high-water season groundwater levels and streamflows (**Appendix A**). Like the low-water season model, the high-water season model is steady-state. The following changes were made:

- Distributed recharge from precipitation was increased to improve the model's match to groundwater levels measured on March 10, 2010.
- Woodland Creek streamflow at Long Lake was increased to 13.8 cfs, as measured on March 10, 2010.
- A diversion of 0.05 cfs from Woodland Creek to Goose Lake was simulated, as measured on March 10, 2010.
- Stream segments that were not previously calibrated since they were dry in the low-water season model (Lake Lois and Woodland Creek between Lake Lois and Beatty Springs) were calibrated.

Note that no aquifer properties and no other boundary conditions were altered. The amount

of distributed recharge necessary to raise local groundwater heads to the observed high-water season values was less than expected because the model tended to over-predict mounding locally below the creek. The calibrated high-water season distributed recharge is less than the annual average recharge in the McAllister Model (**Table 7**) - which is not realistic. The relatively low regional recharge used for the high-water season model also probably results in regional groundwater heads that are relatively low compared to heads near the creek - and this could affect the distribution of simulated effects on stream base flows.

Depending on the basin modeled, the best estimate of steady-state site capacity in the high-water season ranged from 0.2 to 0.4 mgd, and the NLD rates were the same as the site capacity rates (**Table 8**). This result occurred because as the infiltration rate was increased, groundwater was first exposed at ground surface near the creek and not within the basins themselves for all simulations. Since surface flooding cannot occur by definition at the site capacity or NLD rate, both the site capacity and NLD rate values range between 0.2 and 0.4 mgd even though no simulated reclaimed water particles discharge to the creek or at the surface where simulated flooding occurs. In these simulations, about 10 to 11 feet of vadose zone still existed below the simulated infiltration basins (**Table 8**). Though the UWC model predicts that local flood water will have no reclaimed water component, based on PGG's conceptual model of the site, some reclaimed water is expected to be part of the flood water at infiltration rates above the NLD rate.

The high-water season model is expected to underestimate the site capacity and NLD rates. The model over-predicts the height of the water table mound that occurs below the creek as a result of stream loss to the aquifer, and thus is expected to over-estimate the height of the reclaimed water mound. If the height of the reclaimed water mound is over-estimated, the site capacity and NLD rates are likely to be under-estimated. Although this effect influences both the low-water and high-water season simulations, it is expected

to have the greater effect on the high-water season estimates of site capacity and NLD rates. All high-water site capacities and NLD rates are limited by groundwater (possibly with a component of reclaimed water) emerging near the creek, where the high-water season mound caused by stream loss to the aquifer is greatest.

5.3 Modeling to Assess Groundwater and Surface Water Effects

Reclaimed water infiltration will increase stream base flows and stages of groundwater lakes such as Goose Pond. The increased water levels and flows are caused by changes in groundwater head transmitted through the groundwater flow system. Reclaimed water may or may not discharge to the surface water features as the head increases. This section describes the hydraulic effects of infiltration and mounding, whereas the flow paths and travel times of the infiltrated reclaimed water are discussed in Section 5.4.

Hydraulic effects were evaluated using the following model scenarios:

Low-Water Season Scenarios:

- No additional recharge (pre-infiltration for comparison)
- Basin 2 infiltrating at its site capacity of 1.3 mgd
- Basin 2 infiltrating at its NLD rate of 0.8 mgd
- Basin 2 infiltrating at the 1 mgd rate
- Sensitivity of NLD rate in each basin to lowering of upper aquifer hydraulic conductivity to 100 ft/day from 200 ft/day

High-Water Season Scenarios:

- No additional recharge (pre-infiltration for comparison)
- Basin 2 infiltrating at its site capacity and NLD rate of 0.3 mgd

Basin 2 is used in this analysis because it lies physically between basins 1 and 3 (**Figure 8**), and has site capacity and NLD rates that are also intermediate. Differences in effects among the three basins are expected to be more significant for simulation of the 1 mgd rate compared to the site capacity or the NLD rate because the latter two are scaled up or down based on simulated effects whereas no compensation for effects is applied in simulation of the 1 mgd rate. However, PGG did not perform multiple sensitive-feature analyses to confirm this expectation.

Both the McAllister and UWC models represent the Tri-Lakes with river cells, which hold lake heads constant while predicting changes of groundwater seepage into and out of the lakes based on changes in groundwater elevation. A change in groundwater elevation associated with drawdown (in the case of pumping, as simulated by the McAllister Model) or mounding (in the case of infiltration, as simulated by the UWC Model) will change the hydraulic gradient across the lakebed and thereby change the rate of flow between the lake and groundwater predicted by the model. Although the simulation is not a perfect representation of the field condition, the method used to estimate the effects to the water budget under both drawdown and mounding is the same. Thus the reduction in groundwater recharge from the Tri-Lakes caused by mounding of the water table during reclaimed water infiltration is included with other changes to Woodland Creek flow in the subsections to follow. Model representation of the Tri-Lakes is further discussed in **Appendix A**.

5.3.1 Base-flow Effects in General

Infiltrating reclaimed water is expected to cause base flow to increase in both upper and lower Woodland Creek and elsewhere. Using steady-state effects near the mouth of the creek (Hollywood Development) plus those of the Tri-Lakes as a measure (**Tables 9 and 10**), base flow is predicted to increase by 58 percent of the *low-water season* NLD rate and 85 percent of the *high-water season* NLD rate. The difference occurs because when the natural water table is closer to the ground surface (high-water season),

more stream reaches are connected to the water table and added water is more likely to cause an increase in base flow.

The NLD rate is predicted to result in base-flow increases without direct discharge of reclaimed water to upper Woodland Creek, whereas infiltrating at the higher 1 mgd and site capacity rates (when this is actually possible) is predicted to result in discharge of reclaimed water to upper Woodland Creek. **Tables 9 and 10** help communicate this result by italicizing numbers that do NOT include reclaimed water flowing into or within Woodland Creek. Bolded values are from scenario/location combinations that likely include reclaimed water in the creek, while non-formatted values correspond to simulated background conditions.

The following subsections discuss the details of base flow and other effects as a result of infiltration in basin 2. Effects from infiltrating in basins 1 and 3 should be only marginally different for similar infiltration rates.

Predicted changes at specific features are sensitive to how they are implemented in the model and may differ from the actual change if infiltration were to occur.

5.3.2 Effects with Basin 2 Infiltrating 1.3 mgd (low-water season site capacity)

Simulations using the low-water season model indicate that a local groundwater mound 21 ft above the ambient water table is estimated in the Qvr under this scenario (**Figure 9**), leaving 3.5 feet of vadose zone below the pond bottom (**Table 6**). Regional groundwater mounding is predicted to occur in the Qva, where the maximum height is 17 feet and the mound extends from approximately Long and Hicks Lakes to near Interstate 5. Lateral extension of the mound is greatest in the Qva aquifer because this layer is more aerially extensive and has a higher horizontal hydraulic conductivity than the Qvr aquifer. Significant groundwater mounding (i.e. where modeled mound height exceeds 1 foot) is not predicted to extend into the Qc aquifer.

At the low-water season site capacity, reclaimed water added to the model is accounted for by increases in flow to upper Woodland Creek (at Lake Lois and above), and the lower reaches below Beatty Springs (**Table 9**)⁶. In the upper Woodland Creek basin, losses from the Tri-Lakes to groundwater decreased by 0.16 mgd (0.25 cfs) as a result of higher groundwater levels. That change is in addition to the following effects predicted by MODFLOW's stream and drain packages for downstream locations, with each sentence below corresponding to a column on **Table 9**. The predicted change in Woodland Creek base flow at Pacific Avenue of 0.27 mgd (0.42 cfs) is equal to a 43 percent increase in base flow at that location and approximately 21 percent of the simulated infiltration rate. At the outlet of Lake Lois, the increased streamflow of 0.28 mgd (0.43 cfs) represents all new base flow compared to the zero base flow of the baseline condition, and is equal to approximately 22 percent of the simulated infiltration rate. Some of the new base flow is expected to infiltrate in the reach below Lake Lois, with little simulated change in base flow between the outlet of Lake Lois to Martin Way; however, as no flow occurred in this reach when low-water season calibration data were collected, it was not possible to calibrate to local stream conditions.

Based on low-water season simulations, flow at Beatty and St. Martin's springs had a predicted increase of 0.27 mgd (0.42 cfs), which represents a 22 percent increase in base flow and equates to 21 percent of the simulated infiltration rate. At the Hollywood Development near the mouth of Woodland Creek, base flow was predicted to increase by 0.70 mgd (1.08 cfs), which equates to an 11 percent increase in base flow and 53 percent of the simulated infiltration rate.

For the Woodland Creek basin as a whole, base flow was predicted to increase by 0.86 mgd

⁶ On Tables 9 and 10, values for Tri-Lakes, Pacific Ave. and the springs, are stand-alone, whereas the values for Lake Lois, Martin Way, and the Hollywood Development are cumulative with respect to upstream flows.

(1.33 cfs), which equates to 66 percent of the simulated infiltration rate (column on far right of **Table 9**).

Since most reclaimed water does not directly discharge to Woodland Creek, the increased flux is mostly due to groundwater displaced by reclaimed water. See the next subsection for discussion of effects while infiltrating the NLD rate (when *no* reclaimed water enters the local creek).

5.3.3 Effects with Basin 2 Infiltrating 0.8 mgd (low-water season NLD rate)

The NLD rate is the maximum rate at which reclaimed water is not expected to discharge to upper Woodland Creek. It is a range because the basins do not have equal NLD rates. This section, **Table 9**, and **Figure 10**, are based on simulations of the low-water season NLD rate from basin 2 (0.8 mgd). The maximum mound heights of the NLD rate simulation for the Qvr and Qva layers are five and four feet lower than the respective site capacity maximum mound heights (**Table 6**) because the infiltration rate is lower. The extent of mounding is also less (**Figure 10**). Although reclaimed water does not discharge to the local creek under the NLD rate (by definition), base flow does increase in upper Woodland Creek because less lake and creek water is lost to the aquifer, while in lower Woodland Creek more native groundwater enters the creek than without reclaimed water infiltration.

Flow in upper Woodland Creek is expected to increase slightly as a result of infiltrating at the low-water season NLD rate. In the upper Woodland Creek basin, losses from the Tri-Lakes to groundwater decreased by 0.13 mgd (0.20 cfs) as a result of higher groundwater levels. In addition, the simulated increase to base flow at Pacific Avenue is 0.08 mgd (0.12 cfs), which represents a 13 percent increase in base flow and equates to 10 percent of the simulated infiltration rate. No increase is predicted at the outlet of Lake Lois (**Table 9**). For the NLD rate, all of the additional flow observed at Pacific Avenue infiltrates at Lake Lois, resulting in no additional surface water discharge from the lake. For lower

Woodland Creek, flow at Beatty and St. Martin's springs combined was predicted to increase by 0.21 mgd (0.32 cfs), which represents a 17 percent increase in base flow and equates to 27 percent of the simulated infiltration rate. At the Hollywood Development near the mouth of Woodland Creek, base flow was predicted to increase by 0.34 mgd (0.52 cfs), which represents a six percent increase in base flow and equates to 42 percent of the simulated infiltration rate.

For the Woodland Creek basin as a whole, base flow was predicted to increase by 0.47 mgd (0.73 cfs), which equates to 58 percent of the simulated infiltration rate (column on far right of **Table 9**).

5.3.4 Effects with Basin 2 Infiltrating 1.0 mgd (1 mgd rate)

Effects on base flow from infiltrating 1.0 mgd (the 1 mgd rate) in basin 2 are intermediate between the effects of the site capacity and NLD rates discussed in the preceding subsections. All the 1 mgd simulations were based on the low-water season model. Refer to **Tables 6** and **9** and **Figure 11** for details.

5.3.5 Effects with Basin 2 Infiltrating 0.3 mgd (high-water season site capacity and NLD rates)

This section, **Table 10**, and **Figure 12**, are based on simulations of the high-water season site capacity/NLD rate from basin 2 (0.3 mgd or 0.46 cfs). The maximum Qvr mound height of the high-water season site capacity/NLD rate simulation is about 4.4 feet. The Qvr mound does not build up to ground surface, leaving 10 to 12 feet of vadose zone (**Table 8**). The extent of the Qva mound is also greatly reduced (**Figure 12**). Although reclaimed water does not discharge to the local creek under the NLD rate (by definition), base flow does increase because in upper Woodland Creek less creek water is lost to the aquifer, while in lower Woodland Creek more native groundwater enters the creek than without reclaimed water infiltration (reclaimed water also enters the lower creek). Flow in upper

Woodland Creek is expected to increase slightly as a result of infiltrating at the high-water season NLD rate (**Table 10**). The model predicted that losses from the Tri-Lakes to groundwater decreased by 0.02 mgd (0.03 cfs) as a result of higher groundwater levels. In addition, the simulated increase to base flow at Pacific Avenue was 0.13 mgd (0.20 cfs) which is a two percent increase and equates to 45 percent of the simulated infiltration rate. At the Lake Lois outlet base flow is predicted to increase by 0.22 mgd (0.34 cfs), which is a three percent increase and equates to 75 percent of the simulated infiltration rate.

For lower Woodland Creek, flow at Martin Way was predicted to increase by 0.20 mgd (0.31 cfs) which is a four percent increase and equates to 67 percent of the simulated infiltration rate. Although reclaimed water is predicted to discharge at Beatty Springs, flow at those springs in the high-water simulations did not change greatly (ie: reclaimed water mostly replaced other groundwater). Spring flow was predicted to increase by 0.01 mgd (0.015 cfs), which is a one percent increase and equates to five percent of the infiltration rate. At the Hollywood Development near the mouth of Woodland Creek, base flow was predicted to increase by 0.24 mgd (0.37 cfs), which represents a two percent increase in base flow and equates to 79 percent of the infiltration rate.

For the Woodland Creek basin as a whole, base flow was predicted to increase by 0.25 mgd (0.39 cfs), which equates to 85 percent of the simulated infiltration rate (column on far right of **Table 10**).

Comparison of the low-water season and high-water season simulations using the NLD rates indicates that:

- A higher percentage of the infiltration rate is accounted for in base-flow increases in the high-water season than the low-water season. This occurs because the water table is naturally closer to the creek in the high-water case, and therefore the on-set of groundwater drainage to the creek (and re-

duction in stream losses elsewhere) begins at a lower infiltration rate. The exception is at Beatty and St. Martin's springs which intercept the water table in all cases.

- The percent increase in base flow is lower in the high-water season than the low-water season. This occurs because base flows are naturally much higher in the high-water season, and infiltration rates are lower.
- In the high-water simulation of the NLD rate, change to base flow is predicted at Martin Way, whereas in the low-water simulations the creek is dry there and no change is predicted.

5.3.6 Effects from Infiltration at NLD rate if K_h is 100 ft/day (low-water season NLD rate sensitivity analysis)

Estimated NLD rates decrease if aquifer hydraulic conductivity is assumed to be 100 ft/day instead of 200 ft/day (Section 5.2.1 and **Table 6**). The effect of infiltration on base flow under this assumed change in hydraulic conductivity is shown on **Table 9** for basin 2. Predicted base flow effects are similar in geographic distribution to predicted effects using "best estimate" values of hydraulic conductivity (200 ft/day); however, the absolute changes to base flow are reduced due to the reduced NLD infiltration rate (0.5 vs 0.8 mgd in basin 2).

5.4 Flow Paths and Time of Travel

This section describes flow paths of natural recharge and reclaimed water in the ground downstream of the project site, and the time that reclaimed water is expected to take to flow in the ground between the infiltration facility and locations of discharge.

Due to groundwater mounding in layers corresponding to Q_{vr} , Q_{vt} , and Q_{va} , the flow path of reclaimed water will significantly differ from the natural recharge flow path. With reclaimed wa-

ter infiltration, the change in shallow gradient in the low-water season causes some of the reclaimed water to flow to the north and discharge at Beatty and St. Martin's springs rather than flow northeast in the Qc aquifer. Similar, but less dramatic changes occur in the high-water season simulations (compare flow paths in **Figures 13 and 14** versus **Figures 9, 10, 11, and 12**). Reclaimed water will also flow upgradient for a limited extent towards the Tri-Lakes before flowing northwest in either the Qva aquifer or the sandy erosional window aquifer.

Within the 10-year window evaluated for this project, discharge of reclaimed water to Woodland Creek occurs in two general areas:

- within the Park
- at Beatty and St. Martin's springs

Since the NLD rate is defined as the maximum rate that does not result in discharge within upper Woodland Creek, infiltration at the NLD rate should only result in reclaimed discharge at the springs. Therefore, although the NLD rate changes seasonally and will require attention during operations, under that rate the nearest location of discharge of reclaimed water to Woodland Creek should remain at the springs regardless of the season.

Travel times of reclaimed water through the aquifer to Woodland Creek are sensitive to the infiltration rate mostly because the rate influences where the water will first emerge. For instance, at the site capacity rates, reclaimed water discharges to the creek in the Park under most scenarios and travel times are short, whereas under the lower NLD rate, discharge occurs to the creek (springs) far away and travel times are thus longer. Above the threshold at which discharge of reclaimed water to a location (pond, lake, spring, well, or creek) begins, travel times to that location are not very sensitive to infiltration rate unless the flow path enters a new high-permeability layer as a result of increased mound height.

In all cases, the shortest travel time is to Goose Pond (less than three months), which is not di-

rectly connected to Woodland Creek. Travel time to upper Woodland Creek (in the Park) is also less than three months when the infiltration rate is high enough to overcome the natural gradient, which is away from the creek. The site capacity and 1 mgd rates are high enough to cause that flow reversal, but the NLD rate (by definition), is not.

At the site capacity rate, model results also show flow to St. Martin's Spring in a 0.75- to one-year time of travel whereas at the lower 1 mgd and NLD rates flow to St. Martin's Spring does not occur within 10 years. The abrupt reduction in travel time to St. Martin's Spring at the higher infiltration rate is caused by the build-up of the groundwater mound in a shallow high-permeability model layer which was saturated over less of the flow path under the lower infiltration rate scenarios. Although conceptually possible, the abrupt change is an artifact of model layering which is not well constrained over most of the flow path in question.

5.4.1 Method of Analysis

Groundwater flow paths and travel times were calculated with MODPATH using the groundwater flow field simulated by MODFLOW. Flow paths represent advective transport (which yields an average travel time). A set of 12 particles were simulated to originate from each model cell representing the water table below the infiltration facility, and were tracked through the flow system. In each cell, four particles were released from starting elevations of 10, 50, and 90 percent of the cell's thickness. Each calculated particle location is associated with a travel time from the beginning of the simulation. For each discharge feature discussed below, estimated travel times represent the first arrival of particles reaching the location. Since the model is three-dimensional, flow paths vary in three dimensions from the infiltration facility. Whereas some reclaimed water is predicted to flow in the shallower (Qvr and Qva) aquifers, some is also predicted to flow in the deeper Qc aquifer. Deeper flow paths are typically associated with longer travel times.

Flow paths were tracked for 10 years. Reclaimed water will continue to flow in the ground, and potentially discharge to surface water bodies and wells after the 10-year time of travel.

Selected water supply wells were simulated in the model and are thus potential discharge locations. Wells included in the McAllister model were retained, then active Group A and B wells on the Department of Health database within one mile of the site were added, as was the nearby Jackson well which is a private well. See **Appendix A** for a description of simulated pumping rates.

The intakes (screens) of simulated wells were assigned model layers based on well depths (**Appendix A**). The depths of lakes and the creek are also model variables (and are generally shallow). Because the reclaimed water flow paths, well intakes, and surface water bodies are depth-specific, plan-view maps may show flow paths crossing-by wells, lakes, and the creek even though those features do not capture the reclaimed water (the water and possible discharge features are off-set vertically). **Figures 9, 10, 11, and 12** have this shortcoming and thus the text and tables must be referred to for information on capture of reclaimed water by wells and surface water features.

5.4.2 Low-water Season Site Capacity (basin 2 infiltrating 1.3 mgd)

At the low-water season site capacity infiltration rate, reclaimed water flows through Goose Pond and discharges to upper Woodland Creek, within three months of travel in the ground, but does not discharge to Beatty Springs until about three years travel time (**Figure 9** and **Table 11**). Note that Goose Pond is a closed pond, with no surface water inlet or outlet (ie: it is part of the groundwater flow system). Reclaimed water is expected to flow below Lake Lois and Goose Lake, and not discharge to them. Although reclaimed water is not expected to discharge to Lake Lois through the ground it may flow to that lake from upstream creek flow under this site capacity scenario. As previously noted, reclaimed water is simulated as discharging at St.

Martin's Spring after roughly 9 to 12 months, though this short travel time is questionable given its sensitivity to model layering.

One well was identified within the reclaimed water flow paths predicted by MODPATH. Reclaimed water is simulated as taking more than three years to reach the Lamplighter well (Qva aquifer).

The intakes of other simulated wells are above, below, or laterally away from simulated reclaimed water flow paths. Although the Jackson and Sprout wells are closest to the infiltration facility, reclaimed water is simulated as flowing above the screened intervals of those Qvr/Qva wells and not being captured. The Sprout well is screened from 95 to 99 feet below ground and the Jackson well is assumed to be similar; however, construction information regarding the Jackson well was unavailable. If it is screened between 20 and 40 feet below ground surface, it would most likely capture reclaimed water within three months. City of Lacey's Well 7 (TQu aquifer) and the Lake Lois water system well (Qva aquifer) are not likely to capture reclaimed water; however, reclaimed water in the Qva aquifer is simulated to come near the Lake Lois well.

5.4.3 Low-water Season NLD rate (basin 2 infiltrating 0.8 mgd)

At the low-water season NLD rate, simulated reclaimed water flows through Goose Pond within three months of travel in the ground, but does not discharge to Woodland Creek until Beatty Springs, after more than three years travel time (**Figure 10** and **Table 11**). Discharge does not occur to St. Martin's Spring within 10 years. Reclaimed water is expected to pass below, and not enter, Goose Lake or Lake Lois. Capture and travel times to wells are similar to the site capacity case.

5.4.4 1 mgd rate (basin 2 infiltrating 1.0 mgd)

At the 1 mgd rate simulated with the low-water season model, reclaimed water flows through

Goose Pond, and discharges to upper Woodland Creek within three months of travel in the ground (**Figure 11** and **Table 11**). Travel time to Beatty Springs is still about three years. Discharge does not occur to St. Martin's Spring within 10 years. Reclaimed water is expected to pass below, and not discharge directly to Goose Lake or Lake Lois, but Lake Lois may receive reclaimed water from upstream surface water flow. Capture and travel time to wells is similar to the site capacity case.

5.4.5 High-water Season NLD rate (basin 2 infiltrating 0.3 mgd)

At the high-water season NLD rate, simulated reclaimed water flows through Goose Pond within three months of travel in the ground, but does not discharge to Woodland Creek until Beatty Springs, after more than four years travel time (**Figure 12** and **Table 11**). Reclaimed water is expected to pass below, and not enter Goose Lake or Lake Lois. Simulated wells did not capture reclaimed water within a 10 year travel time. In general, shallow flow paths in the high-water season are displaced to the south and west compared to low-water season flow paths, as a result of the larger natural groundwater mound caused by loss of creek water to the ground.

5.4.6 Ambient Groundwater Flow Paths

Comparison of **Figures 13 and 14** indicates that without reclaimed water infiltration, flow paths at the park in the high-water season are displaced to the south and west compared to those in the low-water season. The cause of the south- and westward displacement is likely the naturally higher water table mound under the creek in the high-water season. Some south and west displacement of ambient groundwater flow paths is realistic; however, the modeled displacement for both ambient and reclaimed water flow paths is likely over-estimated to the extent that the water table mound below the creek is over-estimated.

6.0 ANNUAL VOLUME

A facility operating at either the site capacity or NLD rate will have a seasonally variable infiltration rate. The rate will depend on regional groundwater levels that in-turn depend mostly on antecedent precipitation. In order to calculate the total volume of reclaimed water that is likely to be infiltrated using the NLD rate, PGG generated a synthetic regional groundwater hydrograph for the average precipitation year, related the modeled NLD rate to the synthetic hydrograph, and then calculated the volume of water that could be infiltrated assuming a different ambient groundwater level for each day of the year. PGG's estimates are shown on **Figure 15**, and described in more detail in **Appendix B**.

An estimated 550 acre-feet of water could be infiltrated in the average precipitation year under the NLD rate, which is equivalent to an average annual infiltration rate of 0.49 mgd. Variables and assumptions used to develop this estimate are listed below.

- Precipitation at Olympia Airport and the site linearly correlate (they do not need to be equal).
- Real groundwater levels vary according to the synthetic hydrograph. The synthetic hydrograph was generated using an Antecedent Precipitation Index for Head (APIH) explained in **Appendix B**.
- The NLD rate is 0.8 mgd when the ambient groundwater elevation below the favorable infiltration area (at MW-1S) is 137.92 feet above sea level (that is the modeled head and the basis for the low-water season NLD rate estimate).
- The NLD rate is 0.3 mgd when the ambient groundwater elevation below the favorable infiltration area (at MW-1S) is 145.84 feet (that is the modeled head and the basis for the high-water season model estimates).
- The NLD rate varies in an inverse-linear manner with ambient groundwater elevation.

- The site is operated all year.

Deviations from the assumptions above, and the unique character of each water year, will cause actual volumes to differ from the volumes predicted by this method.

A correction factor was used to partially compensate for the fact that the APIH heads do not match the observed and modeled heads exactly, as explained in **Appendix B**. **Figure 15** plots infiltration rates with a constant correction factor of +0.1 mgd which raises the minimum and maximum modeled rates to 0.23 and 0.8 mgd, respectively, and results in the average annual volume prediction of 550 acre-feet.

7.0 SUMMARY OF FINDINGS

To assess the feasibility of large-scale reclaimed water infiltration at Woodland Creek Community Park, field work was conducted to measure hydrogeologic properties, and a numerical groundwater model was adapted to simulate infiltration.

Field work indicated that the site lies over a former valley that is backfilled with sand and gravel. The backfilled valley roughly parallels Woodland Creek. Glacial till is absent in the favorable infiltration area but occurs just upstream, likely indicating the head or sidewall of the backfilled valley. Twelve borings, twelve piezometers, six infiltration tests, four staff gages, and wet- and dry-season water-level and streamflow measurements were made to characterize the site and understand the local relationship between groundwater and Woodland Creek.

On October 19, 2009 and March 10, 2010 the elevation of Woodland Creek was higher than local groundwater near the Park, indicating that surface water flows out of the creek into the aquifer. Between Long Lake and the outlet of Lake Lois, the creek lost 1.62 cubic feet per second (cfs) of water to the aquifer in the low-water season of October 2009, and 5.37 cfs during the high-water season of March 2010. Loss of creek water to the aquifer accounts for the

creek going dry downstream of Lake Lois during a typical dry season.

To simulate infiltration of reclaimed water, a sub-regional model (Upper Woodland Creek model, or UWC model) was adapted from the regional McAllister Model. The McAllister Model is an established groundwater model that has been used by the cities of Olympia, Lacey, and Yelm for water rights mitigation design. The UWC model was calibrated to local conditions in the Upper Woodland Creek basin between Long Lake and Beatty Springs.

Local data for model refinements were derived from field work performed by HDR Inc. and Pacific Groundwater Group (PGG) for this project, by Amec along Carpenter Road at Lake Lois, and by City of Lacey survey crews within Lake Lois. Following refinement, the UWC model was calibrated in steady state to local low-water and high-water season streamflow and groundwater elevations. The calibrated UWC model was then used to estimate feasible infiltration rates for reclaimed water during low-water and high-water seasons.

Our best estimate of the range of low-water season *site capacity*, which is defined as the maximum infiltration rate which does not result in flooding, is 0.9 to 1.4 million gallons per day (mgd) depending on the location of the infiltration pond. Our best estimate of the range of the *no-local-discharge* (NLD) infiltration rate, which is the maximum rate that does not result in flooding or local discharge of reclaimed water at Woodland Creek, was found to be 0.8 to 0.9 mgd.

The model was also used to estimate the low-water season NLD rate if the permeability of the upper aquifer was half of our best estimate (i.e. 100 ft/day instead of 200 ft/day). The NLD rates reduced to 0.5 to 0.6 cfs under that assumption. That degree of variation in permeability is possible and suggests that a large scale pilot test or flexible site development plan is warranted.

For high-water season simulations, the estimated site capacity and NLD rates are the same value

for each simulated basin, and vary from 0.4 to 0.2 mgd between basins. The high-water season rates are lower than the low-water season rates because natural groundwater recharge from precipitation will raise the water table, leaving less “freeboard” to fill with reclaimed water.

The model was also used to evaluate the effect of infiltration on nearby surface-water bodies and wells. Increased groundwater-fed base flow in Woodland Creek in low-water simulations was equal to 56 to 66 percent of the reclaimed water infiltration rate. In high-water simulations, change in groundwater base flow was equal to 85 percent of the reclaimed water infiltration rate. Those changes to base flow include changes to groundwater recharge from the Tri-Lakes, which are less certain than changes predicted for Woodland Creek proper. The remaining effects are accounted for by increased flows in more remote model features.

Increases to base flows in the creek occur when infiltrating at the NLD rates even though reclaimed water does not enter the local creek. Base flows increase at NLD rates because the lakes and creek lose less water to the aquifer when reclaimed water is infiltrated, and because the addition of reclaimed water forces more natural groundwater into the creek in gaining reaches and springs.

Under the NLD rate range, reclaimed water is predicted to flow with groundwater in two directions. One flow path is to the west through Goose Pond (a closed surface-water feature reached within three months of infiltration), back to the shallow aquifer, and eventually into the deeper Qc aquifer. The other predominant flow path is to the north where discharge to Woodland Creek at Beatty Springs occurs after a travel time of about three years for the low-water season simulation (**Table 11**).

When low-water season infiltration rates exceed the NLD rate, local discharge to Woodland Creek is predicted within three months of infiltration. Discharge to St. Martin’s Spring is also predicted within one year for the highest infiltration rate modeled (1.3 mgd); however, that oc-

curs because the reclaimed water travels further in a high permeability model layer. That layering is not documented by field data over most of the flow path and thus the short travel time may be an artifact of model layer assumptions.

One local well (the Lamplighter Well) is also likely to capture some reclaimed water under all low-water season simulated infiltration rates, with a travel time exceeding three years. City of Lacey’s Well No. 7 and the non-municipal Jackson, Lake Lois, and Sprout wells are not likely to capture any reclaimed water, regardless of season. Although the Jackson and Sprout wells are close to the infiltration basins, simulated reclaimed water transits the aquifer at a shallower depth than the well screens, and thus flows over (not into) the simulated well screens.

In high-water simulations using the site capacity and NLD rate (which were equivalent), local discharge to upper Woodland Creek does not occur, and the reclaimed water travel time to Beatty Springs increases to 4.5 to 4.75 years (**Table 11**). Since both the low-water and high-water travel times (~3 and ~4.5 years, respectively) are greater than the time frame between annual low- and high-water seasons (~6 months), actual travel times will likely be between the travel times estimated under the low-water and high-water conditions.

Since site capacity and NLD rates both vary seasonally, maximizing the volume of infiltrated water requires a method to vary the operational infiltration rate throughout the year. Monitoring of the groundwater and creek level is recommended to adjust the operational infiltration rate to match either the site capacity rate or NLD rate, whichever is chosen as the basis for design and permitting. If that approach is taken to infiltrate at the NLD rate, local hydraulic gradients between Woodland Creek and the shallow aquifer should remain downward.

To estimate the volume of water that can be infiltrated using a seasonally variable infiltration rate, PGG generated a spreadsheet calculator. Using an estimated (synthetic) average annual groundwater hydrograph and the low-water and

high-water NLD rates predicted in this report, the calculator indicates that about 550 acre-feet of water can be infiltrated during the average precipitation year. As noted above, groundwater monitoring would be required to maintain the maximum operational rate consistent with the NLD assumptions. In addition to seasonal variations, operational infiltration rates and the annual volume may vary from predicted values because of limitations in our knowledge and simulation of actual field conditions, as discussed below. Prior to final design, a large-scale pilot test could be performed to improve knowledge of achievable infiltration rates.

The accuracy of the site capacity, NLD rate, annual volumes and travel-time estimates, are subject to model limitations and knowledge of field conditions such as:

- Averaging of elevations and aquifer properties across model cells (minimum size 50 x 50 ft).
- Limited knowledge of the variation in aquifer and aquitard properties.
- Limitations of model calibration.
- Simplified representation of the relationship between the creek and groundwater. Both the McAllister and UWC models simulated Long Lake and Hicks Lake in a simple manner that does not fully reflect existing conditions and complexities.
- Approximations of the annual groundwater hydrograph and NLD rate/groundwater level relationship in the spreadsheet calculator.
- Extreme precipitation events are not considered and will affect facility operations.

REFERENCES

Amec Earth and Environmental, Geotechnical Engineering Report, September 10, 2009, Carpenter Road SE, Pacific Ave. to Martin Way. Consulting report submitted to the City of Lacey.

CDM Inc., 2002. Interim Report – Model Construction and Steady State Calibration, McAllister Well field Numerical Model. Consulting report submitted to City of Olympia.

Drost, B.W., G.L. Turney, N.P. Dion, and M.A. Jones. 1998. Hydrology and Quality of Ground Water in northern Thurston County, Washington. U.S Geological Survey Water-Resources Investigations, Report 92-4109 (revised).

Golder Associates. 2006. Report on Groundwater Modeling and Water Right Applications and Transfers. Consulting report submitted to the City of Lacey.

HDR, 2007. Woodland Creek Park Test Pit Explorations. Consulting report submitted to the City of Lacey.

Logan, R.L, Walsh, T.J., Schasse, H.W., and M. Polenz. 2003. Geologic Map of the Lacey 7.5-minute Quadrangle, Thurston County, Washington. Washington State Department of Natural Resources, Division of Geology and Earth Resources, Open File Report 2003-9.

Pacific Groundwater Group, 2007. Current Conditions Report, Woodland Creek Pollutant Load Reduction Project. Consulting report submitted to Thurston County Public Health and Social Services.

Pringle, R.F. 1990. Soil Survey of Thurston County, Washington. US Soil Conservation Service.

Washington Department of Ecology, 2006. Henderson Inlet Watershed Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Temperature Total Maximum Daily Load Study. Publication No. 06-03-012

Table 1. Generalized Hydrostratigraphy

Name	Hydro Character	Local Thickness Range (ft)	Within Backfilled Erosional Channel (at site and downstream)	Outside of Erosional Channel (upstream and off-channel)
Vashon Recessional Outwash (including late recession sandy lake deposits, Qvr)	Aquifer, generally not used for water supply	10-100	Combined Qvr (including sandy lake sediments) and possibly Qva. "Upper Aquifer" in this report.	Qvr including sandy lake sediments
Vashon Till (Qvt)	Aquitard	0-50		Qvt
Vashon Advance Outwash (Qva)	Water supply aquifer	0-60		Qva
"Kitsap Formation" (Qf)	Aquitard	50	Qf	Qf
Penultimate Drift (Qc)	Water supply aquifer ("sea level aquifer")	50-100	Qc	Qc
Lower glacial and interglacial strata	Aquifers and aquitards		TQu	TQu

Table 2. Piezometer and Staff Gage Construction and Survey Data

Station ID	Type	UWID	State Plane South (ft, NAD 83) Northing	State Plane South (ft, NAD 83) Easting	MP Elevation (ft, NGVD29)	Well Depth (ft BGS)	Screen Top (ft BGS)	Screen Bottom (ft BGS)	Completion Date	MP Stick Up (ft AGS)	Well Depth Measured (ft BMP)
MW-1S	piezometer	BBK353	629388.5	1068419.5	163.39	30	25	30	15-Oct-09	-0.39	29.57
MW-1D	piezometer	BBP008	629384.1	1068433.8	163.20	93	87	92	24-Nov-09	-0.36	92.5
MW-2S	piezometer	BBK356	629694.8	1068427.3	156.90	22	12	22	15-Oct-09	-0.51	20.89
MW-2D	piezometer	BBK364	629692.1	1068431.6	156.86	28	27	28	21-Oct-09	-0.57	27.06
MW-3S	piezometer	BBK357	629764.3	1068509.4	151.15	14	9	14	15-Oct-09	-0.57	13.69
MW-3D	piezometer	BBK363	629761.4	1068511.2	150.98	18	17	18	21-Oct-09	-0.44	17.28
MW-4	piezometer	BBK361	629754.1	1068547.8	150.77	10	5	10	16-Oct-09	-0.29	9.92
MW-5	piezometer	BBK358	629920.5	1068573.4	158.56	28	18	28	16-Oct-09	-0.4	26.97
MW-6	piezometer	BBK354	629293.4	1069077.0	155.98	18	8	18	15-Oct-09	-0.36	17.61
MW-7	piezometer	BBK355	629440.9	1069085.2	153.96	14	9	14	15-Oct-09	-0.29	13.29
MW-8	piezometer	BBK360	629487.8	1069064.7	154.20	10	5	10	16-Oct-09	-0.44	9.91
MW-9	piezometer	BBK359	629579.2	1069082.0	154.97	16	6	16	16-Oct-09	-0.5	14.4
SG-1P	piezometer		629749.3	1068538.7	148.89	4.8	4.1	4.6	19-Oct-09	2.2	
SG-1	staff gage		629749.3	1068538.7	148.89				19-Oct-09	2.2	
SG-2P	piezometer		629477.5	1069078.2	152.56	4.9	4.2	4.7	19-Oct-09	2.1	
SG-2	staff gage		629477.5	1069078.2	152.56				19-Oct-09	2.1	
SG-4	staff gage		630432.6	1067956.6	153.65				19-Oct-09		
SG-3Alt	staff gage		630289.7	1068882.0	150.97				25-Nov-09		

UWID = Unique Well ID (Department of Ecology)

MP = measuring point

BGS = below ground surface

AGS = above ground surface

BMP = below measuring point

Table 3. Hydraulic Conductivity Data

	Location	Kv		Kh	Non-Directional K		Horizon Depth (ft)	Infiltration Horizon
		(in/hr)	(ft/d)	(ft/d)	(in/hr)	(ft/d)		
Double-Ring Infiltrometer Data	I-1	25	50				3.9	very clean medium to coarse sand. Trace gravel.
	I-5	4	8				3.5	brown, silty, fine to coarse sand with trace fine gravel
	I-6	0.5	1				3.5	brown, very fine sand. Trace to slightly silty.
	I-8	82	164				4.2	brown, fine to coarse very sandy, gravel. Trace silt.
	I-14	40	80				3.5	very clean fine to coarse sand
	I-16	0.05	0.1				3.5	mottled gray silt/clay. Trace fine sand
Soil Survey Data	Cagey	6 - 20	12 - 40				2.3 - 5	trace silty to silty, fine to medium sand
	Everett	> 20	> 40				1.7 - 5	trace silty to slightly silty, fine to coarse sandy to very sandy, gravel
Grain Size Analysis Data*	TP-5				54	108	8 - 10	slightly silty, fine to coarse sand with trace gravel
	TP-6				5	10	10 - 12	slightly silty, fine sand
	TP-7				313	626	10-11	slightly gravelly, fine to coarse sand
	TP-8				157	314	10 - 12	gravelly, fine to medium sand with trace silt
	TP-9				152	303	10 - 12	gravelly, fine to medium sand, trace silt
	TP-10				115	229	8 - 9	slightly silty, medium to coarse sandy, gravel
	TP-11				1365	2731	10	medium to coarse very sandy, gravel. Trace silt
	TP-14				277	554	8 - 10	slightly fine gravelly, fine to coarse sand
Slug Test Data	TP-15				117	233	10 - 11	fine to medium sand, trace silt and trace gravel
	MW-1S			1				fine to medium sand, local gravel
	MW-1D			2				fine sand
	MW-2S			17				
	MW-2D			1				
	MW-3S			14				
	MW-3D			127				
	MW-4			3				
	MW-5			12				
	MW-6			20				
	MW-7			46				
	MW-8			60				
	MW-9			51				
Injection Test Data	MW-2S			144				
	MW-2D			82				
	MW-3S			166				
	MW-3D			286				
Geomean			13	22		260		
Median			40	33		303		
Average			44	65		568		
Minimum			0.1	1		10		
Maximum			164	286		2731		
Geomean Kv, Coarse Site Data			48					
Geomean Kh, Slug Test Data				12				
Geomean Kh, Injection Test				154				

Kv = vertical hydraulic conductivity

Kh = horizontal hydraulic conductivity

* = calculated using the Hazen equation

Geomean = geometric mean of hydraulic conductivity values, defined as $K_{gm} = (K_1 K_2 K_3 \dots K_N)^{1/N}$

Table 4. Synoptic Water Level Data

Well ID	MP Elevation ft, NGVD29	10/19/2009 Data			3/10/2010 Data		
		Time	Depth to Water	Water Elevation, ft NGVD29	Time	Depth to Water	Water Elevation, ft NGVD29
MW-1S	163.39	11:46	23.72	139.67	11:41	17.52	145.87
MW-1D	163.20	NA	NA	NA	11:48	17.83	145.37
MW-2S	156.90	12:11	19.37	137.53	11:07	12.37	144.53
MW-2D	156.86	NA	NA	NA	11:15	12.33	144.53
MW-3S	151.15	12:32	13.50	137.65	10:41	6.71	144.44
MW-3D	150.98	NA	NA	NA	10:46	6.49	144.49
MW-4	150.77	12:47	dry	<140.85	10:18	5.63	145.14
MW-5	158.56	12:53	21.06	137.50	9:50	13.82	144.74
MW-6	155.98	13:20	7.99	147.99	12:43	8.24	147.74
MW-7	153.96	11:19	6.92	147.04	13:03	6.63	147.33
MW-8	154.20	10:45	dry	<144.29	13:17	7.07	147.13
MW-9	154.97	10:15	12.99	141.98	13:25	7.88	147.09
SG-1	148.89	15:15	1.95	146.94	14:38	1.64	147.25
SG-1P	148.89	15:15	dry	<142.09	14:42	3.45	145.44
SG-2	152.56	15:59	2.19	150.37	13:58	1.67	150.89
SG-2P	152.56	15:59	dry	<145.76	14:03	5.36	147.20
SG-3ALT	150.97	16:10	NA*	145.68	15:10	1.85	149.12
SG-4	153.65	17:00	9.15	144.50	15:27	8.52	145.13

NA = not available, measuring point not installed on 10/19/2009

*SG-3ALT did not exist on 10/19/09. Instead a measuring location along the concrete dam was used. High water levels in November 2009 submerged the dam, at which point SG-3ALT was installed. Water levels taken at both measuring points on the same date were used to convert water level data measured prior to the installation of SG-3ALT into elevation values.

Table 5. Synoptic Streamflow Data^

Flow	Location	Date	Time	Latitude	Longitude	Discharge (cfs)	Est. Accuracy	Notes
Upstream -----> Downstream	WC MW	10/19/09	10:13	47 02 50.8	122 02 50.8	0		The channel is dry. No flow observed at either upstream or downstream end of culvert. A discontinued USGS stream gaging station is at this location.
	Trib MW	10/19/09	~10:20			0		The channel is dry. No flow observed at either upstream or downstream end of culvert. Small stagnant pool present on downstream end of culvert.
	WC LL	10/19/09	10:45	47 02 31.5	122 48 07.9	0		The channel is dry. No flow observed at footbridge.
	WC PA	10/19/09	11:05	47 02 20.8	122 47 44.8	0.98	+/- 5%	Discharge measurement was made 40 ft below the downstream end of the culverts.
	GL Div	10/19/09	11:45	47 02 12.2	122 47 21.3	0		There is water in the channel but it is backwater. No velocities were observed.
	WC RB	10/19/09	13:50	47 02 06.7	122 46 56.3	1.62	+/- 8%	Discharge measurement was made 20 ft downstream of the downstream side of the railroad bridge. There is a pond on the the upstream side of the bridge. The only location where all flow can be measured is 20 ft downstream of the bridge.
Upstream -----> Downstream	WC MW	03/10/10	11:15	47 02 58.9	122 48 18.1	7.02	+/- 5%	Measured discharge near staff gage at upstream end of box culvert. At same location as 10/19/09 discharge measurement. Latitude and longitude measured with hand-held GPS on 3/10 has a higher degree of accuracy than what was measured 10/19.
	Trib MW	03/10/10	12:07	47 03 00.1	122 48 13.6	0.1	Estimate	Estimated discharge at the downstream end of an 18 inch diameter concrete culvert under Martin Way. Flows into Woodland Creek.
	WC LL	03/10/10	13:10	47 02 30.8	122 48 08.8	8.43	+/- 5%	Measured discharge 50 ft downstream from footbridge.
	WC PA	03/10/10	14:25	47 02 21.6	122 47 47.1	12.7	+/- 5%	Discharge measurement was made at the downstream end of two 4 ft. diameter circular culverts.
	GL Div	03/10/10	15:36	47 02 15.7	122 47 19.3	*0.05	Estimate	*There is a 2 ft high debris or beaver dam forming a pond which has the same water surface elevation as Woodland Creek. Estimated Woodland Creek water flowing over the beaver dam into Goose Lake.
	WC RB	03/10/10	16:30	47 02 07.1	122 46 57.3	13.8	+/- 8%	Discharge measurement was made 10 ft downstream of the downstream side of the railroad bridge.

^Streamflow data measured by River Measurement, a division of WEST Consultants, Inc.

cfs = cubic feet per second

WC MW = Woodland Creek at Martin Way

Trib MW = Woodland Creek Tributary at Martin Way

WC LL = Woodland Creek at Lake Lois outlet

WC PA = Woodland Creek at Pacific Avenue

GL Div = Goose Lake Diversion off of Woodland Creek

WC RB = Woodland Creek at Railroad Bridge (Long Lake outlet)

Table 6. Low-Water Season Site Capacity and No-Local-Discharge Rate Modeling Results

Infiltration Basin	Scenario	Infiltration Rate (mgd)	Maximum Groundwater Mound Elevation (ft, NGVD 29)	Land Surface Elevation of Cell (ft, NGVD 29)	Remaining Vadose Zone (Pond Bottom - Mound Top^, ft)	Comments
1	NLD	0.8	154.0	167.1	9.1	Above this rate reclaimed water locally discharges at Woodland Creek
1	NLD Sensitivity*	0.6	155.8	167.8	8.0	Sensitivity analysis, above this rate reclaimed water locally discharges at Woodland Creek
1	1 mgd	1	156.3	168.4	8.1	
1	SC	1.4	160.4	168.7	4.3	Surface cell flooding occurs at higher simulated infiltration rates
2	NLD	0.8	153.6	166.2	8.6	Above this rate reclaimed water locally discharges at Woodland Creek
2	NLD Sensitivity*	0.5	153.7	166.2	8.5	Sensitivity analysis, above this rate reclaimed water locally discharges at Woodland Creek
2	1 mgd	1	155.7	166.2	6.5	
2	SC	1.3	158.7	166.2	3.5	Surface cell flooding occurs at higher simulated infiltration rates
3	NLD & SC	0.9	155.1	162.8	3.7	Surface cells flood at higher simulated infiltration rates
3	NLD Sensitivity*	0.6	156.6	162.8	2.2	Sensitivity analysis, surface cell flooding occurs at higher simulated infiltration rates
3	1 mgd	1	156.2	162.8	2.6	Surface cell floods near Woodland Creek

NLD =No-Local-Discharge Rate; 1 mgd = 1 mgd Rate; SC = Site Capacity; NLD & SC = No-Local-Discharge Rate and Site Capacity (onsite flooding is predicted, discharge of reclaimed water to the creek is not)

*For sensitivity simulations, the horizontal hydraulic conductivity of the infiltration zone sediments was lowered from 200 ft/d to 100 ft/d

^Calculation assumes a pond bottom 4 feet below the surface elevation of the cell. This value could change due to design criteria or spatial location.

Table 7. Comparison of Modeled Recharge Rates

Scenario	McAllister Model Recharge Zones					
	3	4	6	7	9	10
McAllister Model Annual Recharge (in/yr)	14.42	17.83	21.31	22.14	27.00	28.66
UWC Low-Water Season Model Annual Recharge (in/yr)	9.46	11.74	14.02	14.54	17.70	18.75
UWC High-Water Season Model Annual Recharge (in/yr)	11.83	14.67	17.52	18.18	22.12	23.43

Note: This table lists McAllister Model recharge zones within the UWC model domain. Zones 7, 9, and 10 combined occupy the majority (roughly 90 percent) of the UWC model domain.

Table 8. High-Water Season Site Capacity and No-Local-Discharge Rate Modeling Results

Infiltration Basin	Scenario	Infiltration Rate (mgd)	Maximum Groundwater Mound Elevation (ft, NGVD 29)	Land Surface Elevation of Cell (ft, NGVD 29)	Remaining Vadose Zone (Pond Bottom - Mound Top^, ft)	Comments
1	NLD & SC	0.4	151.6	166.2	10.6	Surface cells flood at higher simulated infiltration rates
2	NLD & SC	0.3	150.5	164.4	9.9	Surface cells flood at higher simulated infiltration rates
3	NLD & SC	0.2	149.0	163.6	10.6	Surface cells flood at higher simulated infiltration rates

NLD & SC = No-Local-Discharge Rate and Site Capacity (onsite flooding is predicted, discharge of reclaimed water to the creek is not)

^Calculation assumes a pond bottom 4 feet below the surface elevation of the cell. This value could change due to design criteria or spatial location.

Table 9. Low-Water Season Modeled Regional Flux Changes For Basin 2¹

Upstream -----> Downstream								
	Infiltration Rate	Tri-Lakes Recharge Flux (TL)	Woodland Creek Streamflow, Pacific Ave (PA)	Woodland Creek Streamflow, Lake Lois Outlet (LL)	Woodland Creek Streamflow, Martin Way ² (MW)	Beatty & Saint Martin's Springs Discharge Flux (BS)	Woodland Creek Streamflow, Hollywood Development ³ (HD)	Woodland Creek Basin Net Discharge ⁴
Modeled Flux of Feature (mgd)								
Pre-Infiltration	0	3.10	0.63	0.00	0.00	1.26	6.07	NA
NLD Sensitivity ⁵	0.5	3.01	0.70	0.00	0.00	1.39	6.27	NA
NLD ⁵	0.8	2.97	0.71	0.00	0.00	1.47	6.41	NA
1 mgd	1	2.95	0.78	0.10	0.09	1.51	6.55	NA
SC	1.3	2.94	0.90	0.28	0.27	1.53	6.77	NA
Change in Flux Relative to Pre-Infiltration Flux (mgd)								
NLD Sensitivity ⁵	0.5	-0.09	0.07	0.00	0.00	0.12	0.19	0.28
NLD ⁵	0.8	-0.13	0.08	0.00	0.00	0.21	0.34	0.47
1 mgd	1	-0.15	0.15	0.10	0.09	0.24	0.48	0.62
SC	1.3	-0.16	0.27	0.28	0.27	0.27	0.70	0.86
Relative Change in Flux Compared to Pre-Infiltration Flux (Base-Flow Effects)								
NLD Sensitivity ⁵	0.5	-3%	11%	NA	NA	10%	3%	NA
NLD ⁵	0.8	-4%	13%	NA	NA	17%	6%	NA
1 mgd	1	-5%	24%	NA	NA	19%	8%	NA
SC	1.3	-5%	43%	NA	NA	22%	11%	NA
Relative Change in Flux Compared to Infiltration Rate (Mitigation Efficiency)								
NLD Sensitivity ⁵	0.5	-17%	14%	0%	0%	25%	39%	56%
NLD ⁵	0.8	-16%	10%	0%	0%	27%	42%	58%
1 mgd	1	-15%	15%	10%	9%	24%	48%	62%
SC	1.3	-13%	21%	22%	21%	21%	53%	66%
Upstream Features With Streamflow Affecting Local Streamflow⁶								
		X	X	PA	PA, LL	X	PA, LL, MW, BS	TL, PA, LL, MW, BS, HD

Positive changes in flux indicate an increase in flux at the feature, negative flux changes indicate a decrease for the above simulations. For a given feature, italicized values indicate that flux changes result from natural groundwater discharge, while bolded values indicate that reclaimed water is discharged to or transported by the creek. Non-italicized and non-bolded flux values correspond to the pre-infiltration (background) flux at a feature.

¹ Infiltration was simulated as occurring at Basin 2. NLD Sensitivity = No-Local-Discharge Rate Sensitivity Analysis; NLD = No-Local-Discharge Rate; 1 mgd = 1 mgd Rate; SC = Site Capacity

² No streamflow was observed in the Woodland Creek reach between Lake Lois and Martin Way for the low-water season synoptic data set, therefore stream loss parameters for this reach could not be calibrated during the primary (low-water season) UWC model calibration process. Predicted impacts thus have significant uncertainty.

³ Discharge at the Hollywood Development equals the sum of modeled stream discharge from Woodland Creek at the Hollywood Development and the drain discharge from Saint Martin's Spring.

⁴ Net Discharge equals the sum of flux changes in modeled stream discharge from Woodland Creek at the Hollywood Development and drain discharge from Saint Martin's Spring, plus the change in recharge flux from the Tri-Lakes (the net addition the Tri-Lakes recharge flux is due to a negative recharge flux being subtracted from positive discharge fluxes).

⁵ For the NLD rate, no reclaimed water discharge occurs upstream of Beatty Springs

⁶ The modeled Woodland Creek stream system transports water from the outlet of Long Lake to the Hollywood Development. Several stream fluxes in this table are affected by water transported from upstream. Locations with an "X" indicate that flow from tabulated upstream stations does not directly affect the local stream station.

Table 10. High-Water Season Modeled Regional Flux Changes For Basin 2¹

Upstream -----> Downstream								
	Infiltration Rate	Tri-Lakes Recharge Flux (TL)	Woodland Creek Streamflow, Pacific Ave (PA)	Woodland Creek Streamflow, Lake Lois Outlet (LL)	Woodland Creek Streamflow, Martin Way (MW)	Beatty & Saint Martin's Springs Discharge Flux (BS)	Woodland Creek Streamflow, Hollywood Development ² (HD)	Woodland Creek Basin Net Discharge ³
Modeled Flux of Feature (mgd)								
Pre-Infiltration	0	2.40	8.11	7.49	4.73	2.56	14.59	NA
NLD ⁴ & SC	0.3	2.39	8.24	7.71	4.92	2.57	14.82	NA
Change in Flux Relative to Pre-Infiltration Flux (mgd)								
NLD ⁴ & SC	0.3	-0.02	0.13	0.22	0.20	0.01	0.24	0.25
Relative Change in Flux Compared to Pre-Infiltration Flux (Base-Flow Effects)								
NLD ⁴ & SC	0.3	-1%	2%	3%	4%	1%	2%	NA
Relative Change in Flux Compared to Infiltration Rate (Mitigation Efficiency)								
NLD ⁴ & SC	0.3	-6%	45%	75%	67%	5%	79%	85%
Upstream Features With Streamflow Affecting Local Streamflow⁵								
		X	X	PA	PA, LL	X	PA, LL, MW, BS	TL, PA, LL, MW, BS, HD

Positive changes in flux indicate an increase in flux at the feature, negative flux changes indicate a decrease for the above simulations. For a given feature, italicized values indicate that flux changes result from natural groundwater discharge, while bolded values indicate that reclaimed water is discharged to or transported by the creek. Non-italicized and non-bolded flux values correspond to the pre-infiltration (background) flux at a feature.

¹ Infiltration was simulated as occurring at Basin 2. NLD & SC = No-Local-Discharge Rate and Site Capacity (onsite flooding is predicted, discharge of reclaimed water to the creek is not)

² Discharge at the Hollywood Development equals the sum of modeled stream discharge from Woodland Creek at the Hollywood Development and the drain discharge from Saint Martin's Spring.

³ Net Discharge equals the sum of flux changes in modeled stream discharge from Woodland Creek at the Hollywood Development and drain discharge from Saint Martin's Spring, plus the change in recharge flux from the Tri-Lakes (the net addition the Tri-Lakes recharge flux is due to a negative recharge flux being subtracted from positive discharge fluxes).

⁴ For the NLD rate, no reclaimed water discharge occurs upstream of Beatty Springs

⁵ The modeled Woodland Creek stream system transports water from the outlet of Long Lake to the Hollywood Development. Several stream fluxes in this table are affected by water transported from upstream. Locations with an "X" indicate that flow from tabulated upstream stations does not directly affect the local stream station.

Table 11. Travel Time Estimates^

Scenario & Infiltration Rate	Low-Water Season Travel Times			High-Water Season Travel Times
	Basin 2, No-Local-Discharge Rate	Basin 2 1 MGD Rate	Basin 2, Site Capacity	Basin 2, Site Capacity & No-Local-Discharge Rate
	0.8 mgd	1 mgd	1.3 mgd	0.3 mgd
Goose Pond	< 0.25	< 0.25	< 0.25	< 0.25
Upper Woodland Creek	NA	< 0.25	< 0.25	NA
Goose Lake	NA	NA	NA	NA
Lake Lois	NA	NA	NA	NA
Beatty Springs	3 - 3.25	2.75 - 3	2.75 - 3	4.5 - 4.75
Saint Martin's Spring	NA	NA	0.75 - 1	NA
Sprout Well	NA	NA	NA	NA
Jackson Well	NA	NA	NA	NA
Lake Lois Well	NA	NA	NA	NA
Unnamed Well	NA	NA	NA	NA
Lamplighter Well	3.25 - 3.5	3.25 - 3.5	3 - 3.25	NA
Lacey Well 7	NA	NA	NA	NA

[^]Travel time estimates are in years. NA indicates particles are not simulated as reaching the feature within 10 years.

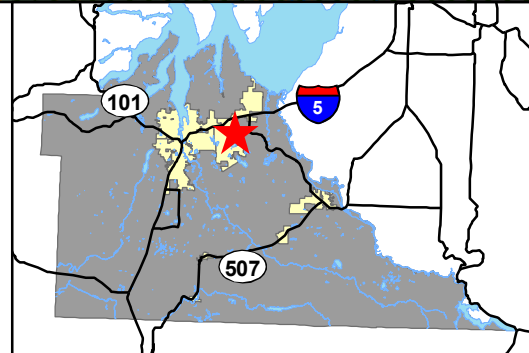
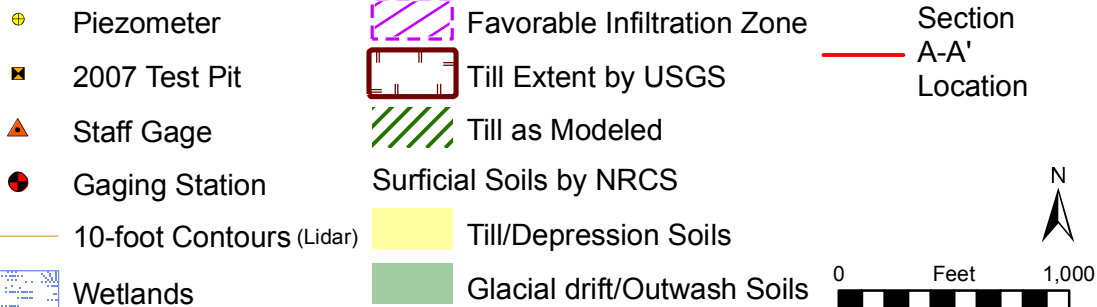
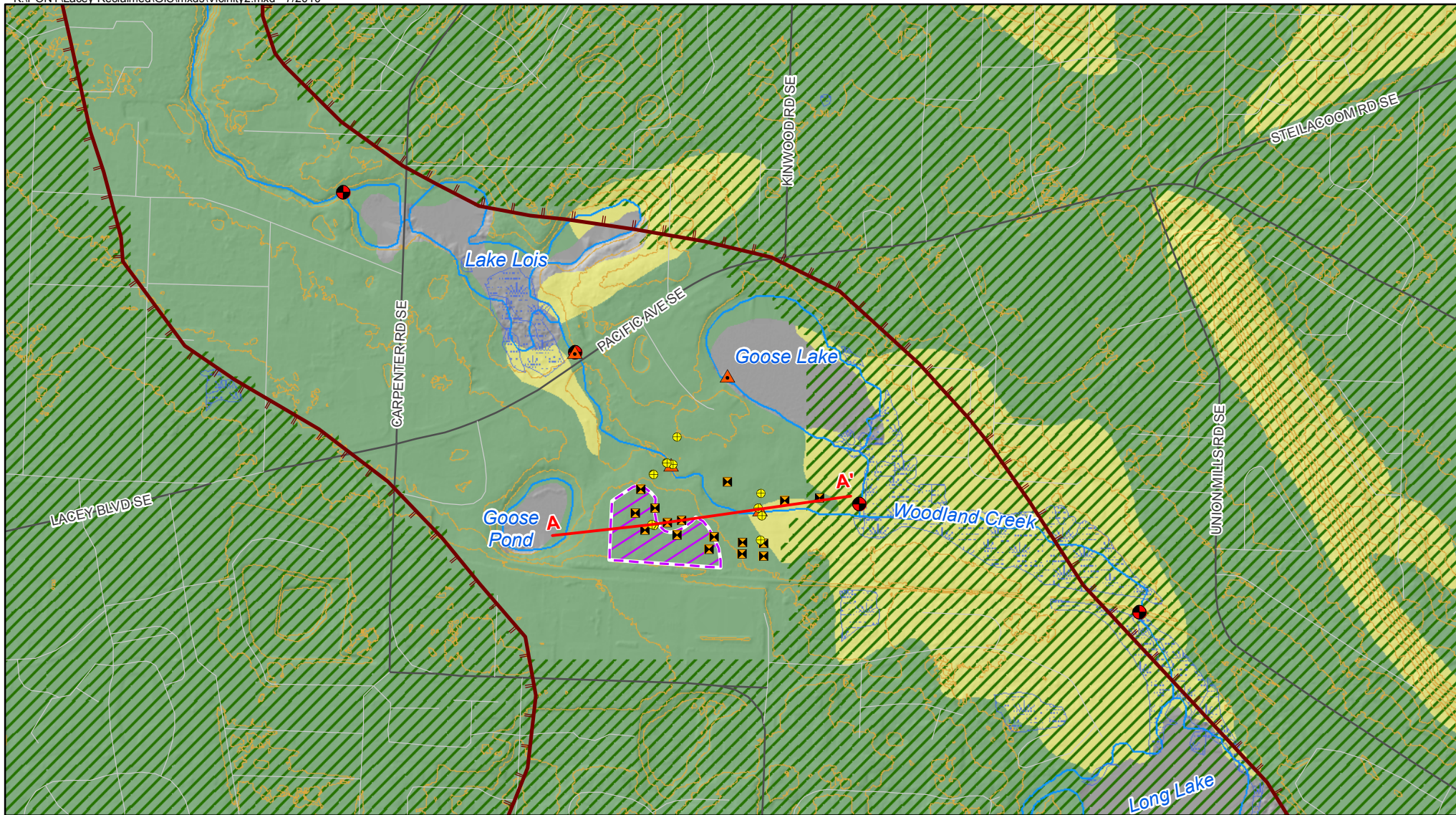
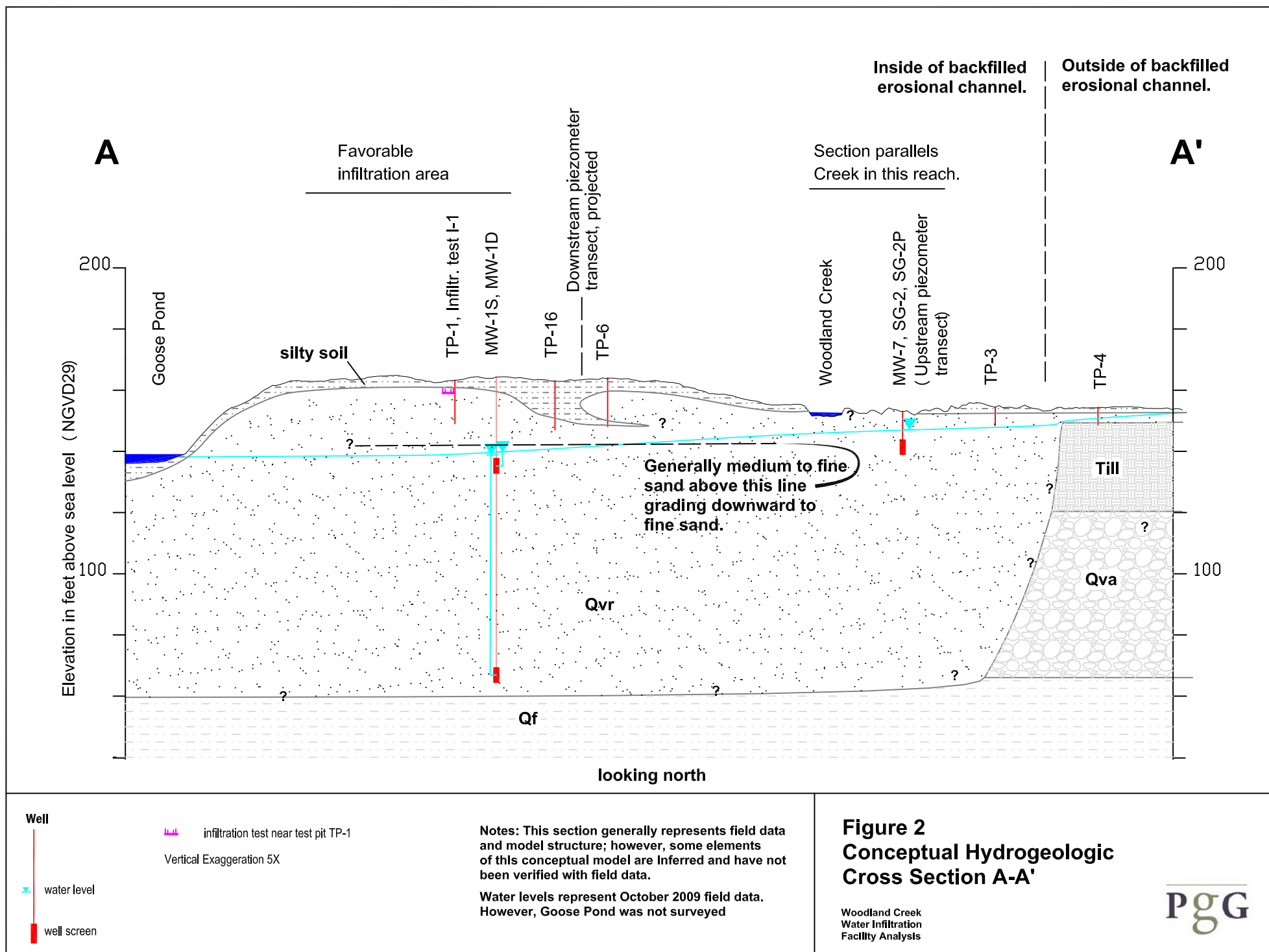
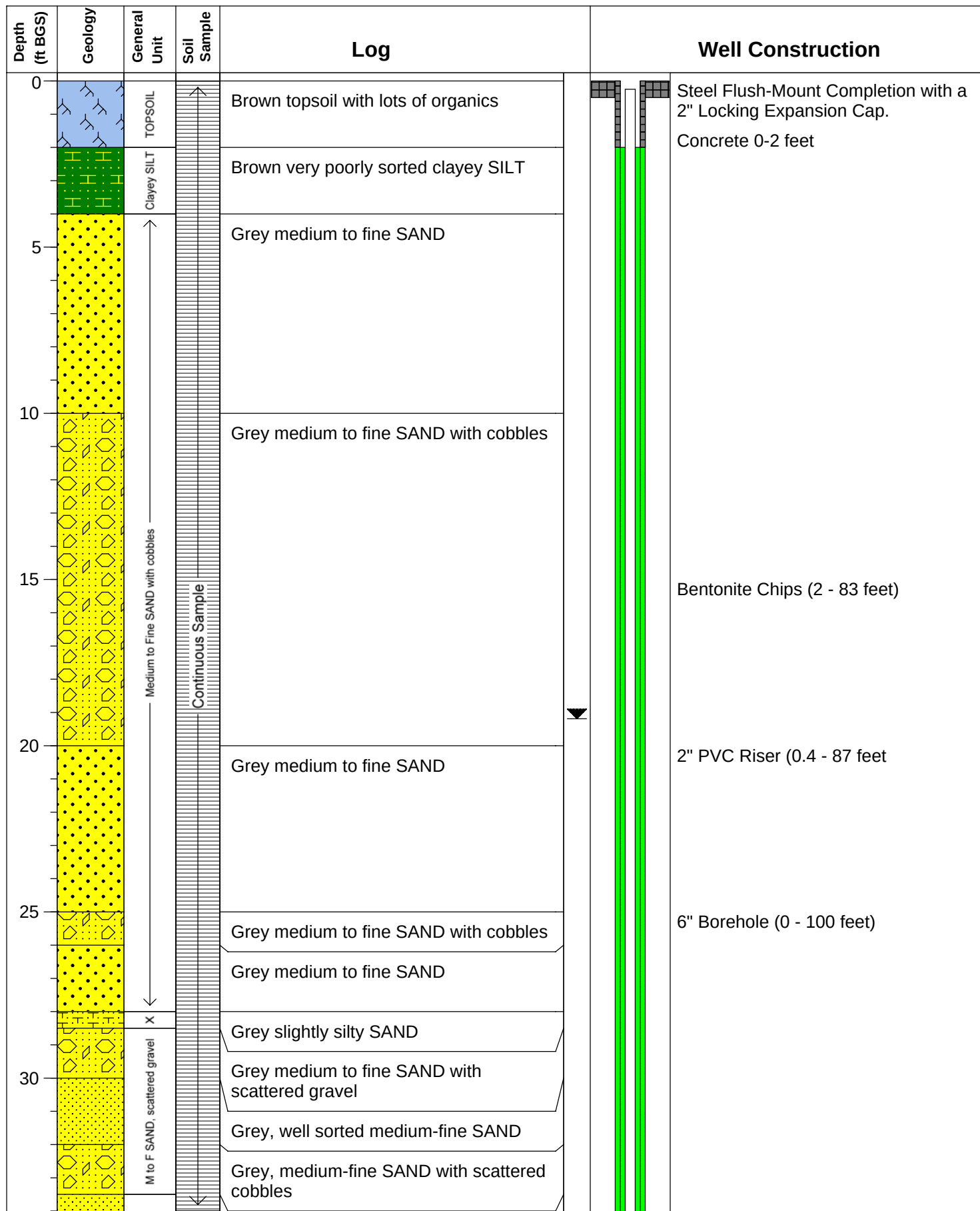


Figure 1
Vicinity and
Geologic Map

Woodland Creek
Water Infiltration
Facility Analysis

PGG





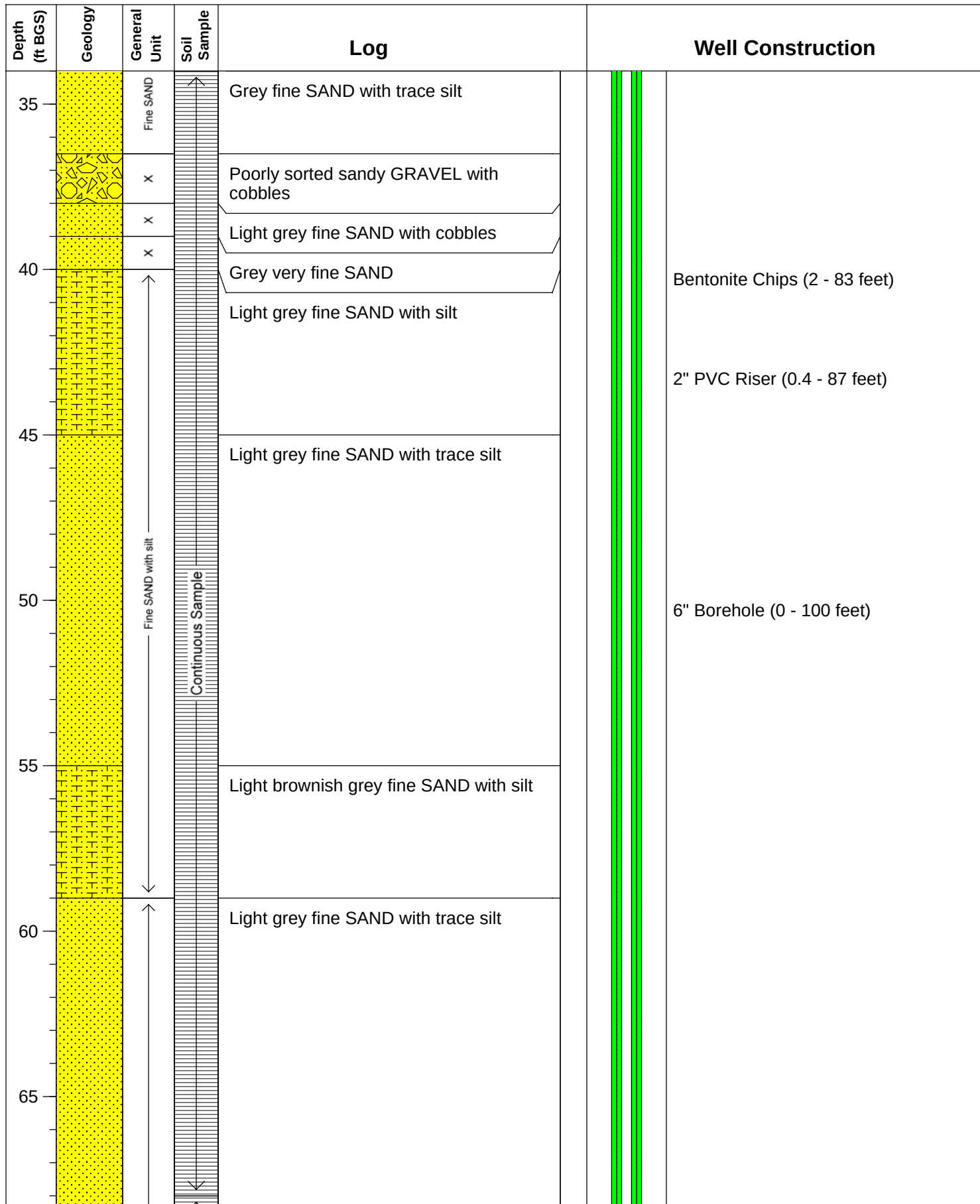
Project Name: Lacey Reclaimed
 Drilling Method: Sonic
 Driller: Jeremy Thompson
 Boart Longyear
 Consulting Firm: Pacific Groundwater Group
 Logged by: Doug Kelly
 Location: Woodland Creek Park, Lacey, WA

Well Name: MW-1D
 Ecology ID: BBP008
 MP Elevation: 163.20 ft
 Datum: NGVD 29
 Installed: 11/24/09
 DTW on 11/27/09: 19.19 ft bmp
Page 1 of 3

Figure 3
GEOLOGIC LOG AND AS-BUILT
FOR WELL MW-1D

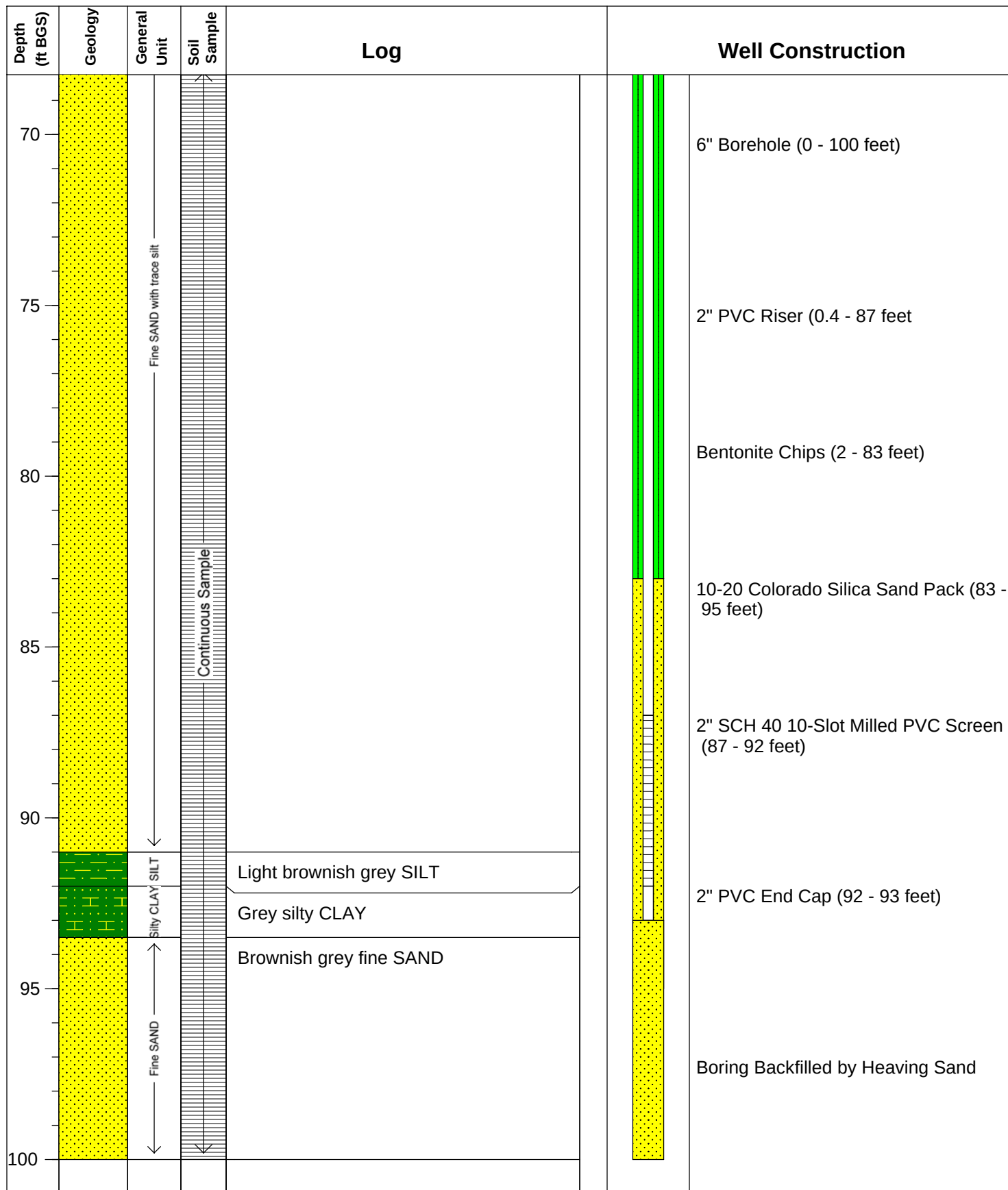
Woodland Creek Water
 Infiltration Facility Analysis





Project Name: Lacey Reclaimed
 Drilling Method: Sonic
 Driller: Jeremy Thompson
 Boart Longyear
 Consulting Firm: Pacific Groundwater Group
 Logged by: Doug Kelly
 Location: Woodland Creek Park, Lacey, WA

Well Name: MW-1D
 Ecology ID: BBP008
 MP Elevation: 163.20 ft
 Datum: NGVD 29
 Installed: 11/24/09
 DTW on 11/27/09: 19.19 ft bmp
Page 2 of 3



Project Name: Lacey Reclaimed
 Drilling Method: Sonic
 Driller: Jeremy Thompson
 Boart Longyear
 Consulting Firm: Pacific Groundwater Group
 Logged by: Doug Kelly
 Location: Woodland Creek Park, Lacey, WA

Well Name: MW-1D
 Ecology ID: BBP008
 MP Elevation: 163.20 ft
 Datum: NGVD 29
 Installed: 11/24/09
 DTW on 11/27/09: 19.19 ft bmp
Page 3 of 3

Figure 3
GEOLOGIC LOG AND AS-BUILT
FOR WELL MW-1D

Woodland Creek Water
 Infiltration Facility Analysis





- 137.46 ● Monitoring Well (with water-table elevation)
- 146.94 ▲ Staff Gage (with surface-water elevation)
- 2007 Test Pit
- Estimated Water Table Elevation Contours
- ▨ Favorable Infiltration Zone
- 1-foot Contours (Lidar)
- Section A-A' Location

0 Feet 200
Elevations in Feet, NGVD 1929



Figure 4
Groundwater & Surface
Water Elevations
10/19/09
Woodland Creek
Water Infiltration
Facility Analysis



- 137.46 + Monitoring Well (with water-table elevation)
- 146.94 ▲ Staff Gage (with surface-water elevation)
- 2007 Test Pit
- Estimated Water Table Elevation Contours
- ▨ Favorable Infiltration Zone
- 1-foot Contours (Lidar)
- Section A-A' Location

0 Feet 200
Elevations in Feet, NGVD 1929



Figure 5
Groundwater & Surface
Water Elevations
3/10/2010
Woodland Creek
Water Infiltration
Facility Analysis

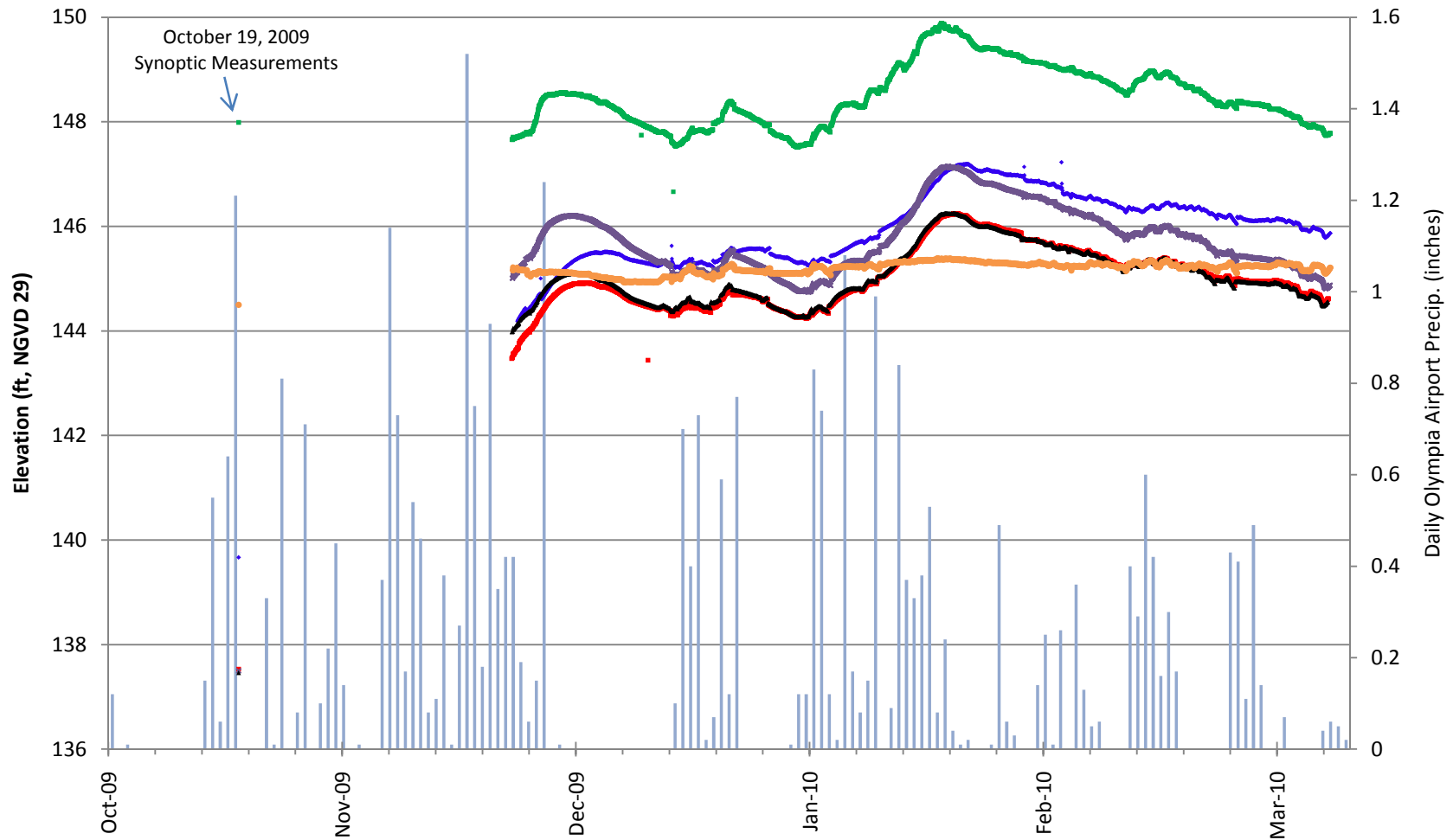
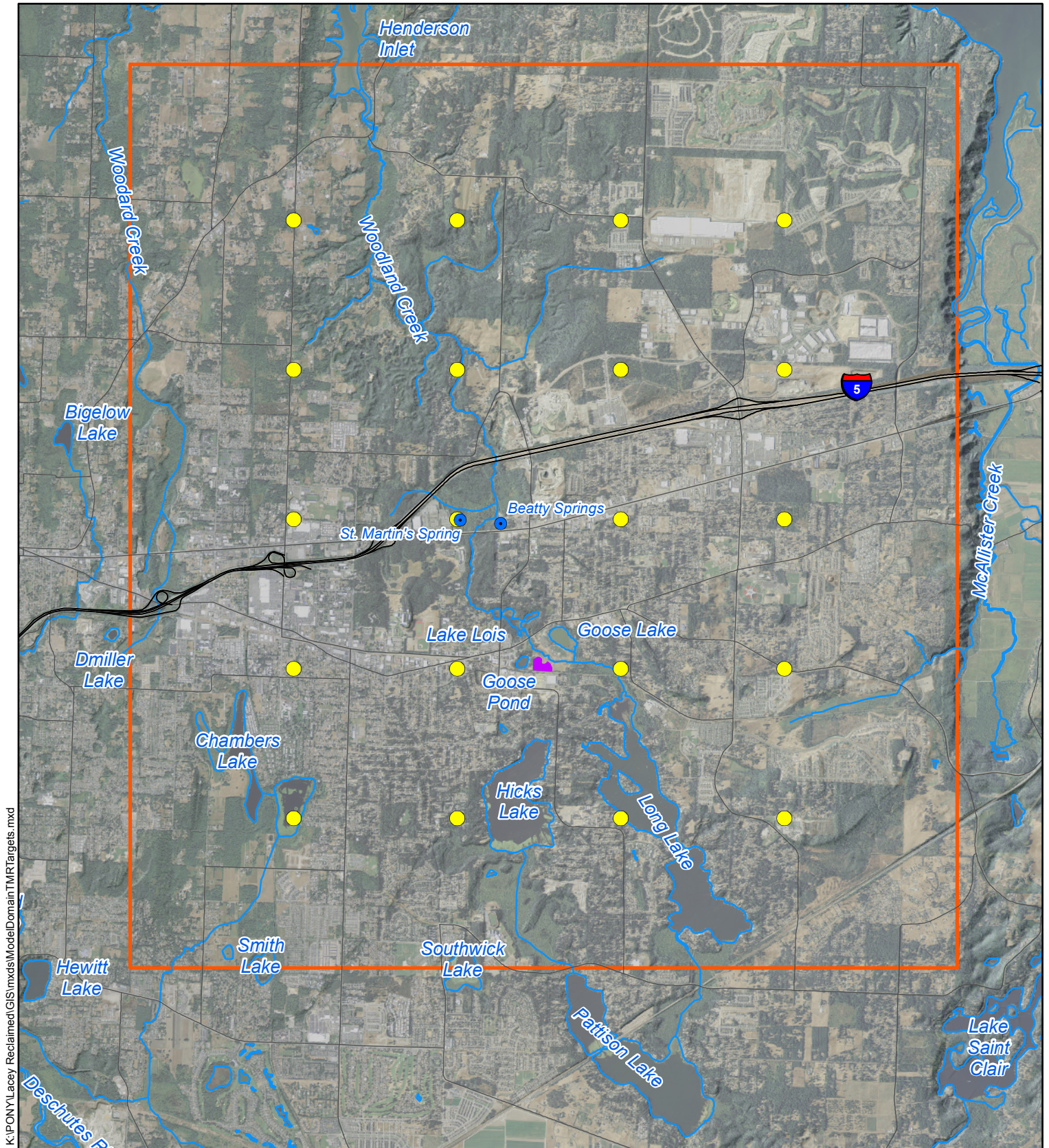


Figure 6
Well and Stream
Hydrographs

Woodland Creek
Water Infiltration
Facility Analysis





K:\PONY\Lacey Reclaimed\GIS\mxds\ModelDomain\TMRTargets.mxd

- Calibration Targets
- Model Domain
- Infiltration Site

0 Feet 5,000

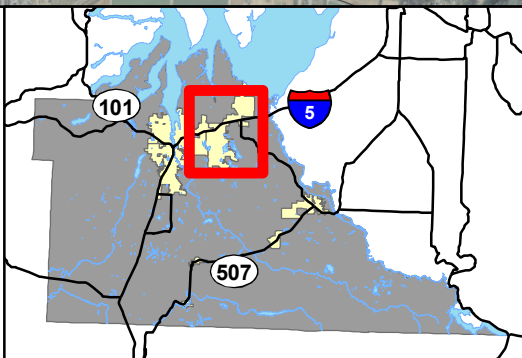


Figure 7
UWC Model Domain
and TMR Calibration
Target Locations

Woodland Creek
 Water Infiltration
 Facility Analysis

pgg

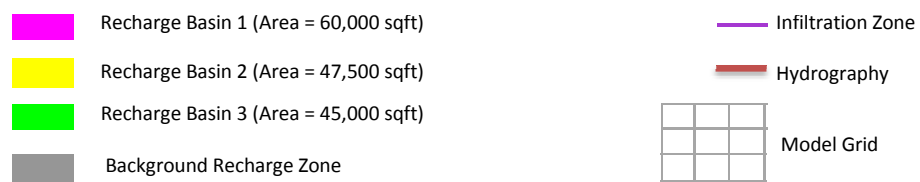
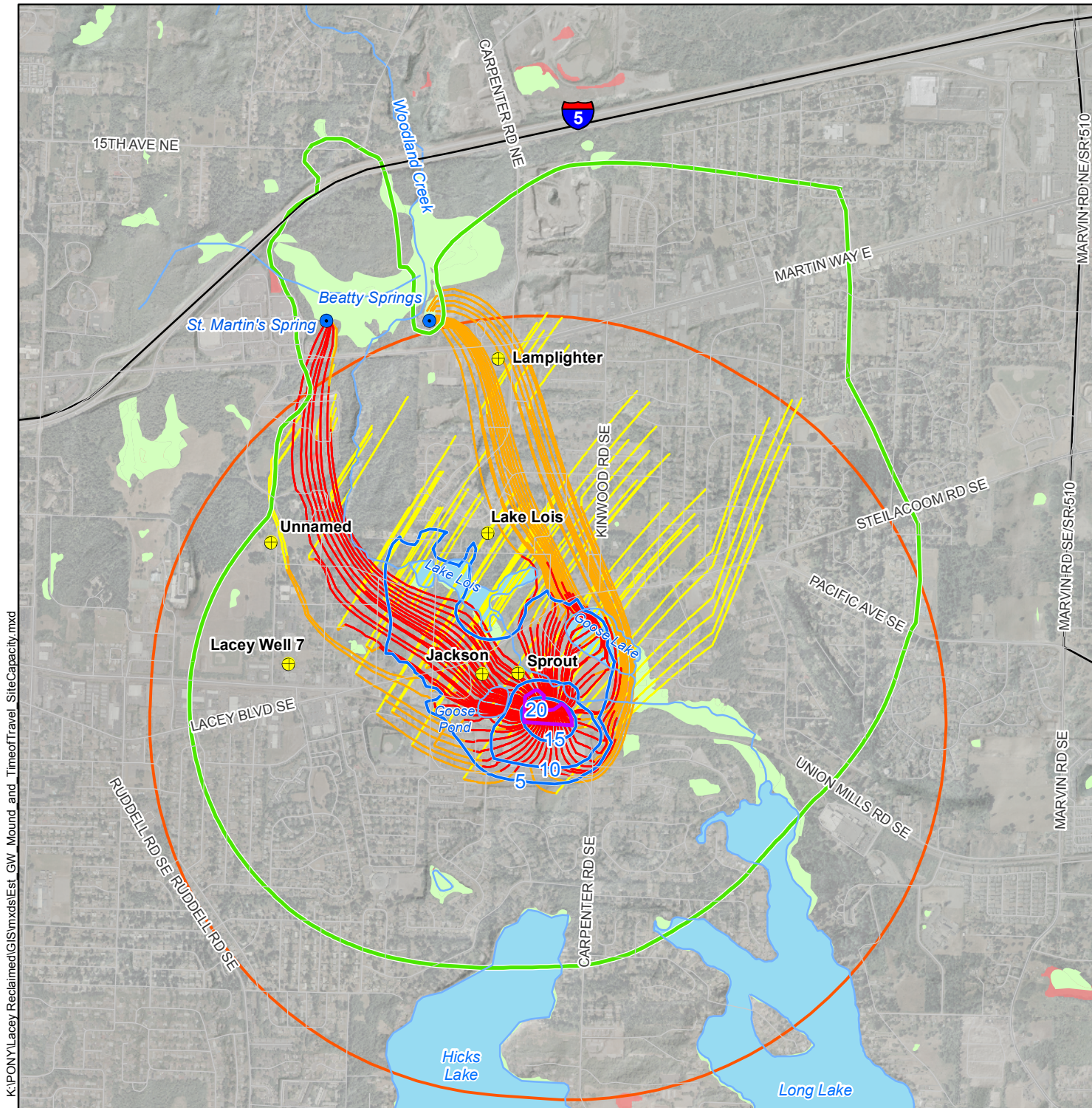


Figure 8
UWC Model Infiltration Recharge Zones

Woodland Creek Water
 Infiltration Facility Analysis

PGG



K:\PONY\Lacey Reclaimed\GIS\mxd\Est. GW Mound and TimeofTravel SiteCapacity.mxd

- Nearby Water Supply Wells (Flow paths may go over or under well intake, see text)
- Infiltration Site with 1.3 mgd Infiltrated at Basin 2
- Groundwater Mound in Qvr Aquifer (5-ft contours)
- Groundwater Mound in Qva Aquifer (1-ft contour)
- 1-Year Groundwater Flow Paths
- 5-Year Groundwater Flow Paths
- 10-Year Groundwater Flow Paths
- 1-Mile Buffer of Infiltration Site
- Wetlands
- High Groundwater Hazard Areas

0 Miles 0.5

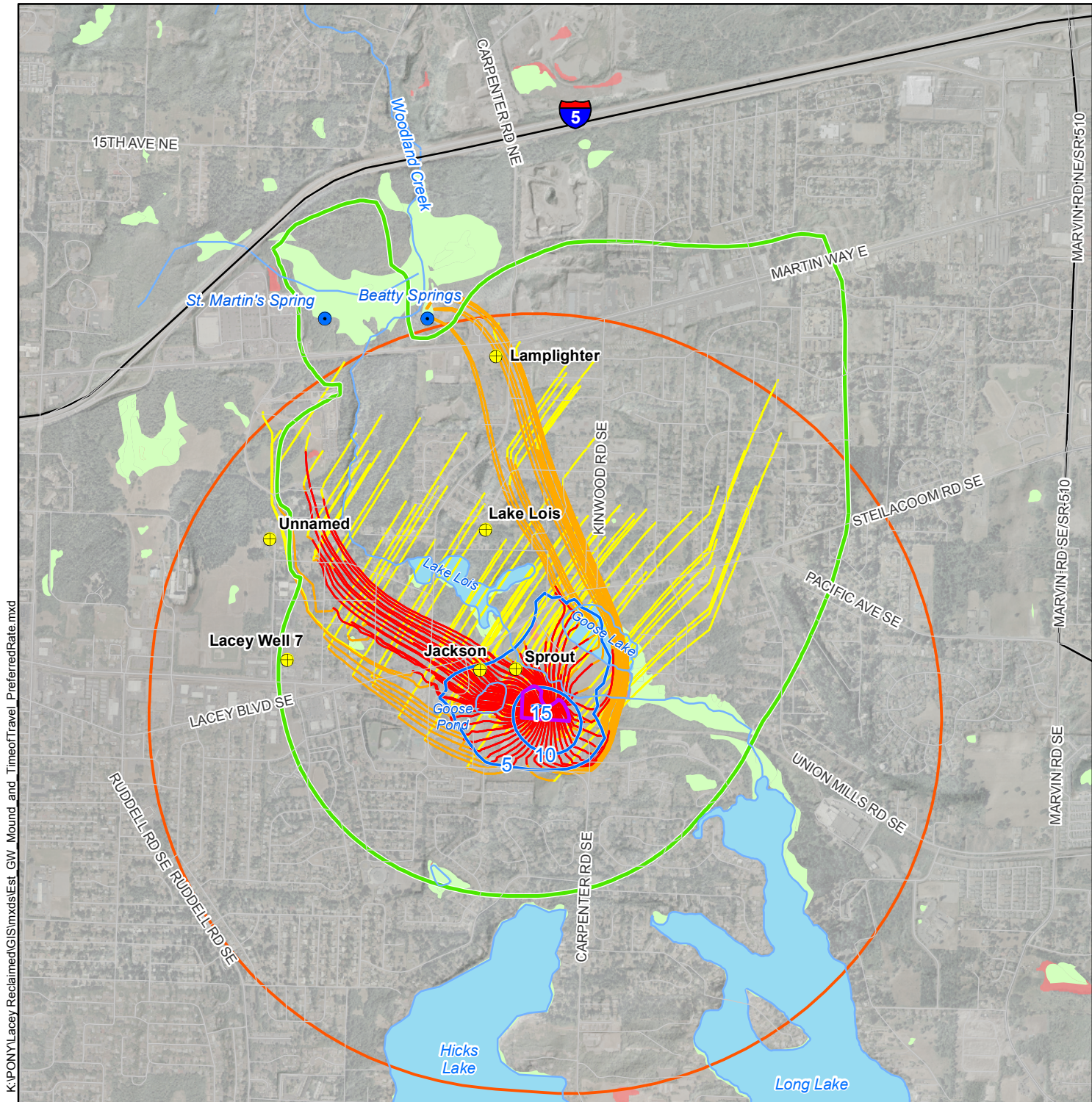


Figure 9

Low-Water Season
Estimated Groundwater
Mound and Reclaimed
Water Time of Travel,
Site Capacity

Woodland Creek
Water Infiltration
Facility Analysis

pgg



K:\PONY\Lacey Reclaimed\GIS\mxd\Est GW Mound and TimeofTravel PreferredRate.mxd

- Nearby Water Supply Wells (Flow paths may go over or under well intake, see text)
- Infiltration Site with 0.8 mgd Infiltrated at Basin 2
- Groundwater Mound in Qvr Aquifer (5-ft contours)
- Groundwater Mound in Qva Aquifer (1-ft contour)
- 1-Year Groundwater Flow Paths
- 5-Year Groundwater Flow Paths
- 10-Year Groundwater Flow Paths
- 1-Mile Buffer of Infiltration Site
- Wetlands
- High Groundwater Hazard Areas

0 Miles 0.5

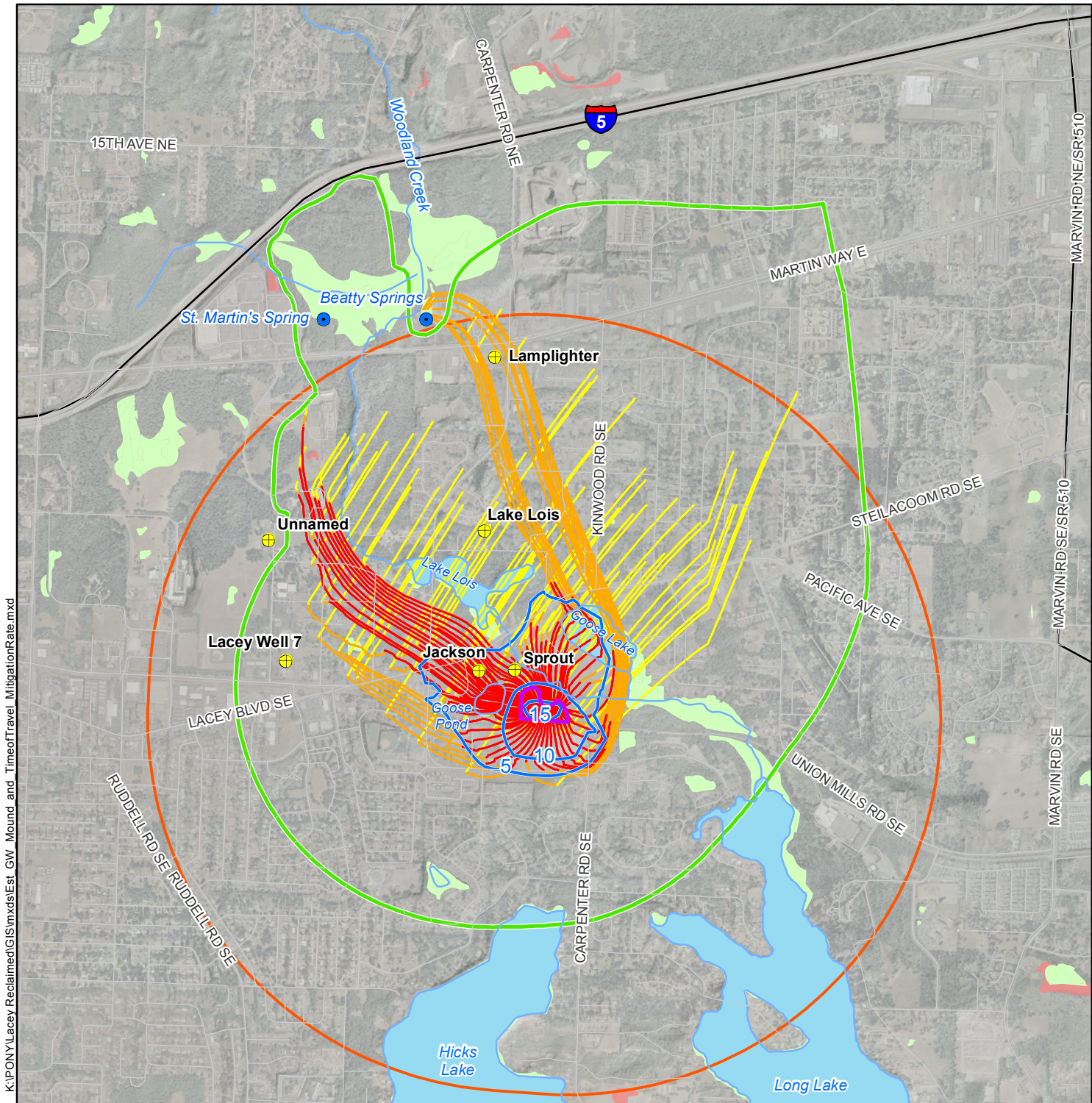


Figure 10

Low-Water Season
Estimated Groundwater
Mound and Reclaimed
Water Time of Travel,
No-Local-Discharge Rate

Woodland Creek
Water Infiltration
Facility Analysis

pgg



K:\PONY\Lacey Reclaimed\GIS\mxd\Est. GW Mound and TimeofTravel MitigationRate.mxd

-  Nearby Water Supply Wells (Flow paths may go over or under well intake, see text)
-  Infiltration Site with 1 mgd Infiltrated at Basin 2
-  Groundwater Mound in Qvr Aquifer (5-ft contours)
-  Groundwater Mound in Qva Aquifer (1-ft contour)
-  1-Year Groundwater Flow Paths
-  5-Year Groundwater Flow Paths
-  10-Year Groundwater Flow Paths
-  1-Mile Buffer of Infiltration Site
-  Wetlands
-  High Groundwater Hazard Areas

0 Miles 0.5



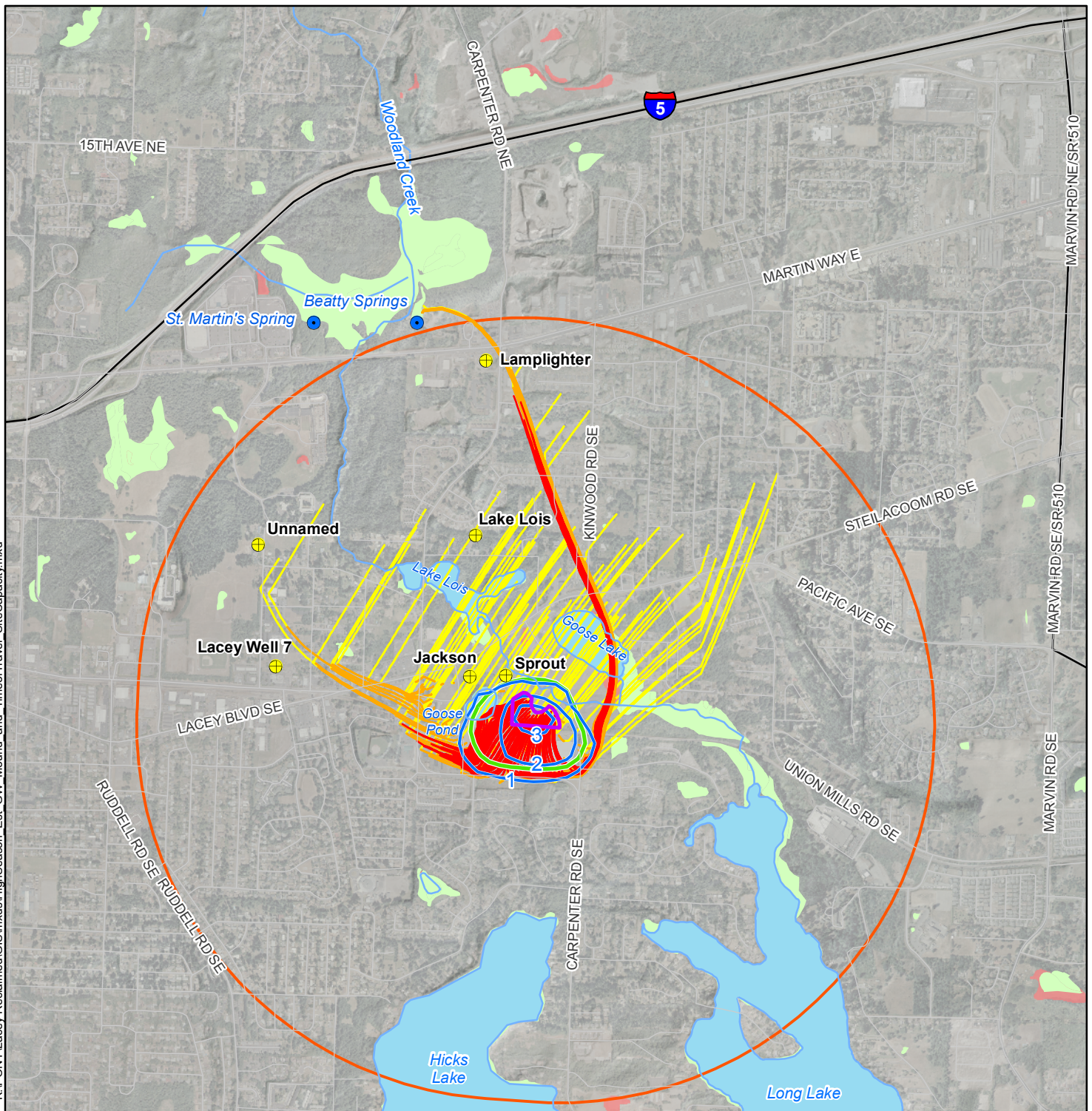
Figure 11

Low-Water Season
Estimated Groundwater
Mound and Reclaimed
Water Time of Travel,
1 MGD Rate

Woodland Creek
Water Infiltration
Facility Analysis

pgg

K:\PONY\Lacey Reclaimed\GIS\mxd\HighSeason_Est_GW_Mound_and_TimeofTravel_SiteCapacity.mxd



- Nearby Water Supply Wells (Flow paths may go over or under well intake, see text)
- Infiltration Site with 0.3 mgd Infiltrated at Basin 2
- Groundwater Mound in Qvr Aquifer (1-ft contours)
- Groundwater Mound in Qva Aquifer (1-ft contour)
- 1-Year Groundwater Flow Paths
- 5-Year Groundwater Flow Paths
- 10-Year Groundwater Flow Paths
- 1-Mile Buffer of Infiltration Site
- Wetlands
- High Groundwater Hazard Areas

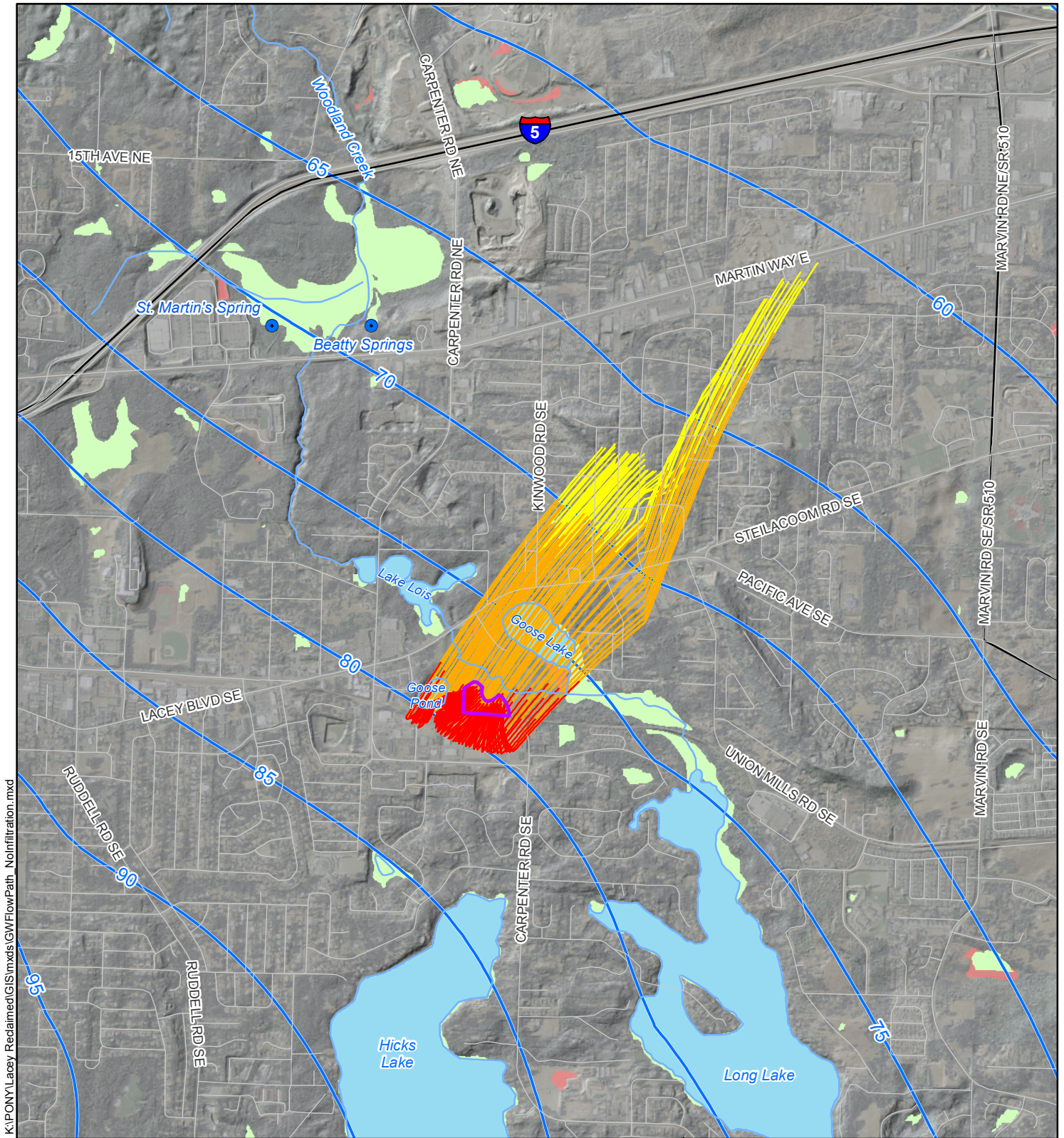
0 Miles 0.5



Figure 12
High-Water Season
Estimated Groundwater
Mound and Reclaimed
Water Time of Travel,
Site Capacity and
No-Local-Discharge Rate

Woodland Creek
Water Infiltration
Facility Analysis

pgg



K:\PONY\Lacey Reclaimed\GIS\mxds\GWFlowPath_NoInfiltration.mxd

- Infiltration Site
- Modeled Qc Head Contours (feet)
- 1-Year Groundwater Flow Paths
- 5-Year Groundwater Flow Paths
- 10-Year Groundwater Flow Paths
- Wetlands
- High Groundwater Hazard Areas

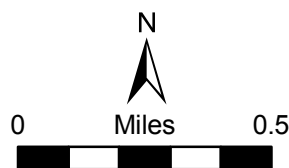
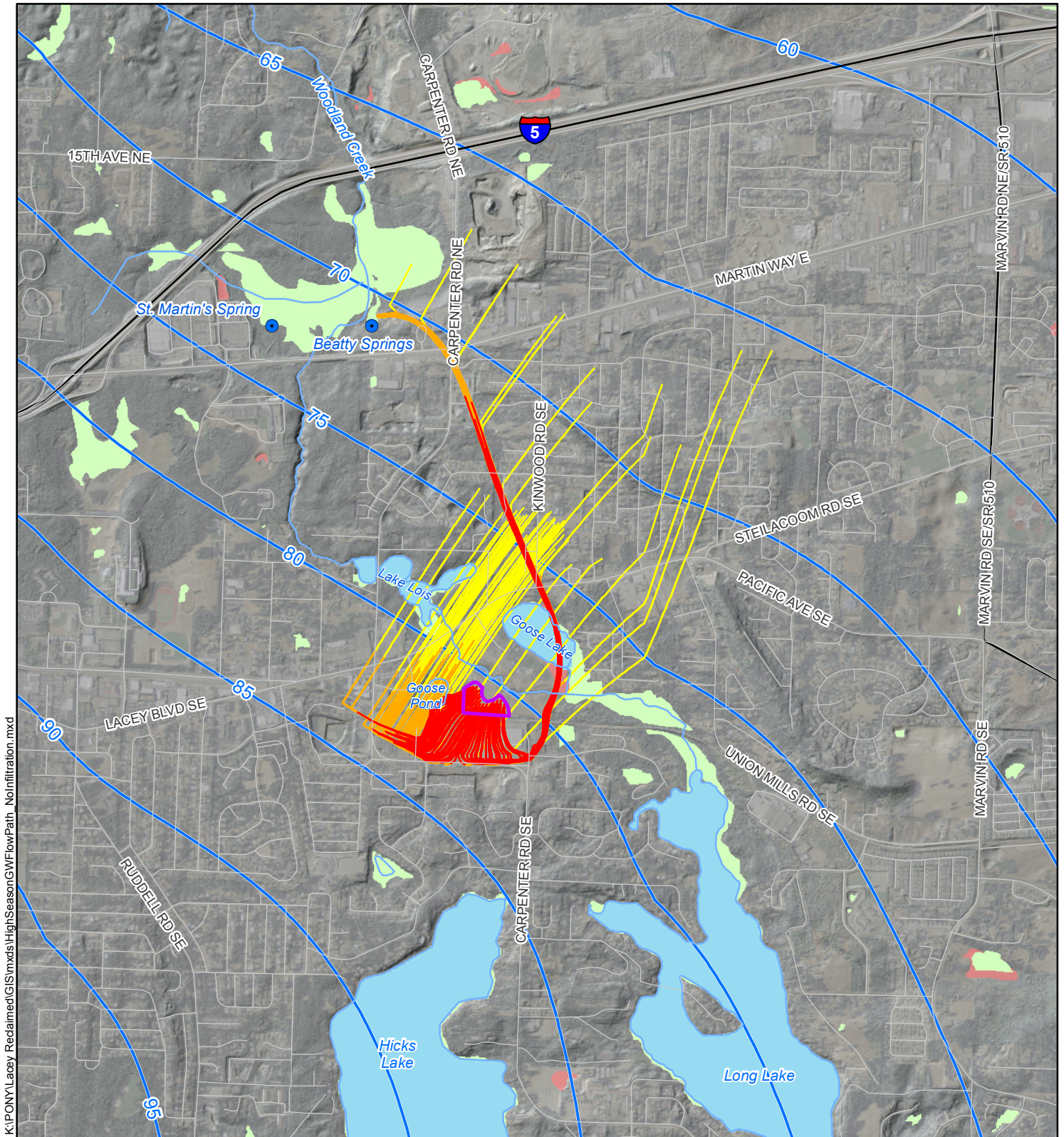


Figure 13

**Low-Water Season Ambient
Groundwater Flow Paths
Without Reclaimed
Water Infiltration**

Woodland Creek
Water Infiltration
Facility Analysis

PgG



K:\PONY\Lacey Redefined\GIS\mxd\HighSeasonGWFlowPath_NoInfiltration.mxd

- Infiltration Site
- Modeled Qc Head Contours (5-ft contours)
- 1-Year Groundwater Flow Paths
- 5-Year Groundwater Flow Paths
- 10-Year Groundwater Flow Paths
- Wetlands
- High Groundwater Hazard Areas

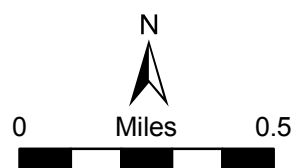
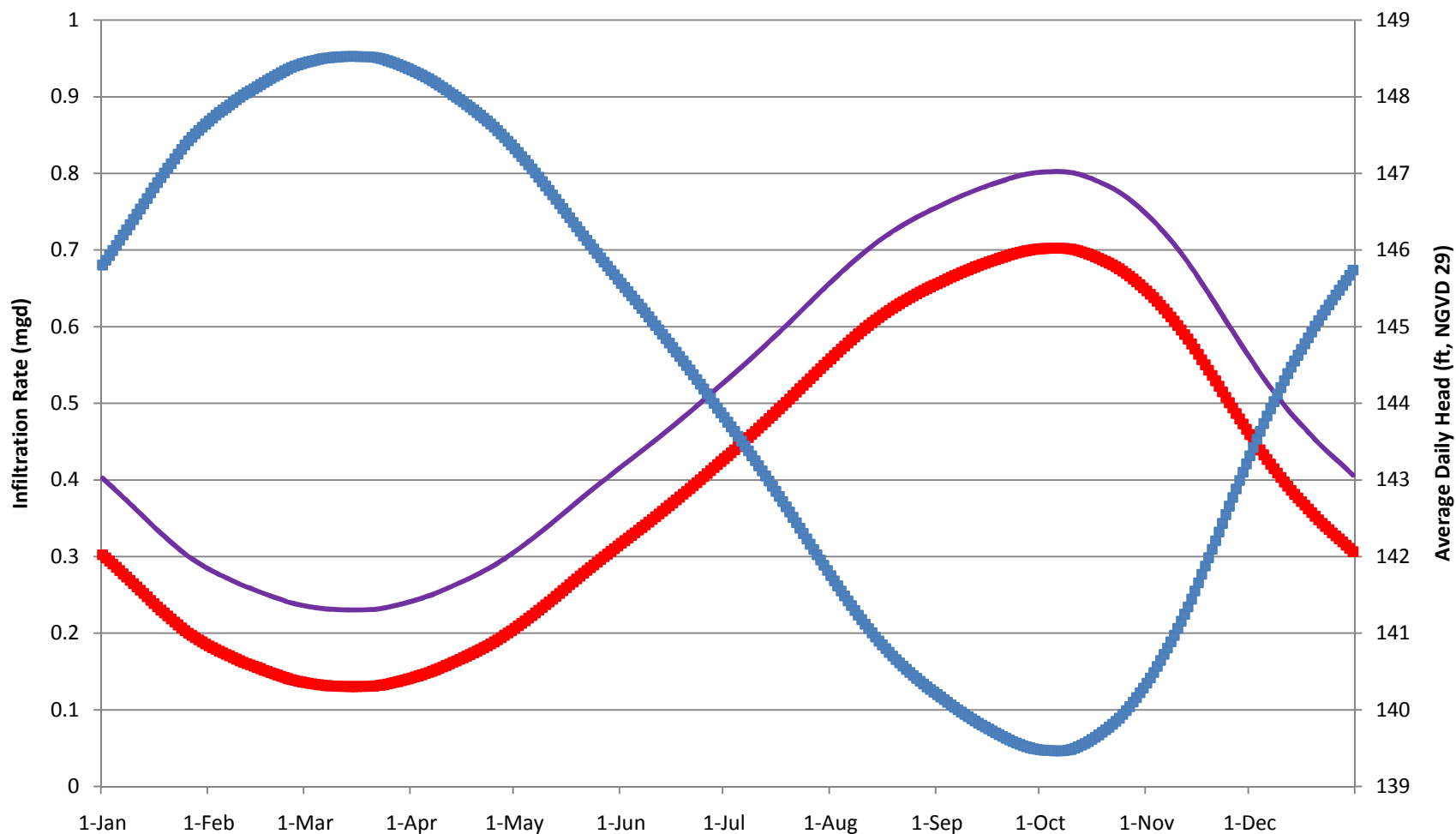


Figure 14
High-Water Season Ambient
Groundwater Flow Paths
Without Reclaimed
Water Infiltration

Woodland Creek
 Water Infiltration
 Facility Analysis

PgG



- Uncorrected Infiltration Rate
- Infiltration Rate with Correction of +0.1 mgd
- MW-1S Average Daily Head from APIH

Note: see Appendix B for derivation.

Figure 15
Variation of No-Local-Discharge Rate as a
Function of Daily Ambient Groundwater
Elevation

Woodland Creek
 Water Infiltration
 Facility Analysis



APPENDIX A
UPPER WOODLAND CREEK MODEL DOCUMENTATION

APPENDIX A

UPPER WOODLAND CREEK MODEL DOCUMENTATION

1.0 INTRODUCTION

This appendix documents the development and use of the Upper Woodland Creek (UWC) numerical groundwater model. The UWC Model was adapted directly from the most recent transient version (version 20d) of the McAllister Model (CDM, 2002), a 3-dimensional numerical model used by the City of Olympia and more recently refined by Golder Associates (2006, 2008a, 2008b) for the Cities of Lacey and Yelm. The McAllister Model has been used by the Cities for water rights mitigation design and is an established groundwater model. The UWC model documented in this memo is a sub-regional model that was refined to encompass local geologic and hydrologic features and calibrated to local conditions in the Upper Woodland Creek basin between Long Lake and Beatty Springs (**Main Text Figure 7**). Following model refinement, two versions of the steady-state UWC model were created to simulate low- and high-water season conditions. This appendix first presents model refinements and then documents model calibration for the low- and high-water seasons.

The UWC model was developed and run using MODFLOW Surfact 3 (which is updated from version 2.2 and allows stream package simulations (Hydrogeologic Inc., 1996)) and the Groundwater Vistas™ graphical user interface. The original McAllister Model was created using MODFLOW Surfact 2.2 based on the USGS MODFLOW model for Thurston County (Drost et al, 1999). Changes made to the most recent McAllister model for use in the UWC model are documented in sections below.

2.0 MODEL DOMAIN AND SUB-REGIONAL GRID REFINEMENT

The McAllister model extends in an east-west direction from the Nisqually River to the Deschutes River, and in the north-south direction from Budd and Henderson Inlets to Lake Lawrence. The UWC model is based on a subsection of the McAllister model and extends in the north-south direction from the mouth of Woodland Creek to the wetlands south of Long Lake, and in the east-west direction from approximately the west edge of the buried McAllister/Nisqually River erosional valley to Woodard Creek (**Main Text Figure 7**). Though only Hicks and Long Lake were simulated in the UWC model (and not Pattison Lake), the two lakes and their associated wetlands are referred to as the Tri-Lakes in this report.

The most recent McAllister model grid is composed of 266 rows and 217 columns, with grid cells ranging in size from 100x100 feet to 1250x1350 feet. In creating the UWC model, a telescopic mesh refinement was performed using “parent cells” from the McAllister model. All “daughter cells” in the UWC model had a cell size of 250x250 feet and retained the hydrologic properties of the parent cells. Groundwater heads predicted by the McAllister model were used as boundary conditions along the edges of the UWC model domain. Specifically, PGG used heads from October of the final simulation year of the McAllister model (year six) as constant head boundary conditions along these outer boundaries.

3.0 LOCAL GRID REFINEMENT

The 250 x 250 foot grid of the UWC model was further refined to 50 x 50 foot cells in the vicinity of Woodland Creek Community Park. This higher resolution grid allowed for more accurate delineation of Woodland Creek, monitoring locations, and ground surface elevations for flooding evaluation. Following the addition of rows

and columns, the model grid was smoothed to ensure that cell areas are no larger than 1.5 times their neighboring cell areas. **Figure A-1** shows the finalized UWC model grid.

4.0 SURFACE ELEVATION AND LAYER REFINEMENT

Because parent cells from the Olympia model are generally larger than daughter cells in the UWC model, modeled geologic layer surfaces in the UWC model were “blocky” and uneven (for example a 1000 foot x 1000 foot parent model cell assigns the same layer elevation to all 16 of the 250 foot x 250 foot daughter cells, creating a surface characterized by blocks of cells with equal elevations). Layer elevations were therefore refined to the finer UWC model grid using spline interpolation, which created smooth layer top and bottom elevations.

Land surface elevations used in the McAllister Model for some areas of the Woodland Creek basin were previously recognized to be inaccurate, with local differences between modeled and observed land surface elevations of over 40 feet (Massmann and Romero, 2006). To improve ground surface elevations for the overall basin and to allow for more accurate evaluation of local flooding, ground surface elevations from the McAllister model were replaced with LIDAR surface elevations (**Figure A-2**). For each model cell, the average LIDAR elevation for that cell was computed and imported into the model. LIDAR elevations were available from the Puget Sound LIDAR Consortium at a grid interval of 6 feet by 6 feet.

Numerous cells had an updated LIDAR top elevation for Layer 1 below the original bottom elevation of model Layer 1, and therefore model layer elevations and thicknesses required editing to avoid negative layer thicknesses. For areas where the new Layer 1 thickness was less than five feet, it was assumed that the Layer 1 bottom elevation is five feet below the Layer 1 top elevation (**Figure A-2**). Thicknesses for all layers below Layer 1 were assumed accurate in the

McAllister model, so lower layer elevations were all shifted down equally where Layer 1 bottom elevations were edited.

Following the layer modification mentioned above, an additional five layers were added to the model (for a total of 14 layers), with two additional layers added to Layer 1 (Qvr) and three layers added to Layer 2 (Qvt). These layers were added to allow for greater vertical resolution of the water table in layers where groundwater mounding would occur. Parent layers corresponding to Qvr and Qvt were subdivided by relative percent thicknesses to make layer thicknesses at the infiltration site approximately 5 feet. A summary of model layering and corresponding units can be found in **Table A-1**.

5.0 LOCAL HYDROLOGIC REFINEMENTS

In the McAllister model, Woodland Creek was simulated as a river boundary condition. River boundary condition inputs include stage and conductance¹. A limitation of river cells when applied to losing stream systems is that they can act as an unlimited source of water when the river stage is higher than water table elevation. Since Woodland Creek is a losing stream between Long Lake and Beatty Springs, all of Woodland Creek was modeled using the stream (not river) boundary condition. The primary difference between stream and river boundary conditions is that stream cells track surface water flow (based on stream gains and losses for upstream cells) and in losing reaches a stream cell will not provide any water to the aquifer if there is no surface water present in the cell. Total stream conductance values were kept the same as those used for Woodland Creek in the McAllister model, while stream stages were revised using LIDAR data for the stream cells. In some cases, stream stages were lowered substantially (by greater than 20 ft).

¹ Conductance = (Hydraulic Conductivity of Sediment Bed x Feature Length x Feature Width)/ Thickness of Sediment Bed, or $C = KLW/D$.

Woodland Creek perennially flows downstream of Beatty Springs. As this spring and St Martin's Spring were not included in the McAllister model, they were added to the UWC model. Both springs were assigned an elevation of 75 feet (Drost and others, 1999), locating Beatty in UWC model Layer 8 and St. Martin's in Layer 4. St. Martin's Spring was modeled as a drain, while Beatty Springs was modeled as a stream cell to allow for streamflow tracking.

Lakes near the infiltration site (Goose Lake, Goose Pond, and Lake Lois), were modeled as groundwater features with zones of high hydraulic conductivity ($K = 100,000$ ft/d) and storage values of 1 extending from Layer 1 through Layer 3 (Goose Lake and Lake Lois) or Layer 4 (Goose Pond). Goose Pond has no surface water inflow or outflow, and in the dry season the diversion from Woodland Creek to Goose Lake is not always active. During the dry season Lake Lois has surface water inflow from Woodland Creek but no surface water outflow. Refer to the main text for more information on Lake Lois. For steady-state modeling purposes, the lake stage is assumed constant (no change in storage) and the streamflow losses measured between Pacific Avenue and the outlet of Lake Lois are assumed due to infiltration only. Although in reality evaporation also occurs, for the low-water season (when the most evaporation would occur) it is estimated to account for only 2% of the 0.98 cfs of stream loss occurring in the vicinity of Lake Lois.

A series of stream cells were added over Lake Lois to allow water transported by Woodland Creek to infiltrate at Lake Lois. This was done to account for a model limitation of stream cells, which is that at the end of a modeled stream, all water transported by the stream is removed from the model. This modeling approach prevented a large amount of water from being removed from the model near the infiltration site. A similar approach was taken at Goose Lake (which has only wet season surface water inflow via a diversion off Woodland Creek), with a ring of stream cells encircling the lake.

Simulation of Long Lake and Hicks Lake remains effectively the same between the McAllister model and the UWC model. In the McAllister model, the Tri-Lakes are modeled in Layer 2 (Qvt), while in the UWC model these lakes and their associated wetlands are modeled in Layers 4, 5, and 6 which stratigraphically correspond with Qvt (**Table A-1**). In both models these lakes and wetlands are modeled using river cells, with stage and total conductance values not changed. Additionally, Woodard Creek, Chambers Lake, Chambers ditch, and several small lakes were simulated in the same manner as the McAllister model. These features were modeled using river cells, with river stages and total conductance values unchanged between models. River stages for Woodard Creek and Chambers Ditch were updated in the UWC model using LIDAR surface elevations.

Drain cells near northern and eastern no-flow boundaries were modified minimally. Total conductance values were not changed, while drain stages were only modified if the drain elevation plotted below its layer's bottom elevation following the editing of layer elevations.

6.0 LOCAL GEOLOGIC REFINEMENTS

As noted in the main text, what is interpreted as an erosional channel backfilled by mostly deltaic and lacustrine sands is present beneath the infiltration site and along much of Woodland Creek. This erosional feature is mapped by the USGS (Drost and others, 1998) as a window where Qvt is not present. Based on the lithology observed in the MW-1D borehole, PGG interprets that this erosional feature cuts through Qvr, Qvt, and Qva. Medium to fine grained sand is present to approximately 33 feet below ground surface at the site, with fine sand present from 33 to 97 feet below ground surface. Data from Amec (2002) suggest that the channel is filled with high transmissivity sands and gravels where Carpenter Road crosses Lake Lois.

Based on the erosional window mapped by the USGS and geologic data for the infiltration site and Lake Lois area, an erosional window was placed in the UWC model in units Qvr, Qvt, and Qva (**Table A-1**). The aquifer within the channel was represented by model cells with properties typical of sands (below the site) transitioning to high permeability sands and gravels downstream. **Table A-2** and **Figure A-3** show the implementation of the erosional window in different model layers.

7.0 ADDITION OF LOCAL WELLS

Active group A and B Public Water Supply (PWS) wells from the Department of Health (DOH) database within 1 mile of the infiltration area were added to the model (“DOH wells”). Only four active DOH wells were identified (Lacey Well 7, Lamplighter, Sprout, Lake Lois), with one (Lacey Well 7) already included in the model. Additionally, the Jackson domestic well was included in the model although it was not identified by DOH or the Department of Ecology well log database. The Sprout and Lacey Well 7 wells were located using coordinates from the DOH database, while the Jackson, Lamplighter, and Lake Lois wells were located using their ownership information and street address.

DOH wells were assigned pumping layers based on screen depth and the interpretation of well logs. In instances where the screen elevation located a well in a modeled aquitard, professional judgment was used to locate the well in the most reasonable modeled aquifer. For wells with no depth information in the DOH database, the Department of Ecology well log database was searched; if depth data still could not be obtained, the well was assumed to be screened in Layer 8 (Qva), the shallowest regional aquifer.

Modeled pumping rates for the DOH wells were calculated assuming that each connection consumed 350 gallons per day (gpd). This rate is conservatively high and is appropriate for large

rural-residential lots. The Lacey Well 7 pumping rate was updated. Using City of Lacey October pumping rates from 2006 through 2009, the UWC low-water season pumping rate for Lacey Well 7 averages 1,035,360 gpd (719 gpm) and the high-water season rate averages 616,320 gpd (428 gpm). These rates are approximately 3.5 times greater than the corresponding McAllister model pumping rates. The increased rates were deemed appropriate as they are more representative of foreseeable future pumping rates.

8.0 UWC MODEL CALIBRATION

Since the UWC models are both steady state and the McAllister model and the natural system are transient, low- and high-water season “equivalent steady-state recharge rates” were derived through calibration so that compared heads between either the two models (for the low-water season) or the UWC model and local observed water levels (for the high-water season) agreed. The calibrated low- and high-water season recharge rates represent the annual recharge needed, assuming equal recharge occurs each day, to maintain onsite aquifer heads at the low- or high-water season elevations year-round.

Since low-water season data were available first, the UWC model was initially calibrated using low-water season data. The calibrated low-water season model was then recalibrated for high-water season conditions, with very minimal modifications made to hydraulic parameters, and no changes made to aquifer parameters.

8.1 LOW-WATER SEASON MODEL CALIBRATION

The steady state recharge rate was initially calibrated for the low-water season UWC model, after which local refinements and changes to model parameters were made for the groundwater elevation and streamflow calibration. The calibration process is summarized below.

Recharge Calibration

To calibrate the low-water season UWC model, a grid of 20 targets using heads from the McAllister model for October was used in each of the nine original model layers (for a total of 176 target locations, with four targets excluded due to overlap with aquifer cells modeled as having no flow). Six different recharge zones from the McAllister model occur in the UWC model. These recharge zones were modified proportionately during recharge calibration, with no other model parameters varied.

The best match of heads between the two models occurred when the steady-state recharge was set equal to approximately 66 percent of the annual recharge range used in the McAllister model and estimated by the USGS (Drost and others, 1998). The optimal steady-state recharge simulation was identified as having the lowest sum of squared residual heads for model Layers 1 through 4 (where mounding effects will be most pronounced). A residual is the remaining value after a simulated model value is subtracted from the target or observed value. The optimized simulation's residual head statistics for Layers 1 through 4 (for a total of 76 targets) had a mean of -0.01 feet, and a standard deviation of 5.31 feet.

Groundwater Elevation and Streamflow Calibration

Field data used for the low-water season calibration of the UWC model include surface water flow data from the Henderson Inlet TMDL Report (Ecology, 2006), data from the USGS Thurston County model report (Drost and others, 1999), and low-water season synoptic water level and streamflow data collected by PGG (see main text). Calibration objectives ranked by importance (in terms of site capacity modeling) are listed below.

- 1) Woodland Creek should lose an appropriate amount of water between Long Lake and Pacific Avenue monitoring stations and the groundwater elevations within the erosional window should be reasonable, along with horizontal and vertical gradients.

- 2) Spring discharge at Beatty and St Martin's springs should be realistic along with the approximate head gradient between the infiltration site and the springs.
- 3) Woodland Creek should have no surface water flow from Lake Lois to the Martin Way/Beatty Springs vicinity.
- 4) Streamflow at the mouth of Woodland Creek should be reasonable.

Calibration of the UWC model was performed using a trial-and-error process where horizontal and vertical hydraulic conductivities as well as stream and drain conductances were modified. The goal of the calibration process was to get model values to closely approximate observed values. A brief discussion below covers each calibration objective and steps taken to reach the objective. **Table A-3** tabulates observed and modeled values for calibration locations.

In the UWC low-water season model, Woodland Creek is implemented as a stream which starts at the outlet of Long Lake, with an initial flux of 139,968 cfd (1.62 cfs) as was measured for the synoptic water level data set on October 19, 2009. The final calibrated streamflow value for Woodland Creek at Pacific Avenue (0.97 cfs) is almost equal to the observed low-water season value of 0.98 cfs. For the stream segments between Long Lake and Pacific Avenue, stream conductances were raised from the original values used in the McAllister model. For stream segments between Long Lake and the diversion off Woodland Creek to Goose Lake, a hydraulic conductivity value of 0.1 ft/d and a width of 250 feet were used to represent the broad wetlands in this area. Stream segments between the Goose Lake diversion and Pacific Avenue used a calibrated hydraulic conductivity value of 11.2 ft/d. Other than upstream of the Goose Lake diversion, no attempt to estimate stream widths and bed thicknesses for Woodland Creek was made (data were not available). If appropriate values for these parameters were available, it is assumed that the calculated conductance would not change since the calibration process would yield a different hydraulic conductivity which

would give the same conductance value ($C = KLW/D$). Length values used in the conductance calculation equals the length of the stream cell.

Observed groundwater elevations, vertical hydraulic gradients, and horizontal hydraulic gradients at Woodland Creek Park were targeted for water level calibration (see main text for field data). Modeled water levels at the site were lowered to an appropriate level by raising the hydraulic conductivity of Layer 9 (Q_f). Zones of variable hydraulic conductivity were then added to the erosional window to improve the horizontal hydraulic gradient. Model calibration to water levels, the vertical gradient, and the horizontal gradient was reasonable but not perfect. The modeled vertical gradient was 14% too high and the modeled horizontal gradient was 49% too low.

The final simulation of the erosional channel had horizontal/vertical hydraulic conductivities (feet per day) of 200/50 for the infiltration site, 40/6.6 upstream of the infiltration site, and 1250/209 downstream of the infiltration site. The low hydraulic conductivity zone upstream of the site has been indirectly observed based on higher groundwater elevations and quick increases in water levels (approximately five feet in three days) during the seasonal wetting-up of the site. The high hydraulic conductivity zone downstream of the site is qualitatively supported by Amec (2002) borings at Lake Lois but remains largely conceptual. The upper bound of reasonable hydraulic conductivity values was applied downstream of the site, underpinned by reasoning that a zone of high hydraulic conductivity is necessary to increase the onsite horizontal hydraulic gradient and that a highly conductive zone must be present for Woodland Creek to go dry in this vicinity. The high conductivity zone was modeled as extending to the mouth of Woodland Creek. Calibrated hydraulic conductivity values are shown in **Table A-2**, while the spatial distribution of hydraulic conductivity zones is shown in **Figure A-3**.

The calibrated horizontal gradient and relative elevations between the infiltration site and Martin Way appears reasonable, as the USGS has

mapped a change in head between 25 and 50 feet, while the model predicts 41 feet of head change. Discharge fluxes at Beatty and St Martin's springs are also reasonable, with modeled values (1.3 and 0.7 cfs) falling within the observed range of low-water season discharge.

The calibrated low-water season UWC model simulates no streamflow at the outlet of Lake Lois which is consistent with the observed synoptic low-water season value (0 cfs). Higher stream conductance values and an underlying zone of high hydraulic conductivity sediments significantly increased the simulated water loss at the lake relative to the McAllister model (where Lake Lois is marginally gaining). Modeled streamflow between Lake Lois and Martin Way was zero.

The calibrated flow of Woodland Creek for the low-water season at its modeled outlet (near river mile 1.0 which is the Hollywood Development monitoring site of the TMDL) was 9.4 cfs. Observed low-water season flows (August and September 2003) from the TMDL range from 12.56 to 13.48 cfs, with an average of 13.02 cfs. For the original USGS model, the USGS defined an acceptable range of simulated streamflow for Woodland Creek near its mouth to be plus or minus 30 percent of the observed value. The UWC model's streamflow of 9.4 cfs falls within the acceptable range of modeled streamflows as defined by the USGS.

Main Text Figure 13 shows the ambient low-water season groundwater flow direction from the site using the calibrated UWC model. "Particle tracing," where water particles are traced to understand the fate of local recharge water and its time of travel, was performed to examine where water recharging at the infiltration site is most likely to flow. **Main Text Figure 13** indicates that groundwater flow is to the northeast towards Puget Sound, with transport predominantly occurring in the Qc aquifer. Some flow in the shallower sandy erosional window aquifer also occurs, as shown by the flow northwest of the infiltration site.

8.2 HIGH-WATER SEASON MODEL CALIBRATION

The low-water season UWC model was recalibrated to establish the high-water season UWC model. The only changes made to the low-water season model were to update streamflow volumes entering Woodland Creek from Long Lake and being diverted to Goose Lake to values observed during the high-water season synoptic data set (respectively 13.8 and 0.05 cfs). Parameters calibrated in the high-water season model were limited to recharge and stream conductances for stream reaches that went dry or were completely dry when observed in the low-water season. These reaches could not be properly calibrated in the low-water season UWC model and thus required modification.

Recharge Calibration

Recharge rates for the high-water season UWC model were calibrated using locally observed head values from the high-water season synoptic data set (collected on March 10, 2010). Recharge rates for different recharge zones were varied proportionately. The calibrated recharge rates that most accurately simulated observed heads were 82 percent of the annual recharge rates used in the McAllister model (**Main Text Table 7**). This recharge rate is unrealistically low, as one would expect a high-water season recharge rate to be greater than the average annual recharge rate. This low optimal recharge rate is likely caused by the model being too sensitive to groundwater mounding at Woodland Creek Park (the observed groundwater mound beneath the creek during the wet season is approximately one foot; the model simulates a four to six foot mound, with the simulated mound raising local heads enough so that below average recharge rates can yield optimal calibrations).

Groundwater Elevation and Streamflow Calibration

Field data used for the high-water season calibration of the UWC model include surface water flow data from the Henderson Inlet TMDL Report (Ecology, 2006), data from the USGS

Northern Thurston County report (Drost and others, 1998), and high-water season synoptic water level and streamflow data collected by PGG and presented in the main text. Ranked calibration objectives were the same as those for the low-water season calibration, with the only difference being that reasonable streamflow should be simulated for Woodland Creek at the Lake Lois outlet and Martin Way (locations which were dry in the low-water season synoptic data set).

Calibration of the high-water season UWC model was performed using a trial-and-error process where stream conductances were modified from Lake Lois to Beatty Springs. The goal of the calibration process was to get model values to closely approximate observed values. A brief discussion below covers each calibration objective and steps taken to reach the objective. **Table A-4** tabulates observed and modeled values for calibration locations.

In the UWC high-water season model, the initial flux of Woodland Creek at the Long Lake outlet is 1,192,320 cfd (13.8 cfs) as was measured for the synoptic water level data set on March 10, 2010. The final calibrated streamflow value for Woodland Creek at Pacific Avenue (12.5 cfs) is almost equal to the observed low-water season value of 12.7 cfs.

Observed groundwater elevations at Woodland Creek Park are about two feet lower than the calibrated values from the high-water season UWC model. Vertical and horizontal gradients are affected by that calibration error. The modeled vertical gradient was 68% too high and the modeled horizontal gradient was 21% too low. The likely result of this bias is that too much downward flow will be simulated in the high-water season model.

The calibrated horizontal gradient and relative elevations between the infiltration site and Martin Way are reasonable, as the USGS has mapped a change in head between 25 and 50 feet, while the model predicts 44 feet of head change. Discharge fluxes at Beatty and St Martin's springs are also reasonable, with modeled

values (1.6 and 2.3 cfs) falling within the observed range of high-water season discharge.

The calibrated high-water season UWC model simulates 11.6 cfs of streamflow at the outlet of Lake Lois, which is 37 percent higher than the observed flow of 8.4 cfs.

Streamflow in Woodland Creek at Martin Way was simulated as 7.3 cfs, which is four percent greater than the observed value of 7.0 cfs. Though streamflow at the Lake Lois outlet is simulated significantly higher than was observed, the Woodland Creek streamflow simulated at Martin Way is reasonable and indicates that much of the water which should have infiltrated at Lake Lois instead infiltrates between the Lake Lois outlet and Martin Way.

The calibrated flow of Woodland Creek at the Hollywood Development for the high-water season was 22.6 cfs. Observed high-water season flows (December 2002 through March 2003 and January 2004 through March 2004) from the TMDL range from 19.3 to 67.1 cfs, and therefore model results are reasonable.

Main Text Figure 14 shows the ambient high-water season groundwater flow direction from the site using particle tracing in the calibrated UWC model. **Main Text Figure 14** indicates that groundwater flow is to the northeast towards Puget Sound, with transport predominantly occurring in the Qc aquifer. Other flow paths include towards Beatty Springs in the Qva aquifer, and to the northwest in the shallower sandy erosional window aquifer.

9.0 MODEL ACCURACIES

The accuracy of all UWC model results are subject to uncertainties (as with all models) that are due to limitations in modeling approach and knowledge of field conditions. Specifically, PGG acknowledges the following considerations:

- Model predictions are made for low-water and high-water season conditions, while most

travel estimates exceed the duration of any single season. Over a multiple-year time scale, groundwater flow will occur at the average annual flow velocity, which will yield travel times between the low- and high-water season travel times.

- Site capacity is calculated by estimating whether a 50-by-50 foot model cell will have surface flooding. Since average elevations for each 50 foot by 50 foot cell were used, it is possible that areas of the cell with below-average elevations could have flooding at site capacity.
- Estimates of the NLD infiltration rate (no local discharge of reclaimed water) and travel times are based on a discrete number of particle traces and thus not 100% of the reclaimed water is “tracked.” It is possible that some “untracked” flow paths may transport particles to Woodland Creek or to other features.
- Individual model features are sensitive to how the feature is expressed in the model and any simplifications or assumptions made relating to it. Therefore, travel-time and flow-volume estimates will be affected and possibly biased by how a feature is implemented in the model. Sub-regional scale predictions (such as groundwater flow direction and flow paths) will be less sensitive to how an individual feature is implemented.
- Predictive results are sensitive to the model’s approximation of the relationship between groundwater and Woodland Creek. That relationship is relatively well known at Woodland Creek Community Park where field work was performed, at Lake Lois where the City sponsored previous geotechnical work, and at Beatty Springs where groundwater emerges; however, it is less well known in-between those locations and at Tri-Lakes.
- Both low- and high-water season models simulated a more significant groundwater mound beneath Woodland Creek at the park than was observed in field data. This over-predicted mound could cause NLD rate and some site capacity predictions (when site capacity is limited by near-creek flooding) to

be biased low. This bias is likely greater in the high-water season.

- The calibrated recharge rate for the high-water season yielded reasonable onsite groundwater elevations; however, as synoptic groundwater elevations farther from the site were not available or calibrated to, it is unclear how below-average-annual recharge rates would affect far-field heads. Far-field heads in the high-water season are most likely under-predicted, and thus far-field surface-water discharges could be under-predicted.
- The synoptic data for the high-water season was not collected when annual maximum heads were observed. Since the model is calibrated to the high-water season synoptic data set, the predicted high-water season site capacity/NLD rates are greater than the predicted minimum annual rates.
- Both the McAllister and UWC models simulate Long Lake and Hicks Lake in a relatively simple manner that may not reflect complexities present.
- As with most hydrogeologic evaluations, model results are sensitive to hydraulic conductivity of soils, aquifers, and aquitards - which are not known perfectly. This project included a limited sensitivity analysis to address uncertainty with regard to hydraulic conductivity.

ATTACHMENTS

Table A-1	Comparison of Model Layering and Corresponding Geologic Units
Table A-2	Calibrated Hydraulic Conductivity in Feet per Day
Table A-3	Low-Water Season UWC Model Calibration Parameters
Table A-4	High-Water Season UWC Model Calibration Parameters
Figure A-1	UWC Refined Model Grid
Figure A-2	Areas with Modified Layer Elevations, UWC Model
Figure A-3	UWC Model Hydraulic Conductivity Zones

10.0 REFERENCES

- Amec Earth and Environmental. September 10, 2009. Geotechnical Engineering Report, Carpenter Road SE, Pacific Ave. to Martin Way. Consulting report submitted to the City of Lacey.
- CDM Inc., 2002. Interim Report – Model Construction and Steady State Calibration, McAllister Well field Numerical Model. Consulting report submitted to City of Olympia.
- Drost, B.W., G.L. Turney, N.P. Dion, and M.A. Jones. 1998. Hydrology and Quality of Ground Water in northern Thurston County, Washington. U.S Geological Survey Water-Resources Investigations, Report 92-4109 (revised).
- Drost B.W., Ely, D.M., and W.E. Lum, II. 1999. Conceptual Model and Numerical Simulation of the Ground-Water-Flow System in the Unconsolidated Sediments of Thurston County, Washington. U.S Geological Survey Water-Resources Investigations, Report 99-4165.
- Golder Associates. 2006. Report on Groundwater Modeling and Water Right Applications and Transfers. Consulting report submitted to the City of Lacey.
- Golder Associates, 2008a. Groundwater Modeling of Madrona and Evergreen Estates Well Water Right Applications. Consulting report submitted to the City of Lacey.
- Golder Associates, 2008b. Groundwater Modeling of New Water Right and Transfer Applications, City of Yelm, Washington. Consulting report submitted to the City of Yelm.
- Harbaugh, A.W., and McDonald, M.G. 1996. User's documentation for MODFLOW-96. U.S. Geological Survey Open-File Report 96-485.

- Hydrogeologic, Inc., 1996. MODFLOW-SURFACT Software (Version 3.0). Herndon, VA.
- HDR, 2007. Woodland Creek Park Test Pit Explorations. Consulting report submitted to the City of Lacey.
- Massmann, J. and Romero, N., 2006. Numerical Simulation of the Groundwater Flow System in the Woodland Creek Watershed. Consulting report submitted to the Squaxin Island Tribe.
- Pollock, D.W., 1994. User's Guide for MODPATH/MODPATH-PLOT, Version 3. U.S. Geological Survey Open-File Report 94-464.
- Washington Department of Ecology, 2006. Henderson Inlet Watershed Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Temperature Total Maximum Daily Load Study. Publication No. 06-03-012

Table A-1. Comparison of Model Layering and Corresponding Geologic Units

McAllister Model				UWC Model					
				Outside Erosional Channel		Within Erosional Channel			Lake
Layer	Unit	Top Elevation^	Lake Location*	Layer	Unit	Layer	Unit	Top Elevation^	Locations*
1	Qvr	171.0	LL	1	Qvr	1	Medium-to-Fine Sand	163.9	LL, GL, GP
				2		2		157.5	LL, GL, GP
				3		3		152.5	LL, GL, GP
2	Qvt Aquitard	148.8	LoL, HL	4	Qvt Aquitard	4	Medium-to-Fine Sand	149.1	GP, LoL, HL
				5		5		142.5	LoL, HL
				6		6		137.5	LoL, HL
				7		7	Fine Sand	130.0	
3	Qva	120.8		8	Qva	8		120.5	
4	Qf Aquitard	65.8		9	Qf Aquitard	9	Qf Aquitard	66.5	
5	Qc	14.1		10	Qc	10	Qc	14.0	
6		-8.9		11		11		-8.8	
7	TQu Aquitard	-32.0		12	TQu Aquitard	12	TQu Aquitard	-31.6	
8	TQu	-82.0		13	TQu	13	TQu	-81.6	
9		-266.9		14		14		-266.5	

^Layer top elevations are in feet (NGVD 1929). Elevations are reported for the model cell where MW-1D is located.

* LL = Lake Lois, GL = Goose Lake, GP = Goose Pond, LoL = Long Lake, HL = Hicks Lake

Table A-2. Calibrated Hydraulic Conductivity in Feet per Day

McAllister Model		UWC Model			
		Outside Erosional Channel		Within Erosional Channel	
Layer	Kh/Kv	Layer	Kh/Kv	Layer	Kh/Kv
1 (Qvr)	32/8, 100/25, 200/50	1	32/8, 100/25, 200/50	1	40/6.6, 200/50, 1250/209
		2		2	
		3		3	
2 (Qvt)	1/0.005	4	1/0.005	4	
		5		5	
		6		6	
		7		7	2/0.4
3 (Qva)	252/36*	8	252/36*	8	
4 (Qf)	1/0.0025	9	2.75/.006875	9	2.75/.006875
Below Qf no changes were made to hydraulic parameters from the McAllister model					

*Sediments with this value predominantly occur in the erosional channel region, near the mouth of Woodland Creek the sediment Ks are 35/5.

Table A-3. Low-Water Season UWC Model Calibration Parameters

Calibration Parameter	Observed Data		Modeled Value	Units	Percent Difference
	Source	Value			
WC Flow, Pacific Avenue	PGG Synoptic Data, 10/19/2009	0.98	0.97	cfs	-1%
Onsite Groundwater Elevations*	PGG Synoptic Data, 10/19/2009	137.5 - 142.0	138.7 - 140.9	ft	0%
Onsite Vertical Gradient^	PGG Synoptic Data, 10/19/2009	0.0105	0.0119	ft/ft	14%
Onsite Horizontal Head Loss (MW-9 to MW-5)*	PGG Synoptic Data, 10/19/2009	4.5	2.3	ft	-49%
Flow Beatty Springs	TMDL Low-Water Season Data	0.84 - 2.94	1.3	cfs	0%
Flow St Martin's Spring	USGS, TMDL Low-Water Season Data	0.4 - 2.5	0.7	cfs	0%
Head Loss Between Site and Martin Way Above Beatty Springs	USGS Qva Water Level Map	25 - 50	41	ft	0%
WC Flow, Lake Lois Outlet	PGG Synoptic Data, 10/19/2009	0	0	cfs	0%
WC Flow, Martin Way	PGG Synoptic Data, 10/19/2009	0	0	cfs	0%
WC Flow, Hollywood Development [#]	TMDL Low-Water Season Data	12.6 - 13.5	9.4	cfs	-28%

*Onsite groundwater elevations are compared between MW-5 and MW-9. Heads from these wells were also used to define onsite horizontal head loss. Wells MW-6 and MW-7 had groundwater elevations between 5 and 6 ft higher than MW-9 during the 10-19-2009 dry season synoptic data set, but water levels from these wells are not considered representative of steady state dry season conditions since they rose ~5 ft during the three days preceeding the synoptic data set.

^MW-1D had not been installed on 10/19/09. Based on data following its 11/24/09 installation, the vertical gradient at the site for 10/19/09 was assumed to be 0.0105 ft/ft.

The USGS criterion for acceptable streamflow calibration for Woodland Creek was 30%.

Table A-4. High-Water Season UWC Model Calibration Parameters

Calibration Parameter	Observed Data		Modeled Value	Units	Percent Difference
	Source	Value			
WC Flow, Pacific Avenue	PGG Synoptic Data, 3/10/2010	12.7	12.5	cfs	-1%
Onsite Groundwater Elevations*	PGG Synoptic Data, 3/10/2010	144.7 - 147.1	147.0 - 148.8	ft	2%
Onsite Vertical Gradient^	PGG Synoptic Data, 3/10/2010	0.0081	0.0135	ft/ft	68%
Onsite Horizontal Head Loss (MW-9 to MW-5)*	PGG Synoptic Data, 3/10/2010	2.3	1.9	ft	-21%
Flow Beatty Springs	TMDL High-Water Season Data	1.4 - 7.6	1.6	cfs	0%
Flow St Martin's Spring	TMDL Data	0.9-2.5	2.3	cfs	0%
Head Loss Between Site and Martin Way Above Beatty Springs	USGS Qva Water Level Map	25 - 50	44	ft	0%
WC Flow, Lake Lois Outlet	PGG Synoptic Data, 3/10/2010	8.4	11.6	cfs	37%
WC Flow, Martin Way	PGG Synoptic Data, 3/10/2010	7.0	7.3	cfs	4%
WC Flow, Hollywood Development	TMDL High-Water Season Data	19.3 - 67.1	22.6	cfs	0%

*Onsite groundwater elevations are compared between MW-5 and MW-9. Heads from these wells were also used to define onsite horizontal head loss

^From MW-1D and MW-1S data

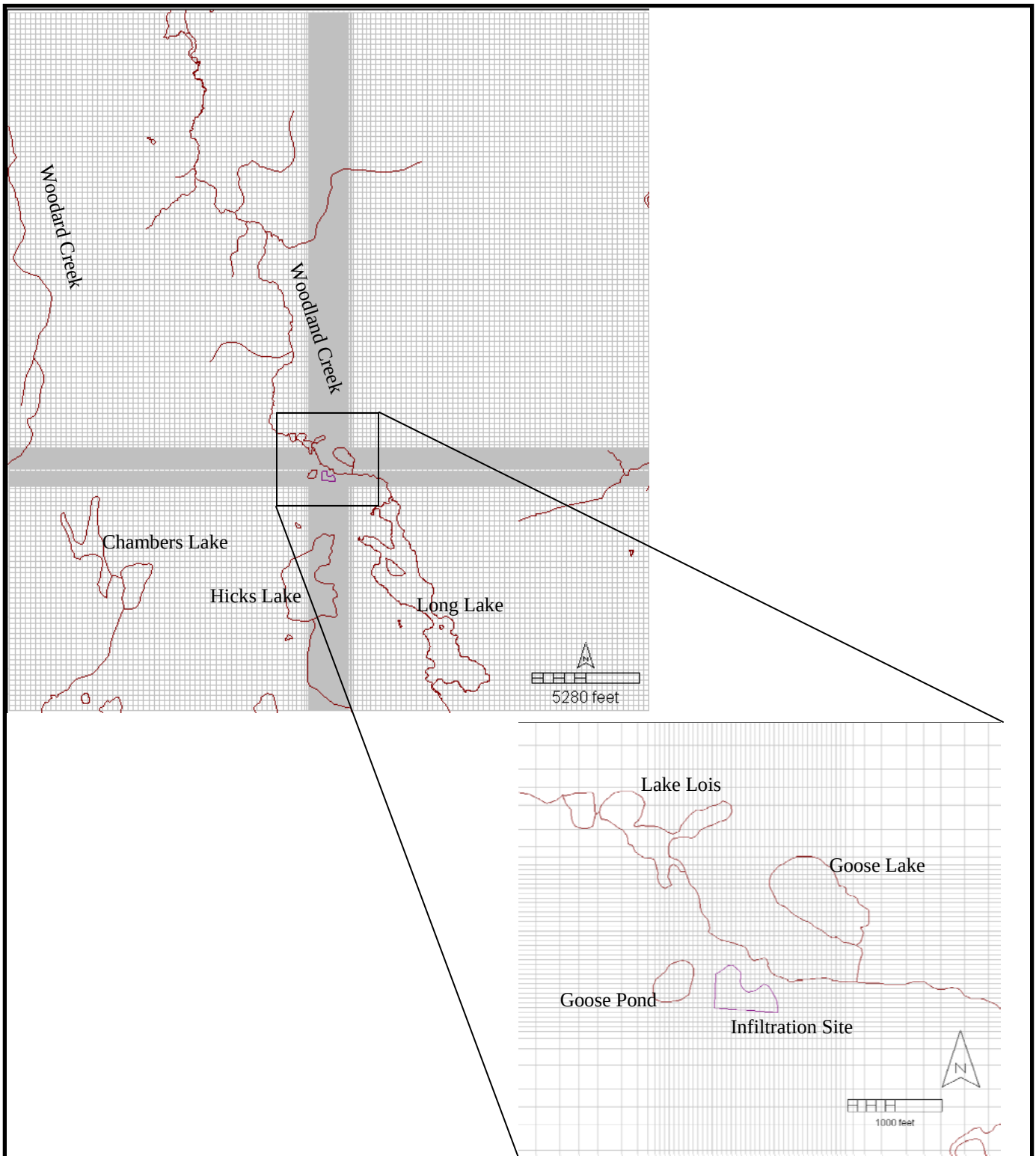


Figure A-1
UWC Refined Model Grid

Woodland Creek Water
Infiltration Facility Analysis

K:\PONY\Lacey Reclaimed\GIS\mxd\Model_DifferenceElev\ldar.mxd

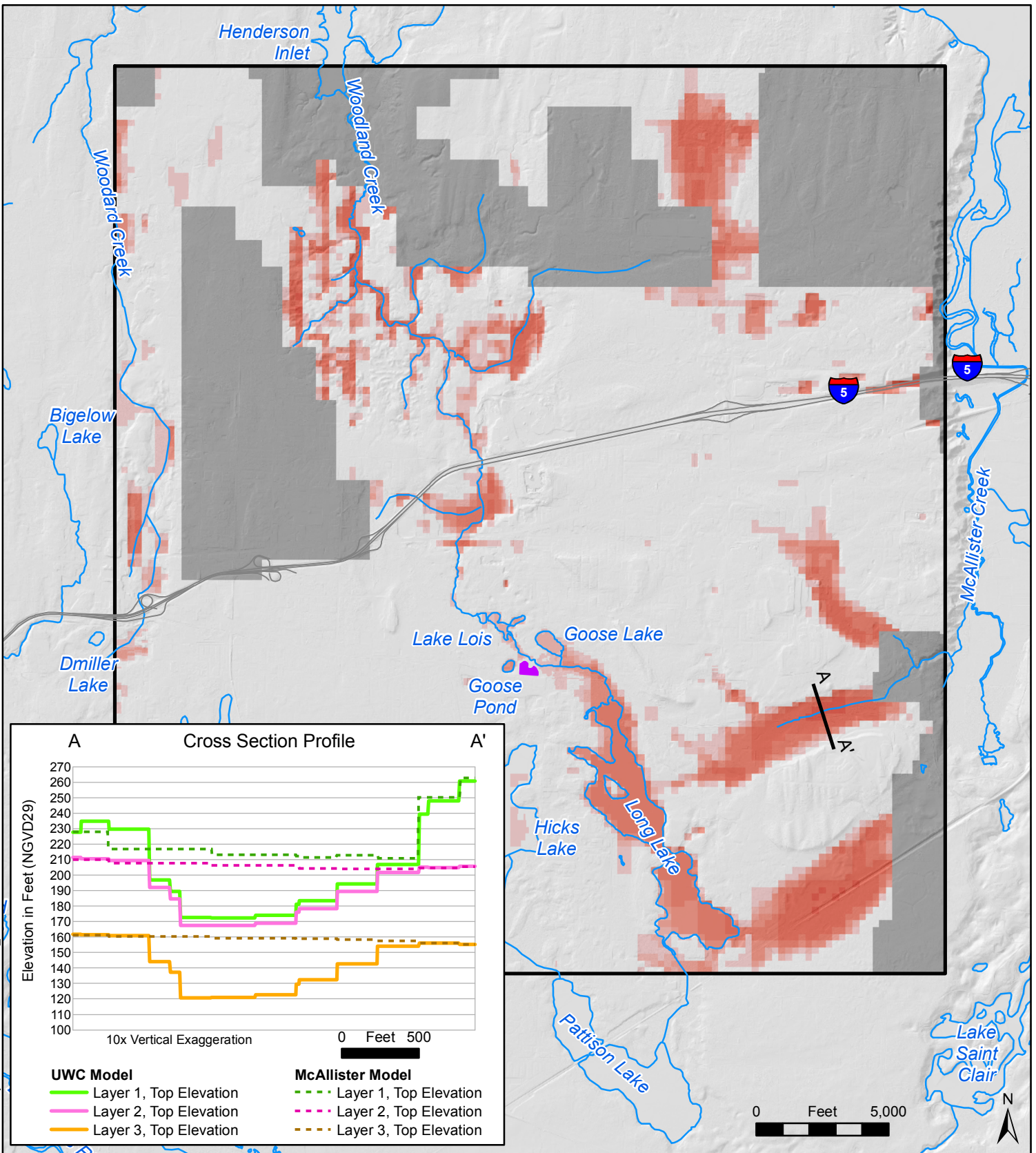
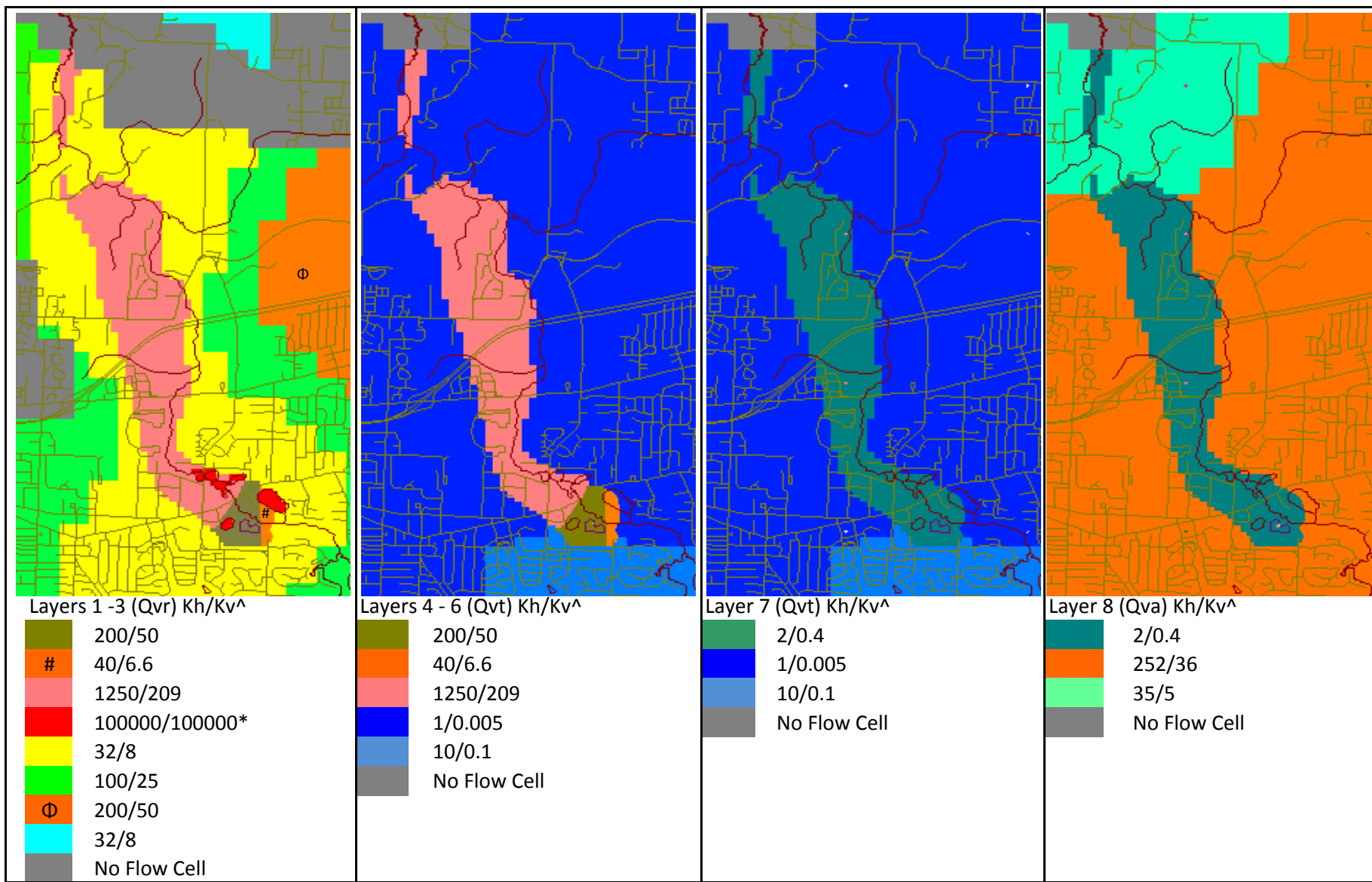


Figure A-2
Areas with Modified
Layer Elevations,
UWC Model

Woodland Creek
Water Infiltration
Facility Analysis





Notes:

^ Kh and Kv values are reported in feet/day

* High K zones for Goose Lake and Lake Lois were modeled in layers 1 through 3, while Goose Pond's high K zones are in layers 1 through 4.

— Hydrography
— Infiltration Site
— Roads

1" ≈ 5000 ft

Figure A-3

UWC Model Hydraulic Conductivity Zones

Woodland Creek Water
Infiltration Facility Analysis

PGG

APPENDIX B
VARIABLE INFILTRATION RATE CALCULATOR

APPENDIX B

VARIABLE INFILTRATION RATE CALCULATOR

1.0 INTRODUCTION

This appendix summarizes the development of the variable infiltration rate calculator derived for the favorable infiltration area at Woodland Creek Park. The calculator spreadsheet can be used to estimate a total infiltration volume over a user-specified time period. The following steps were taken to develop the calculator and are discussed in detail in following sections.

- 1) Historic precipitation data from the Thurston County Fairgrounds and the Olympia Airport were reviewed to estimate an average precipitation rate for each day of the year.
- 2) Based on the average annual precipitation data, an average annual groundwater head was estimated for the favorable infiltration area using an *antecedent precipitation index for head* (APIH).
- 3) Low-water and high-water season UWC model results were used to correlate infiltration rate to ambient depths to water during the low- and high-water seasons.
- 4) The relationship between infiltration rate and depth to water was applied to the APIH average daily heads to estimate daily infiltration rates and volumes.

2.0 PRECIPITATION RECORDS

Approximately eight years of precipitation data from the Thurston County Fairgrounds were available and evaluated. Over the time period

with available data (4/1/2002 through 2/17/2010) several data gaps were observed, with 179 of the 2880 days in the time period having no data. During this time period, the average annual precipitation was 41.5 in/yr.

Approximately 62 years of precipitation data from the Olympia Airport were available and evaluated. Over this time period (6/1/1948 through 4/30/2010) the average annual precipitation was 51.0 in/yr. Data gaps were not present in the period of record. Over the time period when data from the Thurston County Fairgrounds exists, the average annual precipitation at the Olympia Airport was 48.5 in/yr (or 17 percent more precipitation than observed at the Fairgrounds).

While the Fairgrounds are closer to the project site than the Olympia airport (about 1.1 miles versus about 6.5 miles), PGG used Olympia Airport data to calculate average daily precipitation rates for use at the site. Olympia Airport data were used due to the longer and more complete period of record. Additionally, the simulated heads generated through the APIH analysis (see below) are generally not sensitive to different daily precipitation data sets if they are linearly related.

Precipitation data over the period of record from the Olympia Airport were used to calculate average daily precipitation rates. Though many years of data were used, a high variability in average daily precipitation rates was observed (**Figure B-1**). To lessen the effects of day-to-day variation, the data were smoothed over 21 days. Smoothed average daily precipitation rates were calculated by averaging the average daily precipitation rate for date being evaluated and all 10 days before and after the date. **Figure B-1** compares calculated average daily precipitation values with smoothed average daily precipitation values.

3.0 ANTECEDENT PRECIPITATION INDEX FOR HEAD (APIH)

The APIH is used as a mathematical predictor of depth to groundwater (DTW) based on historical (antecedent) precipitation (Swope, 1990). It uses a correlation between a long precipitation record and a shorter DTW record to simulate historic DTWs. The influence of precipitation on APIH decreases with its age; therefore precipitation that is more recent is given greater weight by use of a decay coefficient. The APIH is most applicable to regions where DTWs are dominated by the effects of direct precipitation rather than by surface water, tidal interactions, or by the infiltration of snow melt. Though the project site is influenced by surface water losses, other methods to estimate historic groundwater elevations (such as using a regression relationship to a well with a long time period of DTW data or using a numerical model) were not considered feasible.

An APIH was developed using DTWs from the shallow well MW-1S at the project site and Olympia Airport precipitation data. MW-1S was chosen since it is the well closest to the favorable infiltration area and farthest from Woodland Creek. Manual water levels were used for the APIH relation, comprised of five water levels collected between October 19, 2009 and March 10, 2010. Transducer data were not included in the APIH correlation since the relative weighting of the low-water season manual measurement (**Main Text Figure 6**) would have been much less if several thousand transducer data points were added. The location of MW-1S is shown in **Main Text Figure 4**.

3.1 APIH AND CORRELATION EQUATIONS

The calculation of APIH is an iterative process involving several steps, which are outlined below.

- 1) An antecedent precipitation index (API) is initially calculated, using the relationship

$$API_d = (API_{d-1} C) + P_d \quad (\text{Equation 1})$$

API_d is the API for day d , API_{d-1} is the API value on the previous day, C is a decay coefficient, and P_d is the precipitation which fell on day d . Equation 1 indicates that API_d is influenced by preceding daily API values, with more recent values having a greater impact on API_d .

- 2) All observed depth to groundwater values are linearly correlated to the API values for each date where head values are available, using the relation

$$DTW_d = m(API_d) + b \quad (\text{Equation 2})$$

DTW_d is the observed depth to groundwater on day d , m is the slope of the linear relation, and b is the y-intercept of the relation. The value of the decay coefficient (C), which changes API values according to Equation 1, is varied until the linear correlation coefficient between the API_d and DTW_d is optimized (ie at a maximum).

- 3) After optimizing C and defining m and b values from Equations 1 and 2, APIH values are generated using

$$APIH_d = m(API_d) + b \quad (\text{Equation 3})$$

Equation 3 comes directly from Equation 2, with the previously optimized m , b , and C values used to generate APIH data for time periods when precipitation data exists but DTW data do not exist.

Table B-1 presents optimized APIH parameters. Of note is the high value of the decay coefficient obtained using this method (0.99552), which reflects the fact that groundwater drainage is slow. **Figure B-2** compares APIH data with observed groundwater heads for MW-1S.

Following definition of APIH parameters, Equation 3 was used in conjunction with the average daily precipitation calculated previously to estimate average daily groundwater elevations for MW-1S. Because of the cumulative aspect of the APIH, the average daily precipitation data were applied successively over ten years, with the last year used for average daily groundwater elevation estimates. Early APIH_d values were not used as they were low and inaccurate. Estimated average daily groundwater elevations are shown in **Main Text Figure 15**.

4.0 RELATING INFILTRATION RATE TO DEPTH TO WATER

The UWC model simulated the low-water season NLD rate at 0.8 mgd, with a pre-infiltration modeled head of 137.92. The high-water season UWC model simulated a NLD rate of 0.3 mgd, with a pre-infiltration modeled head of 145.84. A regression line was fit between these points, with the equation used to define a relationship between groundwater elevation and NLD infiltration rate. For this relationship, modeled initial heads were used rather than observed heads since the NLD infiltration rate is based on the model.

To verify that a linear function comparing infiltration rate to groundwater elevation is appropriate, several hypothetical mounding simulations were run using the CSUPAW model (Sunada, 1985). In these simulations, infiltration rates were varied while the groundwater elevation was constant. At a given distance from a recharge feature, the modeled groundwater mound height increased linearly with infiltration rate. Thus, applying a linear relationship between the MODFLOW-derived NLD rates and initial heads appears reasonable.

5.0 VARIABLE INFILTRATION RATE CALCULATOR

Main Text Figure 15 presents the daily relationship between head and infiltration rate predicted with the variable infiltration rate calculator. The electronic calculator version of this figure can be used to estimate a total infiltration volume over a user-specified time period. As this calculator is based on numerous assumptions and extrapolations from modeled data, numerous sources of uncertainty could bias the total annual infiltration volumes predicted by the calculator. Sources of uncertainty and/or error could include:

- The unique character of each water year will cause the average groundwater elevations used in the calculator to at best be approximations of actual head. Therefore the infiltration rate for any given day is expected to vary from year to year.
- The synoptic high-water season monitoring event for this project did not occur when groundwater elevations were at their actual maximum (the maximum observed head was 1.35 ft higher than the high-water season synoptic head). Therefore, the actual high-water season NLD rate may be slightly less than 0.3 mgd since the UWC model did not simulate the highest water levels observed. However, the high-water season UWC model has also likely under-predicted the NLD rate (see main text and **Appendix A**). These sources of error may off-set one-another.
- The maximum APIH groundwater elevation for MW-1S is 1.28 feet above the maximum observed groundwater elevation in MW-1S. This APIH inaccuracy causes the calculator to have a minimum infiltration rate of 0.13 mgd instead of the 0.3 mgd calculated by MODFLOW for the high-water season.
- The minimum APIH groundwater elevation agrees with the minimum observed elevation at MW-1S, but the MODFLOW model head (used to calculate the 0.8 mgd low water

season NLD rate) was 1.75 ft lower (a reasonable, but not perfect calibration to head). This results in the variable infiltration rate calculator predicting the maximum infiltration rate being 0.7 mgd instead of the 0.8 mgd calculated by MODFLOW.

Optional correction factors are included in the spreadsheet to compensate for these, and other unforeseen, issues. Predicted infiltration rates can be corrected by either adding a constant to all predicted rates, or multiplying all predicted rates by a percentage. **Main Text Figure 15** has a constant correction factor of +0.1 mgd to raise the minimum and maximum infiltration rates to 0.23 and 0.8 mgd, respectively, which are similar to the MODFLOW-predicted NLD rates.

ATTACHMENTS

Table B-1: APIH Parameters for MW-1S

Figure B-1: Average Daily Precipitation and 10-Day Center Averaged Daily Precipitation, Olympia Airport

Figure B-2: Comparison of Observed and APIH Simulated Heads for MW-1S

REFERENCES

Sunada, D.K. 1985. Flow From Wells and Recharge Pits Version 3 User's Manual. Colorado State University Groundwater Program.

Swope, S.P. 1990. Analysis of Water Level and Water Quality Data from Smelterville Flats, Kellogg Idaho. University of Idaho, Department of Hydrology, School of Mines Master's Thesis.

Table B-1. APIH Parameters for MW-1S

MW-1S	
slope (ft/ft)	0.6405
intercept (ft)	124.38
decay	0.99552
Correlation Coeff	0.97

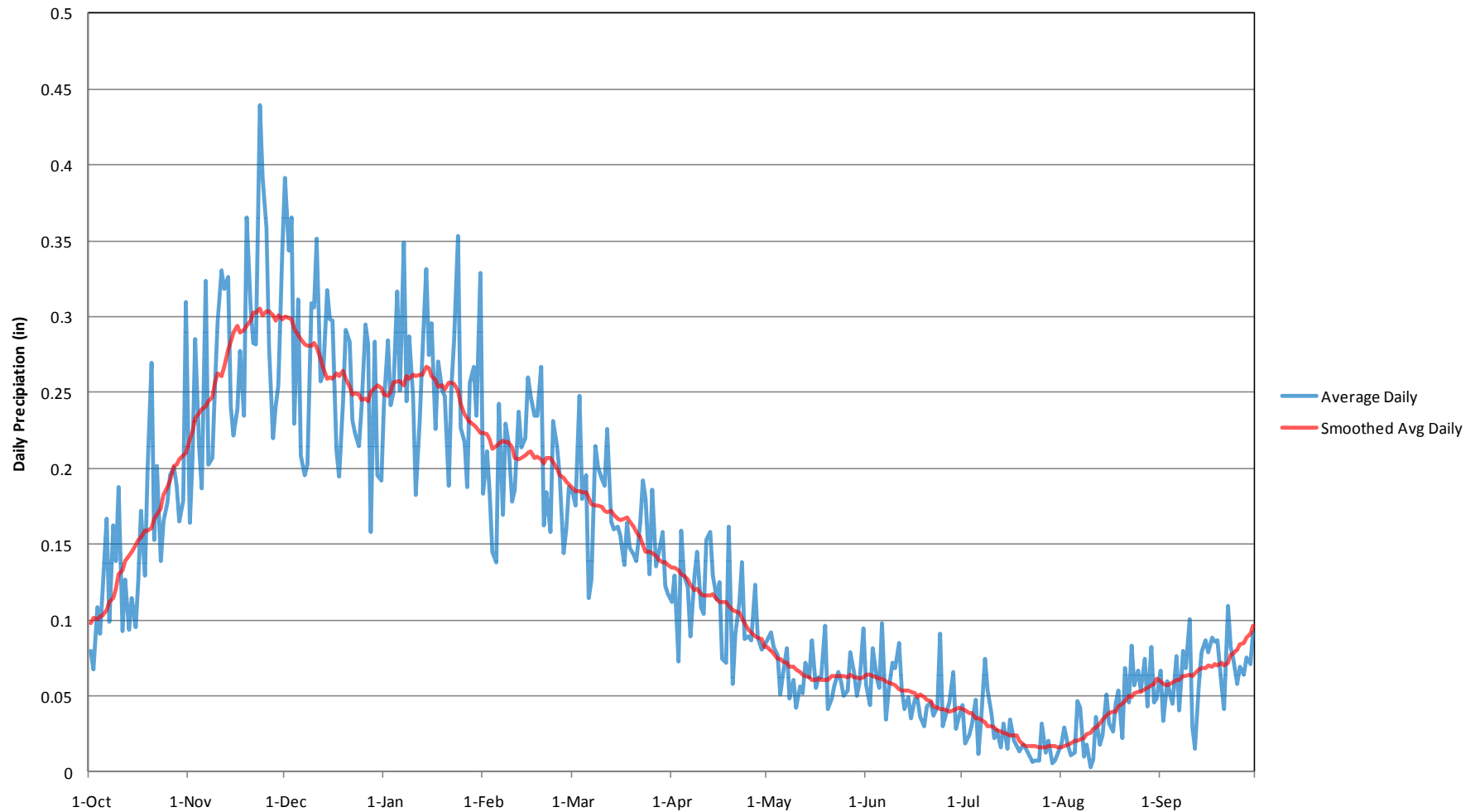


Figure B-1
Average Daily Precipitation and 10-Day Center Averaged Daily Precipitation, Olympia Airport

Woodland Creek Water
Infiltration Facility Analysis



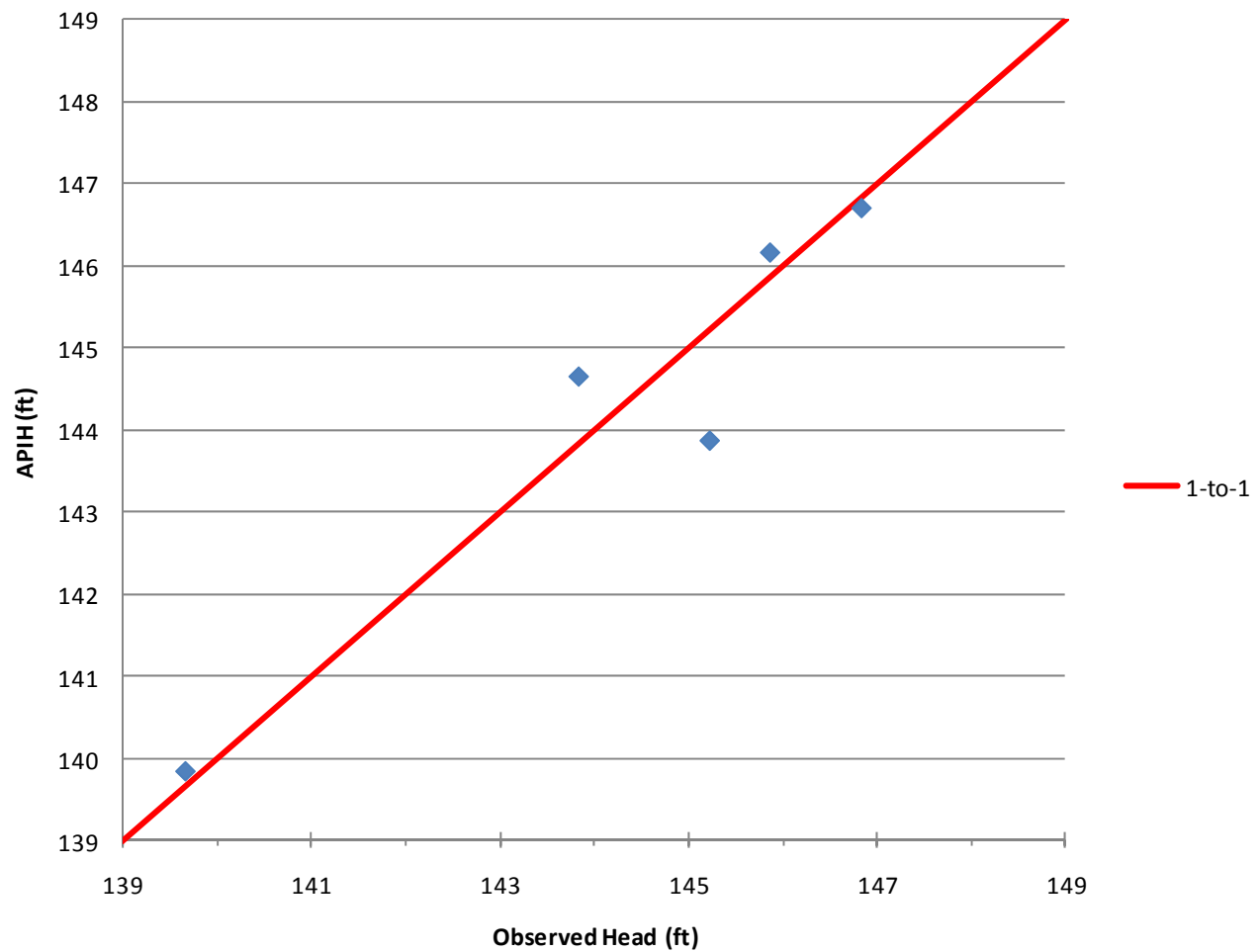


Figure B-2
Comparison of Observed and APIH Simulated Heads for MW-1S

Woodland Creek Water
Infiltration Facility Analysis



Technical Memorandum

To: Technical Sub-Committee

From: Reclaimed Water Policy Task Force

Date: December 4, 2019

Re: Reclaimed Water Supply Agreement Revisions

This document is intended to memorialize the rationale used in determining the volumes of reclaimed water listed in the revised Supply Agreements between LOTT and the partner jurisdictions. Each Supply Agreement includes a Section 3.0 Supply of Reclaimed Water. Subsection 3.3 outlines the volumes of reclaimed water available to LOTT and to the partner jurisdiction. These volumes are derived from *Table 2. Reclaimed Water Net Reuse Capacity* in the Distribution Methodology and previously negotiated allocations from the original Supply Agreements.

Table 2. Reclaimed Water Net Reuse Capacity

	Budd Inlet Reclaimed Water Plant	Martin Way Reclaimed Water Plant
Actual Production and Use		
Production	0.55-1.26	1.10-1.63
LOTT Use	0.55-0.77	0.41-0.57
Net Reuse Capacity (NRC)	0.00-0.71	0.53-1.22
Storage Volume	0.00-1.00	None

All volumes are listed in million gallons per day (MGD)

Supply Agreements for the Martin Way Reclaimed Water Plant

For purposes of the revised Supply Agreements, Net Reuse Capacity from the Martin Way Reclaimed Water Plant is assumed to be 1.06 million gallons per day (mgd). The value comes from subtracting the maximum amount used by LOTT for LOTT purposes (0.57 mgd) from the maximum amount produced at the plant (1.63 mgd). LOTT operational staff carefully reviewed the values used in the agreements for production, LOTT reserve, and Net Reuse Capacity. They were comfortable using 1.06 mgd as the basis for available supply from the Martin Way Plant. This value assumes the high end of production, but also assumes a maximum value for LOTT's reserve. Reserving the maximum for LOTT uses provides a cushion because LOTT does not consistently need this volume. It is used during the hottest months of the year when evaporative loss from the Hawks Prairie Ponds is high and significant make-up water is needed.

The Reclaimed Water Policy Task Force and the TSC ultimately chose these values because they realistically reflect what can be made available at present and they include a cushion.

In the LOTT/Lacey Supply Agreement, subsection 3.3 stipulates that reclaimed water will be made available as follows:

- (a) *LOTT reserves up to 570,000 gallons per day of the reclaimed water produced at the Reclaimed Water Plant for its own use.* This is the maximum amount LOTT uses from the Martin Way Plant, as described above.
- (b) *Subject to available remaining supply of reclaimed water, the LOTT Alliance shall make available up to 880,000 gallons per day, of reclaimed water to the City at the Delivery Point(s), except when temporary interruptions in service occur due to circumstances described in section 4.5 of this agreement.* The 880,000 gpd value is related to an understanding between Lacey and Olympia regarding how they determine their relative credit for water rights mitigation at their Woodland Creek Groundwater Recharge Facility. They have agreed to a split of 83% to Lacey, and 17% to Olympia. The two cities requested that the values for the Supply Agreements apply that same proportion. Thus, Lacey has access to 83% of the 1.06 mgd Net Available Supply.
- (c) *Subject to an increase in production of reclaimed water at the Reclaimed Water Plant and at such time as the Net Reuse Capacity (net available supply) reaches 1,750,000 gallons per day, the volume of reclaimed water available to the City may reach a maximum of 1,450,000 gallons of reclaimed water each day.* This section is intended to recognize that although 1.75 mgd is not currently available for reuse from the Martin Way Plant, the partners have already negotiated allocations up to that amount, and the Net Reuse Capacity will at some point in the future be expanded to meet the full 1.75 mgd. This section allows the City to utilize their full allocation of 1.45 mgd as soon as it becomes available, without requiring an update to the Supply Agreement.

In the LOTT/Olympia Supply Agreement, subsection 3.3 stipulates that reclaimed water will be made available as follows:

- (a) *LOTT reserves up to 570,000 gallons per day of the reclaimed water produced at the Reclaimed Water Plant for its own use.* This is the maximum amount LOTT uses from the Martin Way Plant, as described above.
- (b) *Subject to available remaining supply of reclaimed water, the LOTT Alliance shall make available up to 180,000 gallons per day, of reclaimed water to the City at the Delivery Point(s), except when temporary interruptions in service occur due to circumstances described in section 4.5 of this agreement.* The 180,000 gpd value is related to an understanding between Lacey and Olympia regarding how they determine their relative credit for water rights mitigation at their Woodland Creek Groundwater Recharge Facility. They have agreed to a split of 83% to Lacey, and 17% to Olympia. The two cities requested that the values for the Supply Agreements apply that same proportion. Thus, Olympia has access to 17% of the 1.06 mgd Net Available Supply.
- (c) *Subject to an increase in production of reclaimed water at the Reclaimed Water Plant and at such time as the Net Reuse Capacity (net available supply) reaches 1,750,000 gallons per day, the volume of reclaimed water available to the City may reach a maximum of 300,000 gallons of reclaimed water each day.* This section is intended to recognize that although 1.75 mgd is not

currently available for reuse from the Martin Way Plant, the partners have already negotiated allocations up to that amount, and the Net Reuse Capacity will at some point in the future be expanded to meet the full 1.75 mgd. This section allows the City to utilize their full allocation of 0.30 mgd as soon as it becomes available, without requiring an update to the Supply Agreement.

Supply Agreements for the Budd Inlet Reclaimed Water Plant

For purposes of the revised Supply Agreements, Net Reuse Capacity from the Budd Inlet Reclaimed Water Plant is assumed to be 0.71 mgd. The value comes from subtracting the typical amount used by LOTT for LOTT purposes (0.55 mgd) from the maximum amount produced at the plant (1.26 mgd). In this case, the maximum value for LOTT's reserve is not utilized because the Budd Inlet system has the added benefit of a 1.0 mgd storage tank to supplement instantaneous supply, therefore building in additional cushion is not necessary.

In the LOTT/Olympia Supply Agreement, subsection 3.3 stipulates that reclaimed water will be made available as follows:

- (a) *LOTT reserves up to 770,000 gallons per day of the reclaimed water produced at the Reclaimed Water Plant for its own use.* Here, the maximum amount is listed to allow for that full use when necessary.
- (b) *Subject to available remaining supply of reclaimed water, LOTT shall make available up to 460,000 gallons each day, of reclaimed water to the City at the Delivery Point(s) except when temporary interruptions in service occur due to circumstances described in section 4.5 of this agreement.* The 460,000 gpd represents the amount of reclaimed water allocated to Olympia through initial negotiations, however, Olympia currently only uses 60,000 gpd. Olympia and Tumwater have entered into a side agreement that allows Tumwater to utilize up to 400,000 gpd of Olympia's allotted water. The Supply Agreement lists Olympia's full allocation, even though they do not currently use that amount, because they could eventually change the terms of their side agreement with Tumwater and put that water to use.

In the LOTT/Tumwater Supply Agreement, subsection 3.3 stipulates that reclaimed water will be made available as follows:

- (a) *LOTT reserves up to 770,000 gallons per day of the reclaimed water produced at the Reclaimed Water Plant for its own use.* Here, the maximum amount is listed to allow for that full use when necessary.
- (b) *Subject to available remaining supply of reclaimed water, LOTT shall make available up to 650,000 gallons each day, of reclaimed water to the City at the Delivery Point(s) except when temporary interruptions in service occur due to circumstances described in section 4.5 of this agreement.* The 650,000 gpd represents the amount of reclaimed water that Tumwater can access through its side agreement with Olympia (400,000 gpd), plus Tumwater's new allocation of 250,000 gpd that was negotiated as part of the recent updates to the reclaimed water agreements and the Distribution Methodology. The Supply Agreement covers the maximum volume that Tumwater can access yet does not guarantee access to that full amount. Through their side agreement, the cities recognize that Olympia and Tumwater cannot concurrently

access the 400,000 gpd and that Olympia reserves the right to change the conditions of Tumwater's access at some point in the future if they develop use for the water.

The reclaimed water agreements are a complex set of documents that understandably can be confusing. The intent of this memo is to shed additional light on why certain values were used in the agreements. This institutional knowledge may be helpful in future revisions to the agreements.

APPENDIX C

RECLAIMED WATER ASR PRE-FEASIBILITY EVALUATION



TECHNICAL MEMORANDUM

City of Lacey Reclaimed Water Master Plan – Reclaimed Water ASR Pre-Feasibility Evaluation (updated 1/2024)

To: Daniel Reisinger, PE, Carollo Engineers, Inc.

From: Dennis Orlowski, LHG; Kenny Janssen, LG; Matt Kohlbecker / GSI Water Solutions, Inc.

Date: January 4, 2024

1. Introduction

This document presents findings from a preliminary evaluation of the potential for the City of Lacey (City) to use aquifer storage and recovery (ASR) as a means to inject and store excess reclaimed water available during the winter and spring months for non-potable uses during the summer. This assessment describes the reclaimed water ASR concept, provides an overview of the regulatory and permitting requirements for using reclaimed water as recharge source water for ASR in the State of Washington, and evaluates certain key feasibility factors as a preliminary assessment of whether ASR in the Lacey area expands the volume of reclaimed water for the irrigation seasons.

This technical memorandum supersedes the previous similarly titled documents that were dated June 8, 2017, and September 4, 2020. In particular, this updated version includes a significant revision to the previous Regulatory Framework section that reflects the contents of the Washington Reclaimed Water Rule (173-219 WAC), which was adopted on January 23, 2018. Also, the Water Quality section of this memorandum has now been completed, using information recently made available from a study completed for the LOTT Water Alliance. The remaining portions of the memorandum are generally unchanged from the 2017 version.

2. Reclaimed Water ASR Concept

Aquifer storage and recovery generally involves injecting and storing treated drinking water into an aquifer system via an existing or new well for later recovery and beneficial use for municipal supply. Alternative applications, however, are rapidly expanding beyond municipal uses to include non-potable and other uses (e.g., industrial, irrigation, ecological benefits, and groundwater replenishment) and alternative source options, such as reclaimed water and stormwater.

The ASR concept for the City of Lacey would include direct groundwater recharge of Class A reclaimed water available from the wastewater treatment facility. Direct recharge of the water would be accomplished via a series of injection wells capable of a combined recharge rate of 1-2 mgd (700-1,400 gpm). Recharge would likely take place during periods when surplus reclaimed water is available from the facility (i.e., winter and spring). Injecting 1-2 mgd over a 6-month period equates to an estimated storage volume of between 180 and 360 million gallons (MG). The development of these general ASR performance estimates is explained further in Section 5.3 of this memorandum.

The recharge water would then be stored in the aquifer and recovered during the summer months for non-potable uses (e.g., irrigation and industrial). The length of the storage period and the volume of the recharge water recovered will vary depending on the aquifer hydraulic properties, physical and chemical changes to the

water that may take place during the storage period, and length of the non-potable demand period. Recovery of the stored water could utilize the same wells used for injection, or use separate down-gradient recovery wells to capture the stored water as it moves down-gradient.

3. Regulatory Framework

In Washington, ASR projects using treated *drinking water* as the source have been authorized and operated in accordance with an established set of regulations. Those regulations also authorized the use of *reclaimed water* as the source water for ASR, but there was uncertainty about the relevance or applicability of numerous other regulations pertaining to groundwater protection, drinking water, reclaimed water, etc. Implementation of the Reclaimed Water Rule (173-219 WAC) in 2018 has provided a clearer regulatory pathway for ASR projects proposing to use reclaimed water as the source water for storage and recovery.¹ Reclaimed water is defined as water derived in any part from wastewater with a domestic wastewater component that has been adequately and reliably treated, so that it can be used for beneficial purposes (Revised Code of Washington, RCW 90.46.010). Reclaimed water is not considered wastewater.

3.1 Reclaimed Water Use Act (RCW 90.46)

In 1992 the Washington State Legislature approved the Reclaimed Water Use Act (“Act”) as chapter 90.46 Revised Code of Washington (RCW). The Act establishes requirements for reclaimed water use in Washington, including the basis for rule writing and permitting authority, establishment of initial standards and legislative intent of reclaimed water generation, distribution, and use. The Act directed the Department of Ecology (Ecology) and Department of Health (Health) to develop standards for reclaimed water use and to jointly administer a reclaimed water program.

3.2 Reclaimed Water Rule (173-219 WAC)

On January 23, 2018, the Legislature adopted the Reclaimed Water Rule (“Rule”) as chapter 173-219 Washington Administrative Code (WAC). The Rule describes specific allowable beneficial uses of reclaimed water, and the required level of treatment for each use.

The reclaimed water ASR project conceptualized herein would be authorized by the Rule. Specifically, the Rule allows for projects proposing to recharge groundwater with reclaimed water. Groundwater recharge projects include *indirect* and *direct* recharge and storage where only direct recharge is applied for ASR. Indirect groundwater recharge introduces reclaimed water to groundwater via surface or shallow subsurface infiltration. Direct groundwater recharge introduces reclaimed water directly and immediately into an aquifer, through injection using a well completed in the aquifer or by some other means. Reclaimed water stored in an aquifer can be recovered later for beneficial uses, such as irrigation.

For reclaimed water/ASR projects in particular, the Reclaimed Water Rule is very useful in that it provides clarity to regulatory questions or uncertainties that existed in the past. It also effectively consolidates numerous other applicable regulations. These aspects of the Rule are discussed in the next section.

It is important to note that the Rule requires individual, five-year reclaimed water permit(s) be issued for the generation, distribution, and use of reclaimed water in Washington state, thus ensuring that each project is designed and evaluated on a case-by-case basis. The LOTT Water Alliance holds the reclaimed water permits for both the Budd Inlet and Martin Way Reclaimed Water Plants. Revisions to the existing permits would be required to authorize the use of reclaimed water for an ASR project.

¹ All included with the updated version of the “Reclaimed Water Facilities Manual (The Purple Book)”, published by the Washington State Departments of Ecology and Health, Publication No. 15-10-024, revised February 2019.

3.2.1 Reclaimed Water Rights and ASR-Reclaimed Water Projects

The owner of a wastewater treatment facility reclaiming the water with a permit issued under the provisions of the Reclaimed Water Use Act has the exclusive right to any reclaimed water generated by the facility (RCW 90.46.120) and as such does not need a water right for reclaimed water use. However, if the water is transferred to another party for distribution or use, the permittee must do so under a legal contract to assure proper and safe water use.²

3.2.2 ASR-Reclaimed Water Projects

ASR-reclaimed water projects are also specifically exempt from water rights requirements. The State Water Code (RCW 90.03 and 90.44) states that the use, distribution, storage, and recovery from storage of *reclaimed water* is exempt from having to obtain a water right permit. However, this exemption is granted *only* if a permit for recovery of reclaimed water from aquifer storage is reviewed under the standards established under RCW 90.03.370(2) for ASR projects. RCW 90.03 relates to reservoir permits, which are typically required for ASR projects to artificially store water in an underground geological formation (or “reservoir”) and subsequently recover it for beneficial use.

Furthermore, the Washington ASR rule (173-157 WAC) exempts “projects storing and recovering *reclaimed water* in an aquifer”; in other words, the ASR rule does not apply to reclaimed water projects, even those that fundamentally achieve the same goal, but with the use of reclaimed water instead of treated drinking water.

To address these apparent regulatory inconsistencies, the Reclaimed Water Rule incorporates *equivalent* technical requirements and standards so that the *direct groundwater recharge and recovery of reclaimed water stored in an aquifer* does not rely on, or reference, the ASR Rule or related reservoir rules. Instead, the Reclaimed Water Rule effectively incorporates those other applicable standards into the following required portions of the Rule:

- Engineering report contents (WAC 173-219-210)
- Reclaimed water permit terms and conditions (WAC 173-219-270)
- Use-based standards (WAC 173-219-390).

Placing equivalent standards and requirements into the Reclaimed Water Rule is intended to reduce much past confusion related to different statutory requirements and/or exemptions from requirements.

Also, it is notable that the Reclaimed Water Rule does not explicitly use the terms “aquifer storage and recovery”, or “ASR.” Instead, the Rule refers to the “direct groundwater recharge and recovery of reclaimed water stored in an aquifer.” This semantic distinction is likely intended to reduce confusion between the two separate sets of regulations.³

3.3 Local City and County Regulations

Standards are placed for new uses within certain groundwater time-of-travel zones to protect potable water supply sources. Lacey Municipal Code 14.36.180 prohibits direct groundwater recharge and surface percolation using reclaimed water within a one-year time-of-travel of municipal production wells. The location of any future ASR wells designed to use reclaimed water as source water for recharge and the anticipated recharge storage zones will need to be located outside any one-year groundwater time-of-travel to protect existing drinking water supply sources from any viral, microbial, and direct chemical contamination.

Regulations of activities defined in Title 24 of Thurston County Code of Ordinances (TCC) for the purposes identified in TCC 24.01.010 apply to the following Critical Areas:

- Chapter 24.10 – Critical aquifer recharge areas

² Reclaimed water stored in an aquifer remains the property of the person that recharged it to the aquifer.

³ For brevity, this memorandum uses the phrases *reclaimed water-ASR project*, or *reclaimed water recharge and recovery project* (or some other equivalent variation), but recognizing that the Rule uses the more expanded and somewhat cumbersome language described here.

- Chapter 24.15 – Geologic hazards
- Chapter 24.20 – Frequently flooded areas
- Chapter 24.25 – Fish and wildlife habitat conservation areas
- Chapter 24.30 – Wetlands

Infiltration of reclaimed water by means of application to the land's surface above agronomic rates in these Critical Areas, however, are currently prohibited under these regulations, though conditioned as follows: *critical area regulations will be proposed when more information is available to Thurston County from the Regional Groundwater Recharge Scientific Study, and using other studies and information for reclaimed water following the requirements of the Growth Management Act (Chapter 36.70A RCW).*

Though infiltration of reclaimed water (application to the land's surface above agronomic rates) is currently prohibited, related activities that are allowed by the County without a critical area permit (A) or permitted subject to a critical area permit (P) include:

- Land spreading irrigation with reclaimed water at agronomic rates (A).
- Other new and existing uses identified by the County as posing a risk to groundwater quality (P).

Class II Injection wells (WAC 173-218-040(2)) are strictly prohibited in all aquifer recharge area categories defined by Thurston County. Injection wells used as part of a reclaimed water project, however, are considered Class V injection wells according to WAC 173-218 and are allowed in Washington under a permit. The Thurston County Critical Areas Ordinance, however, does not explicitly prohibit Class V injection wells used as part of a reclaimed water project in any of the Critical Areas. It is likely that this activity would be considered a new use identified by the County as posing a potential risk to groundwater quality and subject to a critical area permit.

4. Regulatory Requirements for Groundwater Recharge and Recovery (ASR) Using Reclaimed Water

Direct groundwater recharge and recovery using reclaimed water is authorized by the Reclaimed Water Rule. The Rule effectively redefines the term *aquifer storage and recovery* (ASR) for projects using reclaimed water with the following:

- Direct groundwater recharge: refers to release of reclaimed water into groundwater through direct injection, typically using wells completed in the aquifer.
- Recovery of reclaimed water stored in an aquifer: the recovery of the reclaimed water that has been stored in an aquifer (i.e., aquifer recovery). Reclaimed water stored in an aquifer remains the property of the entity that recharged it to the aquifer.

The remainder of this section provides an overview of the regulatory requirements for implementation of a project proposing to directly recharge groundwater using reclaimed water, with recovery of the stored water for subsequent beneficial use.

4.1 Lead Regulatory Agency

Reclaimed water use in Washington is jointly regulated by the Washington Department of Ecology (Ecology) and Department of Health (Health). The two state agencies have developed the assignment of the lead agency role to correspond with permit issuance already done by that agency. For example, a wastewater utility that has an existing discharge permit from Ecology and wishes to produce and beneficially use reclaimed water from its effluent will work with Ecology as the lead agency; in those cases, as the non-lead agency Health would be consulted on matters related specifically to the protection of public health.

For the reclaimed water ASR use being considered by the City, Ecology would likely be the lead agency. In addition to the issuance of existing discharge permits, Ecology is also the lead agency for discharges to surface waters of the state and for recharge of groundwater, at rates exceeding 100,000 gallons per day (gpd).

4.2 Early Planning Process and Agency Communication

To help ensure the success of a proposed reclaimed water project, the Reclaimed Water Rule requires early consultation with the lead and non-lead agencies to discuss the project objectives and to determine the scope of the project-specific planning process. This is typically done in a pre-planning meeting, or series of meetings, between the proponent and agency staff.

In general, planning for all new or expanded reclaimed water projects will require lead agency review and approval of the following documents:

- Feasibility Analysis
- Engineering Report
- Plans and Specifications

4.3 Feasibility Analysis

Proponents of a reclaimed water project must develop a feasibility analysis that demonstrates they have the long-term technical, management, legal, and financial capacity to design, construct, operate, and maintain the reclaimed water facility. The analysis must also show that distribution and beneficial end uses of the reclaimed water are feasible. The general purpose of the analysis is to document that the proponent has sufficient resources to provide public health and environmental protection over a 20-year planning period.

The following are key components that are expected to be required for the feasibility analysis; any additional required elements would be established early in the planning process between the City and the lead and non-lead agencies:

4.3.1 Existing Documents

Existing documents can be submitted and considered for use in meeting the feasibility analysis requirements, such as groundwater and aquifer protection plans (RCW 90.44.400 and 173-100 WAC) or comprehensive reclaimed water plans (RCW 57.16.0100). However, implementation of a new reclaimed water use will require additional specialized reports and studies as discussed below and in following sections.

4.3.2 Preliminary Water Right Impairment Analysis

A feasibility analysis will require a preliminary water right impairment analysis. A water right is impaired when there is an interruption or interference in the availability of water, or degradation of the quality of water, caused by decreasing or ceasing a wastewater discharge to freshwater in order to reclaim the water, that could adversely affect an existing water right holder.

The required scope and complexity of a water right impairment analysis will generally depend on the number and location of existing water right holders, including: (1) groundwater rights that could be affected by the proposed use; or (2) surface water rights that are either hydraulically connected to the local groundwater system, or those that could be affected by reduced discharge of reclaimed water to their source.

4.3.3 Hydrogeologic Evaluation (recommended as part of feasibility analysis)

Projects proposing to use reclaimed water for groundwater recharge and recovery will require a hydrogeologic evaluation (see Section 5.1.1). While this evaluation is required specifically as part of the engineering report, it is recommended that it instead be completed sooner as part of the feasibility analysis. Early completion of the

hydrogeologic evaluation is recommended due to the complexities involved in any type of ASR project, and particularly those that propose to use reclaimed water as the source water for injection and recovery.

4.4 Engineering Report

For projects proposing to use reclaimed water for groundwater recharge and recovery, the Reclaimed Water Rule requires that an applicant provide complete project details in a reclaimed water engineering report. In general, the engineering report is to include information requested by the lead agency to assess the specific treatment and use of reclaimed water for application to recharge groundwater, and its recovery for subsequent beneficial use. The engineering report will form the basis for project conditions written into a reclaimed water permit.

Engineering reports for reclaimed water recharge and recovery projects must include the following key components (* discussed in more detail in separate following sections):

- **Hydrogeologic Evaluation***
- **Project Operation Plan***
- **Legal Framework** – including project water rights documentation, other water rights in aquifer recharge project area, instream flows or stream closures within project area, and impairment analysis (if potential exists for water rights holders to be impacted by groundwater recharge, storage, or recovery of reclaimed water).
- **Environmental Assessment and Analysis** – including environmental aspects of aquifer recharge project area; identification of any nearby contaminated areas, land uses, wetland habitat, flood plains, surface water bodies or springs.
- **Mitigation Plan** – to identify actions to be taken to prevent adverse impacts to the environment.
- **Project Monitoring Plan***

4.4.1 Hydrogeologic Evaluation for Reclaimed Water Used to Recharge Groundwater

Projects proposing to use reclaimed water for groundwater recharge and recovery will require a hydrogeologic evaluation. The hydrogeologic evaluation will have to conform to the requirements established in the *Criteria for Sewage Works Design*, Section E3-4 Groundwater Quality Standards Checklist (Ecology Publication No. 98-37). Furthermore, the evaluation is to be prepared by a professional hydrogeologist licensed by the state of Washington.

The hydrogeologic evaluation is to identify numerous aspects of the site hydrogeology to be used to establish permit conditions that are protective of groundwater quality. Some of these aspects include: lateral and vertical extent of the storage aquifer; storage capacity of the aquifer; aquifer flow characteristics (e.g., permeability, predominant flow direction and gradient); chemical compatibility of reclaimed water when mixed with natural groundwater, and locations of all wells or other sources of groundwater of record within the area affected.

Aquifer transmissivity and the recoverability of stored water are two aspects of site hydrogeology that will be used to establish the conditions of the permit. The aquifer transmissivity in the East Lacey area is relatively higher compared to other areas in the aquifer system. With all else being equal, piezometric changes in aquifer systems with comparatively higher transmissivities will take place more rapidly and over broader areas in response to aquifer recharge or recovery pumping compared to systems with lower transmissivities. More transmissive aquifer systems can also accept recharge water more readily and avoid the need to seal the ASR wellhead to prevent flowing conditions at the surface from over-pressurization of the aquifer system. Together this would mean that the water level buildup during ASR recharge operations or drawdown during ASR

recovery pumping in a highly transmissive system would be less inside the well (and in the aquifer at distance from the well) compared to a less transmissive system.

During the storage period post-recharge and prior to recovery, the recharged water may drift slowly away from the ASR well. The distance the stored water will drift is dependent upon the storage time and the hydraulic gradient, permeability, and effective porosity of the aquifer system. The drift distance will be greater in a more transmissive aquifer system under an equal hydraulic gradient, which could contribute to a potential loss of stored water and low recovery percentages.

As part of the hydrogeologic evaluation, a conceptual hydrogeologic model will need to be developed to guide the development of the project design, identify data gaps, define additional data collection needs (e.g., required locations of monitoring wells), and, perhaps most importantly, allow for identification of any potential fatal flaws for the proposed recharge project.

It is recommended that the hydrogeologic evaluation begin early in the planning process, i.e., as part of the initial feasibility analysis. In order to generate accurate data with which to design the injection and recovery portions of the reclaimed water system, pilot testing of aquifer properties and groundwater quality may be conducted prior to engineering report submission. Before such preliminary work commences, pilot test(s) must be authorized by Ecology, which entails Ecology review and approval of: (1) pilot well test plan and (2) water quality testing plan (QAPP) submitted by the applicant.

Direct groundwater recharge projects using reclaimed water must identify, in either the hydrogeologic evaluation or a subsection of the engineering report, the existence and proximity of any designated groundwater protection area that could be affected by the project. These areas include: wellhead protection areas, sole source aquifers, aquifer protection areas, critical aquifer recharge areas, special groundwater protection areas, and groundwater management areas.

4.4.2 Project Operation Plan

A project operation plan will be required that guides operational aspects of the proposed reclaimed water recharge and recovery project. Work completed previously for the hydrogeologic evaluation, including pilot testing, aquifer characterization and engineering design will be used to develop the project operation plan, to include:

- Planned recharge and recovery rates and durations
- Recharge water availability (quantity, seasonality, etc.)
- Variability in source water quality; water treatment methods
- Aquifer storage period
- Proposed recharge and recovery facilities (recharge and recovery wells, related conveyance and other appurtenances).
- Treatment methods to meet groundwater quality standards

4.4.3 Project Monitoring Plan

The reclaimed water permit issued by the lead agency will establish the point, or points, of compliance for enforceable limits. The following are potential options for the monitoring point(s) of compliance:

- End-of-pipe in the reclaimed water prior to recharge/injection
- Groundwater within the receiving aquifer (i.e., monitoring wells)
- In a surface water body in hydraulic continuity with groundwater, at a point beyond project property boundaries, when needed to verify compliance with surface water quality standards.

Establishing specific point(s) of compliance and other monitoring requirements will be part of the early planning process, and will require collaboration with Ecology and Health.

4.4.3.1 Monitoring of Receiving Groundwater Body

To establish groundwater points of compliance, a groundwater monitoring plan prepared by the permittee will be required, and after approval by the lead agency will be incorporated into the reclaimed water permit.

Development of the monitoring plan will depend on reclaimed water quality and quantity, and site-specific soil and hydrogeologic characteristics. At least two downgradient monitoring wells would be required, but the proposed number and locations of wells are to be described in the conceptual hydrogeologic model and the monitoring plan, or as part of the engineering report. The groundwater monitoring plan is also to establish baseline concentrations in groundwater for reclaimed water constituents prior to beginning recharge operations, other constituents of concern, monitoring frequency, and other elements as required by the lead agency.

4.4.3.2 End-of-Pipe Monitoring for Groundwater Quality Protection

Monitoring of reclaimed water quality at the end-of-pipe might be required to verify that the reclaimed water treatment facility is in compliance with permitted discharge constituent concentrations. End-of-pipe monitoring can also be used to assess whether the reclaimed water quality meets groundwater quality criteria (173-200 WAC) when it is recharged to groundwater.

4.5 Water Quality Requirements for Direct Groundwater Recharge

Prior to distributing to the subsurface, the reclaimed water must meet all other requirements for treatment, reliability, conveyance, distribution, etc. as addressed by the Reclaimed Water Rule. Specifically, reclaimed water used for groundwater injection must meet all of the following water-quality criteria⁴:

- Class A reclaimed water requirements (173-219-330 WAC)
- Use-based performance standards for direct groundwater recharge using reclaimed water (Table 3 in 173-219-390 WAC)
- Compliance with Ecology's groundwater quality standards (173-200 WAC) and Health's drinking water standards (246-290-310 WAC), at the point of injection in the receiving groundwater, or at the end of pipe prior to distribution to the aquifer, or at an alternative point of compliance.

In addition to required compliance with the above water quality standards, all wells used to inject and recover stored reclaimed water would have to be registered with Ecology under the Underground Injection Control Program (173-218 WAC).

4.5.1 Groundwater Antidegradation Policy (173-200-030 WAC)

Regardless of the level of treatment of the source water used for ASR recharge, the project must comply with 173-200-030 WAC, specifically the State's antidegradation policy. The stated goal of the antidegradation policy is to ensure the purity of the State's groundwaters and to protect the natural environment. The policy requires that existing and future beneficial uses are maintained and protected, and degradation of high quality groundwater shall not be allowed. The policy also states that contaminants that will reduce the existing quality shall not be allowed to enter such waters, except in those instances where it can be demonstrated that:

- An overriding public interest (OPI) will be served; and
- All contaminants proposed for entry into said groundwater shall be provided with all known, available, and reasonable methods of prevention, control, and treatment (AKART) prior to entry.

Numeric groundwater quality criteria are provided in 173-200 WAC for both primary and secondary contaminants and radionuclides (List I) and carcinogens (List II). In most situations, these criteria constitute

⁴ All applicable water quality standards for a reclaimed water ASR type of project are summarized in Table 12-1 of the Purple Book (revised February 2019).

enforcement limits for various contaminants. There are however, six exceptions set forth in 173-200-050(3)(b) WAC where enforcement limits, other than the criterion, are appropriate. The sixth of these situations is described in 173-200-050(3)(b)(vi) WAC as follows:

(vi) In rare circumstances the department may allow an enforcement limit to exceed a criterion for an activity for a period not to exceed five years without reconsideration of the evidence presented in sub-items (A), (B), and (C) of this subdivision, and if all of the following conditions are met:

(A) The permit holder or responsible person demonstrates to the department's satisfaction that an enforcement limit that exceeds a criterion is necessary to provide greater benefit to the environment as a whole and to protect other media such as air, surface water, soil, or sediments;

(B) The activity has been demonstrated to be in the overriding public interest of human health and the environment;

(C) The department selects, from a variety of control technologies available for reducing and eliminating contamination from each potentially affected media, the technologies that minimize impacts to all affected media; and

(D) The action has been approved by the director of the department or his/her designee.

On the surface, the antidegradation standard would seem to be problematic for virtually any type of ASR project. Even high quality treated drinking water contains constituents that are not typically present in an aquifer (e.g., residual chlorine and disinfection byproducts). For several municipal ASR projects in Washington, however, Ecology has found the benefits of ASR to prevail over potential adverse impacts, and that there is an overriding public interest (OPI) associated with ASR.

At Kennewick for example, the City's source water is treated (filtered and disinfected) surface water from the Columbia River. This source has many constituents not present in the target storage aquifer: chlorine, disinfection byproducts, radiological components, and even basic elements of inorganic and organic chemistry such as alkalinity, organic carbon, and metals differed. The AKART analysis of treatment options to remove all constituents to levels consistent with background groundwater quality or groundwater quality criteria concluded with a capital cost estimate that was infeasible for the City to consider. The alternative point of compliance (APC) monitoring approach was evaluated and the project benefits detailed to compare that compliance approach to APC. This resulted in a request for an OPI determination with respect to the project, which was granted by Ecology.

5. Initial Evaluation of ASR Feasibility

The previous Section 4 included an overview of regulatory requirements specific to proposed reclaimed water recharge and recovery projects. This Section 5 expands on that previous information to include requirements common to all types of ASR projects, and presents an initial evaluation of ASR feasibility in areas of the City.

The approach to evaluating ASR feasibility typically involves an initial desktop assessment of certain key feasibility elements to identify potential fatal flaws and begin to formulate system parameters. Some of the key feasibility elements that should be explored as part of an initial evaluation phase to determine the feasible capacity of an ASR system at a given location include the following:

- **Infrastructure Needs.** Identify what infrastructure needs or engineer upgrades may be necessary for ASR recharge (e.g., storage and peak flow needs, modify an existing well, drill and construct a new well) and what treatment and conveyance requirements may be needed for recharge source water.

- **Storage Aquifer.** Evaluate the aquifer system and assess whether its hydrogeologic characteristics are suitable for supporting ASR operations at rates, volumes, and cost-ratios that are favorable compared to other storage alternatives.
- **Water Quality Pre-Assessment.** Characterize water quality conditions of recharge source water and native groundwater. Compare the water quality conditions against groundwater quality criteria and assess the potential for source water to degrade background groundwater quality. Identify whether there are any apparent water quality or chemical compatibility concerns with regard to regulatory requirements or well performance (i.e., clogging from chemical precipitation) that may impact ASR feasibility.
- **Environmental Assessment.** Conduct an environmental assessment of the proposed project. The assessment would include such elements as proximity to existing users, locations of floodplains and surface water bodies, and potential slope/ground stability issues.

For this initial evaluation, emphasis has been placed on the physical framework of the storage aquifer and general water quality conditions, focusing on developing an approximate range of potential ASR injection rates and storage volumes and identifying potential groundwater antidegradation concerns.

5.1 Hydrogeologic Setting

The area is situated in the south-central portion of the Puget Sound Lowland. The Puget Sound Lowland is a north-south-oriented basin that has experienced repeated deposition, erosion and reworking of geologic sediments during glacial and interglacial periods. The repeated glacial advances and retreats covered the area with layered, unconsolidated glacial and non-glacial deposits. The most recent (Vashon) glacial advance reached its maximum extent approximately 17,000 years ago.

5.1.1 Groundwater System

The groundwater system in the study area has been described by Wallace and Molenaar (1961), Noble and Wallace (1966), Drost et al. (1998), and Drost et al. (1999). The hydrostratigraphic units known to exist within this area of Thurston County are illustrated on geologic cross-sections⁵ provided in the City's 2011 Wellhead Protection Plan (Golder 2011a) and summarized below:

- Post-Vashon (Holocene) Alluvial and Deltaic Sediments
- Vashon Recessional Outwash (Qgo and Qgos)
- Vashon Glacial Till (Qgt)
- Vashon Advance Outwash (Qga)
- Pre-Vashon Glaciolacustrine Deposits (Qpf)
- Pre-Vashon Gravel (Qpg)
- Unconsolidated Quaternary and Tertiary Deposits (TQu)
- Bedrock (Tb)

The alluvial and deltaic sediments are present along stream valleys and have nominal significance in storing groundwater (Golder 2011a). The recessional outwash deposits (Qgo and Qgos, collectively referred to as Qgo) form a thin (< 40 feet thick) unconfined water table aquifer throughout a large part of the region where perched by the till, and supports mostly small domestic supply wells.

The till (Qgt) and glaciolacustrine (Qpf) deposits are typically composed of low-permeability, fine-grained sediments and presumably act as confining or semi-confining layers for deeper groundwater flow systems throughout most of the Lacey area.

⁵ Adapted from Pacific Groundwater Group (2003) and Northwest Land and Water (2008).

The bedrock unit (Tb) consists of sedimentary claystone, siltstone and sandstone and igneous deposits of andesite and basalt. Bedrock is known to contain some water in fractures and joints, but is considered an unreliable source due to low yields and poor water quality (Drost et al., 1998).

The primary aquifer units include the advance outwash (Qga), pre-Vashon gravel (Qpg), and unconsolidated (TQu) deposits:

- The Qga deposits lie beneath and are generally confined by the overlying Qgt till. The Qga is a relatively permeable aquifer unit consisting generally of sand and gravel, and is relatively widespread throughout the subsurface ranging in thickness between 10 and 65 feet. This unit is the primary source for most domestic wells, though does supply some higher capacity municipal and industrial wells in the area. This aquifer unit supplies a few of the City's wells in the College Street and Hawks Prairie areas (Golder 2011a). Between approximately 30 and 35 percent of the wells located in northern Thurston County are completed in this unit (Drost et al. 1998).
- The Qpg deposits underlie and are mostly confined by the overlying Qpf glaciolacustrine deposits. The Qpg unit consists of stratified sand and gravel and is laterally extensive, ranging in thickness between 15 and 70 feet. This aquifer unit is the primary supply source for several of the City's wells in the College Street, East Lacey, and Hawks Prairie areas (Golder 2011a). Between approximately 30 and 35 percent of the wells located in northern Thurston County are completed in this unit (Drost et al. 1998).
- The unconsolidated and undifferentiated deposits of the TQu underlie the Qpg unit. The TQu consists of glacial and non-glacial sediments of clay, silt, sand, and gravel, and is known to consist of layers of fine-grained confining beds and coarse-grained, confined aquifer units (Drost et al., 1999). The TQu is widespread throughout the region, extending from approximately 300 feet above mean sea level in the southeast to greater than 1,500 feet below mean sea level along the Puget Sound. The City has several high-capacity supply wells located in the College Street and Hawks Prairie areas that are completed in and obtain water from this unit (Golder 2011a). Approximately 15 percent of the wells located in northern Thurston County are completed in this unit (Drost et al. 1998).

5.1.2 Regional Groundwater Levels and Flow Direction

The regional groundwater flow direction in the three primary aquifer units is generally north toward the Puget Sound and north-northeast toward McAllister Valley (Golder 2011a). The regional groundwater flow direction and hydraulic gradient in these units appear disrupted in some areas by localized changes in aquifer permeability and thickness.

Groundwater in the Qga unit generally flows north-northeast. The hydraulic gradient is relatively flat in the College Street and Hawks Prairie areas (0.001 ft/ft) and steepens toward the north-northeast along the Puget Sound and McAllister Valley areas. Groundwater from the Qga is known to discharge as springs and seeps along the eastern margin of the valley. With the exception of discharge locations, groundwater levels in the Qga are generally shallowest (typically less than 50 feet below ground surface; bgs) in the College Street area and deepest (approximately 50 to 80 feet bgs) in the Hawks Prairie area (Golder 2011a).

Groundwater in the Qpg unit generally flows northeastward. The hydraulic gradient varies from as shallow as 0.0025 ft/ft in the East Lacey and Hawks Prairie areas to as high as 0.01 ft/ft in the tri-lakes area. The Qpg groundwater level is more than 100 feet below the Qga groundwater level suggesting hydraulic separation between the two units (Golder 2011a). Groundwater levels in the Qpg unit are generally deepest (greater than 150 feet bgs) in the East Lacey and Hawks Prairie areas.

Groundwater in the TQu unit follows a somewhat similar regional north-northeast flow pattern as exhibited in the Qpg unit. Compared to the overlying Qpg and Qga units, the TQu hydraulic gradient is more subdued and relatively uniform, ranging from approximately 0.003 ft/ft in the College Street and Hawks Prairie to 0.006 ft/ft in the East Lacey area. In the East Lacey and Hawks Prairie areas, groundwater levels in the TQu are similar to those in the Qpg suggesting some degree of hydraulic continuity between the two units.

Groundwater levels in the TQu unit are generally deepest (greater than 150 feet bgs) in the Hawks Prairie area.

5.2 City Production Wells

The City currently produces water from several wells individually completed in the three primary aquifer units. Reliable production capacities are reported by Golder (2011a) and Carollo (2013) to range between:

- 170 and 750 gpm (0.2 and 1.1 mgd) for City wells completed in the Qga;
- 230 and 1,600 gpm (0.3 and 2.3 mgd) for City wells⁶ completed in the Qpg; and
- 650 and 1,800 gpm (0.9 and 2.6 mgd) for City wells completed in the TQu.

Most of the City's wells are completed in the Qpg and deeper TQu aquifer units. The City's highest producing (> 1,000 gpm) wells are completed in the Qpg unit in the East Lacey area (Madrona Park wells) and in the TQu unit in the College Street (Well 7) and Hawks Prairie areas. These wells are generally high-performing, with pumping specific capacity values ranging between approximately 20 and 700 gpm per foot of drawdown (gpm/ft).

5.3 Conceptual ASR Storage Model

A conceptual model and general characteristics of the aquifer system can be used to estimate the aquifer storage capacity volume and the distance from an ASR well that the reclaimed water will displace native groundwater for a given total recharge volume. The conceptual storage model estimates ASR storage area and volume assuming recharge and recovery via plug-flow.

Because (1) the alluvial and deltaic sediments have been reported to have nominal significance in storing groundwater, (2) the Qgo unit is thin and unconfined and also appears to have limited storage capacity, and (3) groundwater in the Qga discharges to McAllister Valley via springs and seeps and may be impacted by ASR activities in this unit, the target ASR storage units discussed in this section are limited to the Qpg and TQu units.

5.3.1 Estimated Aquifer Storage Capacity

The available storage capacity of an aquifer is a function of the aquifer storativity and the influence of local hydraulic boundary conditions. A basic estimation of the available aquifer storage capacity (acre-feet) can be calculated as follows:

$$Volume = SAh$$

where S is the aquifer storativity (dimensionless), A is the aquifer extent or area in acres, and h is the available water-level buildup capacity in feet (assumed equivalent to the static water level). This is a theoretical calculation for ideal circumstances, and assumes injection water levels will remain below ground surface and the water level buildup in the aquifer during injection is cylindrical.

The aquifer storativity value for the Qpg unit, based on localized pumping tests conducted at City wells in the East Lacey area (Golder 2011a), is reported in the range of 3×10^{-6} to 7.2×10^{-6} ; this is lower than expected given that aquifer storativity values for confined aquifers and these types of deposits typically range between 1.0×10^{-4} and 1.0×10^{-3} (Lohman 1972; Todd 1980; Boonstra 1989). Storativity for the TQu unit was estimated to be 2.0×10^{-4} based on a pumping test conducted at the City of Yelm's SW Well 1A (Golder 2011b).

The aquifer extent of the Qpg and TQu deposits were presumed equal, and was estimated as the region bounded by the Puget Sound to the north, Henderson Inlet and Woodland Creek to the west, Nisqually River to the east, and Chambers Prairie to the south. The area encompassing this region is estimated at 25,000 acres.

⁶ Excluding the shallow Nisqually wells 19A and 19C located adjacent to the Nisqually River.

Using the historical water level data reported by Golder (2011a), the available Qpg storage capacity is estimated to range as low as 40 to 815 MG in the College Street area to as high as 160 to 1,875 MG in the East Lacey area. For the TQu unit, the storage capacity is estimated to range as low as 50 to 530 MG in the College Street area to as high as 400 to 2,445 MG in the Hawks Prairie Area. Results are summarized in Table 1. The aquifer storage capacity estimates indicate that the Qpg and TQu units in the Hawks Prairie and East Lacey areas are potential candidate locations that appear capable of receiving and storing the target reclaimed water storage volume. Relatively shallow Qpg and TQu groundwater levels in the College Street area may preclude this area as a candidate location for storage, unless the wellhead is designed to inject water under pressurized conditions.

The estimated storage capacity ranges shown on Table 1 for the Qpg and TQu units in different areas of the City are acknowledged to be quite broad; this current level of uncertainty is due to the inherent variability in the two principal variables used to derive aquifer storage capacity: storativity and available build-up capacity. In particular, it should be noted that the estimated reclaimed water storage volumes are highly sensitive to aquifer storativity. Accurate estimations of storativity (and consequently, storage volume) require large-scale hydraulic testing, and thus the assumed storativity values used for this preliminary evaluation may not be representative of actual aquifer conditions in all areas. Further hydrogeologic characterization of a candidate aquifer storage zone at a prospective site or sites is recommended to better assess its potential storage capacity.

5.3.2 Estimated Injection Capacity

The injection capacity of a well is the maximum rate at which water can be introduced into the underlying aquifer and is dependent primarily on the hydrogeologic characteristics of the formation. Injection rates for ASR wells designed to be both an injection and recovery well are ordinarily limited to 75 percent of the maximum pumping rate. The limitation is to allow for overpumping (i.e., backflushing) the well at rates higher than injection, to facilitate removal of solids that may have been transported down the well during recharge, prevent clogging of the wellbore, and maintain optimal well performance. If necessary, recharge can take place under pressurized conditions with the appropriate well and wellhead design. Injection wellhead connections, pump/recharge columns, and electrical cable fittings can be designed and tightly sealed to withstand planned recharge pressures and transient aquifer pressure changes, prevent backflow, and allow pressurized recharge.

Based on the reliable pumping capacities reported for City wells completed in the Qpg and TQu units, it appears that injection rates could range between 230 and 1,200 gpm (0.3 and 1.7 mgd) in the Qpg, and between 500 and 1,350 gpm (0.7 and 1.9 mgd) in the TQu.

5.3.3 Estimated Storage Area

The radius of the recharge reservoir (distance from an ASR well that source water will displace native groundwater, sometimes referred to as the “bubble” radius) depends on the total recharge volume and the hydraulic characteristics of the aquifer, and can be estimated as:

$$\text{Recharge Reservoir Radius} = \sqrt{\frac{V}{7.48 * \pi * b * n_e}}$$

where V is the volume of water recharged (gallons), π is 3.14159, b is the saturated aquifer thickness (feet), and n_e is the effective porosity (dimensionless). The recharge reservoir radius is inversely proportional to b and n_e , so the greater b and n_e , the smaller the radial distance source water will displace native groundwater away from the well during recharge.

Using (1) an estimated recharge volume of between 180 and 360 MG, (2) estimated aquifer thickness of between 50 and 250 feet, and (3) assumed effective porosity of between 0.13 and 0.46 typical of unconsolidated sand and gravel deposits, the radius of the recharge reservoir from the ASR well is estimated

to range between 250 and 1,500 feet. This indicates that given a relatively large storage volume, the aquifer will store most of the recharge water within a short distance of the ASR well.

5.3.4 Aquifer Transmissivity

Aquifer transmissivity is one hydraulic characteristic of the aquifer system needed to determine the rate of flow for recharged water (and associated groundwater level response) and the distance the recharged water may drift during storage under a known hydraulic gradient. A relatively high transmissive aquifer may or may not affect recoverability of the stored water. Recoverability will depend on aquifer transmissivity and other factors, such as storage duration, recovery pumping rate, and the hydraulic gradient of the aquifer system. The longer the recharged water is left in storage prior to recovery pumping, the further it will drift from the ASR well(s) and the greater potential for loss of stored water (i.e., low recovery percentage). The drift distance in a highly transmissive aquifer system under a low hydraulic gradient, however, could be similar to the drift distance in a poorly transmissive system under a high hydraulic gradient. Though more transmissive aquifer systems can accept recharge water more readily than less transmissive systems, there is no ideal transmissivity range for ASR projects.

5.3.5 Conceptualized ASR Well

Average injection capacity values for the City's production wells were used to conceptualize the performance of a single ASR well completed in either the Qpg or TQu units (performance data for the Nisqually wells were not included in calculating an estimated injection capacity because high groundwater levels in that area greatly limit the available water-level buildup capacity).

Assuming an average injection rate of 1.1 mgd (750 gpm; based on the range identified in Section 5.3.2) and an injection period of 180 days (December through May), the injection capacity of a single ASR well is estimated at 200 MG, depending on actual aquifer storativity values and excluding any aquifer storage constraints or potential well interference impacts from any neighboring ASR wellfield wells. Assuming a recovery pumping rate of 1.4 mgd (1,000 gpm), it would require approximately 135 days to recover up to 95 percent of the stored water volume (permitted ASR projects in Washington have limited recovery to between 65 and 95 percent of the stored water volume). The estimated performance parameters for this single conceptualized ASR well are summarized in Table 2.

5.3.5.1 Planning-Level Cost Estimate

Planning-level cost estimates (Table 3) for two conceptual ASR wells (one completed in the Qpg unit and one in the TQu) were developed using recent drilling subcontractor cost estimates (including prevailing wage rates) and equipment/material prices, average completed depths of existing City wells for these units⁷, and year 2020 dollars.

The planning-level cost estimate for a single conceptual ASR well completed in the Qpg unit is estimated to range between \$480,000 and \$670,000, including sales tax.

The planning-level cost estimate for a single conceptual ASR well completed in the deeper TQu unit is estimated to range between \$880,000 and \$1,225,000, including sales tax.

These estimates do not include allowances for equipping the wells with pumps/motors, downhole flow control valves, or above-ground appurtenances nor do they include any engineering consulting, administrative or permitting fees.

These cost estimates should be refined after completing any site specific investigations and will depend on actual site conditions, competitive market conditions, regulatory requirements, project schedules, and other factors.

⁷ Completed City well depths range between approximately 80 and 390 feet for Qpg wells (average = 250 feet) and between 290 and 665 for TQu wells (average = 540 feet).

5.4 Water Quality

This section provides a preliminary comparison of groundwater and reclaimed water quality. Groundwater quality data were compiled for the Qpg and TQu units using historic water quality data on file with Health for the City's drinking water system for a minimum period of record of 15 years. Groundwater quality in the East Lacey and Hawks Prairie areas for the Qpg unit were compiled from source wells S21, S22, S28, and S29, and from source wells S19 and S31 for the TQu unit.

Reclaimed water quality data were obtained from sampling events completed as part of two studies conducted for the LOTT Clean Water Alliance.⁸ For that study, quarterly sampling was conducted between November 2014 and October 2015 at LOTT's two reclaimed water treatment facilities: the Budd Inlet Reclaimed Water Plant (BIRWP) and the Martin Way Reclaimed Water Plant (MWRWP). More recent and representative reclaimed water quality data are available from monthly and quarterly sampling events conducted during 2018 at the MWRWP⁹. Both facilities produce Class A reclaimed water, including nitrogen removal, which is required for reclaimed water direct discharge and recovery projects.

The reclaimed water samples were analyzed for an extensive range of constituents, with a focus on determining what residual chemicals remain in the reclaimed water after treatment at LOTT's treatment plants. "Residual chemicals" in this case refers to certain types of chemicals that may remain in reclaimed water after treatment, including pharmaceuticals, personal care products, and other organic chemicals typically found at very low concentrations in reclaimed water.

A number of residual chemicals were detected in reclaimed water samples from both the BIRWP and MWRWP. Some of these chemicals have corresponding drinking water regulatory limits, whereas others do not (i.e., the latter being so-called *contaminants of emerging concern*). A thorough comparison of these low-level contaminant concentrations in reclaimed water is beyond the scope of this ASR pre-feasibility evaluation, but if the City proceeds with a reclaimed water ASR project this could be a topic of discussion with Ecology and Health.

The available water quality data are summarized in Table 4. Volatile and synthetic organic compounds (VOCs and SVOCs) for the groundwater/well sources were all below reporting limits and not shown in Table 4. As mentioned previously, there was only a single VOC/SVOC detection in the reclaimed water samples, and thus it is also not shown on Table 4.

It is also notable that the reclaimed water samples were analyzed for the presence of only dissolved metals, whereas State (and EPA) groundwater and drinking water regulations pertain to total metal concentrations. Therefore, a comparison of total metal concentration in reclaimed water to regulatory limits could not be made.

From this preliminary assessment, it can be generally concluded that none of the analytes tested in the reclaimed water samples exceeded the groundwater or drinking water criteria shown on Table 4. Certain reclaimed water constituents, however, have shown elevated values relative to those criteria: maximum total dissolved solids concentrations in the BIRWP and MWRWP samples were 420 mg/L and 370 mg/L, respectively, compared to the regulatory limit of 500 mg/L; sodium concentrations at MWRWP samples ranged between 50 and 60 mg/L, compared to the 20 mg/L action level; and total coliforms were detected in samples from both sources. Although the concentrations of these analytes are less than established primary and secondary drinking water standards, they (and possibly others) would need to be considered in an AKART assessment prior to the consideration by the State to allow their entry into the groundwater system.

⁸ Wastewater and Reclaimed Water Quality Characterization (Task 1.3), LOTT Clean Water Alliance Reclaimed Water Infiltration Study, Technical Memorandum, February 7, 2017. Prepared by HDR for LOTT.

⁹ Tracer Test and Water Quality Monitoring (Task 2.1.3), LOTT Clean Water Alliance Reclaimed Water Infiltration Study, Report, October 30, 2019. Prepared by HDR for LOTT.

Summary

Initial findings from this preliminary assessment suggest that the Qpg and TQu aquifer units present in the Lacey area are both potential candidates for developing reclaimed water storage zones. The TQu unit, however, appears to be a slightly better candidate considering comparatively higher production capacities, deeper flow system, apparent higher storage capacity and injection rates, and lesser development (i.e., fewer number of wells). In particular, the East Lacey and Hawks Prairie areas appear as top potential candidate sites based on deeper Qpg and TQu groundwater levels (i.e., greater water-level buildup capacity during injection) compared to the College Street and west Lacey areas.

Class V injection wells using Class A reclaimed water for ASR supply must be outside any one-year groundwater time-of-travel of municipal production wells (Lacey Municipal Code 14.36.180). The Thurston County Critical Areas Ordinance, however, does not explicitly prohibit Class V injection wells used as part of a reclaimed water project in any of the County's designated Critical Areas. It is likely that this activity would be considered a new use identified by the County as posing a potential risk to groundwater quality and subject to a critical area permit. Land spreading irrigation with reclaimed water at agronomic rates is allowed by Thurston County without a critical area permit (TCC 24.10.190).

Elevated nitrate levels along Marvin Road could adversely impact ASR recharge or recovery activities in this area. ASR operational data, however, indicates that major ions and dissolved oxygen concentrations should decrease as ASR operations proceed. Nitrate in recharge water is expected to be somewhat reduced to nitrogen (N₂) or ammonia (NH₃) during storage as a result of denitrification (Mirecki, 2004).

Estimated injection rates (0.3 to 1.7 mgd for Qpg wells and 0.7 to 1.9 mgd for TQu wells) based on the productivity of existing City wells indicate that the number of injection wells needed to achieve the maximum 2 mgd treatment plant flow could be 1-6 Qpg ASR wells and 1-3 TQu ASR wells. The recharge radius of the storage zone is estimated to range between 250 and 1,500 feet around a single 1-2 mgd ASR well, and less under a multiple injection-well scenario. Given some uncertainty in the aquifer storativity values, further aquifer testing of existing wells and/or drilling and testing exploratory test wells at targeted locations may be needed to validate these estimates. A relatively high transmissive aquifer system may or may not affect recoverability of the stored water. Recoverability will depend on aquifer transmissivity and other factors, such as storage duration, recovery pumping rate, and the hydraulic gradient. Both LOTT facilities produce Class A reclaimed water, which is required for reclaimed water direct discharge and recovery projects. However, a much more thorough evaluation of source water quality, including its compatibility with native groundwater, would be required as part of the feasibility analysis required for a potential reclaimed water ASR project.

Next Steps

Initial findings from this preliminary evaluation support the following next steps, should the City decide to proceed with this concept further:

- **Schedule a pre-planning meeting with Thurston County.** This meeting is recommended for understanding whether ASR activities using Class A reclaimed water (i.e., injection using Class V UIC wells, temporary aquifer storage, and subsequent recovery for non-potable uses) would be considered a new use posing a potential risk to groundwater quality and what specific critical area permitting requirements may need to be addressed and what future work may be required.
- **Proceed with a pre-feasibility assessment phase.** The following tasks are recommended for additional assessment to confirm the feasibility of the reclaimed water ASR project under consideration:
 - Further evaluate the Qpg and TQu aquifer systems in the Qpg and TQu Lacey area to better estimate aquifer storativity and potential storage capacities in these units. This could be completed through advanced analyses of available pumping test data, or by conducting pumping tests specifically designed to estimate storativity.

- Conduct a spatial analysis to evaluate potential locations for ASR wells and identify areas potentially affected by anticipated ASR activities. The analysis would consider standard setback requirements for wells, proximity to existing wells and water users, wellhead capture zone delineations for municipal supply wells, and identification of receptors potentially influenced by ASR operations.
- Conduct a more in-depth water quality assessment to include the following (although consultation with both Ecology and Health should occur before proceeding with this work, as an initial step of the project feasibility analysis):
 - Complete a more thorough evaluation of reclaimed water quality against groundwater quality criteria and native Qpg and TQu groundwater quality to assess the potential for source water to degrade background groundwater quality.
 - Complete a geochemical compatibility evaluation of the reclaimed source water and receiving Qpg and TQu groundwater, focusing on whether the mixed water may dissolve or precipitate minerals or mobilize potential contaminants.
- Conduct a preliminary environmental assessment of the proposed project that would include such elements as locations of floodplains and surface water bodies and potential slope/ground stability issues.
- **Schedule a pre-planning meeting with Ecology.** This meeting would be invaluable for discussing project objectives, and identifying any potential obstacles to permitting the project, any special circumstances that may affect the proposed project, and the scope and need for any unique requirements.

References

- Boonstra, J., 1989, SATEM: Selected Aquifer Test Evaluation Methods, ILRI Publication 48, International Institute for Land Reclamation and Improvement, Wageningen, The Netherlands.
- Carollo Engineers (Carollo), 2013, City of Lacey Water System Comprehensive Plan Update, February 2013.
- Drost, B.W., G.L. Turney, N.P. Dion, and M.A. Jones, 1998, Hydrology and Quality of Ground Water in Northern Thurston County, Washington. U.S. Geological Survey Water Resources Investigations Report 92-4109 [revised]. Prepared in cooperation with Thurston County Department of Health.
- Drost, B.W., G.L. Turney, N.P. Dion, and M.A. Jones, 1999, Conceptual Model and Numerical Simulation of the Ground-Water Flow System in the Unconsolidated Sediments of Thurston County, Washington. U.S. Geological Survey Water Resources Investigations Report 99-4165. Prepared in cooperation with Thurston County Department of Health.
- Golder Associates, Inc. (Golder), 2011a, City of Lacey Wellhead Protection Report for the Water System Plan Update 2011, submitted to Carollo Engineers, Seattle, Washington, May 3, 2011.
- Golder, 2011b, The City of Yelm Southwest Well 1A Development Report, Drilling, Well Construction and Testing, submitted to City of Yelm, Washington, March 15, 2011.
- HDR, 2017, Wastewater and Reclaimed Water Quality Characterization (Task 1.3), LOTT Clean Water Alliance Reclaimed Water Infiltration Study, Technical Memorandum, February 7, 2017. Prepared by HDR for LOTT.
- Lohman, S.W., 1972, Ground-Water Hydraulics, Geological Survey Professional Paper 708, United States Geological Survey, Washington, DC.
- Mirecki, J.E., 2004, Water-Quality Changes during Cycle Test at Aquifer Storage Recovery (ASR) Systems of South Florida. US Army Corps of Engineers, Environmental Laboratory. ERDC/EL TR-04-8. 53p.
- Noble, J. B. and Wallace, E. F., 1966, Geology and Ground-Water Resources of Thurston County, Washington; Volume 2: Washington Division of Water Resources Water-Supply Bulletin 10, v. 2, 141 p., 5 plates.
- Northwest Land and Water (NLW), 2008, Hawks Prairie Area Hydrogeologic Characterization Report. Prepared for The City of Lacey. December 29, 2008.
- Pacific Groundwater Group (PGG), 2001, Salmon Creek Drainage Basin Conceptual Hydrologic Model, prepared for URS Corp and Thurston County Water and Waste Management, June 2001.
- PGG, 2003, City of Lacey Water System Plan 2003. Chapter 6 – Wellhead Protection Program.
- Todd, D.K., 1980, Groundwater Hydrology, 2nd ed., John Wiley & Sons, New York, 535p.
- Wallace, E.F. and D. Molenaar, 1961, Geology and Groundwater Resources of Thurston County, Volume 1: Washington Division of Water Resources, Water Supply Bulletin No. 22.
- Washington State Department of Ecology (Ecology), 1997, Water Reclamation and Reuse Standards, September 1997.
- Washington State Department of Ecology (Ecology), 2006, Water Rights Impairment Analysis Guidance for Reclaimed Water Facilities, February 2006.
- Washington State Department of Ecology, 2019, Reclaimed Water Facilities Manual (The Purple Book), Publication No. 15-10-024, revised February 2019.

This page left intentionally blank

Table 1: Estimated Qpg and TQu Transmissivities and Aquifer Storage Capacities

Aquifer Unit	Transmissivity (gallons per day per foot)			⁽¹⁾ Estimated Storativity Range, S (dimensionless)			⁽²⁾ Estimated Aquifer Area, A (acres)	⁽³⁾ Available Water-Level Buildup Capacity, h (feet)			Estimated Aquifer Storage Capacity, V = SAh					
											(acre-feet)			(MG)		
Qpg Aquifer																
College Street Area	24,400	to	93,500	1E-04	to	1E-03	25,000	50	to	100	125	to	2,500	41	to	815
Hawks Prairie Area	23,500			1E-04	to	1E-03		150	to	175	375	to	4,375	122	to	1,426
East Lacey Area	1,800,000	to	4,430,000	1E-04	to	1E-03		200	to	230	500	to	5,750	163	to	1,874
TQu Aquifer																
College Street Area	30,000	to	190,000	2E-04	to	1E-03	25,000	35	to	65	175	to	1,625	57	to	530
Hawks Prairie Area	4,500	to	71,000	2E-04	to	1E-03		250	to	300	1,250	to	7,500	407	to	2,444
East Lacey Area	not available			2E-04	to	1E-03		100	to	150	500	to	3,750	163	to	1,222

Notes: (1) Aquifer storativity values were estimated to range between 1×10^{-4} and 1×10^{-3} based on typical values reported by Lohman (1972), Todd (1980), and Boonstra (1989) and a pumping test conducted at the City of Yelm's SW Well 1A (Golder 2011b); (2) Aquifer extent of the Qpg and TQu were presumed equal and was estimated as the region bounded by the Puget Sound to the north, Henderson Inlet and Woodland Creek to the west, Nisqually River to the east, and Chambers Prairie to the south; and (3) available water-level buildup capacities were estimated based on historical water level data reported by Golder (2011a) and PGG (2003); reported ground surface elevations or elevations estimated using Google Earth at the well sites, and were assumed equal to static water levels. Transmissivity values from Golder (2011a).

This page left intentionally blank

Table 2: Conceptualized ASR Well (Injection and Recovery)

	⁽¹⁾ Estimated Injection Rate		Injection Period (days)	Stored Volume (MG)	Estimated Recovery Rate		⁽²⁾ Recovery Period (days)	⁽²⁾ Recovery Volume (MG)
	(mgd)	(gpm)			(mgd)	(gpm)		
Conceptual ASR Well	1.1	750	180	200	1.4	1,000	135	190

Note: (1) Estimated for a single well, based on 75% of average pumping capacity reported for City wells completed in either the Qpg or TQu deposits (excluding Nisqually wells) (refer to Section 5.3.2 of text) (2) based on a 95 percent recovery of stored water (actual allowable recovered volume may be less)

This page left intentionally blank

Table 3: Planning-Level Cost Estimates for Single Qpg and TQu Injection Wells

Item	Aquifer Unit	
	Qpg (assumed well depth = 250 feet) ⁽²⁾	TQu (assumed well depth = 550 feet) ⁽²⁾
Well drilling, construction, and testing	\$375,000	\$687,500
Construction contingency (30%)	\$112,500	\$206,250
Construction Subtotal (w/out sales tax)	\$487,500	\$893,750
City sales tax (9.4%)	\$45,825	\$84,013
⁽¹⁾ TOTAL ESTIMATED COST	\$535,000	\$980,000
⁽¹⁾ TOTAL ESTIMATED COST (-10%)	\$480,000	\$880,000
⁽¹⁾ TOTAL ESTIMATED COST (+25%)	\$670,000	\$1,225,000

Note: (1) All estimated cost values are in 2020 dollars and rounded to the nearest \$5,000. (2) The assumed casing diameter is 16-inch (nominal).

This page left intentionally blank

TABLE 4: WATER QUALITY SUMMARY

ANALYTE GROUP / Analyte	Groundwater (WAC 173-200-040)	Drinking Water MCL/SMCL (WAC 246-290-310)	Native Groundwater			Source Water	
			Qpg		TQu	Budd Inlet Reclaimed Water ⁽¹⁾	Martin Way Reclaimed Water ⁽²⁾
			Wells S21, S22, S28	Well S29	Well S19, S31		
			Result	Result	Result	Result	Result
INORGANICS							
Ammonia-nitrogen, mg/L	--	--	--	--	< 1	ND - 2.9	ND - 3
Chloride, mg/L	250	250	6 - 8	20 - 23	1 - 9	70 - 150	48 - 64
Cyanide, mg/L	--	0.2	< 0.05	< 0.05	< 0.01	--	--
Fluoride, mg/L	4.0	2 (SMCL), 4 (MCL)	< 0.2	< 0.2 - 0.5	0.2	--	--
Hardness, mg/L	--		76-82	158	30 - 60	--	--
Nitrate-N, mg/L	10	10	2.3 - 3.8	< 0.2 - 1	< 0.2 - 0.2	1.8 - 4.6	0.59 - 2.6
Nitrite-N, mg/L	--	1	< 0.2	< 0.2	< 0.2	ND	ND
Silica (as SiO2), mg/L	--	--	37 - 41	35 - 42	46 - 54	--	--
Sulfate, mg/L	250	250 (SMCL)	7 - 8	9 - 50	2 - 3	23 - 35	27 - 31
Sulfide, mg/L	--	--	--	--	--	ND	ND
TOTAL METALS / METALLOIDS							
Aluminum, mg/L	--	0.05 to 0.2 (SMCL)	--	--	--	--	--
Antimony, mg/L	--	0.006	< 0.003 - 0.005	0.005 - 0.006	< 0.002	--	--
Arsenic, mg/L	0.00005	0.01	< 0.001 - 0.002	0.002 - 0.003	< 0.002	--	ND
Barium, mg/L	1.0	2	< 0.1	< 0.1 - 0.4	< 0.1	--	--
Beryllium, mg/L	--	0.004	< 0.003	0.0008 - 0.003	< 0.002	--	--
Cadmium, mg/L	0.01	0.005	< 0.001 - 0.002	0.002	< 0.002	--	ND
Calcium, mg/L	--	--	47 - 51	101 - 121	17 - 20	--	33 - 35
Chromium, mg/L	0.05	0.1	< 0.007 - 0.01	0.01 - 0.02	< 0.01	--	ND

TABLE 4: WATER QUALITY SUMMARY

ANALYTE GROUP / Analyte	Groundwater (WAC 173-200-040)	Drinking Water MCL/SMCL (WAC 246-290-310)	Native Groundwater			Source Water	
			Qpg		TQu	Budd Inlet Reclaimed Water ⁽¹⁾	Martin Way Reclaimed Water ⁽²⁾
			Wells S21, S22, S28	Well S29	Well S19, S31		
			Result	Result	Result	Result	Result
Copper, mg/L	1	1.3**	< 0.02 - 0.05	0.026 - 0.04	< 0.02	--	0.0034 - 0.014
Iron, mg/L	0.3	0.3 (SMCL)	< 0.1	< 0.1 - 0.198	< 0.03 - 0.35	--	ND - 0.025
Lead, mg/L	0.05	0.015**	< 0.001 - 0.02	< 0.001 - 0.011	< 0.001	--	ND
Magnesium, mg/L	--	--	--	--	< 0.01	--	9 - 10
Manganese, mg/L	0.05	0.05 (SMCL)	< 0.01	< 0.01 - 0.014	< 0.01 - 0.09	--	0.002 - 0.0072
Mercury-CVAFS, mg/L	0.002	0.002	< 0.0002 - 0.0005	0.0004 - 0.01	< 0.0005	--	ND
Nickel, mg/L	--	0.1	< 0.005 - 0.04		< 0.04	--	ND
Selenium, mg/L	0.01	0.05	< 0.002	0.04 - 0.1	< 0.005	--	ND
Silver, mg/L	0.05	0.1 (SMCL)	0.01	0.01 - 0.1	< 0.001	--	ND
Sodium, mg/L	--	20**	7 - 8	11 - 11.5	5 - 9	--	50 - 60
Thallium, mg/L	--	0.002	< 0.001 - 0.002	0.002	< 0.001	--	--
Zinc, mg/L	5.0	5	< 0.2	< 0.2	< 0.05	--	0.076 - 0.11
MISCELLANEOUS							
Color, C.U.	15	15	< 5	< 5 - 15	2 - 5	--	--
pH, S.U.	6.5-8.5	6.5 to 8.5 (SMCL)	7.2	--	--	6.82 - 7.16	7.07 - 7.28
Total Dissolved Solids , mg/L	500	500 (SMCL)	--	220	140	290 - 420	330 -370
BACTERIOLOGICALS							
E. Coli	--	--	Absent; < 1	Absent; < 1	Absent; < 1	--	Absent - Present
Total Coliform (Presence/Absence)	1	Absent	Absent; < 1	Absent; < 1	Absent; < 1	<1 - 9.5	Present

TABLE 4: WATER QUALITY SUMMARY

ANALYTE GROUP / Analyte	Groundwater (WAC 173-200-040)	Drinking Water MCL/SMCL (WAC 246-290-310)	Native Groundwater			Source Water	
			Qpg		TQu	Budd Inlet Reclaimed Water ⁽¹⁾	Martin Way Reclaimed Water ⁽²⁾
			Wells S21, S22, S28	Well S29	Well S19, S31		
			Result	Result	Result	Result	Result
RADIOLOGICALS							
Gross Alpha, pCi/L	15	15	0.42 - 3	3	< 3	--	--
Gross Beta, pCi/L	50	4 millirem/yr	--	--	1	--	--
Radium 228, pCi/L	5+	5+	< 1 - 0.22	< 1	< 1	--	--

Notes: (1) Wastewater and Reclaimed Water Quality Characterization (Task 1.3), LOTT Clean Water Alliance Reclaimed Water Infiltration Study, Technical Memorandum, February 7, 2017, and
 (2) Tracer Test and Water Quality Monitoring (Task 2.1.3), LOTT Clean Water Alliance Reclaimed Water Infiltration Study, Report, October 30, 2019.

--: Not reported

** : Not regulated by the WA State Board of Health, but acknowledged to have a public health significance. Levels shown are "action levels" set by the EPA and referenced in WAC 246-290-310

†: As combined radium

ND: Not Detected

MCL: Maximum Contaminant Level

mg/L: Milligrams per liter

pCi/L: Picocuries per liter

SMCL: Secondary Maximum Contaminant Level

This page left intentionally blank