CITY OF MERCER ISLAND

GENERAL SEWER PLAN

Project Contract No. 9925A00

November 2018

FINAL

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City of Mercer Island

General Sewer Plan

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LIST OF ABBREVIATIONS

AACE	American Academy of Cost Engineers
AC	Asbestos Cement
ADWF	Average Dry Weather Flow
BMP	Best Management Practice
BWF	Base Wastewater Flow
CAO	critical areas ordinance
ccf	hundred cubic feet
CCTV	Closed-Circuit Television
cf	cubic feet
CI	Cast Iron
CIP	Capital Improvements Program
CIPP	Cured In-Place Pipe
City	City of Mercer Island
CMMS	Computerized Maintenance Management System
CMOM	Capacity, Management, Operation, and Maintenance
Corps	U.S. Army Corps of Engineers
CPP	Countywide Planning Policies
d	depth
D	Diameter
d/D	depth to pipe diameter ratio
DI	Ductile Iron
DNS	Determination of Non-Significance
DOH	Washington State Department of Health
DWF	Dry Weather Flow
Ecology	Washington State Department of Ecology
ENR	Engineering New Report
ESA	Endangered Species Act
FCS	Financial Consulting Solutions Group, Inc.
FG	Fiberglass Reinforced
FOG	Fats, Oil, and Grease
FRC	fast response corresponding mainly to direct inflow
ft	feet
G	General
GIS	Geographic Information System
GMA	Growth Management Act
gpad	gallons per acre per day
GWI	Groundwater Infiltration
HDPE	High-Density Polyethylene
HGL	Hydraulic Grade Line

HGMH	Hydraulic Gradient Manhole
HMI	Human Machine Interface
I/I	infiltration and inflow
Island	Mercer Island
KCC	King County Code
KCDNR	King County Department of Natural Resources
L	Lakeline
LF	Linear Foot
LTGO	Limited General Obligation
MACP	Manhole Assessment and Certification Program
mgd	million gallons per day
MH	manhole
MICC	Mercer Island City Code
MSGP	Municipal Stormwater General Permit
n	Manning coefficient
NAD	National American Datum
NASSCO	National Association of Sewer Service Companies
NAVD 88	North American Vertical Datum of 1988
NEHRP	National Earthquake Hazards Reduction Program
NMFS	National Marine Fisheries Service
O&M	Operation and Maintenance
P	Pipe
PACP	Pipeline Assessment and Certification Program
Plan	General Sewer Plan
PS	Pump Station
PWTF	Public Works Trust Fund
PWWF	Peak Wet Weather Flow
PVC	Polyvinyl Chloride
R&R	Repair and Replacement
RCP	Reinforced Concrete Pipe
RCW	Revised Code of Washington
RDII	Rainfall Derived Infiltration and Inflows
RUL	Remaining Useful Life
RWSP	Regional Wastewater Services Plan
SCADA	Supervisory Control and Data Acquisition
SEPA	State Environmental Protection Act
SOP	Standard Operating Procedure
SPU	Seattle Public Utilities
SRC	Slow response corresponding mainly to infiltration
SSO	Sanitary Sewer Overflow
UID	Utility Improvement District

ULID	Utility Local Improvement District
UTRC	Utilities Technical Review Committee
WAC	Washington Administrative Code
WaPUG	Wastewater Planning Users Group
WWF	Wet Weather Flow

In accordance with Washington Administrative Code (WAC) 173-240, the City of Mercer Island (City) is required to have a general sewer plan (Plan) that demonstrates the City's ability to provide service that meets or exceeds the requirements of the State. The Plan is intended to provide the City with a "living" plan that can be used and adapted to assist in decision making for the next 20 years. The Plan represents a large revision of the City's last Plan, completed in 2003 (City of Mercer Island, February 2003).

ES.1 SYSTEM DESCRIPTION

The City's service area encompasses the entire island of Mercer Island (Island), which is located in the southern half of Lake Washington. The City has operated its sewer system since 1975, when it assumed ownership of a portion of the system when the Mercer Island Sewer District was disbanded. The City assumed ownership of the East Mercer Sewer District system in 1988 – see Section 2.2.1 and 3.2.1 for more details. The City's sewer system comprises numerous gravity collection pipes, as shown in Figure ES.1, which were constructed between 1955 and 1965. The Sewer system follows the steep terrain of the Island down toward Lake Washington and into the Lakeline sewer system. The Lakeline system discharges flow to King County Department of Natural Resources (KCDNR) interceptors at the northern and southern ends of the Island for ultimate treatment and disposal.

The City is essentially built-out, with majority growth expected to occur through redevelopment of the Town Center. The existing system is aging and will continue to require investment to meet the City's level of service goals.

Note, the City's service area does not include small, privately owned collection systems that serve the Shorewood Apartment Complex and the Covenant Shores Development. Shorewood Apartments discharges directly to KCDNR facilities. Covenant Shores discharges directly to the City's Lakeline System – See Section 2.1.2.2 for more detail.

ES.2 GENERAL SEWER PLAN PURPOSE

The primary purpose of this Plan is to develop a "living" document that is flexible and that can be readily modified to respond to ongoing redevelopment activities, such as the projected density growth in the Town Center, and maintenance requirements. This Plan is consistent with the land use designations and build-out projections detailed in the *Comprehensive Plan of the City of Mercer Island* (City of Mercer Island, 6/2016).

KCDNR North Mercer Pump Station

Pump Station 1

Pump Station 4

Pump Station 10

Lift Station 11

Flushing Station 12

Pump Station 13

Pump Station 14

Pump Station 15

Pump Station 16

Pump Station 17

Pump Station 18

Pump Station 19

Pump Station 20

Pump Station 21

Pump Station 22

Pump Station 23

Pump Station 24

Pump Station 25

KCDNR South Mercer Pump Station

Lake Washington

W Shorewood

E Shorewood

Sunset Highway

SE 22nd St

SE 22nd Pl

SE 24th St

SE 25th St

SE 27th St

SE 28th St

SE 29th St

SE 30th St

SE 30th Pl

SE 32nd St

SE 33rd St

SE 34th St

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84th Ave SE

86th Ave SE

87th Ave SE

88th Ave SE

89th Ave SE

90th Ave SE

91st Ave SE

92nd Ave SE

93rd Ave SE

96th Ave SE

98th Ave SE

72nd Ave SE

76th Ave SE

77th Ave SE

67th Ave SE

71st Ave SE

74th Ave SE

78th Ave SE

72nd Pl SE

76th Pl SE

77th Pl SE

79th Pl SE

80th Ave SE

81st Ave SE

83rd Ave SE

85th Pl SE

86th Pl SE

88th Pl SE

90th Pl SE

91st Pl SE

Fortuna Dr

Island Crest Way

Merrimount Dr

Maple Ln

Forest Ave SE

Evergreen Ln

Holly Ln

Blvd Pl

W Mercer Way

E Mercer Way

Mercerwood Dr

Shorecrest Dr

Fern Hollow

Fernecroft Rd

Dawn Dr

Bonney St

Brook Bay Road

Parkside Ln

Blackford

Meadow Ln

W Ridge Rd

Bluecrest Ln

Lewis Ln

Avalon Dr

Hillside Ln

SE Gallagher Hill Rd

Legend

- King County Pump Station
- Mercer Island Pump Station
- Force Main
  - King County
  - Mercer Island
- Lakeline Main
- Gravity Main by Diameter
  - 10" or Larger
  - 8"
  - 6" or Smaller
- King County Gravity Main
- Service Area Boundary

0 1,500 3,000 Feet

Figure ES.1
Sewer System
General Sewer Plan
City of Mercer Island

carollo

ES.3 APPROVALS

This Plan is required to meet state, county, and local requirements and complies with the requirements of the Washington State Department of Ecology (Ecology) as set forth in WAC 246-271-040, and the Revised Code of Washington (RCW) as set forth in 90.48.110. This Plan is also consistent with KCC 13.24 (Water and Sewer Comprehensive Plans) with respect to sewer system planning. It has been reviewed under the State Environmental Protection Act (SEPA). King County and Ecology must review and approve the Plan. The City Council will approve the final Plan following all other approval processes. Approvals are documented in Appendix A, B, and C. (to be included at a later date).

ES.4 POLICIES AND CRITERIA

Polices and criteria regulate the manner that the City operates and plans for its future. The City's policies and criteria are detailed in the Mercer Island City Code (MICC), the Comprehensive Plan, City ordinance, and through adoption of this and other plans. The following policies and criteria are summarized in Chapter 2. The financial policies and criteria are summarized in Chapter 7.

- Side Sewers
- System Maintenance
- Fats, Oil, and Grease Program
- Design Criteria
- Analysis Criteria

ES.5 CAPACITY EVALUATION

As growth occurs, additional customer flows can exceed sewer capacity. Future growth is anticipated in the Town Center as it increases in density. Chapter 4 describes the development of flow projections and the capacity analysis of the City's Town Center area collection system. An existing hydraulic model of the City's Town Center area collection system was used as a basis to perform a capacity analysis. Capacity deficiencies and proposed improvements to provide sufficient capacity for future development are detailed in the Chapter.

ES.5.1 Hydraulic Modeling Overview

The City’s collection system hydraulic model was constructed using a multi-step process utilizing data from a variety of sources. The latest version (2016) of DHI’s Mike Urban was used to update the hydraulic model.

The City conducted temporary flow monitoring to gain a better understanding of flows in the Town Center and calibrate hydraulic model predicted flows to actual collection system flows.

ES.5.2 Capacity Criteria

The primary criterion used to identify capacity-deficient trunk sewers was the maximum flow depth to pipe diameter ratio (d/D) less than or equal to one. The d/D value is defined as the depth (d) of flow in a pipe during peak flow conditions divided by the pipe's diameter (D).

During peak wet weather conditions, water levels surcharging above the top of pipe (a d/D of 1) were considered deficient.

ES.5.3 Capacity Evaluation

The capacity evaluation was performed for only the Town Center for two land use planning conditions, Existing and Build-out, under a design storm.

Sewer improvements were sized to a d/D of 0.75, which is consistent with the City's Sewer Standards, approved as part of this Plan, for new pipes.

ES.5.4 Recommended Piping Improvements

Improvements were recommended to alleviate the capacity issues under the planning conditions. Improvements to provide sufficient capacity throughout the system mainly include upgrades to pipe diameters. Figure ES.2 illustrates the proposed sewer improvements required to meet the d/D criteria. A total of approximately 3,300 linear feet of pipes ranging from 12-inch to 16-inch are recommended to alleviate capacity deficiencies identified.

It is recommended to expand the hydraulic model to the entire system to determine if additional capacity limitations exist.

ES.6 OPERATION AND MAINTENANCE

Regular Operation and Maintenance (O&M) is required to provide effective and efficient maintenance services for utility rate payers. Delayed O&M may contribute to adverse sewer events, including sewer backups, sanitary sewer overflows (SSOs), pipe breaks, etc. Chapter 5 considers the City's existing and planned O&M activities and programs and provides recommendations to improve existing or address future needs. These activities are greater than the current level of service; therefore, additional workforce may be required in the future to meet City goals.

ES.6.1 Accessibility Improvements

Continued efforts to enhance access along Easements/Right-of-Way for both pump stations and pipelines is recommended. In the short-term, the program is to support construction activities required to address items identified in the Pump Station Condition Assessment. The program is to consider both land easements/right-of-way and docks required for pump station and Lakeline sewer access.

Figure ES.2
Proposed Pipe Capacity
- Related Improvement Projects
General Sewer Plan Update
City of Mercer Island

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ES.6.2 O&M Equipment and Services

The O&M evaluation identified several areas where new O&M equipment and services are recommended, including:

1. Consider contracting with a vendor or purchasing a boat to improve access to several pump stations that have limited land access.
2. Obtain a maintenance agreement with contractor/consultant for ongoing/regular supervisory control and data acquisition (SCADA) system upkeep.

ES.6.3 Lakeline and Pump Station Improvements

A comprehensive condition assessment of the Lakeline and pump stations is recommended. It is expected that the Lakeline and Pump Station assessment will require a phased approach:

1. The first phase should seek to establish access to the Lakeline, and pump stations.
2. The second phase should seek to conduct a comprehensive condition assessment of the Lakeline. Previously identified high priority pump station maintenance issues should be addressed, where possible.
3. The third phase will develop repair and replacement (R&R) needs for the Lakeline and pump stations, as well as updates to standard operating procedures. Prioritize improvements using risk.

The City has recently completed a pump station condition assessment and its improvement recommendations should be implemented in recommended time frames. Many of the small improvements may be implemented by City Staff or under a small works contract.

ES.6.4 R&R Program

Consider establishing a phased R&R Program to address pump station renewal and long-term management of the collection system:

- Continue and expand the existing closed-circuit television (CCTV) inspections using National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) / Manhole Assessment and Certification Program (MACP) compliant inspection protocols.
- Continue and expand Sewer Main and Manhole replacement, and Backyard Main Replacement activities.
- Develop a comprehensive R&R program. The program may address up to 11,000 feet (2.1) miles of pipe per year through 2029 and an additional 29,000 feet of low and medium priority pipes, as shown in Figure ES.3. Refine the pipeline replacement timing and prioritization as additional information is available.

Note
Pipes without diameter label are 8" and less

Legend

Pipeline Replacement Prioritization
- Low Priority
- Medium Priority
- High Priority

- Lakeline Gravity Main
- Data Unavailable
- Private Pipelines
- King County Pipelines
- Service Area Boundary

Feet
0 1,500 3,000

Figure ES.3
Pipeline Replacement Prioritization
General Sewer Plan Update
City of Mercer Island

ES.7 CAPITAL IMPROVEMENT PLAN

The Plan recommendations were incorporated into the City's Capital Improvements Program (CIP) for the wastewater system. The purpose of the CIP is to provide the City with a 20-year guideline for planning and budgeting of its wastewater system. The CIP consists of proposed projects, cost estimates, and a schedule.

ES.7.1 Projects

CIP projects are based on recommended system improvements and R&R projects. Total CIP costs by category are summarized in Table ES.1.

ES.7.2 Cost Estimates

The CIP cost estimates presented in Table ES.1 are American Academy of Cost Engineers (AACE) Class 4 estimates. Class 4 estimates are budget level estimates. Actual costs may vary from these estimates by -30 percent to +50 percent. These costs were determined based on the City's and Consultant’s perception of current conditions at the project locations. Costs presented in this chapter are in 2017 dollars (Engineering New Report (ENR) 20 City Index of 10532) and have not been escalated.

ES.7.3 Schedule

CIP projects were allocated into one of three planning periods based on technical need and available City resources:

- Short-term (2019-2024)
- Medium-term (2025-2028)
- Long-term (2029-2038)

The short-term planning horizon is allocated to individual years to be consistent with the City’s CIP planning. Projects in medium- and long-term planning horizons do not provide the same level of specificity, reflecting the uncertainty in future needs and City resources. The project timing in this table is subject to change as the City regularly reviews and updates its CIP based on changing conditions and priorities.

Table ES.1 CIP Project Summary
General Sewer Plan
City of Mercer Island

Project Type	Total CIP Cost Estimate	CIP Phasing								
		2019	2020	2021	2022	2023	2024	Short-term (2019-2024)	Mid-term (2025-2028)	Long-term (2029-2038)
General	$1,779,600	$279,800	$138,800	$104,000	$ -	$104,000	$ -	$626,600	$300,500	$852,500
Pipe	$68,164,600	$337,000	$581,300	$555,800	$631,300	$437,000	$946,500	$3,488,900	$18,668,700	$46,007,000
Pump Station	$12,453,900	$499,500	$407,000	$1,063,800	$1,100,800	$786,300	$333,000	$4,190,400	$4,563,500	$3,700,000
Lakeline	$38,355,000	$185,000	$370,000	$185,000	$185,000	$495,000	$495,000	$1,915,000	$6,195,000	$30,245,000
CIP Total	**$120,753,100**	**$1,301,300**	**$1,497,100**	**$1,908,600**	**$1,917,100**	**$1,822,300**	**$1,774,500**	**$10,220,900**	**$29,727,700**	**$80,804,500**
Annual Cost	$6,038,000	$1,301,300	$1,497,100	$1,908,600	$1,917,100	$1,822,300	$1,774,500	$1,703,000	$7,432,000	$8,080,000

ES.8 FINANCIAL EVALUATION

The City operates the sewer system as a self-supporting utility. The Sewer Utility is designed to operate like a business, charging rates for the purpose of removing sewer from City residents. All expenses are supported through rates charged to City residents and businesses. The City also has a financial policy of funding capital projects on a pay-as-you-go basis, however, the City will occasionally finance major capital projects with debt.

A projection of the annual utility revenues, expenses, and fund balances for the next six years, based on the 2017-2018 adopted biennial budget and changes expected to occur in the various categories over the subsequent six-year period. These changes are anticipated to be a result of new customers, declining water use (the basis for commercial and public sewer rates), general inflation, anticipated changes to the capital reinvestment plan and other related factors. This type of forecast is routinely used by Finance staff for planning purposes only. Based on this projection, the City will be able to fund the proposed CIP on a pay-as-you go basis.

The financial evaluation does not set billing rates. Rates are set by the City Council with a recommendation from the Utility Board. City staff and public provide input as part of the Utility's budget adoption.

The City has prudently issued little debt over the years, maintaining a sizable debt capacity. The City has consistently followed a conservative fiscal management policy, which is reflected by the Aaa rating from Moody's Investors Service (2017). The City has no immediate plans to issue additional debt. However, if this action becomes necessary, the City can expect a proposed bond issue to receive a similarly favorable credit rating and, therefore, to sell at lower interest rates than would otherwise be possible.

When grant opportunities are available and line up with current Sewer Utility capital reinvestment needs, City Staff pursue grant opportunities. However, there have not been many grants available to the Island in recent years.

SUMMARY AND INTRODUCTION

The City of Mercer Island (City) is updating its General Sewer Plan (Plan) to provide a road map for redevelopment and maintaining a high level of service for existing customers. The City's service area encompasses the entire island of Mercer Island (Island), which is located in the southern half of Lake Washington, as shown in Figure 1.1. The City is essentially built-out, where majority growth is expected to occur through redevelopment of the Town Center. The existing system is aging and will continue to require investment to maintain a high level of service. The Plan is intended to provide the City with a "living" plan that can be used and adapted to assist in decision making for the next 20 years.

The City has completed three previous sewer plans:

1. Sewer System Comprehensive Plan - Final Report (City of Mercer Island, January 1987),
2. Comprehensive Sewer Plan Update (City of Mercer Island, March 1995), and
3. General Sewer Plan (City of Mercer Island, February 2003).

The 1987 plan was a Comprehensive Sewer Plan that identified areas where infiltration and inflow (I/I) exceeded Metro's (now King County Department of Natural Resources (KCDNR)) allowance of 1,100 gallons per acre per day (gpad), and identified capacity concerns in two basins. The 1995 plan was an update limited specifically to the condition of the Lakeline System and evaluation of a few select basins. The 2003 plan provided a comprehensive evaluation of the system and guided the City in its single largest capital improvement project since the construction of the system, the Sewer Lakeline System Replacement of Reach 3.

This Plan was prepared in accordance with requirements of WAC 173-240-050, which is administered by the Washington State Department of Ecology (Ecology), and meets the requirements of the Washington Growth Management Act.

1.1 BACKGROUND AND GOALS

The City has operated a majority of its sewer system since 1975, when the Mercer Island Sewer District was dissolved. The City's sewer area also includes the East Mercer Sewer District, which previously operated as a separate agency and provided sewer services for 252 acres on the northeast part of the Island. The City's service area coincides with the City boundaries that encompasses the entire Island. It does not include small, privately owned collection systems that serve the Shorewood Apartment Complex, which discharges directly to KCDNR facilities.

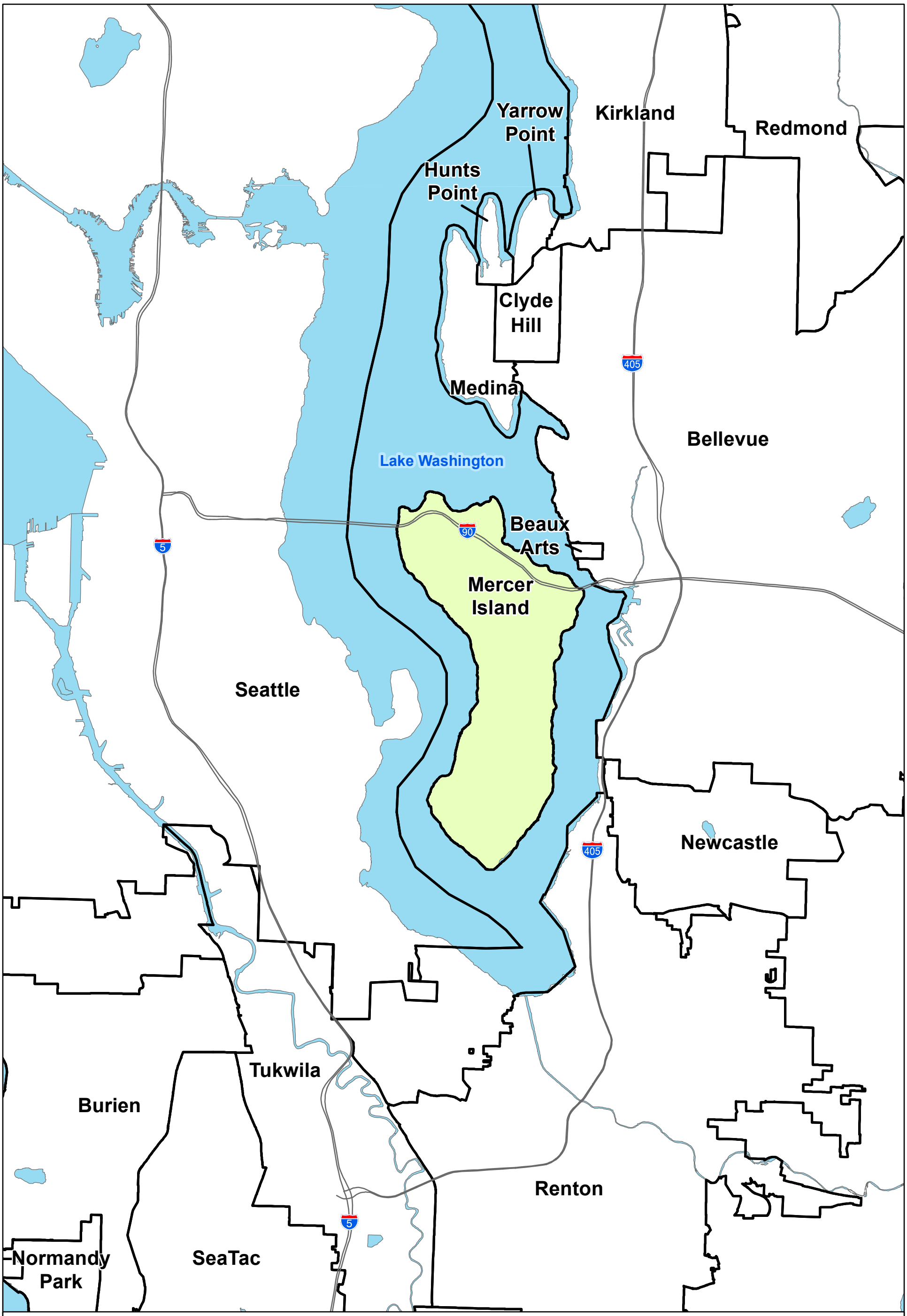

Figure 1.1
Vicinity Map
General Sewer Plan
City of Mercer Island

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The City's sewer system comprises numerous gravity drainage basins that follow the steep terrain down toward Lake Washington and into the Lakeline system. The Lakeline system discharges flow to KCDNR interceptors at the northern and southern ends of the Island for ultimate treatment and disposal through a series of pump stations and gravity mains within Lake Washington.

1.1.1 Previous Plans

Ecology mandated that no sewage overflows into Lake Washington would be allowed after July 1, 1988. This mandate became the driving force behind the 1987 plan, whose goals were to prevent overflows into Lake Washington and to provide conveyance capacity for existing and future users. The 1987 plan included an assessment of the sewer system's capacity and reliability, and limited testing for I/I. This testing showed that I/I in portions of the northern half of the City's sewer system exceeded the Metro allowance of 1,100 gpad. The 1987 plan recommended that the City improve the reliability of its sewer system by disconnecting sources of inflow to show immediate results, with the provision that infiltration might need to be addressed in the future.

The 1995 plan further investigated issues identified in the 1987 plan and made recommendations to address these issues. This investigation included a condition assessment of the Lakeline system. The cast iron portions were found to be structurally sound. The asbestos cement (AC) portions, although they were found to have sufficient pipe strength at the time, exhibited brittleness and had inadequate ground cover, making these portions of the pipe a notable risk. The Lakeline has limited points of access, so the 1995 plan recommended developing an emergency response plan to deal with operational problems along the Lakeline system. The 1995 plan further investigated the sources of I/I that were noted in the 1987 plan by using smoke testing and closed-circuit television (CCTV) inspection. This investigation pinpointed significant sources of inflow and recommended that those sources be disconnected. The CCTV inspection also noted areas of root intrusion, deteriorated joints, and portions of the pipe that showed structural deficiencies.

The 2003 plan provided a guide for future redevelopment and to define elements required for continued reliable sewer service, while protecting the environment. The Plan addressed important changes in federal regulations and local requirements, including the listing of endangered species in Lake Washington, I/I requirements from KCDNR, and Capacity, Management, Operation, and Maintenance (CMOM) requirements. A hydraulic model was developed to identify improvements needed to meet future growth in the Town Center and evaluate the Lakeline System. The plan summarized recommendations for the now completed Lakeline Replacement Project, which was the single largest capital project since the construction of the sewer system. The plan also documents operation and maintenance (O&M) procedures and issues, including FOG policies.

A capital improvement program (CIP) was developed and a financial evaluation was conducted to recommend methods to fund the CIP.

1.1.2 General Sewer Plan Goals

The primary purpose of this Plan is to develop a "living" document that is flexible and that can be readily modified to respond to ongoing redevelopment, such as the anticipation for the Town Center, and maintenance. This Plan is consistent with the land use designations and build-out projections detailed in the *Comprehensive Plan of the City of Mercer Island* (City of Mercer Island, 6/2016).

The goals of this General Sewer Plan include:

- Prepare the Plan in compliance with WAC Chapter 173-240-050.
- Prepare the Plan to be consistent with King County Code 28.84.050 (pages 28-50).
- Incorporate the newest regulations, studies, and ordinances.
- Use the most recent information to identify improvements needed to meet future Town Center growth.
- Incorporate rehabilitation and renewal of the existing system.
- Evaluate current O&M practices.
- Present a clear and concise CIP and implementation strategy.

1.2 RELATED DOCUMENTS

The Plan relies on previous plans, studies, and reports for guidance and technical information. A brief summary of related documents are provided below.

King County Comprehensive Plan 2012 (King County, November 2013). Establishes an overall direction for land use planning in King County.

City of Mercer Island Engineering Standards, Sanitary Sewer System Division 7 (City of Mercer Island, 2009). Provides specifications and design criteria for sanitary sewer systems within the City's service area.

Maintenance Work Design Project (City of Mercer Island, 2001). Documents processes and procedures used in maintaining the sewer system.

Telemetry System Strategic Plan (CDM, 2002). Assesses the City's instrumentation, telemetry, monitoring, and control systems for the water and wastewater treatment utility.

Criteria for Sewage Works Design (Ecology, 2008). Provides guidance for the design of municipal sewer systems and establishes minimum requirements in the State of Washington.

King County Code, 28.84.050. Defines King County's sewage disposal rules and regulations under Title 28 - Metropolitan Functions, Chapter 28.84 Water Pollution Abatement.

King County Countywide Planning Policies (King County, December 2012). Provides framework for comprehensive plans for King County and cities within the County.

Regional Wastewater Service Plan Comprehensive Review (June 2014). Review and update of the Regional Wastewater Service Plan adopted in 1999, which documents King County's capital improvement plan for wastewater services.

Town Center Plan, Mercer Island 1994. Established design guidelines and code requirements for the Town Center. An update to the plan is underway, referred to as the Town Center Visioning Process or 2015 Town Center Code Update process.

Washington Administrative Code, Title 173. Defines the structure of general sewer plans.

1.3 APPROVALS

This Plan is required to meet state, county, and local requirements, and complies with the requirements of Ecology as set forth in WAC 246-271-040, and the Revised Code of Washington (RCW) as set forth in 90.48.110. This Plan is also consistent with King County Code (KCC) 13.24 (Water and Sewer Comprehensive Plans) with respect to sewer system planning.

King County and Ecology must review and approve the Plan. In King County, the Plan will be reviewed by the Utilities Technical Review Committee (UTRC) and approved by the King County Executive. Since Mercer Island does not serve unincorporated King County, King County Council approval is not necessary. Note, no adjacent utilities and local governments have jurisdiction to assess consistency with ongoing and adopted planning efforts outside King County and Ecology. The Adopting Resolution is included in Appendix A. See Appendix B for the State Environmental Protection Act (SEPA) and Determination of Non-Significance (DNS) documents. See Appendix C for the agency and King County comments.

1.4 ORGANIZATION AND CONTENTS

A brief summary of the contents of each chapter of this General Sewer Plan are provided below.

Chapter 2 - Planning Considerations. Summarizes policies, criteria, and standards. Defines the existing sewer service boundary, land use, and surrounding area characteristics.

Chapter 3 - Existing Sewer System. Describes the existing sewer system components. Sewer system design criteria are presented and City standards that are more stringent than Ecology's are highlighted.

Chapter 4 - Collection System Analysis. Presents flow projections and pipe capacity evaluation for the Town Center, using the updated and calibrated hydraulic model, and the lift station capacity evaluation. Summarizes existing condition assessments for the collection system and establishes a remaining useful life (RUL) for the gravity collection system.

Chapter 5 - Operation and Maintenance. Describes the City's O&M practices, documents ongoing maintenance issues, and recommends programmatic changes to address O&M issues.

Chapter 6 - Capital Improvement Program. Establishes recommended CIP projects to meet the City's sewer system needs through 2035. Provides cost estimates (in 2016 dollars) and anticipated scheduling of both individual and programmatic improvements.

Chapter 7 - Financial Analysis. Presents an analysis of the City's current sewer funding and a discussion of alternative methods of financing CIP projects.

Chapter 2

PLANNING CONSIDERATIONS

Planning considerations for the City of Mercer Island (City) sewer system are presented in this Chapter. The sewer service area, history, and surrounding area characteristics are summarized. Land use and zoning are presented and are used in subsequent chapters to predict future sewer flows. Regulatory considerations and City policies and criteria are summarized to provide direction and set the requirements for the entire General Sewer Plan.

2.1 SEWER SERVICE AREA AND RELATIONSHIP WITH KING COUNTY

The City is responsible for the collection and conveyance of sewerage within its service area to King County Department of Natural Resources (KCDNR) facilities for treatment, except the private Shorewood collection system.

2.1.1 Sewer Service Area

The City's Sewer Service Area coincides with the City boundaries, which encompasses the entire Island. There are two small privately owned areas near I-90, as shown in Figure 2.1. Two KCDNR facilities flow eastward conveying sewage off Mercer Island (Island) to the KCDNR's treatment facility in Renton.

2.1.2 Interagency Agreements

Interagency agreements serve as legal documents for the conveyance of sewage generated within one agency to the facilities of another agency. The City has an agreement with KCDNR.

2.1.2.1 KCDNR Agreement for Sewage Treatment and Disposal

On April 26, 1961, the City and KCDNR (formerly known as Metro) entered into an agreement for KCDNR for treatment and disposal of sewage generated within the City, which are provided for reference in Appendix D. The original agreement was amended on March 19, 1985 to extend the agreement by an additional 20 years. The amended agreement will continue in full force until July 1, 2036.

The agreement stipulates that Mercer Island will send all sewage to King County. It does not limit the amount of sewage flow or stipulate water quality limits for domestic sewage.

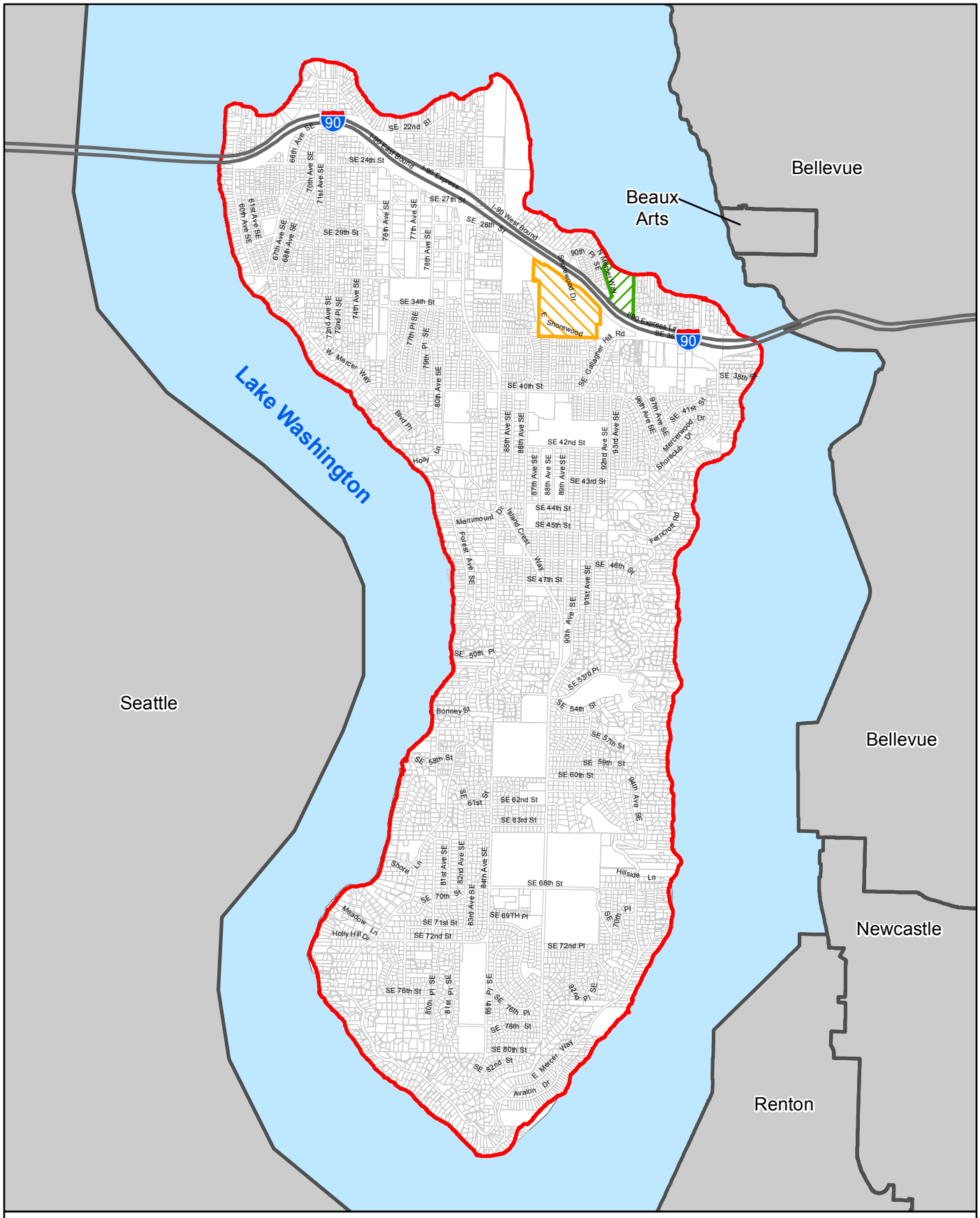

Figure 2.1
Service Area Boundary
General Sewer Plan
City of Mercer Island

carollo

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All of Mercer Island's sewage discharges to KCDNR interceptors located on the Island within the City's service area. Sewage collected north of SE 40th St flows to the KCDNR North Pump Station. Sewage collected south of SE 40th St flows to the KCDNR South Mercer Pump Station. All sewage from the City is treated at the King County South Treatment plant in Renton.

King County facilities within Mercer Island's service area are described in Chapter 3 - Existing System.

2.1.2.2 Private Collection Systems

Shorewood Apartments and the Covenant Shores Development each have privately owned collection systems. Shorewood Apartments is located south of I-90; its sewage is discharged north under I-90, directly into KCDNR facilities. The Covenant Shores Development is located north of I-90; its sewage is discharged north into the City-owned Lakeline where it flows east towards PS 11 and then into KCDNR facilities.

2.2 SEWER SERVICE AREA HISTORY

The City's sewage system was constructed in the 1950s and 1960s, and includes several sewer drainage basins. The steep topography of the Island allows the City to take advantage of the gravity flow; pump stations are used only to convey flow around the Island and into KCDNR facilities located within the City.

2.2.1 General History of Sewer Service in the City of Mercer Island

The majority of the sewage system was constructed in stages by the Mercer Island Sewer District through three Utility Local Improvement Districts (ULID) in 1955, 1958, and 1965. ULID 1, constructed about 1956, encompassed the northeastern corner of the Island. The City assumed control of these systems in 1975 when the Mercer Island Sewer District was dissolved. ULID 2, constructed in 1960, occupied the northern portion of the Island, excluding Shorewood Apartments, Covenant Shores Development, and the East Mercer Sewer District. ULID 3, constructed after 1964, covered about 2,340 acres on the southern half of the Island. The sewage system within the East Mercer Sewer District is believed to have been constructed in the 1950's as part of the Mercerwood plat development. The City assumed control of this system in 1988.

Within ULID 1, the Lakeline pipes were constructed of asbestos cement (AC). A portion of this AC pipe in the lake was replaced in the early 1960s with cast iron (CI) pipe as part of the Metro North Mercer Island Interceptor project. A second portion of the AC pipe in the lake was replaced in 2011 with ductile iron (DI) pipe as part of a City Lakeline Replacement project. The portions of the Lakeline constructed within ULID 2 and 3 were constructed of CI pipe.

2.2.2 Onsite Sewage Disposal Systems

Septic systems within Mercer Island's service area are under the purview of Seattle/King County Public Health. The City does not actively monitor the location of septic systems. Most properties are connected to the public sewer system. With the ongoing re-development of single-family properties on the Island, it is expected that most, if not all, septic systems have been decommissioned.

Policies 3.1, 3.2, and 3.3 in the Utilities Element of the City's Comprehensive Plan pertain to septic tanks.

2.3 SURROUNDING VICINITY CHARACTERISTICS

Mercer Island is a narrow island with steep sides located in the southern half of Lake Washington. The features of the Island are the result of glacial action and the erosion caused by receding glaciers.

2.3.1 Topography

Mercer Island has a large slender plateau that extends from north to south down the center of the Island, as shown in Figure 2.2. According to the North American Vertical Datum of 1988 (NAVD 88), the highest point on the Island is 394 feet near Rotary Park. The remainder of this narrow plateau is above 300-feet. Steep ravines, which surround most of the Island, extend from the plateau down to the shoreline, near an elevation of 18 feet. Northwest of the north-south-oriented plateau is a valley that falls below the 100 feet of elevation. This valley includes the Town Center and the Luther Burbank Park areas, which separates the narrow plateau from First Hill in the northwestern corner of the Island. First Hill is near an elevation of 300 feet.

2.3.2 Critical Areas

On November 21, 2005, the City adopted a Critical Areas Ordinance, which is reflected in Chapter 19.07 of the Mercer Island City Code (MICC). The purpose of the Critical Areas Ordinance is, pursuant to MICC 19.07.010, inclusive of the following:

A. To designate and protect critical areas as mandated by Chapter 36.70A RCW;

B. To include best available science in developing policies to protect the functions of critical areas as mandated by Chapter 36.70A RCW;

C. To prevent undue hazards to public health, safety, and welfare by minimizing impacts to critical areas;

D. To implement the city's comprehensive plan; and

E. To respond to the goals and objectives of the Washington State Growth Management Act, while reflecting the local conditions and priorities of Mercer Island.

Regulated critical areas on Mercer Island are identified as watercourses, wetlands, geohazard areas (including, seismic, landslide, and erosion hazard areas and steep slopes), and wildlife habitat conservation areas. Shoreline areas are not included within the definition of “critical areas.” Pipelines or facilities constructed in areas of steep slopes require careful consideration to minimize future hazards. Figure 2.3 shows slopes in two different categories: less than 15 percent, and greater than15 percent. As mentioned previously, the steep slopes occur predominantly on the perimeter of the Island, thus resulting in the numerous gravity drainage basins.

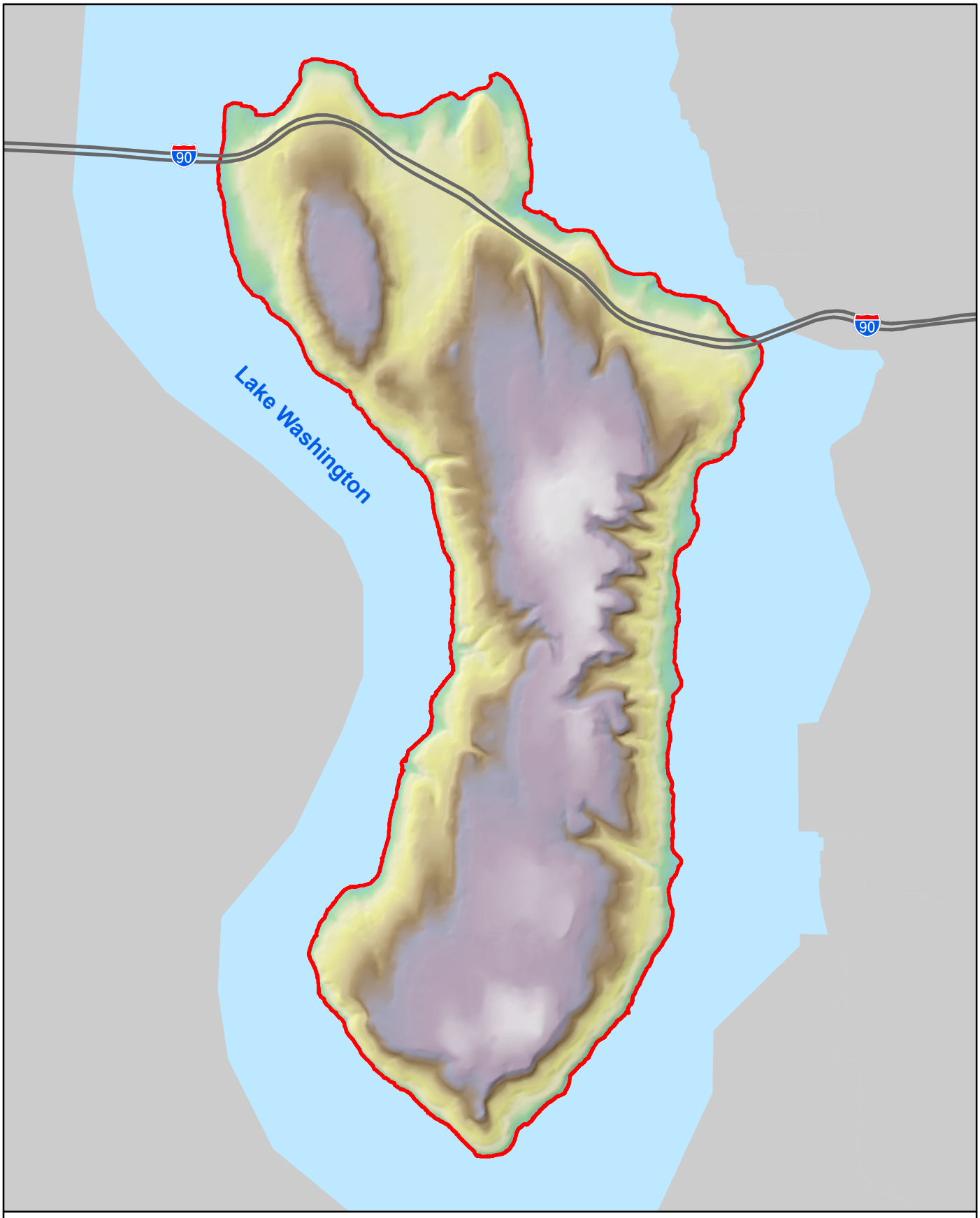
Seismic activity is common in the Puget Sound region. One of the major faults in this region is the Seattle Fault, which has an east-west orientation. Geologic evidence, as well as gravity surveys, indicates that the position of this fault can be approximated by I-90, which crosses the northern end of the Island. The National Earthquake Hazards Reduction Program (NEHRP) publishes general seismic categories to aid in design and construction, which are shown for the Island in Figure 2.4. Categories relate to the structural requirements that are incorporated into national and local building codes, where "A" is the most permissive and "F" is the most restrictive. Categories are a function of both the seismic vulnerability and the criticality of land use or building type.

2.3.3 Geology

The Vashon glacier formed many of the current day features in and around the Island. The Vashon glacier carved out Lake Washington and deposited glacial till on the higher elevations of the Island. Closed depressions within the till are poorly drained, which led to the formation of organic soils. As the glacier receded, large amounts of water discharged from the glacier sorted the gravel and sand within the glacier as the gravel and sand settled. These gravelly sandy layers of glacial outwash range in thickness from 4 to 100 feet. Silty lacustrine sediments are found on the steep slopes in the valley that separates First Hill, in the northwest portion of the Island, from the narrow plateau in the center of the Island.

2.3.4 Soils

Island Soils are glacier deposits with slow to medium runoff potential with limited infiltration. A more steeply sloped area may have rapid to very rapid runoff potential. Alluvial and terrace soil deposits along the steep slopes and shorelines of the Island and in the valley, separate the First Hill from the remainder of the Island. Characteristics of the alluvial and terrace soil deposits may vary, but are generally well drained. Seasonal high groundwater levels occur throughout the Island, with strong local variability depending on soils and slope. Seasonal and annual variability should be expected, since groundwater levels on the Island are based solely on local precipitation, except on shorelines.



Legend

Elevation

High : 380'

Low :0'

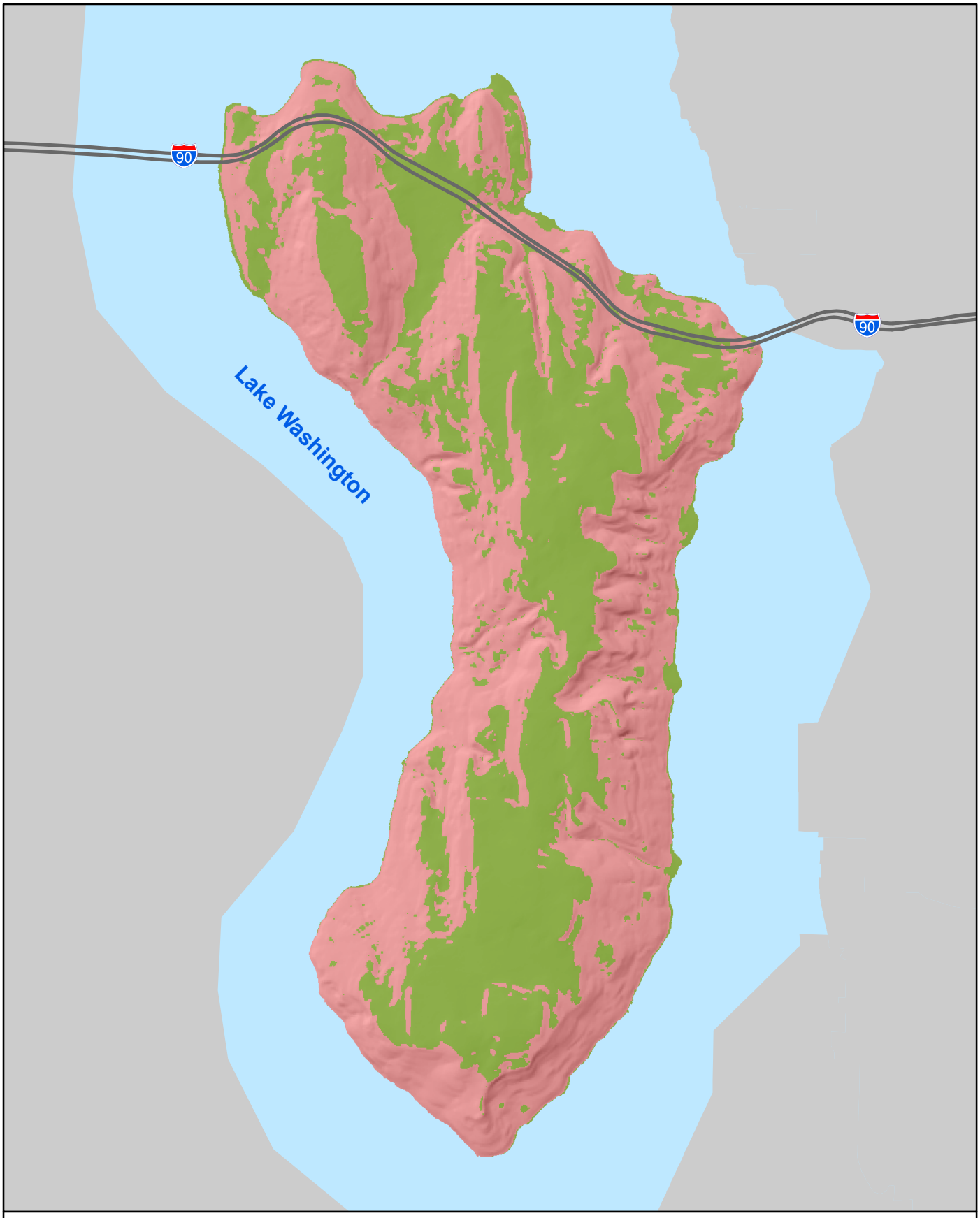
Mercer Island City Limits

I 90

N

0 1,500 3,000 Feet

Figure 2.2
Topography
General Sewer Plan
City of Mercer Island
carollo



Legend

Slope

- Less than 15%
- Greater than 15%

I 90

N

0 1,500 3,000 Feet

Figure 2.3
Critical Slope
General Sewer Plan
City of Mercer Island

carollo

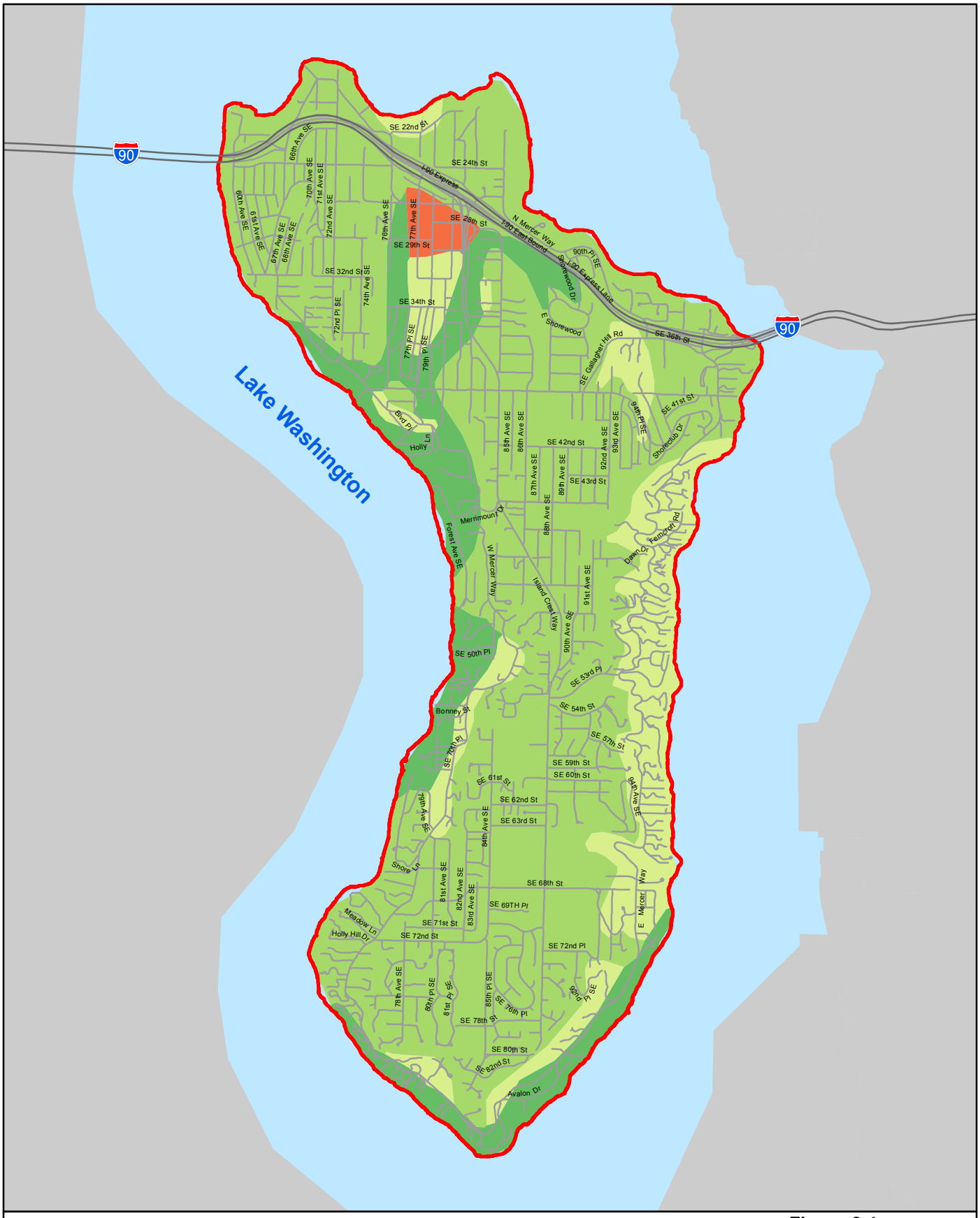


Figure 2.4
Seismic Class
General Sewer Plan
City of Mercer Island

carollo

2.3.5 Climate

Maritime air from the Pacific Ocean is the major climate feature for Mercer Island, and the Puget Sound region, leading to pronounced wet and dry seasons. Average annual rainfall for Mercer Island is 36 inches. The majority of the rain occurs as low-intensity, long duration storms, but occasional thunderstorms and intense rainfall events do occur.

Seventy-five percent of the rainfall occurs between October and March. During this time, the Puget Sound area is characterized by low clouds and relatively high humidity. High groundwater levels and stream flows on the Island can occur during the wet winter season and in the spring.

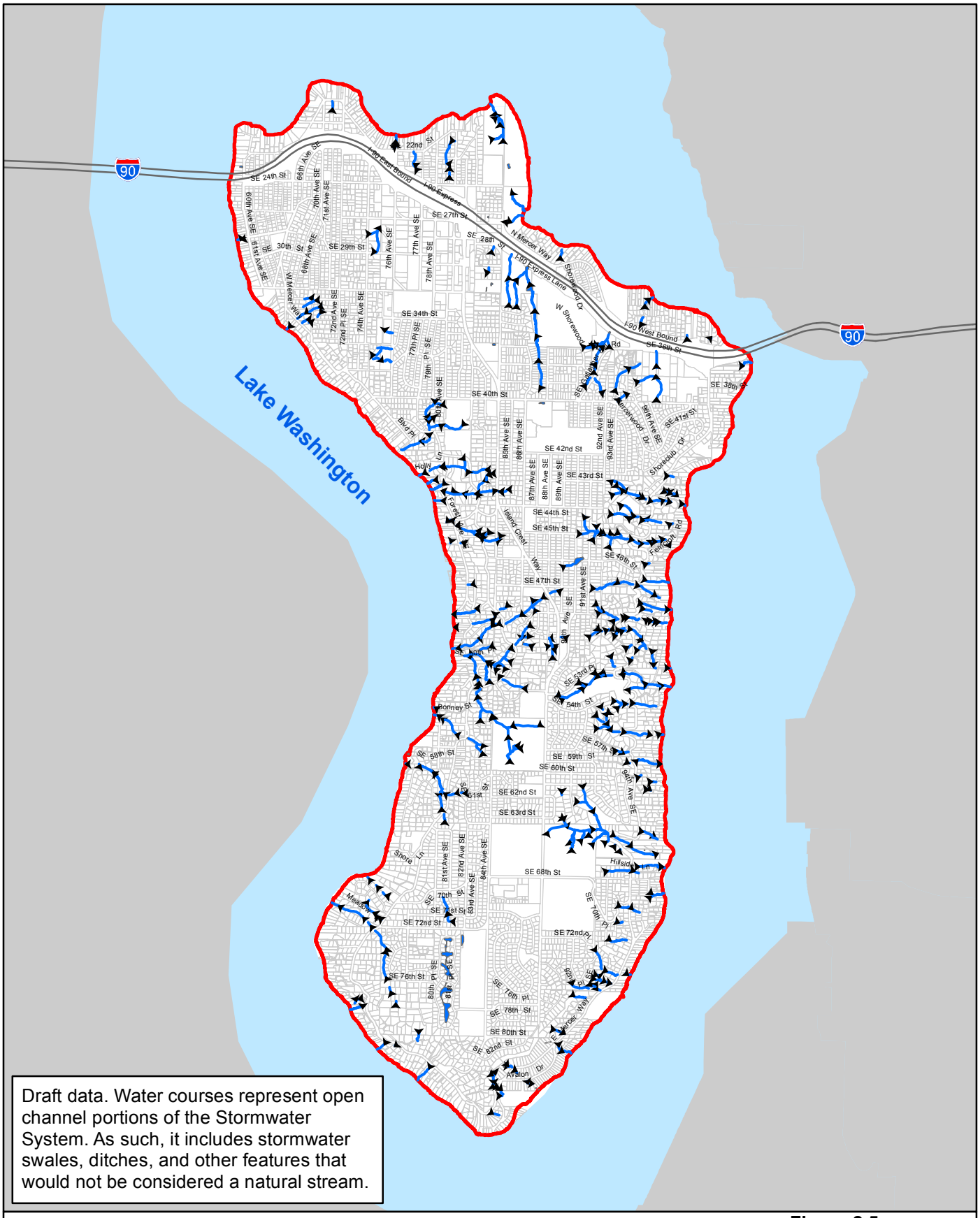
Average temperatures on the Island range from the mid to high 50's to the high 70's during the summer and mid-30's to upper 40's and low 50's during the winter. During a typical winter, the ground frost level averages 4 to 8 inches; however, it can extend as deep as 15 inches during extended cold periods with no snow cover.

Mercer Island exhibits local wind patterns that are influenced by the "lake effect" caused by temperature differences between Lake Washington and the Island.

2.3.6 Water Resources

Mercer Island is an Island surrounded by Lake Washington, which is one of the largest lakes in the State of Washington. The Sammamish and Cedar rivers are the primary tributaries to the Lake and the Hiram Chittenden Locks are the sole outlet of the Lake. Lake Washington is a salmon bearing water body. The level of Lake Washington is regulated by the Hiram Chittenden Locks that is operated by the U.S. Army Corps of Engineers (Corps), located in the Ballard Area of the City of Seattle. The Corp maintains the Lake level within a 2-foot ranges between 20-feet (winter) and 22-feet (summer). The winter elevation is maintained to allow for annual maintenance, minimize wave and erosion damage and provide storage space for high-flow. The Lake level is increased for the summer to ensure adequate flows for lock operations, fish passage, and to meet water quality objectives.

The City has cataloged water courses in the Stormwater management system on the Island, which is shown in Figure 2.5. Sanitary sewer overflows into the mapped water courses have the potential to impact the environment. The City does not have lakes or ponds due to its steep topography. Note, the City’s data does not differentiate between natural and artificial water courses or perennial and ephemeral flows. The City is currently refining its water course data to better manage its water courses.



Draft data. Water courses represent open channel portions of the Stormwater System. As such, it includes stormwater swales, ditches, and other features that would not be considered a natural stream.

Legend

- Water Courses With Flow Direction
- Water Bodies
- Service Area Boundary

N

0 1,500 3,000 Feet

Figure 2.5
Water Courses
General Sewer Plan
City of Mercer Island

carollo

Mercer Island's water courses tend to be short and relatively steep as a result of the Island's topography. The individual drainages are small (i.e., none are larger than about 300 acres), and many exhibit perennial flow, at least in their lower reaches. Many of the watercourses flow in steep narrow canyons with forested slopes. Nearly all of the watercourses have been impacted by the extensive development that has occurred over most of the Island. Particularly near the shoreline, many of the banks are armored or the watercourses are tight-lined with pipes.

2.3.7 Water Supply

The City's water supply and distribution system is described in the 2015 Water System Plan (City of Mercer Island, 2015). A map of City water facilities is shown in Figure 2.6. The City purchases all of its supply from Seattle Public Utilities (SPU). The City's water system consists of over 115 miles of distribution main, two above-ground storage tanks located at the reservoir site, and over 85 pressure reducing stations to manage service pressures in the Island's steep terrain. Additionally, the City maintains one well that is independent from the distribution system and is utilized solely for water supply in the event of an emergency.

Proper design of both sewer and water infrastructure has mitigated the risk of sewer system impacts on the drinking water facilities. All sewer collection and water distribution pipes are designed with adequate separation, and additional protections where warranted. The City maintains sanitary control on its drinking water facilities and supply taps from Seattle Public Utilities. The City's sole emergency well is adequately set back from sanitary sewer facilities, per regulatory standards.

2.4 LAND USE

The 2010 census reported the population of the City was 22,699. In 2012, the City had 9,952 total housing units and 6,581 jobs. The population is expected to increase to 26,000 for build-out conditions under current land use zoning. Within the foreseeable future, land use zoning is not expected to change.

2.4.1 System Land Use Zoning

Land use zoning in the City is primarily residential, as shown in Figure 2.7 and Table 2.1 and Figure 2.7. The majority of the commercial and multifamily development is located in the Town Center and along the Interstate 90 corridor. There is no industrial land use within the City. Town Center zoning provides flexibility to encourage mixed-use development. No changes in zoning are proposed in the future, except for the Town Center.

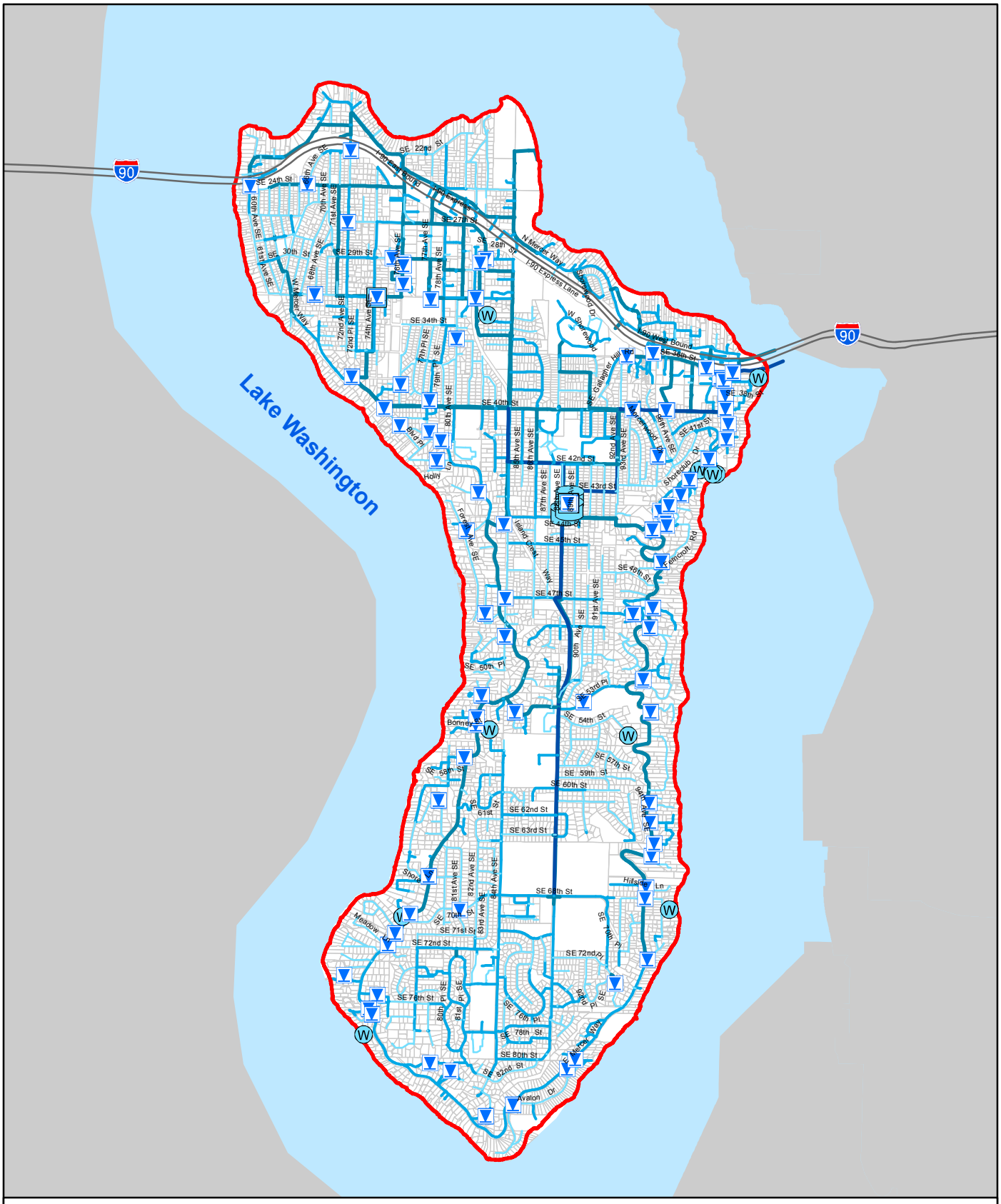


Figure 2.6
Water System
General Sewer Plan
City of Mercer Island

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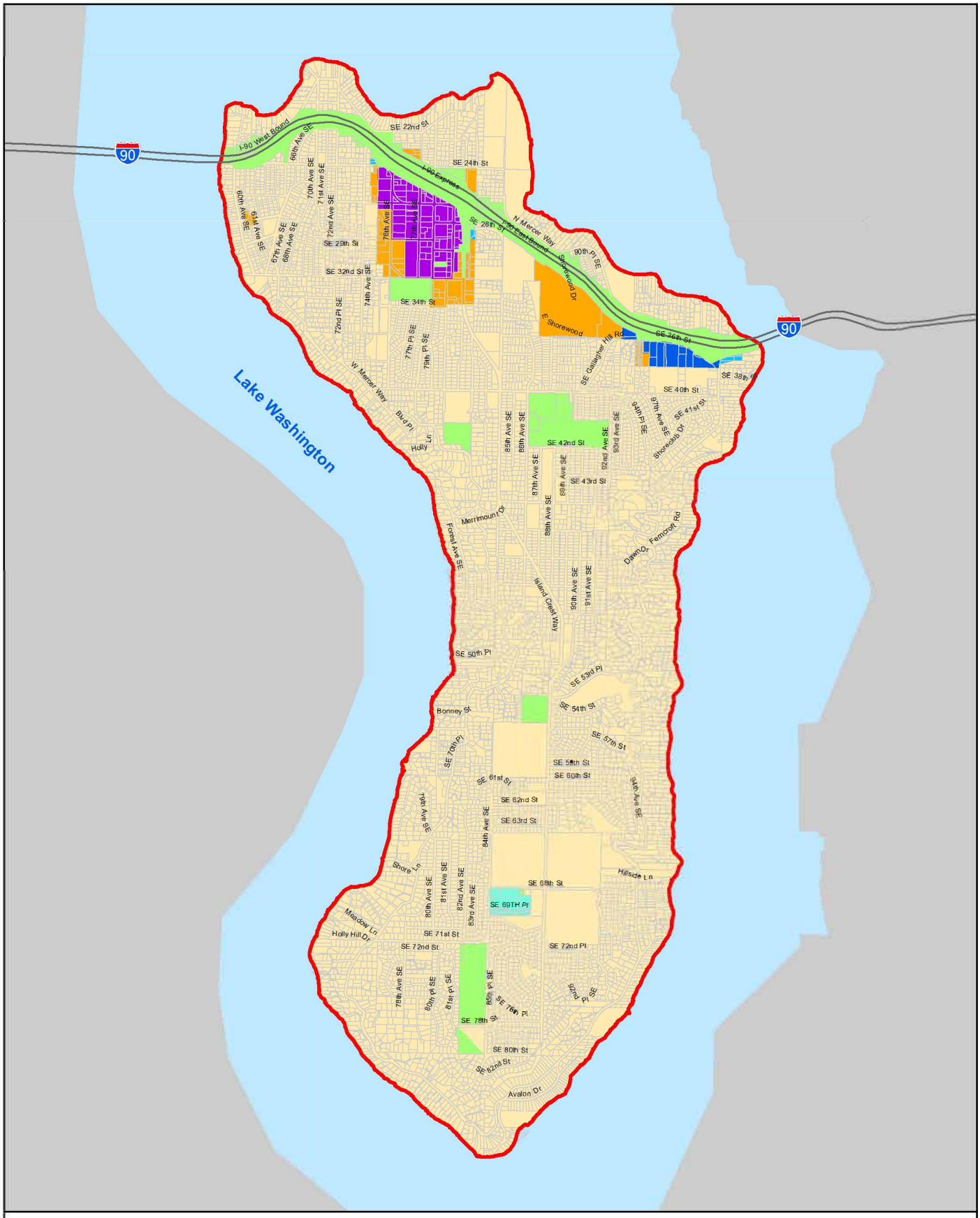

Figure 2.7
Zoning Summary
General Sewer Plan
City of Mercer Island

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Table 2.1 Mercer Island Zoning General Sewer Plan City of Mercer Island		
Zoning District	**Land Use**	**Area (acres)**
B	Business	3
C-O	Commercial	19
MF-2, 2L, 3	Multiple Family	99
P	Public Institution	184
PBZ	Planned Business Zone	15
R-8.4, 9.6, 12, 15	Single Family	3,705
TC	Town Center	77
Total		4,102

2.4.2 Town Center Zoning

The City is essentially at build-out, with most growth occurring in the Town Center. The Town Center Plan is expected to develop into mixed-use commercial/office and residential. The City underwent a Town Center visioning process during the same time frame as the Plan update (approved June 2016) that will update the future zoning of this area. For the purposes of the Plan, the Town Center zoning is based on the approved zoning at the time of the Plan (December 2015), shown in Figure 2.8. Note, the changes proposed in the Town Center visioning process will reduce density; therefore, use of approved zoning was considered conservative.

2.5 REGULATORY CONSIDERATIONS

2.5.1 Washington State Department of Ecology

Washington State Department of Ecology (Ecology) defines the objectives and content of a general sewer plan in Section G1-3 Criteria for Sewage Works Design, more commonly known as the "The Orange Book." This Sewer Plan complies with these guidelines as well as with those listed in WAC 173-240-050.

2.5.2 Growth Management Act

As required by the 1990 Growth Management Act (GMA), the City must serve the sewer needs of its planned growth within the next 6 years of this Sewer Plan. For the City, the planned growth is focused on redevelopment, specifically redevelopment of the Town Center. The City's Comprehensive Plan update was ongoing during the development of this Plan. Land use incorporated into the flow projections were based on the adopted land use, not draft information. A sewer system assessment will be completed and used to develop a capital improvements project (CIP) to accommodate the planned growth.

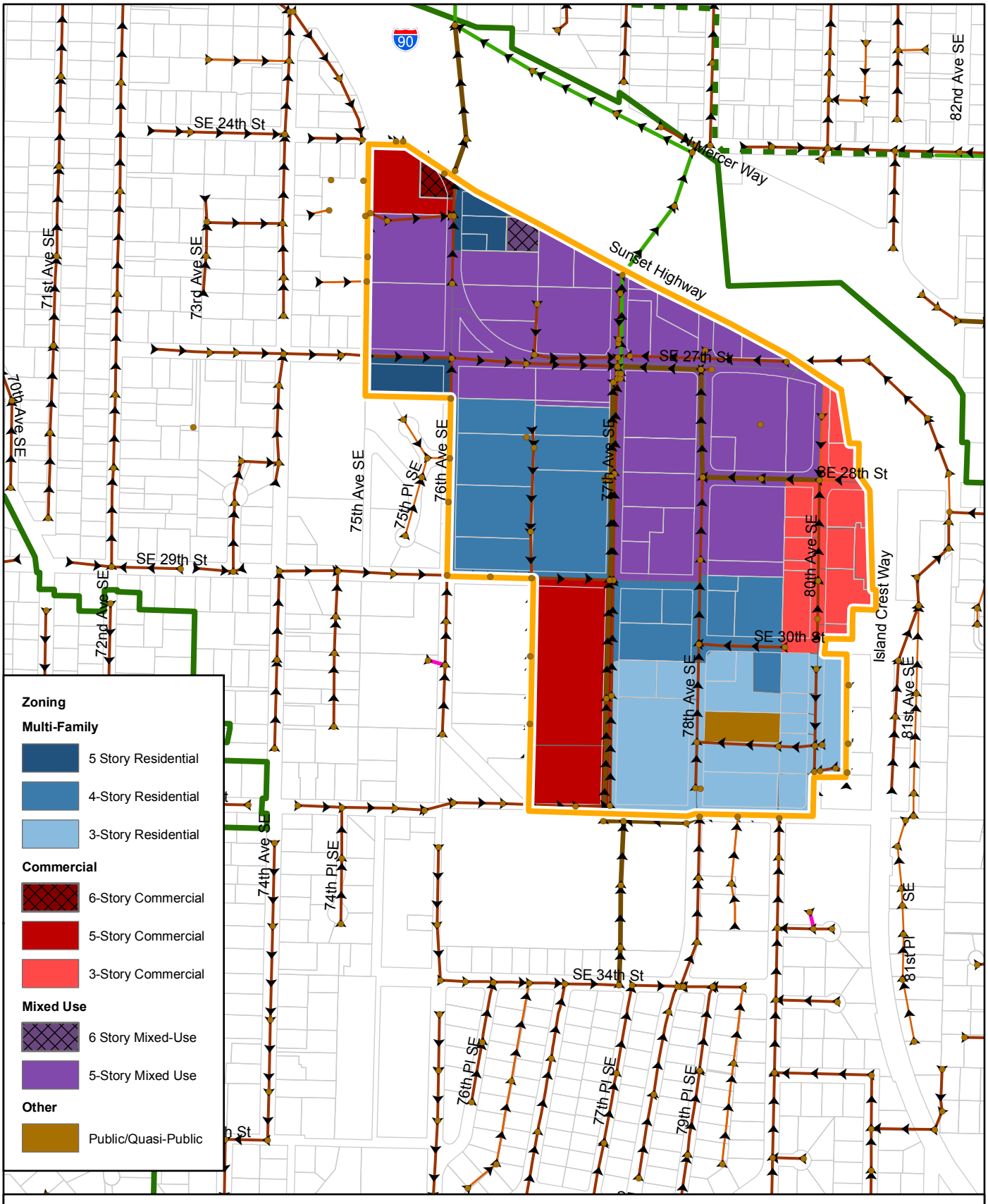

Figure 2.8
Town Center Land Use
General Sewer Plan
City of Mercer Island

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2.5.3 2017 King County Comprehensive Plan

The King County Comprehensive Plan 2017 (King County, December 2017) was adopted by the King County Council December 2016 and updated in December 2017. The Comprehensive Plan is the fifth major update to the King County Comprehensive Plan. The GMA requires that comprehensive plans achieve a set of 13 planning goals and address planning in terms of capital facilities and utilities. Chapter 9, titled "Services, Facilities, and Utilities," discusses sanitary sewers and wastewater treatment. King County and adjoining sewer utilities are to prioritize the replacement of onsite sewer systems with service from public sewers where available.

2.5.4 KCDNR Regional Wastewater Services Plan

Adopted by King County in 1999, the Regional Wastewater Services Plan (RWSP) outlines a "number of important projects, programs, and policies for King County to implement through 2030 (KCDNR 2015)." Of those programs, Regional infiltration and inflow (I/I) Control directly impacts the City.

2.5.5 Environmental Species Act

The Endangered Species Act (ESA) is a federal regulation that restricts municipalities from activities that could deteriorate water quality in areas that are the natural habitat for species listed under the ESA. The Pacific Northwest is under the jurisdiction of the National Marine Fisheries Service (NMFS), which can list a species as endangered or threatened under the ESA. Endangered species are classified as those in danger of extinction; threatened species are considered "likely to become endangered in the foreseeable future." Both classifications are protected by the ESA upon listing. NMFS is allowed to issue protective regulations to ensure conservation of endangered species under Section 9. The same regulations can apply for threatened species, but the 4(d) Rule allows NMFS to provide exceptions to the Section 9 regulations.

In 1999, Chinook salmon, Puget Sound trout, and Costal Bull trout were listed as threatened species under the ESA. Part of the habitat for these species is Lake Washington; therefore, the listing of these species will have a regulatory impact on the Island. One of the regulations in Section 9 of the ESA prohibits the "take" of a listed species. Under the ESA, "take" is considered to be activities that lead to the intentional or unintentional harm of a listed species. Wastewater discharge is an activity that can lead to the incidental "take" of a listed species; therefore, the City has enacted a practice that prohibits overflows from the sewer system. Additionally, it is recommended that maintenance and construction activities associated with the Lakeline should be scheduled so that they do not interfere with the migration or breeding practices of listed salmon species.

2.5.6 Phase II Municipal Stormwater General Permit

The City's Phase II Municipal Stormwater General Permit (MSGP) largely pertains to its stormwater system. The MSGP does not allow illicit connections of sanitary sewer to stormwater systems or direct inflow of stormwater systems into the sanitary sewer. As such, any sanitary sewer overflow (SSO) that may reach surface water or groundwater is considered an unpermitted discharge to waters of the state under state law.

2.6 POLICIES AND CRITERIA

Polices and criteria regulate the manner that the City operates and plans for its future. The City's policies and criteria are detailed in MICC, the Comprehensive Plan, City ordinance, and through adoption of this and other plans. Policies and criteria for sewer service, side sewers, maintenance and the Fats, Oil, and Grease (FOG.) program have been summarized in Table 2.2 through Table 2.5. Tables 2.6 and Table 2.7 summarize design and analysis policies and criteria. Note, financial policies and criteria are presented in Chapter 7.

Table 2.2 General Service Policies
General Sewer Plan
City of Mercer Island

Policy Type	Policy	Source
Service Statement	The city of Mercer island desires to protect, promote and preserve the public health, safety and welfare of its citizens through best management practices of its public water system.	MICC 15.06.010
Ownership	City Ownership of Sewer Facilities. The sewer system is owned and operated by the city, except to the extent that private ownership is otherwise indicated as a matter of record. Such public facilities typically include mains, pump stations, or manholes.	MICC 15.06.050.A
Required Connections	All structures which contain facilities for the disposal of sewage shall be connected to the public sewer system (Ord. 14C-03 § 2).	MICC 15.06.060
Septic Tanks	The City shall require that all new development be connected to the sewer system.	Com Plan 3.1
Septic Tanks	Existing single-family homes with septic systems shall be allowed to continue using these systems so long as there are no health or environmental problems. If health or environmental problems occur with these systems, the homeowners shall be required to connect to the public sewer system.	Com Plan 3.2
Septic Tanks	Any septic system serving a site being re-developed must be decommissioned according to county and state regulations, and the site must be connected to the sewer system.	Com Plan 3.3
Inter-agency Cooperation	The city shall actively work with regional and adjoining local jurisdictions to manage, regulate, and maintain the regional sewer system.	Com Plan 3.4

Table 2.2 General Service Policies General Sewer Plan City of Mercer Island		
Policy Type	**Policy**	**Source**
Overflow Prevention	The city shall take whatever steps are economically feasible to prevent overflows.	Com Plan 3.5
I/I Program	The city shall design and implement programs to reduce I/I wherever these programs can be shown to significantly increase the capacity of the sewer system at a lower cost than other types of capacity improvements.	Com Plan 3.6
Shoreline	Utility facilities should be designed and located to assure no net loss of shoreline ecological functions, preserve the natural landscape, and minimize conflicts with present and planned land and shoreline uses while meeting the needs of future populations.	Comp Plan IV.5.1

Table 2.3 Side Sewers General Sewer Plan City of Mercer Island		
Policy Type	**Policy**	**Source**
Sewer Facility Requirements	Whenever property is developed or redeveloped, sewer mains shall be extended through and to the extremes of the property being developed, as required by the city, when needed for the orderly extension of the public sewer system. Whenever property is developed or redeveloped in any way such that sewage discharge is changed in content or volume, new sewer facilities shall be required whenever necessary to: 1. Meet hydraulic capacity requirements; or 2. Replace or relocate existing facilities as required or authorized by the city; or 3. Meet industrial waste pretreatment requirements.	MICC 15.06.70.B
Side Sewer Application	An application for a side sewer permit shall be signed and made by the owner of the property to be served or by a licensed side sewer contractor representing the owner of the property.	MICC 15.06.030
Side Sewer Permit	No permit will be issued for side sewer construction before the public or private sewer main is accepted by the city. Prior to the issuance of a side sewer permit, the city engineer shall establish that a sewer main of sufficient size and suitable type and condition is available for the connection. [MICC 15.06.040.B] If an application for a permit is denied, the property owner may appeal the city engineer's decision by submitting a written application for appeal, together with the applicable fees, within 14 days of the date of denial. The appeal will be heard before the city's hearing examiner. (Ord. 14C-03 § 2) [MICC 15.06.040.E]	MICC 15.06.040

Table 2.3 Side Sewers General Sewer Plan City of Mercer Island		
Policy Type	**Policy**	**Source**
Side Sewer Ownership	Side sewers are owned by the property owner. Property owners shall be responsible for the development, maintenance, and repairs of side sewers and their appurtenances.	MICC 15.06.050.B
Engineering and Design Standards	The property owner is responsible for providing an adequate and qualified design for the installation of all sewer facilities required by this code [MICC].	MICC 15.06.070.A
Construction Requirements	Construction standards shall be as described in this chapter [Title 15 of MICC] and the city's standard drawings. The city engineer may designate the manner and place where the side sewer shall connect to the public sewer system, specify the material, size and grade of the side sewer, and determine whether or not a permit is needed. Side sewers shall be constructed as described in this chapter and the city's standard drawings.	MICC 15.06.080

Table 2.4 System Maintenance General Sewer Plan City of Mercer Island		
Policy Type	**Policy Type**	**Policy Type**
Sewer System Maintenance	The city is responsible for the maintenance of the public sewer system. Owners of private sewer systems, side sewers, and backwater valves are solely responsible for maintenance and operation of such. (Ord. 14C-03 § 2).	MICC 15.06.100
Use of Right of Way	Utilities should be located in existing rights of way and corridors whenever possible.	Comp Plan 2015 IV.5.2
Easements	An easement, in a form approved by the city engineer, is required whenever: 1. A public sewer facility will be built on private property; or 2. A private sewer facility will be built over two or more legally established lots; or 3. A side sewer will serve two or more properties. (Ord. 14C-03 § 2).	MICC 15.06.150
Right of Entry for Inspection	Any designated city official may enter the private property at all reasonable times to conduct inspections, tests or to carry out other duties imposed by this code. If entry is refused, the city official shall have recourse to every remedy provided by law to secure entry. (Ord. 14C-03 § 2).	MICC 15.06.170

Table 2.5 Fats, Oil, and Grease Program General Sewer Plan City of Mercer Island		
Policy Type	**Policy Type**	**Policy Type**
Fats, Oils, and Grease (FOG) Program	The city has established a program intended to prevent, control and correct the discharge of fats, oils and greases, and industrial waste within the public sewer system which could cause blockages, operational failures or premature degradation of the public sewer system.	MICC 15.06.130.A
FOG Discharge Prohibited	No FOG in amounts that may inhibit or interfere with the performance of the city sewer system shall be discharged into the city sewer system without the installation of a pretreatment device of a type and capacity to be approved by the city engineer, and located as to be readily accessible for cleaning and inspection	MICC 15.06.130.E.1
Pretreatment of Discharges	The city shall require the pretreatment of discharges to the public sewer system, except single-family residences, if necessary to prevent and/or correct hazardous, dangerous, or explosive conditions or blockage, operational failure or premature degradation of the public sewer system. Notwithstanding the above, all restaurants and food-processing businesses shall install pretreatment methods, such as grease interceptors, oil-water separators, and other best available technology, to reduce or eliminate FOG discharges.	MICC 15.06.130.B
New Construction	New construction for commercial kitchens that may discharge FOG in amounts that may inhibit or interfere with the performance of the city sewer system, and particularly any commercial kitchen that will be required to install a Type I hood pursuant to the International Mechanical Code, Section 507, requires installation of a pretreatment device approved by the city engineer.	MICC 15.06.130.F
Compliance in Ongoing Businesses	New commercial kitchen that may discharge FOG in amounts that may inhibit or interfere with the performance of the city sewer system, and particularly any commercial kitchen required to install a Type I hood pursuant to the International Mechanical Code, Section 507, that is conducting an ongoing business in an existing building or facility that does not have an effective pretreatment device as of the date of passage of the ordinance codified in this section shall take measures to ensure that it is not in violation of the discharge prohibitions of this section [15.06.130] by no later than 12 months from such date.	MICC 15.06.130.G.1.a

Table 2.5 Fats, Oil, and Grease Program General Sewer Plan City of Mercer Island		
Policy Type	**Policy Type**	**Policy Type**
Responsibility for Expense	All pretreatment devices shall be installed, operated, and maintained at the owner's expense.	MICC 15.06.130.H.1
Maintenance Required	Pretreatment devices shall be kept in continuous, efficient and effective operation. Regular maintenance shall include periodic removal of the accumulated waste material in accordance with best management practices (BMPs) developed by the city engineer. No such collected discharge shall be introduced into the public sewer system and shall be disposed of in accordance with all local, state and federal regulations.	MICC 15.06.130.H.2
Records Required	Records of disposal and proper maintenance shall be kept by the owner or operator in accordance with best management practices (BMPs) and submitted to the city engineer annually on or before December 31. (Ord. 14C-03 § 2).	MICC 15.06.130.H.3
Other Prohibited Discharges	No person shall discharge or cause the discharge of any of the… [wastes listed in MICC 15.06.140] into the public sewer system, by direct or indirect means:	MICC 15.06.140

2.6.1 Design and Construction Standards

System design criteria and standards have been developed to provide a consistent minimum level of service is maintained throughout the sewer system and to facilitate planning, design, and construction of sewer system projects. Design and construction documents for all projects within the City shall be prepared based on the most current edition of the City's draft Engineering Standards, as presented in Appendix E. Additionally, the City uses Ecology's Criteria for Sewage Works Design (2008) and the most current edition of the Washington State Department of Transportation standard specifications. When a conflict exists, the more stringent of the two standards shall be used.

Table 2.6 Design Criteria General Sewer Plan City of Mercer Island		
Subject	**Policy**	**Source**
Minimum Gravity Main Size	No sewer shall be less than 8 inches in diameter except that, in special cases, 6-inch diameter sewer lines may be approved by Ecology if the 6-inch lines meet the conditions listed in the Orange Book Section C1-4.1.	Orange Book Section C1-4.1
Minimum Pipe Slope	Pipe Diameter — Minimum Slope 8-inch — 0.40 ft per 100 ft 10-inch — 0.28 ft per 100 ft 12-inch — 0.22 ft per 100 ft 14-inch — 0.17 ft per 100 ft 15-inch — 0.15 ft per 100 ft 16-inch — 0.14 ft per 100 ft 18-inch — 0.12 ft per 100 ft 21-inch — 0.10 ft per 100 ft 24-inch — 0.08 ft per 100 ft 27-inch — 0.07 ft per 100 ft 30-inch — 0.06 ft per 100 ft 36-inch-sewer minimum slope = 0.05 ft per 100 ft	Orange Book Section C1-4.4
Pipe Material	Any generally accepted material for sewers, such as polyethylene, ductile iron, PVC, or concrete, will be given consideration, but the material selected should be adapted to local conditions, such as characteristics of industrial wastes, possibility of septicity, soil characteristics, exceptionally heavy external loadings, abrasion, and similar problems.	Orange Book Sections C1-4.1 C1-4.8
Force Main Size	Except for small grinder and effluent pump installations, piping for force mains should not be less than 4 inches in diameter. As a general rule, whenever the velocity exceeds 8 fps, a larger pipe should be used.	Orange Book Sections C2-3.1

Table 2.6 Design Criteria General Sewer Plan City of Mercer Island		
Subject	**Policy**	**Source**
Force Main Velocity	At pumping capacity, a minimum self-scouring velocity of 2 fps should be maintained unless flushing facilities are provided. Velocity should not exceed 8 fps. Optimum velocities for reducing maintenance costs and preventing accumulation of solids range between 3.5 and 5 fps.	Orange Book Sections C2-3.2
Manning's coefficient	An "n" value of 0.013 shall be used in Manning's formula for the design of all sewer facilities (regardless of pipe material) except inverted siphons, where an "n" value of up to 0.015 can be used.	Orange Book Section C1-4.3
Separation of Water and Sewer Pipelines	The minimum separation requirements apply to all gravity and pressure sewers of 24-inch diameter or less. Larger sewers may create special hazards because of flow volumes and joint types, and generally require additional separation. A minimum horizontal separation of 10 feet between sanitary sewers, reclaimed water lines, and any existing potable water lines, and a minimum vertical separation of 18 inches between the bottom of the drinking water line and the crown of the sewer shall be maintained. The distance shall be measured edge to edge (i.e., from the outer diameter of the pipes). Sewer lines crossing water lines at angles including perpendicular shall be laid below the water lines to provide a separation of at least 18 inches between the invert of the water line and the crown of the sewer.	Orange Book Section C1-9.1
Lift Station Capacity	The firm capacity of a pumping station shall be equal to or greater than the peak hourly design flow. Because mechanical and electrical equipment is typically designed for a 20 year life, it is recommended that the peak design flow be based on a 20-year forecast or greater. The station shall be designed to remain fully operational during the 100-year flood/wave event.	Orange Book Sections C2-1.2.1 C2-1.2.3 C2-1.1

Table 2.6 Design Criteria General Sewer Plan City of Mercer Island		
Subject	**Policy**	**Source**
Lift Station Redundancy	The number of pumps selected shall allow the station to provide the peak design flow with the largest pump out of order. Also, the number of pumps should correlate to the wetwell size and prevent excessively short periods between pump starts. On constant speed pump stations, the number of pumps is often based on the pumping capacity required to provide a minimum scour velocity in the force main.	Orange Book Section C2-1.2.3
Lift Station Reliability	All sewage pump stations should be designed with capability for emergency power in case the primary electrical feed is out of service. A portable engine generator unit that is plugged into a pigtail at the pump station commonly provides emergency power for small pump stations. Larger pump stations should have permanent engine generator units with automatic transfer switches to transfer the electrical feed from the primary to the standby unit when a power failure is detected by the instrumentation and control system.	Orange Book Section C2-1.8.3

Table 2.7 Analysis Criteria General Sewer Plan City of Mercer Island		
Subject	**Policy**	**Source**
Design Storm	In accordance with all applicable federal, state, and local regulations, the City should design its wastewater system facilities to adequately and reliably convey peak hour flows associated with a Design Storm event without overflowing or discharging to any water bodies. The Design Storm is defined as a 20-year, 24-hour historical storm.	Proposed New Policy
Pipe Capacity	Depth of flow versus the diameter of the pipe (d/D) ratio shall be equal to or less than 100% during the design storm (peak wet-weather flows) for existing infrastructure.	Proposed New Policy

Table 2.7 Analysis Criteria General Sewer Plan City of Mercer Island		
Subject	**Policy**	**Source**
Collection System Forcemain	Velocity should not exceed 8 fps during the peak wet weather design storm flow.	Proposed New Policy
Lakeline Pump Stations and Forcemain	Design shall be based on the Orange Book. Additional project specific criteria that address the unique nature of the Lakeline shall be also be taken into account.	Proposed New Policy

2.7 RECLAIMED WATER

The City will coordinate with King County WTD for the use of reclaimed water, as requested. Given the Island's location, it is the City's understanding that King County WTD has no plans to provide reclaimed water to the Island in the foreseeable future. The City has several irrigated playfields owned by the City or School District. The Island does not have a golf course or large industrial/commercial customers that could potentially use large volumes of reclaimed water at this time. The combination of small lots, dense tree canopy, and steep slopes are anticipated to limit reclaimed water use by residential customers.

Chapter 3

EXISTING SEWER SYSTEM

3.1 PURPOSE

The purpose of a sewage collection system is to adequately convey sewage to locations where it can be treated and safely discharged. This chapter describes the City of Mercer Island's (City) existing sewer system.

3.2 EXISTING SEWER SYSTEM

Sewage from within the City is primarily from single-family residential sources, with some minor commercial and multifamily residential sources at the north end of the Island. The City takes advantage of topography by relying on gravity flow for the majority of the collection system. A major feature of the collection system is the Lakeline system, which is a series of pump stations and low-pressure mains that convey the flow around the perimeter of the Island. The Lakeline system discharges the flow into the King County Department of Natural Resources (KCDNR) facilities located on the Island. The sewage is then conveyed through one of two KCDNR interceptors and eventually to the South Treatment Plant in the City of Renton for treatment.

3.2.1 Collection System

The sewer collection system is a separate sanitary system intended to convey sanitary sewage only. The City has a separate storm sewer system to convey stormwater runoff. The City does not have a combined sewer system.

The sanitary collection system consists of approximately 2,400 manholes and 105 miles of pipe. The majority of the system was originally constructed by the Mercer Island Sewer District through three Utility Local Improvement Districts (ULIDs) in the late 1950s and early 1960s. The City assumed control of the systems in 1975 when the Mercer Island Sewer District was dissolved. A smaller portion of the system, within the East Mercer Sewer District is believed to have been constructed in the 1950s. The City assumed control of this system in 1988. There are two private collection systems on the Island: Shorewood Apartments and Covenant Shores Retirement Community. Flows from Shorewood Apartments discharges directly into KCDNR Manhole #45-121 and therefore, it is not a City customer. Flows from Covenant Shores discharges directly into the City’s Lakeline collection system; therefore, it is a City customer. Figure 3.1 depicts the City’s collection system. Appendix G includes a large scale map that depicts the flow direction of the collection system.

Legend

- PS King County Pump Station
- PS Mercer Island Pump Station

Force Main

- King County
- Mercer Island
- Lakeline Main

Gravity Main by Diameter

- 10" or Larger
- 8"
- 6" or Smaller
- King County Gravity Main
- Service Area Boundary

Private Collection Systems

- Shorewood

Figure 3.1
Sewer System
General Sewer Plan
City of Mercer Island

carollo

Table 3.1 presents an inventory of the collection system piping according to the latest available Geographic Information System (GIS) data. Lakeline piping is presented in the follow section.

There are relatively steep slopes marked by numerous ravines along both sides of the Island. These features result in the sewer system having numerous drainage basins. Sewage flows by gravity from these basins to the Lakeline system.

3.2.2 Lakeline System

The Lakeline system acts as a collection system and a pump system. It is composed of a series of pump stations and pipelines which are divided into five separate hydraulic systems called reaches that encircle the Island and convey the City's sewer flows to the KCDNR facilities located on the Island.

Each reach consists of a series of pumping stations and connecting pipes. A reach begins at an upstream pumping station and ends at a KCDNR facility.

- Reaches 1 and 2 end at the South Mercer Pump Station;
- Reaches 3 and 4 end at the KCDNR Inlet structure that connects to the North Mercer Pump Station;
- Reach 5 consists of two segments that begin at the south end of Luther Burbank Park and flush station 12 and converge at PS 11. Flows are pumped from PS 11 to MH 45-121 where wastewater then flows by gravity directly into the KCDNR interceptor.

This section describes the characteristics of the Lakeline system and the unique features that ensure operability.

3.2.2.1 Lakeline System Pipelines

The majority of the Lakeline system is located in Lake Washington approximately 5 to 100 feet offshore. There are approximately 12.9 miles of Lakeline pipe ranging from 8 to 18 inches in diameter. The system collects wastewater generated in the many subbasins of the island. These flows enter the system either at the pump stations or by direct connections to the Lakeline. Flows from individual houses located along the shoreline also enter the Lakeline by direct connection.

The energy for conveyance within the Lakeline system comes primarily from the pump stations. However, some direct gravity sewer connections and side sewer connections are located high enough above the Lakeline system that they can discharge to it without pumping.

Table 3.1 Collection System Pipe Material Inventory
General Sewer Plan
City of Mercer Island

Diameter	Asbestos Cement	Cast Iron	Vitrified Clay	Concrete	Ductile Iron	Galvanized Steel?	HDPE	Poly Vinyl Chloride	Reinforced Concrete Pipe	Resin	Unknown	Total	% of Total
Unknown	-	-	-	-	154	-	760	-	-	-	5,914	6,828	1%
4	30	-	-	-	-	-	-	-	-	-	-	30	0%
6	1,560	155	340	4,873	585	-	110	4,707	-	-	514	12,845	3%
8	290,556	15,843	1,736	105,538	14,036	-	-	8,731	-	318	7,363	444,122	87%
10	24,901	3,345	-	1,107	984	-	99	-	-	-	412	30,848	6%
12	2,092	1,130	-	1,167	-	-	-	233	-	-	1,253	5,876	1%
14	-	160	-	-	-	-	-	-	-	-	-	160	0%
16	-	439	-	-	2,089	-	-	-	-	-	-	2,528	0%
18	-	65	-	-	-	39	-	-	568	-	-	672	0%
20	-	-	-	-	-	-	1,410	-	-	-	-	1,410	0%
21	-	-	-	-	-	-	-	-	473	-	-	473	0%
24	-	-	-	-	2,437	-	-	-	787	-	-	3,223	1%
48	-	-	-	-	-	-	-	-	889	-	-	889	0%
Total	319,140	21,137	2,076	112,685	20,285	39	2,380	13,671	2,717	318	15,456	509,905	
% of Total	63%	4%	0%	22%	4%	0%	0%	3%	1%	0%	3%		

Most of Reaches 3 and 4 were constructed of AC pipe as part of ULID 1 in 1956. In 1961 a segment of pipe in Reach 3, from PS 13 to PS 5 (SE 32nd St, abandoned in 2011) was constructed of CI under ULID 2. In the early 1960s a portion of the AC pipe in Reach 3 was replaced with CI. An additional 3,000 feet of the Lakeline in Reach 3 was replaced with CI in 1970 as part of a Metro (now known as KCDNR) North Mercer Island Interceptor project. As part of the 1994 construction of the second I-90 floating bridge, approximately 170 feet of Reach 3 was replaced with ductile iron pipe. In 2011 the remaining AC pipe in Reach 3, from SE 32nd Street (Proctor Landing) to Roanoke Way was replaced with DI pipe. Reaches 1, 2, and 5 were constructed of CI under ULID 2 and ULID 3. The material and length of each Lakeline reach is given in Table 3.2.

3.2.2.2 Lakeline System Pump Stations

Pump stations within the Lakeline system consist of 17 sewage pump stations and 1 flush stations, as shown in Figure 3.1. These pump stations convey sewage and flushing water through the Lakeline system to the KCDNR facilities located on the Island. Pump station characteristics are presented in Table 3.3. Pump stations 1 through 7 were constructed as part of ULID 1 in 1956. Pump station 1 and 4 are the only facilities that remain. Pump Station 2, 3, and 6 are presumed to have been abandoned as part of the I-90 construction. Pump station 7 was abandoned after its subbasin was converted to gravity flow in the late 1980s. Pump station 4 was rebuilt at a new location under the I-90 west high-rise and Pump station 5 was abandoned as part of the Lakeline and Pump Station No. 4 Replacement project in 2011. Stations 9 through13 were constructed within ULID 2 in the early 1960s. Stations 9 was decommissioned in 2013 and Station 12 operate as flush station. The remaining pump stations (14 to 25) were constructed in ULID 3 in the mid-1960s. Although pump station 25 was located within the East Mercer Sewer District, it was constructed as part of ULID 3 to convey sewage from that district.

Table 3.2 Lakeline System Pipe Material Inventory
General Sewer Plan
City of Mercer Island

Diameter	Asbestos Cement	Cast Iron	Ductile Iron	Reinforced Concrete Pipe	Unknown	Total	% of Total
Unknown	-	-	-	-	3,390	3,390	4%
4	-	16	-	-	-	16	0%
6	257	113	-	-	150	521	1%
8	2,744	11,040	4,354	-	-	18,139	21%
10	1,473	15,557	135	79	-	17,245	20%
12	489	9,115	-	-	-	9,604	11%
14	-	7,620	-	-	-	7,620	9%
16	-	10,725	1,545	-	-	12,269	14%
18	-	9,481	4,650	-	-	14,131	17%
20	-	-	2,587	-	-	2,587	3%
Total	4,963	63,668	13,271	79	3,540	85,522	
% of Total	6%	74%	16%	0%	4%		

Table 3.3 Pump Station Data General Sewer Plan City of Mercer Island			
Reach	**Pump Station No.**	**No. of Pumps**	**Rating of Pumps**
Reach 1	PS 25	2	7.5 hp
Reach 1	PS 24	2	5 hp
		1	7.5 hp chopper
Reach 1	PS 23	3	7.5 hp
Reach 1	PS 22	3	7.5 hp
Reach 2	PS 14	2	5 hp submersible
Reach 2	PS 15	2	5 hp
Reach 2	PS 16	3	7.5 hp
Reach 2	PS 17	3	7.5 hp
Reach 2	PS 18	3	7.5 hp
Reach 2	PS 19	3	10 hp
Reach 2	PS 20	3	10 hp
Reach 2	PS 21	3	10 hp
Reach 3	PS 13	3	5 hp
Reach 3	PS 4	3	60 hp submersible
Reach 4	PS 1	1	7.5 hp chopper
		1	5 hp
Reach 5	PS 10	2	7.5 hp chopper
Reach 5	PS 11	2	7.5 hp chopper

All of the pumps in the pump stations were replaced in the early 1990s with Cornell pumps as part of a system-wide improvement. Pump station 14 was using its original pneumatic ejector pump until 2014 when the station was retrofit with 2 submersible pumps.

Each pump station has its own generator to provide emergency power during outages, as required by Ecology.

At this time, City operators have limited information on the capacity and utilization of the pump stations. Operators are able to track wet well levels and view when the PS is operating; however, the existing telemetry system does not have historian feature to provide historical data for an analysis. The City has planned SCADA improvements through 2024 to modernize its pump stations controls and provide a historian feature to allow capacity and utilization to be tracked.

3.2.2.3 Hydraulic Control Structures

The Lakeline system operates under pressure derived primarily from the pump stations, but also partly from the gravity connections. The elevation of the free water surface in those connections matches the hydraulic grade line imposed by the pump stations. To help protect private property, the City requires check valves on service laterals that are connected directly to the Lakeline system.

Private property is also protected by hydraulic gradient structures, which prevent the hydraulic grade line from rising above a specified elevation.

Three types of hydraulic gradient controls were installed when the Lakeline system was constructed: (1) a hydraulic gradient manhole, (2) a weir located in the wet well, and (3) a midline relief structure. The locations of the different types of hydraulic control structures are shown in Figure 3.2, where gravity overflow structures may be either a wet well weir or a midline relief structure. Schematics of these structures are provided in Figure 3.3.

- The first type is a simple open weir located at the top of a wet well between the discharge pipe from the pumps and the interceptor pipeline. The weir allows excess flows to simply fall back into the wet well below.
- The second type is a weir located in a manhole adjacent to a pumping station, called a Hydraulic Gradient Manhole (HGMH). HGMHs are located just downstream of the pump station. If a blockage occurs and the hydraulic gradient exceeds the weir elevation, wastewater overflows the weir and returns to the pump station wet well.
- The third type is the midline relief structure. These structures are located at intermediate points along the Lakeline system and operate similarly to the HGMHs. Should a downstream blockage occur, overflows at the weir discharge directly to Lake Washington rather than returning to the wet well.

Weir elevations were reportedly set at an elevation slightly lower than the lowest service connection downstream of the overflow. Thus the structures protect individual homes from flooding by limiting the possible hydraulic gradelines downstream of a control weir. Table 3.4 documents the overflow elevations of these structures from available as-builts. The City does not have as-builts for PS 1 and plans to replace the station in 2022. The City monitors high wet well alarms at all stations, which allows them to identify periods of high flows.

Legend

- PS — King County Pump Station
- PS — Mercer Island Pump Station
- Gravity Overflow
- Hydraulic Grade Manhole
- Lakeline Gravity Main
- Service Area Boundary

Gravity Main by Diameter

- 10" or Larger
- 8"
- 6" or Smaller

N

0 1,500 3,000 Feet

Figure 3.2
Hydraulic Gradient Structures
General Sewer Plan
City of Mercer Island

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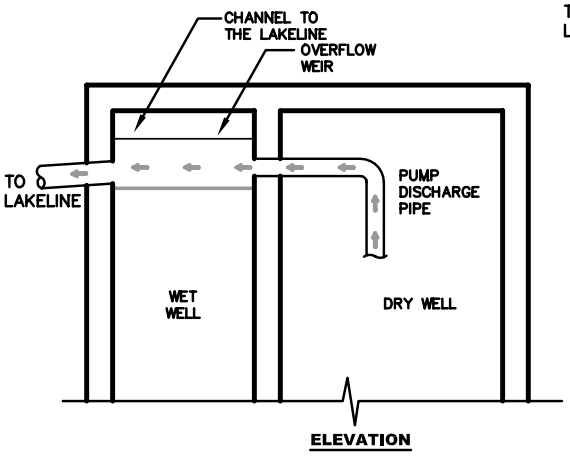
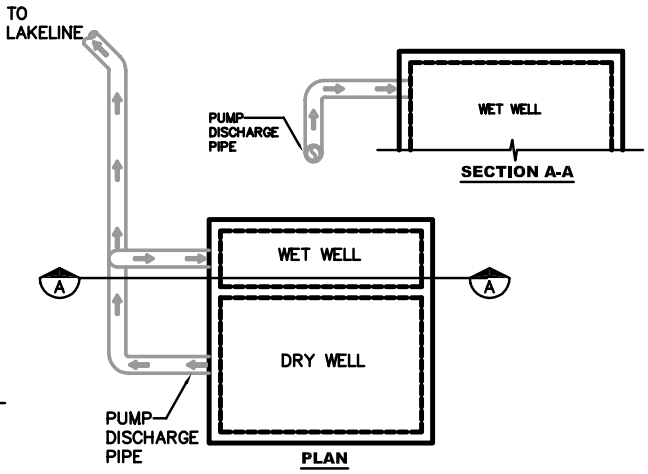
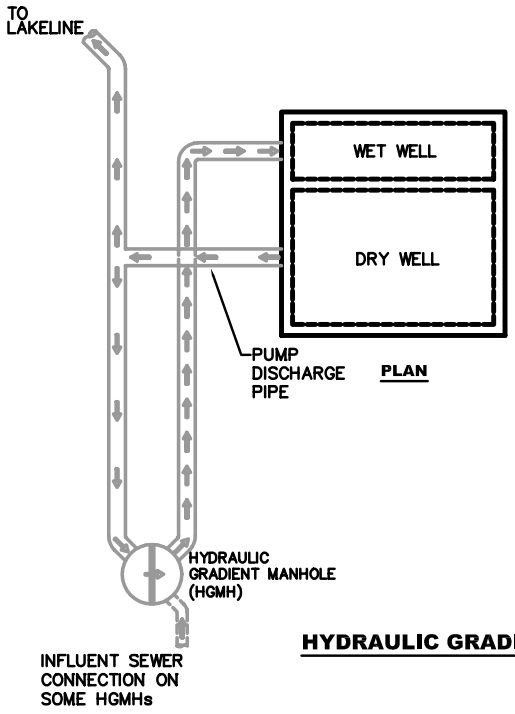
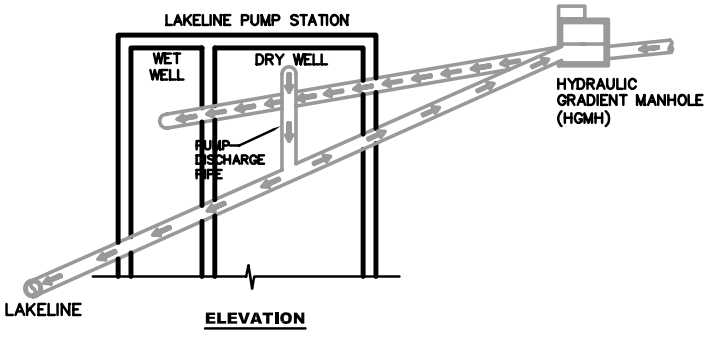


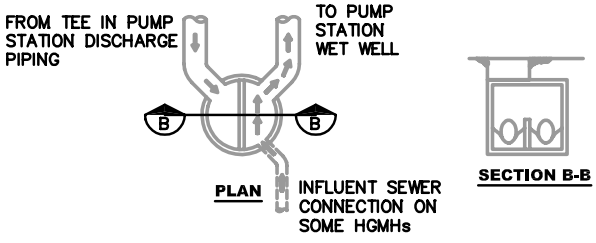
WEIR IN PUMP STATION WET WELL



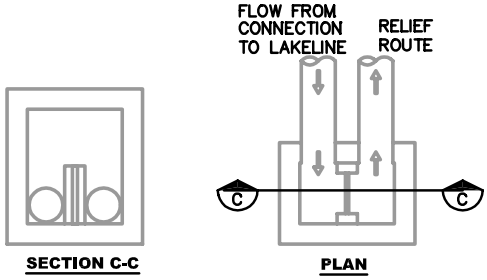
CONNECTION TO PUMP STATION WET WELL







HYDRAULIC GRADIENT MANHOLE (HGMH)



MIDLINE RELIEF STRUCTURE

LEGEND

FLOW ROUTE UNDER NORMAL OPERATING CONDITIONS
RELIEF ROUTE

CITY OF MERCER ISLAND,WA
Figure 3.3
Hydraulic Control Structures Schematic Details

CH2MHILL

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Table 3.4 Hydraulic Control Structure Elevations
General Sewer Plan
City of Mercer Island

Reach	Pump Station No.	Type	Elevation (ft NGVD 29)
Reach 1	PS 25	Weir	17.57
Reach 1	PS 24	Hydraulic Control	17.4
Reach 1	OF-34-1 (Mid-line Relief between PS 24 & PS 23)	Mid-line Relief	15.75
Reach 1	PS 23	Hydraulic Control	19
Reach 1	PS 22	Hydraulic Control	18.75
Reach 1	OF-26-1 (Mid-line Relief between PS 2 & KC)	Mid-line Relief	15.75
Reach 2	PS 14	None	NA
Reach 2	PS 15	Hydraulic Control	18.08
Reach 2	PS 16	Weir	17.05
Reach 2	PS 17	Hydraulic Control	16.37
Reach 2	PS 18	Hydraulic Control	18.4
Reach 2	PS 19	Hydraulic Control	20.9
Reach 2	OF-20-1 (Mid-line Relief between PS 19 & PS 20)	Mid-line Relief	17.25
Reach 2	PS 20	Hydraulic Control	18.7
Reach 2	PS 21	Hydraulic Control	19.8
Reach 3	PS 13	None	NA
Reach 3	PS 4	None	NA
Reach 3	OF-55-1 (Mideline Relief north of PS 13)	Mid-line Relief	17.2
Reach 3	OF-56-1 (Mideline Relief north of PS 13)	Mid-line Relief	17.2
Reach 4	PS 1	Weir	Unknown
Reach 4	OF-48-1 (Mideline Relief US of PS 1)	Mid-line Relief	15.78(1)
Reach 5	OF-79-1 (outside PS 10)	Hydraulic Control	15.75
Reach 5	PS 11	Hydraulic Control	15.75

Notes:
(1) Survey Grade information is not available. Approximate overflow elevation.

No known overflows have occurred from mid-line relief structures, which were designed for emergency bypass in extreme conditions. The City has planned to upgrade the telemetry system to a full SCADA system, including monitoring at these locations.

3.2.2.4 Odor Control

Most of the City's pump stations utilize biofiltration for odor control. PS 4 has a carbon-filter system that was constructed as part of the Lake Line and PS 4 project in 2011. Bioxide is also used for odor control and is typically added at pump stations 16 and 20 annually between the months of April and November.

3.2.2.5 Special Catch Basins

Most of the Lakeline system influent connections are equipped with special catch basins which collect debris that could cause plugging of the pipe system and pump damage. These special catch basins provide a last line of defense to keep grit and debris from getting into the Lakeline. There are 48 special catch basins on the Island, as shown in Figure 3.4.

3.2.2.6 Telemetry

Telemetry data from the pump stations are transmitted to the Supervisory Control and Data Acquisition (SCADA) system in the city's Maintenance building. This data includes the operational status of each pump and generator and the status of various station alarms, wet well levels, pump set points and lead/lag pump alternation throughout the system. The telemetry data can be accessed to obtain pump station operation data, trending historical data and current on-line data.

Communications from the stations to the Maintenance building is through two telecommunications companies. 15 stations communicate through a leased DS1 (T1) circuit from Centurylink. The Maintenance facility communicates to the pump station sites through a leased Ethernet service from Centurylink. Under a two-year pilot project (begun in 2015) two stations (PS 18 and 24) connect to the SCADA system using a wireless WAN LTE/3G modem. A secure VPN connection through Verizon's data network to the City's network connects these stations to the telemetry system. If this pilot is successful the remaining stations may be converted to this wireless model.

The control system hardware and software are proprietary and technical support is available from a single service provider.

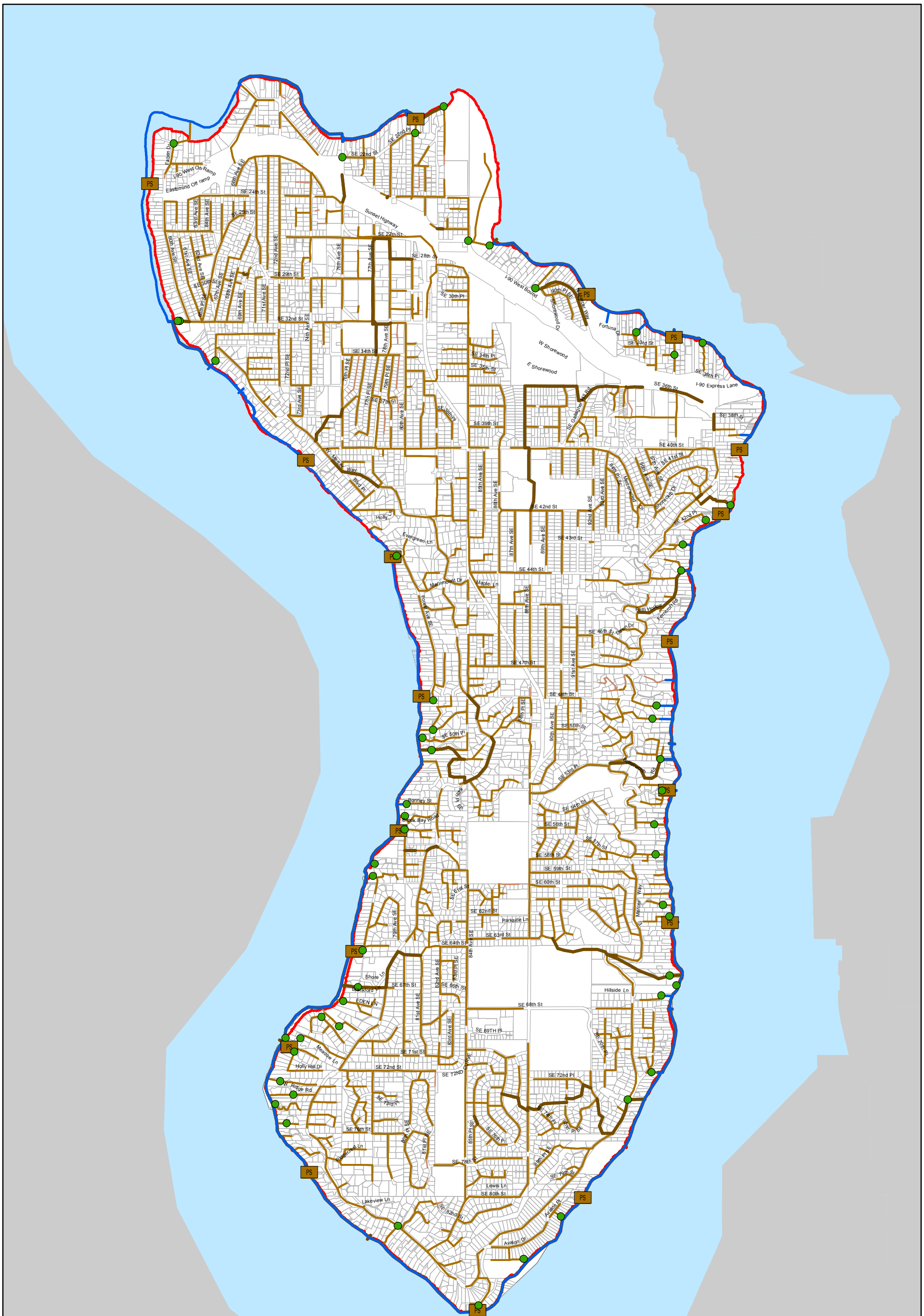


Figure 3.4
Special Catch Basins
General Sewer Plan
City of Mercer Island

carollo

3.2.3 KCDNR Facilities

KCDNR facilities located on the Island, shown on Figure 3.1, include the inlet structure at 76th Ave SE (Lincoln Landing), the North and South Mercer pump stations, Manhole #45-121, and the associated force mains, which receive flows from the City's collection system and Lakeline system. Reaches 1 and 2 flow to the South Mercer Pump Station, which pumps the sewage through a KCDNR underwater force main to the Eastside Interceptor. Reaches 3 and 4 discharge into the inlet structure at Lincoln Landing and then into the North Mercer Pump Station. Sewage from Reach 5/Manhole #45-121 discharges to the North Mercer Pump Station force main. Flows from the North Mercer Pump Station are pumped east to the Sweyolocken Pump Station in Bellevue, where it is pumped to the Eastside Interceptor. Sewage is conveyed to the South Treatment Plant in the City of Renton for treatment.

3.3 WATER RECLAMATION

The City strives to be a sustainable community and recognizes the importance of developing alternative resources for certain types of water use where appropriate. The City may develop projects or consider participation as appropriate in water reuse projects and programs developed by King County or others where feasible.

King County currently has no plans to provide reclaimed water within the City’s service area. In accordance with the City’s commitment towards a sustainable community, it may continue to work with King County to identify opportunities and explore options to deliver reclaimed water within the City’s service area if an economic source of reclaimed water becomes available.

Chapter 4

COLLECTION SYSTEM ANALYSIS

This chapter describes the development of flow projections and the capacity analysis of the City of Mercer Island's (City's) Town Center area collection system, shown in Figure 4.1. The Town Center is the only area of the City anticipated to increased flows due to growth. The remaining portions of the City are built out and are believed to have sufficient capacity.

Hydraulic modeling was intended to evaluate the sewer system capacity. An existing hydraulic model of the City's Town Center area collection system was used as a basis to perform the capacity analysis. Development and calibration of the hydraulic model is described in this Chapter. Capacity deficiencies and proposed improvements to provide sufficient capacity for future development are detailed in the Chapter.

4.1 SEWER COLLECTION SYSTEM FLOWS

The City has separate sewer and stormwater collection systems, where only wastewater is conveyed in the sanitary sewer system. However, some groundwater and stormwater inevitably enter the sanitary sewer through defects in pipes and manholes and illicit storm drain connections. Therefore, sewer flows may vary substantially between dry and wet weather.

The different flow components are described in the section below and illustrated in Figure 4.2.

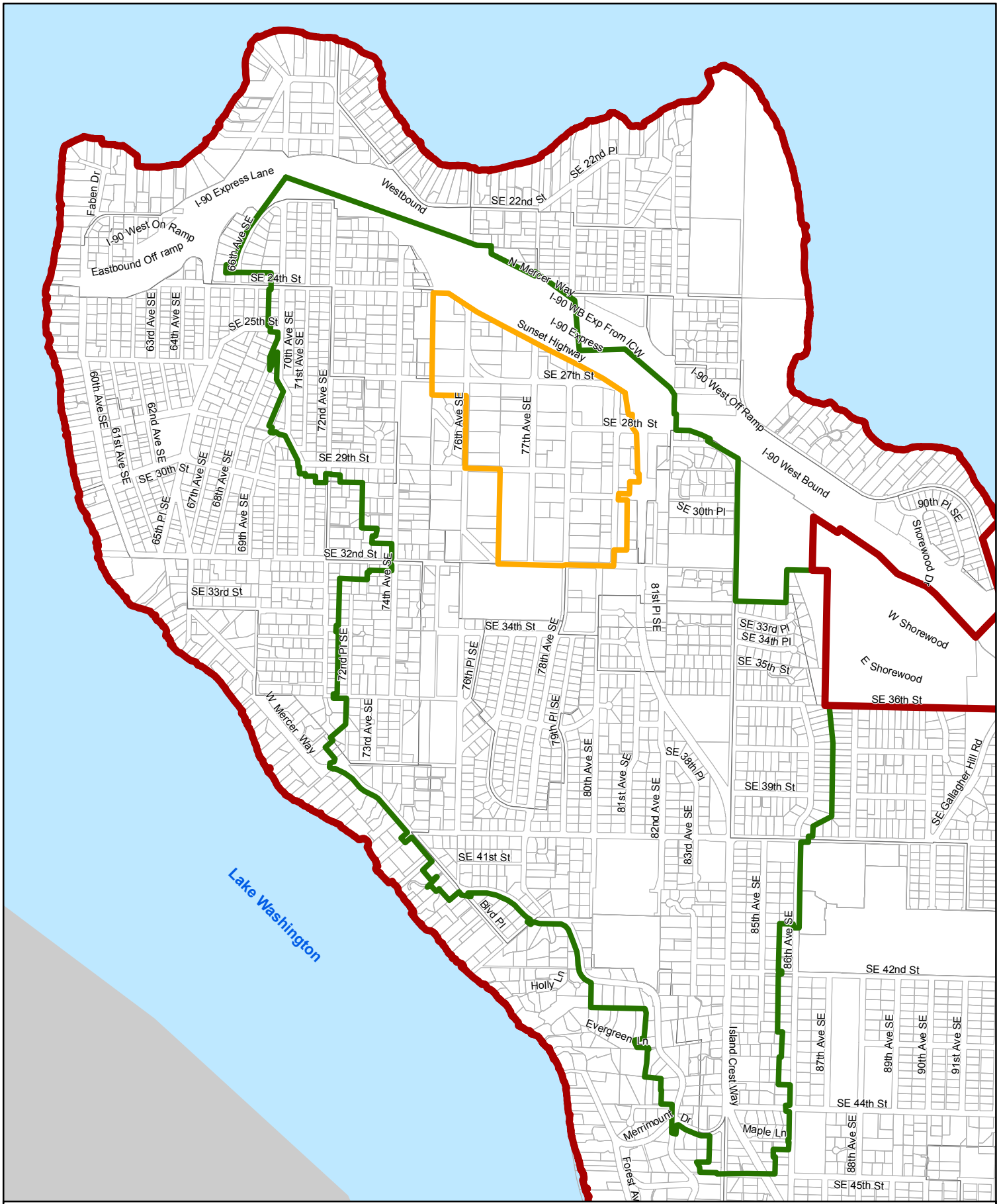
4.1.1 Dry Weather Flow Components

There are two primary components of Dry Weather Flow (DWF):

- Base Wastewater Flow (BWF).
- Dry Weather Groundwater Infiltration (GWI).

4.1.1.1 Base Wastewater Flow

The BWF is the sanitary flow generated by routine water usage of the City's residential, commercial, and mixed-use customers. Conveying this flow is the primary function of the collection system. The flow has a diurnal pattern that varies by customer. Typically, a residential diurnal pattern has two peaks with the more pronounced peak following the wake-up hours of the day, and a less pronounced peak occurring in the evening. Commercial and mixed-use patterns, though they vary depending on the type of use, typically have more consistent higher flow patterns during business hours, and lower flows at night. Furthermore, the diurnal flow pattern of a weekend may vary from the diurnal flow experienced during a weekday.



Legend

- Study Area
- Town Center Outline
- Service Area Boundary
- Parcels

0 500 1,000 Feet

Figure 4.1
Study Area
General Sewer Plan Update
City of Mercer Island

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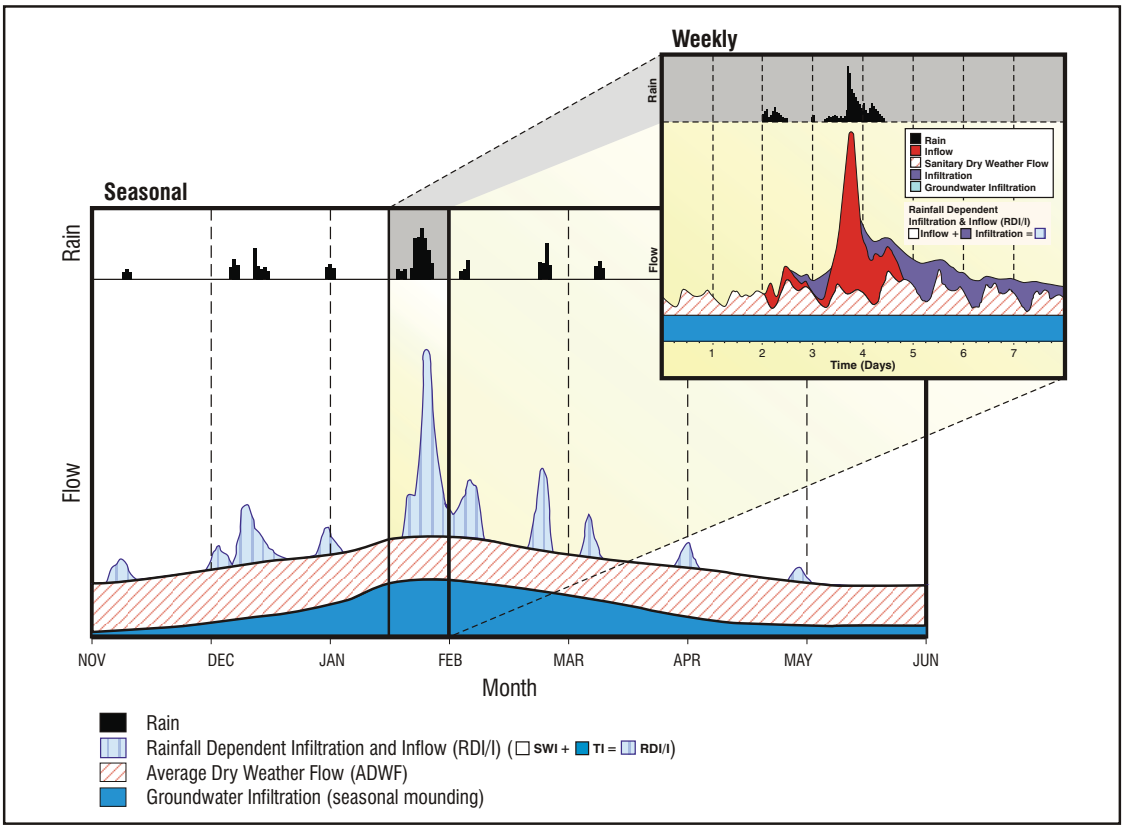
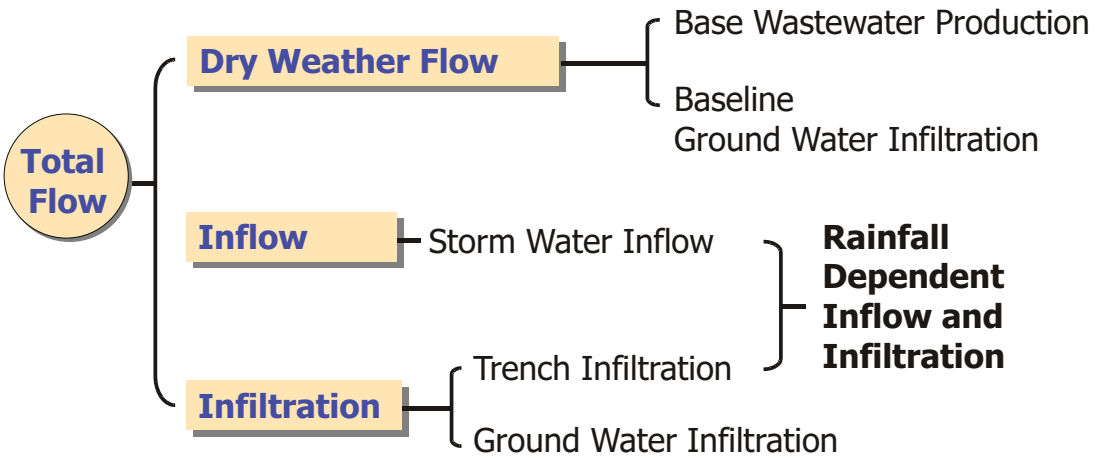




Note: This figure is not based on flow data specific to the City or this Master Plan

TYPICAL WASTEWATER FLOW COMPONENTS

FIGURE 4.2

CITY OF MERCER ISLAND
GENERAL SEWER PLAN

carollo

4.1.1.2 Dry Weather Groundwater Infiltration

Dry weather GWI enters the sewer system through defects such as cracks, misaligned joints, manhole defects, and broken pipelines. Dry weather GWI only occurs when the relative depth of the groundwater table is higher than the depth of the pipeline and where there is a defect; therefore it varies throughout the system. Dry weather GWI (or base infiltration) cannot easily be separated from BWF by flow measurement techniques. Therefore dry weather GWI is typically grouped with BWF.

4.1.1.3 Average Dry Weather Flow

Average Dry Weather Flow (ADWF) is the average flow that occurs on a daily basis during the dry weather season. The ADWF serves as the baseline flow in the hydraulic model. Diurnal (24-hour) patterns are applied to ADWFs, and cumulatively make up the flows experienced in the Study Area. The diurnal patterns developed for the Study Area are shown in Appendix G.

4.1.2 Wet Weather Flow Components

Wet Weather Flow (WWF) includes two components:

1. Inflow and Infiltration (I/I);
2. GWI.

4.1.2.1 Inflow and Infiltration

The stormwater I/I response in the sewer system to rainfall is seen immediately (inflow) or within hours after the storm (infiltration).

Inflow is stormwater that enters the sewer system via a direct connection to the system, such as roof drain and downspout connections, leaky manhole covers, and illicit storm drain cross-connections. Infiltration is stormwater that enters the sewer system by percolating through the soil and then through defects in pipelines, manholes, and joints. The adverse effects of I/I entering the sewer system is that it increases both the flow volume and peak flows such that the sewer system could be operating at or above its capacity. If too much I/I enter the sewer system, sanitary sewer overflows (SSOs) could occur.

4.1.2.2 Wet Weather Groundwater Infiltration

Wet weather GWI is not specific to a single rainfall event, but rather to the effects on the sewer system over the entire wet weather season. The depth of the groundwater table rising above the pipe invert elevation causes GWI. Sewer pipes within close proximity to a body of water can be greatly influenced by groundwater effects.

Wet weather GWI is associated with extraneous water entering the sewer system through defects in pipes and manholes while the ground is saturated during the wet weather season. Wet weather GWI may occur throughout the year, although rates are typically higher in the late winter and early spring in the Pacific Northwest.

4.2 FLOW MONITORING

The City contracted with ADS to conduct a temporary flow monitoring program within the City's Study Area. The purposes of the flow monitoring was to gain a better understanding of flows in the Town Center and to calibrate hydraulic model predicted flows to actual collection system flows to evaluate the system's capacity, and estimate basin I/I. The temporary flow monitoring data was collected for a period of approximately 6 months from January 21, 2016 to July 22, 2016. ADS summarized the flow monitoring data as a stand-alone report. The report is included in Appendix F.

4.2.1 Flow Monitoring Description

4.2.1.1 Flow Monitoring Sites and Tributary Areas

Flow monitors were installed in three manholes allowing flow, depth, and velocity measurements to be collected during the monitoring period.

The meter sites were selected to best isolate and model the critical areas and subareas within the sewer system. The three flow monitoring locations, as well as the area tributary to each site, are shown on Figure 4.3. Table 4.1 lists the flow monitoring locations and the diameters for the sewers where the meters were installed. Figure 4.5 also provides a schematic, on the bottom left corner, illustrating the flow monitoring locations to help understand how the basins connect and how sewer flows between basins.

Table 4.1 Flow Monitoring Locations
General Sewer Plan
City of Mercer Island

Monitor Site	Manhole ID	Pipe Diameter (inch)	Location
Site 1	61-908	10	At the intersection of S.E. 24th St. and 76th Ave. S.E.
Site 2	S11	24	North bound left lane of N. Mercer Way
Site 3	61-197	10	Along Mercerdale Park, 153 feet north of 7719 S.E. 34th St.

4.2.1.2 Rain Gauge

Rainfall data was obtained through the King County Department of Natural Resources (KCDNR). KCDNR maintains a real-time precipitation rain gage[1] in the Study Area by the Mercer Island Boys and Girls Club on 86th Ave. S.E. and S.E. 42nd St; its geographical location is shown on Figure 4.3.

4.2.2 Existing Average Dry Weather Flow Development

During the flow monitoring period, depth and velocity data were collected at each meter at 5-minute intervals. Carollo Engineers, Inc. (Carollo) aggregated the 5-minute data to hourly data for use in the hydraulic model.

ADWF was developed using the driest days from the flow monitoring period based on the following set of minimum criteria:

- No rain occurring within the previous 5-day period.
- Selected days must exhibit average-day flows within 85 percent-115 percent of the average-day flows of remaining dry days.

Characteristic dry weather 24-hour diurnal flow patterns for each site were developed based on the hourly data. The hourly flow data were also used to calibrate the hydraulic model for the observed dry weather flows during the flow monitoring period. Hourly patterns for weekday and weekend flows vary and were separated to better understand dry weather flow.

Carollo estimated the average weekday and weekend dry weather levels and velocities at each site from the data provided by ADS for use in the model calibration process.

[1] Source: http://green2.kingcounty.gov/hydrology/GaugeMap.aspx

Site 1
MH ID: 61-908

Site 2
MH ID: S-11

Site 3
MH ID: 61-197

PS-1

PS-4

PS-10

PS-13

PS-14

SE 20th St
I-90 Express Lane Westbound
Faben Dr
I-90 West On Ramp
Eastbound Off ramp
66th Ave SE
SE 22nd St
SE 22nd Pl
I-90 West Bound On Ramp
N Mercer Way
SE 24th St
62nd Ave SE
63rd Ave SE
64th Ave SE
SE 25th St
71st Ave SE
72nd Ave SE
70th Ave SE
I-90 WB Exp From ICW
Sunset Highway
SE 26th St
SE 27th St
I-90 Express
I-90 West Off Ramp
76th Ave SE
77th Ave SE
SE 28th St
SE 29th St
61st Ave SE
60th Ave SE
SE 30th St
65th Pl SE
67th Ave SE
68th Ave SE
69th Ave SE
SE 30th Pl
I-90 West Bound
Shorewood Dr
W Concord
W Shorewood
E Shorewood
SE 32nd St
SE 33rd St
74th Ave SE
78th Ave SE
81st Pl SE
SE 33rd Pl
SE 34th St
SE 34th Pl
SE 35th St
84th Ave SE
72nd Pl SE
76th Pl SE
77th Pl SE
SE 36th St
SE 37th St
SE 37th Pl
79th Pl SE
80th Ave SE
81st Ave SE
82nd Ave SE
SE 38th Pl
SE 39th St
SE Gallagher Hill Rd
W Mercer Way
SE 40th St
83rd Ave SE
SE 41st St
85th Ave SE
Blvd Pl
Holly Ln
86th Ave SE
SE 42nd St
Evergreen Ln
Carol Ln
87th Ave SE
89th Ave SE
SE 43rd St
Merrimount Dr
Maple Ln
Island Crest Way
88th Ave SE
SE 44th St
SE 45th St
Forest Ave SE
SE 46th St
SE 47th St
91st Ave SE
Lake Washington

8"
10"
12"
16"

To King County Pump Station
Site 01
Site 02
Site 03

FLOW MONITORING SCHEMATIC

Legend

- Rain Gauge
- Manhole
- King County Pump Station
- Mercer Island Pump Station

Gravity Main by Diameter
- 10" or Larger
- 8"
- 6" or Smaller
- Pressurized Main

GIS Pipe Flow Direction

Other System Pipe Ownership
- Shorewood
- Private
- King County
- Lakeline Gravity Main

- Study Area
- Town Center Outline
- Parcels
- Service Area Boundary

Basins
- Meter 1
- Meter 2
- Meter 3

Figure 4.3
Flow Monitoring Site Locations
General Sewer Plan Update
City of Mercer Island

Document Path: E:\KRC D DRIVE\Mercer Island\MXDs\Figure 4.3.mxd

Figure 4.4 illustrates a typical variation of weekday and weekend flow in the City, which is based on the data collection from Site 2. Table 4.2 summarizes the gross ADWF at each site for weekdays and weekends, which includes the meter basin flow and all flows coming from any upstream meters. Table 4.3 summarizes the net ADWF for each site, which exclude flows from areas upstream of the meter basin flow.

Table 4.2 Weekday vs Weekend Average Dry Weather Flows
General Sewer Plan
City of Mercer Island

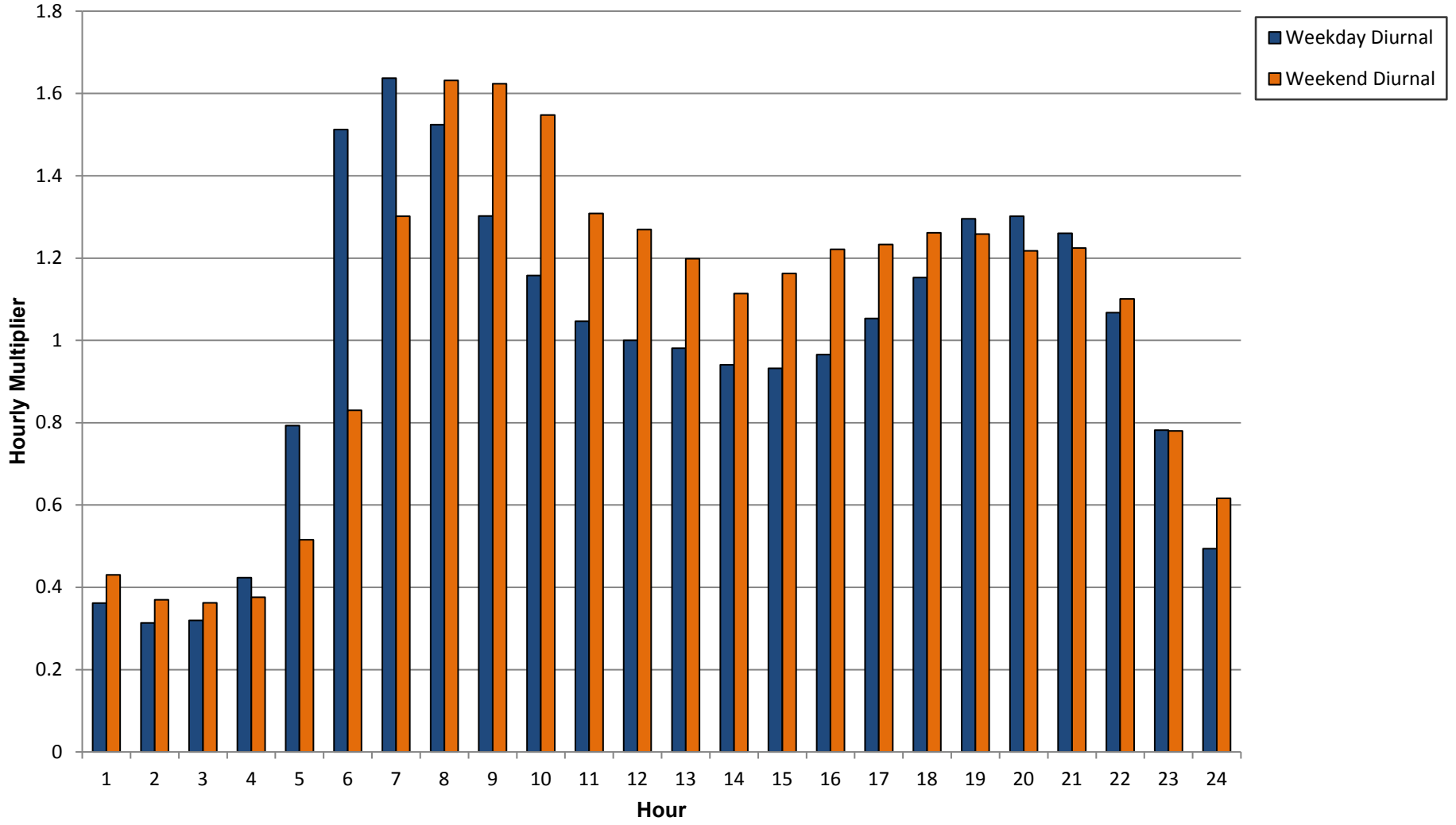
Site ID	Gross Weekday ADWF (mgd)	Gross Weekend ADWF (mgd)	Weekday/Weekend Ratio
Site 1	0.074	0.071	1.05
Site 2	0.511	0.499	1.02
Site 3	0.077	0.082	0.95

Notes:
(1) Source: ADS Temporary Flow Monitoring Program Data.
(2) Gross values include the meter basin flow and all flows coming from any upstream meters.

Table 4.3 Average Dry Weather Flow Estimates
General Sewer Plan
City of Mercer Island

Site ID	Gross ADWF (mgd)	Net ADWF (mgd)	Meter Relationship
Site 1	0.073	0.073	=Site 1
Site 2	0.508	0.429	=Site 2 - Site 3
Site 3	0.078	0.078	=Site 3

Notes:
(1) Source: ADS Temporary Flow Monitoring Program Data.
(2) Gross values include the meter basin flow and all flows coming from any upstream meters.
(3) Gross ADWF = (Gross Weekday*5+Gross Weekend*2)/7.
(4) Net values correspond to the meter basin flow independently from the upstream meters. Upstream meter flows are subtracted to obtain the net values.



TYPICAL WEEKDAY VS WEEKEND DRY WEATHER FLOW VARIATION (METER 2)

FIGURE 4.4

CITY OF MERCER ISLAND
GENERAL SEWER PLAN

4.2.3 Wet Weather Flows

4.2.3.1 Rainfall Data

An important part of the flow monitoring program is the collection and analysis of rainfall data. Three significant rainfall events occurred during the course of the flow monitoring period, as well as a few other relatively minor events. The rainfall data recorded over the course of the flow monitoring program is illustrated in Figure 4.5. Table 4.4 summarizes the total rainfall recorded at the rain gauge during the main rainfall events.

Table 4.4 Major Rainfall Events Summary
General Sewer Plan
City of Mercer Island

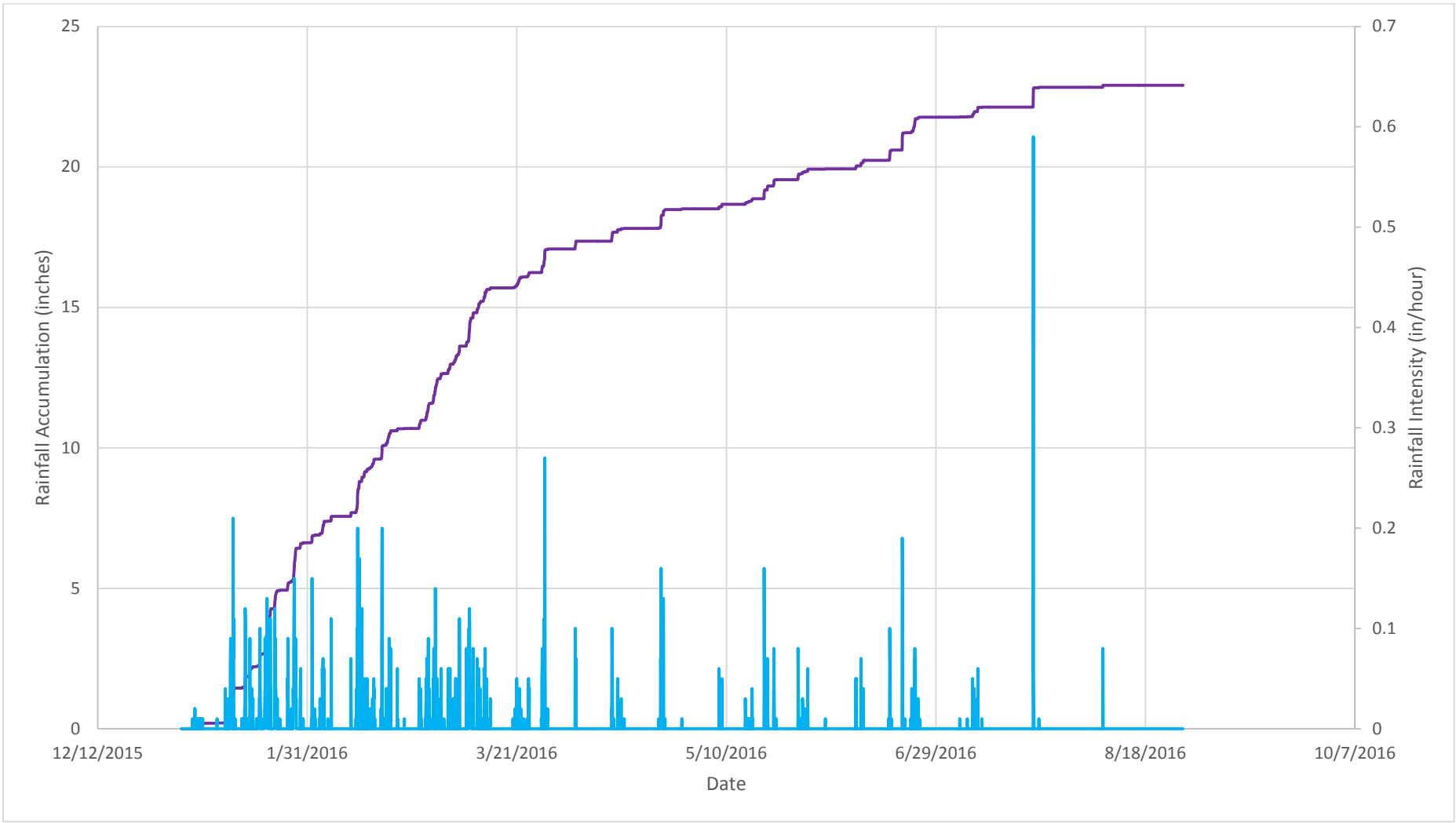
	King County Raingage	
Rainfall Event Dates	**Max Rainfall Intensity (inch/hour)**	**Rainfall Volume (inch)**
1/21/2016 - 2/2/2016	0.15	4.08
2/10/2016 - 2/24/2016	0.20	3.13
2/27/2016 - 3/19/2016	0.14	4.82

The storms recorded during the Temporary Flow Monitoring Program did present data in terms of the collection system's I/I response to wet weather flow events, and is appropriate for I/I analysis and model calibration purposes.

4.2.3.2 Wet Weather Flow Data

The flow monitoring data was evaluated to determine how the collection system responds to wet weather events. The rainfall event that occurred on January 28, 2016 was associated with the largest I/I response during the flow monitoring period.

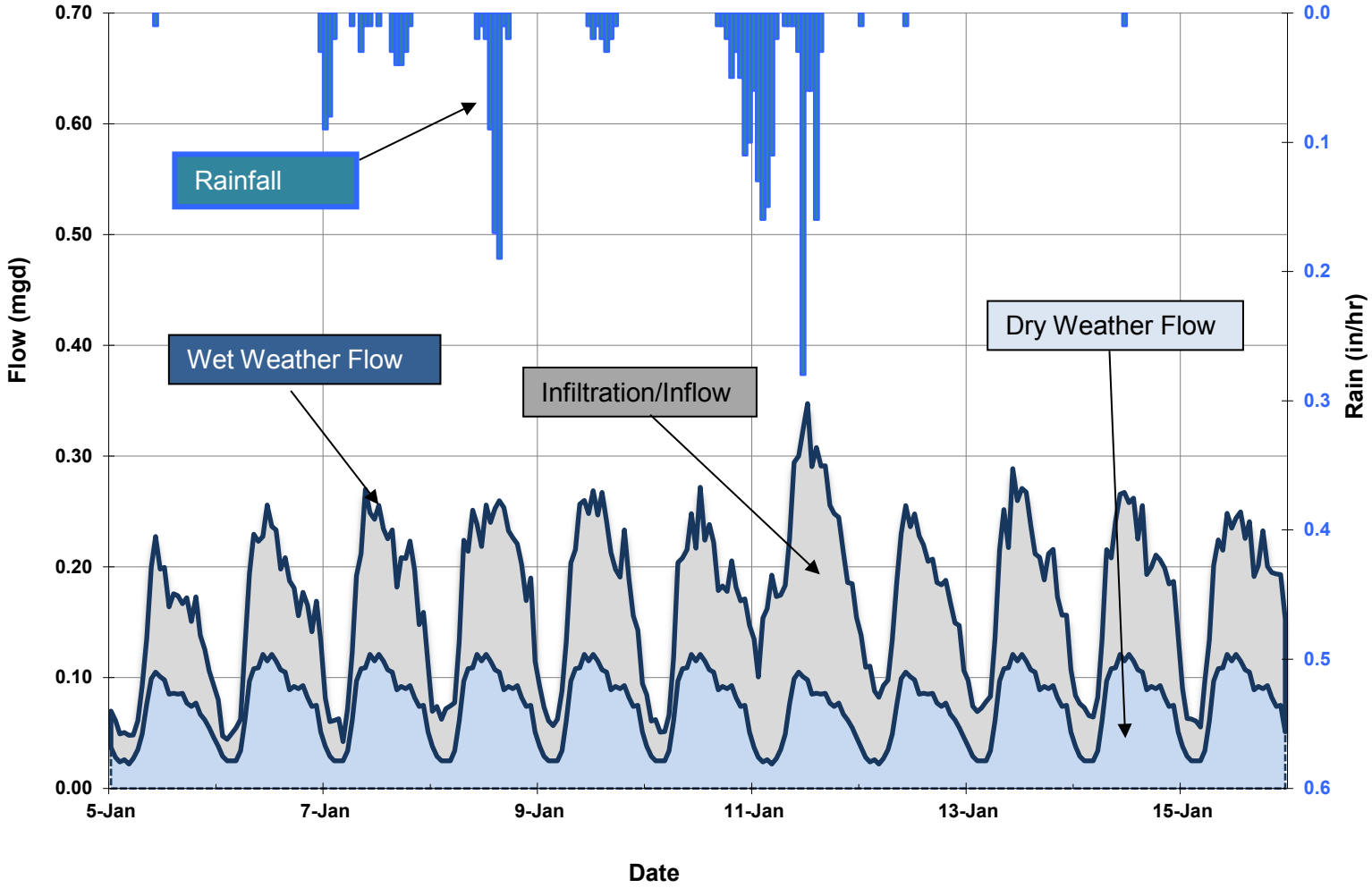
Figure 4.6 shows an example of the wet weather response at Site 2 during the January 28, 2016 rainfall event. The light blue area is the base sanitary flow while the gray area is the measured flow from the flow monitoring period. As can be seen in the figure, discernible amounts of I/I do enter the system during wet weather events. Similar graphs were generated for the remaining monitoring sites can be found in Appendix F. Table 4.5 shows the highest peak flows recorded during the flow monitoring program.



RAINFALL ACTIVITY OVER FLOW MONITORING PERIOD

FIGURE 4.5

CITY OF MERCER ISLAND
GENERAL SEWER PLAN



EXAMPLE OF WET WEATHER FLOW RESPONSE (SITE 2)

FIGURE 4.6

CITY OF MERCER ISLAND
GENERAL SEWER PLAN

Table 4.5 Wet Weather Flows Summary[1] General Sewer Plan City of Mercer Island			
Site ID	Gross ADWF (mgd)	Gross Peak Hourly Flow (mgd)	Peaking Factor
Site 1	0.073	0.576	7.9
Site 2	0.508	1.663	2.8
Site 3	0.078	0.466	5.9
City Average			

Notes:
(1) Source: ADS Flow Monitoring Program Report.

4.3 COLLECTION SYSTEM FLOW PROJECTIONS

The sections below describe the data and methods used to estimate future sewer flows. This includes establishing flow factors, and estimating future flows. Flow projections and analysis were only performed for the Study Area

4.3.1 Land Use

Land use information is an integral component in estimating the amount of wastewater generated. The type of land use in an area will affect the volume of the wastewater generated. Additionally, the service area is typically comprised of both sewered and unsewered areas: Sewered areas contribute flow to the collection system, while unsewered areas are vacant or undeveloped land and do not currently contribute flow to the collection system. The following section describes the land use assumptions for the Study Area.

4.3.1.1 Existing Land Use

The existing land use is presented in Figure 4.7. Of the Study Area's total existing area of 521.7 acres, approximately 474 acres is sewered (i.e., contribute flows to the sewer system) and 48 acres are unsewered (vacant, undeveloped, parks, open spaces, etc.). Table 4.6 provides a summary of the land use categories and acreage in the Study Area.

The largest land use category is residential, which accounts for approximately 404 acres, or approximately 77 percent of total acreage. Commercial, and mixed-use make up approximately 48 acres, or 9 percent of the total.

Table 4.6 Existing Land Use Acreage General Sewer Plan City of Mercer Island		
Land Use Classification	**Stories**	**Total (acres)**
Multi-family Residential	5	1.4
Multi-family Residential	4	14.4
Multi-family Residential	3	19.0
Multi-family Residential	2	0.4
Commercial	5	2.3
Commercial	4	0.2
Commercial	3	1.4
Commercial	2	8.0
Commercial	1	26.3
Mixed-Use	5	9.4
Mixed-Use	4	0.5
Single Family Residential	N/A	369.1
Public/Quasi-Public	N/A	21.4
Park/Open Space	N/A	40.2
Parking/Vacant	N/A	7.7
Total (acres)		**521.7**

4.3.1.2 Future Land Use

The future study area land use is presented in Figure 4.8 and corresponds to the adopted Comprehensive Land Use Plan. The future study area includes build-out of the entire Study Area. Table 4.7 provides a summary of the future land use categories in the Study Area.

The largest future land use category remains residential, which accounts for approximately 404 acres, or approximately 77 percent of total acreage. Under build-out conditions, mixed-use developments increase from 10 acres to 55 acres, and commercial developments drop from 38 acres to only 3 acres.

Table 4.7 Future Land Use Acreage General Sewer Plan City of Mercer Island		
Land Use Classification	**Stories**	**Total (acres)**
Multi-family Residential	5	1.4
Multi-family Residential	4	13.2
Multi-family Residential	3	20.5
Multi-family Residential	2	1.3
Commercial	5	1.4
Commercial	3	0.6
Commercial	2	0.4
Commercial	1	0.4
Mixed-Use	5	18.4
Mixed-Use	4	15.3
Mixed-Use	3	20.8
Single Family Residential	N/A	368.2
Public/Quasi-Public	N/A	19.7
Park/Open Space	N/A	40.2
Parking/Vacant	N/A	
Total (acres)		**521.7**

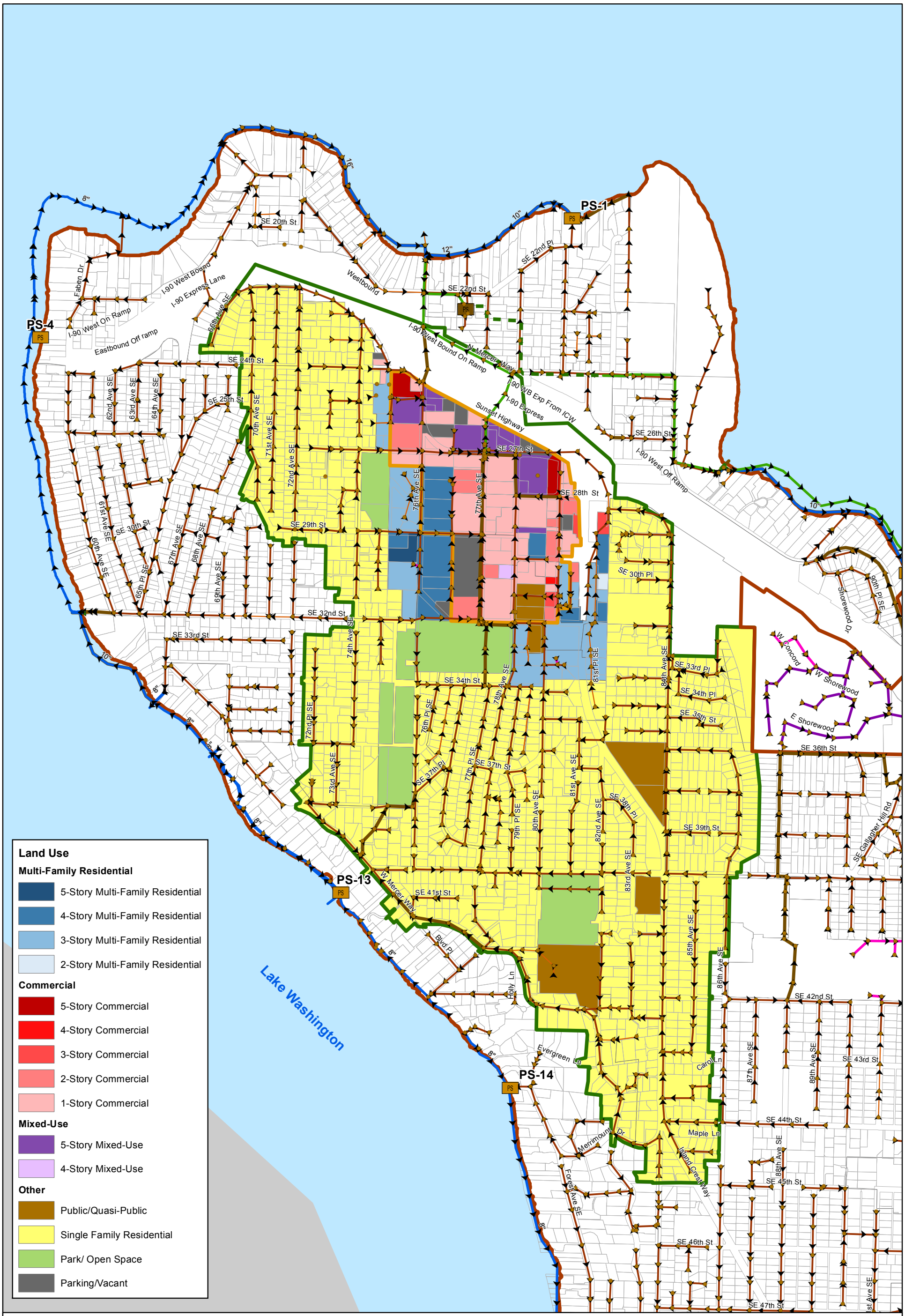


Figure 4.7
Study Area Existing Land Use
General Sewer Plan Update
City of Mercer Island

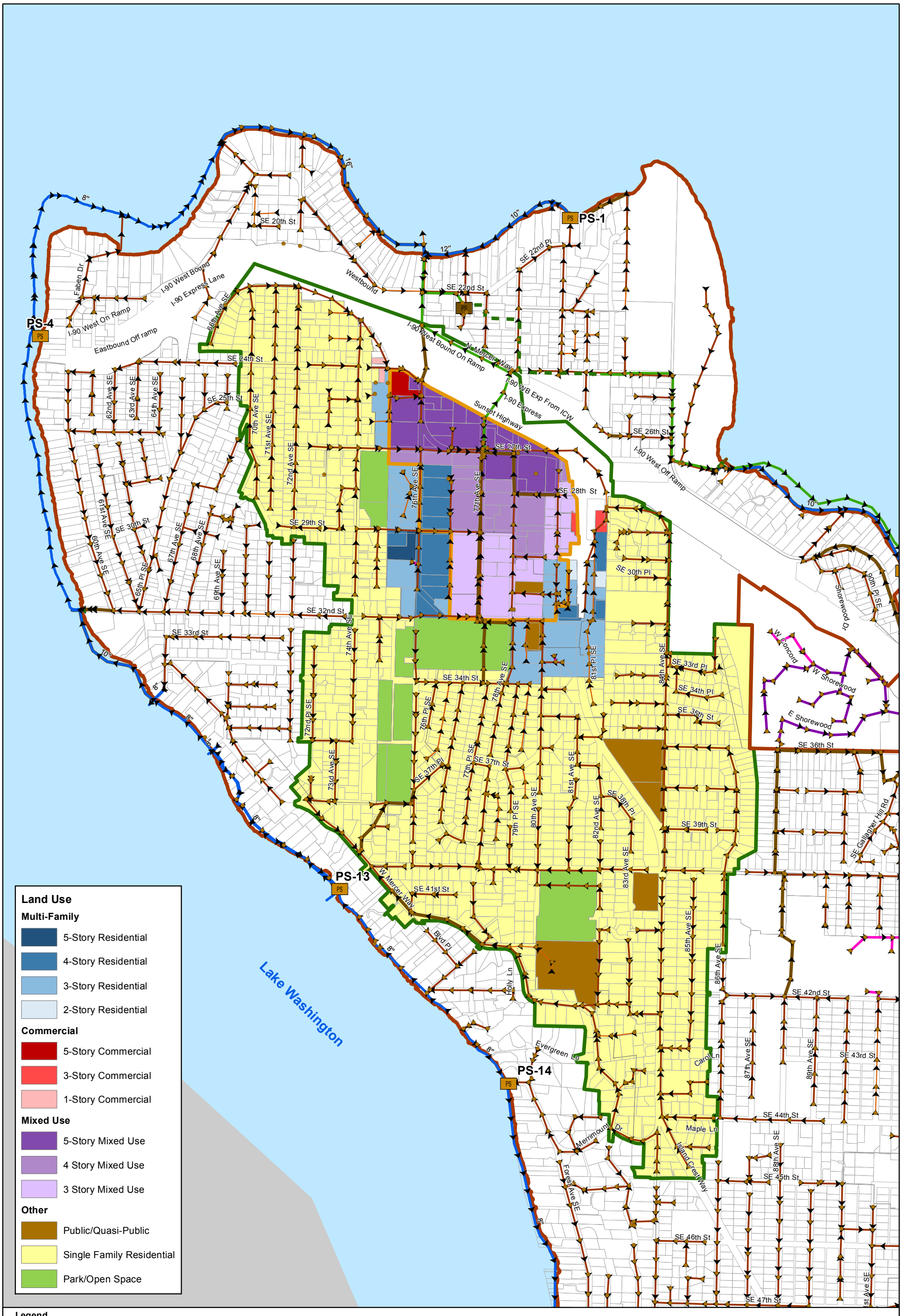


Figure 4.8
Study Area Build Out Land Use
General Sewer Plan Update
City of Mercer Island

4.3.2 Industrial Wastewater

The City does not have industrial businesses on the Island. At any given time, there are temporary construction dewatering that are permitted as industrial dischargers, which vary in both number and location depending on construction activities. The City also may have permitted groundwater remediation at any given time, which also is considered an industrial dischargers. King County maintains an up-to-date list of active industrial discharge permits.

4.3.3 Population Growth Projections

The state's Growth Management Act (GMA) requires cities to accommodate a certain amount of additional growth over the 20 year planning horizon from 2015 to 2035. The City maintains an up to date summary of population growth projections on its website, referred to as the "Growth Management Act and Comprehensive Planning Frequently Asked Questions", which is summarized below.

Mercer Island's projected population growth is approximately 5,900 additional people between 2006 and 2035. In 2010, Mercer Island had 22,699 people. By 2017, the City's estimated population grew 6.6 percent to 24,210. For the purposes of the General Sewer Plan (Plan), it was anticipated the 2035 population to be approximately 28,000 people.

The City plans development based on housing units, rather than population. The City needs to plan for housing an additional 2,320 households between 2006 and 2035. Mercer Island has averaged 2.54 people per household. The starting year of 2006 is used rather than 2015 because several earlier amendments to State law delayed the requirement to update Comprehensive Plans. Therefore, growth that actually occurred between 2006 and 2015 needs to be considered in planning to 2035. The difference between Mercer Island's 2035 housing growth target (2,320 units) and permitted housing unit growth between 2006-2017 (1,049 units) is 1,271 housing units. The City has achieved 45 percent of its 2035 housing target in 41 percent of the growth planning period (2006-2035). Based on the City's zoned capacity for these housing units to be built in the Town Center Area.

4.3.4 Wastewater Flow Coefficients

In order to develop wastewater flow projections and allocate future flows to the collection system, relationships between land use and wastewater generation were developed. These relationships, called wastewater flow factors are established based on the average wastewater flow generated for each existing land use type. The land use flow factors were established to project the estimated ADWF through future development of the City's wastewater collection system and project future flows within the Study Area boundary.

Average wastewater flow coefficients are rates, usually expressed in gallons per acre per day (gpad), applied to either gross or net acres for calculating average day flow generated from a particular land use. A flow coefficient was developed for each of the land use classifications discussed previously. The flow coefficient provides a means to transform a land use category from acreage into wastewater flow. The resulting flow is then input into

the appropriate sewer area in the sewer system model. Wastewater flow coefficients for residential areas can range between 500 to 8,000 gpad, and commercial and mixed use areas might range from 1,000 to 15,000 gpad based on the type of development. Land uses designated as open space and parks are assumed to generate negligible amounts of sewage flow, and as a result have a flow coefficient of zero.

The coefficients are developed using the following procedure:

- Average flows for each flow metering tributary area are extracted from the flow-monitoring data.
- Using geographic information system (GIS), the acres for each land use type contained in each flow-monitoring tributary area are calculated.
- Preliminary coefficients for each land use type are assumed based on typical values, which can be estimated from the approximate number of dwelling units per acre, the assumed per capita wastewater generation rates, and/or the typical number of people per dwelling unit for each land use type.
- The coefficients for each flow metering tributary area are adjusted up or down (balanced) within a reasonable range (based on engineering judgment) until the calculated average flows from each tributary match what was measured during the flow monitoring period. If the flow coefficients produced average flows that were significantly different from the field measured flows, further investigation was conducted to verify that the tributary basins were delineated correctly and if the collection system configuration was representative of the existing system.
- Once the coefficients for the three flow meter tributary areas are balanced, the weighted average of the coefficients for each land use type is calculated based on the acreage contribution from each metering tributary area.
- Individual meter calibrated flow factors were used to allocate existing flows to the study area for each flow monitoring basin, while weighted average flow coefficients were used to plan future flows and allocate additional flows in the collection system based on future projected development.

Table 4.8 presents the weighted wastewater flow coefficients and land use areas that represent the study area's existing ADWF. As with most cities, residential land use makes up the majority of developed land and wastewater flow. For Mercer Island, residential customers (Single-family Residential and Multi-family Residential) make up approximately 65 percent of the current flow in the study area. Detailed wastewater flow coefficients developed for each flow monitoring basin can be found in Appendix G.

4.3.5 Projected Average Dry Weather Flow

Developing an accurate estimate of the future quantity of wastewater generated at build-out of the collection system is an important step in maintaining and sizing sewer system facilities, for both existing conditions and future scenarios.

Base flow can be estimated for a wastewater system by comparing dry weather flow and wet weather flow at the various flow monitoring locations. To estimate ADWF for more specific areas, such as individual wastewater basins, dry weather flows are typically estimated based on the area contributing to flows and flow coefficients developed for each land use type. This method is developed based on the assumption that areas with similar land uses, such as low density residential parcels, produce equivalent quantities of wastewater flow. System-wide flows can be compared to known flows at flow monitors, or at the treatment plant to verify accuracy. This method of estimating base flows is an industry standard for planning and provides sufficiently accurate data for planning purposes.

Table 4.8 Wastewater Flow Balance Summary
General Sewer Plan
City of Mercer Island

Land Use	Stories	Developed Area (acres)	Planning Wastewater Flow Factor (gpad)	Existing ADWF (mgd)
Multi-family Residential	5	1.4	7,500	0.010
Multi-family Residential	4	14.4	6,000	0.086
Multi-family Residential	3	19.0	4,500	0.086
Multi-family Residential	2	0.4	3,000	0.001
Commercial	5	2.3	4,690	0.011
Commercial	4	0.2	4,000	0.001
Commercial	3	1.4	3,000	0.004
Commercial	2	8.0	2,290	0.018
Commercial	1	26.3	990	0.026
Mixed-Use	5	9.4	12,070	0.113
Mixed-Use	4	0.5	10,400	0.005
Single Family Residential	N/A	369.1	530	0.196
Public/Quasi-Public	N/A	21.4	1,000	0.021
Park/Open Space	N/A	40.2	0	0.000
Parking/Vacant	N/A	7.7	0	0.000
			Total Estimated ADWF =	0.580
			Measured ADWF=	0.580
			% Difference =	-0.3%

4.3.5.1 Projection Methodology

The projected ADWFs were developed based on the future land use map (Figure 4.8). The flow coefficients developed for the existing land use categories were applied to the future build-out land use (acres) to project the wastewater flow generated from anticipated

redevelopment and infill. The resulting flows represent the projected inflow in the hydraulic model.

Flows were developed for each parcel in the Study Area. Flows are separated between existing flows and infill/redevelopment flows. Existing flows are developed for currently developed and connected parcels and flow factors calibrated under Section 4.3.2 for each wastewater basin. Infill/growth flows correspond to additional flows expected in the future. Parcels currently vacant and parcels with projected higher flow usage in the future are assigned planning flow factors to estimate additional future flows in the future.

Each parcel's existing land use classification is compared with future land use classification from the Comprehensive Plan. The following allocation was then performed:

- Where parcels that show the same land use classification, maintained no additional flow was assigned.
- Where parcels are anticipated to redevelop or infill and produce greater wastewater, flows were assigned additional ADWF. ADWFs for currently vacant parcels are developed using planning flow factors for each land use type. ADWFs for parcels that are assumed to have higher future wastewater production, were allocated additional flow equal to the difference between existing and future flow factors.
- The assumption was made that when the provided land use data showed a decrease in land use classification, no change was made and the existing flow for the parcel remained the same. This is a conservative assumption that assumes that existing flows will not decrease in the future in the Study Area system.

4.3.5.2 Projected Average Dry Weather Flows

The projected ADWFs estimated for each flow monitoring basin using the developed planning flow factors are summarized in Table 4.9. Future ADWFs for the Study Area are anticipated to increase to 0.922 million gallons per day (mgd) under build-out conditions.

Table 4.9 ADWF Projections Summary by Flow Monitoring Basin
General Sewer Plan
City of Mercer Island

FM Basin ID	Total Existing ADWF (1)(mgd)	Total Build-out ADWF (mgd)	Percent ADWF Increase
Site 1	0.073	0.092	+ 26.0%
Site 2	0.429	0.751	+ 75.0%
Site 3	0.078	0.079	+ 0.1%
Total Study Area	**0.580**	**0.922**	**+ 58.9%**

Notes:
(1) Source: ADS Flow Monitoring Program.

4.3.5.3 Water Conservation Impacts on Average Dry Weather Flows

Increased water efficiency of fixtures and appliances has created a lasting per capita water use reduction since the 1980s, particularly for residential customers. The City participates in regional water conservation program sponsored by the Saving Water Partnership. It is anticipated that the City's continued water conservation will result in a modest decrease in per capita dry weather flows. However, the City does not anticipate future reductions to impact wastewater operations in the future. First, the City's steep topography negates common maintenance issues caused from low flows, such as solids settling. Second, the total average dry weather flow may be similar to it is today. Typical redevelopment in the City results in increased number of fixtures, either through larger homes or increased density. While the new fixtures maybe more efficient, reductions in flow from the new fixtures are likely offset by the increased number of fixtures.

4.3.6 Projected Peak Wet Weather Flow Development

Peak wet weather flows (PWWF) in a wastewater collection system are caused by rainfall dependent I/I. Peak hour flows can result in flows more than ten times the base flow, causing utilities to construct high-capacity infrastructure to convey and treat these extraneous flows. This section describes the methodology used for developing existing and future peak hour flows within the Study Area's sewer system, which was subsequently used for performing the capacity analysis as described in Section 4.6. To develop the design flows in the hydraulic model, the design storm is routed through the model and the resulting I/I from existing and future development creates the design flow.

4.3.6.1 Design Storm

Design storms are rainfall events used to analyze the performance of a collection system under peak flows and volumes, and have specific recurrence interval and rainfall duration. Developing a design storm can be accomplished in different ways: historical data, synthetic storms, custom storm, etc. Consistent with previous planning, a historical storm from November/December 2001 was used as the design storm for the capacity analysis. The design storm includes two major events: November 28, 2001, which was estimated to be a 50-year recurrence storm, and December 11, 2011, which was estimated to be a 100-year recurrence storm. Return frequencies for the design storm were evaluated as part of the 2003 Plan.

Figure 4.9 shows the historical design storm. The historical storm resulted in a peak rainfall intensity of 0.32 inch/hour and a maximum 24-hour volume of 3.19 inches. These maximum values occurred on November 14, 2001.

4.3.6.2 I/I Degradation Assumption

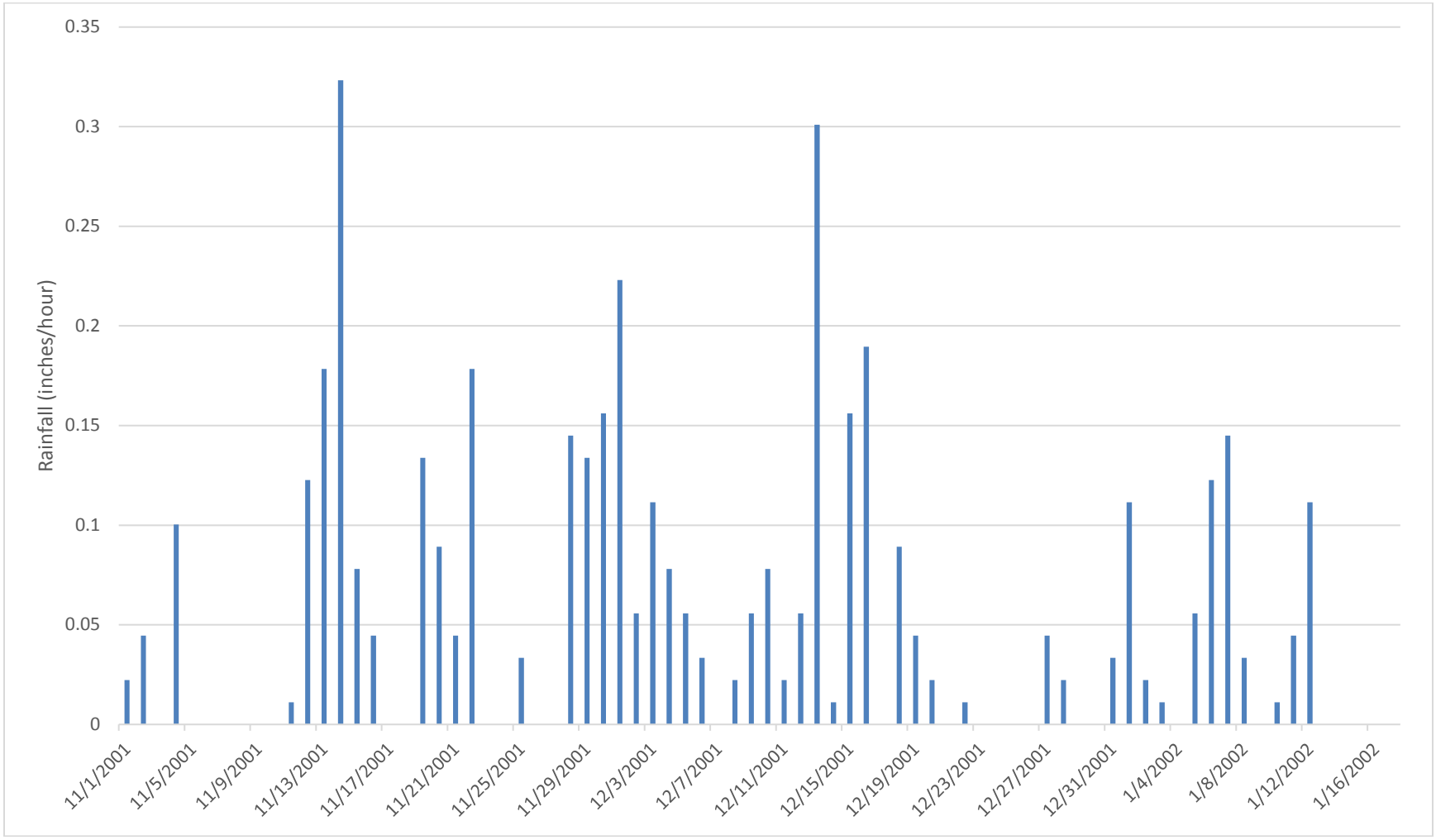
As collection pipelines age and degrade, they are susceptible to greater I/I. For the development of future hourly peak flows, the existing collection system was assumed to

degrade at a rate of 7 percent per decade, thereby increasing the I/I rate each year. This rate comes from a King County Study published in 2014.[2]

4.3.6.3 Capacity Bottleneck Assumption

The peak flows (existing and future) for the flow monitoring basins presented in Table 4.10 include improvements to correct capacity deficiencies presented in Section 4.6 - Capacity Evaluation. The improvement projects alleviate capacity bottlenecks upstream in each basin, which allows higher peak flows to be conveyed through the system. All values below represent the flows if the capacity bottlenecks are resolved. This ensures that the PWWF truly represents the peak hour flow, without dampening due to upstream capacity deficiencies. Peak flows without improvements would be underestimates of actual peak system inflow.

[2] Updated Planning Assumptions for Wastewater Flow Forecasting, King County, July 2014.



DESIGN STORM
(NOVEMBER/DECEMBER 2001)

FIGURE 4.9

CITY OF MERCER ISLAND
GENERAL SEWER PLAN

4.3.6.4 Existing and Projected Peak Wet Weather Flows

The PWWF represents the maximum hourly flow rate under the selected design storm presented in Section 4.3.4 and land use scenarios. Table 4.10 provides the peak hour design flow under both existing and future scenarios for each wastewater basin.

Note, the elimination of bottlenecks from the system likely causes the PWWF predictions to be higher than with existing infrastructure. The PWWFs from these scenarios more closely represent the wastewater inflows to the system.

Table 4.10 Study Area Existing and Projected Wastewater Flows
General Sewer Plan
City of Mercer Island

Condition[3]	Average Dry Weather Flow (ADWF) (mgd)	Peak Wet Weather Flow (PWWF)[1] (mgd)	R-Value (%)	Peak I/I Rate (gpad)	Peaking Factor (PWWF:ADWF)[2]
Existing	0.65	3.65	6.3	5,800	5.6
Build-Out	0.92	4.57	7.0	6,900	5.0

Notes:
(1) The PWWF flow is the peak hourly flow during the design storm event.
(2) Peaking factor is the Peak Wet Weather Flow divided by the Average Dry Weather Flow.
(3) These conditions represent the flows from the Study Area if the capacity bottlenecks are resolved. This ensures that the PWWF truly represents the peak hour flow, without dampening due to upstream capacity deficiencies.

The peak flows were used to develop three important parameters for understanding I/I as follows:

- **R-Value (%):** A metric typically used to quantify the severity of the system's I/I is the R-value. The R value is defined as the percentage of rainfall volume that makes it into the collection system as I/I. The R-value provides a means to compare the relative magnitude and severity of total I/I volume between different basins and different storm events. Systems with R-values less than 5 percent are often considered to be performing well; this criterion will be used for this Plan. Because the infiltration component is usually more predominant than the inflow component on a totalized Rainfall Derived Infiltration and Inflows (RDII) volume flow basis, the R-value is listed as an indicator of infiltration. The system shows R-value above 6 percent, which is a sign of significant infiltration.
- **Peak I/I Rate (gpad):** The Peak I/I Rate is the peak flow rate of all non-sanitary flows. Peak I/I Rates are calculated by subtracting the base sanitary flow from the peak flow for each basin. These rates indicate how much peak I/I is coming from each basin. The Peak I/I Rate is listed as an indicator of inflow. I/I Rates are largely dependent on

the contributing area of land; typical values are not available. Ideally, a wastewater system would have no I/I flows. In general, a peak I/I per acre value greater than 3,500 gpad represents a high response of a collection system, while a peak RDII per acre value greater than 7,000 gpad is considered significantly high.

The study Area shows significantly high inflow, mainly due to flow monitoring basin 1.

- **Peaking Factor:** Peaking factors are the ratio between peak flow and base sanitary flow and are commonly used for wastewater infrastructure design. These factors are derived by dividing the peak flow by the base sanitary flow for each basin. Due to the prolonged rainy season, wastewater agencies in the northwest typically experience peaking factors from two to ten, and in some cases more than ten.

  The PWWF to ADWF peaking factor of 5.6 is moderate and consistent with the other systems of similar age and material. The decrease in peaking factor reflects the increase in future density of the Town Center area, which will increase base flows without increasing I/I.

4.3.6.5 Wet Weather Flows outside of Town Center

The City does not have flow monitoring data to analyze wet weather flows and I/I beyond the Town Center sewershed. The City encourages WTD to provide sufficient monitoring in the upcoming 2020 decadal monitoring to evaluate I/I on a basin by basin level. As presented in this Plan, the City plans to upgrade its pump stations Supervisory Control and Data Acquisition (SCADA) to provide flow measurement by 2024 to both improve system operation and evaluate the performance of the system. While this data trends in I/I, it is not a substitute for the decadal flow monitoring.

4.4 HYDRAULIC MODEL DEVELOPMENT

4.4.1 Hydraulic Model Overview

A sewer collection system model is a simplified representation of the real sewer system. Sewer system models can assess the conveyance capacity for a collection system. In addition, sewer system models can perform “what if” scenarios to assess the impacts of future developments and land use changes. The City’s collection system hydraulic model was constructed using a multi-step process utilizing data from a variety of sources. This section summarizes the hydraulic model development process, including a summary of the modeling software selection, a description of the modeled collection system, the hydraulic model elements, and the model creation process.

4.4.1.1 Selected Hydraulic Modeling Software

The City's previous collection system hydraulic model was developed using the Mike Urban hydraulic modeling software package, developed by DHI. Mike Urban uses the MOUSE engine, which is widely used throughout the world for planning, analysis, and design related to stormwater runoff, combined sewers, sanitary sewers, and other drainage systems.

The latest version (2016) of Mike Urban was used to update the hydraulic model. More information about the modeling software can be found in the Mike Urban Collection Systems Guide (DHI, 2007).

4.4.1.2 Elements of the Hydraulic Model

The following provides a brief overview of the various elements of the hydraulic model and the required input parameters associated with each:

- **Junctions:** Sewer manholes, cleanouts, as well as other locations where pipe sizes change or where pipelines intersect are represented by junctions in the hydraulic model. Required inputs for junctions include rim elevation, invert elevation, and surcharge depth (used to represent pressurized systems). Junctions are also used to represent locations where flows are split or diverted between two or more downstream links.
- **Pipes:** Gravity sewers and force mains are represented as pipes in the hydraulic model. Input parameters for pipes include length, friction factor (e.g., Manning's n for gravity mains, Hazen Williams C for force mains), invert elevations, diameter, and whether or not the pipe is a force main.
- **Storage Nodes:** For sewer system modeling, storage nodes typically are used to represent lift station wet wells (although other storage basins, etc. can be modeled as storage nodes). Input parameters for storage nodes include invert elevation, wet well depth, and wet well cross section.
- **Pumps:** Pumps are included in the hydraulic model as links. Input parameters for pumps include pump curves and operational controls.
- **Outfalls:** Outfalls represent areas where flow leaves the system. For sewer system modeling, an outfall typically represents the connection to the influent pump station at a wastewater treatment plant or in the case of the Town Center area to the King County interceptor.
- **Rain Gauges:** Rain gauges are input into the hydraulic model to simulate historical or theoretical hourly rainfall events.
- **Subcatchments:** Subcatchments represent the hydrologic units of land area whose topography and drainage characteristics direct surface runoff from known storm drainage cross connections to a single discharge point in the sewer system. Subcatchment parameters ultimately determine how much stormwater inflow and infiltration enters the sewer system.
- **Inflows:** The following are the two types of wastewater flow sources that can be injected into individual model junctions (and storage nodes):
  - Dry Weather. Dry weather inflows simulate base sanitary wastewater flows and represent the average flow. The dry weather flows can be multiplied by up to four patterns that vary the flow by month, day, hour, and day of the week (e.g.,

weekday or weekend). The dry weather diurnal patterns are adjusted during the dry weather calibration process. Two diurnal patterns were developed for each basin respectively, representing weekday and weekend days.

– RDII. RDII are flows into the collection system originating from rainfall. Several models are available in Mike Urban to capture these effects. The models have a number of parameters that are adjusted during the wet weather calibration process (see Section 4.4.3) to model the flows into the collection during different storm events.

4.4.2 Hydraulic Model Update

The hydraulic model only represents the Study Area. The Town Center area is the City's primary business district located generally between 76th Ave. S.E., S.E. 32nd St., Island Crest Way, and I-90. The following sections only discuss the Town Center area of the City's collection system.

4.4.2.1 Model Update Process

The City's hydraulic model combines information on the physical and operational characteristics of the wastewater collection system, and performs calculations to solve a series of mathematical equations to simulate flows in pipes:

- **Step 1** - The City's GIS shape files for the sewer collection system were obtained.
- **Step 2** - The GIS data were reviewed and compared to the information on pipes and manholes from the hydraulic model.
- **Step 3** - The collection system pipeline and facility data were updated in the modeling software as necessary. Once all the relevant data was updated and input into the hydraulic model, the model was reviewed to verify that the model data was input correctly and that the flow direction and size of the modeled pipelines were logical.
- **Step 4:** Dry weather wastewater flows were then allocated to the appropriate model junctions. These flows were scaled up or down, as necessary, to match the dry weather flows recorded during the flow monitoring period during the dry weather calibration.
- **Step 5** - The hydraulic model contains certain run parameters that need to be set by the user at the beginning of the project. These include run dates, time steps, reporting parameters, output units, and flow routing method. Once the run parameters were established, the model was debugged to ensure that it ran without errors or warnings.

Figure 4.10 presents the elements of the Study Area wastewater collection system included in the hydraulic model. Non-modeled pipelines are shown in grey. Table 4.11 presents a summary of the modeled sewer system by diameter and length of pipe. These totals only include length of pipes located within the Study Area.

Note, the MOUSE model included the City's Lakeline system, which was carried forward in the updated Mike Urban model. The Lakeline system is outside of the Study Area and was not verified or updated, as it was not included in the analysis.

Figure 4.10
Modeled Collection System
General Sewer Plan Update
City of Mercer Island

Document Path: E:\KRC D DRIVE\Mercer Island\MXDs\Figure 4.10.mxd

Table 4.11 Study Area Modeled System Pipelines General Sewer Plan City of Mercer Island		
Diameter (inches)	**Length (LF)**	**Percent of Modeled System (%)**
6-inch	3,200	3.1%
8-inch	92,395	88.3%
10/12-inch	5,063	4.8%
16/18-inch	598	0.6%
21/24-inch	3,345	3.2%
Total	**104,601**	**100%**

Notes:
(1) Source: City of Mercer Island hydraulic model database.

4.4.2.2 Wastewater Flow Allocation

Determining the quantity of dry weather wastewater flows generated by a municipality and how the flows are distributed throughout the collection system is an important component of the hydraulic modeling process. Adequate estimates of the volume of wastewater are important in maintaining and sizing sewer system facilities, both for present and future conditions. Wastewater flows were allocated (assigned to specific nodes) in the hydraulic model for both ADWF and PWWF.

ADWF were allocated using the flow coefficients and land use categories, as described below:

- **Step 1:** The City's study area was broken up into 263 individual loading polygons. Each loading polygon represents the geographic area that contributes flows into a single model node (i.e., trunk system manhole). In an all pipe model, such as the City's hydraulic model, a loading polygon could be as small as a few parcels.
- **Step 2:** The loads were calculated for each loading polygon using GIS software program by multiplying the appropriate flow coefficient by the land use acreage.
- **Step 3:** The hydraulic model's load allocation assigned the calculated average dry weather flow to the appropriate node in the sewer system model.
- **Step 4:** The allocated loads were adjusted as necessary during the dry weather flow calibration process (see Section 4.4.3) to closely match the actual measured dry weather flows recorded during the flow monitoring period.

4.4.2.3 Inflow and Infiltration: Time-Area Model A and RDII

Mike Urban has several modules to estimate the wet weather inflow and infiltration in each basin. For this study, the Mouse Time-Area Model A and RDI methods were chosen to model inflow and infiltration respectively.

Two important I/I parameters determined through calibration are the areas of "connected pervious" and "connected impervious" land contributing flow to each basin's collection system. These areas represent the equivalent area of land accumulating rainfall to produce the wet weather flow measured at the downstream flow meter. For example, if a flow meter measures a fast response to a storm event, the model calculates the amount of impervious land that is accumulating rainfall and contributing surface runoff to the collection system. Connected pervious land represents the equivalent amount of land absorbing rainfall and slowly contributing wet weather flow to the collection system.

The Model A and RDI flow components are combined to create a hydrograph for each basin that simulates how the system responds to rainfall events.

4.4.3 Hydraulic Model Calibration

Hydraulic model calibration is a crucial component of the hydraulic modeling effort. Calibrating the model to match data collected during the flow monitoring program ensures the most accurate results possible. The calibration process consists of calibrating to both dry and wet weather conditions.

Both dry and wet weather flow monitoring were conducted at the 3 metering sites presented in Section 4.2. DWF calibration ensures an accurate depiction of base wastewater flow generated within the Study Area. The WWF calibration consists of calibrating the hydraulic model to a specific storm event or events to accurately simulate the peak and volume of I/I into the sewer system. The amount of I/I is essentially the difference between the WWF and DWF components.

4.4.3.1 Calibration Standards

The hydraulic model was calibrated in accordance with international modeling standards. The Wastewater Planning Users Group (WaPUG), a section of the Chartered Institution of Water and Environmental Management, has established generally agreed upon principles for model verification. The dry weather and wet weather calibration focused on meeting the recommendations on model verification contained in the "Code of Practice for the Hydraulic Modeling of Sewer Systems," published by the WaPUG (WaPUG 2002)[3], as summarized below.

4.4.3.1.1 *Dry Weather Calibration Standards:*

Dry weather calibration should be carried out for two dry weather days and the modeled flows and depths should be compared to the field measured flows and depths. Both the modeled and field measured flow hydrographs should closely follow each other in both shape and magnitude.

[3] Code of Practice for the Hydraulic Modeling of Sewer Systems," published by the WaPUG (WaPUG 2002)

In addition to the shape, the flow hydrographs should also meet the following criteria as a general guide:

- The timing of flow peaks and troughs should be within one hour.
- The peak flow rate should be within the range of ±10 percent.
- The volume of flow (or the average rate of flow) should be within the range of ±10 percent. If applicable, care should be taken to exclude periods of missing or inaccurate data.

4.4.3.1.2 *Wet Weather Calibration Standards:*

Wet weather calibration should be conducted for three separate storms. For at least two of the three storm events picked from the flow monitoring period, the model simulated flows and depths should be compared to the field measured flows and depths. The flow hydrographs for both events should closely follow each other in both shape and magnitude, until the flow has substantially returned to dry weather flow rates.

In addition to the shape, the flow hydrographs should also meet the following criteria as a general guide:

- The timing of the peaks and troughs should be similar with regard to the duration of the events.
- The peak flow rates at significant peaks should be in the range of +25 percent to -15 percent and should be generally similar throughout.
- Modeled volume of flow should be within +20 percent to -10 percent of measured volume of flow.
- The depth of surcharge should be in the range of +20-inches to -4 inches.
- The unsurcharged depth should be within the range of ± 4 inches.

The WaPUG recommends that for wet weather calibration, the use of a single calibration period incorporating a number of rainfall events should be considered whenever possible. In other words, if the flow monitoring program captured several back to back storms, it may be preferable to use the back to back storms events as the calibration storms, as opposed to calibrating to two separate storms that have occurred weeks or months apart.

Model calibration simulations should be run for a duration long enough that the I/I response is no longer apparent in the measured data.

4.4.3.2 Dry Weather Flow Calibration

4.4.3.2.1 *Dry Weather Calibration Process*

The DWF calibration process consists of several elements, as outlined below:

- **Divide the system into areas tributary to each flowmeter.** The first step in the calibration process was to divide the City into flowmeter tributary areas. Three tributary areas were created, one for each flowmeter from the flow monitoring program.
- **Define flow volumes within each area.** The next step was to define the flow volumes within each area, which was accomplished in the flow allocation step.
- **Create diurnal patterns to match the temporal distribution of flow.** A diurnal curve is a pattern of hourly multipliers that are applied to the base flow to simulate the variation in flow that occurs throughout the day. Two diurnal curves were developed for each flow monitoring tributary area, one representing weekday flow and one representing weekend flow. The diurnal patterns were initially developed based on the flow monitoring data and adjusted as part of the calibration process until the model simulated flows closely matched the field measured flows. Figure 4.11 shows the calibrated weekday and weekend diurnal patterns for the area tributary to Meter Site 2. Similar diurnal curves were developed for each of the meters and its tributary area. These additional curves are available in Appendix G.

4.4.3.2.2 *Dry Weather Calibration Results*

Table 4.12 provides a summary of the dry weather flow calibration using the average and daily peak flow results for both weekday and weekend conditions. As shown on Table 4.12, the model simulated average and peak flows for both weekday and weekend DWF were all within 10 percent. In general, the percent difference between the overall modeled and measured DWF ranged between -1.4 percent and 4.2 percent.

Appendix G contains a detailed dry weather flow calibration summary sheet for each of the 14 metering sites. Each calibration sheet provides plots that compare the model simulated and field measured flow data for both weekday and weekend conditions. An example of the dry weather calibration for Meter Site 2 is shown on Figure 4.11.

There is very good correlation of the field measured data to the model output results. All sites were within the calibration standards with most sites around +/-2 percent of the measured field data.

Table 4.12 Dry Weather Flow Calibration Results General Sewer Plan City of Mercer Island					
	Weekday		Week-end		Average
Flow Meter ID	Flow Volume Diff (%)	Peak Flow Diff (%)	Flow Volume Diff (%)	Peak Flow Diff (%)	Flow Volume Diff (%)
Site 1	-1.4%	-1.3%	3.1%	2.6%	-0.2%
Site 2	-1.3%	-1.2%	0.7%	0.8%	-0.7%
Site 3	4.2%	1.0%	-1.7%	-2.8%	2.5%

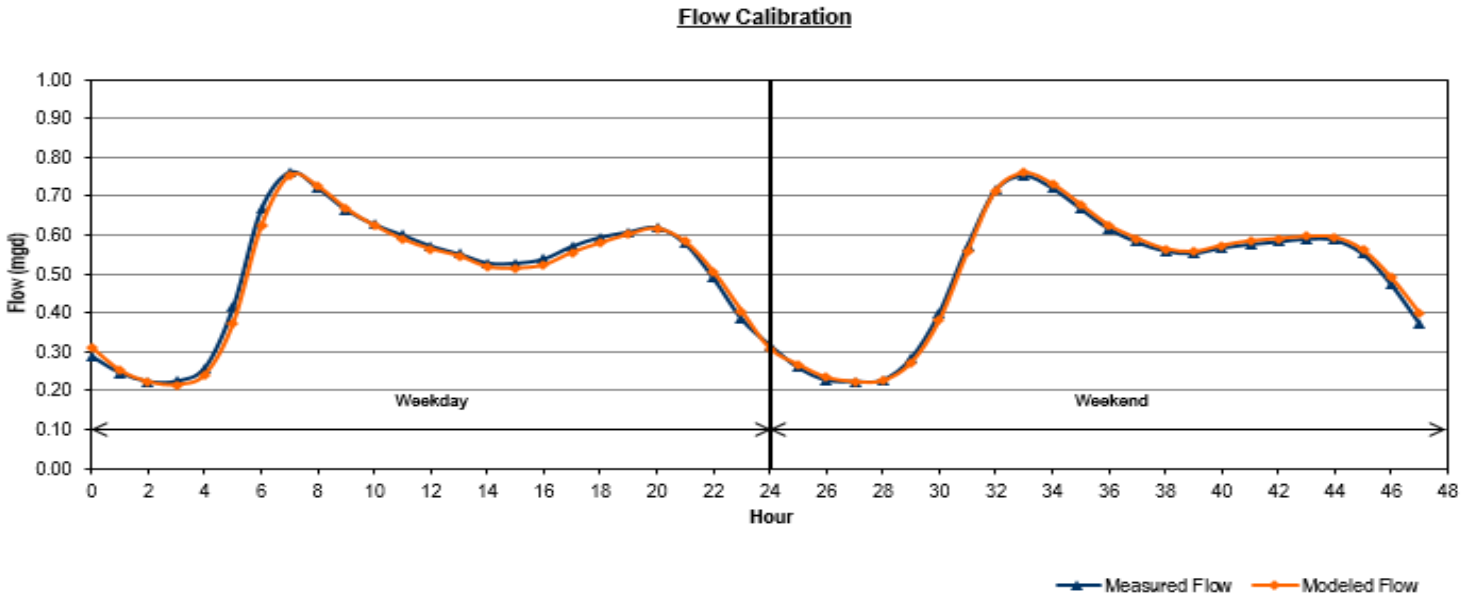
4.4.3.3 Wet Weather Flow Calibration

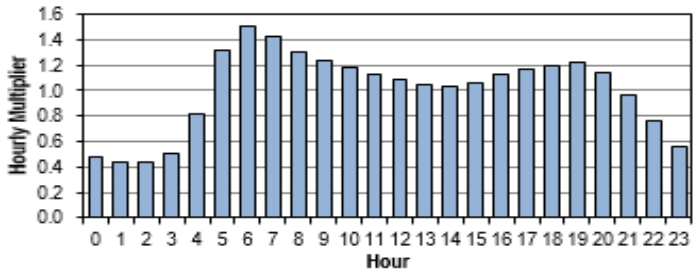
4.4.3.3.1 *Wet Weather Flow Calibration Process*

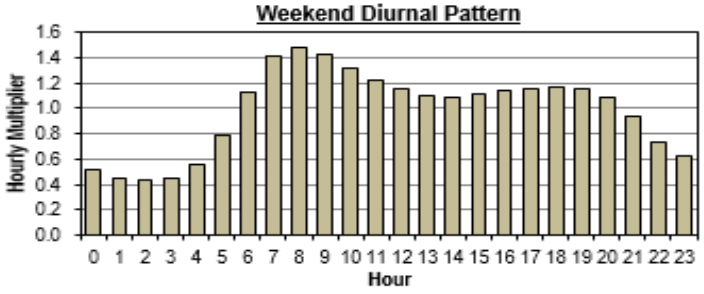
The WWF calibration enables the hydraulic model to accurately simulate I/I entering the collection system during a large storm. As outlined below, the WWF calibration process consists of several elements:

- **Identify calibration rainfall events.** The WWF calibration process consists of running model simulations of historic rainfall events based on data collected as part of the flow monitoring program. The goal of any wet weather flow monitoring program is to capture and characterize a system's response to a significant rainfall event, preferably during wet antecedent moisture conditions.

  The selection of a particular calibration storm or group of storms is based on a review of the flow and rainfall data. Table 4.13 below summarizes the three storms picked for calibration of the three monitoring sites. Figure 4.12 illustrates the storms used in the model calibration process.







EXAMPLE OF DIURNAL PATTERN AND DRY WEATHER CALIBRATION (SITE 2)

FIGURE 4.11

CITY OF MERCER ISLAND
GENERAL SEWER PLAN

Table 4.13 Calibration Storms Summary General Sewer Plan City of Mercer Island		
Storm ID	**Start Date**	**End Date**
Storm 01	1/21/2016	2/2/2016
Storm 02	2/10/2016	2/24/2016
Storm 03	2/27/2016	3/19/2016

- **Define RDII tributary areas.** For the WWF calibration, RDII flows are superimposed on top of the DWF. The model calculates two types of response: a SRC (slow response corresponding mainly to infiltration) and a FRC (fast response corresponding mainly to direct inflow).

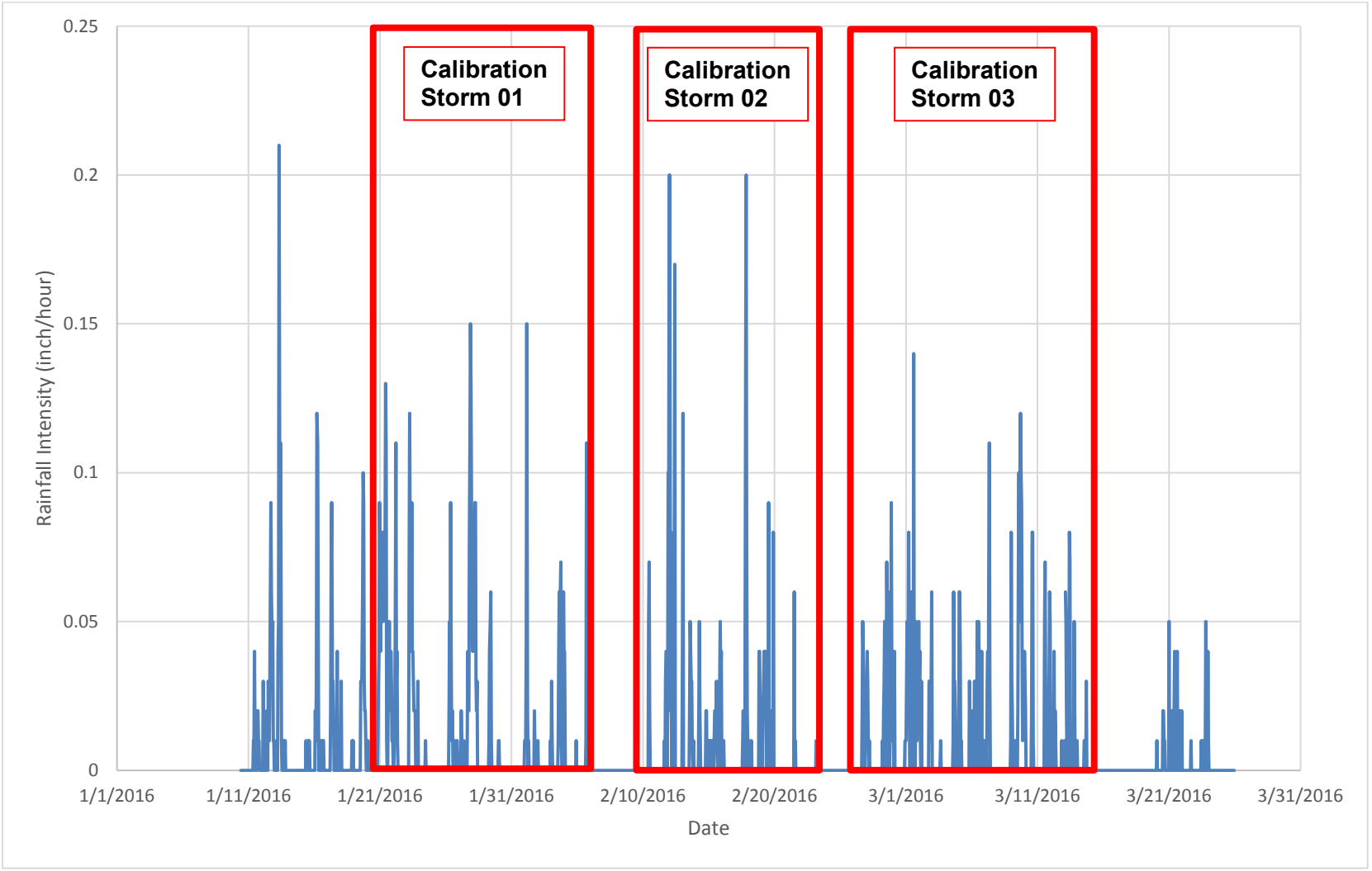
- **Create I/I parameter database and modify to match field measured flows.** The main step in the WWF calibration process involves calibration Model A and RDI parameters for each of the three flow monitoring basin.

  As with the dry weather calibration, the wet weather calibration process compared the meter data with the model output. Comparisons were made for average and peak flows as well as the temporal distribution of flow until flows returned to their baseline levels.

- **Adjust model variables to match field measured velocity and flow depths.** Once the model simulated flows acceptably matched the field measured flows, the model simulated velocity and flow depth were compared to the field measured velocity and flow depth. Adjustments were made to various model parameters until the modeled and measured velocity and depth closely matched one another. The primary varied parameter for this process are pipeline roughness (Manning's n), although other parameters can also be adjusted as calibration results are generated.

  Manning's roughness coefficients, or n values, have industry accepted ranges based on a number of variables. Roughness coefficients increase over time depending on the construction methods, installation quality, system maintenance, and other environmental factors. There can be certain factors within the City's collection system that can result in roughness coefficients that differ from the typical range.

  If the model is unable to reasonably match the field measured flow depth and velocity without leaving the acceptable range of Manning's roughness coefficients, further investigation is conducted to help determine the cause of the discrepancy. Some issues that could cause such a discrepancy can include errors in the slope or diameter of a pipeline, downstream blockages, pipeline sags, and, in some cases, influences from downstream lift station operations.



CALIBRATION STORMS SELECTION

FIGURE 4.12

CITY OF MERCER ISLAND
GENERAL SEWER PLAN

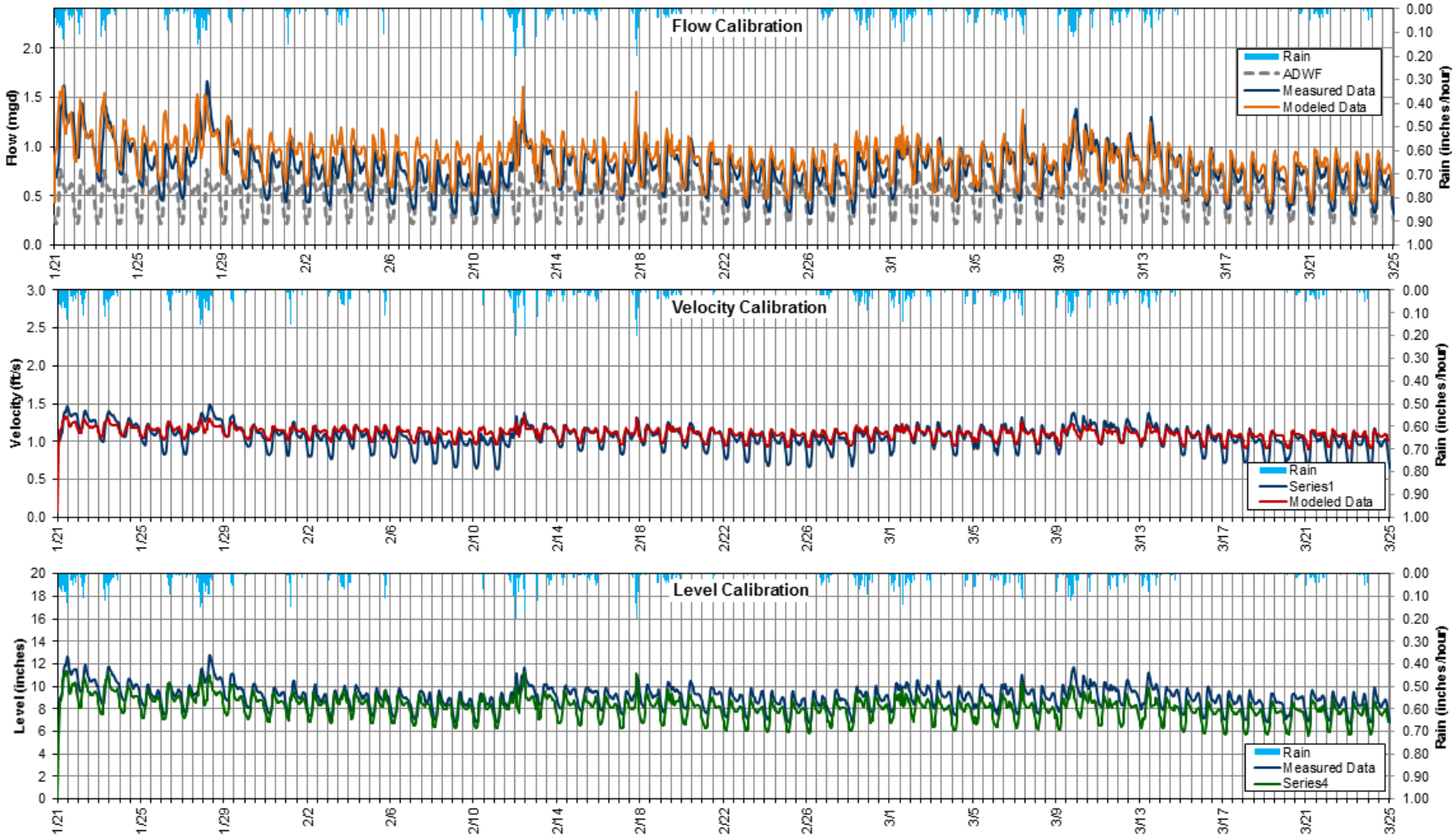
4.4.3.3.2 *Wet Weather Calibration Results*

Appendix G contains a detailed wet weather flow calibration summary sheet for each of the 3 meter sites. Each calibration sheet provides plots that compare the model simulated and field measured flow, velocity, and level data for the calibration storms. An example of the wet weather calibration for Site 2 is shown on Figure 4.13.

Table 4.14 provides a summary of the wet weather flow calibration using the average and peak flow results. As shown on Table 4.14, the model simulated average and peak flows at all meter sites were within the acceptable tolerances for at least two storms out of three, and therefore the model was considered calibrated and ready to use for capacity analysis purposes.

4.4.3.4 Model Recommendations

To facilitate evaluation of the entire sewer system, it is recommended that the City expand the hydraulic model to cover the entire Island. The full system model can be created using the City's GIS and existing information on the capacity and controls of the Lakeline and KCDNR Pump Stations. It is recommended that the City calibrate its hydraulic model sequentially when basins are added and model is expanded.



EXAMPLE OF WET WEATHER CALIBRATION (SITE 2)

FIGURE 4.13

CITY OF MERCER ISLAND
GENERAL SEWER PLAN

Table 4.14 Wet Weather Flow Calibration Results
General Sewer Plan
City of Mercer Island

Meter Number	Pipe Diameter (inch)	Storm 1 (1/21/2016-2/2/2016) Percent Error[1] Avg. Flow (%)	Storm 1 Peak Flow (%)	Storm 1 Max Level (inch)	Storm 2 (2/10/2016-2/24/2016) Percent Error[1] Avg. Flow (%)	Storm 2 Peak Flow (%)	Storm 2 Max Level (inch)	Storm 3 (2/27/2016-3/19/2016) Percent Error[1] Avg. Flow (%)	Storm 3 Peak Flow (%)	Storm 3 Max Level (inch)
Site 1	33	**23.4%**	1.2%	-2.5	12.2%	**42.3%**	-2.0	-3.6%	-10.6%	-2.9
Site 2	18	12.4%	-3.0%	-3.3	13.7%	17.0%	-2.2	6.2%	-1.1%	-2.4
Site 3	12	**28.2%**	-3.6%	-0.6	7.9%	21.0%	-0.7	-2.9%	-13.0%	-1.0

Notes:
(1) Percent Error = (Modeled - Measured)/Measured *100.
(2) Bold numbers are outside WaPUG recommended criteria. At least 2 out of three storms are within recommended criteria, therefore, the model was considered calibrated.

4.5 SYSTEM EVALUATION CRITERIA

Capacity evaluation of the Study Area was performed in accordance with the criteria established in this section. Sewer pipe capacities are dependent on many factors, including roughness of the pipe, the maximum allowable depth of flow, etc. Assumptions of these factors are discussed below.

4.5.1 Manning Coefficient (n)

The Manning coefficient 'n' is a friction coefficient and varies with respect to pipe material, size of pipe, depth of flow, smoothness of pipe and joints, and extent of root intrusion. For sewer pipes, the Manning coefficient typically ranges between 0.011 and 0.017, with 0.013 being a representative value used for sewer system master planning. New pipes were assumed to have a Manning's coefficient of 0.013.

4.5.2 Flow Depth Criteria (d/D)

The primary criterion used to identify capacity-deficient trunk sewers or to plan for future infrastructure is the maximum flow depth to pipe diameter ratio (d/D). The d/D value is defined as the depth (d) of flow in a pipe during peak flow conditions divided by the pipe's diameter (D). The operating criterion varies for existing sewers and for new sewers.

When evaluating existing sewers, using a conservative d/D ratio may lead to unnecessary replacement of existing pipelines. During PWWF, water levels were allowed to rise up to a d/D of 1. Sewers were not allowed to surcharge under these maximum flow conditions. If the flow depth was greater than the maximum allowed, then the sewer was deemed deficient and a larger sewer was proposed to provide greater flow capacity.

When designing new sewers, it is common practice to adopt variable flow depth criteria for different pipe sizes. Design d/D ratios typically range from 0.5 to 0.92, with the lower values used for smaller pipes, which may experience flow peaks greater than design flow or may experience blockages from debris, paper or rags. The City's draft Sewer Standards define the acceptable d/D values for design of new sewers as 0.75 at peak flow rate.

The maximum allowable d/D ratios for design flow conditions are summarized in Table 4.15. These design flow depths are relatively conservative and provide for some flexibility capacity to allow changes in projected flows, I/I, or land use.

Table 4.15 Depth Criteria General System Plan City of Mercer Island	
Facility	**Allowable d/D**
Existing Sewers	No surcharging allowed (d/D<1 allowed)
New Sewers	0.75

4.6 TOWN CENTER COLLECTION SYSTEM CAPACITY EVALUATION

A capacity analysis of the modeled Town Center collection system was performed using the City's calibrated hydraulic model and using the system evaluation criteria outlined above. The capacity analysis entailed identifying areas in the sewer system where the planning criterion for surcharging was exceeded. The capacity evaluation was performed for the Study Area only and two planning conditions under the design storm: Existing and Build-out.

4.6.1.1 Surcharge Due To Backwater

Pipelines with a Hydraulic Grade Line (HGL) surcharging the pipe crown in manhole are not necessarily capacity deficient. Surcharging of a pipe can occur due to backwater effects of a downstream pipe, not due to exceeding the theoretical capacity of the pipe itself. If the downstream pipe is capacity deficient, it can cause backup - and even reversal - of flow in the upstream pipe, resulting in surcharge of the upstream pipe that otherwise is not capacity limited. If the downstream pipe capacity is increased, then the upstream pipe may no longer require capacity improvements.

For this reason, the hydraulic model was analyzed to identify the pipeline segments that are the cause of the surcharged conditions.

4.6.1.2 Existing System

For the existing collection system, the PWWF was routed through the hydraulic model for the November/December 2011 design storm. In accordance with the established criteria for existing sewers, pipes that were surcharging were identified. Figure 4.14 shows the locations of the existing pipes at capacity in the study area in red. Red pipes are surcharging under PWWF conditions. Pipes highlighted in orange on Figure 4.14 correspond to pipes approaching surcharging (above 85 percent full, but not surcharging). Pipes highlighted in green and brown corresponds to pipes respectively flowing less than 85 percent full and less than 50 percent full under PWWF conditions. These pipes have

sufficient capacity for the rest of the planning period. There are 5 main locations of deficiencies flagged in the hydraulic model under existing conditions:

- At the intersection of S.E. 24th St. and 76th St S.E.
- Along S.E. 32nd St., east of the intersection of 77th Ave. S.E.
- East of the intersection of 72nd Ave. S.E. and S.E. 22nd St., south of I-90 through Mercerdale Park and along 77th Ave. S.E.
- Several Pipes intersecting W. Mercer Way.

Note, surcharging may not be observed in the above locations, except during large wet-weather events; such as the design storm.

4.6.1.3 Build-out Conditions

The build-out system analysis was performed in a similar manner to the existing system. Figure 4.15 shows the surcharged pipes in the Study Area under build-out conditions.

The additional projected flows from the build-out development in the Town Center intensify the capacity issue, exacerbating the existing deficiency. There are two additional locations of deficiencies in the study area:

- South of Mercerdale Hillside Park.
- At the intersection of 77th Ave. S.E. and S.E. 27th St.

Note, surcharging may not be observed in the above locations, except during large wet-weather events; such as the design storm.

Legend

- Maximum d/D Ratio > 1
- Maximum d/D Ratio between 0.85 and 1
- Maximum d/D Ratio between 0.5 and 0.85
- Maximum d/D Ratio less than 0.5
- System not evaluated as part of the collection system analysis
- Service Area Boundary
- Study Area
- Parcels
- Zoning
- Neighboring Cities

0 500 1,000 Feet

Figure 4.14
Collection System Capacity Deficiencies - Existing Deficiencies
General Sewer Plan Update
City of Mercer Island

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Legend

- Maximum d/D Ratio > 1
- Maximum d/D Ratio between 0.85 and 1
- Maximum d/D Ratio between 0.5 and 0.85
- Maximum d/D Ratio less than 0.5
- System not evaluated as part of the collection system analysis
- Service Area Boundary
- Study Area
- Parcels
- Zoning
- Neighboring Cities

0 500 1,000 Feet

Figure 4.15
Collection System Capacity Deficiencies - Build-out Deficiencies
General Sewer Plan Update
City of Mercer Island

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4.7 RECOMMENDED CAPACITY IMPROVEMENTS

This section presents the proposed sewer improvements on pipes to mitigate existing, and build-out identified deficiencies and to serve future users.

4.7.1 Pipe Improvement Assumptions

When an increase to capacity is required, existing sewers can be upgraded or a parallel or relief sewer can be constructed. For the purposes of this Plan, unless otherwise stated, we assumed that a capacity deficient sewer would be upgraded to a larger diameter. The upgraded pipeline generally followed the same slope as the existing pipeline, with the exception where survey data revealed negative or flat slopes in an existing alignment.

As the City continues to grow, it is recommended that the proposed pipeline diameters be constructed so that the facilities have sufficient capacity for build out conditions. Building a smaller interim project with the plans of upsizing in the future to account for further growth is not recommended due to the extended useful life of the improvements proposed herein. The proposed pipe diameter represents the ultimate diameter for build out conditions.

Both Figure 4.16 and Table 4.16 should be used together to locate the proposed improvement and to gain details of the improvement (length, diameter, street location, etc.). The improvement identification number links the figure and table. The improvements summarized in Table 4.16 use a cross-referenced number system. The columns used in this table refer to the following:

- **Project ID:** Assigned unique identifier associated with each improvement project. This is an alphanumeric number that starts with one letter indicating the type of improvement P= Pipe and continues with a number and a letter.
- **Type of improvement:** Pipelines, other.
- **Street Description:** Street in which the improvement is proposed.
- **Action:** Indicates whether the proposed improvement is a replacement pipeline, parallel pipeline, or a new facility.
- **Existing Size:** This is the size of the existing pipeline/facility. It represents the diameter of the existing pipelines (inches).
- **Proposed Size:** This is the size of the proposed improvement. It represents the diameter of the proposed pipelines (inches).
- **Length:** Estimated length of the proposed improvement (in feet). It should be noted that the length estimates do not account for re-routing the alignment to avoid unknown conditions.
- **Upstream/Downstream Manhole ID:** This is the start and end manhole (MH) IDs for each improvement project.

- **Reason:** This section explains the reason why this improvement is proposed and needed (surcharging, flow diversions…)

4.7.2 Recommended Piping Improvements

This section provides a description of the recommended improvements to alleviate the capacity issues under the planning conditions. Improvements to provide sufficient capacity throughout the system mainly include upgrades to pipe diameters. Figure 4.16 illustrates the proposed sewer improvements required to meet the planning criteria, including the proposed pipeline diameter for the improvement.

In accordance with the established planning criteria, new sewer pipelines were sized such that the maximum flow d/D did not exceed 0.75.

Table 4.16 provides more detail of each improvement project, including the diameter and length of the improvement, and corresponds to the improvements shown in Figure 4.16.

Piping improvements are considered to be non-growth related. The flow projections assume a 7 percent increase in I/I per decade based on King County's 2014 Study, which was the sole driver of Projects 1 through 4, 7, & 8. No additional domestic flows were added beyond the immediate Town Center area. Projects 5 and 6 were deficient in the existing conditions and therefore the need for improvements were not considered to be growth related.

4.7.2.1 Project 1 - W. Mercer Way

The sewer pipes located along W Mercer Way, east of the intersection with Holly Ln. lacks capacity to convey design flows and surcharges during the design storm starting under existing conditions.

Project 1 consists of replacing approximately 446 feet of existing 8-inch pipes with 12-inch pipes. The pipe to replace is flat relatively to the surrounding pipes, which creates a bottleneck along this line. Upsizing this pipe will help alleviate the surcharging caused by this section of pipe. This project was identified as medium priority for repair and replacement (R&R) replacement in Chapter 5 - Operations and Maintenance.

4.7.2.2 Project 2 - Mercerdale Hillside Park

The sewer pipes located south of Mercerdale Hillside Park lack capacity to convey design flows and surcharges during the design storm starting under build-out conditions. Existing PWWF does not surcharge during the design storm in this section. Additional flows upstream due to I/I degradation cause surcharging in this section of pipe.

Project 2 consists of replacing approximately 551 feet of existing 10-inch pipes with 12-inch pipes. The pipe to replace is flat relatively to the surrounding pipes, which creates a bottleneck along this line. Because of the flat section of pipes, HGL rise in these pipes,

causing surcharging. A portion of this project was also identified as high priority for R&R replacement in Chapter 5 - Operations and Maintenance.

Table 4.16 Proposed Recommended Improvements
General Sewer Plan
City of Mercer Island

Project ID	Type of Improvement	Street Description	Action	Existing Diameter (inch)	Proposed Diameter (inch)	Length (feet)	From MH ID	To MH ID	Reason	Comment
Project 1	Pipeline	W. Mercer Way, north of Evergreen Ln.	Upsize pipe	8	12	446	61-45	61-67	Capacity Deficient under existing and build-out conditions.	New Problem due to flow re-allocation more upstream in the system than the former model.
Project 2	Pipeline	South of Mercerdale Hillside Park, connecting to 75th Ave. S.E.	Upsize pipe	10	12	551	61-91	61-95	Capacity Deficient under build-out conditions (flat pipes upstream of steep pipe caused HGL to rise above pipe crown).	New problem due to flow re-allocation in the model and flow increase (I/I degradation for build-out conditions).
Project 3	Pipeline	Through Mercerdale Park and at the intersection of S.E. 34th St. and 77th Ave. S.E.	Upsize pipe	8/10	12	1,183	61-130	61-199	Capacity Deficient under existing and build-out conditions.	Problem area known the last Plan.
Project 4	Pipeline	Intersection of S.E. 32nd St. and 77th Ave. S.E.	Upsize pipe	10	16	241	61-200	61-199	Capacity Deficient under existing and build-out conditions.	Problem area known the last Plan.
Project 5	Pipeline	At the intersection of 77th Ave. S.E. and S.E. 27th St	Reconfiguration	-	-		NA	NA	Increase carrying capacity of the pipes in the area (addition of two manholes).	Problem area known the last Plan.
Project 6	Pipeline	At the intersection of S.E. 24th St. and 76nd Ave.	Upsize pipe	8	12	441	49-32	TempID9	Capacity Deficient under build-out conditions (flat pipes upstream of steep pipe caused HGL to rise above pipe crown).	Problem area known the last Plan.
Project 7	Pipeline	At the intersection of I-90 and 74th Ave. S.E.	Upsize pipe	8	12	14	49-82	49-81	Capacity Deficient under existing and build-out conditions.	New problem due to flow re-allocation more upstream in the system than the former model.
Project 8	Pipeline	East of the intersection of 72nd Ave. S.E. and S.E. 22nd St., south of I-90	Upsize pipe	8	12	441	49-84	49-83	Capacity Deficient under existing and build-out conditions.	New problem due to flow re-allocation more upstream in the system than the former model.
Total (feet)						**3,317**				

Figure 4.16
Proposed Pipe Capacity
- Related Improvement Projects
General Sewer Plan Update
City of Mercer Island

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4.7.2.3 Project 3 - Mercerdale Park

The sewer pipes located through Mercerdale Park and at the intersection of S.E. 34th St. and 77th Ave. S.E. lack capacity to convey design flows and surcharges during the design storm under existing conditions. Additional flows under build-out conditions extend the surcharging south along 77th Ave. S.E. during the design storm.

Project 3 consists of replacing approximately 1,183 of existing 8-inch and 10-inch pipes with a 12-inch pipe. Upsizing this pipe will help alleviate the surcharging caused by this section of pipe. A portion of this project was also identified as high priority for R&R replacement in Chapter 5 - Operations and Maintenance.

4.7.2.4 Project 4 - S.E. 32nd St. and 77th Ave. S.E.

The sewer pipes located along S.E. 32nd St. at the intersection with 77th Ave. S.E. lack capacity to convey design flows and surcharges during the design storm with existing conditions. The pipe to replace is flat relatively to the surrounding pipes, which creates a bottleneck along this line.

Project 4 consists of upsizing 241 feet of pipe from a 10-inch pipes to a 16-inch pipeline. A 16-inch diameter pipeline is necessary to meet the City's design criteria.

4.7.2.5 Project 5 - 77th Ave. S.E. and S.E. 27th St.

Under build-out conditions, surcharging is anticipated during the design storm at the intersection of S.E. 27th St. and 77th Ave. S.E. This area is located where the City's system connects to the King County system. This intersection historically held a lift station and the remaining piping is in a hydraulically inefficient configuration. It is recommended that the City and King County coordinate to improve capacity in these pipes.

The recommended alternative analysis would determine whether this option is feasible and cost-effective. A reconfiguration of this intersection would increase the carrying capacity of the pipes in this area. This would be done by adding two manholes, the first to connect the outlet pipe of manhole 59-5 to the 24-inch pipe and the second to connect the outlet pipe of manhole 60-2 to the 24-inch pipe. This intersection should be monitored by the City's staff and reevaluated when flows increase due to the Town Center redevelopment and increase in I/I.

4.7.2.6 Project 6 - S.E. 24th St. and 76th Ave S.E.

The sewer pipes located at the intersection of S.E. 24th St. and 76th Ave. S.E. lack capacity to convey design flows and surcharge during the design storm starting under existing conditions. This pipe captures the whole flow monitoring site 1 that shows a projected PWWF of 0.9 mgd.

Project 6 consists of replacing 441 feet of existing 8-inch with 12-inch sewer pipes along S.E. 24th St. Upsizing this pipe will help alleviate the surcharging caused by this section of

pipe. This project was also identified as medium priority for R&R replacement in Chapter 5 - Operations and Maintenance.

The highway crossing located on the west side of the Town Center shows capacity restriction. The crossing and downstream piping are owned by King County. It is recommended that the City work with King County to increase conveyance capacity. One option would be to divert high flows to the east highway crossing. This would require constructing 814 feet of new 16-inch sewer along Sunset Highway to the intersection with 77th Ave. S.E.

4.7.2.7 Project 7 - 74th Ave. S.E.

The sewer pipes located at the intersection of I-90 with 74th Ave. S.E. lack capacity to convey design flows. This small section of pipe (14 feet) is flat, therefore limiting the capacity of this section and rising HGL upstream of this pipe.

Project 7 consists of upsizing 14 feet of pipes from an existing 8-inch to a 12-inch pipeline. The flat section of pipes at the intersection of I-90 with 74th Ave. S.E. causes bottlenecking and makes the HGL rise fast in the upstream pipelines.

4.7.2.8 Project 8 - S.E. 22nd St. and 72nd Ave. S.E.

The sewer pipes located along S.E. 22nd St., east of the intersection of S.E. 22nd St. with 72nd Ave. S.E., surcharges during the design storm starting under existing conditions. This section of pipes is relatively flat, limiting capacity. The surcharging in this section of pipes reflects sharp flow spikes observed in the flow monitoring data. It is recommended to monitor this area to confirm hydraulic behavior in this section of pipes.

Project 8 consists of upsizing 441 feet of pipes from an existing 8-inch to a 12-inch pipeline. The flat section of pipes located east of the intersection of S.E. 22nd St. and 72nd Ave. S.E. causes bottlenecking and makes the HGL rise fast in the upstream pipelines.

4.7.3 Proposed Capacity Improvements Summary

A total of approximately 3,300 linear feet of pipes ranging from 12-inch to 16-inch are recommended to alleviate capacity deficiencies identified in this chapter. These improvements will be combined with the recommended improvements that were identified for condition purposes in Chapter 5 - Operations and Maintenance. Costs estimates and phasing of the improvements will be provided for each project in Chapter 6 - Capital Improvement Plan.

OPERATIONS AND MAINTENANCE

Regular operations and maintenance (O&M) is required to provide effective and efficient maintenance services for utility rate payers. Delayed O&M may contribute to adverse sewer events, including sewer backups, sanitary sewer overflows, pipe breaks, etc. This Chapter considers the City of Mercer Island's (City's) existing and planned O&M activities and programs and recommendations to improve existing or address future needs.

5.1 OPERATION AND MAINTENANCE ACTIVITIES

The City's regular O&M activities are summarized in this Section. The breadth and timing of activities reflect the City Staff goals, where current, physical, legal, and resource limitations have not allowed the City to meet their goals for some activities. Activities are divided into Collection System O&M and Lakeline, Pump Station, and Special Catch Basin O&M.

5.1.1 Collection System O&M

Collection system O&M aims to continue the good working function of the gravity collection system. O&M activities include inspection, maintenance, and repair of the system. Collection system O&M activities are completed by the City and its contractors, as described below and summarized in Table 5.1.

5.1.1.1 Collection System Cleaning

Collection system cleaning includes jetting, root control, and grease cleaning. Pipelines that have repeated O&M issues are shown in Figure 5.1. The City O&M staff jet the sewer system on a regular basis for pipelines with maintenance issues, as shown in Figure 5.2. Other system pipelines are jetted on an as-needed basis. In conjunction with jetting, the City typically conducts root control and grease cleaning. It is recommended that the City meet their goal of cleaning the entire system every 5 years and problem areas more frequently as needed. Routine system cleaning (jetting, root control, and grease cleaning) should be conducted shortly before the Closed Circuit Television (CCTV) inspections program; therefore, the two programs may be linked.

5.1.1.2 CCTV Inspection

The City contracts the CCTV inspection of the sewer system to a vendor. CCTV inspection is primarily used to identify clogs, roots, grease, and defects. Identified issues are resolved on a as needed basis, as discussed in this Chapter. Review of the existing materials furnished by the contractor could be improved by providing a standardized rating of inspected pipelines, rather than a summary of defects in the pipe system. Ratings would provide pipe condition to be incorporated in the identification of pipes requiring repair and replacement.

Table 5.1 Operations and Maintenance Activities
General Sewer Plan
City of Mercer Island

Activity	Criteria	Goal	Activity Frequency	Comments
Collection System O&M				
Jet Cleaning	Routinely clean sewer system. Clean known problem areas more frequently to prevent back-up.	Clean Island-wide every 5 years. Clean problem areas up to 3 times per year.	Continuous	Primarily in-house work; some contracted work as needed.
Root Control	Perform as-needed.	Treat annually; cut problem areas as-needed.	As-needed depending on application.	Performed with Jet Cleaning activity; contracted work.
Grease Removal	Perform routinely with jet cleaning activity. Perform as-needed in known problem areas.	Routine cleaning every 5 years. Clean known problem areas up to 3 times per year.	Continuous	Performed with Jet Cleaning activity.
CCTV inspection	Routinely conduct to confirm condition of pipes, suspected blockages, breaks, and other issues.	TV Island-wide every 5 years.	Continuous	Contracted work. Recommend collecting data in accordance with PACP/MACP standards including Geographic Information System (GIS) -based codes.
Smoke Testing	Perform as-needed in areas where suspect problems.	By project or area specific where suspect problems.	As-needed	Recommended activity. Not conducted since 2003.

Table 5.1 Operations and Maintenance Activities
General Sewer Plan
City of Mercer Island

Activity	Criteria	Goal	Activity Frequency	Comments
Sewer repairs	Perform as-needed.	Prioritize replacements during CIP budget process and repair through an ongoing annual repair program.	Annual	Contracted work
Manhole inspections and repairs	Perform as-need to confirm condition of MH, repair functional integrity of MH.	Inspect routinely with cleaning/CCTV activity. Repair as-needed when condition of MH has become unsafe, up to 5 per year.	Periodic	Predominantly contracted work. Minor repairs by City.
Lakeline, Pump Station, and Special Catch Basin O&M				
Pump station inspection	Proper functioning of pumps and back-up power.	Inspect each pump station once a week.	Continuous	
Pump station cleaning and maintenance	Clean station and wet well and perform preventative repairs and replacement.	Clean and maintain all pump stations annually. Exercise valves every 3 months.	Continuous	
Telemetry maintenance	Routine calibration including alarm verification. Conduct as-needed system upgrades to replace outdated system hardware / software.	Calibrate system including alarm verification annually. Upgrade the system when components become obsolete.	Continuous	Need Maintenance Agreement with contractor/consultant in place for ongoing/regular system upkeep.

Table 5.1 Operations and Maintenance Activities
General Sewer Plan
City of Mercer Island

Activity	Criteria	Goal	Activity Frequency	Comments
Odor Control facility maintenance	Routinely maintain to control/reduce odor complaints.	Bioxide application May thru October; Carbon Filter replacement annually; Sand Filter repair as needed.	Continuous	Carbon Filter removal is contracted work. All other maintenance is performed in-house.
Easement & Right-of-Way access	Maintain well defined access to pump stations through written/recorded agreement with property owners. Routinely clean around station sites dependent on location and need.	Well defined access or easement agreements. Annual maintenance including vegetation control, painting, etc.	Annual	Reference Easements/ Access for Pump Station Rehabilitation Project (Study) 1990 by OTT Engineering. Typically access is across private property which is maintained by the home owner. Pump Stations (PS's) within public ROW or on Park street ends are maintained by sewer staff.
Special catch basin maintenance	Routinely clean to prevent debris from entering the Lake Line.	Clean 2 times per year	Continuous	Many are difficult to access and clean. Install new where none currently exist.
Lakeline inspection, cleaning, and maintenance	Routinely conduct to confirm condition of pipeline, suspected blockages, breaks and other issues.	Clean: annually, particularly the new line both sides of PS 4, and the line north of PS 16. Maintenance: as-needed.	Clean known accessible problem areas and new Reach 4 gravity line annually.	Access to the pipeline limits current activities. Recommend installation of access points to the Lake line to allow annual inspection and cleaning.

Table 5.1 Operations and Maintenance Activities General Sewer Plan City of Mercer Island				
Activity	**Criteria**	**Goal**	**Activity Frequency**	**Comments**
Administrative Tasks				
Administrative duties and staff meetings	Meet to share information, schedule, plan work, and discuss capital needs.	Weekly team staff meetings; every other month department safety meetings; every other month all-department staff meetings.	Continuous	
Tool and equipment cleaning/ maintenance	Perform preventative maintenance to ensure compliance with safety standards.	Jet truck preventative maintenance every 3 months and cleaned after each use; confined space entry equipment inspected before each use.	Continuous	
Customer Service Support	Perform field investigations and follow up to respond to customer concerns.	Field evaluation by CRT within 24-hours depending on the concern.	Continuous	
Training and conferences	Network with others in the industry to stay abreast of new trends and innovations.	Participate in professional group meetings to stay abreast of new trends and innovations annually.	Continuous	

It is recommended the City collect data in accordance with the Pipeline Assessment and Certification Program (PACP) and Manhole Assessment and Certification Program (MACP) standards developed by the National Association of Sewer Service Companies (NASSCO). PACP/MACP creates inspection data that is consistent, complete, and captured in a format that can be readily accessed for analysis. The programs specify standard observation codes and grades (ratings) to be applied to all structural and maintenance-related defects. It also allows the condition of the pipelines to be tracked through time to better establish remaining useful life.

CCTV inspection data should be provided in a database consistent with the PACP/MACP standards. This database structure, used throughout the industry, allows the data to be directly linked to Computerized Maintenance Management Systems (CMMS). Additionally, it is recommended the City consider obtaining GIS-based data to help visualize the results of the inspections.

The City crews personally inspect manholes; at this time, they do not use CCTV or other camera technologies.

5.1.1.3 Smoke Testing

Smoke testing is not regularly conducted by the City. Smoke testing complements CCTV inspection by identifying illicit connections to the sewer, such as connected downspouts, yard or basement drains, and sump pumps. Additionally, smoke testing may identify defects in customer owned service laterals. While the smoke is harmless, defective sewer connections may allow sewer into buildings; causing alarm to customers. Therefore, public outreach is recommended in conjunction with smoke testing. It is recommended that smoke testing be completed for all pipeline or manhole projects with suspected illicit connections or high rates of inflow and infiltration (I/I).

5.1.1.4 Sewer and Manhole Repair and Maintenance

Staff inspects pipes and manholes as part of regular activities (CCTV inspection review, jetting, etc.) and in response to an issue in the collection system. Issues identified in inspections are repaired on an as-needed basis. Repairs to pipelines may include replacing or repairing the pipe using open cut trenches or trenchless technologies, such as pipe bursting or cured in-place pipe (CIPP). Repairs to manholes include replacement of deteriorating steps, covers, and frames to ensure safe access. Other maintenance activities including sealing manholes, patching holes in manhole walls, and repairing other identified defects. The City typically contracts out all repairs, except minor work that may be completed by Staff.

Note
Pipes without diameter label are 8" and less

Legend

Sewer Maintenance Problems
- Accumulation Of Solids
- Grease
- Inflow
- Roots
- Use Low Pressure

- Existing Gravity Main
- Parks
- Service Area Boundary

Miles
0 0.25 0.5

Figure 5.1
Recurring Maintenance Problems and Routines
General Sewer Plan
City of Mercer Island

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Note
Pipes without diameter label are 8" and less

Legend

- Existing Gravity Main
- Lakeline Gravity Main
- Private Pipelines
- King County Pipelines
- Data Unavailable
- Service Area Boundary

Jetting Schedule

- 3 months
- 6 months
- 1 year
- 2 year
- Discontinued

0 1,500 3,000 Feet

Figure 5.2
Hydro Jetting
Maintenance Schedule
General Sewer Plan Update
City of Mercer Island

5.1.2 Lakeline, Pump Station, and Special Catch Basin O&M

City staff conducts O&M activities on the Lakeline, related pump stations, and special catch basins as needed. Below describes the City's existing activities and goals for the Lakeline and related infrastructure.

5.1.2.1 Pump Station Inspection and Maintenance

City staff conducts regular inspections and maintenance of pump stations in accordance to set goals. The City monitors its PS via telemetry and conducts on-site inspections at least every 3 weeks. Staff confirm proper functioning of pumps and back-up power, as well as inspect the grating, the wet and dry wells, the electrical and instrumentation, and the odor control equipment. Pump inspections typically occur every two to three weeks. Regular maintenance activities include clean the station and wet well, perform preventative repairs, exercise valves, and perform other needed activities. Pump station cleaning and preventive repairs and replacements are performed on an annual basis. Additional maintenance is performed, as required, to maintain the function of all pump and flush stations. City staff responds to alarms as they arise.

Accessibility for the City is defined as ease of access to drive heavy equipment to the PS for maintenance or construction activities. All stations are currently accessible by foot, however not all are accessible by truck and a few are accessible by water. The City has gained agreement for pedestrian access from adjacent home owners at PSs with limited accessibility. Maintenance staff currently uses the Mercer Island Police boat on an emergency basis to access pump stations that are difficult to reach by land. This arrangement is not ideal; however, it has worked for station access in an emergency. It is not a viable option for transporting large equipment and parts. The City has occasionally contracted the use of a work boat and/or barge when required. It is recommended the City consider contracting with a vendor for marine services and/or purchasing a Sewer Utility boat as it had in the past.

PS generators, which are a common source of alarms, are located further inland and are largely accessed directly with a vehicle.

Note, a detailed Pump Station Condition Assessment was completed by City staff in November 2015 is summarized elsewhere in this Chapter.

5.1.2.2 Special Catch Basin Maintenance

The City has over 48 special catch basins to reduce grit and debris from entering the Lakeline. When accessible, special catch basins are inspected and cleaned out by a vactor truck approximately twice a year. However, many special catch basins are difficult to access, as shown in Figure 5.3 and summarized in Table 5.2, and some cannot be accessed for cleaning. Accessibility for the City is defined as ease of access to drive vactor equipment to the special catch basins for maintenance activities. Special catch basins with limited accessibility can be reached using long lengths of hose; however, this makes the cleaning process substantially less efficient. Special catch basins that are not regularly cleaned may allow grit and debris to enter the Lakeline and may create odor issues.

Table 5.2 Special Catch Basin Accessibility Issues
General Sewer Plan
City of Mercer Island

Accessibility	Number of Catch Basins	Portion of Catch Basins (%)
Accessible	26	54%
Limited	22	46%

In 2016, the City began the process to modify existing or install new special catch basins to aid in the O&M of the Lakeline. Modification or replacement of special catch basins are needed to improve hydraulics and settling, increase access, and allow the City to inspect lateral lines from special catch basins to the Lakeline.

5.1.2.3 Easement & Right of Way Access Maintenance

City staff conducts annual maintenance on public right-of-ways used for pump stations and special catch basins, including vegetation control, painting, etc. Typically access is provided across private property, where the easement is maintained by the property owner.

Note, accessibility issues for the Lakeline and pump stations are discussed separately in this Chapter.

5.1.2.4 Lakeline Inspection, Cleaning, and Maintenance

The Lakeline is located beneath Lake Washington approximately five to 100 feet (ft) offshore. There are five separate reaches of Lakeline. Reach 3 was replaced with Ductile Iron Pipe in 2011. This new pipe is located in easements to facilitate O&M. The City goal is to annually clean Reach 3, both sides of PS 4, and the line north of PS 16. The remaining Lakeline piping cannot be accessed for inspection or cleaning.

The condition of the Lakeline, with the exception of Reach 3, is unknown, largely due to access limitations. Installation of new access points in the Lakeline is recommended, as needed, to facilitate regular inspection and maintenance. Installation of new access points may require acquisition of new easements or property. An initial full condition assessment

of the Lakeline is recommended, followed by annual inspection and cleaning. The condition assessment will likely include CCTV inspection and may require more advanced non-contact technologies to identify pipe wall thickness and further evaluate pipe defects.

Figure 5.3
Special Catch Basin Access
General Sewer Plan Update
City of Mercer Island

5.1.2.5 Telemetry Maintenance

The City monitors and controls the Lakeline pump stations using telemetry. The City reports that the telemetry system is aging and may not achieve modern network security standards. Maintenance staff have indicated that the Supervisory Control and Data Acquisition (SCADA) master Human Machine Interface (HMI), commonly referred to as the "Big Blue Box", needs to be replaced. The City currently conducts maintenance on the telemetry system on an as-needed basis. The City is currently exploring obtaining a maintenance agreement with a contractor/consultant for ongoing/regular system telemetry system upkeep.

Given that the current telemetry system is outdated and parts are obsolete, it is recommended that the City conduct a comprehensive telemetry system evaluation. The evaluation should identify existing telemetry system deficiencies and future needs and identify a schedule for replacement.

5.1.2.6 Odor Control Facility Maintenance

Many of the pump stations contain biofiltration odor. Additionally some stations are equipped with Carbon Filters as part of the wetwell ventilation system, which are replaced annually by a contractor.

To address seasonal odor issues, the City adds Bioxide at select pump stations May thru October. The City's Pump Station Condition Assessment noted that Bioxide had spilled and caused corrosion at several pump stations. It is recommended that the Bioxide equipment and standard operating procedure (SOP) be reviewed and updated, as necessary, to resolve this issue.

5.1.2.7 Administrative Tasks

The City conducts administrative tasks as needed to maintain a well-functioning utility. These include administrative duties, staff meetings, tool and equipment cleaning/maintenance, customer service support, and staff training.

The City implemented a new CMMS, Cityworks, in 2018. Cityworks has a GIS-centric asset management system that allows for a centralized recording of infrastructure assets; enabling crews to make operational decisions utilizing information captured within Cityworks. The new system has an updated user interface; enhanced work order management; and ability to manage maintenance assets. The CMMS system allows seamless incorporation of NASSCO PACP/MACP CCTV data.

5.2 OPERATION AND MAINTENANCE PROGRAMS

O&M programs address complex issues that typically require interagency coordination beyond that typically performed by maintenance staff. The City has three ongoing O&M programs that are summarized in the section below. The City's goals for these programs

are summarized in Table 5.3: Fats, Oil, and Grease (FOG) / Industrial Waste Program, Backyard Main Replacement, and Overflow Emergency Response.

5.2.1 FOG / Industrial Waste Program

The City's Lakeline system is particularly susceptible to FOG, given its year around cool temperature. The City implemented FOG / Industrial Waste Program began in 2003 and was updated in 2014 in conjunction with a new City ordinance (No. 14C-03) expanding its scope. The FOG / Industrial Waste Program require pretreatment of discharges, except in single-family residences. Minimal public outreach effort is performed, as time and staffing allows, to educate both commercial and residential customers of FOG best practices. Additional public outreach efforts and regular coordination with the Building officials is recommended.

5.2.2 Backyard Sewer Replacement

Approximately 20 percent of the collection system are "Backyard sewers" that are sewers located on private property, mainly in residential areas, that do not have easement documentation. Access to these sewers is difficult because of landscaping, fences, and improvements that have been built near and over the sewers in some locations. In addition to the access difficulties, roots from adjacent trees are entering the sewers and causing blockages in some locations. Other sewers are located in steep ravines along the outer edge of the Island. These are difficult to access even by foot.

Figure 5.4 shows sewer lines with accessibility issues that are located in ravines and sewers not located within the public right-of-way. It is recommended that this activity be continued and expended as part of a proposed comprehensive Repair and Replacement (R&R) Program to address the approximately 250 backyard sewers.

5.2.3 Overflow Emergency Response Plan

An overflow emergency response plan provides a standardized course of action for sewer collection system personnel to follow in the event of a Sanitary Sewer Overflow (SSO). The City's overflow emergency response plan describes the utility’s planned options for response, remediation, and notification measures under different SSO scenarios. The City responds immediately to overflows and reports the overflow within 24 hours. This includes overflows to waterbodies, overflow that does not flow into waterbodies, and backups into homes.

Table 5.3 Operations and Maintenance Programs
General Sewer Plan
City of Mercer Island

O&M Program	Criteria	Goal	Program Frequency	Comments
FOG / Industrial Waste Program	Keep the pipes clean through education, enforcement and follow-up	Maintain a robust program	Continuous	City code is recently updated. Need staff resources that could be devoted to a program to ensure success.
Backyard Sewer Replacement	Reinvestment in public mains located on private property to ensure continued reliable cost effective system	Ongoing program to respond to 'backyard' sewers where access is difficult or non-existent	As prioritized or as budget allows	Identify mains, work necessary; prioritize and budget
Overflow Emergency Response	Maintenance Call-out book SOP for Sewage Spill Response Procedures	Report within 24 hours, respond immediately	Ongoing emergency response	

Note
Pipes without diameter label are 8" and less

Legend

Sewer Accessibility Issues

- None
- Outside ROW
- Ravine Line
- Ravine line outside ROW

- Lakeline Gravity Main

Feet
0 1,500 3,000

Figure 5.4
Sewer Accessibility Issues
General Sewer Plan Update
City of Mercer Island

5.3 EASEMENT \ RIGHT-OF-WAY \ ACCESS

Development patterns within the City has led to widespread issues in accessing sewer infrastructure; effecting both gravity mains and pump stations. Approximately a quarter of all pipelines in the system have accessibility issues, as shown in Figure 5.4. The City has identified and mapped its existing easements and right-of-ways. Additionally, City staff have recently updated Pump station accessibility, which is summarized in Appendix H. Resolution of accessibility issues will require new or modified easements and right-of-ways. In some cases, pipes are located under homes and will need to be relocated. It is recommended the City begin a systematic program to improve access via its easements and right-of-ways to support O&M and construction activities. The program should consider both land easements/right-of-way and docks required for lake access.

5.4 REMAINING USEFUL LIFE ASSESSMENT

As presented in Chapter 2, the collection system was developed through three utility improvement districts (UID) and the Mercerwood sewer system in the late 1950s through 1970s. The gravity collection system includes approximately 600,000 linear feet (LF) of pipe. The Lakeline includes 17 pump stations, one Flush Station, and approximately 88,000 ft of largely submerged piping. The length of time that this infrastructure is anticipated to remain functional is commonly called the useful life. Beyond the useful life, the increasing costs of maintenance associated with a failing infrastructure will likely warrant replacement.

Pipe manufacturers establish a theoretical useful life based on pipe material; however, the actual useful life is commonly lower due to soil conditions, aggressive wastewater materials, roots, installation errors, etc. Older pipelines exceeding their usable life may be at higher risk of failure and may allow increased I/I to enter the system. Rehabilitation of older pipelines may use trenchless technologies or require traditional open trench replacement.

Pumps stations useful life is commonly assessed by component, such as pump, wet well, electrical system, etc. Each component may be rehabilitated as it reaches its usable life, rather than replacing the entire pump station. Regular maintenance conducted by the City helps extend the useful life; however, the infrastructure will eventually reach the end of its usable life and require rehabilitation or replacement.

Remaining useful life (RUL) can be defined as the length of time before a pipe will reach the end of its useful life, and is helpful for identifying upcoming repair or replacement projects due to the age and condition of a pipe. RUL is calculated as the difference between the useful life and the age of the infrastructure. For example, a 50 year old pipeline with a 75 year useful life would have 25 years of RUL.

5.4.1 Pipeline Useful Life

Customized pipe useful life based on material were developed using staff's knowledge of the collection system. Table 5.4 presents the estimated useful lives of various pipe material present in the system, as well as the percentage of the material in the system. Much of the gravity system is composed of Asbestos Cement (AC) pipe. The useful life AC pipe has can be variable due to manufacture, as well as typical issues, such as soil aggressiveness or installation. The City has had very few issues with its AC pipe and established a useful life of 75 years. Periodic review of AC pipe useful life is recommended, especially if the City experiences increased failures or identifies widespread deficiencies through CCTV. The City has had more issues with its concrete pipes and established a useful life of 60 years. A typical useful life was assigned to cast iron (CI) and ductile iron (DI) pipes of 60 years and 80 years, respectively. These materials represent over 93 percent of the distribution system. Remaining materials do not have a large impact on the analysis.

Table 5.4 Useful Life of Pipes
General Sewer Plan
City of Mercer Island

Pipe Material	Percentage of Collection System	Useful Life Assumptions (years)
Asbestos Cement	54%	75
Cast Iron (CI)	14%	60
Vitrified Clay	<1%	75
Concrete	19%	60
Ductile Iron (DI)	6%	80
Galvanized Steel?	<1%	60
High-density polyethylene (HDPE)	<1%	80
Other	2%	50
Poly Vinyl Chloride (PVC)	2%	80
Reinforced Concrete Pipe (RCP)	<1%	80
Resin	<1%	60
Unknown	1%	60

5.4.2 Pipeline Remaining Useful Life

Pipe age and material type were used to determine the RUL of the collection system pipelines. GIS data were used to determine the type of material and year that pipe segments were installed. The City's GIS dataset was well populated with less than one percent of pipelines missing age (install year) and/or material data. Pipes with missing install year data were assumed to be constructed in 1966, which is the median age of the system, with one exception. The pipe install year was missing for the portion of the system historically developed by the East Mercer Sewer District for the Mercerwood Plant, which was largely constructed with concrete pipe. The system is believed to be largely constructed in the mid to late 1950s; therefore an install year of 1959 was used for these pipes. The identified pipeline RUL is a high level analysis that should be further refined with more detailed information collected from the City's CCTV inspections and other maintenance activities.

The calculated RUL of the City's collection system is shown in Figure 5.5 and Figure 5.6. Figure 5.7 shows the RUL for each pipe in the collection system using three color coded categories:

- Red indicates pipe that is expected to reach the end of their useful life in the next 10 years, including pipes that are beyond its predicted useful life,
- Orange represents pipe with an RUL of between 10 and 20 years, and
- Green represents pipe that has a remaining useful life of over 20 years.

Figure 5.8 presents the replacement by decade (i.e., 2010's = 2016 to 2019, 2020's = 2020-2029, etc.). These results are summarized by pipe material in Table 5.5. The majority of the concrete collection system will reach the end of its useful life by the end of the decade. The majority of the asbestos cement and cast iron pipe will reach the end of its useful life by 2029. In total, approximately 85 percent of the collection system will reach the end of its usable life by 2029. Replacement of all 85 percent of pipes is not feasible given City resources. Therefore, prioritized repair and replacement of pipes with the highest risk to the system is recommended to maintain a high level of service at an achievable cost. Section 5.4.4 provides recommendations for the prioritized R&R of these pipelines

5.4.2.1 Lakeline Remaining Useful Life

The Lakeline is not included in the Pipeline RUL analysis. Typical ranges of useful life are a useful tool for considering pipelines over an entire system; however, they are not well suited for unique circumstances like the Lakeline. Installation in wet environments is challenging and may have resulted in a greater number of minor defects (dips, joint defection, etc.) than the typical system and/or less than ideal slopes. Additionally, the physical, chemical, and biological properties of littoral sediments likely lead to a different corrosion potential than the typical system. Given these unknowns, it is highly recommended the City conduct a physical condition assessment of the Lakeline to establish its remaining useful life.

Note
Pipes without diameter label are 8" and less

Legend

Sewer Gravity Main Installation Decade

- Unknown
- 1950's
- 1960's
- 1970's
- 1980's
- 1990'
- 2000's
- 2010's

Service Area Boundary

0 0.25 0.5 Miles

Figure 5.5
Pipeline Installation Decade
General Sewer Plan
City of Mercer Island

Document Path: E:\KRC D DRIVE\Mercer Island\MXDs\Fig_05_05.mxd

Note
Pipes without diameter label are 8" and less

Legend

Sewer Gravity Main Material

- Asbestos Cement
- Cast Iron
- Clay
- Concrete
- Ductile Iron
- HDPE
- Other
- PVC
- RCP
- RES
- Unknown

Service Area Boundary

N

0 0.25 0.5 Miles

Figure 5.6
Pipeline Material
General Sewer Plan
City of Mercer Island

Document Path: E:\KRC D DRIVE\Mercer Island\MXDs\Fig_05_05.mxd

Note
Pipes without diameter label are 8" and less

Legend

Remaining Useful Life

- < 10 Years of Remaing Useful Life
- 10 - 20 Years of Remaining Useful Life
- > 20 Years of Remaining Useful Life

- Lakeline Gravity Main
- Data Unavailable
- Private Pipelines
- King County Pipelines
- Service Area Boundary

0 1,500 3,000 Feet

Figure 5.7
Pipeline Remaining Useful Life
General Sewer Plan Update
City of Mercer Island

Note
Pipes without diameter label are 8" and less

Legend

Replacement Decade
- 2010
- 2020
- 2030
- 2040 and Later

- Lakeline Gravity Main
- Data Unavailable
- Private Pipelines
- King County Pipelines
- Service Area Boundary

N

0 1,500 3,000 Feet

Figure 5.8
Pipeline Replacement by Decade
General Sewer Plan Update
City of Mercer Island

Table 5.5 Pipeline Replacement by Decade
General Sewer Plan
City of Mercer Island

Material	Length of Pipe (ft)									Material Total
	2010	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**2080**	**2090**	
AC	6,746	296,441	17,546	2,207	1,163	-	-	-	-	**324,104**
CI	751	80,763	3,201	91	-	-	-	-	-	**84,806**
Clay	-	-	340	1,736	-	-	-	-	-	**2,076**
Concrete	85,383	24,872	222	2,157	-	-	51	-	-	**112,685**
DI	-	-	500	1,333	9,659	15,000	2,471	10	4,585	**33,557**
Fiberglass Reinforced (FG)	-	-	39	-	-	-	-	-	-	**39**
HDPE	-	-	-	-	-	-	-	2,269	110	**2,380**
Other	9,871	248	1,640	2,103	303	-	-	-	-	**14,165**
PVC	-	-	50	450	3,677	5,070	1,623	2,401	401	**13,671**
RCP	-	1,907	889	-	-	-	-	-	-	**2,796**
Resin	-	-	-	-	-	318	-	-	-	**318**
Unknown	1,550	-	-	-	-	3,281	-	-	-	**4,831**
Decade Total	**104,301**	**404,231**	**24,427**	**10,076**	**14,801**	**23,670**	**4,145**	**4,681**	**5,096**	**595,428**

5.4.3 Pipeline Repair or Replacement Prioritization

In the coming decades, the City will need to make decisions between continuing maintenance, repairing, or replacing its aging infrastructure. The RUL analyses found that approximately 500,000 ft (95 miles) of pipe will reach the end of its useable life by 2029. This would require R&R of approximately 39,000 ft (7.3 miles) of pipe per year through 2029. Given limited resources, the City's available R&R budget should be prioritized to address the pipelines with the highest risk. Risk is defined as:

- Risk = Vulnerability * Criticality

The RUL provides an indication of the vulnerability or likelihood of failure. Criticality or consequence of failure is defined by asking the question, "If the pipe fails, then what will be the impact to the system?" Typical drivers for highly critical pipes are size of service disruptions, risk to public health, timeframe for repair of pipeline, impact to sensitive areas (i.e. shorelines, streams, wetlands, etc.), etc. Identifying criticality for the entire system requires a detailed study that is beyond the scope of this General Sewer Plan (Plan). In lieu of this, pipeline replacement was prioritized based on ranking, known maintenance and structural criteria currently tracked by the City. The priority scoring of each maintenance and structural criteria, as shown in Table 5.6, were rated by City staff in a scale from 1 to 5, with 1 being the best and 5 the worst. Given two similar pipes, the pipe with a higher score would be replaced before a lower score. Pipes with accessibility issues, also known as backyard mains, are highly critical, since they are more difficult to make emergency repairs on pipe failures. Additionally, pipe failures may impact structures that have been built too close to the pipes. Pipes with roots were also considered highly critical, as the R&R would reduce the risk of blockage or collapse and required O&M activities.

A combined prioritization was assigned to each pipe using the City's GIS data. Multiple criteria were added when occurring on a single pipe (i.e. accessibility issues plus roots). Pipes were assigned to three categories of prioritization based on their prioritization scoring:

- Low Priority: No Prioritization Criteria
- Medium Priority: Combined rating less than 4
- High Priority: Combined rating more than 4

The results of the high level prioritization are shown in Figure 5.9 and summarized in Table 5.7. The majority of pipes (54 percent) within the system had no known issues and assigned a low prioritization. The system has a similar quantity of medium (22 percent) and high priority (24 percent) pipes. R&R of high priority pipes would require the City to address approximately 11,000 ft (2.1 miles) of pipe per year through 2029. R&R of medium priority pipes would require the City to address approximately 10,200 ft (1.9 miles) of pipe per year through 2029. Medium priority pipes were largely due to pipe size and to a lesser extent accumulation of solids or

grease. Accessibility issues were the most common reason for a high priority rating. Overall, only 3 percent of pipes were impacted by more than one criteria.

Table 5.6 Pipeline Replacement Prioritization Criteria
General Sewer Plan
City of Mercer Island

Criteria [1]	Description	Percentage of Collection System (%)	Criteria Scoring (1 = least, 5 = worst)[2]
Pipe Size (>8")	Diameter of Pipe. Larger diameter pipes typically carry more flow	18%	2
Accumulation of Solids	Flagged by O&M staff for having excessive solids accumulation	10%	1
Grease	O&M staff regularly jet pipe for FOG	<1%	3
Roots	O&M staff regularly remove roots	<1%	4
Accessibility Issues	Pipelines that have limited or difficult access	23%	5

Notes:
(1) Criteria identified based on City 2015 GIS records.
(2) Ratings identified by City Staff in January 2016.

Table 5.7 Pipeline Replacement by Decade
General Sewer Plan
City of Mercer Island

	Length of Pipe (ft)									Priority Total
Priority	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**2080**	**2090**	
Low	72,459	211,691	6,240	3,644	1,216	14,775	2,216	2,074	4,628	**318,943**
Medium	12,502	97,135	6,914	1,578	9,381	3,597	346	1,624	-	**133,078**
High	19,340	95,406	11,273	4,853	4,204	5,298	1,583	982	468	**143,407**
Decade Total	**104,301**	**404,231**	**24,427**	**10,076**	**14,801**	**23,670**	**4,145**	**4,681**	**5,096**	**595,428**

Note
Pipes without diameter label are 8" and less

Legend

Pipeline Replacement Prioritization
- Low Priority
- Medium Priority
- High Priority

- Lakeline Gravity Main
- Data Unavailable
- Private Pipelines
- King County Pipelines
- Service Area Boundary

Feet
0 1,500 3,000

Figure 5.9
Pipeline Replacement Prioritization
General Sewer Plan Update
City of Mercer Island

5.4.4 Pipeline Repair or Replacement Recommendations

Developing a risk based comprehensive R&R Program to address the long-term management of the collection system is recommended. The R&R program replacement schedule of between 11,000 ft per year (high priority pipes) and 40,000 ft per year (all pipes) is needed through 2029. The R&R Program should leverage four components:

- CCTV inspection,
- Sewer Main and Manhole Repair,
- Backyard Main Replacement, and
- Sewer Main Lining and Replacement.

The City's CCTV program is expected to continue to be the primary method to identify deficiencies and R&R approach, as well as monitoring the rate of decline in existing pipeline condition. As discussed previously, it is recommended CCTV inspections be recorded using NASSCO PACP/MACP standards to obtain consistent and complete information. The RUL and R&R prioritization of pipes should be revised based on the CCTV findings.

The existing Sewer Main and Manhole Repair and Backyard Main Replacement activities will likely need to be expanded to meet the R&R goals. In particular, the Backyard Main Replacement activities are expected to disproportionally address high priority pipes. Sewer Main Lining may be a cost effective approach for high priority pipes with limited access that do not require relocation. Additionally, sewer lining is often cost-effective for pipes in areas where excavation is challenging (etc. deep pipes, constrained right-of-ways, steep slopes, etc.). Open trench pipeline replacement may be more cost-effective for less challenging locations.

5.5 PUMP STATION REMAINING USEFUL LIFE

City staff conducted a Pump Station Condition Assessment in October and November 2015, which are summarized in Table 5.8 and provided in Appendix H. The assessments and system checks rated and established a RUL, referred to as life expectancy, for major pump station components including:

- Pumps,
- Intake and Outlet Valves,
- Structure,
- Wetwell, and
- Hydraulic Gradient Manhole.

Each major component was broken into five to ten subcomponents that were rated. Ratings ranged from excellent or very good condition, to average condition where backlog maintenance is required, to component in very poor condition and requires immediate attention. Additionally,

system checks were conducted for alarms, excessive noise, excessive vibration, excessive heat, oil level, leaks, and others. The City made detailed comments to document specific issues and/or maintenance requests. In addition to the general categories listed, the assessment indicated all sump pumps and valves required maintenance and repair.

City staff assigned a life expectancy or RUL for each component:

- 0 to 1 year: immediate need
- 2 to 5 years: address in short-term planning horizon
- 6 to 10 years: address in medium-term planning horizon
- 6 to 25 years: address in medium- to long-term planning horizon

The criticality of each pump station was rated by City staff based on the consequence of failure. For example, a pump station that would flood homes was given a very high criticality, while a flush station (does not move sewage) was given a very low rating.

Additionally, Seahurst Electrical conducted an electrical system analysis of the pump stations. The electrical system analysis included energized system visual and mechanical inspection, infrared thermal scanning, and "walk through" evaluation. The comprehensive analysis considered electrical panels and breakers, auto transfer switches, and pump motors. Identified problems are summarized in Table 5.9. Seahurst Electrical prioritized as critical (immediate attention required), severe (Attention required in 30 to 90 days), or as an alert (needs attention as time permits).

Table 5.8 Pump Station Condition Assessment Repair and Replacement Timeframe
General Sewer Plan
City of Mercer Island

Name (1)	Criticality (2)	Structure Replacement	Pump 1 Replacement	Pump 2 Replacement	Pump 3 Replacement	Immediate Repair Needs (3)
Pump Station #1	Low	Medium- to Long-term	Medium-term	Short-term	NA	PS Interior, Wetwell, and Structural
Pump Station #4	Very high	Medium- to Long-term	Medium-term	Medium-term	Medium- to Long-term	
Pump Station #10	Medium	Medium- to Long-term	Medium-term	Short-term	NA	PS Interior
Pump Station #11	High	Medium- to Long-term	Short-term	Short-term	NA	PS Interior
Flush Station #12	Very Low	Medium- to Long-term	Short-term	Short-term	NA	PS Interior

Table 5.8 Pump Station Condition Assessment Repair and Replacement Timeframe
General Sewer Plan
City of Mercer Island

Name (1)	Criticality (2)	Structure Replacement	Pump 1 Replacement	Pump 2 Replacement	Pump 3 Replacement	Immediate Repair Needs (3)
Pump Station #13	High	Medium- to Long-term	Short-term	Short-term	Short-term	PS Interior and Structural
Pump Station #14	Low	Medium- to Long-term	Medium-term	Medium-term	NA	
Pump Station #15	High	Medium- to Long-term	Short-term	Short-term	Short-term	Wetwell
Pump Station #16	Very high	Medium- to Long-term	Short-term	Short-term	Short-term	Wetwell
Pump Station #17	Very high	Medium- to Long-term	Short-term	Short-term	Short-term	
Pump Station #18	Very high	Medium- to Long-term	Short-term	Short-term	Short-term	PS Interior and Wetwell
Pump Station #19	High	Medium- to Long-term	Short-term	Short-term	Short-term	Wetwell
Pump Station #20	Very high	Medium- to Long-term	Short-term	Short-term	Short-term	Wetwell
Pump Station #21	Medium	Short-term	Short-term	Short-term	Short-term	Wetwell
Pump Station #22	Medium	Medium- to Long-term	Short-term	Short-term	Short-term	Wetwell and Pump 2
Pump Station #23	Very high	Medium- to Long-term	Short-term	Short-term	Short-term	Wetwell and Pump 3
Pump Station #24	Medium	Medium- to Long-term	Short-term	Short-term	Medium-term	
Pump Station #25	Medium	Medium- to Long-term	Medium-term	Medium-term	NA	Wetwell

Notes:

(1) Condition assessment conducted by City Staff in October and November of 2015.
(2) Criticality or consequence of failure was assigned by City maintenance staff.
(3) All stations were found to need repair or replacement of valves and sump pumps, if applicable.

Table 5.9 Identified Pump Station Electrical Issues
General Sewer Plan
City of Mercer Island

Name	System Component (Problem Description)	Priority
Pump Station #4	Branch Circuit Panel (Heat)	Critical
Pump Station #10	Branch Circuit Panel (Enclosures)	Alert
Pump Station #14	Branch Circuit Panel (Heat) Individual Disconnect Switch (Enclosures)	Alert
Pump Station #15	Branch Circuit Panel (Heat and Enclosures)	Alert
Pump Station #16	Individual Model Case Breaker (Heat) Branch Circuit Panel (Heat) Individual Disconnect Switch (110 Requirements and fuses)	Alert
Pump Station #17	Branch Circuit Panel (Heat) Individual Disconnect Switch (Enclosures and Heat)	Alert
Pump Station #19	Individual Disconnect Switch (Heat)	Alert
Pump Station #21	Individual Disconnect Switch (Fuses) Branch Circuit Panel (Housekeeping)	Alert
Pump Station #22	Branch Circuit Panel (Heat) Individual Disconnect Switch (Heat and Fuses)	Alert
Pump Station #23	Individual Disconnect Switch (Enclosures)	
Pump Station #24	Branch Circuit Panel (Enclosures)	Alert

Notes:
(1) Summary from Seahurst Electricals Electrical System Analysis (December 2015).
(2) All stations and inspected components not listed were found to be in acceptable condition.

The condition assessment identified that all pump stations, except the recently constructed PS 4 and PS 14, will require rehabilitation or replacement in the next 25 years. Further, pumps in fourteen PS are projected to reach the end of their useful life in the next five years (short-term period). It is recommended that the City implement a PS Renewal Program to systematically R&R ageing pump stations. PS 21 appears to be in the worst condition and may serve as a suitable pilot project for the program.

In general, very high and high criticality should be prioritized over lower criticality pump stations. Recommended highly critical pump stations are summarized in Table 5.10. However, it is acknowledged that condition and accessibility may initially drive pump station prioritization.

Table 5.10 Critical Pump Station Summary
General Sewer Plan
City of Mercer Island

Name	Criticality	Major Replacement Needed
Pump Station #11	High	Short-term
Pump Station #13	High	Short-term
Pump Station #15	High	Short-term
Pump Station #16	Very high	Short-term
Pump Station #17	Very high	Short-term
Pump Station #18	Very high	Short-term
Pump Station #19	High	Short-term
Pump Station #20	Very high	Short-term
Pump Station #21	Very high	Short-term
Pump Station #23	Very high	Short-term

5.6 OPERATION AND MAINTENANCE RECOMMENDATION SUMMARY

O&M recommendations from this Chapter are summarized below. Due to the breadth and scope of recommendations, it is recommended the City continue to evaluate O&M staffing levels to provide adequate resources to achieve the stated O&M goals and the below recommendations.

5.6.1 Accessibility Improvements

Continue efforts to enhance access along Easements/Right-of-Way for both pump stations and pipelines. In short-term, program to support construction activities required to address items identified in the Pump Station Condition Assessment. The program to consider both land easements/right-of-way and docks required for lake access. It is envisioned that the program will work with property owners to maintain and enhance access in the future. For example, the program may work with homeowners to install fence gates to allow crews to conduct regular collection system cleaning and CCTV inspection.

5.6.2 O&M Equipment and Services

The O&M evaluation identified several areas where new O&M equipment and services are recommended, including:

1. Consider contracting with vendor or purchasing a boat to improve access to several pump stations that have limited land access.
2. Obtain a maintenance agreement with contractor/consultant for ongoing/regular system Telemetry system upkeep.

5.6.3 Lakeline and Pump Station Improvements

A comprehensive condition assessment of the Lakeline, pump stations, and special collection basins is recommended. Incorporate the City's recent pump station condition assessment into the comprehensive evaluation. It is expected that the condition assessment will require a phased approach. The first phase should seek to establish access to the Lakeline, pump stations, and special collection basins, including:

- Conduct pipe survey to verify location of Lakeline and service laterals.
- Install new access points in the Lakeline, as needed, to facilitate the condition assessment, as well as regular inspection and maintenance. Installation of new access points may require acquisition of new easements or property.
- Improve access to pump stations, as described in Section 5.3.
- Modify existing or install new special collection basins to aid in the operation and maintenance of the Lakeline. Special collection basins should be designed to allow CCTV inspection of the lateral main to the Lakeline.
- Conduct an evaluation of the City's Telemetry system. System upgrades may be required for aging system components, network security, and SCADA master (HMI).

The second phase should seek to conduct a comprehensive condition assessment of the Lakeline, including:

- Conduct initial inspection and assessment. Identify segments of pipe or manholes for more detailed evaluation.
- Conduct more detailed evaluations to identify pipe wall thickness and further evaluate pipe defects. It is recommended that non-contact technologies be considered, such as ultrasonic thickness testing and radiography (completed in 2019).

It is expected that multiple initial assessment technologies will need to be used due to the varying distances between access points. Common technologies include CCTV inspection, 360 degree digital or laser scanning, sonar, dye testing, and smoke testing.

Improvements from the City's recent pump station condition assessment should be implemented in recommended time frames. Many of the small improvements may be implemented by City

Staff or under a small works contract, including updating the Bioxide equipment and SOP. Incorporate and update, as needed, condition assessments for pump stations, and special collection basins into the comprehensive condition assessment.

Based on the condition assessment, develop R&R needs for infrastructure, as well as updates to standard operating procedures. Prioritize improvements using risk based on the comprehensive condition assessment and a detailed criticality assessment.

5.6.4 R&R Program

Consider establishing a phased R&R Program to address pump station renewal and long-term management of the collection system. Initially, it is recommended to continue and expand the existing CCTV inspections, Sewer Main and Manhole replacement, and Backyard Main Replacement activities. R&R of high priority pipes would require 11,000 ft (2.1) miles of pipe per year through 2029. Identify and document NASSCO PACP/MACP compliant deficiencies as part of CCTV inspection Program to refine the pipeline RUL used to generate the pipe R&R estimates. Consider using a GIS-based platform to maintain and visualize CCTV data. Refine pipeline prioritization based on risk developed using the comprehensive condition assessment and a detailed criticality assessment.

CAPITAL IMPROVEMENTS PLAN

6.1 INTRODUCTION

This chapter summarizes the City of Mercer Island's (City's) capital improvements program (CIP) for the wastewater system that are based on the analyses in previous chapters. The purpose of the CIP is to provide the City with a guideline for planning and budgeting of its wastewater system. The CIP consists of proposed projects, cost estimates, and a schedule.

6.1.1 Capital Project Categories

Capital projects can be categorized by the nature of infrastructure. These include:

- General (G)
- Pipe (P)
- Pump Station (PS)
- Lakeline (L)

General projects are upgrades and studies that are not infrastructure specific, such as General Sewer Plan Updates. Pipe projects refer to projects in the gravity collection system. Pump Station projects are limited to the City's pump stations. Lakeline projects include the Lakeline, its laterals, and hydraulic structures/special collection basins.

6.1.2 Capital Project Types

Projects can be allocated into two types to support development of rates and connection charges:

1. Capacity – Provides additional system capacity to meet future demand growth.
2. Non-Capacity – Repair and replacement of system.

All capital projects in this General Sewer Plan are non-capacity or not growth related. New projects that arise from future individual developments may be considered capacity projects, or a mix of capacity and non-capacity. In these cases, the City will likely be required to pay the non-capacity portion and the developer pays the capacity portion of the project.

6.1.3 Capital Planning Periods

CIP projects were allocated into one of three planning periods referenced in previous chapters:

- Short-term (2019-2024)

- Medium-term (2025-2028)
- Long-term (2029-2038)

The short-term planning horizon is allocated to individual years to be consistent with the City's CIP planning. Projects in medium- and long-term planning horizons do not provide the same level of specificity, reflecting the uncertainty in future needs and City resources. The project timing in this Chapter is subject to change as the City regularly reviews and updates its CIP based on changing conditions and priorities.

6.2 COST ESTIMATING ASSUMPTIONS

6.2.1 Cost Estimate Level

The CIP cost estimates presented in this chapter are American Academy of Cost Engineers (AACE) Class 4 estimates. Class 4 estimates are budget level estimates. Actual costs may vary from these estimates by -30 percent to +50 percent. These costs were determined based on the City's and Consultant's perception of current conditions at the project locations.

All costs are in January 2017 dollars. The Engineering New Report (ENR) U.S. 20-City Construction Cost Index for January 2017 is 10,532. The estimates are subject to change as the project design matures. Cost of labor, materials, equipment may vary in the future.

6.2.2 Cost Estimates Elements

The CIP cost estimates were based on construction costs that are inflated using cost factors to account for non-construction project elements. The cost factors for the City's CIP, are shown in Table 6.1. For a typical project, the cost factors would increase the construction costs by 85 percent to represent total construction costs. However, City Staff reviewed all individual projects costs and removed cost factors in some cases.

Table 6.1 Cost Factors
General Sewer Plan
City of Mercer Island

Adjustment Factors	Description	Factor
Contingency	Costs that may occur due to uncertainty in project scope and conditions.	30%
General Conditions & Overhead	Contractor costs indirectly related to construction.	25%
Engineering/Planning	Cost for planning and design of project	20%
City Admin	Cost to administer the project.	10%

6.2.3 Pipeline Unit Costs

Pipeline unit cost assumptions are shown in Table 6.2. These costs were developed from recent construction costs from the City and typical cost adjustments for various diameter sizes. Pipeline replacement unit costs assume open-trench construction in improved areas. Costs include pavement cutting, excavation, hauling, shoring, pipe materials and installation, backfill material and installation, and pavement replacement. The unit costs are for construction in stable soil at a depth ranging between 3 to 12 feet. Steep slopes, deeper pipe depths, or environmentally sensitive areas may result in additional costs. Additionally costs do not include acquisition of right-of-way or easements.

Trenchless pipe rehabilitation, or pipe lining, is a common and cost-effective method for repair and rehabilitation of aging pipes. Cured-in-place pipes (CIPP) is a common technique available in a variety of materials and vendors. Unit costs presented in Table 6.2 assume CIPP structural liners, including pipe preparation, lining installation, and the restoration of laterals (i.e. pavement cutting, excavation, hauling, and shoring, etc.).

These costs are construction costs only and do not reflect the Contingency, General Conditions & Overhead, Engineering/Planning, and City Admin.

Table 6.2 Pipeline Unit Costs
General Sewer Plan
City of Mercer Island

Pipe Size (Inches)	Pipeline Replacement Unit Cost ($/Linear Foot)(1)	Trenchless Pipe Rehabilitation Unit Cost ($/Linear Foot)(1, 2)
8	$126	$34
10	$134	$34
12	$144	$37
16	$170	$40

Notes:
(1) Pipeline unit costs are for construction only.
(2) Costs for Cured in place pipe (CIPP).

6.2.4 Additional Costs

Costs for the CIP including: onsite generators, flow monitoring, and repair and replacement program costs to rehabilitate pumps stations, were estimates based on past projects, as presented in Table 6.3.

Table 6.3 Additional Costs General Sewer Plan City of Mercer Island	
Type	**Cost ($)**
Onsite Generator	$50,000 per generator installation
Flow Monitoring	$35,000 per project
Pump Station R&R improvements	$300,000 per improvement
Note: (1) Other costs are for construction only. (2) R&R: Repair and Replace.	

6.3 CIP PROJECT SHEETS AND COSTS

CIP projects are based on the analyses presented in previous chapters that recommended system improvements and repair and replacement projects. The CIP projects are summarized in Table 6.4. Costs presented in this chapter are in 2017 dollars (ENR 20 City Index of 10532) and have not been escalated.

An individual Project Sheet was generated for each CIP project and includes project identifiers, description, costs, project type, and comments to aid in future implementation. A location map is included for projects that are located in a specific area. To aid in finding individual projects, Project Sheets have been separated in sections by project category:

- General
- Pipelines
- Pump Stations
- Lakeline

A summary of costs by project category and type is presented at the end of the Chapter.

Table 6.4 CIP Project Summary
General Sewer Plan
City of Mercer Island

Project No.		Project Name	Total CIP Cost Estimate	CIP Phasing									Project Type	
				2019	2020	2021	2022	2023	2024	Short-term (2019-2024)	Mid-term (2025-2028)	Long-term (2029-2038)	Capacity	Non-Capacity
General			$ 1,779,600	$ 279,800	$ 138,800	$ 104,000	$ -	$ 104,000	$ -	$ 626,600	$ 300,500	$ 852,500		
G-1	-	Pipe Flow Monitoring	$ 1,040,000	$ 104,000	$ -	$ 104,000	$ -	$ 104,000	$ -	$ 312,000	$ 208,000	$ 520,000	0%	100%
G-2	-	Comprehensive Hydraulic Model Development	$ 360,800	$ 175,800	$ -	$ -	$ -	$ -	$ -	$ 175,800	$ 92,500	$ 92,500	0%	100%
G-3	-	Comprehensive I/I Evaluation	$ 138,800	$ -	$ 138,800	$ -	$ -	$ -	$ -	$ 138,800	$ -	$ -	0%	100%
G-4	-	General Sewer Plan Update	$ 240,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 240,000	0%	100%
Pipe			$ 68,164,600	$337,000	$ 581,300	$ 555,800	$ 631,300	$ 437,000	$ 946,500	$ 3,488,900	$18,668,700	$ 46,007,000		
P-1	-	W Mercer Way Pipe Upsize	$ 118,800	$ -	$ -	$ 118,800	$ -	$ -	$ -	$ 118,800	$ -	$ -	0%	100%
P-2	-	Shorecliff Ln Pipe Upsize	$ 146,800	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 146,800	$ -	0%	100%
P-3	-	Mercerdale Park Pipe Upsize	$ 315,200	$ -	$ -	$ -	$ -	$ -	$ 315,200	$ 315,200	$ -	$ -	0%	100%
P-4	-	SE 32nd St Pipe Upsize	$ 75,800	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 75,800	$ -	0%	100%
P-5	-	77th Ave SE and SE 27th St Intersection Reconfiguration	$ 74,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 74,000	0%	100%
P-6	-	SE 24th St Pipe Upsize	$ 117,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 117,500	$ -	0%	100%
P-7	-	74th Ave SE Upsize	$ 3,700	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,700	0%	100%
P-8	-	East of 72nd Ave. S.E. and S.E. 22nd St., south of I-90	$ 107,900	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 107,900	0%	100%
P-9	WS101U	Backyard Sewer System Improvements	$ 804,900	$ 37,000	$231,300	$ 37,000	$ 231,300	$ 37,000	$ 231,300	$ 804,900	$ -	$ -	0%	100%
P-10	-	Comprehensive Pipeline R&R Program	$66,400,000	$ 300,000	$350,000	$ 400,000	$ 400,000	$ 400,000	$ 400,000	$2,250,000	$18,328,600	$45,821,400	0%	100%
Pump Station			$ 12,453,900	$ 499,500	$ 407,000	$1,063,800	$1,100,800	$ 786,300	$ 333,000	$ 4,190,400	$ 4,563,500	$ 3,700,000		
PS-1	WS712P	Pump Station Accessibility Improvements	$ 444,000	$ 37,000	$ 74,000	$ 37,000	$ 74,000	$ 37,000	$ 74,000	$ 333,000	$ 111,000	$ -	0%	100%
PS-2	-	Generator Replacement	$ 1,387,500	$ 92,500	$ 92,500	$ 92,500	$ 92,500	$ -	$ -	$ 370,000	$ 92,500	$ 925,000	0%	100%
PS-3	-	Pump Station Monitoring	$ 971,400	$ -	$ 129,500	$ 194,300	$ 194,300	$ 194,300	$ 259,000	$ 971,400	$ -	$ -	0%	100%
PS-4	-	PS 23, 24, 25 Capacity Improvements	$ 1,961,000	$ 370,000	$ 111,000	$ 740,000	$ 740,000	$ -	$ -	$ 1,961,000	$ -	$ -	0%	100%
PS-5	-	Pump Station R&R Improvements	$ 4,440,000	$ -	$ -	$ -	$ -	$ 555,000	$ -	$ 555,000	$ 1,110,000	$ 2,775,000	0%	100%
PS-6	WS713T	Telemetry/SCADA Upgrades and Maintenance	$ 3,250,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,250,000	$ -	0%	100%
Lakeline			$ 38,355,000	$ 185,000	$370,000	$ 185,000	$185,000	$ 495,000	$ 495,000	$ 1,915,000	$ 6,195,000	$ 30,245,000		
L-1	WS711C	Lakeline Access	$ 2,350,000	$ 185,000	$ 185,000	$ -	$ -	$ 495,000	$ 495,000	$1,360,000	$ 495,000	$ 495,000	0%	100%
L-2	-	Lakeline Condition Assessment	$ 4,000,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,000,000	$ 2,000,000	0%	100%
L-3	-	Reach 4 Lakeline Replacement	$ 4,255,000	$ -	$ 185,000	$ 185,000	$ 185,000	$ -	$ -	$ 555,000	$ 3,700,000	$ -	0%	100%
L-4	-	Lakeline R&R Program	$27,750,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$27,750,000	0%	100%
CIP Total			$120,753,100	$1,301,300	$1,497,100	$1,908,600	$1,917,100	$1,822,300	$1,774,500	$10,220,900	$ 29,727,700	$ 80,804,500	$ -	$120,753,100
Annual Cost			$ 6,038,000	$1,301,300	$1,497,100	$1,908,600	$1,917,100	$1,822,300	$1,774,500	$ 1,703,000	$ 7,432,000	$ 8,080,000	$ -	$6,038,000

6.3.1 General Project Sheets

General projects apply to the overall system and include:

- G-1 Pipe Flow Monitoring
- G-2 Comprehensive Hydraulic Model Development
- G-3 Comprehensive I/I Evaluation
- G-4 General Sewer Plan Update

General notes on the projects include:

- G-1 Pipe Flow Monitoring assumes a vendor installs, maintains, and processes data from flow monitoring. Each flow monitoring period will address different sewer subbasins. Due to the large number of sewer sub-basins, multiple monitoring periods will be required. Monitoring should be targeted in advance of related projects, such as upcoming PS rehabilitation projects and other work.
- G-2 Comprehensive Hydraulic Model Development is anticipated to occur over time. An initial effort will build a full-Island model and calibration 5 mini-basins. Further calibration will occur as flow data is available Pump Stations and flow monitoring in the collection system.
- G-3 Comprehensive I/I Evaluation flow data at pump stations and flow monitoring conducted as part of the hydraulic model calibration are used to measure I/I. No additional flow monitoring was assumed for the project.
- G-4 General Sewer Plan budget reflects a comprehensive evaluation, including considering the entire Gravity Sewer system.

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: G-1 **Budget Number:**
Project Name: Pipe Flow Monitoring
Facility Type: Pipe

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	**$ 1,040,000**
Non-capacity:	100%	$ 1,040,000	

Project Description:

Conduct flow monitoring in pipe system network. Flow data collected from manholes will be used for ongoing calibration of the hydraulic model, and support prioritization of project and future reinvestment in the Comprehensive Pipeline R&R program.

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency 0%	GC & Overhead 0%	Engineering/ Planning 20%	City Admin 10%	Total Project Cost	Project Timing
Flow Monitoring	1	LS	$ 80,000	$ -	$ -	$ 16,000	$ 8,000	$ 104,000	2019
Flow Monitoring	1	LS	$ 80,000	$ -	$ -	$ 16,000	$ 8,000	$ 104,000	2021
Flow Monitoring	1	LS	$ 80,000	$ -	$ -	$ 16,000	$ 8,000	$ 104,000	2023
Flow Monitoring	2	LS	$ 80,000	$ -	$ -	$ 32,000	$ 16,000	$ 208,000	Mid-term
Flow Monitoring	5	LS	$ 80,000	$ -	$ -	$ 80,000	$ 40,000	$ 520,000	Long-term

Notes on Cost Estimation:

Assumes $5k for each flow meter installed up to 10 per year, $15k for installation of meters, and $15k for data storage/transfer for total of $80,000.

Project Location:

Notes:

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: G-2 **Budget Number:**
Project Name: Comprehensive Hydraulic Model Development
Facility Type: General

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	**$ 360,800**
Non-capacity:	100%	$ 360,800	

Project Description:

Develop a system-wide hydraulic model to aid in identifying capacity issues and rehabilitation methods. The hydraulic model should include the Lakeline system. Calibrate and validate the updated hydraulic model using collected flow monitoring at the exit of large sewer basins. Update model to incorporate pump station flow information when available. Plan to recalibrate the model every 10 years with the update to the General Sewer Plan.

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency	GC & Overhead	Engineering/ Planning	City Admin	Total Project Cost	Project Timing
				30%	25%	20%	10%		
Model Development	1	LS	$ 50,000	$ 15,000	$ 12,500	$ 10,000	$ 5,000	$ 92,500	2019
Calibration of Mini-basins	5	Mini-Basin	$ 9,000	$ 13,500	$ 11,250	$ 9,000	$ 4,500	$ 83,300	2019
Model Update w pump station flows	1	LS	$ 50,000	$ 15,000	$ 12,500	$ 10,000	$ 5,000	$ 92,500	Mid-term
Model Update w General Sewer Plan	1	LS	$ 50,000	$ 15,000	$ 12,500	$ 10,000	$ 5,000	$ 92,500	Long-term

Notes on Cost Estimation:

Anticipate $50,000 for consultant services to update model with pump station flow data. Anticipate an additional $50,000 for consultant services to recalibrate the model with the update to the General Sewer Plan in 2029.

Project Location:

Notes:

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: G-3 **Budget Number:**
Project Name: Comprehensive I/I Evaluation
Facility Type: General

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	**$ 138,800**
Non-capacity:	100%	$ 138,800	

Project Description:

The city currently does not have a comprehensive plan to monitor flows to evaluate, identify or address specific problems related to high I/I (inflow & infiltration). During wet weather events pump stations may operate at capacity due to groundwater and surface water entering into the sewer pipe system. This project will conduct comprehensive I/I investigation (hand in hand with Hydraulic Modeling project) of the Island sewer basins to identify areas of concern.
Ideally all surface water and groundwater is kept out of the wastewater system. This information will be rolled into the pipeline R/R program to be used for prioritizing future pipeline R/R projects.

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency 30%	GC & Overhead 25%	Engineering/ Planning 20%	City Admin 10%	Total Project Cost	Project Timing
I/I Evaluation	1	LS	$ 75,000	$ 22,500	$ 18,750	$ 15,000	$ 7,500	$ 138,800	2020
				$ -	$ -	$ -	$ -	$ -	
				$ -	$ -	$ -	$ -	$ -	

Notes on Cost Estimation:

Costs assume flow data at pump stations and flow monitoring conducted as part of the hydraulic model calibration are used to measure I/I. No additonal flow monitoring was assumed for the project.

Project Location:

Notes:

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: G-4 **Budget Number:**
Project Name: General Sewer Plan Update
Facility Type: General

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	$ 240,000
Non-capacity:	100%	$ 240,000	

Project Description:
Update to the General Sewer Plan is recommended every 10 years to keep the Plan up-to-date.

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency 30%	GC & Overhead 0%	Engineering/ Planning 20%	City Admin 10%	Total Project Cost	Project Timing
General Sewer Plan Update	1	LS	$ 150,000	$ 45,000	$ -	$ 30,000	$ 15,000	$ 240,000	Long-term
				$ -	$ -	$ -	$ -	$ -	
				$ -	$ -	$ -	$ -	$ -	

Notes on Cost Estimation:
Costs assume consultant fees of $150,000 based on fees for the update approved by Council in 2018.

Project Location:

Notes:

6.3.2 Pipe Project Sheets

Pipeline projects improve capacity and repair or replace the City's wastewater system. Pipe projects included in this CIP are system improvements in the Town Center and its tributary (P-1 through P-8), as shown in Figure 6.1. The Backyard Sewers mains are shown in Figure 6.2 and pipe R&R projects are presented in more detail in Chapter 5 - Operations and Maintenance and shown in Figure 6.3.

Pipe Project CIP includes:

- P-1 W Mercer Way Pipe Upsize
- P-2 Shorecliff Ln Pipe Upsize
- P-3 Mercerdale Park Pipe Upsize
- P-4 SE 32nd St Pipe Upsize
- P-5 77th Ave SE and SE 27th St Intersection Reconfiguration
- P-6 SE 24th St Pipe Upsize
- P-7 74th Ave SE Upsize
- P-8 East of 72nd Ave. S.E. and S.E. 22nd St., south of I-90
- P-9 Backyard Sewer System Improvements
- P-10 Comprehensive Pipeline R&R Program

General notes on the projects include:

- P-1 through P-8 were identified through the Town Center Hydraulic modeling. Project lengths should be updated during design based on site specific conditions. The flow projections assume a 7% increase in I/I per decade based on King County's 2014 Study, which was the sole driver of Projects 1 through 4, 7, & 8. No additional domestic flows were added beyond the immediate Town Center area. Projects 5 and 6 were deficient in the existing conditions and therefore the need for improvements were not considered to be growth (capacity) related.
- Costs for P-9 Backyard Sewer System Improvements were based on 2017/2018 City budget levels. Backyard main improvements costs vary widely depending on site conditions; therefore, the City completes as many improvements as possible with available funds.
- P-10 Comprehensive Pipeline R&R costs are based on replacement of high and medium priority pipes and CIPP rehabilitation of low priority pipes. Actual pipeline R&R methods and costs should be determined based on site specific conditions.

Figure 6.1
Proposed Pipe Capacity
- Related Improvement Projects
General Sewer Plan Update
City of Mercer Island

Document Path: E:\KRC D DRIVE\Mercer Island\MXDs\Figure 6.01D.mxd

Note
Pipes without diameter label are 8" and less

Legend

Sewer Accessibility Issues
- None
- Outside ROW
- Ravine Line
- Ravine line outside ROW

Lakeline Gravity Main

Feet
0 1,500 3,000

Figure 6.2
Sewer Accessibility Issues
General Sewer Plan Update
City of Mercer Island

Note
Pipes without diameter label are 8" and less

Legend

Pipeline Replacement Prioritization
- Low Priority
- Medium Priority
- High Priority

- Lakeline Gravity Main
- Data Unavailable
- Private Pipelines
- King County Pipelines
- Service Area Boundary

Feet
0 1,500 3,000

Figure 6.3
Pipeline Replacement Prioritization
General Sewer Plan Update
City of Mercer Island

Document Path: E:\KRC D DRIVE\Mercer Island\MXDs\Fig_06_03.mxd

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: P-1 **Budget Number:**
Project Name: W Mercer Way Pipe Upsize
Facility Type: Pipe

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	$ 118,800
Non-capacity:	100%	$ 118,800	

Project Description:

Upsize pipe segment along W Mercer Way near West Mercer Elementary School from 8-inch to 12-inch diameter. This project is required to prevent surcharging during storm events in the short-term. Monitor manhole 61-67 for surcharge conditions during storm events. Complete flow data collection and pre-design/feasibility first to confirm need and scope project for construction.

This pipe is a high priority for replacement for both capacity and O&M reasons. The slope of this pipe is shallow, which contributes to surcharging and the accumulations of solids.

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency 30%	GC & Overhead 25%	Engineering/ Planning 20%	City Admin 10%	Total Project Cost	Project Timing
W Mercer Way Pipe Upgrade	446	LF	$ 144	$ 19,267	$ 16,056	$ 12,845	$ 6,422	$ 118,800	2021
				$ -	$ -	$ -	$ -	$ -	
				$ -	$ -	$ -	$ -	$ -	

Notes on Cost Estimation:

Project Location:

Notes:
See full map on "Maps" tab.

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: P-2 **Budget Number:**
Project Name: Shorecliff Ln Pipe Upsize
Facility Type: Pipe

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	$ 146,800
Non-capacity:	100%	$ 146,800	

Project Description:

Surcharging may occur in the future due to increased infiltration as pipes degrade. Monitor manhole 61-95 for surcharge conditions during storm events. Complete flow data collection and pre-design/feasibility first to confirm need and scope project for construction.

Upsize pipe segment near Shorecliff Ln from 10-inch to 12-inch diameter to eliminate surcharging.

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency 30%	GC & Overhead 25%	Engineering/ Planning 20%	City Admin 10%	Total Project Cost	Project Timing
Mango St and Shorecliff Ln Pipe Upsize	551	LF	$ 144	$ 23,803	$ 19,836	$ 15,869	$ 7,934	$ 146,800	Mid-term
				$ -	$ -	$ -	$ -	$ -	
				$ -	$ -	$ -	$ -	$ -	

Notes on Cost Estimation:

Project Location:

Notes:
See full map on "Maps" tab.

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: P-3 **Budget Number:**
Project Name: Mercerdale Park Pipe Upsize
Facility Type: Pipe

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	$ 315,200
Non-capacity:	100%	$ 315,200	

Project Description:

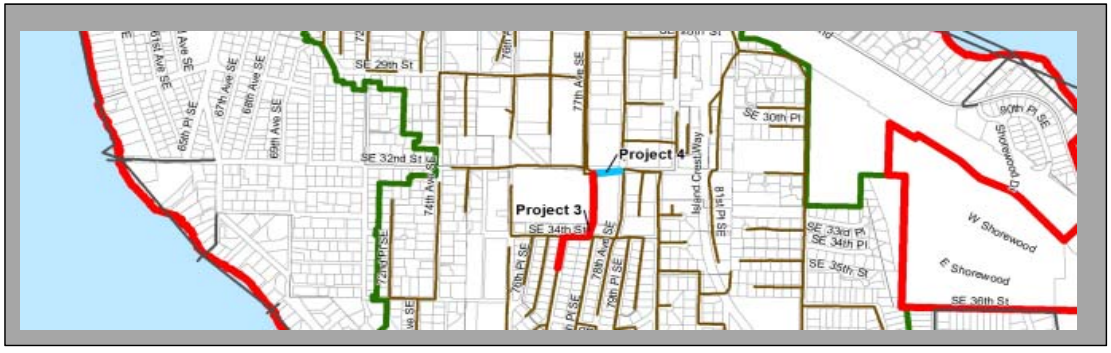
Upsize pipe segment along 77th Ave SE and through Mercerdale Park from 10-inch to to 12-inch diameter. This project is required to prevent surcharging during storm events in the short-term. Monitor manhole 61-199 for surcharge conditions during storm events. Complete flow data collection and pre-design/feasibility first to confirm need and scope project for construction.

This capacity deficiency has been identified since the 2003 General Sewer Plan.

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency 30%	GC & Overhead 25%	Engineering/ Planning 20%	City Admin 10%	Total Project Cost	Project Timing
Mercerdale Park Pipe Upsize	1,183	LF	$ 144	$ 51,106	$ 42,588	$ 34,070	$ 17,035	$ 315,200	2024
				$ -	$ -	$ -	$ -	$ -	

Notes on Cost Estimation:

Project Location:



Notes:
See full map on "Maps" tab.

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: P-4 **Budget Number:**
Project Name: SE 32nd St Pipe Upsize
Facility Type: Pipe

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	$ 75,800
Non-capacity:	100%	$ 75,800	

Project Description:

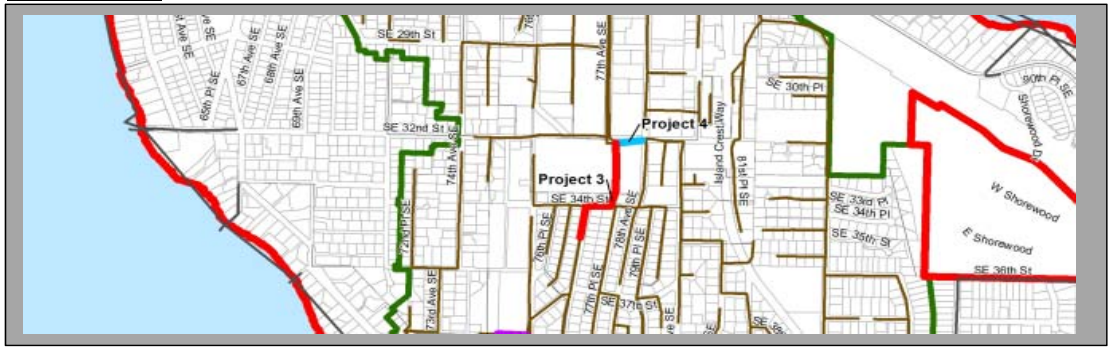
Upsize pipe segment at SE 32nd St and 77th Ave SE from 10-inch to 16-inch diameter. This project is required to prevent surcharging during storm events in the medium-term. Complete flow data collection and pre-design/feasibility first to confirm need and scope project for construction.

This capacity deficiency has been identified since the 2003 General Sewer Plan.

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency 30%	GC & Overhead 25%	Engineering/ Planning 20%	City Admin 10%	Total Project Cost	Project Timing
SE 32nd St Pipe Upsize	241	LF	$ 170	$ 12,291	$ 10,242.50	$ 8,194	$ 4,097	$ 75,800	Mid-term
				$ -	$ -	$ -	$ -	$ -	

Notes on Cost Estimation:

Project Location:



Notes:
See full map on "Maps" tab.

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: P-5 **Budget Number:**
Project Name: 77th Ave SE and SE 27th St Intersection Reconfiguration
Facility Type: Pipe and Manhole

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	$ 74,000
Non-capacity:	100%	$ 74,000	

Project Description:

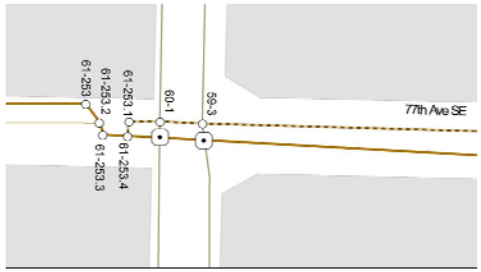
Simplify configuration of pipe intersections at the intersection of SE 27th SE 77th Ave SE to increase the carrying capacity of the pipes in this area with the addition of two manholes.

This capacity deficiency has been identified since the 2003 General Sewer Plan.

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency 30%	GC & Overhead 25%	Engineering/ Planning 20%	City Admin 10%	Total Project Cost	Project Timing
Configuration Upgrades	1	LS	$ 40,000	$ 12,000	$ 10,000	$ 8,000	$ 4,000	$ 74,000	Long-term
				$ -	$ -	$ -	$ -	$ -	

Notes on Cost Estimation:

Project Location:



Notes:

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: P-6 **Budget Number:**
Project Name: SE 24th St Pipe Upsize
Facility Type: Pipe

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	$ 117,500
Non-capacity:	100%	$ 117,500	

Project Description:

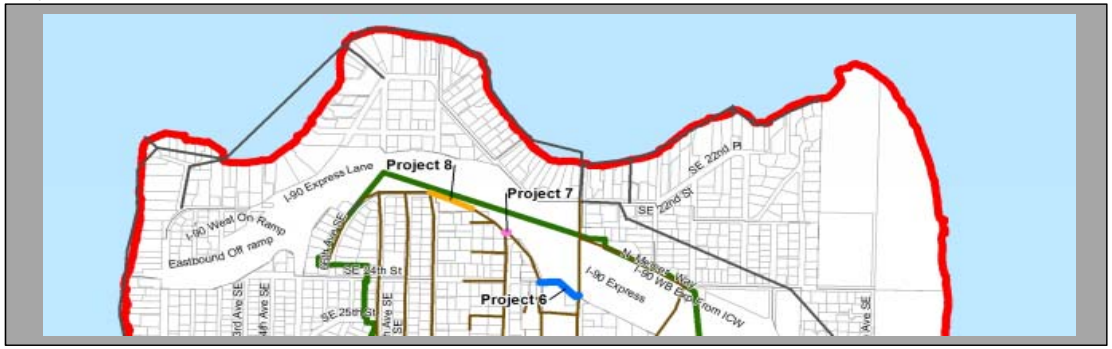
Upsize pipe segment at SE 24th St and 76th Ave SE from 8-inch to 12-inch diameter.
This project is required to prevent surcharging during storm events in the short-term. The slope of this pipe is shallow, which contributes to surcharging and the accumulations of solids. This pipe is a high priority for replacement for both capacity and O&M reasons. Complete flow data collection and pre-design/feasibility first to confirm need and scope project for construction.

This capacity deficiency has been identified since the 2003 General Sewer Plan.

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency 30%	GC & Overhead 25%	Engineering/ Planning 20%	City Admin 10%	Total Project Cost	Project Timing
SE 24th St Pipe Upsize	441	LF	$ 144	$ 19,051	$ 15,876	$ 12,701	$ 6,350	$ 117,500	Mid-term
				$ -	$ -	$ -	$ -	$ -	
				$ -	$ -	$ -	$ -	$ -	

Notes on Cost Estimation:

Project Location:



Notes:
See full map on "Maps" tab.

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: P-7 **Budget Number:**
Project Name: 74th Ave SE Upsize
Facility Type: Pipe

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	$ 3,700
Non-capacity:	100%	$ 3,700	

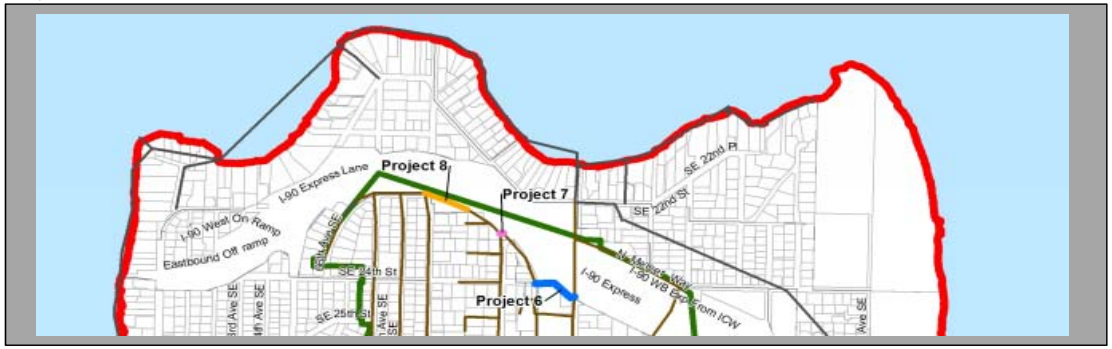
Project Description:

Upsize pipe segment at 74th Ave SE near I-90 from 8-inch to 12-inch diameter.
This project is required to prevent surcharging during storm events . Monitor manhole 49-81 for surcharge conditions during storm events. Complete flow data collection and pre-design/feasibility first to confirm need and scope project for construction.

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency 30%	GC & Overhead 25%	Engineering/ Planning 20%	City Admin 10%	Total Project Cost	Project Timing
74th Ave SE Upsize	14	LF	$ 144	$ 605	$ 504	$ 403	$ 202	$ 3,700	Long-term
				$ -	$ -	$ -	$ -	$ -	
				$ -	$ -	$ -	$ -	$ -	

Notes on Cost Estimation:

Project Location:



Notes:
See full map on "Maps" tab.

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: P-8 **Budget Number:**
Project Name: East of 72nd Ave. S.E. and S.E. 22nd St., south of I-90
Facility Type: Pipe

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	**$ 107,900**
Non-capacity:	100%	$ 107,900	

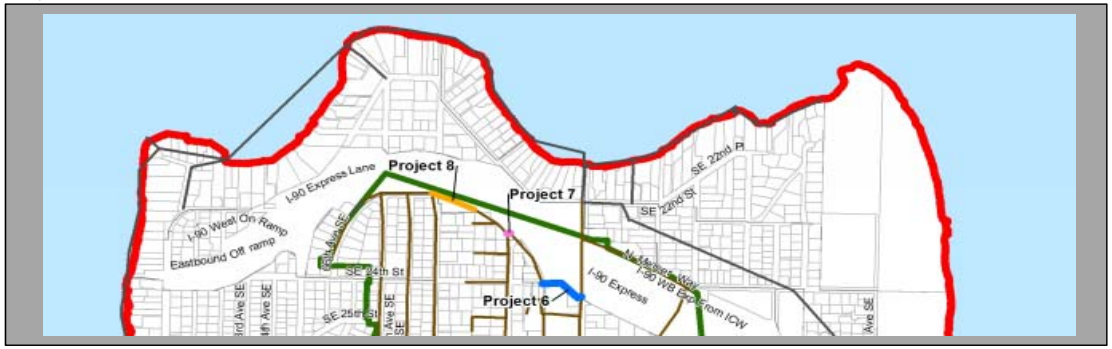
Project Description:

Hydraulic model shows spike of surcharging during storm events. Cause could be related to the hydraulics of the I-90 crossings. Monitor manhole 49-83 and complete project P-6 before project P-8. If surcharging occurs in manhole 49-83 after project P-6 has been completed, City may need to upsize pipe segment parallel to I-90 Trail at SE 22nd St and 72nd Ave SE from 8-inch to 12-inch diameter to eliminate surcharging. Complete flow data collection and pre-design/feasibility first to confirm need and scope project for construction.

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency 30%	GC & Overhead 25%	Engineering/ Planning 20%	City Admin 10%	Total Project Cost	Project Timing
I-90 Trail Pipe Upsize	405	LF	$ 144	$ 17,496	$ 14,580	$ 11,664	$ 5,832	$ 107,900	Long-term
				$ -	$ -	$ -	$ -	$ -	
				$ -	$ -	$ -	$ -	$ -	

Notes on Cost Estimation:

Project Location:



Notes:
See full map on "Maps" tab.

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: P-9 **Budget Number:** WS101U
Project Name: Backyard Sewer System Improvements
Facility Type: Piping and Manholes

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	$ 804,900
Non-capacity:	100%	$ 804,900	

Project Description:

Ongoing program to respond to "backyard" sewers where access is difficult or non-existent. Work may include installation of access points or clean-outs, repair/rehabilitation of pipe, and securing access for future maintenance activities.

This project is budgeted through the short-term planning period. In 2025, this project will be rolled into the comprehensive pipeline R&R program, P-10.

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency 30%	GC & Overhead 25%	Engineering/ Planning 20%	City Admin 10%	Total Project Cost	Project Timing
2019/20 Improvements Design	1	Years	$ 20,000	$ 6,000	$ 5,000	$ 4,000	$ 2,000	$ 37,000	2019
2019/20 Improvements Construction	1	Years	$ 125,000	$ 37,500	$ 31,250	$ 25,000	$ 12,500	$ 231,300	2020
2021/22 Improvements Design	1	Years	$ 20,000	$ 6,000	$ 5,000	$ 4,000	$ 2,000	$ 37,000	2021
2021/22 Improvements Construction	1	Years	$ 125,000	$ 37,500	$ 31,250	$ 25,000	$ 12,500	$ 231,300	2022
2021/22 Improvements Design	1	Years	$ 20,000	$ 6,000	$ 5,000	$ 4,000	$ 2,000	$ 37,000	2023
2021/22 Improvements Construction	1	Years	$ 125,000	$ 37,500	$ 31,250	$ 25,000	$ 12,500	$ 231,300	2024

Notes on Cost Estimation:

Funding levels based on 2017/2018 City budget.

Project Location:

See Figure 6.2 for Backyard Sewer Main locations.

Notes:

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: P-10 **Budget Number:**
Project Name: Comprehensive Pipeline R&R Program
Facility Type: Piping and Manholes

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	**$ 66,400,000**
Non-capacity:	100%	$ 66,400,000	

Project Description:

While the initial CCTV inspections are being performed, continue high priority sewer main and manhole replacement activities (General Sewer System Improvements). Once initial inspections are complete, use NASSCO CCTV inspection data to prioritize pipeline projects and develop comprehensive R&R program to continually replace pipes as they reach the end of their useful life. Coordinate R&R with other O&M programs and City goals, such as accessibility and I&I reduction.

Estimated Annual Replacement over 20 Years:
High Priority R&R 130,872 LF $1.5M/yr
Medium Priority R&R 118,129 LF $0.9M/yr
Low Priority R&R 294,033 LF $0.9M/yr

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency	GC & Overhead	Engineering/ Planning	City Admin	Total Project Cost	Project Timing
				0%	0%	0%	0%		
2019 Pipeline R&R	1	Years	$ 300,000	$ -	$ -	$ -	$ -	$ 300,000	2019
2020 Pipeline R&R	1	Years	$ 350,000	$ -	$ -	$ -	$ -	$ 350,000	2020
2021 Pipeline R&R	1	Years	$ 400,000	$ -	$ -	$ -	$ -	$ 400,000	2021
2022 Pipeline R&R	1	Years	$ 400,000	$ -	$ -	$ -	$ -	$ 400,000	2022
2023 Pipeline R&R	1	Years	$ 400,000	$ -	$ -	$ -	$ -	$ 400,000	2023
2024 Pipeline R&R	1	Years	$ 400,000	$ -	$ -	$ -	$ -	$ 400,000	2024
Mid-term Pipeline R&R	4	Years	$ 4,582,143	$ -	$ -	$ -	$ -	$ 18,328,600	Mid-term
Long-term Pipeline R&R	10	Years	$ 4,582,143	$ -	$ -	$ -	$ -	$ 45,821,400	Long-term

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification:	P-10	**Budget Number:**	
Project Name:	Comprehensive Pipeline R&R Program		
Facility Type:	Piping and Manholes		

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	**$ 66,400,000**
Non-capacity:	100%	$ 66,400,000	

Notes on Cost Estimation:

Existing pipelines with maintenance issues will require pipe replacement. Cured-in-place pipe (CIPP) can be used for all other pipes. Pipe costs shown on "Assumptions" tab. Total cost to replace all pipes is $66M in 20 years, which averages to $3.4M/year.

Program budgeting assumes 11% of pipe replacement will occur beyond the 20-year planning period.

Project Location:

See Figure 6.3 for pipilines with prioritized R&R.

Notes:

6.3.3 Pump Station Project Sheets

Pump Station projects resolve challenges with the City's Pump Stations, which are important components of the Lakeline System. Pump Station projects aim to R&R or upgrade the existing stations, as presented in Chapter 5 - Operations and Maintenance. Projects are anticipated in conjunction with or occur near existing infrastructure, as shown in Figure 6.4:

- PS-1 Pump Station Accessibility Improvements
- PS-2 Generator Replacement
- PS-3 Pump Station Monitoring
- PS-4 PS 23, 24, 25 Capacity Improvements
- PS-5 Pump Station R&R Improvements
- PS-6 Telemetry / Supervisory Control and Data Acquisition (SCADA) Upgrades and Maintenance

General notes on the projects include:

- PS-1 Pump station accessibility improvements includes City estimated costs to improve access and provide 5-days of boat rental per year.
- PS-2 Generator Replacement costs were based on the City's existing budget.
- PS-3 Pump Station Monitoring costs are based on the City's estimates for installing up to three flow meters per lift station. Additional monthly costs may occur if a cellular connection is needed to relay flow data.
- The implementation costs in PS-4 PS 23, 24, 25 Capacity Improvements are budgetary placeholders and should be revisited once the basin flow monitoring and alternative analysis are complete.
- PS-5 Pump Station R&R Improvements costs are based on City estimates for the average R&R of a pump station.
- PS-6 costs are budgetary placeholders and may vary depending on SCADA system selected during the SCADA Master Plan Process (2018).

Figure 6.4
Location of Pump Station CIP
General Sewer Plan
City of Mercer Island

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City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: PS-1 **Budget Number:** WS712P
Project Name: Pump Station Accessibility Improvements
Facility Type: Pump Station

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	$ 444,000
Non-capacity:	100%	$ 444,000	

Project Description:

Address priority pump station accessibility issues to support pump station repair, rehabilitation, and capacity improvements.
Evaluate access at all stations, identify conditions/concerns and needs, prioritize future work.
Consider long term contracting with a vendor to rent a boat or purchasing a boat to access pump stations that have limited land access.

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency 30%	GC & Overhead 25%	Engineering/ Planning 20%	City Admin 10%	Total Project Cost	Project Timing
PS Accessibility Improvements	1	PS	$ 20,000	$ 6,000	$ 5,000	$ 4,000	$ 2,000	$ 37,000	2019
PS Accessibility Improvements	2	PS	$ 20,000	$ 12,000	$ 10,000	$ 8,000	$ 4,000	$ 74,000	2020
PS Accessibility Improvements	1	PS	$ 20,000	$ 6,000	$ 5,000	$ 4,000	$ 2,000	$ 37,000	2021
PS Accessibility Improvements	2	PS	$ 20,000	$ 12,000	$ 10,000	$ 8,000	$ 4,000	$ 74,000	2022
PS Accessibility Improvements	1	PS	$ 20,000	$ 6,000	$ 5,000	$ 4,000	$ 2,000	$ 37,000	2023
PS Accessibility Improvements	2	PS	$ 20,000	$ 12,000	$ 10,000	$ 8,000	$ 4,000	$ 74,000	2024
PS Accessibility Improvements	3	PS	$ 20,000	$ 18,000	$ 15,000	$ 12,000	$ 6,000	$ 111,000	Mid-term
				$ -	$ -	$ -	$ -	$ -	

Notes on Cost Estimation:

Cost estimate assumes creating vehicle access and 6 stations will not require improvements because reasonable access already exists. Dollar cost and priority to be confirmed pending accessibility evaluation.
Boat rental cost estimated at $4,000 per day. Assumed 5 days of boat rental required per year. Boat rental is budgeted as O/M

Project Location:

Notes:

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: PS-2 **Budget Number:**
Project Name: Generator Replacement
Facility Type: Pump Stations

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	**$ 1,645,000**
Non-capacity:	100%	$ 1,645,000	

Project Description:
City's ongoing program to replace sewer pump station generators that provide emergency power.

Project Element		Quantity	Unit	Unit Cost ($/Unit)	Contingency 30%	GC & Overhead 25%	Engineering/ Planning 20%	City Admin 10%	Total Project Cost	Project Timing
Generator Replacement		1	LS	$ 345,000	$	$	$	$ 5,000	$ 350,000	2018
Generator Replacement		1	LS	$ 50,000	$ 15,000	$ 12,500	$ 10,000	$ 5,000	$ 92,500	2019
Generator Replacement		1	LS	$ 50,000	$ 15,000	$ 12,500	$ 10,000	$ 5,000	$ 92,500	2020
Generator Replacement		1	LS	$ 50,000	$ 15,000	$ 12,500	$ 10,000	$ 5,000	$ 92,500	2021
Generator Replacement		1	LS	$ 50,000	$ 15,000	$ 12,500	$ 10,000	$ 5,000	$ 92,500	2022
Generator Replacement		10	LS	$ 50,000	$ 150,000	$ 125,000	$ 100,000	$ 50,000	$ 925,000	Long-term
					$ -	$ -	$ -	$ -	$ -	

Notes on Cost Estimation:
Assumes a lifespan of 25 - 30 years per generator, depending on use . Assumes LS 11 is replaced with KC project in 2020. PS 13, 23, 24 & 25 scheduled 1 per year beginning in 2019. Beginning in 2028 begin programed replacement of generators, at a rate of 1 generator per year. Goal is to move all generators from below ground to above ground. For estimating purposes assume $50,000/generator purchase.

Project Location:

Notes:

PS	last replaced	PS	last replaced
1	2006	19	2008
4	2012	20	2006
10	2006	21	2014
11	?	22	2006
13	1988	23	1988
14	2014	24	2018
15	2008	25	1998
16	2008		
17	2018		
18	2018		
19	2008		

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: PS-3 **Budget Number:**
Project Name: Pump Station Monitoring
Facility Type: Pump Station

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	$ 971,400
Non-capacity:	100%	$ 971,400	

Project Description:

Install flow and level monitoring at pump stations, beginning with higher priority PS's 23, 24, 25, 10 and 15, to evaluate capacity of pump stations versus flow during storm events. Up to three flow meters may be required to determine flow through each pump station. Continue and expand flow monitoring to all City PS's. This project should be coordinated with SCADA system updgrades.
Flow and level monitoring at pump stations will support ongoing hydraulic model development.

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency 30%	GC & Overhead 25%	Engineering/ Planning 20%	City Admin 10%	Total Project Cost	Project Timing
PS 10 and 15 Flow Monitoring	2	LS	$ 35,000	$ 21,000	$ 17,500	$ 14,000	$ 7,000	$ 129,500	2020
PS Flow Monitoring	3	LS	$ 35,000	$ 31,500	$ 26,250	$ 21,000	$ 10,500	$ 194,300	2021
PS Flow Monitoring	3	LS	$ 35,000	$ 31,500	$ 26,250	$ 21,000	$ 10,500	$ 194,300	2022
PS Flow Monitoring	3	LS	$ 35,000	$ 31,500	$ 26,250	$ 21,000	$ 10,500	$ 194,300	2023
PS Flow Monitoring	4	LS	$ 35,000	$ 42,000	$ 35,000	$ 28,000	$ 14,000	$ 259,000	2024

Notes on Cost Estimation:

Assumes 3 $5k flow meters, $10k for installation of meters, and $10k for data storage/transfer. Costs based on City designing and constructing improvements.

Project Location:

Notes:

Pump Stations with yellow marker have identified capacity limitations.
PS 23, 24 & 25 completed in 2018.

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification:	PS-4	**Budget Number:**	
Project Name:	PS 23, 24, 25 Capacity Improvements		
Facility Type:	Pump Station		

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	**$ 1,961,000**
Non-capacity:	100%	$ 1,961,000	

Project Description:

Pump Stations 23, 24, and 25 experience high wet well levels during storm events. It may be necessary to increase the capacity of these pump stations or reduce the I/I of the tributary basins. I/I analysis and monitoring of pump flow is required to determine the best solutions to address capacity issues.

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency 30%	GC & Overhead 25%	Engineering/ Planning 20%	City Admin 10%	Total Project Cost	Project Timing
PS 23, 24 and 25 Basin Flow Monitoring and	1	LS	$ 200,000	$ 60,000	$ 50,000	$ 40,000	$ 20,000	$ 370,000	2019
PS 23, 24, 25 Project Alt Analysis	1	LS	$ 60,000	$ 18,000	$ 15,000	$ 12,000	$ 6,000	$ 111,000	2020
PS 23, 24, 25 Project Implementation	1	LS	$ 400,000	$ 120,000	$ 100,000	$ 80,000	$ 40,000	$ 740,000	2021
PS 23, 24, 25 Project Implementation	1	LS	$ 400,000	$ 120,000	$ 100,000	$ 80,000	$ 40,000	$ 740,000	2022

Notes on Cost Estimation:

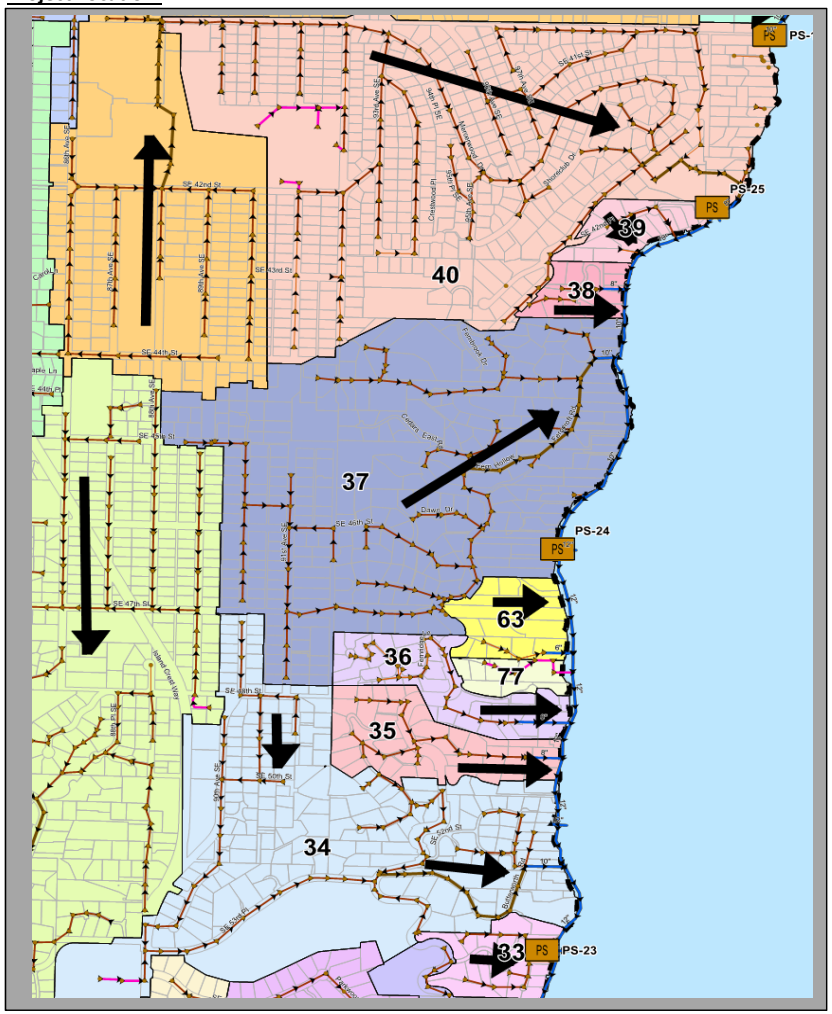
Scope of PS 23, 24, 25 Project Implementation is unknown at this time. Cost estimate for this item is a budgetary placeholder.

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: PS-4 **Budget Number:**
Project Name: PS 23, 24, 25 Capacity Improvements
Facility Type: Pump Station

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	$ 1,961,000
Non-capacity:	100%	$ 1,961,000	

Project Location:



Notes:

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: PS-5 **Budget Number:**
Project Name: Pump Station R&R Improvements
Facility Type:

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	$ 4,440,000
Non-capacity:	100%	$ 4,440,000	

Project Description:

Ongoing program to fund rehabilitation of pump stations. First phase to complete comprehensive review of each station to develop scope of work and priority based on risk, consequence of failure, M/O experience and age. Table 5.11 of the General Sewer Plan provides the most critical PS improvement needs based on staff initial assessment. Critical improvements should be implemented in the Short-term planning period. Less critical improvements can be implemented in the Mid-term or Long-term planning periods addressing one station per biennium.

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency	GC & Overhead	Engineering/ Planning	City Admin	Total Project Cost	Project Timing
				30%	25%	20%	10%		
2023 PS R&R	1	PS	$ 300,000	$ 90,000	$ 75,000	$ 60,000	$ 30,000	$ 555,000	2023
Mid-term PS R&R	2	PS	$ 300,000	$ 180,000	$ 150,000	$ 120,000	$ 60,000	$ 1,110,000	Mid-term
Long-term PS R&R	5	PS	$ 300,000	$ 450,000	$ 375,000	$ 300,000	$ 150,000	$ 2,775,000	Long-term

Notes on Cost Estimation:

Assumes 1 pump station rehabilitation project every biennium (2 years).

Project Location:

Notes:

Pump stations with orange and red markers have high priority R&R needs, and very high priority R&R needs, respectively.

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: PS-6 **Budget Number:** WS713T
Project Name: Telemetry/SCADA Upgrades and Maintenance
Facility Type: General

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	$ 3,250,000
Non-capacity:	100%	$ 3,250,000	

Project Description:

Modernize the Supervisory Control and Data Acquisition (SCADA)/telemetry system to address aging system components and improve SCADA capabilities. Updgrade to the system planned for 10-year increments, beginning in 2028.

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency 30%	GC & Overhead	Engineering/ Planning	City Admin	Total Project Cost	Project Timing
SCADA System Full Upgrade	1	LS	$ 2,500,000	$ 750,000	$ -	$ -	$ -	$ 3,250,000	Mid-term
		LS		$ -	$ -	$ -	$ -	$ -	

Notes on Cost Estimation:

The cost for PLC/Telemetry/SCADA Upgrades will vary widely depending on the upgrade plan established during the Visioning Project. Annual upkeep and maintenance of the system funded through O/M.

Project Location:

Notes:

Visioning Project completed in 2017. Implementation Plan based on full implementationbeginning in 2018 and operational by 2019. Periodic evaluation of system components, annual software updgrades and support funded thru O/M. Recommended future SCADA replacement/upgrade project in 10 years, beginning in 2028 to be operational by 2029.

6.3.4 Lakeline Project Sheets

Lakeline projects were identified in Chapter 5 - Operations and Maintenance. Progressive projects are planned to evaluate and perform R&R the Lakeline and ancillary infrastructure, as needed:

- L-1 Lakeline Access
- L-2 Lakeline Condition Assessment
- L-3 Reach 4 Lakeline Replacement
- L-4 Lakeline R&R Program

General notes on the projects include:

- L-1 Lakeline Access costs are based on City estimates from prior work. These costs do not include property or easement acquisition.
- L-2 Lakeline Condition Assessment costs are conceptual and should be revisited during scoping.
- L-3 Reach 4 Lakeline Replacement costs are based on City estimates from prior projects.
- L-4 Lakeline R&R costs are budgetary placeholders and should be updated based on the findings of L-2 Lakeline Condition Assessment.

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: L-1 **Budget Number:** WS711C
Project Name: Lakeline Access
Facility Type: Lakeline

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	$ 2,350,000
Non-capacity:	100%	$ 2,350,000	

Project Description:

Provide access points for cleaning and other routine maintenance. Evaluate feasibility of and confirm locations for access points into the Lakeline and prioritize locations for future installation. Based on priority, begin preliminary design, environmental reivew and easement discussions for construction of one access point in the short term. Additional access points to be prioritized for design and construction in the mid-term and long-term. Provide additional access to the Lakeline, such as manholes or clean-outs, to facilitate inspection and maintenance. Installation of new access points may require acquisition of new easements or property.

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency 30%	GC & Overhead 25%	Engineering/ Planning 20%	City Admin 10%	Total Project Cost	Project Timing
Feasibility and Pre-Design	1	LS	$ 100,000	$ 30,000	$ 25,000	$ 20,000	$ 10,000	$ 185,000	2019
Environmental and Final Design	1	LS	$ 100,000	$ 30,000	$ 25,000	$ 20,000	$ 10,000	$ 185,000	2020
Access Point Construction	1	LS	$ 300,000	$ 90,000	$ 75,000		$ 30,000	$ 495,000	2023
Access Point Construction	1	LS	$ 300,000	$ 90,000	$ 75,000		$ 30,000	$ 495,000	2024
Access Point Construction Mid-Term	1	LS	$ 300,000	$ 90,000	$ 75,000		$ 30,000	$ 495,000	Mid-term
Access Point Construction Long-Term	1	LS	$ 300,000	$ 90,000	$ 75,000		$ 30,000	$ 495,000	Long-term

Notes on Cost Estimation:

Cost estimate for Mid-Term assumes 1 access point is designed and constructed during that time period. For Long-Term assumes 2 access point are designed and constructed during that time period.

Project Location:

Notes:

Locations to be determined pending evaluation and prioritization.

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: L-2 **Budget Number:**
Project Name: Lakeline Condition Assessment
Facility Type: Lakeline

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	**$ 4,000,000**
Non-capacity:	100%	$ 4,000,000	

Project Description:

Initial condition assessment to complete a high level assessment of the entire Lakeline system and identify segments of pipe for further detailed condition assessment. Initially review historical project documentation from the Lakeline original construction and subsequent projects, as available, to determine the original pipe material, wall thickness, lining, coating, joint type, gasket material, and test pressure. Conduct field investigations and survey to verify the current infrastructure. Verify location of service laterals, clean-outs, in-lake manholes, and other features. Establish a plan and profile for the Lakeline system, likely from historical documentation. Use results of assessment and testing to inform Lakeline R&R

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency	GC & Overhead	Engineering/ Planning	City Admin	Total Project Cost	Project Timing
Initial Lakeline Condition Assessment	50,000	LF	$ 40	$ -	$ -	$ -	$ -	$ 2,000,000	Mid-term
Further Lakeline Condition Assessment	1	LS	$ 2,000,000	$ -	$ -	$ -	$ -	$ 2,000,000	Long-term
				$ -	$ -	$ -	$ -	$ -	

Notes on Cost Estimation:

There are approximately 50,000 LF of Lakeline that needs to be assessed. Cost estimate assumes $40/LF.
It is recommended that non-contact technologies be considered for detailed assessment, such as ultrasonic thickness testing and radiology.

Project Location:

Notes:

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: L-3 **Budget Number:**
Project Name: Reach 4 Lakeline Replacement
Facility Type: Lakeline

Cost Allocation	Percent	Cost	Total Cost
Capacity:		$ -	$ 4,255,000
Non-capacity:	100%	$ 4,255,000	

Project Description:

Evaluate the need for and feasibility of replacing/rehabilitation of Reach 4 AC Lakeline. Assess pipe condition, reevaluate options, identify preferred option(s) and estimate cost of and timing for future design/construction.
Reach 4 is the final remaining section of AC sewer main serving Mercer Island located in Lake Washington. The main was installed in the mid-1950's and is nearing the end of its expected useful life.

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency 30%	GC & Overhead 25%	Engineering/ Planning 20%	City Admin 10%	Total Project Cost	Project Timing
Reach 4 Feasibility and Pre-Design	1	LS	$ 100,000	$ 30,000	$ 25,000	$ 20,000	$ 10,000	$ 185,000	2020
Reach 4 Environmental	1	LS	$ 100,000	$ 30,000	$ 25,000	$ 20,000	$ 10,000	$ 185,000	2021
Reach 4 Final Design and Permitting	1	LS	$ 100,000	$ 30,000	$ 25,000	$ 20,000	$ 10,000	$ 185,000	2022
Reach 4 Construction	1	LS	$ 2,000,000	$ 600,000	$ 500,000	$ 400,000	$ 200,000	$ 3,700,000	Mid-term

Notes on Cost Estimation:

Project Location:

Notes:

City of Mercer Island
General Sewer Plan
Capital Improvement Program

Project Identification: L-4 **Budget Number:**
Project Name: Lakeline R&R Program
Facility Type: Lakeline

Cost Allocation	Percent	Cost	Total Cost
Capacity:	0%	$ -	$ 27,750,000
Non-capacity:	100%	$ 27,750,000	

Project Description:
Based on the initial and further Lakeline condition assessments, implement R&R improvements to continue to operate the Lakeline in a safe and effective manner.

Project Element	Quantity	Unit	Unit Cost ($/Unit)	Contingency 30%	GC & Overhead 25%	Engineering/ Planning 20%	City Admin 10%	Total Project Cost	Project Timing
Lakeline R&R Program	10	Years	$ 1,500,000	$ 4,500,000	$ 3,750,000	$ 3,000,000	$ 1,500,000	$ 27,750,000	Long-term
				$ -	$ -	$ -	$ -	$ -	
				$ -	$ -	$ -	$ -	$ -	

Notes on Cost Estimation:

Project Location:

Notes:

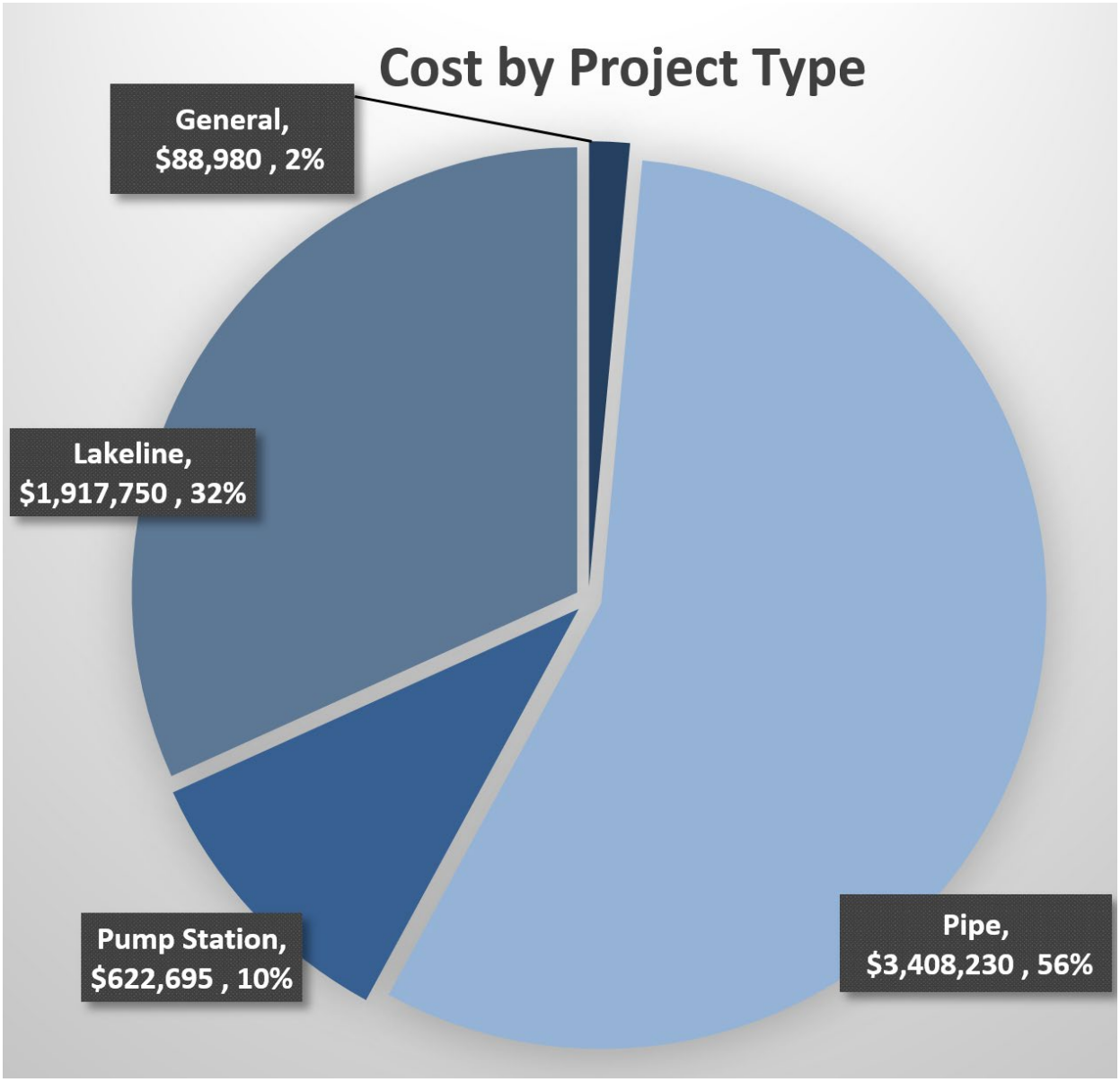
6.3.5 Cost Summary

CIP projects were summarized by project category in Table 6.5. Total and average annual CIP costs over each planning horizon are also summarized, where average annual CIP costs were planned to gradually increase over the planning horizons.

Approximately 75 percent of the short-term projects will be pipe and pump station projects. During the medium-term and long-term, additional costs are largely related to increased R&R of gravity collections system, as well as the Lakeline. Overall, approximately 89 percent of the CIP will address pipeline projects and Lakeline projects, as shown in Figure 6.5.

Table 6.5 CIP Cost by Project Category Summary
Water System Plan
City of Mercer Island

Project Category	Total CIP Cost ($)	CIP Phasing		
		Short-term (2019-2024)	Medium-term (2025-2028)	Long-term (2029-2038)
General	$1,779,600	$626,600	$300,500	$852,500
Pipe	$68,164,600	$3,488,900	$18,668,700	$46,007,000
Pump Station	$12,453,900	$4,190,400	$4,563,500	$3,700,000
Lakeline	$38,355,000	$1,915,000	$6,195,000	$30,245,000
Total Cost	**$120,753,100**	**$10,220,900**	**$29,727,700**	**$80,804,500**
Total Average Annual Cost	**$6,038,000**	**$1,703,000**	**$7,432,000**	**$8,080,000**



SUMMARY OF CIP COSTS THROUGH 2038

FIGURE 6.5

CITY OF MERCER ISLAND
GENERAL SEWER PLAN

FINANCIAL INFORMATION

7.1 INTRODUCTION

This chapter summarizes the current and forecasted financial strength of Mercer Island's Sewer Utility and its funding strategy for recommended capital improvements identified in Chapter 6. Beginning with a review of the past seven years financial history, this chapter evaluates the City of Mercer Island's (City's) current financial condition as well as the revenue sources available to pay for the Sewer Fund's capital needs.

7.2 FINANCIAL POLICIES

Starting in the Spring of 1992, the Finance Department worked closely with the Utility Board to establish financial policies to guide future rate and budget decisions made for the Utilities. The financial policy analysis consisted of identifying, describing, and to the extent possible, evaluating impacts of various elements of the policies. Elements discussed included types and levels of utility reserves, methods of capital improvement funding, methods of capital replacement funding, and rate structure and equity.

In 2012, the City contracted with Financial Consulting Solutions Group, Inc. (FCS) to update the Sewer Rate Model, including revising the capital replacement reserve. The Financial Policies for the Sewer Fund include: (1) Maintaining an operating reserve of 30 days, and (2) Maintaining a capital replacement reserve of 1-2 percent of original asset value. As of 2017, the capital replacement reserve is 1.5 percent of original asset value. The Financial Policies are detailed in the City of Mercer Island's biennial budget.

7.3 SEWER FUND HISTORICAL FINANCIAL PERFORMANCE

The City operates the sewer system as a self-supporting utility. The Sewer Utility is designed to operate like a business, charging rates for the purpose of removing and conveyance to King County Department of Natural Resources (KCDNR) facilities for treatment. All expenses are supported through rates charged to City residents and businesses. The City also has a financial policy of funding capital projects on a pay-as-you-go basis, however, the City will occasionally finance major capital projects with debt. This was the case for the Sewer Lake Line and Pump Station No. 4 Construction project awarded for $24.2M in December 2008, which was partially funded with a $7.0M Public Works Trust Fund loan and $9.4M Limited General Obligation (LTGO) Bonds.

Table 7.1 presents a financial summary of the sewer utility's operating revenues and expenses from 2010 through 2016. During this period rate increases averaged 8.02 percent, contributing to the increasing fund balance in the Sewer Fund. Total revenues (excluding debt proceeds and the sale of fixed assets) increased from $6.4M in 2010 to

$8.8M in 2016. Sewer revenue is impacted by the cost set by King County for Sewage Treatment. For the most part, these costs are “passed through” to individual sewer customers. Other sources of revenue include side sewer permits, connection charges, and interest on investments.

Table 7.1 Sewer System Revenue and Expense Summary, 2010-2016
General Sewer Plan
City of Mercer Island

Year Ending	2010	2011	2012	2013	2014	2015	2016
Beginning Working Capital	**$ 12,818,380**	**$ 4,011,806**	**$ 1,891,651**	**$ 1,501,722**	**$ 1,868,170**	**$ 2,439,841**	**$ 3,378,627**
Revenue							
Sewer System Maintenance	$ 2,770,544	$ 2,967,701	$ 3,177,891	$ 3,293,247	$ 3,672,736	$ 3,958,836	$ 4,193,111
King County Sewage Treatmen	3,381,088	3,805,854	3,814,644	4,228,475	4,228,092	4,461,076	4,469,116
Debt Proceeds (PWTF Loan)	-	350,000	-	-	-	-	-
Federal EPA Grant	204,163	44,908	-	-	-	-	-
Side Sewer Permits	1,788	7,896	8,959	19,646	21,620	21,085	31,543
Connection Charges	19,671	5,457	221,017	193,920	444,060	86,197	40,700
Investment Interest	43,030	10,635	3,342	2,475	7,068	3,838	21,565
Other Revenues (Prior Yr Adj)	-	22,491	(89,556)	3,280	-	-	-
Total Revenue	**$ 6,420,283**	**$ 7,214,943**	**$ 7,136,298**	**$ 7,741,043**	**$ 8,373,575**	**$ 8,531,032**	**$ 8,756,035**
Expenses							
Operating Expense	$ 1,504,442	$ 1,698,832	$ 1,833,611	$ 1,654,711	$ 1,798,155	$ 1,737,352	$ 1,886,912
King County Sewage Treatmen	3,389,981	3,819,741	3,800,572	4,200,988	4,233,815	4,455,264	4,445,555
IFT - Repay SLL Funding	-	2,000,000	-	-	-	-	-
Debt Service	1,104,383	1,087,342	1,090,273	1,108,316	1,103,551	1,108,598	1,101,909
Rate Funded Capital Outlays	9,228,051	729,183	801,771	410,581	666,383	291,033	495,856
Total Expenses	**$ 15,226,857**	**$ 9,335,098**	**$ 7,526,227**	**$ 7,374,596**	**$ 7,801,903**	**$ 7,592,246**	**$ 7,930,232**
Net Increase (Decrease) in Working Capital	**$ (8,806,574)**	**$ (2,120,155)**	**$ (389,929)**	**$ 366,447**	**$ 571,672**	**$ 938,786**	**$ 825,803**
Ending Working Capital	**$ 4,011,806**	**$ 1,891,651**	**$ 1,501,722**	**$ 1,868,170**	**$ 2,439,841**	**$ 3,378,627**	**$ 4,204,431**
Operating Reserve							535,914
Capital Reserve							214,869
Sewer Lake Line Reserve							625,000
CIP - 2017-2022							2,828,648
Overall Rate Increase:	9.75%	9.30%	9.30%	4.00%	8.50%	8.30%	7.00%

Total expenses, which include personnel, materials, supplies, sewage treatment by King County and rate funded capital outlays, have ranged from a low of about $7.4M in 2013 to a high of about $15.2M in 2010 (which included construction costs for the Sewer Lake Line and Pump Station No. 4 Construction project). The largest annual operating expense to the City is the treatment of sewage by King County.

7.4 EXISTING RATE STRUCTURE

Table 7.2 (Single-Family Bimonthly Sewer Rates) and Table 7.3 (Multi-Family and commercial Bimonthly Sewer Rates) present the adopted sewer rates for 2018 for the City. In 2018, rates will increase an average of 7.8 percent over 2017.

The Utility Board annually reviews utility rate updates prepared by City staff and recommends rate changes to the City Council. The 2018 recommended rate increase of 7.8 percent is primarily driven by two things: (1) the cost of capital reinvestment in the sewer system, and (2) the cost of operating and maintaining the City portion of the Sewer system. Full details of the sewer rates for 2018 are detailed in Resolution 1536 and a copy is in Appendix I.

Table 7.2 Single Family Bimonthly Sewer Rates
General Sewer Plan
City of Mercer Island

Classification of User	King County Sewage	City Sewer Line Maintenance		
		Fixed Charge		Volume Charge
	Fixed Charge	Billing Cost	Base Charge (First 600 ccf of AVERAGE Winter Water Use)	Per 100 cf of ACTUAL Water Use
Single Family Residential	$88.44	$8.15	$41.76	$6.96
Low-Income Residential	$88.44	$8.15	$10.44	$1.74

Table 7.3 Multi-Family and Commercial Bimonthly Sewer Rates
General Sewer Plan
City of Mercer Island

Classification of User	King County Sewage Treatment	City Sewer Line Maintenance	
		Fixed Charge	Volume Charge
	Per 100 cf of ACTUAL Water Use	Billing Cost	Per 100 cf of ACTUAL Water Use
Multi-Family Residential	$5.90	$8.15	$6.96
Commercial / Public	$5.90	$8.15	$6.96

7.5 CURRENT BIENNIAL BUDGET FOR SEWER FUND

Table 7.4 presents the forecasted annual sewer revenues, expenses and fund balances, based on the adopted 2017-2018 biennial budget, sewer expenses to date, and forecasted changes to the budget.

Table 7.4 Sewer System Revenue and Expense Summary, 2017-2018
General Sewer Plan
City of Mercer Island

Year Ending	2017 Budget	2018 Budget
Beginning Working Capital	**$ 4,204,431**	**$ 3,525,350**
Revenue		
Sewer System Maintenance	$ 4,357,422	$ 4,633,122
King County Sewage Treatment	4,712,212	4,710,599
Connection Charges	20,600	21,218
Investment Interest	17,707	28,078
Other Revenues	-	-
Total Revenue	**$ 9,107,941**	**$ 9,393,017**
Expenses		
Operating Expense	2,361,104	$ 2,253,828
King County Sewage Treatment	4,727,212	4,722,582
Debt Service	1,083,418	1,057,179
Rate Funded Capital Outlays	1,615,288	3,166,786
Total Expenses	**$ 9,787,022**	**$ 11,200,375**
Net Increase (Decrease) in Working Capital	**$ (679,081)**	**$ (1,807,358)**
Ending Working Capital	**$ 3,525,350**	**$ 1,717,992**
Overall Rate Increase:	5.70%	7.80%

7.6 FINANCIAL OUTLOOK - UPCOMING SIX-YEAR PERIOD

Table 7.5 presents a projection of the annual utility revenues, expenses, and fund balances for the next six years, based on the 2017-2018 adopted biennial budget and changes expected to occur in the various categories over the subsequent six-year period as a result of new customers, declining water use (the basis for commercial and public sewer rates), general inflation, anticipated changes to the capital reinvestment plan and other related factors. This type of forecast is routinely used by Finance staff to develop rate adjustment proposals and to assess the impact of changing budget assumptions on future rate requirements.

Some key assumptions used to forecast future annual revenues and expenses that appear in Table 7.5 are outlined below:

1. King County Sewage Treatment is projecting the following increases for 2019 through 2024: (2019) 3.7 percent; (2020) 0 percent; (2021) 1.74 percent; (2022) 2.46 percent; (2023) 1.90 percent; (2024) an estimated 2.0 percent. Overall, the cost of sewage treatment is expected to increase about 15 percent over the six-year period.

2. Personnel labor costs are expected to increase annually by 5.5 percent while benefit costs are anticipated to increase about 7.5 percent per year for the 6 year period of 2019-2024. Overall, personnel costs are expected in increase about 42 percent over the six-year period.

3. Other maintenance and operations expenses will increase annually by 3.0 percent, based on historical trends and projected increases in the Seattle Consumer Price Index.

4. Rate funding for capital reinvestment is based on the capital reinvestment project plan for 2019-2024. Details of the capital funding needs for anticipated system improvements are detailed in Chapter 6.

5. Debt Service for the 2009 Sewer Lake Line project consists of a Public Works Trust Fund Loan (at a cost of about $410,000 per year) which will be retired in 2026, and Limited Tax General Obligation Bonds (at a cost of about $625,000 per year) which will be retired in 2029.

Table 7.5 Sewer System Revenue and Expense Summary, 2019-2024
General Sewer Plan
City of Mercer Island

Year Ending	2019	2020	2021	2022	2023	2024
Beginning Working Capital	$ 1,717,992	$ 1,784,248	$ 1,862,293	$ 1,759,784	$ 1,902,886	$ 2,442,008
Revenue						
Sewer System Maintenance	$ 4,656,826	$ 4,955,806	$ 5,279,315	$ 5,629,242	$ 5,995,142	$ 6,384,827
King County Sewage Treatment	4,952,612	4,947,789	5,070,856	5,197,959	5,296,720	5,402,655
Connection Charges	21,855	22,510	23,185	23,881	32,000	32,000
Investment Interest	15,148	17,066	32,660	34,765	27,254	36,052
Total Revenue	$ 9,646,440	$ 9,943,172	$ 10,406,017	$ 10,885,847	$ 11,351,117	$ 11,855,534
Expenses						
Operating Expense	$ 2,264,375	$ 2,362,953	$ 2,466,999	$ 2,576,830	$ 2,643,447	$ 2,758,378
King County Sewage Treatment	4,967,612	4,962,789	5,085,856	5,212,959	5,312,005	5,418,246
Debt Service	1,046,897	1,042,284	1,047,070	1,035,856	1,034,242	1,031,829
Rate Funded Capital Outlays	1,301,300	1,497,100	1,908,600	1,917,100	1,822,300	1,774,500
Total Expenses	$ 9,580,185	$ 9,865,127	$ 10,508,525	$ 10,742,746	$ 10,811,994	$ 10,982,953
Net Increase (Decrease) in Working Capital	$ 66,256	$ 78,045	$ (102,508)	$ 143,102	$ 539,122	$ 872,581
Ending Working Capital	$ 1,784,248	$ 1,862,293	$ 1,759,784	$ 1,902,886	$ 2,442,008	$ 3,314,589
Target - 30 days Operating Res	*594,410*	*600,471*	*620,783*	*640,257*	*653,443*	*669,228*
Target - 1.5% Asset Value Capit	*405,908*	*421,890*	*446,070*	*456,902*	*476,983*	*494,699*
Available Working Capital	$ 783,930	$ 839,932	$ 692,931	$ 805,727	$ 1,311,582	$ 2,150,662
Forecasted Rate Increase:	7.80%	7.80%	7.80%	7.80%	7.80%	7.80%

7.7 GRANT AND DEBT FUNDING

For the most part, the City approaches funding of the Sewer Utility (and especially Capital Reinvestment) on a pay as you go basis. Sewer rates are developed to generate the cash needed to maintain, operate, and reinvest in the Sewer Utility. When grant opportunities are available and line up with current Sewer Utility capital reinvestment needs, City Staff pursues grant opportunities. There have not been many grants available to Mercer Island in recent years.

When capital reinvestment needs dictate (ex: due to the size of a project) or when interest rates are low, debt financing may be utilized. The most recent use of debt financing was the Sewer Lake Line and Pump Station No. 4 Construction project awarded for $24.2M in December 2008, which was partially funded with a $7.0M Public Works Trust Fund (PWTF) loan and $9.4M LTGO Bonds. Historically, PWTF loans have also been used to fund Sewer Pump Station rehabilitation projects and Sewer Pump Station generator replacements.

7.8 CURRENT DEBT STATUS AND CREDIT WORTHINESS

The City of Mercer Island has prudently issued little debt over the years, maintaining a sizable debt capacity. The City has consistently followed a conservative fiscal management policy, which is reflected by the Aaa rating from Moody's Investors Service (2017).

The City has no immediate plans to issue additional debt. However, if this action becomes necessary, the Utility can expect a proposed bond issue to receive a similarly favorable credit rating and, therefore, to sell at lower interest rates than would otherwise be possible.

APPENDIX A – ADOPTING RESOLUTION

CITY OF MERCER ISLAND
RESOLUTION NO. 1556

A RESOLUTION OF THE CITY OF MERCER ISLAND, WASHINGTON ADOPTING A NEW GENERAL SEWER PLAN

WHEREAS, the City of Mercer Island's comprehensive General Sewer Plan describes the existing sewer system and service area, forecasts future demands, identifies policies and design criteria for sewer system operation and improvements, describes the operations and maintenance program and identifies a schedule of improvements; and

WHEREAS, the City of Mercer Island's current General Sewer Plan was adopted in February 2003; and

WHEREAS, since that time the City of Mercer Island (City) has experienced growth through redevelopment in the Town Center, and completed a significant undertaking in the replacement of Reach 3 of the Lake Line sewer; and

WHEREAS, chapter 173-240 of the Washington State Administrative Code (WAC) requires the City to have a general sewer plan that demonstrates the City's ability to provide service consistent with the requirements of the State; and

WHEREAS, updates to these plans are required when conditions within a City have changed; and

WHEREAS, the City of Mercer Island Public Works Department has reviewed the current City of Mercer Island General Sewer Plan, the existing sewer system and its operations; and

WHEREAS, the City of Mercer Island Public Works Department has studied the current and projected conditions and developed a thorough and complete plan to meet the City's sewer system needs to the year 2038 and beyond; and

WHEREAS, the City of Mercer Island Public Works Department, on the basis of said review, has created a new General Sewer Plan, dated November 2018, to update the existing General Sewer Plan, dated February 2003, to address the needs of the City; and

WHEREAS, the City of Mercer Island Public Works Department has submitted a draft of the new General Sewer Plan to the Washington State Department of Health and the King County Utilities Technical Review Committee, and obtained preliminary support and approval for its adoption by the City;

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF MERCER ISLAND, WASHINGTON, AS FOLLOWS:

Section 1. New General Sewer Plan Adopted for State and County Approvals.

A new General Sewer Plan, dated November 2018, a copy of which is on file with and available for review through the City Clerk or at
http://www.mercergov.org/files/General%20Sewer%20Plan.pdf
is hereby adopted as the official sewer system plan for the City of Mercer Island pursuant to chapter 35.67 RCW. In compliance with RCW 90.48.110 and chapter 173-240 WAC, this new plan shall be submitted for final approval by the Washington State Department of Health and the King County Utilities Technical Review Committee.

PASSED BY THE CITY COUNCIL OF THE CITY OF MERCER ISLAND, WASHINGTON, AT ITS REGULAR MEETING ON THE 18TH DAY OF DECEMBER 2018.

CITY OF MERCER ISLAND

D. Bertlin

Debbie Bertlin, Mayor

ATTEST:

Deborah A. Estrada, City Clerk

APPENDIX B – STATE ENVIRONMENTAL POLICY ACT (SEPA) CHECKLIST AND DETERMINATION OF NON-SIGNIFICANCE (DNS)

SEPA ENVIRONMENTAL CHECKLIST

Purpose of checklist:

Governmental agencies use this checklist to help determine whether the environmental impacts of your proposal are significant. This information is also helpful to determine if available avoidance, minimization or compensatory mitigation measures will address the probable significant impacts or if an environmental impact statement will be prepared to further analyze the proposal.

***Instructions for applicants*:**

This environmental checklist asks you to describe some basic information about your proposal. Please answer each question accurately and carefully, to the best of your knowledge. You may need to consult with an agency specialist or private consultant for some questions. You may use "not applicable" or "does not apply" only when you can explain why it does not apply and not when the answer is unknown. You may also attach or incorporate by reference additional studies reports. Complete and accurate answers to these questions often avoid delays with the SEPA process as well as later in the decision-making process.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Instructions for Lead Agencies:

Please adjust the format of this template as needed. Additional information may be necessary to evaluate the existing environment, all interrelated aspects of the proposal and an analysis of adverse impacts. The checklist is considered the first but not necessarily the only source of information needed to make an adequate threshold determination. Once a threshold determination is made, the lead agency is responsible for the completeness and accuracy of the checklist and other supporting documents.

Use of checklist for nonproject proposals:

For nonproject proposals (such as ordinances, regulations, plans and programs), complete the applicable parts of sections A and B plus the SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS (part D). Please completely answer all questions that apply and note that the words "project," "applicant," and "property or site" should be read as "proposal," "proponent," and "affected geographic area," respectively. The lead agency may exclude (for non-projects) questions in Part B - Environmental Elements –that do not contribute meaningfully to the analysis of the proposal.

A. Background

1. Name of proposed project, if applicable:
   City of Mercer Island General Sewer Plan (Plan)

2. Name of applicant:
   City of Mercer Island, Public Works Department

3. Address and phone number of applicant and contact person:

City of Mercer Island Public Works Department
9611 SE 36th Street
Mercer Island, WA 98040
Phone: (206) 275-7813
Contact: Anne Tonella-Howe, PE, Assistant City Engineer

4. Date checklist prepared:
March 2018

5. Agency requesting checklist:
City of Mercer Island Development Services Group

6. Proposed timing or schedule (including phasing, if applicable):
The City's Capital Improvement Program, which covers a 20-year planning period, is included in this Plan.

7. Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.
Yes, the City plans to update the Capital Improvement Program section of this Plan on a regular basis, at least every six years. A full update to this Plan is recommended in year 2030.

8. List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.
This SEPA review is for the General Sewer Plan and is a "non-project action". Projects listed in the capital improvement program that may be subject to SEPA regulations will be reviewed individually during design as separate site-specific projects.

9. Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.
No

10. List any government approvals or permits that will be needed for your proposal, if known.
Washington State Department of Ecology, Mercer Island City Council

11. Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)
The purpose of the General Sewer Plan (Plan) is to provide the City of Mercer Island with a plan that defines suitable maintenance for and/or replacement of the infrastructure throughout the Island. The Plan provides a clear and concise 20-year Capital Improvement Program (CIP) and implementation strategy. A component of the CIP contained in this Plan is a list of sewer system projects to be constructed over the next six-years and beyond. The checklist does not address specific projects or site or specific conditions. The projects proposed in the Plan will be reviewed as the engineering studies or scopes of work are developed and discussed in the SEPA review of the individual projects.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.

The General Sewer Plan serves all of Mercer Island which is approximately 6.2 square miles of area. Mercer Island is located in King County in the southern half of Lake Washington between the cities of Seattle and Bellevue. Access to the Island is via I-90, which crosses the Island from east to west.

B. ENVIRONMENTAL ELEMENTS

1. Earth

a. General description of the site:

(circle one): Flat, rolling, hilly, steep slopes, mountainous, other _____

Mercer Island is a narrow Island with steep sides. A large slender plateau extends from north to south down the center of the Island. Steep ravines extend from the plateau down to the shoreline.

b. What is the steepest slope on the site (approximate percent slope)?

Chapter 2 of the Plan generally describes the topopgraphy and critical areas on the Island and includes a Critical Slope Figure defining slope areas less than 15% and greater than 15%. Steep slopes occur predominately on the perimeter of the Island.

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.

There are several soil series on the Island with the Vashon glacier forming many of the current day features in and around the Island. Chapter 2 of the Plan generally describes the geology and soils found on the Island.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

Chapter 2 of the Plan generally describes the critical areas on the Island and includes a Seismic Class Figure defining areas subject to seismic risk and vulnerability.

e. Describe the purpose, type, total area, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill.

It will be necessary to excavate and backfill soils when constructing sewer pipe improvements described in the General Sewer Plan. Quantities of excavated and backfill soils will be determined during project design. Specific excavation, filling and grading activities will be determined under future project and site-specific SEPA review.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

There is potential for erosion to occur during construction of projects. To control short-term erosion, proper construction methods as specificed through Best Management Practices (BMP's) will be installed as necessary for each project. No long-term erosion is anticipated.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

No new impervious surfaces are anticipated to be created. For the most part projects are located in existing roadways. Specific impervious surface area will be determined under future project design and site-specific SEPA review.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

All construction projects will provide erosion control measures, which shall meet all erosion control requirements as required by City standards or as required under site-specific SEPA review.

2. Air

a. What types of emissions to the air would result from the proposal during construction, operation, and maintenance when the project is completed? If any, generally describe and give approximate quantities if known.

Potential vehicular and equipment emissions may affect the ambient air quality for a short period of time during construction of site-specific projects.

b. Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.

No

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

All construction projects will identify measures to reduce or control air emissions as required by City standards or as required under site-specific SEPA review.

3. **Water**

a. Surface Water:

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

Mercer Island is located in the southern portion of Lake Washington and is surrounded by the Lake. A number of watercourses (both seasonal and year-round) are located on the Island. These watercourses flow directly to Lake Washington.

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

Construction of some project components will require work within or adjacent to watercourses and Lake Washington. In particular, projects related to the Lakeline are located in or adjacent to Lake Washington. Specific surface water bodies located on or near each specific project site will be identified under future project design and site-specific SEPA review.

3) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

Filling and dredging within surface waters may be required for specific projects, in particular those projects associate with the Lakeline system. Fill and dredge activities for each specific project site will be identified under future design and site-specific SEPA review.

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

Excavation of pipe trenches in the vicinity of watercourses may require surface water withdrawl or diversion during the construction window. Typically work will be designed to occur during the normally drier months of the year when flows are at a minimum. Surface water withdrawals or diversions for each specific project site will be identified under future design and site-specific SEPA review.

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

No.

6) Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

No discharge of waste materials to surface waters is anticipated for any of the proposed projects.

b. Ground Water:

1) Will groundwater be withdrawn from a well for drinking water or other purposes? If so, give a general description of the well, proposed uses and approximate quantities withdrawn from the well. Will water be discharged to groundwater? Give general description, purpose, and approximate quantities if known.

Not applicable.

2) Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals. . . ; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.

No waste materials will be discharged into the ground.

c. Water runoff (including stormwater):

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

There will be no runoff from the adoption of this plan. Any runoff that may occur during construction of a site-specific project will be mitigated as required by City codes and BMP's.

2) Could waste materials enter ground or surface waters? If so, generally describe.

Any potential for waste materials entering gound or surface waters will be evaluated during site-specifc project design and SEPA review and will be mitigated as required by City codes and BMP's.

3) Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? If so, describe.

It is not anticipated that projects identified in this plan will alter or affect drainage patterns when constructed.

d. Proposed measures to reduce or control surface, ground, and runoff water, and drainage pattern impacts, if any:

Proposed measures to reduce or control surface, ground and runoff water and drainage pattern impacts will be evaluated during site-specific project design and SEPA review and will be mitigated as required by City codes and BMP's.

4. **Plants**

a. Check the types of vegetation found on the site:

____deciduous tree: alder, maple, aspen, other
____evergreen tree: fir, cedar, pine, other
____shrubs
____grass
____pasture
____crop or grain
____ Orchards, vineyards or other permanent crops.
____ wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
____water plants: water lily, eelgrass, milfoil, other
____other types of vegetation

b. What kind and amount of vegetation will be removed or altered?

Any vegetation to be removed for a specific project site will be identified during project design and addressed under SEPA review for the site-specific project.

c. List threatened and endangered species known to be on or near the site.

Threatened or endangered vegetation species for a specific project site will be identified during project design and addressed under SEPA review for the site-specific project.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

Measures to preserve or enchance vegetation for a specific project site will be identified during project design and addressed under SEPA review for the site-specific project.

e. List all noxious weeds and invasive species known to be on or near the site.

Any noxious weeds or invasive species identified for a specific project site will be identified during project design and addressed under SEPA review for the site-specifc project.

5. **Animals**

a. List any birds and other animals which have been observed on or near the site or are known to be on or near the site.

Examples include:

birds: hawk, heron, eagle, songbirds, other:
mammals: deer, bear, elk, beaver, other:
fish: bass, salmon, trout, herring, shellfish, other _____

b. List any threatened and endangered species known to be on or near the site.

Any threatened or endangered species identified for a specific project site will be identified during project design and addressed under SEPA review for the site-specific project.

c. Is the site part of a migration route? If so, explain.

Future project design will identify any species that use specific project sites as part of a migratory route. Any identified migration routes will be addressed under SEPA review for the site-specific project.

d. Proposed measures to preserve or enhance wildlife, if any:

Any measures to preserve or enhance wildlife will be identified during future project design and addressed under SEPA review for the site-specific project.

e. List any invasive animal species known to be on or near the site.

Any invasive animal species identified for a specific project site will be identified during SEPA review for the site-specific project.

6. **Energy and Natural Resources**

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Constructed pump stations will operate using electric-powered pumps with diesel or propane-powered emergency generators

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

No

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

No energy conservation features are included in this Plan. Future project design for site-specific pump station projects may evaluate energy conservation features as applicable.

7. **Environmental Health**

a. Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.

No. Typical operation of a sewer system does not increase exposure to environmental health hazards.

1) Describe any known or possible contamination at the site from present or past uses.

None identified in this Plan. Site contamination will be reviewed during design and site-specific SEPA review and will be mitigated accordingly as required by City codes and BMP's.

2) Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.

There are no known hazardous chemicals/conditions that might affect future project design. There are no known underground hazardous liquid or gas transmission pipeline located on Mercer Island.

3) Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.

Not applicable.

4) Describe special emergency services that might be required.

None are anticipated.

5) Proposed measures to reduce or control environmental health hazards, if any:

None are proposed.

b. Noise

1) What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?

Existing noise will not affect projects propsed in this Plan.

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

Noise due to construction will be short-term for each project. Noise related to pump station operation will be mitigated as necessary to meet City code. Potential noise impacts will be reviewed during design and site-specifc SEPA review.

3) Proposed measures to reduce or control noise impacts, if any:

Construction activities and operation of system improvements will meet applicable noise standards.

8. **Land and Shoreline Use**

a. What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe.

Land use in the City of Mercer Island is primarily residential, with a small percentage of commercial and multi-family development located in the Town Center and along the I-90 corridor. There is no industrial land use within the City.

b. Has the project site been used as working farmlands or working forest lands? If so, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses as a result of the proposal, if any? If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to nonfarm or nonforest use?

No.

1) Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling, and harvesting? If so, how:

No.

c. Describe any structures on the site.

The sewer system consists primarily of underground pump stations and pipelines located in City ROW.

d. Will any structures be demolished? If so, what?

No

e. What is the current zoning classification of the site?

There are multiple zoning classifications for the City that will vary depending upon the specific project site location.

f. What is the current comprehensive plan designation of the site?

There are multiple comprehensive plan designations for the City that will vary depending on specific project site location.

g. If applicable, what is the current shoreline master program designation of the site?

Mercer Island contains two distinct shoreline designations; urban residential and urban park that will vary depending on specific project site location.

h. Has any part of the site been classified as a critical area by the city or county? If so, specify.

The critical areas within the Island include geological hazardous areas characterized by steep slopes, landslides and various levels of seismicity, as well as aquatic areas along the shoreline of Lake Washington. Critial areas will be evaluated during design and site-specific SEPA review.

i. Approximately how many people would reside or work in the completed project?

Not applicable

j. Approximately how many people would the completed project displace?

Not applicable

k. Proposed measures to avoid or reduce displacement impacts, if any:

Not applicable

L. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

The General Sewer Plan has been prepared in accordance with the provisions of the City ‘s Comprehensive Plan. The draft Plan will receive approval from the Mercer Island City Council and the Washington State Department of Ecology.

m. Proposed measures to reduce or control impacts to agricultural and forest lands of long-term commercial significance, if any:

Not applicable

9. **Housing**

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

Not applicable

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.

Not applicable

c. Proposed measures to reduce or control housing impacts, if any:

Not applicable

10. **Aesthetics**

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

The proposed projects are mostly underground pipeline replacement and existing underground pump station improvements. Future project design activities, as applicable, will identify any proposed new structures and will describe proposed height and exterior materials to be used at the specific site.

b. What views in the immediate vicinity would be altered or obstructed?

Not applicable

d. Proposed measures to reduce or control aesthetic impacts, if any:

Future project design activities, as applicable, will identify any proposed measures to reduce or control aesthetic impacts at the specific site.

11. **Light and Glare**

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

Not applicable.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

Not applicable.

c. What existing off-site sources of light or glare may affect your proposal?

Not applicable.

d. Proposed measures to reduce or control light and glare impacts, if any:
Not applicable.

12. **Recreation**

a. What designated and informal recreational opportunities are in the immediate vicinity?
Recreactional opportunities are available in both the city Parks and in Lake Washington.

b. Would the proposed project displace any existing recreational uses? If so, describe.
It is not anticipated that any projects proposed in the General Sewer Plan would displace recreational uses.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:
Proposed measures to reduce or control impacts on recreation will be identified during future project design and site-specific SEPA review.

13. **Historic and cultural preservation**

a. Are there any buildings, structures, or sites, located on or near the site that are over 45 years old listed in or eligible for listing in national, state, or local preservation registers ? If so, specifically describe.
No sites are known or have been identified in this Plan. Site-specific projects will be designed to avoid impacts to historic and cultural resources to the greatest extent possible.

b. Are there any landmarks, features, or other evidence of Indian or historic use or occupation? This may include human burials or old cemeteries. Are there any material evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources.
No sites are known or have been identified in this Plan.

c. Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the department of archeology and historic preservation, archaeological surveys, historic maps, GIS data, etc.
Future project design and site-specific SEPA review will identify locations where there may be potential impacts. Depending on the project location future consultation may occur with the Muckleshoot Tribe and the Dept of Archaeology & Historic Preservation.

d. Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.
Measures will be identified and evaluated during future project design and site-specific SEPA review.

14. **Transportation**

a. Identify public streets and highways serving the site or affected geographic area and describe proposed access to the existing street system. Show on site plans, if any.
The City of Mercer Island is accessed from Seattle and Bellevue via I-90. The transportation road system within the Island is comprised of a network of arterial and

residential streets that would provide access to the site-specific projects proposed in this Plan.

b. Is the site or affected geographic area currently served by public transit? If so, generally describe. If not, what is the approximate distance to the nearest transit stop?

Yes, Mercer Island is currently served by both Sound Transit and King County Metro bus service. In 2023 the Island will be served by Link Light Rail.

c. How many additional parking spaces would the completed project or non-project proposal have? How many would the project or proposal eliminate?

Not applicable

d. Will the proposal require any new or improvements to existing roads, streets, pedestrian, bicycle or state transportation facilities, not including driveways? If so, generally describe (indicate whether public or private).

It is unlikely the site-specific projects will require new road infrastructure. Pipe replacement within a roadway would require restoring the road infrastructure to existing conditions.

e. Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

It is unlikely the project will use water, rail or air transportation.

f. How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and nonpassenger vehicles). What data or transportation models were used to make these estimates?

Not applicable

g. Will the proposal interfere with, affect or be affected by the movement of agricultural and forest products on roads or streets in the area? If so, generally describe.

No

h. Proposed measures to reduce or control transportation impacts, if any:

Measures required to reduce or control transportation impacts will be identified during future design and site-specific SEPA review for each project. Each construction project will include a traffic control plan and a ROW use permit to minimize transportation impacts.

15. **Public Services**

a. Would the project result in an increased need for public services (for example: fire protection, police protection, public transit, health care, schools, other)? If so, generally describe.

No

b. Proposed measures to reduce or control direct impacts on public services, if any.

Not applicable

16. **Utilities**

a. Circle utilities currently available at the site:
electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other _____

b. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.

The utilities proposed in the General Sewer Plan involve the replacement or rehabilitation of the sewer system components identified in the Plan as Pipes, Pumps and Lakeline System.The majority of the construction will be performed by outside contractor hired by the City's Public Works Department.

C. Signature

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: Anne Tonella-Howe, P.E.

Name of signee Anne Tonella-Howe, PE

Position and Agency/Organization Assistant City Engineer, City of Mercer Island Public Works

Date Submitted: 5/23/2018

D. supplemental sheet for nonproject actions

(**IT IS NOT NECESSARY** to use this sheet for project actions)

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity or at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?

Minor temporary increases in emmissions to air and the production of noise could result from equipment and activities during construction of specific projects. No increase in discharge to water, production, storage or release of toxic or hazardous substances is anticipated.

Proposed measures to avoid or reduce such increases are:

Compliance with all applicable local, state and federal regulations.

2. How would the proposal be likely to affect plants, animals, fish, or marine life?

Project components include replacement of portions of the Lakeline sewer system in Lake Washington which could impact fish habitat. Collection system improvements located on land in non-roadway areas may temporarily affect vegetation.

Proposed measures to protect or conserve plants, animals, fish, or marine life are:
Projects will be designed in compliance with all applicable local, state and federal regulations.

3. How would the proposal be likely to deplete energy or natural resources?
Sewer Pump Stations will operate using electric-powered pumps with diesel or propane-powered emergency generators.

Proposed measures to protect or conserve energy and natural resources are:
No measures are proposed.

4. How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?
Project components include replacement of portions of the Lakeline sewer system in Lake Washington, and to pipe-lines on-land that could be located in geologically hazardous areas.

Proposed measures to protect such resources or to avoid or reduce impacts are:
Projects will be designed to avoid, where practicable, or minimize impacts to environmentally sensitive areas. Projects will be designed in compliance with all applicable local, state and federal regulations.

5. How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?
Projects in the General Sewer Plan are not likely to affect land or shoreline use. The Plan has been prepared in accordance with the provisions of the City's Comprehensive Plan.

Proposed measures to avoid or reduce shoreline and land use impacts are:
No measures are proposed.

6. How would the proposal be likely to increase demands on transportation or public services and utilities?
The proposed projects may temporarily increase demands on transportation during construction of the project. No increase in public services or utilites is anticipated.

Proposed measures to reduce or respond to such demand(s) are:
No measures are proposed.

7. Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.
The project does not conflict with local, state, or federal laws for the protection of the environment. Projects listed in the capital improvement program that may be subject local, state or federal laws or requirements will be reviewed individually during design as separate site-specific projects.

DETERMINATION OF NON-SIGNIFICANCE (DNS)

Application No:	**SEP18-009**
Description of proposal:	**The proposal is City Council adoption of the General Sewer Plan, which evaluates sewer capacity, provides recommended infrastructure improvements, and provides recommendations for sewer system operations and maintenance.**
Proponent:	**Anne Tonella-Howe, Assistant City Engineer at the City of Mercer Island**
Location of proposal:	**Mercer Island (proposal applies city-wide)**
Lead agency:	**City of Mercer Island**
Project Documents:	**Please follow this file path to access the associated documents for this project:** https://mieplan.mercergov.org/public/SEP18-009/

Based on review of the proposal and applicable City code sections, the lead agency for this proposal has determined that the proposal does not have a probable significant adverse impact on the environment. An environmental impact statement (EIS) is not required under RCW 43.21C.030(2)(c). This decision was made after review of a completed environmental checklist. This information is available to the public on request.

_____ There is no comment period for this DNS.

_____ This DNS is issued after using the optional DNS process in WAC 197-11-355. There is no further comment period on the DNS.

✓ This DNS is issued under WAC 197-11-340(2); the lead agency will not act on this proposal for 14 days from the date below.

Responsible Official: Robin Proebsting, Senior Planner, on behalf of Evan Maxim, Interim Development Service Group Director
City of Mercer Island
9611 SE 36th Street
Mercer Island, WA 98040
Phone: (206) 275-7717
Email: robin.proebsting@mercergov.org

Date: **July 2, 2018**

Signature: Robin Proebsting

APPENDIX C – AGENCY COMMENT LETTERS AND RESPONSES, AND APPROVALS

King County

Utilities Technical Review Committee
Department of Natural Resources and Parks
King Street Center
201 South Jackson Street, Suite 503
Seattle, WA 98104-3855
www.kingcounty.gov

September 21, 2018

Ms. Anne Tonella-Howe, P.E.
Assistant City Engineer
City of Mercer Island
9611 S.E. 36th Street
Mercer Island WA 98040-3732

Dear Ms. Tonella-Howe:

Thank you for submitting the City of Mercer Island's Draft General Sewer Plan, May 2018, for King County approval. The Utilities Technical Review Committee (UTRC) received the draft Plan on July 30, 2018. In accordance with King County Code chapters 13.24 and 28.84, the UTRC has reviewed the draft Plan for consistency with the King County Comprehensive Plan and the King County Code.

In reviewing the draft Plan, the UTRC found that it is largely consistent with the County's comprehensive plan and code. Following is a list of the additional information necessary before we can make a recommendation for approval of the City's final Plan. We request the final Plan include:

1. A reference to the current 2017 adopted King County Comprehensive Plan as compared to the 2012 plan cited in the draft;
2. Information needed to comply with Washington Administrative Code (WAC) 173-240-050 (3)(d) appropriate for a general sewer plan.
3. An assessment of infiltration and inflow (I/I) at a basin by basin level for the service area in relationship to the allowance of 1,100 gallons per acre per day;
4. A list of all establishments producing industrial wastewater, the quantity of wastewater and periods of production, and the character of the industrial wastewater insofar as it may affect the sewer system or treatment plant. Attached is a list of the known Industrial Waste Discharge permits for establishments within the City that King County has on record;
5. An evaluation or discussion of the impacts, if any, of future water use reduction due to conservation and effect on wastewater flows;
6. A description of opportunities for reclaimed water use as required under RCW 90.48.112. To facilitate the assessment, the Washington State Department of Ecology has published guidance material on their website, or alternatively, the King County

Reclaimed Water Checklist is available online here: http://www.kingcounty.gov/~/media/environment/dnrp/documents/WaterReclamationChecklist12_2011.ashx?la=en; and

7. The resolution adopting the final plan by the City council.

King County is pleased to see the Plan acknowledges I/I as a problem for sewer collection systems, and that the City is working to monitor and reduce I/I in targeted areas. The County along with the cities and sewer districts that deliver wastewater to the regional system is evaluating concepts for I/I reduction at the regional scale. Sewer and side sewer standards, inspection practices, and private side sewer programs are specific types of concepts being explored. Some initial study results are currently available online at https://www.kingcounty.gov/services/environment/wastewater/ii/resources.aspx under the heading Evaluation of I/I Reduction Concepts to Improve the Regional I/I Program. Recommendations from the evaluation are expected in the fall of 2018.

When developing scopes of work for future flow monitoring and/or I/I evaluation, we would encourage you to include a private side sewer component that may expand the information available on the sources of I/I in private side sewers through smoke/dye testing, video inspections, or other approaches. As part of the regional I/I effort, exemplary industry or local I/I best practices in use by local agencies were identified that could be considered by the City.

We look forward to seeing the final Plan and working with you to secure approval of the Plan by the Director of King County's Department of Natural Resources & Parks. If you have any questions or concerns on information in this letter, please do not hesitate to call me at 206-477-5387 or my colleague, Mark Lampard, in our Wastewater Treatment Division at 206- 477-5414.

Sincerely,

Stephen Hirschey
Chair, Utilities Technical Review Committee

cc Mr. Shawn McKone, Water Quality Program, Washington State Department of Ecology

Attachment

CITY OF MERCER ISLAND
DRAFT GENERAL SEWER PLAN - RECEIVED JULY 2018

Reviewing Phase: Draft Report	**Phase:**
Reviewing Agency: King County UTRC	**Organization: City of Mercer Island**
Contact: Steve Hirschey	**Responder: Anne Tonella-Howe**
Date: September 21, 2018	**Response Date: 10/30/2018**

Comment No.	Page Number	Comment	Response	Responsible	Action Item
1		A reference to the current 2017 adopted King County Comprehensive Plan as compared to the 2012 Plan cited in the draft.	Plan will be updated to reference 2017 Plan.	Section 2.5.3 has been updated accordingly.	
2		Information needed to comply with Washington Administrative Code (WAC) 173-240-050 (3)(d) appropriate for a general sewer plan.	Mapping will be updated to include items in WAC per Ecology and UTRC comments.	See Ecology ROC for addressing WAC comments.	
3		An assessment of infiltration and inflow (I/I) at the Basin level for the service area in relationship to the allowance of 1,100 gallons per acre per day.	The City does not have flow monitoring data to provide request information beyond the Town Center sewershed. The City encourages WTD to provide sufficient monitoring in the upcoming 2020 decadal monitoring to evaluate I/I on a basin by basin level. As presented in this Plan, the City plans to upgrade its pump stations SCADA to provide flow measurement by 2024 to both improve system operation and evaluate the performance of the system. While this data trends in I/I, it is not a substitute for the decadal flow monitoring.	New section 4.3.5.5 added to address this comment.	
4		A list of all establishments producing industrial wastewater, the quantity of wastewater and periods of production, and the character of the industrial wastewater in so far as it may affect the sewer system or treatment plant. Attached is a list of the known Industrial Waste Discharge permits for establishments within the City that King County has on record.	The City does not have industry on the Island and we are not aware of any other permits other than what KC has on record. Most of the Industrial Waste Discharge permits on the Island are short-term construction related. The list provided are those permits we are aware of.	New section 4.3.2 added.	
5		Evaluate or discussion of the impacts, if any, of future water use reduction due to conservation and effect on wastewater flows.	Discussion of water use reduction will be provided in Section 4.3. The City does not anticipate any large reductions in wastewater flows in the future. Typical redevelopment in the City results in increased number of fixtures, either through larger homes or increased density. While the new fixtures maybe more efficient, reductions in flow from the new fixtures are likely offset by the increased number of fixtures.	New Section 4.3.5.3 added to address this comment.	
6		A description of opportunities for reclaimed water use per required under RCW 90.48.112. To facilitate the assessment, the Washington State Department of Ecology has published guidance material on their website, or alternatively, the King County Reclaimed Water Checklist is available online.	A discussion of reclaimed water opportunities will be added to a new Section 2.7. The City has limited opportunities for reclaimed water use. Given its location, it is the City's understanding that King County WTD has no plans to provide reclaimed water to the City in the foreseeable future.	New section 2.7 added to address this comment.	
7		The resolution adopting the final Plan by the City Council.	To be provided upon acceptance of the Plan by Ecology and the UTRC.	Included in Appendix A.	
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Daniel Reisinger

To: Anne Tonella-Howe
Subject: RE: Ecology review - Mercer Island General Sewer Plan

From: Hoffman, Maia (ECY) <MHOF461@ECY.WA.GOV>
Sent: Thursday, September 20, 2018 2:29 PM
To: Anne Tonella-Howe <Anne.Tonella@mercergov.org>
Cc: Steve.Hirschey@kingcounty.gov; McKone, Shawn (ECY) <SHMC461@ECY.WA.GOV>
Subject: Ecology review - Mercer Island General Sewer Plan

Hello,

I have completed my review of the City of Mercer Island Draft General Sewer Plan (GSP). My comments are attached. Please update the GSP, as necessary from the comments, and submit to Ecology for final review and approval.

I am assisting Shawn McKone with this review. If you have any questions, feel free to contact either myself or Shawn.

Thank you,

Maia Hoffman
Municipal Facility Permit Manager
Washington Department of Ecology
3190 160th Ave SE, Bellevue, WA 98008
Phone: (425) 649-7146

CITY OF MERCER ISLAND
DRAFT GENERAL SEWER PLAN - RECEIVED JULY 2018

Reviewing Phase: Draft Report	**Phase:**
Reviewing Agency: Ecology	**Organization: City of Mercer Island**
Contact: Maia Hoffman	**Responder: Anne Tonella-Howe**
Date: September 20, 2018	**Response Date: 10/30/2018**

Comment No.	Page Number	Comment	Response	Resolution
1	General - Ch 2	WAC 173-240-050(e) requires the GSP to include the population trend as indicated by available records, and the estimated future population for the stated design period. The planning considerations go into a lengthy discussion on land use zoning and associated changes, but does not mention population. Please include population trends and estimated population growth during the design period.	Population trends have been provided in Section 4.3. These trends are taken from the City's 2015 Water System Plan and are consistent with Regional Planning at the time of publishing.	A new section 4.3 has been added based on the City's Growth Management Act and Comprehensive Planning Frequently Asked Questions.
2	2-1	Include detail for the service agreement with King County DNRP for wastewater treatment that impacts the flow of wastewater to their system. Details may include capacity at South Plant for the Island, max flows allowed at the North and South KC PS, BOD or TSS limits, and any other requirements that limit or regulate the Island's ability to send sewage to KC.	The service agreement with King County WTP is provided in Section 2.1.2.1 and Appendix D. The agreement stipulates that Mercer Island will send all sewage to King County. It does not limit the amount of sewage flow or stipulate water quality limits.	Section 2.1.2.1 has been updated to clarify there is no limit to the sewage.
3	2-9	Missing map of streams, ponds, other water bodies within the service area. WAC 173-240-050(3)(d)(vi) requires layout map that includes location of streams, lakes, and other bodies of water. Direction of flow of major streams, the high and low water elevations of water surfaces at sewer outlets and controlled overflows, if any.	A new Figure 2.5 will be added to Section 2.3.6 with the requested information.	Section 2.3.6 has been updated with water course information. Table 3.4 has been added to document overflow elevations.
4	2-10	Missing map of water systems. WAC 173-240-050(3)(d)(vii) requires layout map of location of wells or other sources of water supply, water storage reservoirs and treatment plants, and water transmission facilities. Provide further discussion about the proximity of water system facilities in relation to wastewater facilities. The focus of this section should be on identifying where wastewater facilities may have an impact on drinking water facilities.	A new Figure 2.6 of water facilities and a brief discussion will be added to Section 2.3.7. Proper design of facilities has mitigated the sewer system on drinking water facilities. The City maintains sanitary control on its drinking water facilities and supply taps from Seattle Public Utilities. The City's sole emergency well is adequately set back from sanitary sewer facilities, per regulatory standards.	Section 2.3.7 has been updated.
5	2-12	Chapter 2.5 Regulatory considerations should include a discussion of Phase II Municipal Stormwater General Permit and relation to sanitary sewer. The MSGP contains requirements that relate to this plan including illicit connections of sanitary sewer to stormwater systems or direct inflow of stormwater systems into the sanitary sewer. The GSP should also note that any SSO that may reach surface water or groundwater is considered an unpermitted discharge to waters of the state under state law.	A discussion of the MSGP has been included in a new Section 2.5.6 per your direction.	Section 2.5.6 has been added to address this comment.
6	General - Ch 3	Missing map(s) including slope and direction of flow of existing piping. WAC 173-240-050(3)(d)(ii) requires these elements. A map of the slope of piping would also serve as a good visual for explaining why certain pipe sections require replacement (Town Center pipe replacement projects).	A new Figure that includes flow arrows has been included in Appendix G (due to its large size) and referenced in Section 3.2.	A new map has been included in Appendix G and reference in section 3.2.1.
7	3-2	Figure 3.1 missing location of Flushing Station 9.	Flush Station 9 was filled with CDF several years ago and is no longer operable. Edits to the text as necessary will be made as necessary to remove reference to this station.	Section 3.2.2 has been edited to reflect FS 9 removal.
8	3-4	Include map of piping with material type designated. Information will give visual representation of R&R based on pipe reasonable useful life	New maps of pipe material and pipe age will be added to Section 5.4.	Figures 5.5 and 5.6 have been added to address this comment.
9	3-7	Provide information on capacity of pumps (gpm) and % utilization.	The City does not have sufficient data to conduct the requested analysis at this time. Operators are able to track wet well levels and view when the PS is operating; however, the existing telemetry system does not have historian feature to provide historical data for an analysis. The City has planned SCADA improvements through 2024 to modernize its pump stations controls and provide a historian feature to allow future analyses.	Text on PS capability has been added to Section 3.2.2
10	3-8	Chapter 1.1.1 stated that no sewage overflows to Lake Washington were allowed after 1988. However, Island has a few midline relief structures which are meant to overflow to Lake Washington with high flows. Include discussion on any overflows that have occurred and corrective actions to eliminate potential overflows.	Chapter 1.1.1 will be modified to clarify the City has reported all known SSOs into Lake Washington to Ecology and taken the necessary corrective actions. No known overflows have occurred from mid-line relief structures, which were designed for emergency bypass in extreme conditions. Proposed corrective actions include upgrading the telemetry system to a full SCADA system, including monitoring at this locations. Monitoring at pump stations help identify operational concerns with the Lake Line.	Text added to section 3.2.2.3 to address this comment.
11	4-1	Include more discussion on why the Town Center area was chosen for the collection system analysis, as supposed to other areas within the Island or expanding the study area to encompass a greater portion of the Island.	Additionally discussion was added to Section 4. Hydraulic modeling was intended to evaluate the sewer system capacity. The Town Center is the only area of the City anticipated to increased flows due to growth. The remaining portions of the City are built out and are believed to have sufficient capacity. The City intends to extend the hydraulic model to the entire island to assist with operational concerns in the 2019/2022 bienium.	Text was added to the introduction to Chapter 4 to address this comment.
12	4-20	Table 4.8 missing footnote (2).	Footnotes are in error and will be deleted.	Footnotes removed from Table 4.8
13	5-7	Only Shorewood private collection system on Figure 5.1 map. Is there a reason why only one of the private collection systems is indicated on the map? Does this private system have sewer issues that have been conveyed to the City?	The Shorewood system has not alerted the City of any sewer issues and will be removed from the Figure.	Figure 5.1 has been updated.

CITY OF MERCER ISLAND
DRAFT GENERAL SEWER PLAN - RECEIVED JULY 2018

Reviewing Phase: Draft Report	**Phase:**
Reviewing Agency: Ecology	**Organization: City of Mercer Island**
Contact: Maia Hoffman	**Responder: Anne Tonella-Howe**
Date: September 20, 2018	**Response Date: 10/30/2018**

Comment No.	Page Number	Comment	Response	Resolution
14	5-9	Table 5.2 is not showing the correct information as stated in the text. "Below describes the City's existing activities and goals for the Lakeline and related infrastructure, and is also summarized in Table 5.2" Table 5.2 is outlining the Special Catch Basin Accessibility Issues not the described activities and goals for the Lakeline.	Thank you. The sentence has been updated to describe Table 5.2.	Table 5.2 has been moved to Section 5.1.2.2.
15	5-9	Provide information on which PS have access issues and the last time (approximate) that City staff have inspected those inaccessible PS.	The text will be update dated to clarify PS accessibility. The City monitors its PS via telemetry and conducts on-site inspections at least every 3 weeks. City staff responds to alarms as they arise. Accessibility for the City is defined as ease of access to drive heavy equipment to the PS for maintenance or construction activities. All stations are currently accessible by foot, however not all are accessible by truck and a few are accessible by water. The City has gained agreement for pedestrian access from adjacent home owners at PSs with limited accessibility. The City Marine Patrol's boat is used for heavy maintenance or occasionally the City contracts for use of a work barge. PS generators, which are a common source of alarms, are located further inland and are largely accessed directly with a vehicle. The Ctiy is currently undergoing a review and evaluation of pump station access to define a long-term plan for improving full access to stations.	Text was added in Section 5.1.2.1 and 5.1.2.2 to address this comment.
16	5-27	FS9 not addressed in Table 5.8. It was mentioned in Chapter 3 that FS9 was offline at this time. What scenario would prompt FS9 to be put back online and what maintenance may be needed to ensure its availability when needed.	The text will be updated to reflect that FS9 was decommissioned in 2013, was filled with CDF and is no longer operable. There is no scenario that would prompt us to rebuild this station in the future.	Chapter 3 text has been updated.
17	6-1	6.1.2 states that "all capital projects in this GSP are non-capacity or not growth related". However, Figure 4.15 and 4.16 show that Project 2 and parts of Project 3 and 5 are only needed at build-out capacity. How are these projects not growth related?	The flow projections assume a 7% increase in I/I per decade based on King County's 2014 Study, which was the sole driver of Projects 1 through 4, 7, & 8. No additional domestic flows were added beyond the immediate Town Center area. Projects 5 and 6 were deficient in the existing conditions (non-capacity) and therefore the need for improvements were not considered to be growth related.	Text added in Setion 4.7.2 to address this comment.
18	6-3	Table 6.2. Why is the trenchless pipe rehab unit cost for 24" not applicable?	The 24" pipe rehabilitation costs are $191/LF. Table 6.2 will be updated accordingly.	Table 6.2 has been updated.
19	6-9	What are the differences in project element "Flow Monitoring"? Provide more detail.	Each flow monitoring period will address different Sewer sub-basins. Due to the large number of sewer sub-basins, the City does not have the resources to monitor its entire system at once. This will also allow the City to target monitoring to support of upcoming PS rehabilitation projects and other work.	Project description on Page 6.6 has been updated.
20	6-16	Figure 4.16 shows that Project 2 need is caused by increased capacity at build-out not due to future I/I. Where is the I/I evaluation discussion for the section of pipe/area proposed in Project 2?	As discussed in Item 17, the text has been updated in Section 4.7.2 for clarify the role of I/I in the capacity improvements.	See Item 17.
21	6-27	Figure 6.4. Reach 4 and Reach 5 do not match the information given in Figure 3.1. If there is a reasoning, provide discussion on different numbering of Reach sections.	Thank you. Figure 6.4 is in error and will be updated.	Figure 6.4 has been updated.
22	6-28	What are the differences in project element "PS Accessibility Improvements"? Provide more detail.	The project is intended to increase the City's ability to access its PS, as discussed in Item 15. A study is currently ongoing to define specific access improvements. The City has budgeted funds based to resolve potential easement issues and make minor physical access improvements.	No change to text
23	6-29	From notes given for Project ID: PS2, it is unclear why the PS24 generator is slated for replacement within the next 5 years. It shows that PS24 was last replaced in 2018. There are numerous PS that have generators older than that. Provide more discussion on this.	Thank you, the text is incorrect and will be updated to reflect the City's latest replacement schedule.	Project sheet updated.

APPENDIX D – SERVICE AGREEMENTS

Executed in 10 counterparts of which this is counterpart No. 8

AGREEMENT FOR SEWAGE DISPOSAL

THIS AGREEMENT made and executed this 20th day of April, 1961, between MERCER ISLAND SEWER DISTRICT, a municipal corporation of the State of Washington, hereinafter referred to as "the District" and the MUNICIPALITY OF METROPOLITAN SEATTLE, a municipal corporation of the State of Washington, hereinafter referred to as "Metro,"

W I T N E S S E T H:

WHEREAS, the public health, welfare and safety of the residents of the District and the residents of the metropolitan area require the elimination of existing sources of water pollution and the preservation of the fresh and salt water resources of the area; and

WHEREAS, growth of population, topographic conditions and preservation of water resources require that certain major sewage disposal works be constructed and operated and that the cities and special districts within the metropolitan area dispose of their sewage in accordance with a comprehensive plan for the metropolitan area; and

WHEREAS, Metro was established by vote of the people in the metropolitan area pursuant to Chapter 35.58 RCW for the purpose of performing the function of metropolitan sewage disposal, has adopted a comprehensive plan for the disposal of sewage from the metropolitan area and intends to develop the facilities needed to carry out such plan and to issue revenue bonds to finance such development; and

WHEREAS, to carry out the purposes of Metro and perform its authorized function and to provide for the disposal of sewage from the District into the metropolitan sewage disposal system it is necessary that a contract be now entered into establishing certain rights and duties of the parties incident thereto;

NOW, THEREFORE, in consideration of the mutual covenants contained herein, IT IS HEREBY AGREED as follows:

Section 1. Definition of Terms. The following words and phrases used in this contract shall have the meanings hereinafter set forth in this section:

(a) The words "Comprehensive Plan" shall mean the Comprehensive Sewage Disposal Plan for the metropolitan area adopted in Resolution No. 23 of the Municipality of Metropolitan Seattle and as same may be hereafter amended from time to time in the manner required by law.

(b) The words "Metropolitan Sewerage System" shall mean all of the facilities to be constructed, acquired or used by Metro as a part of the Comprehensive Plan. The Metropolitan Sewerage System shall generally include sewage disposal facilities with capacity to receive sewage from natural drainage areas of approximately one thousand acres or more. The Metropolitan Sewerage System shall thus include trunk or interceptor sewer facilities extending to a point within each tributary, and natural drainage area, where not more than one thousand acres remain to be served beyond the upper terminus of such trunk or interceptor sewer.

(c) The words "Local Sewerage Facilities" shall mean all facilities owned or operated by the Participant for

the local collection of sewage to be delivered to the Metropolitan Sewerage System.

(d) The words "Metropolitan Area" shall mean the area contained within the boundaries of the Municipality of Metropolitan Seattle as now or hereafter constituted.

(e) The word "Participant" shall mean each city, town, county, sewer district, municipal corporation, person, firm or private corporation which shall dispose of any portion of its sanitary sewage into the Metropolitan Sewerage System and shall have entered into a contract with Metro providing for such disposal.

(f) The words "Residential Customer" shall mean a single family residence billed by a Participant for sewerage charges.

Section 2. Delivery and Acceptance of Sewage: From and after July 1, 1962, the District shall deliver to the Metropolitan Sewerage System all of the sewage and industrial wastes collected by it and Metro shall accept the sewage and wastes delivered for treatment subject to such reasonable rules and regulations as may be adopted from time to time by the Metropolitan Council. Metro shall not directly accept sewage or wastes from any person, firm, corporation or governmental agency which is located within the boundaries of or is delivering its sewage into the Local Sewerage Facilities of any Participant without the written consent of such Participant.

Section 3. Construction of Facilities. Metro shall construct, acquire or otherwise secure the right to use all facilities required for the disposal of sewage delivered to Metro pursuant to this Agreement and shall perform all services required

for the maintenance, operation, repair, replacement or improvement of the Metropolitan Sewerage System, including any additions and betterments thereto.

Section 4. Connection of Local Sewerage Facilities to the Metropolitan Sewerage System. Local Sewerage Facilities of the District shall be connected to the Metropolitan Sewerage System at such time as any portion of the Metropolitan Sewerage System shall be available to receive sewage collected by such facilities. Metro shall, at its sole expense, connect those Local Sewerage Facilities of the District which are now in existence or which shall be constructed in accordance with the rules and regulations of Metro prior to the availability of the Metropolitan Sewerage System. Local Sewerage Facilities constructed after the Metropolitan Sewerage System shall have been made available to the area served by such Local Sewerage Facilities shall be connected to the Metropolitan Sewerage System at the expense of the Participant in accordance with the rules and regulations of Metro.

Section 5. Payment for Sewage Disposal. For the disposal of sewage collected by the District and delivered to Metro. the District shall pay to Metro on or before the last day of each month during the term of this agreement, commencing with the month of July, 1962, a sewage disposal charge determined as provided in this Section 5.

1. For the quarterly periods ending March 31, June 30, September 30 and December 31 of each year every Participant shall submit a written report to Metro setting forth (a) the number of Residential Customers billed by such Participant for local sewerage charges as of the last day of the quarter, (b) the total number of all customers billed by such Participant as of such day and (c) the total water consumption during such quarter

for all customers billed by such Participant other than Residential Customers. The quarterly water consumption report shall be taken from water meter records and may be adjusted to exclude water which does not enter the sanitary facilities of a customer. Where actual sewage flow from an individual customer is metered, the metered sewage flows shall be reported in lieu of adjusted water consumption. The total quarterly water consumption report in cubic feet shall be divided by 2,700 to determine the number of Residential Customer equivalents represented by each Participant's customers other than single family residences. The first report shall cover the quarterly period ending December 31, 1960 and shall be submitted on or before March 1, 1961. Succeeding reports shall be made for each quarterly period thereafter and shall be submitted within thirty (30) days following the end of the quarter. Metro shall maintain a permanent record of the quarterly customer reports from each Participant.

2. To form a basis for determining the monthly sewage disposal charge to be paid by each Participant during any particular quarterly period Metro shall ascertain the number of Residential Customers and Residential Customer equivalents of each Participant for each such quarterly period beginning with the July-September quarter of the year 1962. This determination shall be made by taking the sum of the actual number of Residential Customers reported as of the last day of the next to the last preceding quarter and the average number of Residential Customer equivalents per quarter reported for the four quarters ending with said next to the last preceding quarter, adjusted to eliminate any Residential Customers or Residential Customer equivalents whose sewage is delivered to a governmental

agency other than Metro or other than a Participant for disposal outside of the Metropolitan Area.

3. For the period from July 1, 1962 to December 31, 1963, the monthly rate for each Residential Customer and Residential Customer equivalent of each Participant shall be Two dollars ($2.00) and the monthly sewage disposal charge to be paid by each Participant to Metro shall be obtained by multiplying the number of Residential Customers and Residential Customer equivalents of the Participant as determined in subparagraph 2 of this section by the monthly rate of Two dollars.

4. For each calendar year after the year 1963, the monthly sewage disposal charge payable to Metro shall be determined as follows:

a) Prior to July 1st of each year Metro shall determine its total monetary requirements for the disposal of sewage during the next succeeding calendar year. Such requirements shall include the cost of administration, operation, maintenance, repair and replacement of the Metropolitan Sewerage System, establishment and maintenance of necessary working capital and reserves, the requirements of any resolution providing for the issuance of revenue bonds of Metro to finance the acquisition, construction or use of sewerage facilities, plus not to exceed 1% of the foregoing requirements for general administrative overhead costs.

b) To determine the monthly rate per Residential Customer or Residential Customer equivalent to be used during said next succeeding calendar year, the total monetary requirements for disposal of sewage as determined in subparagraph 4(a) of this section shall be divided by twelve and the resulting quotient shall be divided by the

total number of Residential Customers and Residential Customer equivalents of all Participants ascertained in accordance with subparagraph 2 of this section for the October-December quarter preceding said July 1st; provided, however, that the monthly rate shall not be less than Two Dollars ($2.00) per month per Residential Customer or Residential Customer equivalent at any time during the period ending July 31, 1972.

c) The monthly sewage disposal charge paid by each Participant to Metro shall be obtained by multiplying the monthly rate by the number of Residential Customers and Residential Customer equivalents of the Participant determined as provided in Paragraph 2 of this section. An additional charge may be made for sewage or wastes of unusual quality or composition requiring special treatment, or Metro may require pretreatment of such sewage or wastes. An additional charge may be made for quantities of storm or ground waters entering those Local Sewerage Facilities which are constructed after January 1, 1961 in excess of the minimum standard established by the general rules and regulations of Metro.

5. A statement of the amount of the monthly sewage disposal charge shall be submitted by Metro to each Participant on or before the first day of each month during the term of this agreement commencing with the month of July, 1962, and payment of such charge shall be due on the last day of such month. If any charge or portion thereof due to Metro shall remain unpaid for fifteen days following its due date, the Participant shall be charged with and pay to Metro interest on the amount unpaid from its due date until paid at the rate of 6% per annum, and Metro may, upon failure to pay such amount, enforce payment by any remedy available at law or equity.

6. The District irrevocably obligates and binds itself to pay its sewage disposal charge out of the gross revenues of the sewer system of the District. The District further binds itself to establish, maintain and collect charges for sewer service which will at all times be sufficient to pay all costs of maintenance and operation of the sewer system of the District, including the sewage disposal charge payable to Metro hereunder and sufficient to pay the principal of and interest on any revenue bonds of the District which shall constitute a charge upon such gross revenues. It is recognized by Metro and the District that the sewage disposal charge paid by the District to Metro shall constitute an expense of maintenance and operation of the sewer system of the District prior in lien to any sewer revenue bonds of the District to be hereafter issued. It is further recognized that the District shall have the right to fix its own schedule of rates and charges for sewer service, provided that same shall produce revenue sufficient to meet the covenants contained in this agreement.

Section 6. Responsibility of Participant. Each Participant shall be responsible for the delivery to the Metropolitan Sewerage System of sewage collected by such Participant, for the construction, maintenance and operation of Local Sewerage Facilities, and for the payment of all costs incident to the collection of such sewage and its delivery to the Metropolitan Sewerage System.

Section 7. Records. Permanent books and records shall be kept by Metro of the rates established, the volumes of sewage delivered and discharged into the Metropolitan Sewerage System wherever such volumes are measured and the number of Residential Customers and Residential Customer equivalents reported by each Participant, in addition to complete books

of account showing all costs incurred in connection with the Metropolitan Sewerage System. Such records shall be maintained beginning with the commencement of operation of any part of the Metropolitan Sewerage System.

Section 8. Development of Metropolitan Sewerage System. It is contemplated that the Metropolitan Sewerage System will be developed in stages and the nature of facilities to be constructed, acquired or used and the time of such construction, acquisition or use shall be determined by Metro, it being contemplated that Metro shall ultimately provide sewage disposal service for the entire Metropolitan Area.

Section 9. Reimbursement for and Use of District Facilities. Effective July 1, 1962, or such earlier date as may be mutually agreed upon (hereinafter called "takeover date"), Metro shall have the exclusive right to use and the duty to maintain, operate, repair and replace the facilities which are described in Exhibit "A" attached hereto and by this reference made a part hereof, subject to the continued availability of such facilities to receive, transport or treat sewage delivered by the District. From and after the takeover date Metro shall acquire, construct, maintain, operate, repair and replace all facilities now or hereafter required for the treatment and disposal of sewage delivered by the District and the District shall make payment for such treatment and disposal as provided in Section 5 of this Agreement.

For the privilege of using the facilities described in Exhibit "A" Metro shall pay to the District the total amount of Two Hundred Sixty Two Thousand Three Hundred Thirty DOLLARS ($262,330.0

(hereinafter called "amount of reimbursement"). If the District shall construct improvements or additions to the facilities described in Exhibit "A" with the approval of Metro after the date of this Agreement and prior to the takeover date, the District shall be reimbursed for the actual cost thereof in cash within thirty (30) days following the said takeover date in addition to the amount of reimbursement set forth above. The right of Metro to use facilities designated as "temporary" shall expire six months following the date of completion as determined by Metro of permanent metropolitan facilities adequate to replace such temporary facilities. The District shall continue to retain its existing rights of ownership in the facilities described in this Section 9 and shall continue to pay the principal of and interest on any bonds issued to pay in whole or in part the cost of acquisition and construction of such facilities, provided that any right, title and interest of the District in and to facilities which are designated as "permanent" shall be conveyed by the District to Metro by quit claim deed upon payment of all presently outstanding revenue bonds or general obligation bonds of the District secured by or issued to acquire or construct said facilities.

The District shall give written notice to Metro prior to June 1, 1961, setting forth the manner in which the amount of reimbursement shall be paid. The District may elect to receive all or any portion of said amount in cash within thirty (30) days following the date of delivery of revenue bonds issued by Metro for the purpose of providing funds therefor and, in any event, not later than July 1, 1962 (hereinafter called "cash payment date") and may elect to receive any portion which is not paid on said cash payment date.

together with interest thereon at the rate of 4% per annum from said date, in the form of a credit against the District's monthly sewage disposal charge in equal monthly amounts sufficient to amortize such unpaid amount of reimbursement and interest thereon prior to July 1, 1977. The District may at any time after the cash payment date elect to receive any unpaid portion of the amount of reimbursement in cash with interest at the rate of 4% per annum to date of final payment by giving written notice to Metro at least one year prior to the date such final payment is to be made.

Section 10. Insurance and Liability for Damages. Each particpant with a population of less than 100,000 shall secure and maintain with responsible insurers all such insurance as is customarily maintained with respect to sewerage systems of like character against loss of or damage to the respective sewerage facilities of each and against public and other liability to the extent that such insurance can be secured and maintained at reasonable cost. Any liability incurred by Metro as a result of the operation of the Metropolitan Sewerage System shall be the sole liability of Metro and any liability incurred by the District as a result of the operation of the Local Sewerage Facilities of the District shall be the sole liability of the District.

Section 11. Assignment. Neither of the parties hereto shall have the right to assign this Agreement or any of its rights and obligations hereunder nor to terminate its obligations hereunder by dissolution or otherwise without first securing the written consent of the other party and this Agreement shall be binding upon and inure to the benefit of the respective successors and assigns of the parties hereto. In the event that the District should be dissolved, the local sewer facilities owned and operated by the District within

the Metropolitan Area shall by such act of dissolution be assigned and transferred to Metro subject to any outstanding debts of the District incurred for the construction or acquisition of such facilities and subject to the obligation of Metro to continue to provide sewer service to the residents served by such local facilities upon payment of the reasonable costs thereof.

Section 12. Effective Date and Term of Contract. This Agreement shall be in full force and effect and binding upon the parties hereto upon the execution of the Agreement and shall continue in full force and effect for a period of fifty years unless prior to July 1, 1962, Metro shall not have entered into a firm commitment for the sale of revenue bonds to finance any portion of the Comprehensive Plan, then in such event only, this Agreement shall be terminated as of said date. Metro shall make every reasonable effort to secure such a commitment prior to said date.

Section 13. Notice. Whenever in this Agreement notice is required to be given, the same shall be given by Registered Mail addressed to the respective parties at the following addresses:

Municipality of Metropolitan Seattle
152 Denny Way
Seattle 9, Washington

Mercer Island Sewer District
3030 - 78th S. E.
Mercer Island, Washington

unless a different address shall be hereafter designated in writing by either of the parties.

The date of giving such notice shall be deemed to be the date of mailing thereof. Billings for and payments of sewage disposal costs may be made by regular mail.

Section 14. Execution of Documents. This Agreement shall be executed in ten counterparts, any of which shall be regarded for all purposes as one original. Each party agrees that it will

execute any and all deeds, instruments, documents and resolutions or ordinances necessary to give effect to the terms of this Agreement.

Section 15. Waiver. No waiver by either 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 16. Remedies. In addition to the remedies provided by law, this Agreement shall be specifically enforceable by either party.

Section 17. Entirety. This Agreement merges and supersedes all prior negotiations, representations and agreements between the parties hereto relating to the subject matter hereof and constitutes the entire contract between the parties concerning the disposal of sewage by the District and acceptance of such sewage by Metro for disposal.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the day and year first above written.

MERCER ISLAND SEWER DISTRICT

By _____
Commissioner

_____
Commissioner

_____
Commissioner

ATTEST:

_____
Secretary of the Board of Commissioners

MUNICIPALITY OF METROPOLITAN SEATTLE

By _____
C. Carey Donworth
Chairman of the Council

ATTEST:

_____
Maralyn Sullivan, Clerk of the Council

STATE OF WASHINGTON)
) ss.
COUNTY OF KING)

On this 11th day of APRIL, 1961,

before me personally appeared IVAN M. BRUCE, ROBERT T. LAMSON and PALMER G. LEWIS, to me known to be the Commissioners of Mercer Island Sewer District, a municipal corporation, and acknowledged the within and foregoing instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that they were authorized to execute said instrument and that the seal affixed is the corporate seal of said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year first above written.

Notary Public in and for the State of Washington, residing at Mercer Island, Washington

STATE OF WASHINGTON)
) ss.
COUNTY OF KING)

On this 20 day of April, 1961, before me personally appeared C. CAREY DONWORTH and MARALYN SULLIVAN, to me known to be the Chairman of the Council and Clerk of the Council, respectively, of the Municipality of Metropolitan Seattle, a municipal corporation, and acknowledged the within and foregoing instrument to be the free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that they were authorized to execute said instrument and that the seal affixed is the corporate seal of said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year first above written.

Notary Public in and for the State of Washington, residing at Seattle

EXHIBIT "A"

MERCER ISLAND SEWER DISTRICT

FACILITY	FROM	TO	COMPREHENSIVE PLAN DESIGNATION (SEE FOOTNOTE)	COMPREHENSIVE PLAN REFERENCE (SEE FOOTNOTE)
Permanent Facilities				
Pumping Stations, Force Mains and Trunk Sewer	Pump Station near Roanoke Way and Lake Washington	Pump Station at east end of East Channel Lake Washington Bridge	ELW 28, ELW 29, ELW 30, ELW 31, ELW 33, ELW 34, P.S.-ELW 8, P.S.-ELW 9, P.S.-ELW 10	Table 15-33 Figure 15-15

(NOTE: No property description required)

FOOTNOTE: Comprehensive Plan Designation and Reference are as set forth in the "Metropolitan Seattle Sewerage and Drainage Survey" dated March 1958 and referred to in Section 1 of Resolution No. 23 of Metro.

CITY OF MERCER ISLAND

MUNICIPALITY OF METROPOLITAN SEATTLE

AMENDMENT TO AGREEMENT
FOR SEWAGE DISPOSAL

THIS AMENDMENT made as of the 2nd day of October, 1992 between the City of Mercer Island, successor to Mercer Island Sewer District a municipal corporation of the State of Washington (hereinafter referred to as the "City") and the Municipality of Metropolitan Seattle, a metropolitan municipal corporation of the State of Washington (hereinafter referred to as "Metro");

WITNESSETH:

WHEREAS, the parties have entered into a long term Agreement for Sewage Disposal dated April 20, 1961 (hereinafter referred to as the "Basic Agreement"); and

WHEREAS, an advisory committee composed of elected and appointed officials in the metropolitan area was appointed by the Metropolitan Council to examine the structure of Metro's charges to its participants; and

WHEREAS, said advisory committee, following extensive research, study and deliberations, has recommended certain changes in the structure of Metro's charges to its participants and implementation of said changes requires amendment of the Basic Agreement; and

WHEREAS, the parties have determined that the recommendations are in the best public interest and therefore desire to amend said Basic Agreement to implement said recommendations;

NOW, THEREFORE, it is hereby agreed as follows:

Section 1. Amendment of Section 5 of the Basic Agreement. Section 5 of the Basic Agreement is hereby amended to read as follows:

"Section 5. Payment for Sewage Disposal. For the disposal of sewage hereafter collected by the City and delivered to Metro the City shall pay to Metro on or before the last day of each month during the term of this Agreement, a sewage disposal charge determined as provided in this Section 5.

1. For the quarterly periods ending March 31, June 30, September 30 and December 31 of each year every Participant shall submit a written report to Metro setting forth:

(a) the number of Residential Customers billed by such Participant for local sewerage charges as of the last day of the quarter,

(b) the total number of all customers billed for local sewerage charges by such Participant as of such day, and

(c) the total water consumption during such quarter for all customers billed for local sewerage charges by such Participant other than Residential Customers.

The quarterly water consumption report shall be taken from water meter records and may be adjusted to exclude water which does not enter the sanitary facilities of the customer. Where actual sewage flow from an individual customer is metered, the metered sewage flows shall be reported in lieu of adjusted water consumption. The total quarterly water consumption report in cubic feet shall be divided by 2,250 to determine the number of Residential Customer equivalents represented by each Participant's customers other than single family residences. Metro shall maintain a permanent record of the quarterly customer reports from each Participant.

The City's first quarterly report shall cover the first quarterly period following the date when sewage is first delivered to Metro and shall be submitted within thirty days following the end of the quarter. Succeeding reports shall be made for each quarterly period thereafter and shall be submitted within thirty (30) days following the end of the quarter.

2. (a) To form a basis for determining the monthly sewage disposal charge to be paid by each Participant during any particular quarterly period, Metro shall ascertain the number of Residential Customers and Residential Customer equivalents of each Participant. This determination shall be made by taking the sum of the actual number of Residential customers reported as of the last day of the next to the last preceding quarter and the average number of Residential Customer Equivalents per quarter reported for the four quarters ending with said next to the last preceding quarter, adjusted for each Participant to eliminate any Residential Customers or Residential Customer equivalents whose sewage is delivered to a governmental agency other than Metro or other than a Participant for disposal outside of the Metropolitan Area.

(b) For the initial period until the City shall have submitted six consecutive quarterly reports, the reported number of Residential Customers and Residential Customer equivalents of the City shall be determined as provided in this subparagraph (b). On or before the tenth day of each month beginning with the month prior to the month in which sewage from the City is first delivered to Metro, the City shall submit a written statement of the number of Residential Customers and Residential Customer equivalents estimated to be billed by the City during the next succeeding month. For the purpose of determining the basic reported number of Residential Customers and

Residential Customer equivalents of the City for such next succeeding month, Metro may at its discretion adopt either such estimate or the actual number of Residential Customers and Residential Customer equivalents reported by the City as of the last day of the next to the last preceding reported quarter. After the City shall have furnished six consecutive quarterly reports the reported number of Residential Customers and Residential Customer equivalents of the City shall be determined as provided in the immediately preceding subparagraph (a).

(c) If the City shall fail to submit the required monthly and/or quarterly reports when due, Metro may make its own estimate of the number of Residential Customers and Residential Customer equivalents of the City and such estimate shall constitute the reported number for the purpose of determining sewage disposal charges.

3. The monthly sewage disposal charge payable to Metro shall be determined as follows:

(a) Prior to July 1st of each year Metro shall determine its total monetary requirements for the disposal of sewage during the next succeeding calendar year. Such requirements shall include the cost of administration, operation, maintenance, repair and replacement of the Metropolitan Sewerage System, establishment and maintenance of necessary working capital and reserves, the requirements of any resolution providing for the issuance of revenue bonds of Metro to finance the acquisition, construction or use of sewerage facilities, plus not to exceed 1% of the foregoing requirements for general administrative overhead costs.

(b) To determine the monthly rate per Residential Customer or Residential Customer equivalent to be used during said next succeeding calendar year, the total monetary requirements for disposal of sewage as determined

in subparagraph 3(a) of this section shall be divided by twelve and the resulting quotient shall be divided by the total number of Residential Customers and Residential Customer equivalents of all Participants for the October-December quarter preceding said July 1st; provided, however, that the monthly rate shall not be less than Two Dollars ($2.00) per month per Residential Customer or Residential Customer equivalent at any time during the period ending July 31, 1972.

(c) The monthly sewage disposal charge paid by each Participant to Metro shall be obtained by multiplying the monthly rate by the number of Residential Customers and Residential Customer equivalents of the Participant. An additional charge may be made for sewage or wastes of unusual quality or composition requiring special treatment, or Metro may require pretreatment of such sewage or wastes. An additional charge may be made for quantities of storm or ground waters entering those Local Sewerage Facilities which are constructed after January 1, 1961 in excess of the minimum standard established by the general rules and regulations of Metro.

4. The parties acknowledge that, by resolution of the Metropolitan Council, Metro may impose a charge or charges directly on the future customers of a Participant for purposes of paying for capacity in Metropolitan Sewage Facilities and that such charges shall not constitute a breach of this agreement or any part thereof. The proceeds of said charge or charges, if imposed, shall be used only for capital expenditures or defeasance of outstanding revenue bonds prior to maturity.

In the event such a charge or charges are imposed, the City shall, at Metro's request, provide such information regarding new residential customers and residential customer

equivalents as may be reasonable and appropriate for purposes of implementing such a charge or charges.

5. A statement of the amount of the monthly sewage disposal charge shall be submitted by Metro to each Participant on or before the first day of each month and payment of such charge shall be due on the last day of such month. If any charge or portion thereof due to Metro shall remain unpaid for fifteen days following its due date, the Participant shall be charged with and pay to Metro interest on the amount unpaid from its due date until paid at the rate of 6% per annum, and Metro may, upon failure to pay such amount, enforce payment by any remedy available at law or equity.

6. The City irrevocably obligates and binds itself to pay its sewage disposal charge out of the gross revenues of the sewer system of the City. The City further binds itself to establish, maintain and collect charges for sewer service which will at all times be sufficient to pay all costs of maintenance and operation of the sewer system of the City, including the sewage disposal charge payable to Metro hereunder and sufficient to pay the principal of and interest on any revenue bonds of the City which shall constitute a charge upon such gross revenues. It is recognized by Metro and the City that the sewage disposal charge paid by the City to Metro shall constitute an expense of the maintenance and operation of the sewer system of the City. The City shall provide in the issuance of future sewer revenue bonds of the City that expenses of maintenance and operations of the sewer system of the City shall be paid before payment of principal and interest of such bonds. The City shall have the right to fix its own schedule of rates and charges for sewer service provided that same shall produce revenue sufficient to meet the covenants contained in this Agreement.

Section 2. Effective Date of Amendment. This amendment shall take effect at the beginning of the first quarter following the date first written above with quarters beginning January 1, April 1, July 1, and October 1.

Section 3. Basic Agreement Unchanged. Except as otherwise provided in this amendment, all provisions of the basic agreement shall remain in full force and effect as written therein.

IN WITNESS WHEREOF, the parties have executed this Agreement as of the day and year first written above.

CITY OF MERCER ISLAND

Paul A Lindsey

ATTEST:

Debra E Simmonds

MUNICIPALITY OF
METROPOLITAN SEATTLE

~~Gary Zimmerman~~
Chair of the Council

MAY 22 1992

ATTEST:

Bonnie Mattson

CITY OF MERCER ISLAND

MUNICIPALITY OF METROPOLITAN SEATTLE

EXTENSION OF AGREEMENT FOR SEWAGE DISPOSAL

WHEREAS, the City of Mercer Island (the "City"), as successor to Mercer Island Sewer District, and the Municipality of Metropolitan Seattle (the "Municipality") are parties to a certain Agreement for Sewage Disposal (the "Agreement") dated April 20, 1961, as amended, pursuant to which the City delivers to the Municipality for treatment and disposal all the sewage and industrial wastes it collects from its service area; and

WHEREAS, the Agreement expires by its terms on July 1, 2016; and

WHEREAS, it is in the best interests of the City and the Municipality that the expiration date of the Agreement be extended in order to allow the Municipality to sell and issue its sewer revenue bonds with maturities extending beyond 2016;

NOW, THEREFORE, in consideration of the mutual covenants contained herein and in the Agreement, it is hereby agreed as follows:

The Agreement for Sewage Disposal between the City of Mercer Island, as successor to Mercer Island Sewer District, and the Municipality of Metropolitan Seattle dated April 20, 1961, as amended, is hereby extended for a period of twenty years and shall continue in full force and effect until July 1, 2036.

It is further agreed that all other provisions of said Agreement shall remain unchanged, and the Agreement dated April 20, 1961, as amended, as extended herein shall constitute the entire Agreement for Sewage Disposal between the parties.

DATED: This ~~4th~~ 19th day of ~~December~~ March, 1985

CITY OF MERCER ISLAND

By _____

ATTEST:

_____
City Clerk

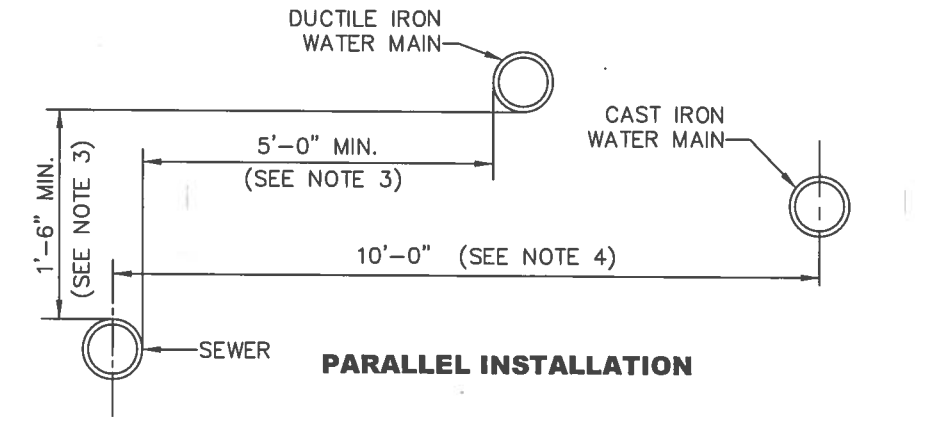
MUNICIPALITY OF METROPOLITAN SEATTLE

By _____
Gary Zimmerman
Chairman of the Council

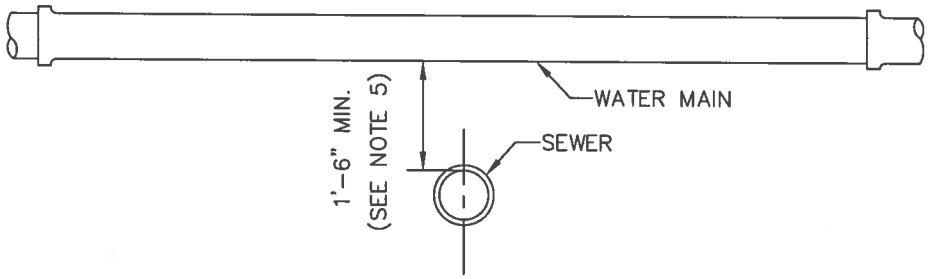
ATTEST:

_____
Bonnie Mattson
Clerk of the Council

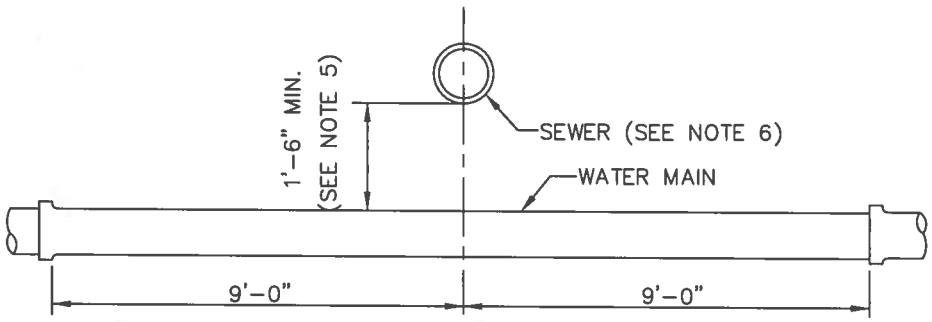
APPENDIX E – DRAFT ENGINEERING STANDARDS



PARALLEL INSTALLATION



CROSSING WATER OVER SEWER



STANDARD SINGLE 18'–0" NOMINAL LENGTH DUCTILE IRON WATER MAIN SECTION CENTERED AT THE POINT OF CROSSING.

CROSSING WATER UNDER SEWER

NOTES

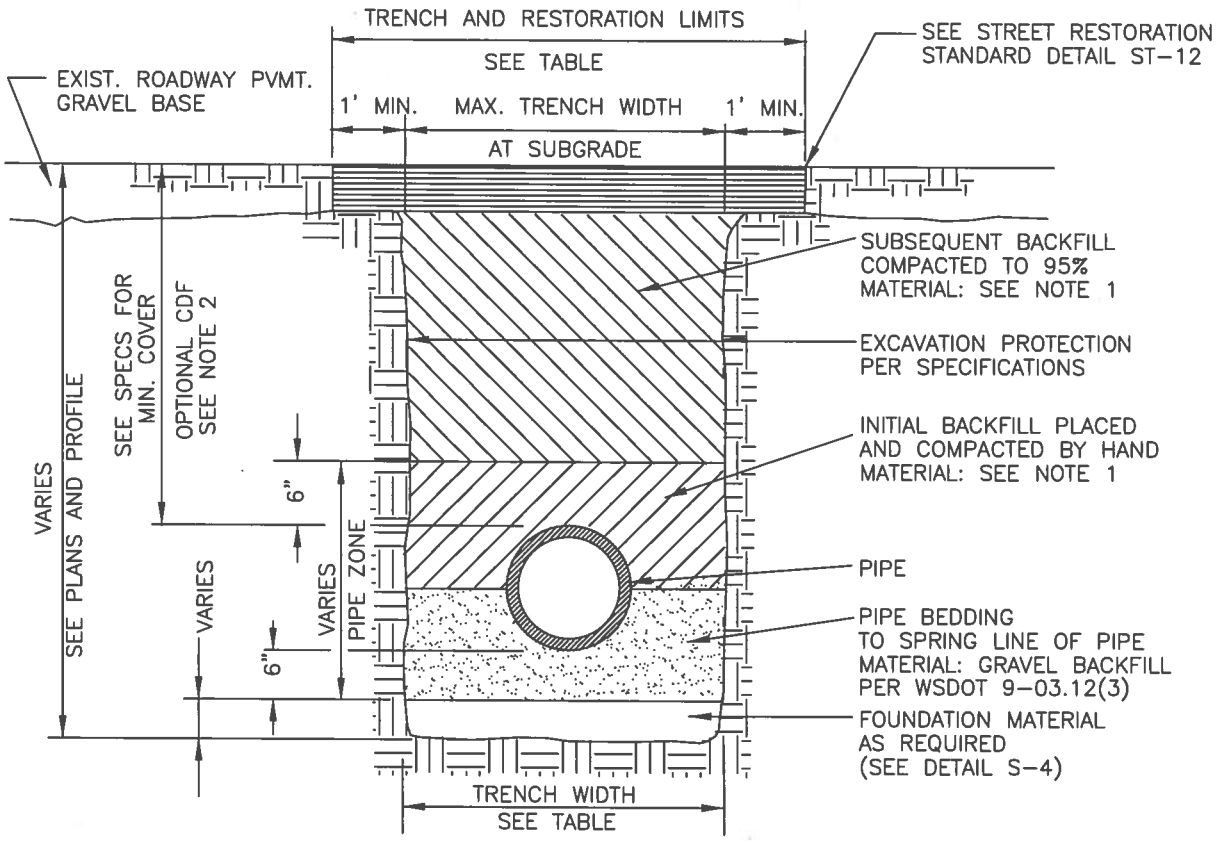
1. ANY EXCEPTIONS TO THE STANDARD PLAN MAY BE APPROVED BY THE CITY ENGINEER.
2. "SEWER" INCLUDES SANITARY SEWER, COMBINED SEWER AND SIDE SEWER.
3. WHERE MINIMUM CLEARANCES CANNOT BE MET, SEWER SHALL BE CONSTRUCTED OF MATERIALS AND WITH JOINTS THAT ARE EQUIVALENT TO WATER MAIN STANDARDS INCLUDING WATER MAIN PRESSURE TESTING REQUIREMENTS.
4. NO VERTICAL CLEARANCE REQUIRED.
5. IF VERTICAL SEPARATION CANNOT BE MET, WATER MAIN SHALL BE A STANDARD SINGLE 18'–0' NOMINAL LENGTH DUCTILE IRON WATER MAIN SECTION CENTERED AT THE POINT OF CROSSING.
6. SEWER SHALL HAVE ADEQUATE FOUNDATION SUPPORT TO PREVENT SETTLEMENT ON THE WATER MAIN AN TO PREVENT DEFLECTION OF WATER MAIN JOINTS.
7. CROSSINGS AT AN ANGLE BETWEEN 90° AND 45° MAY OCCUR BETWEEN 9'–0" AND 6'–0" OF WATER MAIN JOINT FOR CROSSINGS LESS THAN 45° , SEE NOTE 1.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

WATER & SEWER CLEARANCES AND MATERIAL REQUIREMENTS

6–5–2009	NO SCALE	**S-2**

REV DATE						APPROVED



NOTES

1. ALL TRENCH BACKFILL IN PUBLIC RIGHT-OF-WAY OR ROADWAY AREAS SHALL BE CRUSHED SURFACING PER WSDOT 9-09.9(3) OR BANK RUN GRAVEL PER WSDOT 9-03.19, COMPACTED IN 6" LIFTS.
2. CDF FOR BACKFILL MAY BE REQUIRED BY CITY ENGINEER WHEN PROPER COMPACTION AROUND EXISTING UTILITIES MAY NOT BE POSSIBLE. CDF SHALL BE PER WSDOT 2-09.3(1)E.
3. SEE S-4 FOR PIPE BEDDING DETAILS.

TRENCH WIDTH

PIPE SIZE	PIPE ZONE MAX. TRENCH WIDTH	MAX. TRENCH WIDTH AT SUBGRADE	MAX. RESTORATION WIDTH AT SURFACE
SIDE SEWER	2'-0"	2'-0"	6'-0"
4" OR 6"	2'-2"	3'-0"	8'-0"
8"	2'-4"	4'-0"	8'-0"
10"	2'-6"	4'-0"	8'-0"
12"	2'-8"	4'-6"	8'-6"

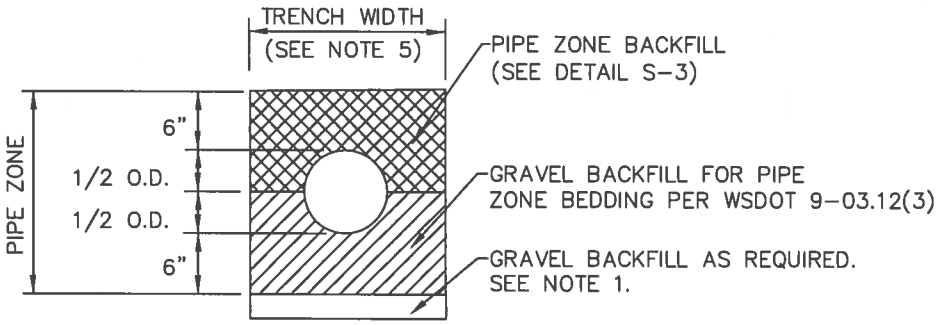
CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

SEWER
TRENCH DETAIL

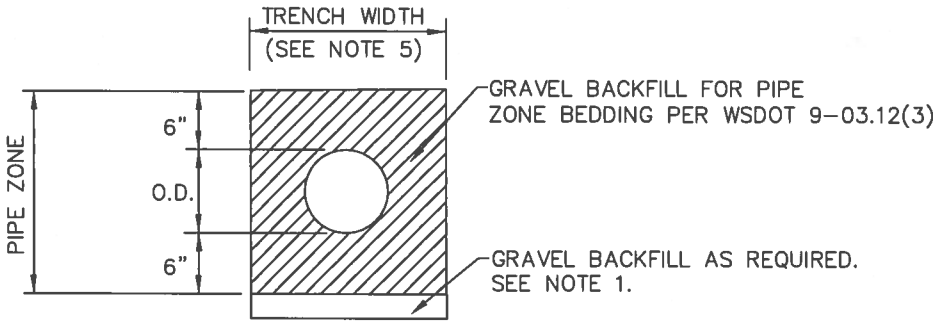
6-5-2009	NO SCALE	**S-3**

REV DATE						APPROVED

BEDDING FOR RIGID PIPE MATERIAL



BEDDING FOR FLEXIBLE PIPE MATERIAL



NOTES

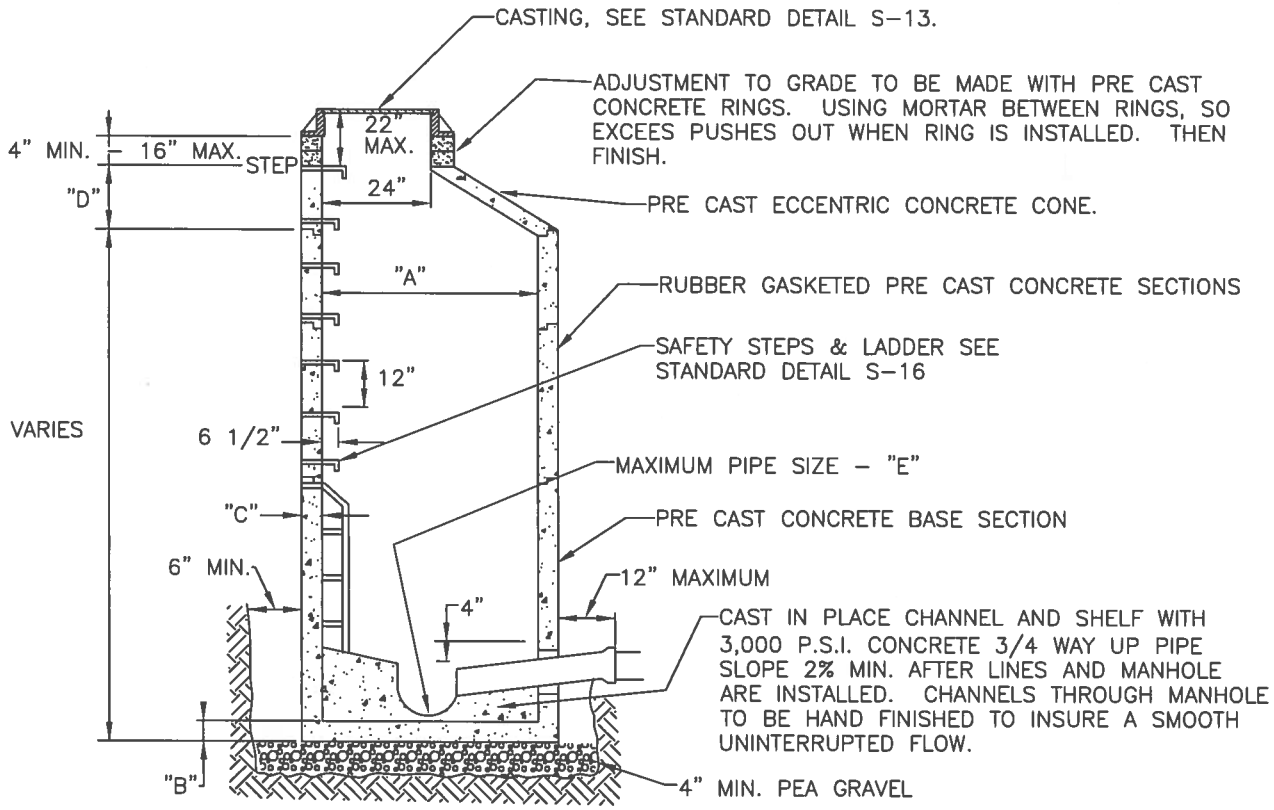
1. EXCAVATE UNSTABLE MATERIAL DOWN TO FIRM SOIL. REPLACE WITH GRAVEL BACKFILL PER WSDOT 9-03.12(3) AS DIRECTED BY THE CITY ENGINEER.
2. PROVIDE UNIFORM SUPPORT UNDER BARREL.
3. HAND TAMP UNDER HAUNCHES.
4. COMPACT BEDDING AND BACKFILL MATERIAL TO 95% MAX. DENSITY EXCEPT DIRECTLY OVER PIPE. HAND TAMP ONLY UNTIL MINIMUM 6" ABOVE TOP OF PIPE.
5. 30" MAXIMUM TRENCH WIDTH FOR PIPE UP TO AND INCLUDING 12", FOR PIPE LARGER THAN 12", USE O.D. PLUS 16".

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

PIPE
BEDDING

6-5-2009	NO SCALE	**S-4**

REV DATE						APPROVED



	"A"	"B"	"C"	"D"	"E"
48" MH	48"	6" MIN.	5" MIN.	24" MIN.	21" I.D.
54" MH	54"	8" MIN.	5.5" MIN.	24" MIN.	24" I.D
60" MH	60"	8" MIN.	6" MIN.	42" MIN.	30" I.D.

NOTES

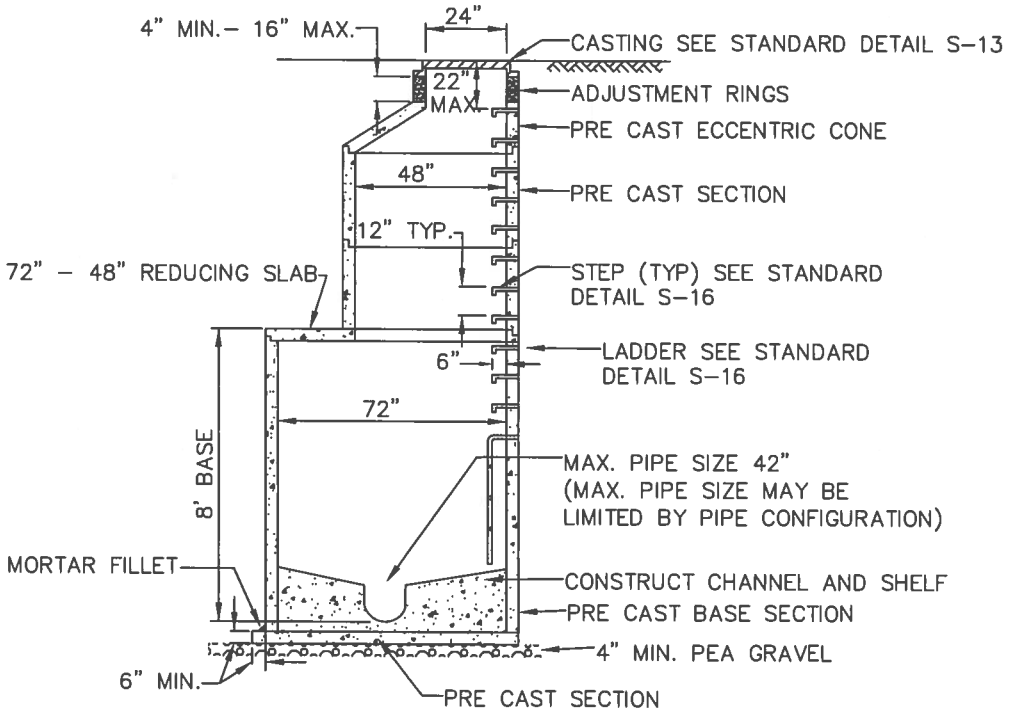
1. PRE CAST SECTIONS SHALL BE REINFORCED PER ASTM SPECS FOR CORRESPONDING SEWER PIPE.
2. SAFETY STEPS, 1" MINIMUM, SEE STANDARD DETAILS S-16. STEPS IN PRE CAST BASE SECTION MAY BE CAST IN PLACE OR MOVABLE SAFETY LADDER GROUTED IN PLACE.
3. ALL HOLES FOR PIPE SHALL BE BLOCKED OUT AT THE TIME OF CASTING THE SECTION.
4. ALL RUBBER GASKETED MANHOLES SHALL BE FURNISHED WITH RUBBER GASKET JOINT CONFORMING ASTM C-443.
5. MINIMUM 2% SLOPE ACROSS MANHOLE.
6. SEE STANDARD DETAIL S-13 FOR MANHOLE FRAME AND COVER.
7. CONNECTION TO MANHOLE WITH PVC PIPE REQUIRES A PVC x CONCRETE ADAPTER.
8. ALL PIPE THROUGH MANHOLE WALL SHALL HAVE A "KOR-N-SEAL" WITH "WEDGE KORBAND" MANUFACTURED BY NPC. INC. OR APPROVED EQUAL.
9. BEDDING AND FOUNDATION MATERIAL REQUIRED AS SHOWN ON DETAIL AND AS NOTED IN THE SPECIFICATIONS.
10. LOCATION OF MANHOLE STEPS SHALL NOT BE OVER FLOW LINES AND SHALL BE APPROVED BY THE CITY ENGINEER.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

TYPE 1 MANHOLE
48" - 60"

7-20-2015	NO SCALE	**S-5**

REV	DATE						APPROVED



72" MANHOLE

NOTES

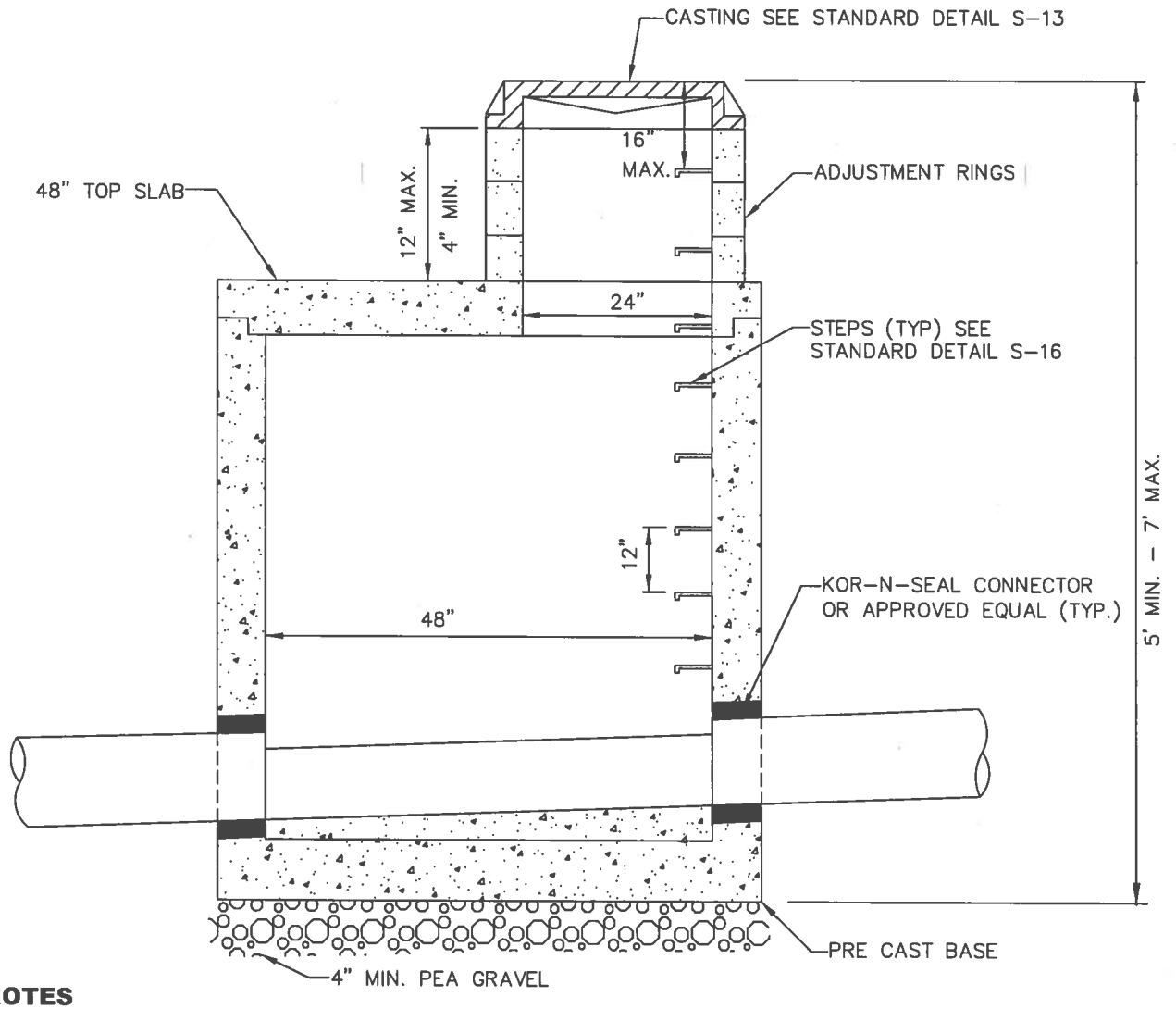
1. PRE CAST SECTIONS SHALL BE REINFORCED PER ASTM SPECS FOR CORRESPONDING SEWER PIPE.
2. SAFETY STEPS, 1" MINIMUM, SEE STANDARD DETAILS S–16. STEPS IN PRE CAST BASE SECTION
3. MAY BE CAST IN PLACE OR MOVABLE SAFETY LADDER GROUTED IN PLACE.
4. ALL HOLES FOR PIPE SHALL BE BLOCKED OUT AT THE TIME OF CASTING THE SECTION.
5. ALL RUBBER GASKETED MANHOLES SHALL BE FURNISHED WITH RUBBER GASKET JOINT CONFORMING
6. ASTM C–443.
7. MINIMUM 2% SLOPE ACROSS MANHOLE.
8. SEE STANDARD DETAIL S–13 FOR MANHOLE FRAME AND COVER.
9. CONNECTION TO MANHOLE WITH PVC PIPE REQUIRES A PVC x CONCRETE ADAPTER.
10. ALL PIPE THROUGH MANHOLE WALL SHALL HAVE A "KOR–N–SEAL" WITH "WEDGE KORBAND"
11. MANUFACTURED BY NPC. INC. OR APPROVED EQUAL.
12. BEDDING AND FOUNDATION MATERIAL
13. REQUIRED AS SHOWN ON DETAIL AND AS
14. NOTED IN THE SPECIFICATIONS.
15. LOCATION OF MANHOLE STEPS SHALL NOT BE
16. OVER FLOW LINES AND SHALL BE APPROVED
17. BY THE CITY ENGINEER.
18. SEE STANDARD DETAIL S–15 FOR THE
19. INSTALLATION OF A MANHOLE OVER AN
20. EXISTING SEWER LINE.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

TYPE II MANHOLE – 72"

6–5–2009	NO SCALE	**S-6**

REV DATE						APPROVED



NOTES

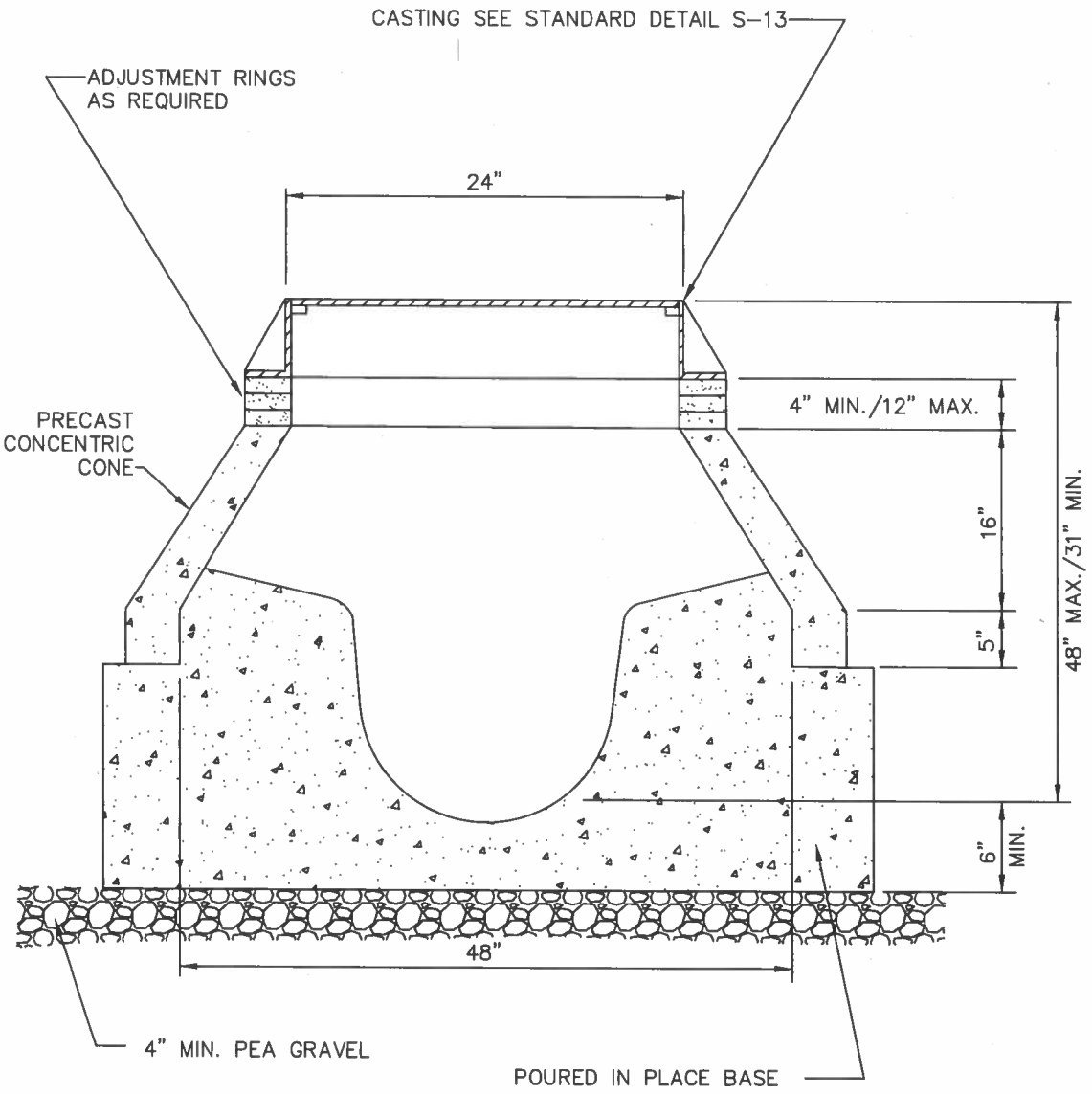
1. PRE CAST SECTIONS SHALL BE REINFORCED PER ASTM SPECS FOR CORRESPONDING SEWER PIPE.
2. SAFETY STEPS, 1" MINIMUM, SEE STANDARD DETAILS S-16. STEPS IN PRE CAST BASE SECTION MAY BE CAST IN PLACE OR MOVABLE SAFETY LADDER GROUTED IN PLACE.
3. ALL HOLES FOR PIPE SHALL BE BLOCKED OUT AT THE TIME OF CASTING THE SECTION.
4. ALL RUBBER GASKETED MANHOLES SHALL BE FURNISHED WITH RUBBER GASKET JOINT CONFORMING ASTM C-443.
5. MINIMUM 2% SLOPE ACROSS MANHOLE.
6. SEE STANDARD DETAIL S-13 FOR MANHOLE FRAME AND COVER.
7. CONNECTION TO MANHOLE WITH PVC PIPE REQUIRES A PVC x CONCRETE ADAPTER.
8. ALL PIPE THROUGH MANHOLE WALL SHALL HAVE A "KOR-N-SEAL" WITH "WEDGE KORBAND" MANUFACTURED BY NPC. INC. OR APPROVED EQUAL.
9. BEDDING AND FOUNDATION MATERIAL REQUIRED AS SHOWN ON DETAIL AND AS NOTED IN THE SPECIFICATIONS.
10. LOCATION OF MANHOLE STEPS SHALL NOT BE OVER FLOW LINES AND SHALL BE APPROVED BY THE CITY ENGINEER.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

48" SHALLOW MANHOLE ASSEMBLY

6-5-2009	NO SCALE	**S-7**

REV DATE						APPROVED



CITY OF MERCER ISLAND

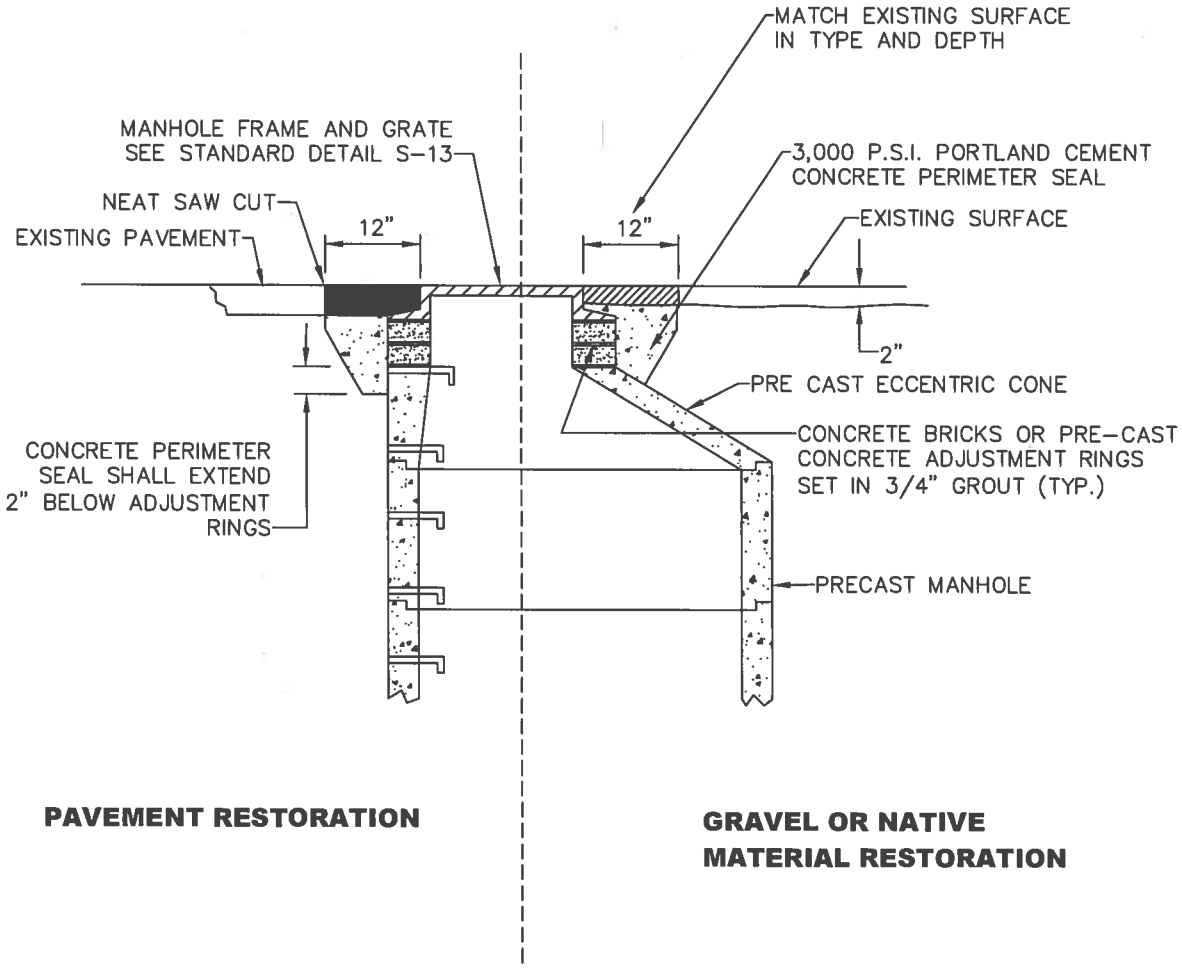
STANDARD DETAILS

SEWER

EXTRA SHALLOW MANHOLE ASSEMBLY

6-5-2009	NO SCALE	**S-8**

REV DATE						APPROVED

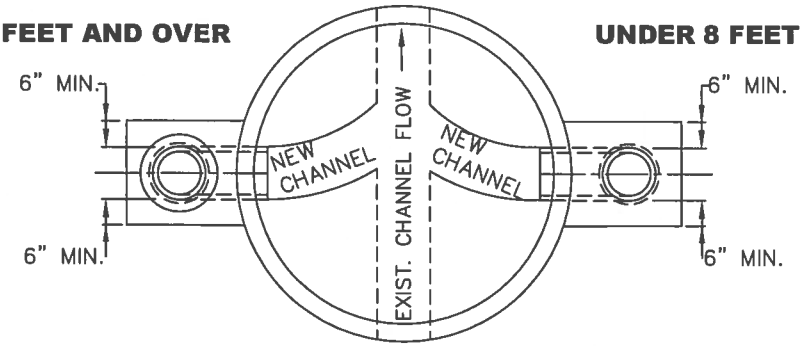


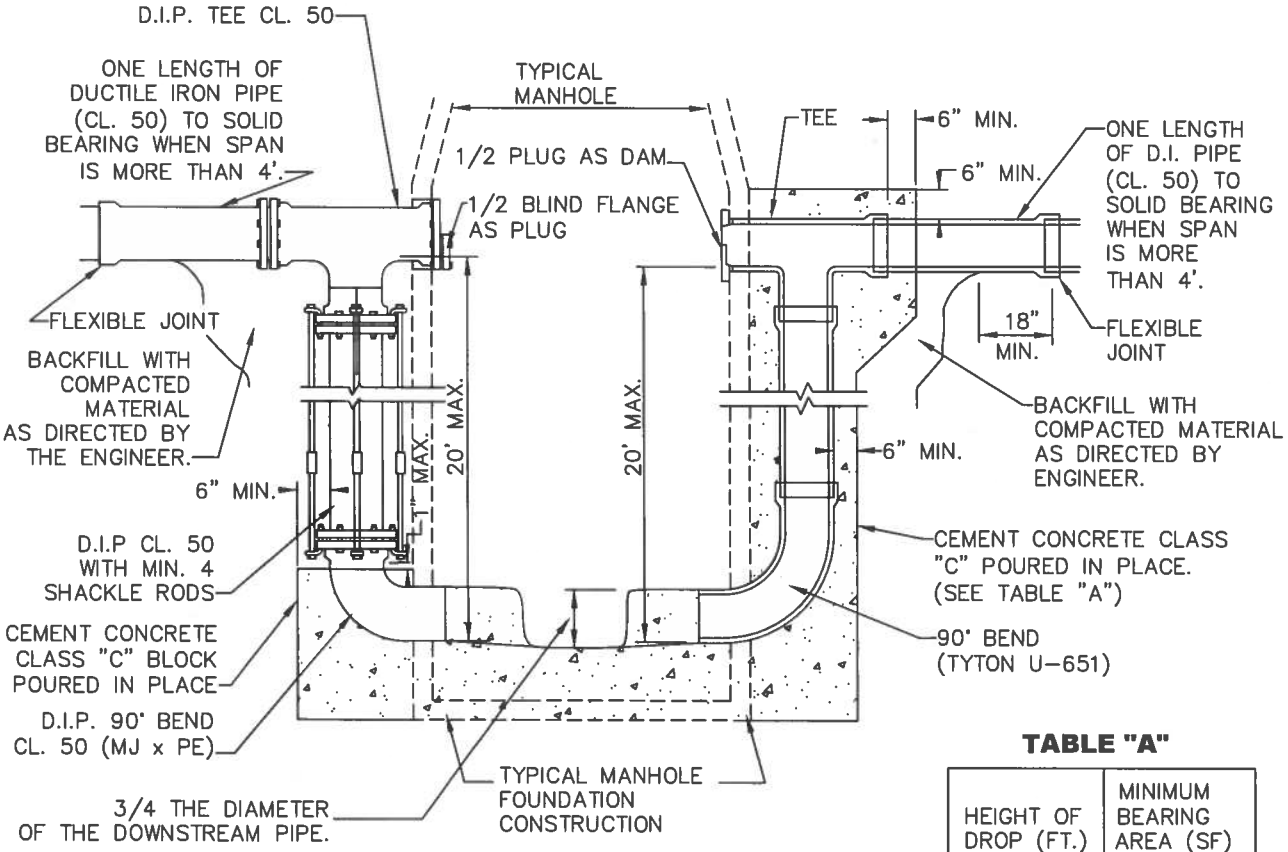
CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

MANHOLE ADJUSTMENT DETAIL

6-5-2009	NO SCALE	**S-9**

REV DATE						APPROVED





DUCTILE IRON DROP CONNECTION

CONCRETE ENCASED DROP CONNECTION

TABLE "A"

HEIGHT OF DROP (FT.)	MINIMUM BEARING AREA (SF)
2.5 – 5	1.0
6 – 10	2.0
11 – 15	2.5
16 – 20	3.0
21 – 25	4.0

BEARING AREA BASED ON 2,000 P.S.I. BEARING LOAD (UP TO 18" DIAMETER PIPE).

NOTES

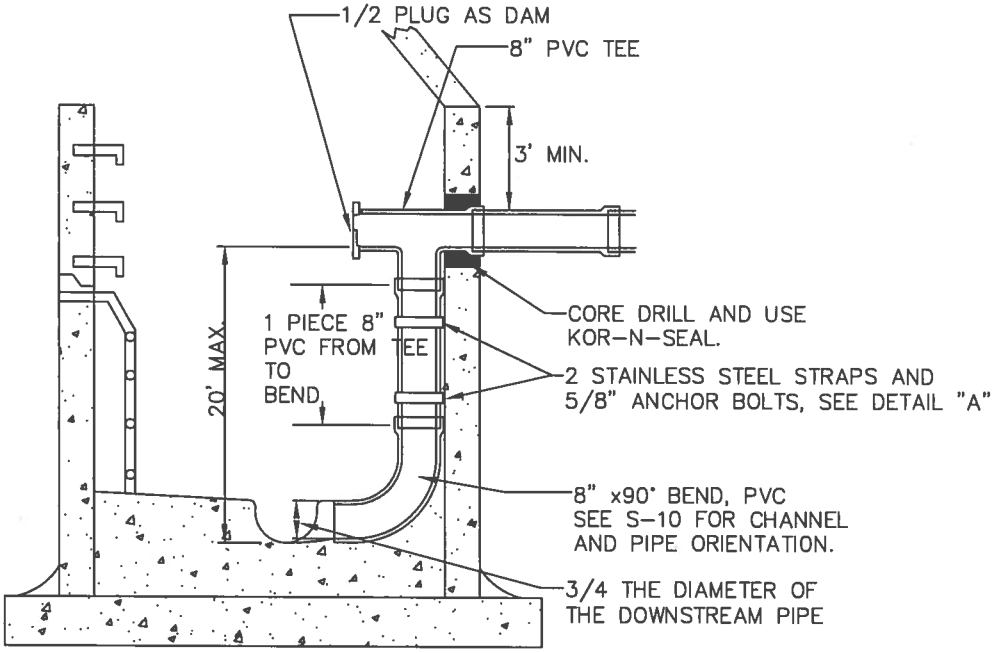
1. ALL DUCTILE IRON PIPE SHALL BE CL. 50.
2. OUTSIDE DROP STRUCTURE SHALL BE INSTALLED ONLY WHERE APPROVED BY THE CITY ENGINEER.
3. DROP TEE TO BE INSTALLED MINIMUM 3' BELOW CONE SECTION.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

OUTSIDE DROP STRUCTURE

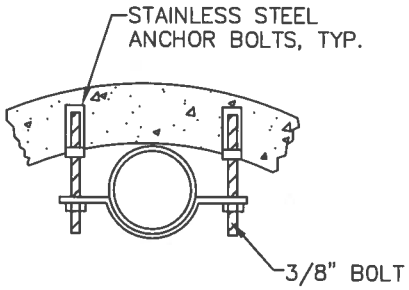
6-5-2009	NO SCALE	**S-10**

REV DATE						APPROVED



NOTES

1. PVC PIPE IS TO BE ASTM 3034 SDR 35, WITH RUBBER GASKET JOINTS.
2. DROP TEE TO BE INSTALLED MINIMUM 3' BELOW CONE SECTION.
3. INSIDE DROP STRUCTURE SHALL BE INSTALLED ONLY WHERE APPROVED BY THE CITY ENGINEER.



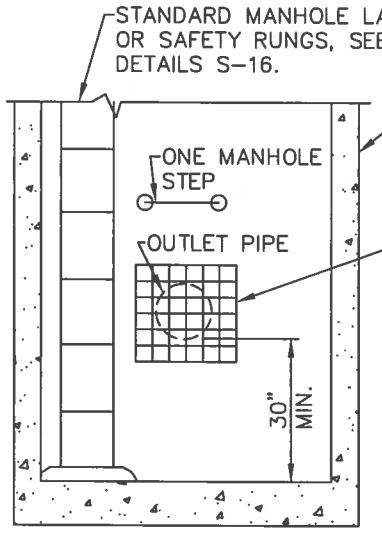
DETAIL "A"

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

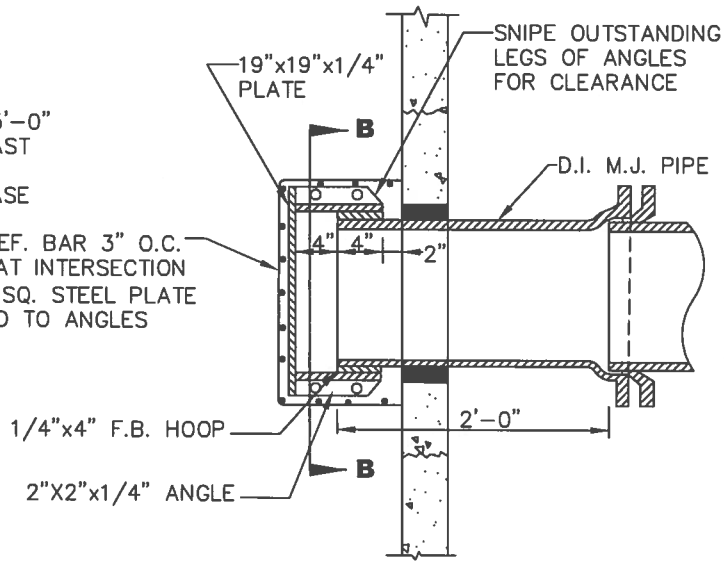
INSIDE
DROP STRUCTURE

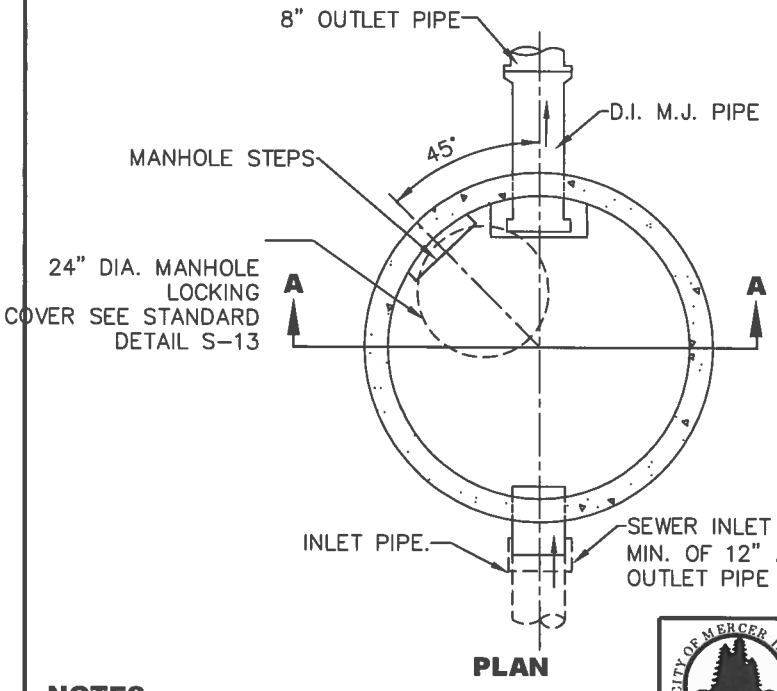
6-5-2009	NO SCALE	**S-11**

REV DATE						APPROVED

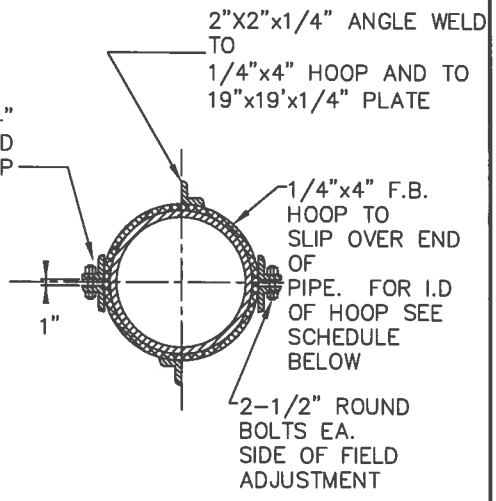


SECTION A-A





PLAN



SECTION B-B

I.D. PIPE	I.D. HOOP
8"	9 1/16"
10"	11 1/8"
12"	13 1/4"

NOTES

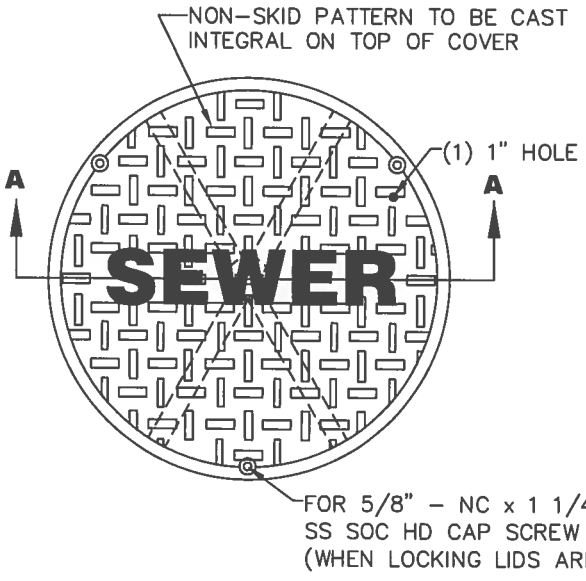
1. COMPLETE ASSEMBLY TO BE GALVANIZED.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

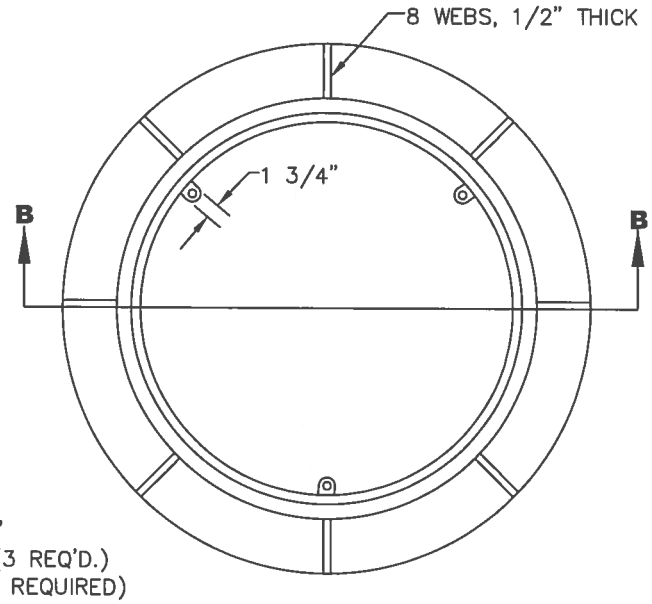
CATCHMENT MANHOLE DETAIL

6-5-2009	NO SCALE	**S-12**

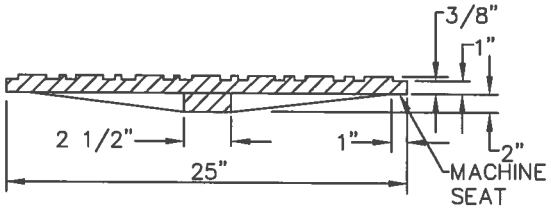
REV DATE								APPROVED



MANHOLE COVER PLAN

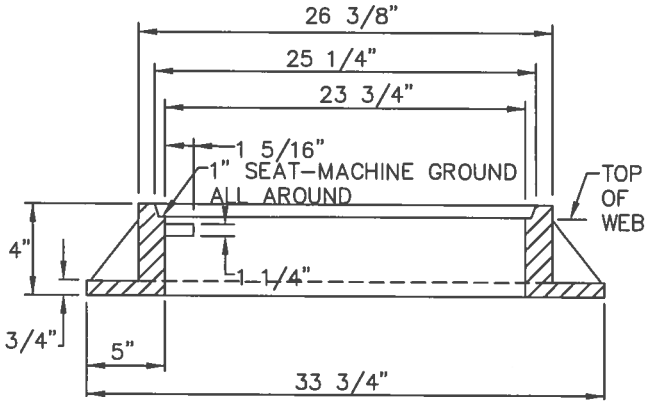


FRAME PLAN



SECTION A-A

CAST IRON–LOCKING COVER
MINIMUM WEIGHT 150 LBS.



SECTION B-B

CAST IRON FRAME
MINIMUM WEIGHT: 150 LBS

NOTES

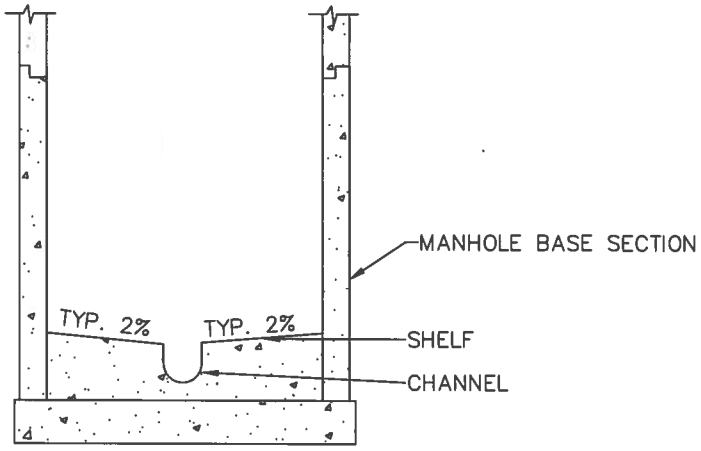
1. COVER SHALL HAVE THE WORD "SEWER" IN 2" RAISED LETTERS.
2. MANHOLE FRAME AND COVER 24" ROUND SHALL BE OLYMPIC FOUNDRY #MH30D/T.
3. WHEN LOCKING LIDS ARE REQUIRED, PROVIDE WRENCH FOR CAP SCREW TO CITY AS REQUIRED.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

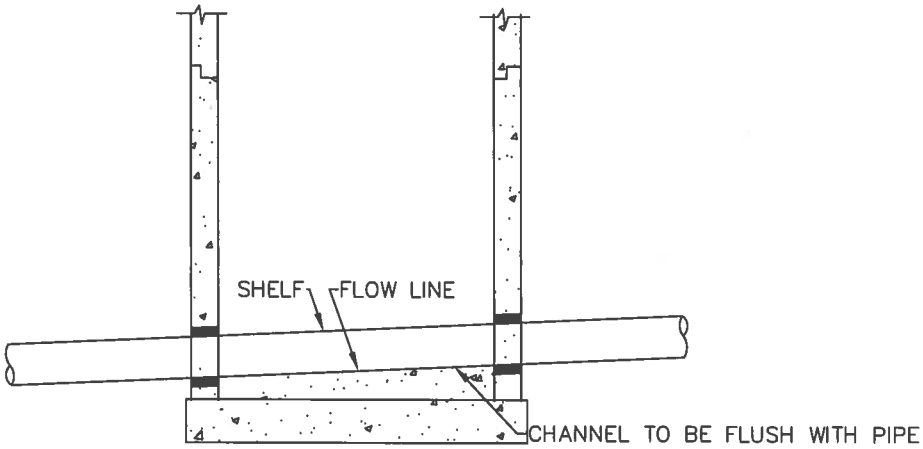
24" MANHOLE FRAME WITH COVER

6-5-2009	NO SCALE	**S-13**

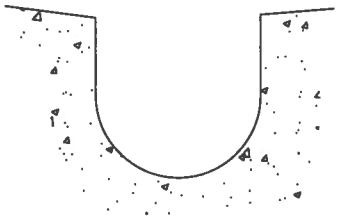
REV DATE						APPROVED



CROSS SECTION



PROFILE



CHANNEL DETAIL

NOTES

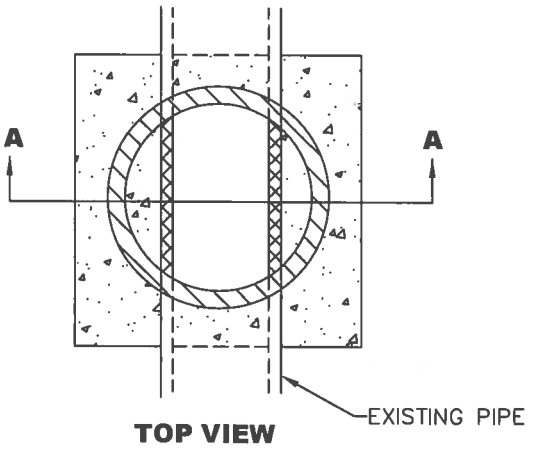
1. MIN. 0.1' DROP ACROSS CHANNEL MAX. 1.0' DROP ACROSS CHANNEL.
2. DEPTH OF CHANNEL MUST BE SAME AS PIPE DIAMETER.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

SEWER MANHOLE
MAIN CHANNEL AND SHELF

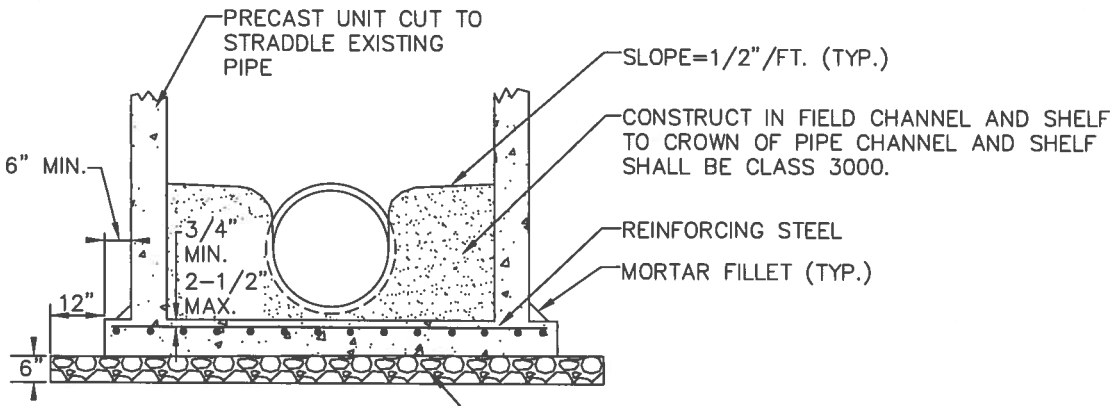
6-5-2009	NO SCALE	**S-14**

REV DATE						APPROVED



TOP VIEW

MANHOLE DIMENSION TABLE			
INSIDE DIAMETER	WALL THICKNESS	BASE THICKNESS	MAXIMUM HOLE SIZE
48"	4"	6"	36"
54"	4 1/2"	8"	42"
60"	5"	8"	48"
72"	6"	8"	48"
84"	8"	12"	48"
96"	8"	12"	48"
108"	10"	12"	48"
120"	11"	12"	48"



SEPARATE CAST IN PLACE BASE

NOTES

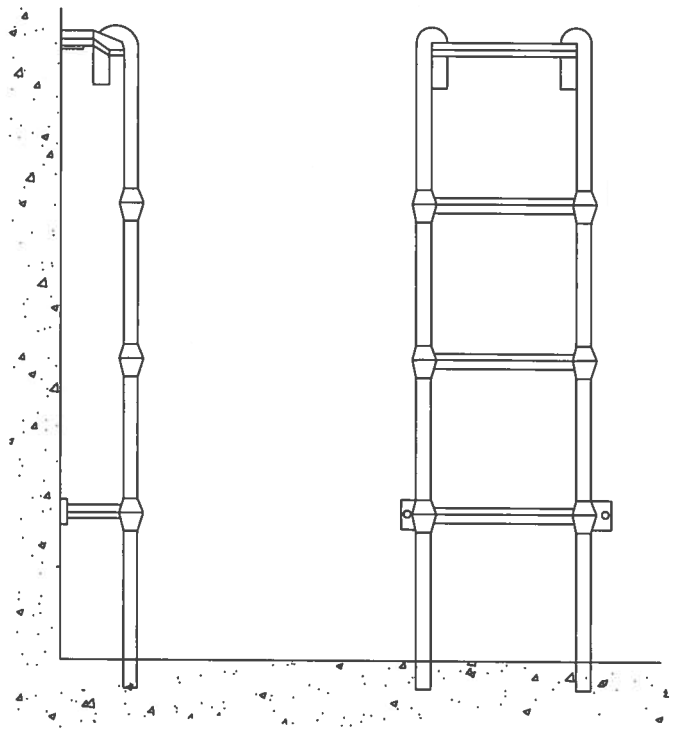
1. EXISTING PIPE SHALL BE SUPPORTED AT ALL TIMES.
2. NO WEIGHT OF THE PRECAST UNIT SHALL BEAR ON THE EXISTING PIPE.
3. CONCRETE FOR CAST-IN-PLACE BASE SHALL BE CLASS 4000.
4. PRECAST MANHOLE SECTION SHALL BE INSTALLED IN ACCORDANCE WITH THE STANDARD PLAN FOR THE SPECIFIED MANHOLE SIZE AND TYPE.
5. MANHOLE SECTIONS SHALL NOT BE INSTALLED UNTIL CONCRETE BASE HAS SET FOR 12 HOURS.
6. THE EXISTING MAIN SHALL BE LEFT IN PLACE AND THE TOP PORTION OF THE MAIN SHALL BE REMOVED. THE BOTTOM PORTION OF THE MAIN SHALL BE TIED IN AS THE CHANNEL OF THE NEW MANHOLE.
7. GROUT ALL OPENINGS TO ENSURE WATER TIGHT STRUCTURE.
8. A FLEXIBLE PIPE-TO-MANHOLE CONNECTOR SHALL BE EMPLOYED IN ALL CONNECTIONS OF RIGID AND FLEXIBLE PIPES TO NEW PRECAST CONCRETE MANHOLES. THE CONNECTOR SHALL BE "KOR-N-SEAL" WITH "WEDGE KORBAND" MANUFACTURED BY NPC. INC., OR APPROVED EQUAL.
9. BASE REINFORCING STEEL SHALL BE PER MANUFACTURER'S RECOMMENDATION.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

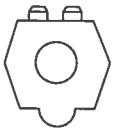
NEW MANHOLE OVER AN EXISTING SEWER LINE

6-5-2009	NO SCALE	**S-15**

REV DATE						APPROVED

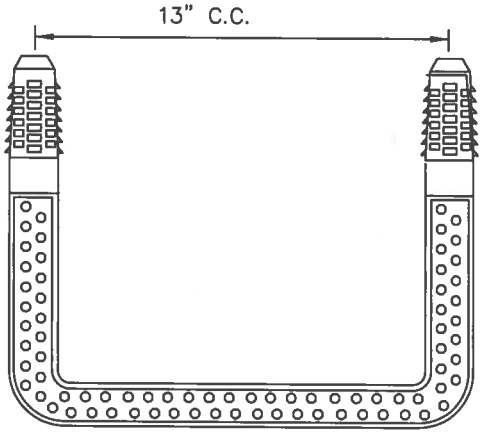


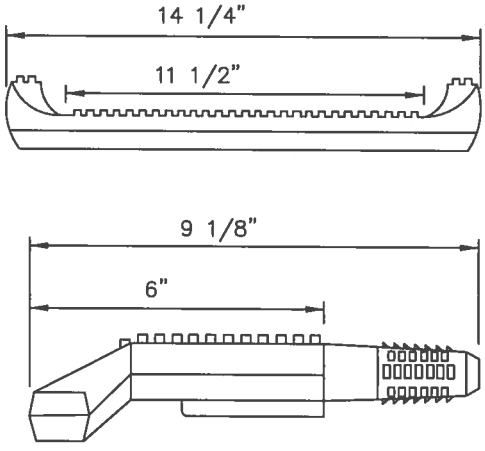
RAIL
9/16" ROUND BAR



RUNG
1/2" GRADE 60

POLYPROPYLENE HANGING LADDER





SAFETY STEPS

NOTES

1. ALL STEPS SHALL MEET THE REQUIREMENTS OF ASTM C-478, AASHTO M-199, WISHA AND ALL OSHA SPECIFICATIONS. THE POLYPROPYLENE CONFORM TO ASTM D-4101. THE 1/2" GRADE 60 DEFORMED REINFORCING BAR MEETS ASTM-A-615. 9/16" COLD DRAWN BAR MEET ASTM C-1018.

2. THE STEPS MAY BE INSTALLED IN THE FOLLOWING MANNER.
   A. CAST IN PLACE.
   B. DRIVEN INTO PREFORMED HOLES WITH CONCRETE CURED TO 3,000 P.S.I. MINIMUM.
   C. DRIVEN INTO PARALLEL 1" DIAMETER HOLES DRILLED 13" ON CENTER, 3 1/2" DEEP.
   D. DRILL TWO 1 1/8" OR 1 1/4" HOLES 3 1/2" DEEP. APPLY EPOXY IN THE HOLE AND AROUND THE BARDS OF THE STEP. PUSH THE STEP INTO THE HOLES ALLOWING THE EPOXY TO FLOW OUT TO THE SQUARE SHOULDER OF THE STEP.

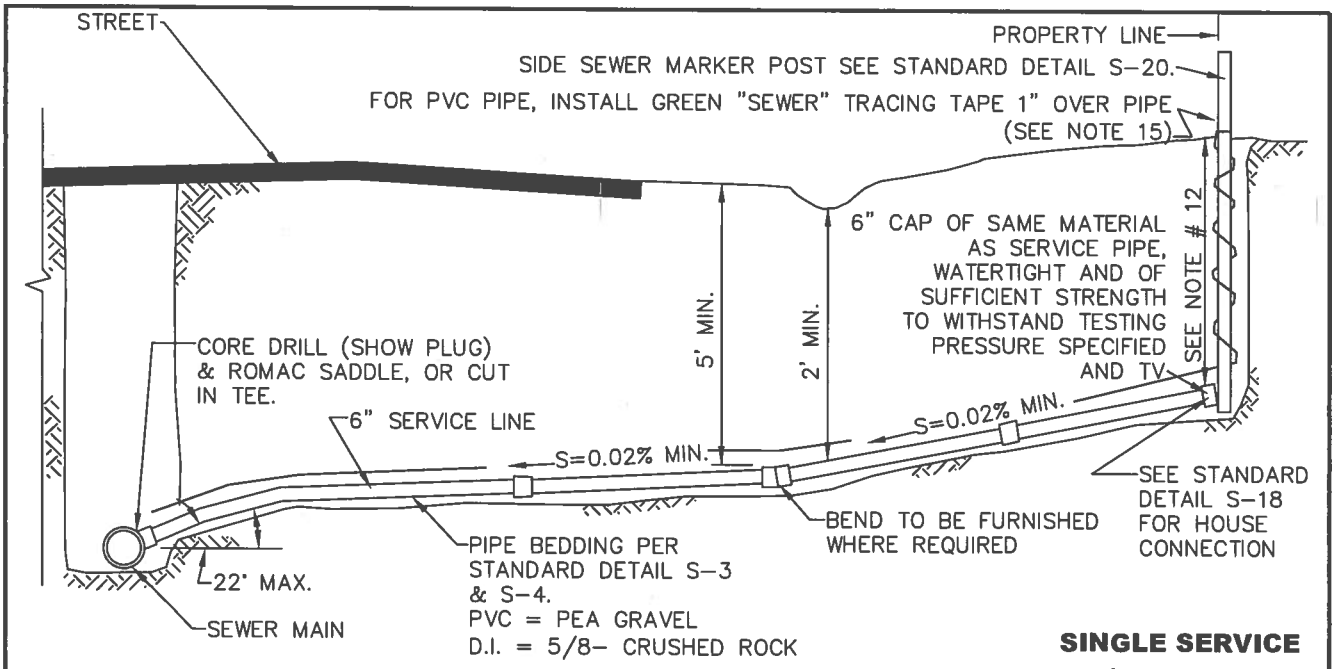
   ANY OF THE ABOVE METHODS SHALL RESIST A PULLOUT FORCE OF OVER 1,000 LBS.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

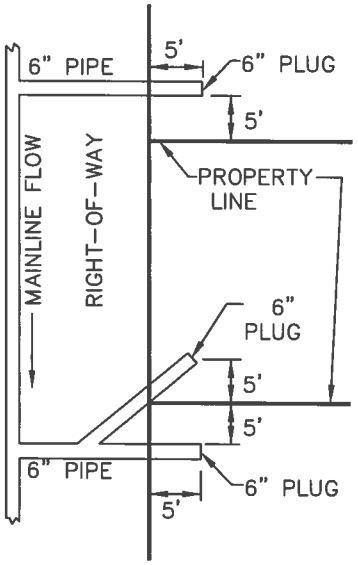
POLYPROPYLENE LADDER AND MANHOLE STEPS

6-5-2009	NO SCALE	**S-16**

REV DATE						APPROVED



SINGLE SERVICE



DOUBLE SERVICE

NOTES

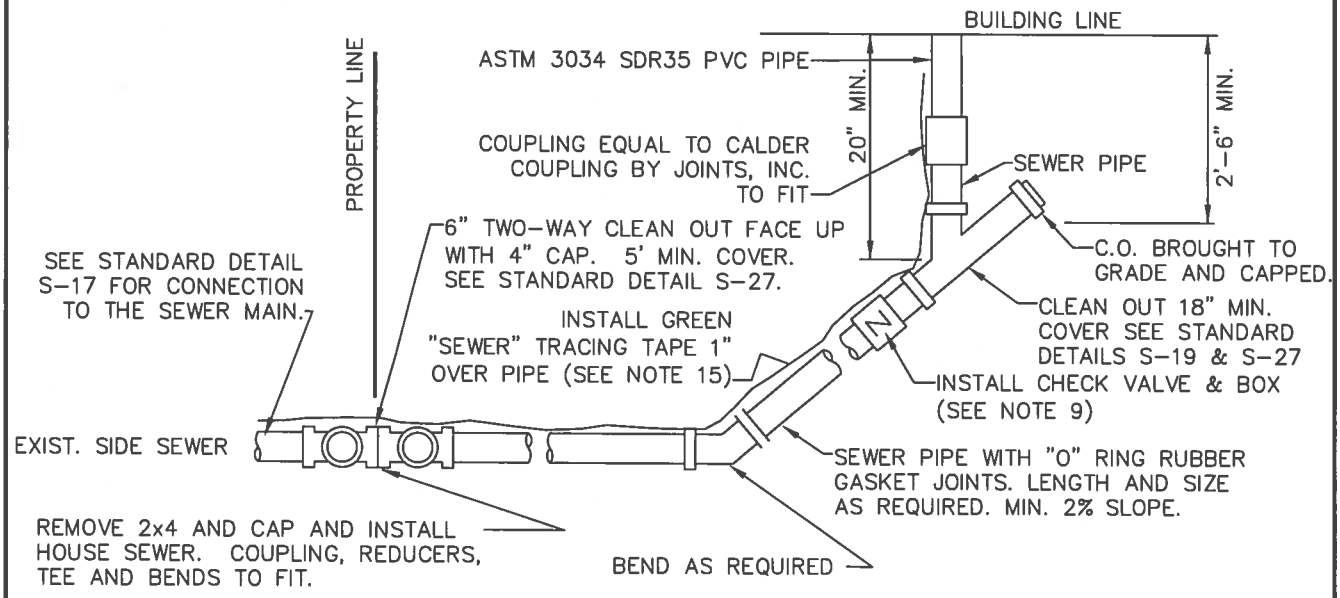
1. ELBOWS SHALL NOT BE GREATER THAN 45 DEGREES.
2. CLEAN OUT IS REQUIRED FOR EACH PIPE LENGTH GREATER THAN 100' AND FOR EACH 90° ACCUMULATED ELBOW/100'.
3. RIGHT-OF-WAY RESTORATION SHALL MATCH OR EXCEED THE ORIGINAL CONDITION AND BE IN ACCORDANCE WITH CITY STANDARDS.
4. ALL TRENCH BACKFILL IN PUBLIC RIGHT-OF-WAY OR ROADWAY AREAS SHALL BE CRUSHED SURFACING PER WSDOT 9-09.9(3) OR BANK RUN GRAVEL PER WSDOT 9-03.19, COMPACTED IN 6" LIFTS OR MAY BE CDF WHEN DIRECTED BY THE CITY ENGINEER (SEE DETAIL S-3).
5. LAY PIPE IN STRAIGHT LINE BETWEEN BENDS. MAKE ALL CHANGES IN GRADE OR LINE WITH 1/8 BEND OR WYE. 90° CHANGE WITH 1/8 BEND AND WYE.
6. 6" SEWER PIPE MINIMUM SIZE IN RIGHT-OF-WAY, AND ELSEWHERE AS DIRECTED BY ENGINEER. 2% MIN. GRADE (UNLESS DIRECTED BY ENGINEER), 50% MAXIMUM.
7. ALL A.C. MAINS TO BE TAPPED IN ACCORDANCE WITH WAC 296-62-00775 STATE/FEDERAL GUIDELINES AND CERTIFICATION.
8. CONSTRUCTION IN RIGHT-OF-WAY MUST BE DONE BY A REGISTERED AND LICENSED CONTRACTOR.
9. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH CURRENT CITY SEWER ORDINANCES.
10. WHERE CITY ENGINEER ALLOWS SIDE SEWER CONNECTIONS TO MANHOLE, INVERT OF SIDE SEWER SHALL BE EQUAL TO OR ABOVE MAIN SEWER CROWN, BUT NOT TO EXCEED 18" ABOVE INVERT OF MAIN SEWER.
11. UNLESS OTHERWISE INDICATED ON PLAN, SIDE SEWER SHALL BE MIN. OF 6' DEEP AT PROPERTY LINE, OR 5' LOWER THAN THE LOWEST ELEVATION, WHICH EVER IS LOWER.
12. ALL PIPE MATERIALS NOT TO STANDARDS WILL BE ABANDONED AND REPLACED WITH DUCTILE IRON OR PVC PIPE OF THE SAME SIZE.
13. IF A BUILDING SEWER IS TO SERVE MORE THAN ONE PROPERTY, BY JOINT AGREEMENT OF THE OWNERS, AN APPROVED EASEMENT INSURING THAT ALL PROPERTIES INVOLVED SHALL HAVE PERPETUAL USE OF THE SIDE SEWER, HAVING PROVISIONS FOR OPERATION, MAINTENANCE, RECONSTRUCTION AND FOR ACCESS FOR REPAIR PURPOSES, SHALL BE SIGNED BY THE OWNERS. THIS EASEMENT SHALL BE RECORDED WITH THE COUNTY AUDITOR. A SIX INCH (MINIMUM) DIAMETER PIPE SHALL BE USED FOR THE COMMON LINE AND A SIX INCH CLEANOUT EXTENDING TO WITHIN 12 INCHES OF THE GROUND SURFACE SHALL BE PROVIDED AT THE WYE WHERE THE UPPER GRADE CONNECTIONS ARE MADE. BACKWATER VALVES SHALL BE INSTALLED ON SERVICE LINES UPSTREAM OF THE CONNECTION TO THE SHARED SIDE SEWER.
14. THE CITY ENGINEER MAY REQUIRE BACKWATER VALVES ON SIDE SEWERS WHEN DEEMED NECESSARY. THE EFFECTIVE OPERATION AND MAINTENANCE OF ANY BACKWATER VALVE SHALL BE THE RESPONSIBILITY OF THE OWNER OF THE SIDE SEWER.
15. UTILITY PIPE TRACER TAPE SHALL BE DETECTABLE BELOW GROUND SURFACE, COLOR CODED, WITH UTILITY NAME PRINTED ON TAPE. CONDUCTIVE WARNING TAPE REQUIRED OVER ALL WATER PIPE. TAPE SHALL BE MANUFACTURER'S STANDARD PERMANENT, BRIGHT-COLORED, CONTINUOUS PRINTED PLASTIC TAPE, ALUMINUM BACKED, INTENDED FOR DIRECT-BURIAL SERVICE. TAPE SHALL BE NOT LESS THAN 6" WIDE X 4 MILS THICK.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

SIDE SEWER CONNECTION AND STUB

6-5-2009	NO SCALE	**S-17**

REV DATE						APPROVED



BUILDING CONNECTION

NOTES

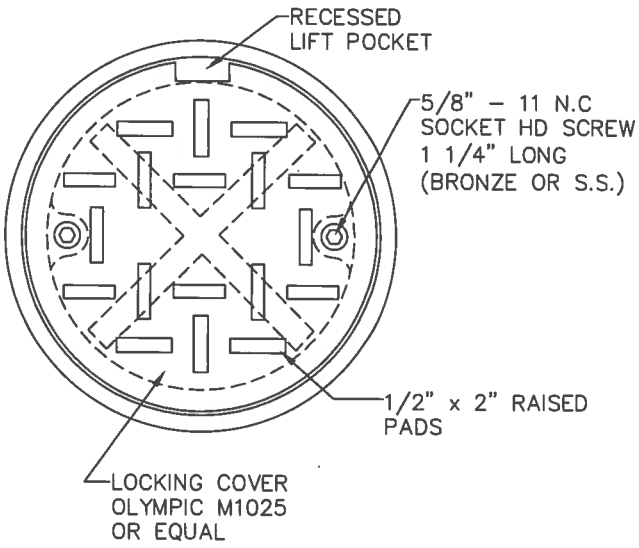
1. ELBOWS SHALL NOT BE GREATER THAN 45 DEGREES.
2. CLEAN OUT IS REQUIRED FOR EACH PIPE LENGTH GREATER THAN 100' AND FOR EACH 90° ACCUMULATED ELBOW/100'.
3. ALL HOUSE PLUMBING OUTLETS MUST BE CONNECTED TO THE SEWER. NO DOWN SPOUTS OR STORM DRAINAGE MAY BE CONNECTED TO THE SEWER SYSTEM.
4. 18" MINIMUM COVERAGE OVER PIPE.
5. LAY PIPE IN STRAIGHT LINE BETWEEN BENDS. MAKE ALL CHANGES IN GRADE OR LINE WITH $\frac{1}{8}$ BEND OR WYE. 90° CHANGE WITH 1/8 BEND AND WYE.
6. 4" SEWER PIPE MINIMUM SIZE ON PROPERTY. 2% MINIMUM GRADE.
7. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH CURRENT SEWER ORDINANCES.
8. ALL CONSTRUCTION REQUIRES A PLAN SHOWING PROPERTY AND DIMENSIONS AND COMPLETION OF SIDE SEWER APPLICATION AND MAINTENANCE AGREEMENT, AS NEEDED.
9. BACK WATER VALVE (CHECK VALVE) IS REQUIRED:
   A. IF CONNECTED TO A SHARED SIDE SEWER.
   B. IF CONNECTION AT HOUSE IS LOWER THAN BOTH UPSTREAM AND DOWNSTREAM MANHOLE.
   C. SEE S-23 & S-24 FOR LAKE LINE REQUIREMENTS.
10. AS-BUILT DRAWING SHOWING LOCATION OF SIDE SEWER & ALL BENDS, C.O. ETC., IN RELATION TO THE HOUSE IS REQUIRED AFTER INSPECTION & INSTALLATION. SEE STANDARD DETAIL S-38 FOR A TYPICAL "AS BUILT".
11. THE MINIMUM PIPE SIZE FOR SIDE SEWERS SHALL BE:
    6" – WITHIN THE PUBLIC RIGHT-OF-WAY.
    4" – SINGLE FAMILY RESIDENCES.
    6" – 2 TO 6 SINGLE FAMILY RESIDENCES.
    6" – BUILDINGS OTHER THAN SINGLE FAMILY RESIDENCES.
12. UTILITY PIPE TRACER TAPE SHALL BE DETECTABLE BELOW GROUND SURFACE, COLOR CODED, WITH UTILITY NAME PRINTED ON TAPE. CONDUCTIVE WARNING TAPE REQUIRED OVER ALL WATER PIPE. TAPE SHALL BE MANUFACTURER'S STANDARD PERMANENT, BRIGHT-COLORED, CONTINUOUS PRINTED PLASTIC TAPE, ALUMINUM BACKED, INTENDED FOR DIRECT-BURIAL SERVICE. TAPE SHALL BE NOT LESS THAN 6" WIDE X 4 MILS THICK.

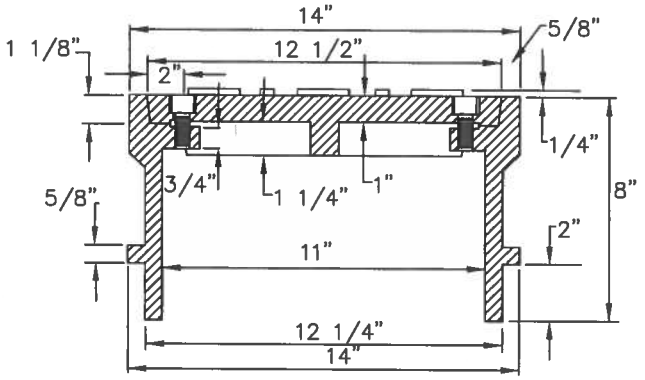
CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

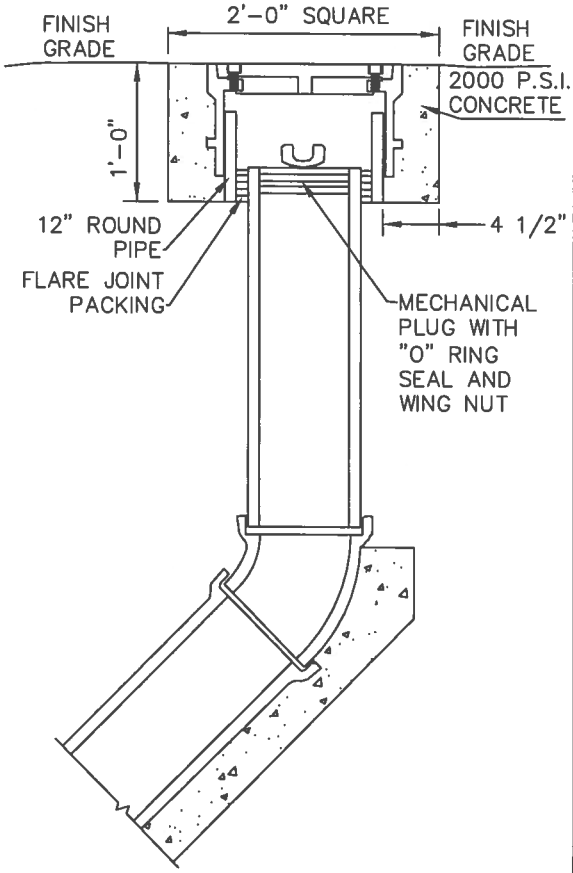
HOUSE SEWER CONNECTION

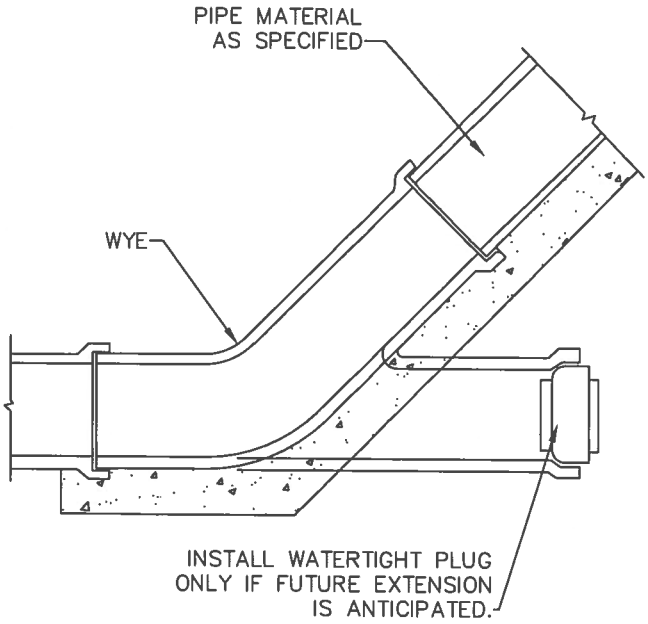
6-5-2009	NO SCALE	**S-18**

REV DATE						APPROVED









FOR PVC PIPE

NOTES

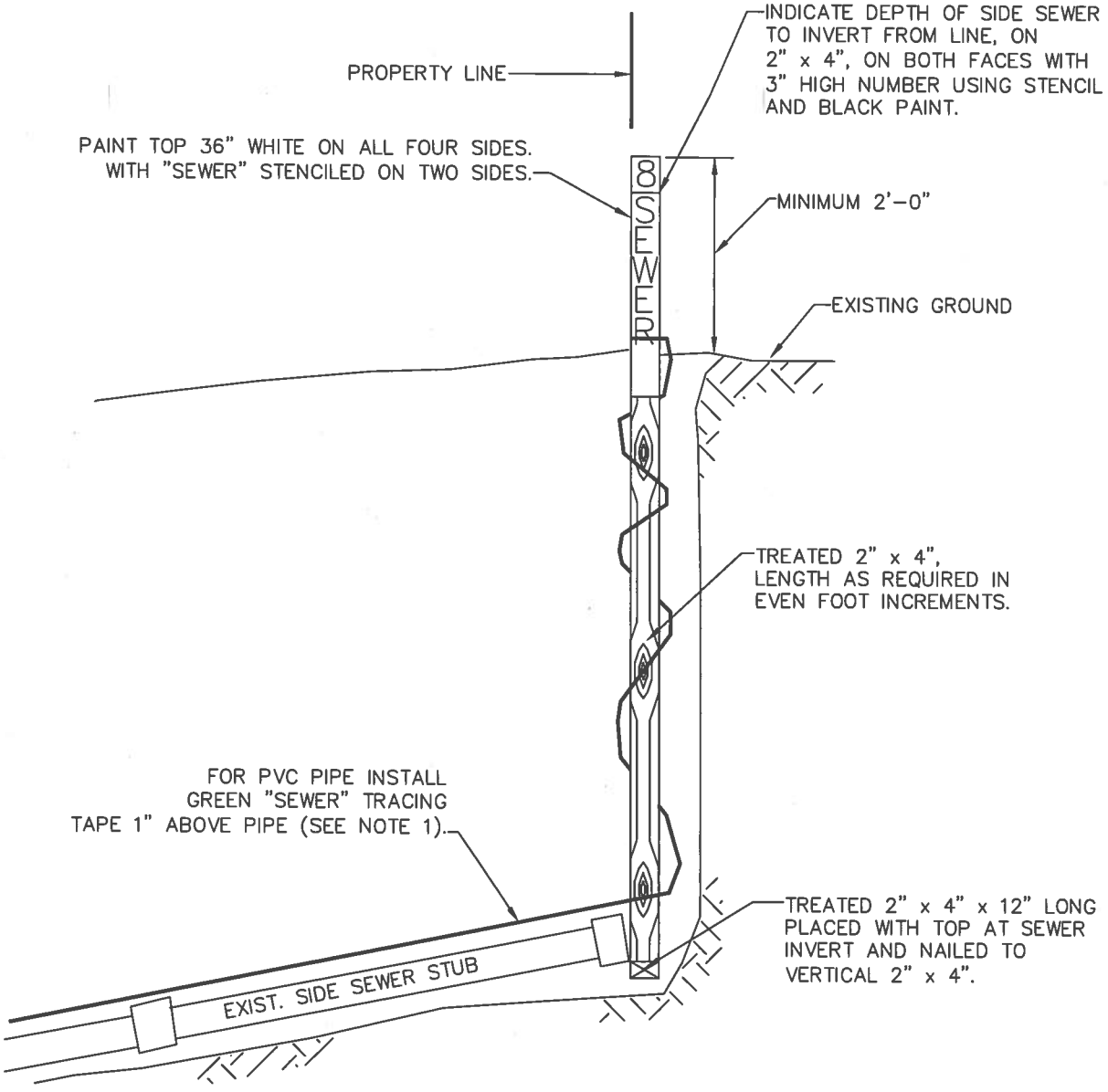
1. SEE S–27 FOR INSTALLATION DETAILS.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

CLEAN OUT DETAIL

6–5–2009	NO SCALE	**S-19**

REV DATE						APPROVED



NOTES

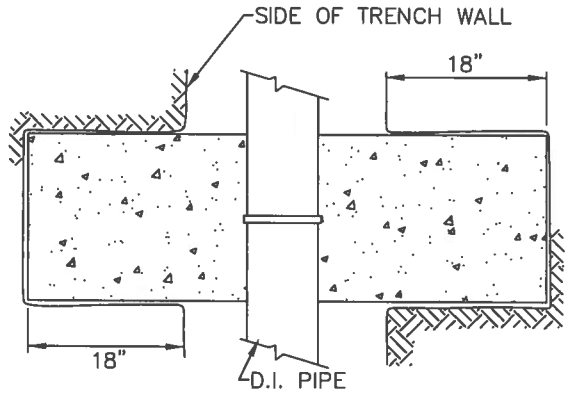
1. UTILITY PIPE TRACER TAPE SHALL BE DETECTABLE BELOW GROUND SURFACE, COLOR CODED, WITH UTILITY NAME PRINTED ON TAPE. CONDUCTIVE WARNING TAPE REQUIRED OVER ALL WATER PIPE. TAPE SHALL BE MANUFACTURER'S STANDARD PERMANENT, BRIGHT-COLORED, CONTINUOUS PRINTED PLASTIC TAPE, ALUMINUM BACKED, INTENDED FOR DIRECT-BURIAL SERVICE. TAPE SHALL BE NOT LESS THAN 6" WIDE X 4 MILS THICK.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

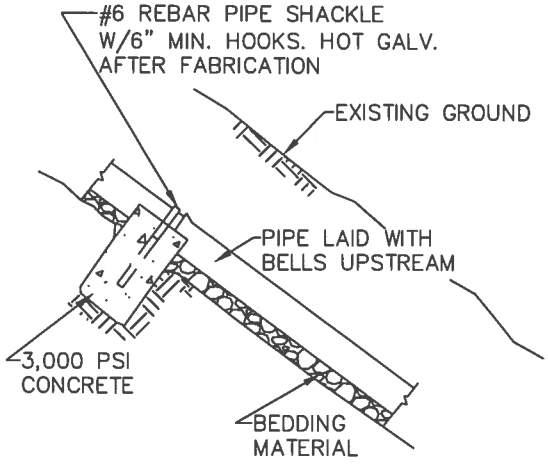
SIDE SEWER MARKER POST

6-5-2009	NO SCALE	**S-20**

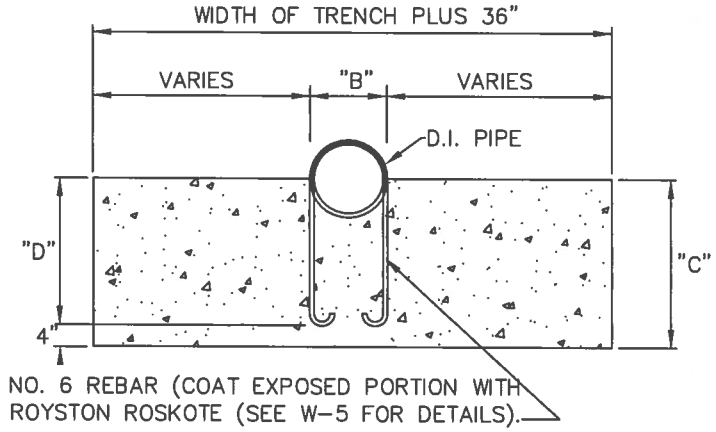
REV DATE						APPROVED



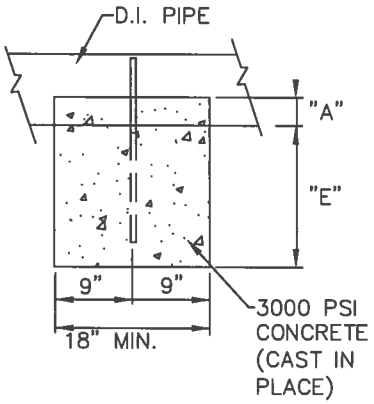
PLAN



PROFILE



ELEVATION



SECTION

PIPE SIZE	DIMENSIONS INCHES				
	A	B	C	D	E
4"	2.4	4.8	17	13	14.6
6"	3.5	6.9	18	14	14.5
8"	4.5	9.1	19	15	14.5
10"	5.6	11.1	20	16	14.4
12"	6.6	13.2	21	17	14.4
14"	7.7	15.3	22	18	14.3
16"	8.7	17.4	23	19	14.3
18"	9.8	19.5	24	20	14.2

NOTES

1. PIPE ANCHORS TO BE USED ONLY AS APPROVED BY THE ENGINEER.
2. CONCRETE SHALL HAVE A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 3000 P.S.I.
3. TIE ROD ASSEMBLIES SHALL BE COATED WITH ROYSTON ROSKOTE #612SM OR APPROVED EQUAL.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

PIPE ANCHOR DETAIL

6-5-2009	NO SCALE	**S-21**

REV DATE						APPROVED

DISCONNECTION

WHEN DEMOLISHING AN EXISTING BUILDING, THE BUILDING SIDE SEWER SHALL BE DISCONNECTED PRIOR TO REMOVAL OF BUILDING FOUNDATIONS. THE CONTRACTOR SHALL INSTALL A MECHANICAL PLUG WITH NON-SHRINK GROUT AT THE END OF THE SIDE SEWER TO REMAIN IN PLACE. DISCONNECTION'S SHALL BE PERFORMED IN THE PRESENCE OF THE CITY'S UTILITY INSPECTOR. THE CONTRACTOR SHALL PROVIDE AN AS-BUILT DRAWING DEPICTING THE DISCONNECTED SIDE SEWER UPON COMPLETION OF THE WORK.

RECONNECTION

WHEN RECONNECTING TO AN EXISTING SIDE SEWER, THE POINT OF RECONNECTION WILL BE DETERMINED BASED ON THE MAGNITUDE OF THE CONSTRUCTION ON THE PROPERTY.

1. PARTIAL INTERIOR REMODEL AND/OR BUILDING ADDITION – NO SIDE SEWER REPLACEMENT REQUIRED UNLESS A KNOWN PROBLEM EXISTS IN THE SIDE SEWER.

2. COMPLETE INTERIOR REMODEL OF RESIDENCE – ASSESS CONDITION OF EXISTING SIDE SEWER THROUGH VIDEO INSPECTION FROM BUILDING TO PROPERTY LINE AND REPLACE AS NEEDED. IF EXISTING SIDE SEWER IS ASBESTOS CEMENT OR CONCRETE, SIDE SEWER SHALL BE REPLACED FROM BUILDING TO PROPERTY LINE, UNLESS THE APPLICANT PROVES, TO THE SATISFACTION OF THE CITY ENGINEER, THAT THE SIDE SEWER IS WATER TIGHT AND IN SOUND CONDITION.*

3. COMPLETE INTERIOR REMODEL AND BUILDING ADDITION – NEW SIDE SEWER FROM BUILDING TO PROPERTY LINE.*

4. CONSTRUCTION OF A NEW SINGLE FAMILY RESIDENCE – NEW SIDE SEWER FROM BUILDING TO PROPERTY LINE.*

5. BACK WATER VALVE INSTALLATION PER CITY ENGINEER, IF SCENARIO 2, 3 OR 4 IS DIRECTLY ATTACHED TO THE LAKE LINE.

VIDEO INSPECTION OF THE EXISTING SIDE SEWER, BETWEEN THE PROPERTY LINE AND THE SEWER MAIN SHALL BE PERFORMED FOR SCENARIOS NUMBER 3 AND 4.

PROVIDE A COPY OF THE VIDEO DOCUMENTATION TO THE CITY ENGINEER.

REPLACEMENT OR REPAIR OF THAT PORTION OF THE SIDE SEWER BETWEEN THE PROPERTY LINE AND THE SEWER MAIN, WILL BE DETERMINED BY THE CITY ENGINEER, BASED ON THE VIDEO INSPECTION.

*IF THE EXISTING SIDE SEWER IS PVC AND IS LESS THAN TEN YEARS OLD, THE SIDE SEWER DOES NOT HAVE TO BE REPLACED IF A VIDEO INSPECTION AND HYDROSTATIC PRESSURE TEST CONFIRMS THAT THE SIDE SEWER IS IN PROPER WORKING CONDITION. THESE TESTS SHALL BE PERFORMED AFTER ALL HEAVY EQUIPMENT THAT COULD DAMAGE THE SIDE SEWER IS OFF OF THE SITE.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

RESIDENTIAL SIDE SEWER
DISCONNECTION & RECONNECTION

6-5-2009	NO SCALE	**S-22**

REV DATE						APPROVED

DISCONNECTION

WHEN ABANDONING A SIDE SEWER IT SHALL BE DISCONNECTED AT THE MAIN PRIOR TO REMOVAL OF BUILDING FOUNDATIONS. THE CONTRACTOR SHALL PLUG THE CONNECTION AT THE MAIN WITH A MECHANICAL PLUG AND NON-SHRINK GROUT. DISCONNECTION'S SHALL BE PERFORMED IN THE PRESENCE OF THE CITY'S UTILITY INSPECTOR. THE CONTRACTOR SHALL PROVIDE AN AS-BUILT DRAWING DEPICTING THE DISCONNECTED SIDE SEWER UPON COMPLETION OF THE WORK.

RECONNECTION

WHEN RECONNECTING TO AN EXISTING SIDE SEWER, THE POINT OF RECONNECTION WILL BE DETERMINED BASED ON THE MAGNITUDE OF THE CONSTRUCTION ON THE PROPERTY.

1. PARTIAL INTERIOR REMODEL AND/OR BUILDING ADDITION – NO SIDE SEWER REPLACEMENT REQUIRED UNLESS A KNOWN PROBLEM EXISTS IN THE SIDE SEWER.
2. COMPLETE INTERIOR REMODEL – ASSESS CONDITION OF EXISTING SIDE SEWER THROUGH VIDEO INSPECTION FROM BUILDING TO SEWER MAIN AND REPLACE AS NEEDED. IF EXISTING SIDE SEWER IS ASBESTOS CEMENT OR CONCRETE, SIDE SEWER SHALL BE REPLACED FROM BUILDING TO PROPERTY LINE.*
3. COMPLETE INTERIOR REMODEL AND BUILDING ADDITION – NEW SIDE SEWER FROM BUILDING AT LEAST TO PROPERTY LINE.*
4. CONSTRUCTION OF A NEW BUILDING – NEW SIDE SEWER FROM BUILDING AT LEAST TO MAIN.*

VIDEO INSPECTION OF THE EXISTING SIDE SEWER, BETWEEN THE PROPERTY LINE AND THE SEWER MAIN SHALL BE PERFORMED FOR SCENARIO NUMBER 3.

PROVIDE A COPY OF THE VIDEO DOCUMENTATION TO THE CITY ENGINEER.

REPLACEMENT OR REPAIR OF THAT PORTION OF THE SIDE SEWER BETWEEN THE PROPERTY LINE AND THE SEWER MAIN, WILL BE DETERMINED BY THE CITY ENGINEER, BASED ON THE VIDEO INSPECTION.

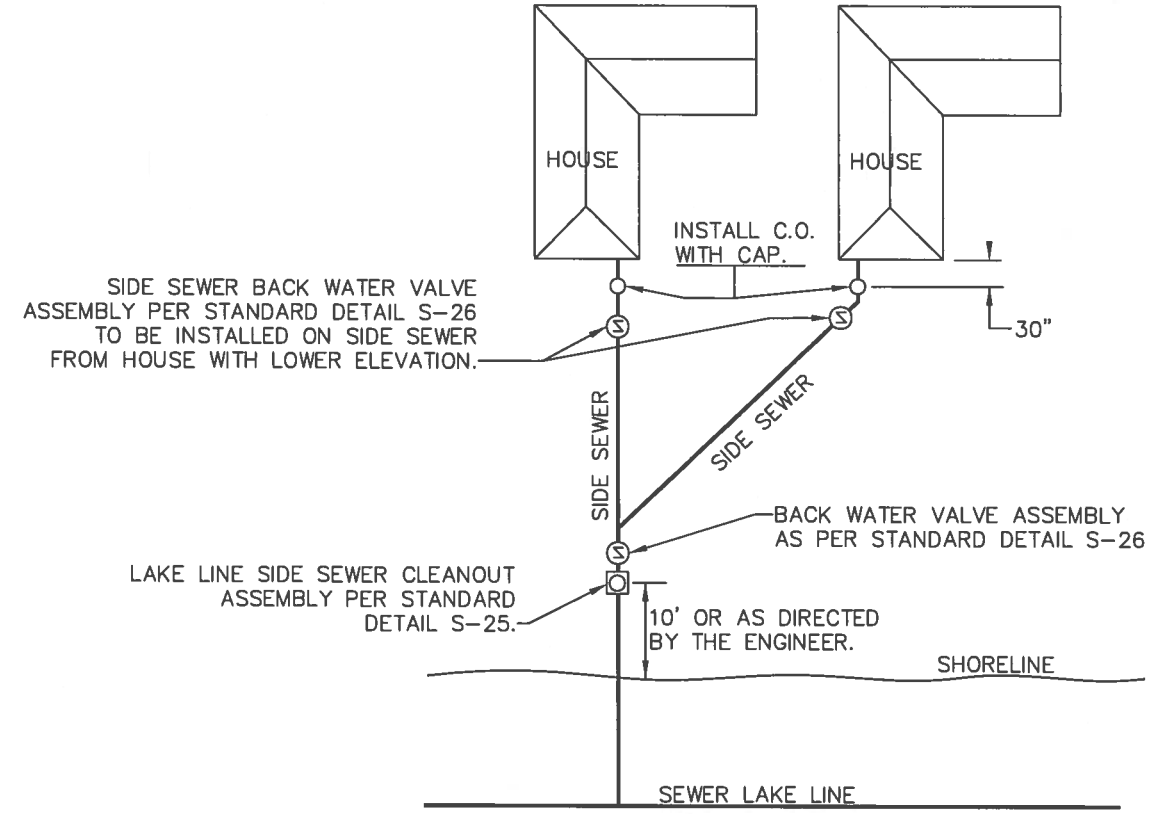
*IF THE EXISTING SIDE SEWER IS PVC AND IS LESS THAN TEN YEARS OLD, THE SIDE SEWER DOES NOT HAVE TO BE REPLACED IF A VIDEO INSPECTION AND HYDROSTATIC PRESSURE TEST CONFIRMS THAT THE SIDE SEWER IS IN PROPER WORKING CONDITION. THESE TESTS SHALL BE PERFORMED AFTER ALL HEAVY EQUIPMENT THAT COULD DAMAGE THE SIDE SEWER IS OFF OF THE SITE.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

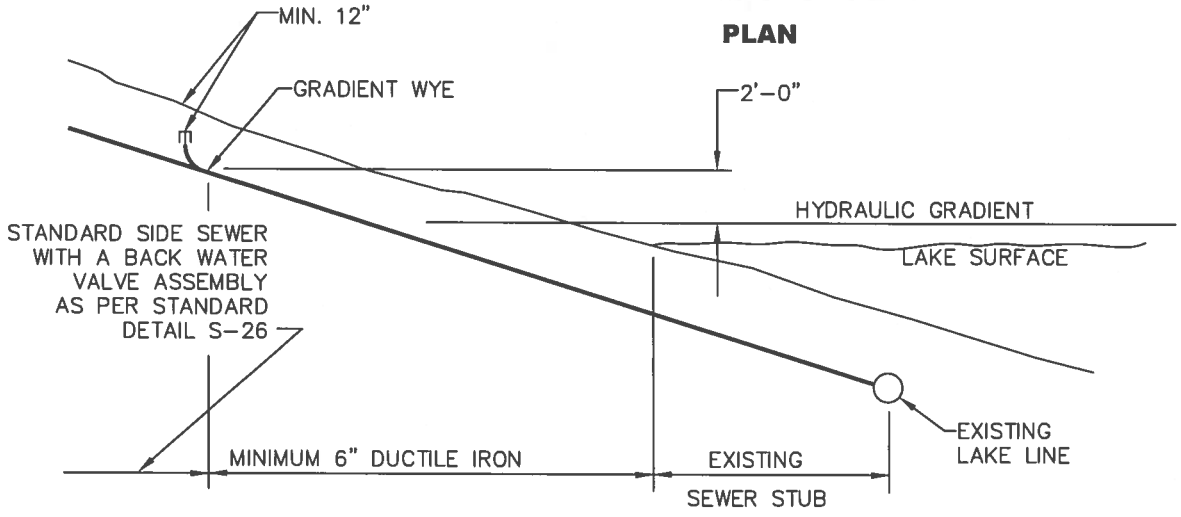
COMMERCIAL/MULTI FAMILY
SIDE SEWER
DISCONNECTION & RECONNECTION

6-5-2009	NO SCALE	**S-22A**

REV DATE						APPROVED



PLAN



ELEVATION

NOTES

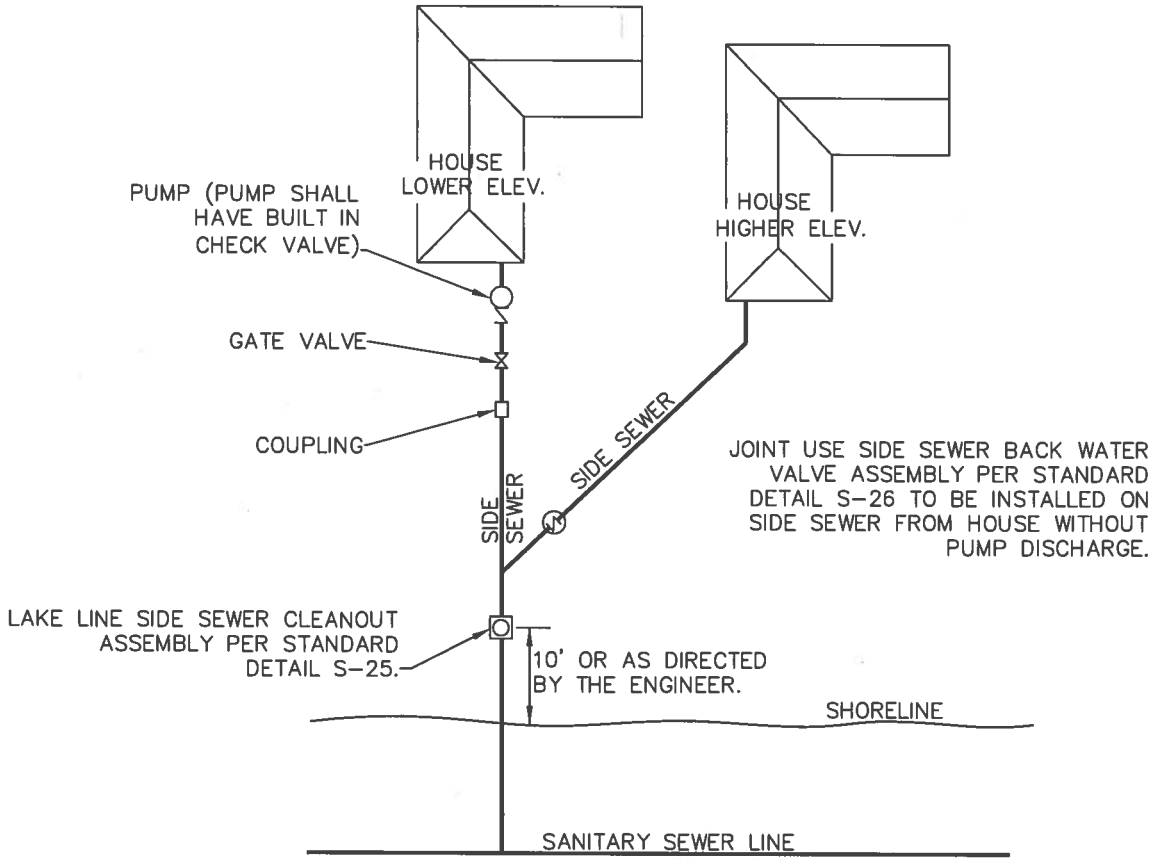
1. BACK WATER VALVE ASSEMBLY IS PRIVATE AND SHALL BE THE PROPERTY OWNERS RESPONSIBILITY FOR MAINTENANCE.
2. PIPE AND MATERIAL SHALL BE DUCTILE IRON TO HYDRAULIC GRADIENT LINE.
3. INSTALL GRADIENT WYE AT HYDRAULIC GRADIENT PLUS 2.0' VERTICAL. CAST IRON WYE WITH MJ PLUG AND 12" OF COVER.
4. INSTALL BACK WATER VALVE BETWEEN WYE AND FIRST SERVICE CONNECTION.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

LAKE LINE CLEANOUT & BACK WATER VALVE ASSEMBLY INSTALLATION ABOVE HYDRAULIC GRADIENT

6-5-2009	NO SCALE	**S-23**

REV DATE						APPROVED



PLAN

NOTES

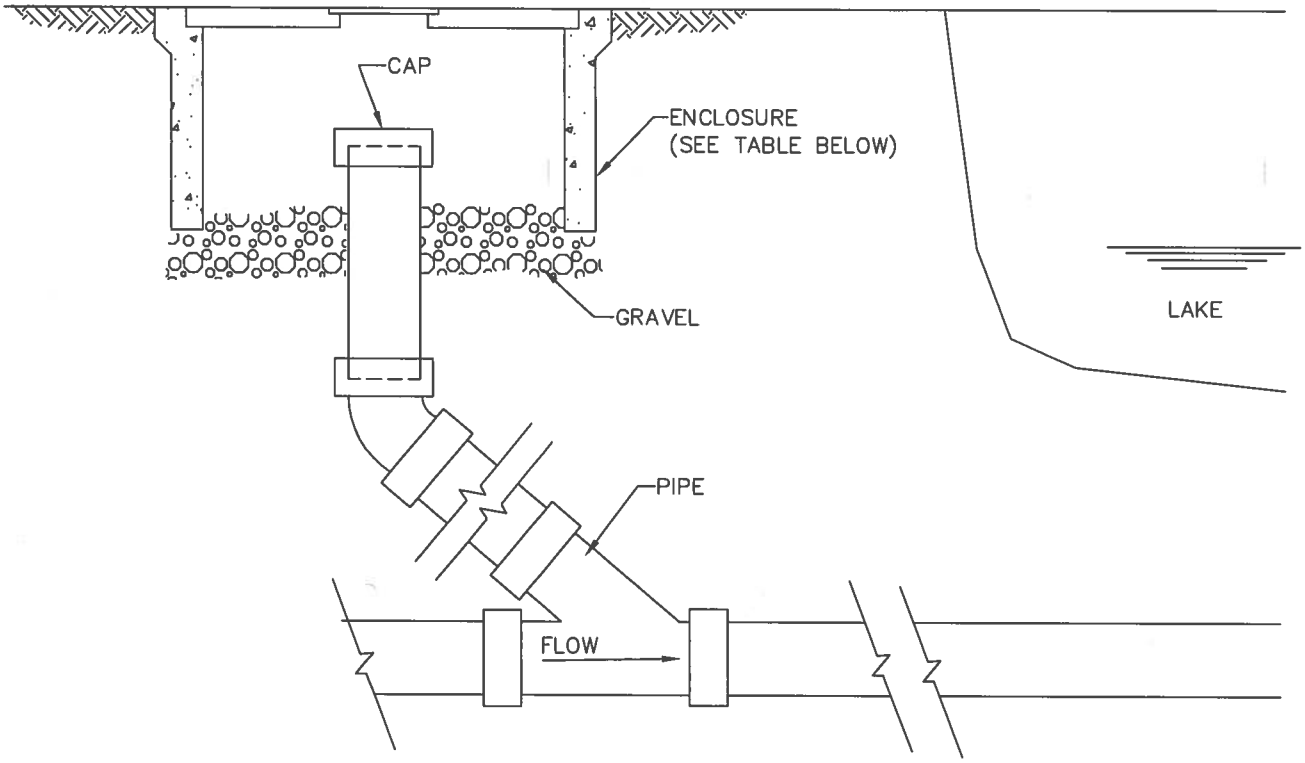
1. BACK WATER VALVE ASSEMBLY IS PRIVATE AND SHALL BE THE PROPERTY OWNERS RESPONSIBILITY FOR MAINTENANCE.
2. TO BE USED ONLY WITH PRIOR APPROVAL OF THE CITY ENGINEER.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

LAKE LINE CLEANOUT & BACK WATER VALVE ASSEMBLY INSTALLATION BELOW HYDRAULIC GRADIENT

6-5-2009	NO SCALE	**S-24**

REV DATE						APPROVED



LAKE LINE CLEANOUT

PIPE SIZE	MATERIAL	CAP	ENCLOSURE	COMMENTS
6"	PVC	SIDU MECHANICAL SEWER PLUG	CONC. METER BOX, FOGTITE 1-D	INSTALLATION BELOW HYDRAULIC GRADIENT
6"	PVC	PVC CAP W/O GASKET	CONC. METER BOX, FOGTITE 1-D	INSTALLATION ABOVE HYDRAULIC GRADIENT
6"	DIP	MECHANICAL JOINT CAP	CONC. METER BOX, FOGTITE 1-D	INSTALLATION ABOVE HYDRAULIC GRADIENT
8"	PVC	PVC CAP W/O GASKET	CONC. METER BOX, FOGTITE NO. 2 (CONC. LID W/ ALUM. INS. PLATE)	INSTALLATION ABOVE HYDRAULIC GRADIENT
8"	DIP	MECHANICAL JOINT CAP	CONC. METER BOX, FOGTITE NO. 2 (CONC. LID W/ ALUM. INS. PLATE)	INSTALLATION ABOVE HYDRAULIC GRADIENT

NOTES

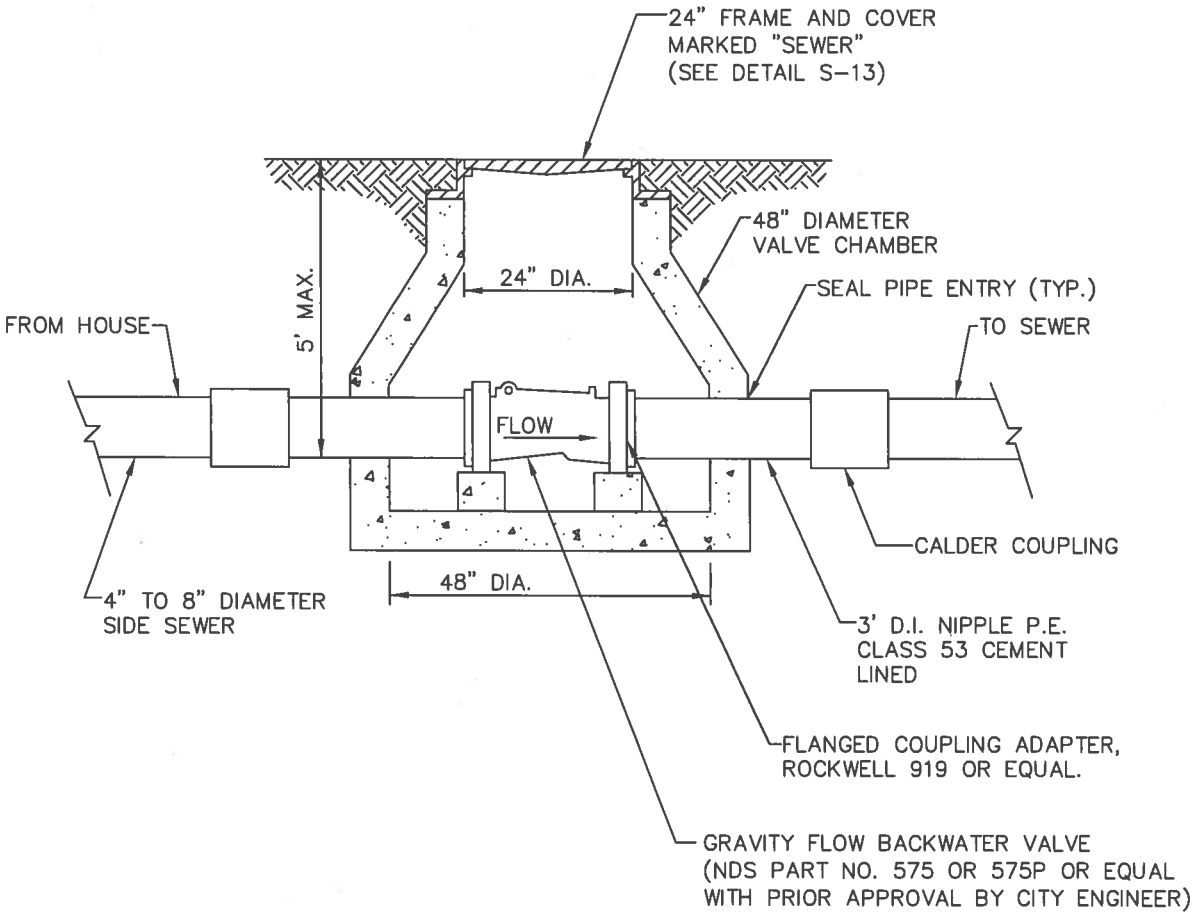
1. IF POSSIBLE, CLEANOUT TO BE LOCATED JUST ABOVE HYDRAULIC GRADIENT OF LAKE LINE. CLEANOUT SHOULD ALSO BE LOCATED TO PROVIDE EASY ACCESS FOR INSPECTION AND MAINTENANCE BY THE HOME OWNER.
2. SEE S-23 & S-24 FOR BACK WATER VALVE LOCATION.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

SIDE SEWER CLEANOUT FOR LAKE LINE CONNECTIONS

6-5-2009	NO SCALE	**S-25**

REV DATE						APPROVED



CITY OF MERCER ISLAND

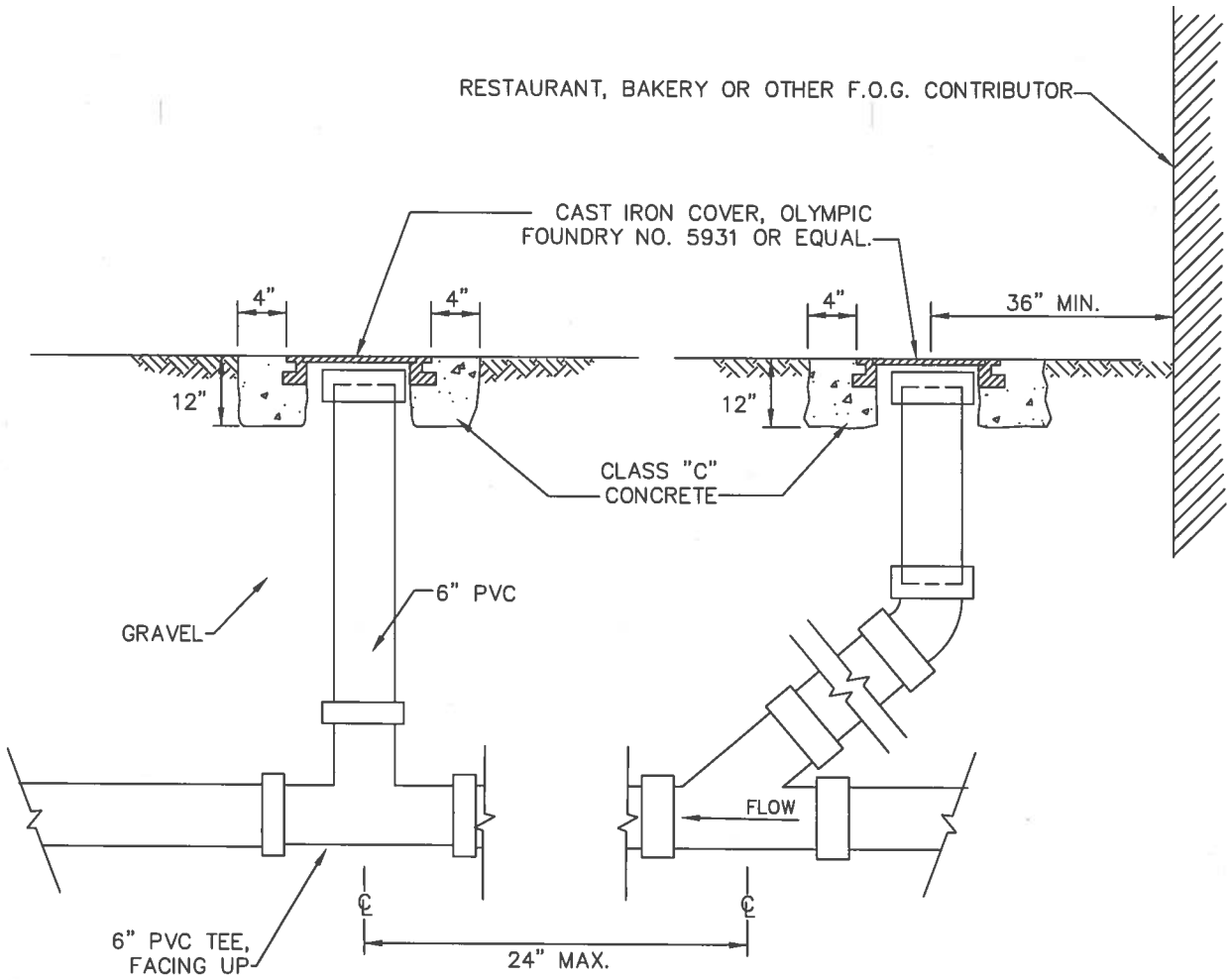
STANDARD DETAILS

SEWER

BACK WATER VALVE ASSEMBLY FOR JOINT USE SIDE SEWER (4" OR 6" DIAMETER)

6-5-2009	NO SCALE	**S-26**

REV DATE						APPROVED



NOTES

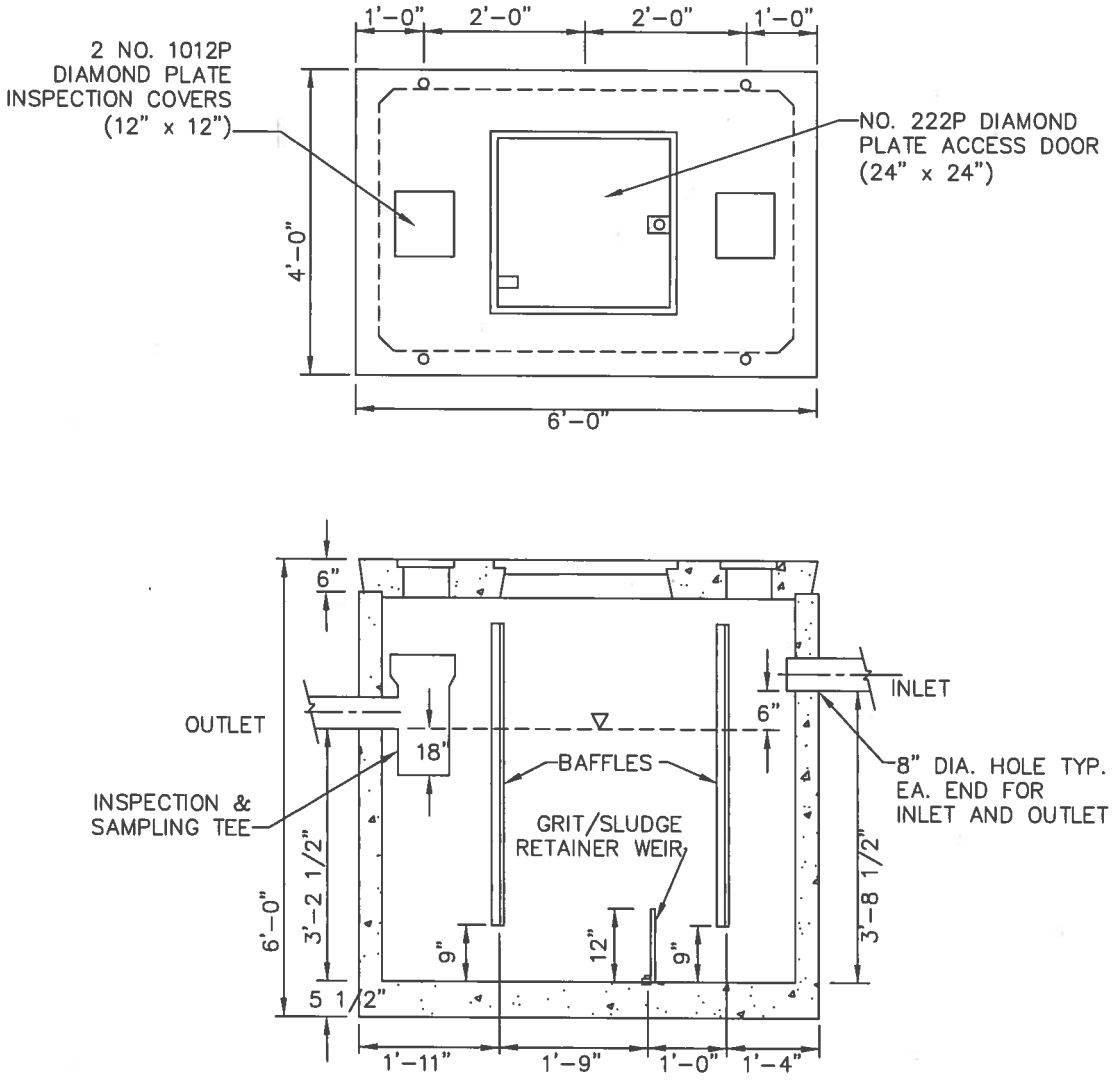
1. INSTALL SAMPLING TEE ON EXISTING OR NEW SIDE SEWER.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

SAMPLING TEE

6-5-2009	NO SCALE	**S-27**

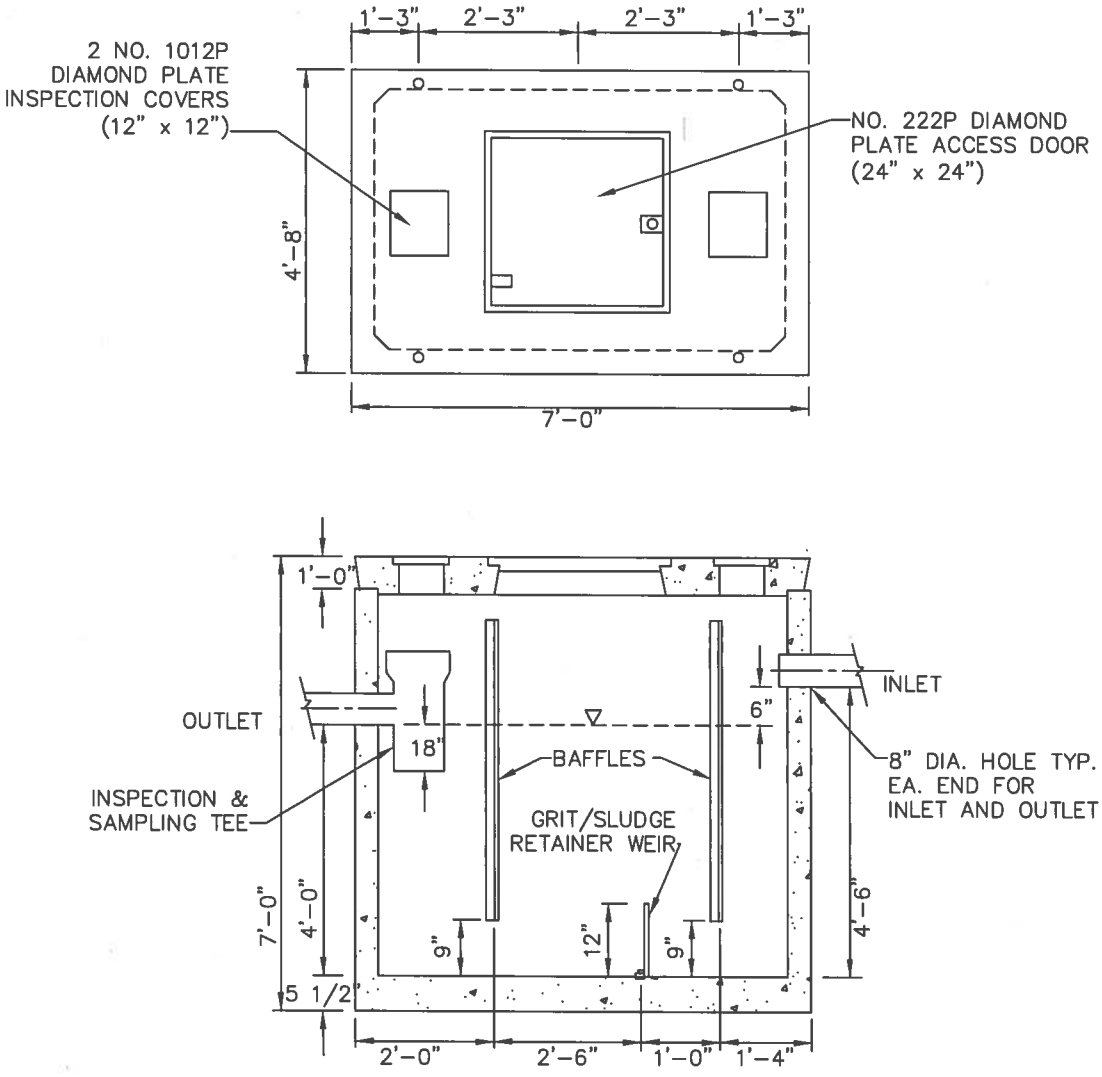
REV DATE						APPROVED



NOTES

1. UTILITY VAULT COMPANY, INC., #660-SA, OR EQUAL.
2. LOCATE WITHIN 20 FEET OF DRIVE FOR ACCESS BY MAINTENANCE VEHICLE.
3. INSPECTION AND SAMPLING TEE TO BE INSTALLED BY CONTRACTOR. LINE SIZED PVC PIPE SHALL BE USED
4. FILL WITH CLEAN WATER PRIOR TO START-UP OF SYSTEM.
5. GRAY AND BLACK WATER SHALL BE CARRIED BY SEPARATE SIDE SEWER.

CITY OF MERCER ISLAND **STANDARD DETAILS** SEWER		
450 GALLON BAFFLE TYPE OIL/WATER SEPARATOR		
6-5-2009	NO SCALE	**S-28**



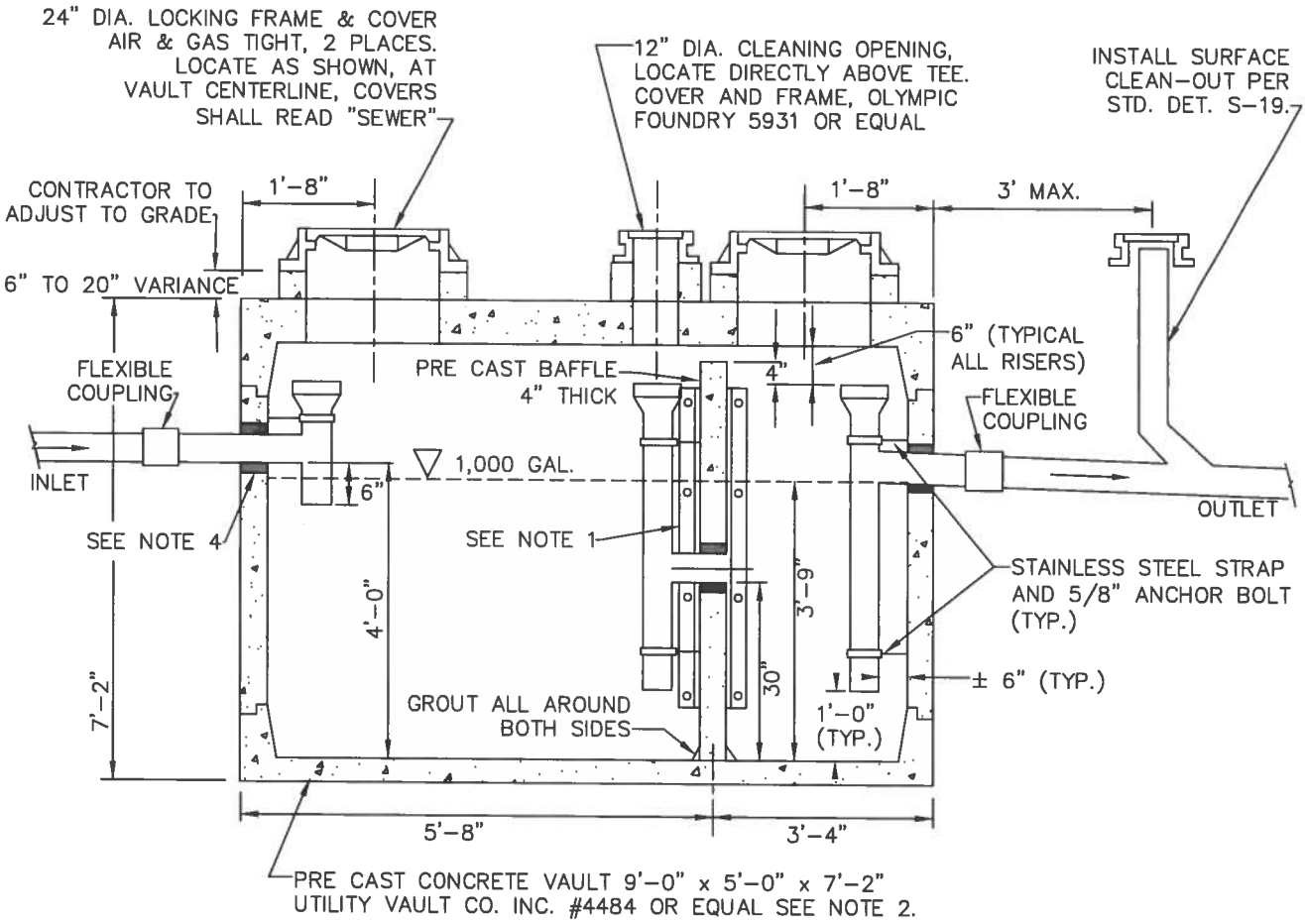
NOTES

1. UTILITY VAULT COMPANY, INC., #577-SA, OR EQUAL.
2. LOCATE WITHIN 20 FEET OF DRIVE FOR ACCESS BY MAINTENANCE VEHICLE.
3. INSPECTION AND SAMPLING TEE TO BE INSTALLED BY CONTRACTOR. LINE SIZED PVC PIPE SHALL BE USED
4. FILL WITH CLEAN WATER PRIOR TO START-UP OF SYSTEM.
5. GRAY AND BLACK WATER SHALL BE CARRIED BY SEPARATE SIDE SEWER.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

800 GALLON BAFFLE TYPE OIL/WATER SEPARATOR

6-5-2009	NO SCALE	**S-29**



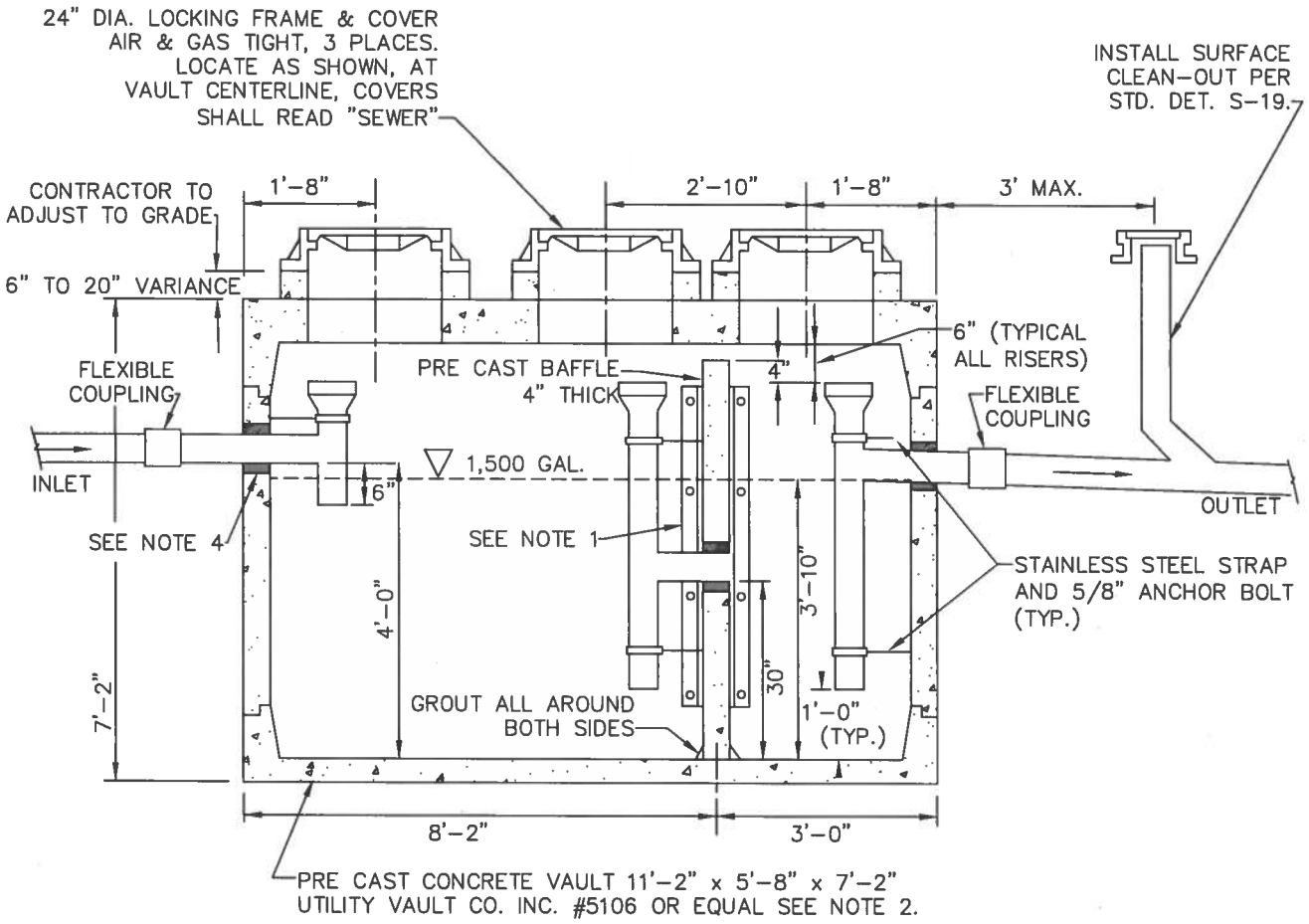
NOTES

1. IF VAULT IS NOT SLOTTED TO ACCEPT PRE CAST CONCRETE BAFFLE THEN PRE CAST CONCRETE BAFFLE SHALL BE HELD IN PLACE BY (2) 3"x3"x3/8" ANGLE (4' LONG) ATTACHED TO VAULT WALL WITH (4 EA.) 1/2" BOLTS AND NUTS (WITH WASHERS) SPACED 14" O.C. ANGLE AND FASTENERS SHALL BE STAINLESS STEEL OR GALVANIZED AND ASPHALT COATED.
2. PRE CAST FAULT AND BAFFLE SHALL HAVE KNOCKOUTS AT ALL PIPE OPENINGS. IF KNOCKOUTS ARE NOT PRESENT THEN PIPE OPENINGS SHALL BE CORE-DRILLED. PIPE OPENINGS SHALL BE 2" LARGER THAN PIPE DIAMETER.
3. LOCATE INTERCEPTOR WITHIN 20' OF DRIVE FOR ACCESS BY MAINTENANCE VEHICLE.
4. CONNECTION TO CONCRETE WALLS WITH PVC PIPE REQUIRE KOR-N-SEAL CONNECTOR OR A.C. x PVC BRANT ADAPTER. SEAL ALL PIPE CONNECTIONS WITH NON-SHRINK GROUT.
5. LINE-SIZED PVC PIPE SHALL BE USED THROUGHOUT.
6. GRAY-WATER ONLY. BLACK-WATER SHALL BE CARRIED BY SEPARATE SIDE SEWER.
7. CLEAN-OUT REQUIRED 3' MAXIMUM DOWNSTREAM OF INTERCEPTOR.
8. FILL WITH CLEAN WATER PRIOR TO START UP OF SYSTEM.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

1,000 GALLON GREASE INTERCEPTOR

6-5-2009	NO SCALE	**S-30**



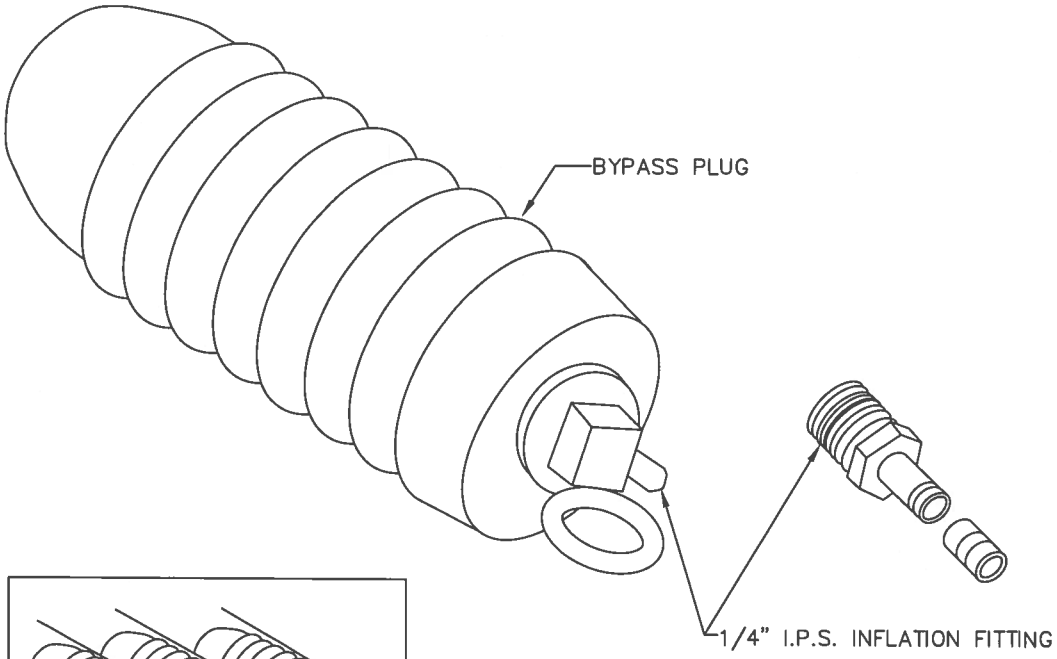
NOTES

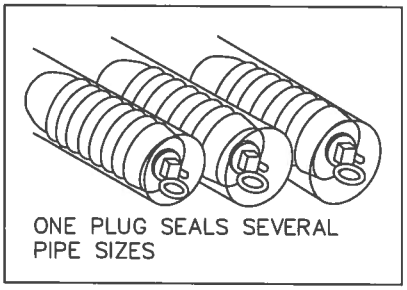
1. IF VAULT IS NOT SLOTTED TO ACCEPT PRE CAST CONCRETE BAFFLE THEN PRE CAST CONCRETE BAFFLE SHALL BE HELD IN PLACE BY (2) 3"x3"x3/8" ANGLE (4' LONG) ATTACHED TO VAULT WALL WITH (4 EA.) 1/2" BOLTS AND NUTS (WITH WASHERS) SPACED 14" O.C. ANGLE AND FASTENERS SHALL BE STAINLESS STEEL OR GALVANIZED AND ASPHALT COATED.
2. PRE CAST FAULT AND BAFFLE SHALL HAVE KNOCKOUTS AT ALL PIPE OPENINGS. IF KNOCKOUTS ARE NOT PRESENT THEN PIPE OPENINGS SHALL BE CORE-DRILLED. PIPE OPENINGS SHALL BE 2" LARGER THAN PIPE DIAMETER.
3. POSITION RISERS BELOW ACCESS OPENINGS TO ALLOW CLEAR ACCESS TO RISER AND VAULT CHAMBER.
4. LOCATE INTERCEPTOR WITHIN 20' OF DRIVE FOR ACCESS BY MAINTENANCE VEHICLE.
5. CONNECTION TO CONCRETE WALLS WITH PVC PIPE REQUIRE KOR-N-SEAL CONNECTOR OR A.C. x PVC BRANT ADAPTER. SEAL ALL PIPE CONNECTIONS WITH NON-SHRINK GROUT.
6. LINE-SIZED PVC PIPE SHALL BE USED THROUGHOUT.
7. GRAY-WATER ONLY. BLACK-WATR SHALL BE CARRIED BY SEPARATE SIDE SEWER.
8. CLEAN-OUT REQUIRED 3' MAXIMUM DOWNSTREAM OF INTERCEPTOR.
9. FILL WITH CLEAN WATER PRIOR TO START UP OF SYSTEM.

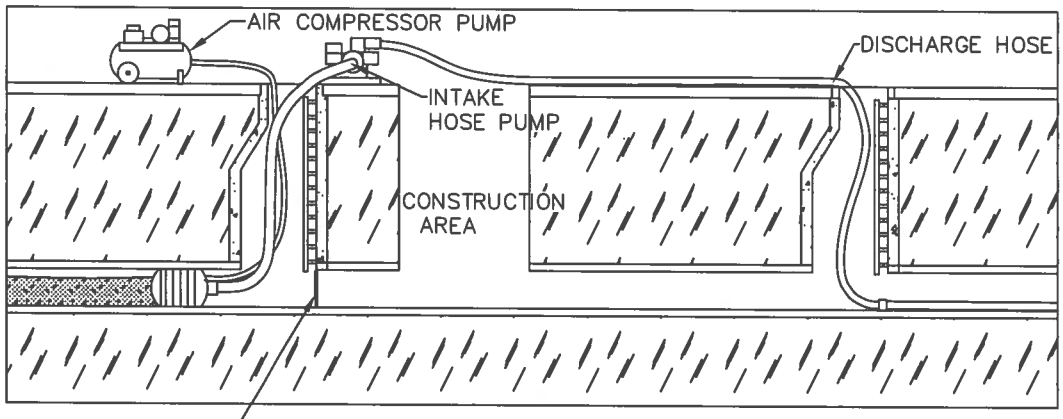
CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

1,500 GALLON GREASE INTERCEPTOR

6-5-2009	NO SCALE	**S-31**







CITY OF MERCER ISLAND

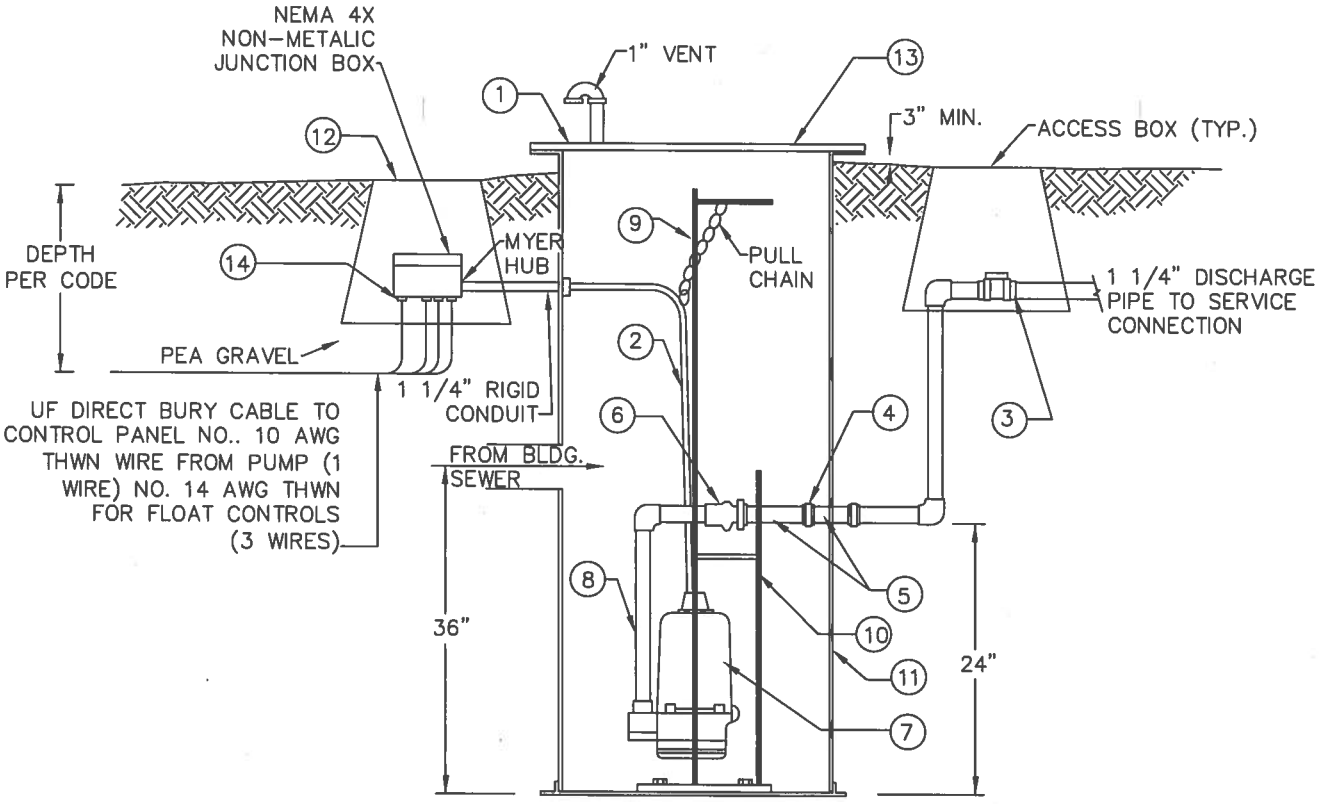
STANDARD DETAILS

SEWER

SEWER MAIN BY-PASS PLUG

6-5-2009	NO SCALE	**S-32**

REV DATE						APPROVED



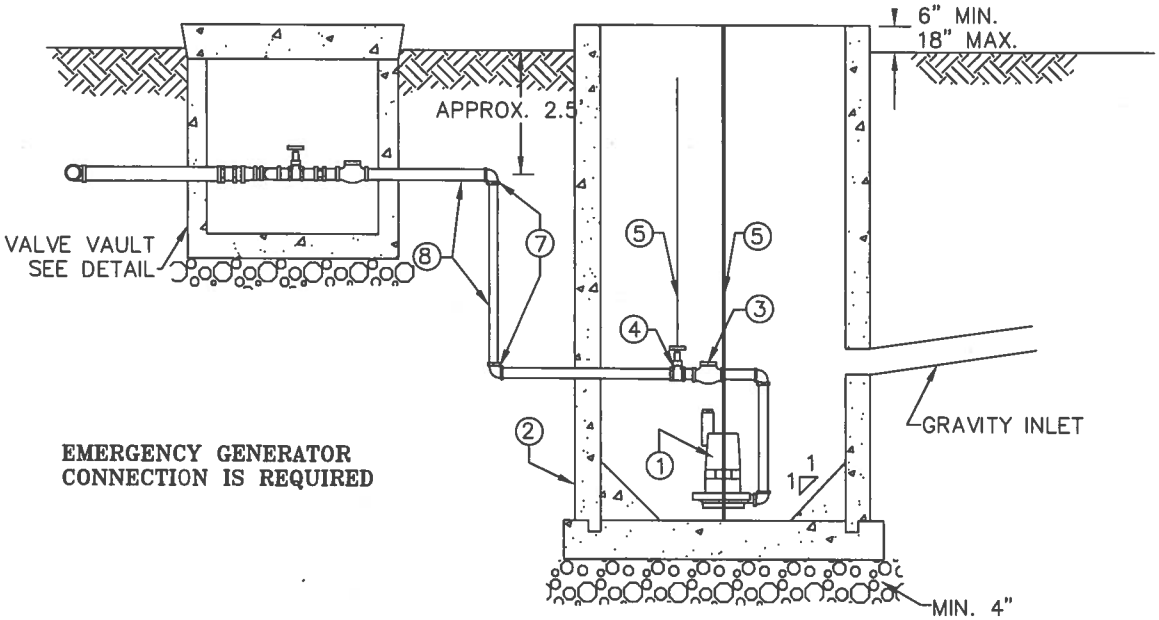
NOTES

1. 24" DIAMETER GALVANIZED COVER.
2. POWER CONDUIT.
3. 1 1/4" PVC TRUE UNION BALL VALVE (SS) HAYWARD OR EQUAL.
4. 1 1/4" GALVANIZED UNION
5. 1 1/4" GALVANIZED NIPPLES
6. CHECK VALVE AND PUMP DISCONNECT HYDROMATIC OR EQUAL.
7. 2 HP GRINDER PUMP.
8. 1 1/4" GALVANIZED PIPING, APPROX. 1.2'.
9. HOT DIPPED GALVANIZED STEEL RAIL GUIDE SYSTEM.
10. HOT DIPPED GALVANIZED PUMP TECH SHORT RAIL.
11. 24" x 60" FIBERGLASS TANK.
12. ACCESS BOX
    NON-TRAFFIC AREAS-EQUAL TO CARSON MODEL 1419-14B, WITH 1419-2B COVER.
    TRAFFIC AREAS-H-20 RATED CONCRETE BOX EQUAL TO FOGTITE B91/2 METER BOX.
    LIDS SHALL BE MARKED ELECTRICAL OR SEWER RESPECTIVELY.
13. TOP CAN BE SET FLUSH WITH GROUND, IF A CONCRETE PAD IS POURED AROUND THE LIFT STATION AND SLOPE AWAY FROM STATION. KEEP ROCKS AND DEBRIS OUT OF STATION.
14. BOTTOM ENTRY WATER TIGHT STRAIN RELIEF CONNECTORS (FOR USE WITH UNDERGROUND CABLES) ATTACH USING LOCK-NUT WITH SEALING FITTING.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

GRINDER LIFT STATION

6-5-2009	NO SCALE	**S-33**

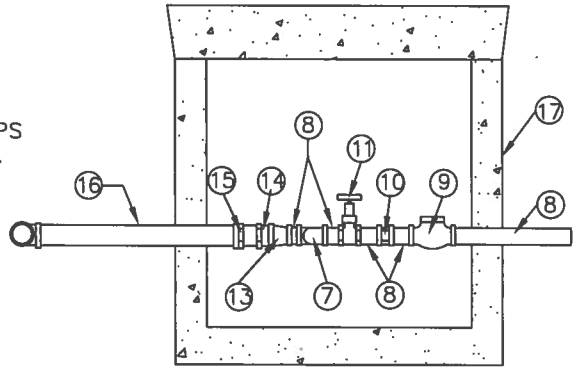


LIFT STATION - ELEVATION

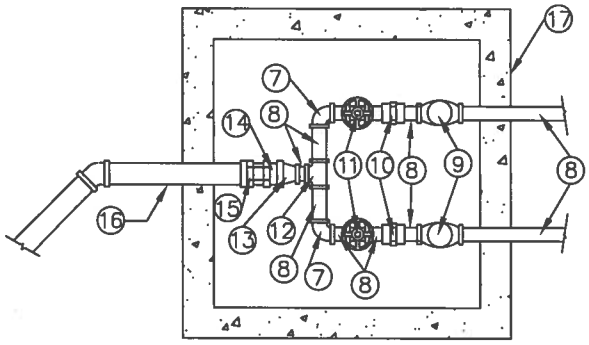
NOTES

ITEMS 1–6 BASED ON HYDR–O–RAIL, HYDR–O–GRIND DUPLEX PACKAGE LIFT STATION AS MANUFACTURED BY HYDROMATIC PUMP COMPANY.

1. 2 EXPLOSION–PROOF SUBMERSIBLE SEWAGE GRINDER PUMPS EQUAL TO HYDROMATIC G2FX500. 5 HP, 1750 RPM MOTOR. DESIGN PINT: 55 GPM AT 54' TDH.
2. 60" LD CONCRETE MANHOLE WITH GROUTED HOPPER BOTTOM.
3. 2" BALL CHECK AGAINST HYDRAULICALLY SEALED DISCHARGE FLANGE EQUAL TO HYDROMATIC.
4. 2" GATE VALVE.
5. 1 1/2" GALVANIZED GUIDE RAILS (2 EACH PER PUMP)
6. GATE VALVE EXTENSION (1 EACH PER VALVE)
7. 2" G.I. 90° BENDS (SxS)
8. 2" G.I. PIPE (SxS)
9. 2" BALL CHECK (SxS)
10. 2" UNION
11. 2" GATE VALVE (SxS)
12. 2" G.I. TEE (SxS)
13. 2" X 2 1/2" G.I. REDUCER (SxS)
14. 2 1/2" G.I. PIPE (SxS)
15. 2 1/2" COUPLING – G.I. TO PVC
16. 2 1/2" PVC PIPE AND FITTINGS–ASTM D 2241
17. CONCRETE VAULT – 3.5' H x 3.5' L x 3.5' W EQUAL TO UTILITY VAULT MODEL 444–LA WITH 44–332P COVER. DRAIN TO NEAREST STORM DRAIN SYSTEM.



VALVE VAULT - ELEVATION



VALVE VAULT - PLAN

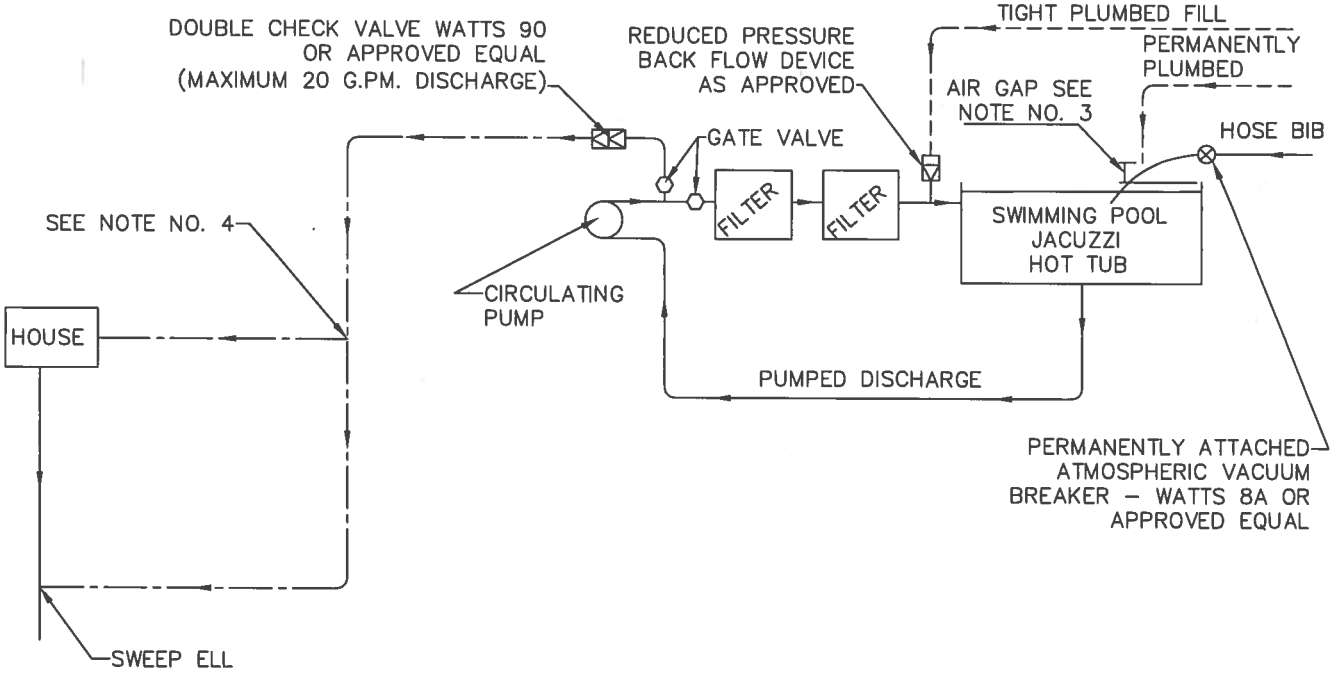
CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

COMMERCIAL AND MULTI–FAMILY
SEWER LIFT STATION
DUPLEX SYSTEM

6–5–2009	NO SCALE	**S-34**

DRAIN SYSTEM ALTERNATIVES

POTABLE WATER SUPPLY ALTERNATIVES



NOTES

1. ADDITIONAL PERMITS THROUGH THE BUILDING DEPARTMENT MAY BE REQUIRED.
2. THE COMPLETE DISCHARGE SYSTEM TO BE PERMANENTLY PLUMBED.
3. AIR GAP = 2 x DISCHARGE PIPE INSIDE DIAMETER (2" PIPE I.D. x2 = 4" AIR GAP) ABOVE THE FLOOD RIM ELEVATION. (MIN. 1")
4. TIGHT PLUMB TO SANITARY SEWER SYSTEM; WITHIN OR OUTSIDE THE HOUSE.
   A. IF INSIDE THE HOUSE: A PLUMBING PERMIT THROUGH THE BUILDING DEPARTMENT IS REQUIRED.
   B. IF OUTSIDE THE HOUSE: A SIDE SEWER REVISION PERMIT IS REQUIRED THROUGH THE DEVELOPMENT SERVICE DEPARTMENT.

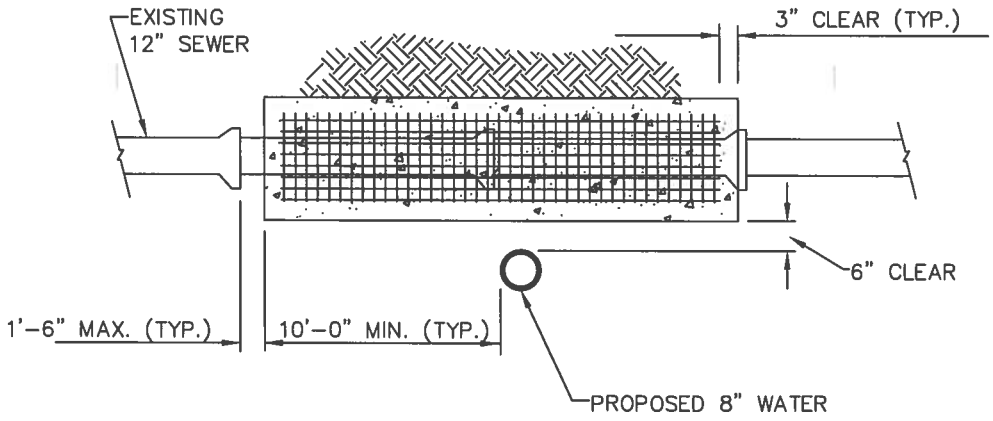
APPLICABLE CODES

1. MERCER ISLAND MUNICIPAL CODE SECT. 17.30.070
2. MERCER ISLAND SEWER DISTRICT ADMINISTRATION CODE SECT 9.04
3. I.A.P.M.O. – UNIFORM SWIMMING POOL, SPA AND HOT TUB CODE 1982

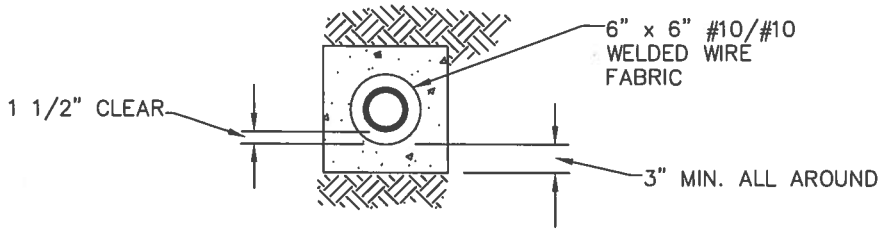
CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

GUIDELINES FOR INSTALLATION HOT TUBS, JACUZZIS & SWIMMING POOLS

6-5-2009	NO SCALE	**S-35**



ELEVATION

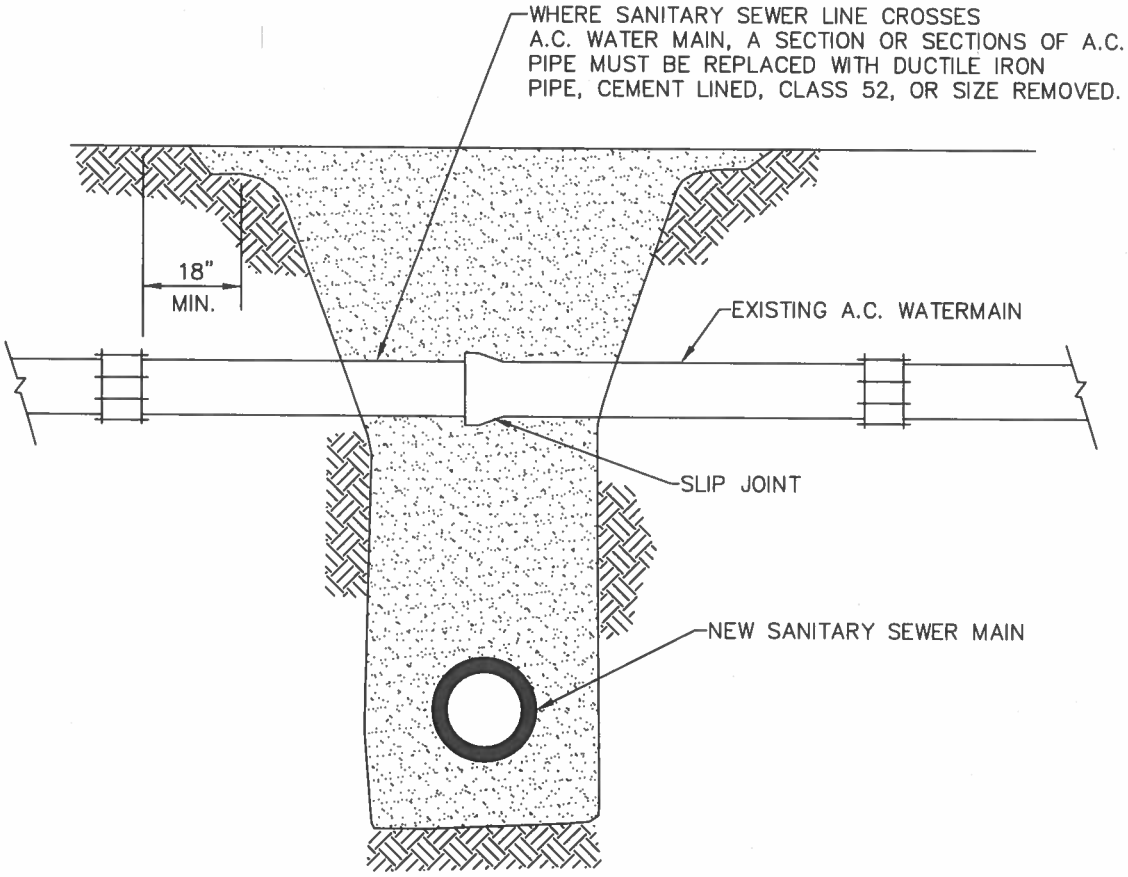


SECTION

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

CONCRETE ENCASEMENT DETAIL

6-5-2009	NO SCALE	**S-36**



SECTION

NOTES

1. IF A.C. PIPE IS TO BE REMOVED, ALL ENVIRONMENTAL PROTECTION AGENCY RULES, PUGET SOUND AIR POLLUTION CONTROL AGENCY REGULATIONS, AND LABOR AND INDUSTRY REQUIREMENTS MUST BE MET.

CITY OF MERCER ISLAND
STANDARD DETAILS
SEWER

CROSSING A.C. PIPE

6-5-2009	NO SCALE	**S-37**

REV DATE						APPROVED

CITY OF MERCER ISLAND

SIDE SEWER AS BUILT

PERMIT NO. 0601-730

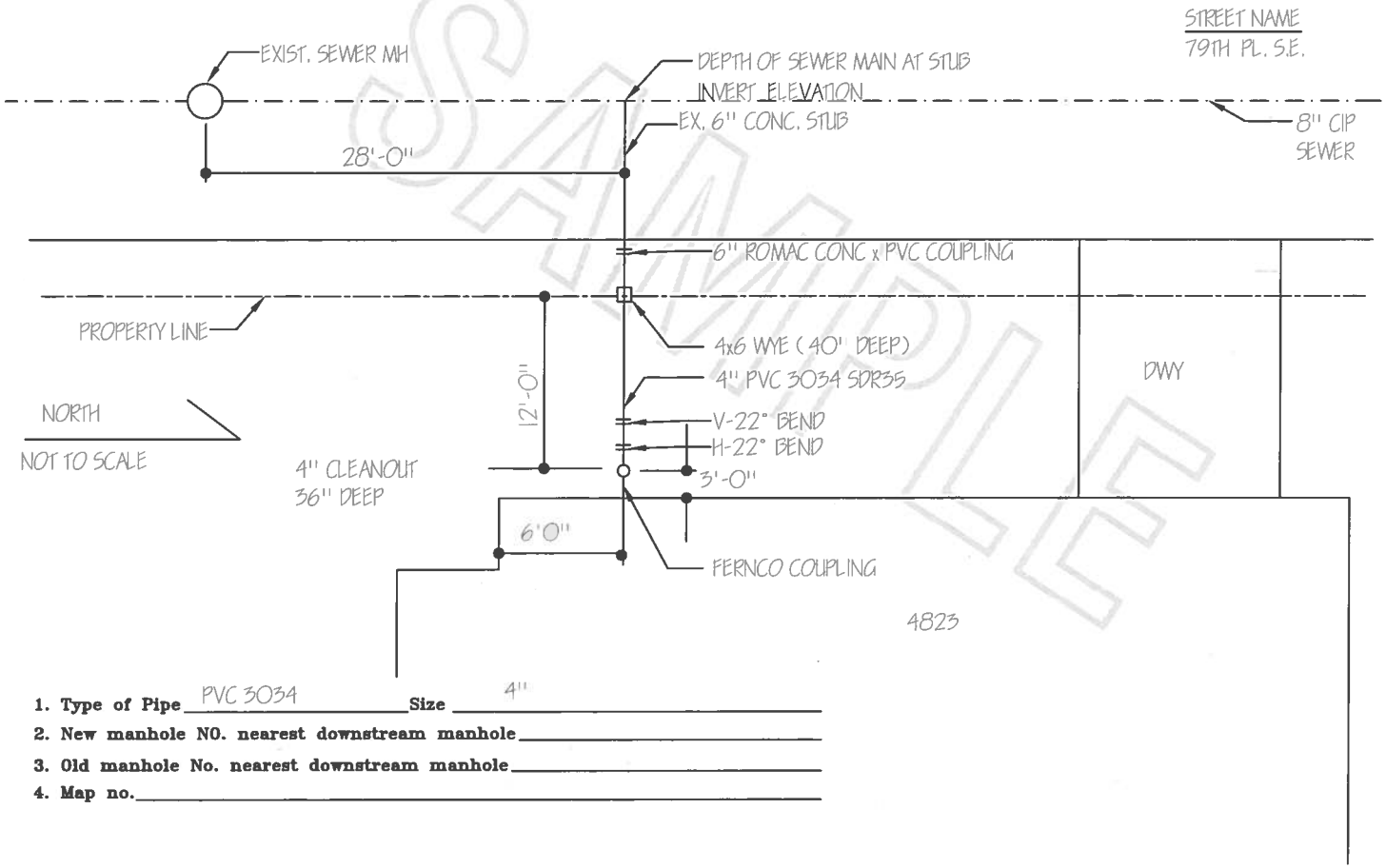
MAIN PERMIT NO. 0501-991

SKETCH NTS ☐

☒ New ☐ Repair ☐ Reconnect

OWNER MAY Address 4823 79 PL. S.E. Contractor SEWER-R-US

Date Permit Issued 06-12-2001 Date job completed and accepted 07-01-2001 By MIKE F. ☐ Copy Maintenance



1. Type of Pipe PVC 3034 Size 4"
2. New manhole NO. nearest downstream manhole
3. Old manhole No. nearest downstream manhole
4. Map no.

CITY OF MERCER ISLAND

STANDARD DETAILS

SEWER

"AS-BUILT" DRAWING

6-5-2009 | NO SCALE | **S-38** | APPROVED

REV DATE

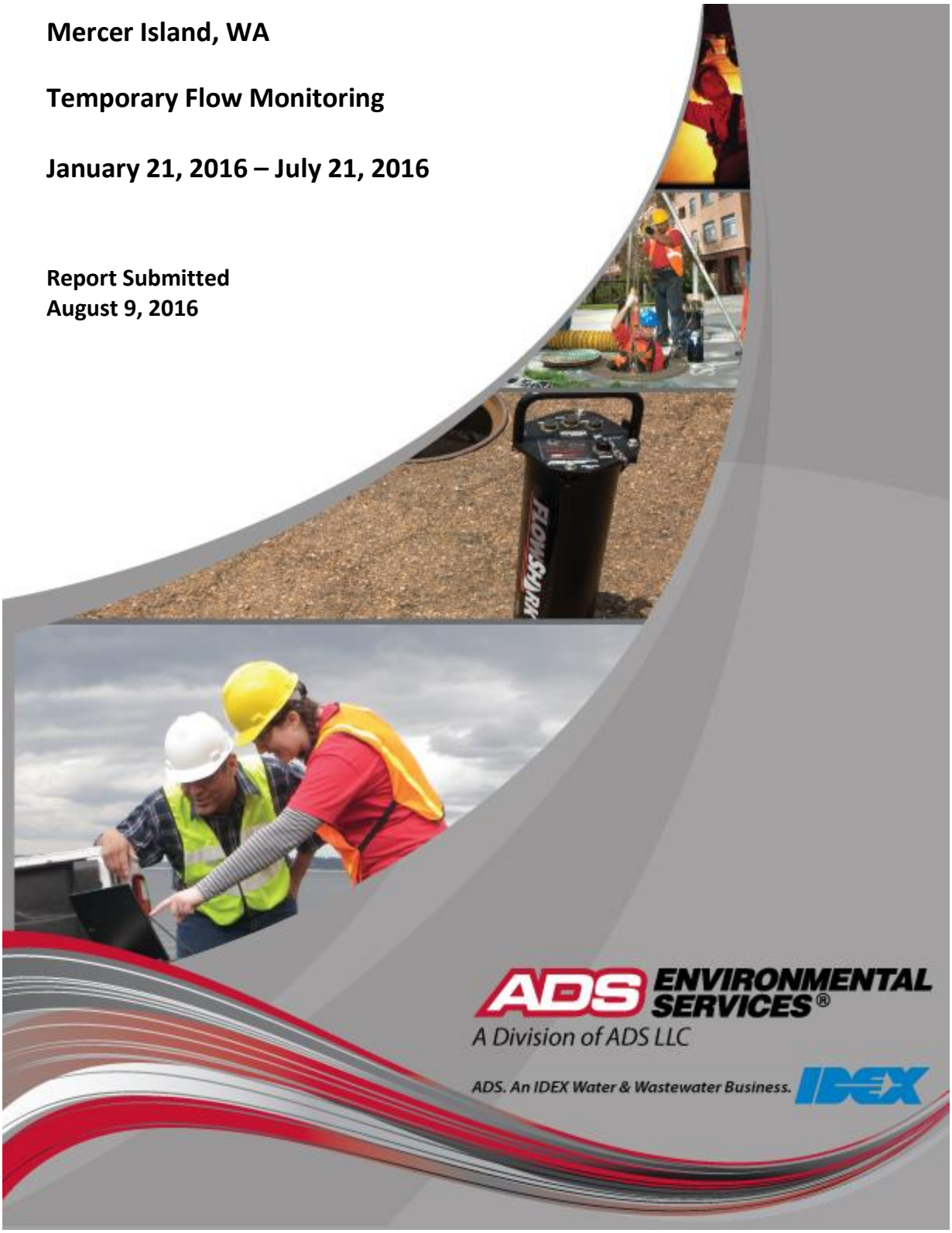
APPENDIX F – ADS FLOW MONITORING PROGRAM REPORT

Mercer Island, WA

Temporary Flow Monitoring

January 21, 2016 – July 21, 2016

Report Submitted
August 9, 2016



ADS ENVIRONMENTAL SERVICES®
A Division of ADS LLC

ADS. An IDEX Water & Wastewater Business. IDEX

Table of Contents

Mercer Island, WA
Temporary Flow Monitoring Project

Prepared for:

Ms. Anne Tonella-Howe, PE
City of Mercer Island Public Works

Prepared by:

ADS, LLC
4455 South 134th Place
Tukwila, WA 98168-6204

Letter of Transmittal

A Division of ADS LLC
4455 South 134th
Place
Tukwila, WA 98168-6204

August 9, 2016

Ms. Anne Tonella-Howe PE
City of Mercer Island

Dear Ms. Tonella-Howe,

ADS is pleased to submit the final report for the monitoring study. The study was conducted on behalf of the City of Mercer Island. Metering was performed during the period of Thursday, January 21, 2016 through Thursday, July 21, 2016. Included in the report are depth, velocity and quantity results for the sites.

In addition, we would be happy to further explain any details about the report that may seem unclear. Should you have any questions or comments, I can be reached at 714-658-5574. You may also contact the Project Manager, Mike Pina at 206-762-5070.

Thank you for choosing ADS products and services to meet your flow monitoring needs.

Regards,

Heather McPherson PE (CA)

Data Analyst, West Coast

ADS LLC
An IDEX Fluid & Metering Business
Accusonic
ADS Environmental Services
Hydra-Stop

Methodology

Introduction

Background

The City of Mercer Island, WA entered into an agreement with ADS Environmental Services to conduct flow monitoring at (3) three metering points located in the City of Mercer Island, WA. The study was contracted for a Six (6) month period. The objective of this study was to measure depth, velocity, and quantify flows.

Project Scope

The scope of this study involved using temporary flow monitors to quantify wastewater flow at the designated locations. Specifically, the study included the following key components.

- Investigate the proposed flow-monitoring sites for adequate hydraulic conditions.
- Flow monitor installations.
- Flow monitor confirmations and data collections.
- Flow data analysis.

Equipment installation was accomplished by January 20, 2016. The monitoring period began on January 21, 2016 and was completed on July 21, 2016 .

Equipment and Methodology

Flow Quantification Methods

There are two main equations used to measure open channel flow: the Continuity Equation and the Manning Equation. The Continuity Equation, which is considered the most accurate, can be used if both depth of flow and velocity are available. In cases where velocity measurements are not available or not practical to obtain, the Manning Equation can be used to estimate velocity from the depth data based on certain physical characteristics of the pipe (i.e. the slope and roughness of the pipe being measured). However, the Manning equation assumes uniform, steady flow hydraulic conditions with non-varying roughness, which are typically invalid assumptions in many sanitary sewers. The Continuity Equation was used exclusively for this study.

Continuity Equation

The Continuity Equation states that the flow quantity (Q) is equal to the wetted area (A) multiplied by the average velocity (V) of the flow.

$$Q = A * V$$

This equation is applicable in a variety of conditions including backwater, surcharge, and reverse flow. Most modern flow monitoring equipment, including the ADS Models, measure both depth and velocity and therefore use the Continuity Equation to calculate flow quantities.

Flow Monitoring Equipment

The monitor selected for this project was the ADS FlowShark . This flow monitor is an area velocity monitor that uses Continuity to measure flow rate.

The ADS FlowShark flow monitor consists of data acquisition sensors and a battery-powered microcomputer. The microcomputer includes a processor unit, data storage, and an on-board clock to control and synchronize the sensor recordings.

Three types of data acquisition sensors are available for the FlowShark flow monitor. The primary depth measurement device is the ADS quad-redundant ultrasonic level sensor. This sensor uses four independent ultrasonic transceivers in pairs to measure the distance from the face of the transceiver housing to the water surface (air range) with up to four transceiver pairs, of the available ones, active at one time. The elapsed time between transmitting and receiving the ultrasonic waves is used to calculate the air range between the sensor and flow surface based on the speed of sound in air. Sensors in the transceiver housing measure temperature, which is used to compensate the ultrasonic signal travel time. The speed of sound will vary with

temperature. Since the ultrasonic level sensor is mounted out of the flow, it creates no disturbance to normal flow patterns and does not affect site hydraulics.
Redundant flow depth data can be provided by a pressure depth sensor, and is independent from the ultrasonic level sensor. This sensor uses a piezo-resistive crystal to determine the difference between hydrostatic and atmospheric pressure. The pressure sensor is temperature compensated and vented to the atmosphere through a desiccant filled breather tube. Pressure depth sensors are typically used in large size channels and applications where surcharging is anticipated. Its streamlined shape minimizes flow distortion.
Velocity is measured using the ADS V-3 digital Doppler velocity sensor. This sensor measures velocity in the cross-sectional area of flow. An ultrasonic carrier is transmitted upstream into the flow, and is reflected by suspended particles, air bubbles, or organic matter with a frequency shift proportional to the velocity of the reflecting objects. The reflected signal is received by the sensor and processed using digital spectrum analysis to determine the peak flow velocity. Collected peak velocity information is filtered and processed using field confirmation information and proprietary software to determine the average velocity, which is used to calculate flow quantities. The sensor's small profile, measuring 1.5 inches by 1.15 inches by 0.50 inches thick, minimizes the affects on flow patterns and site hydraulics.

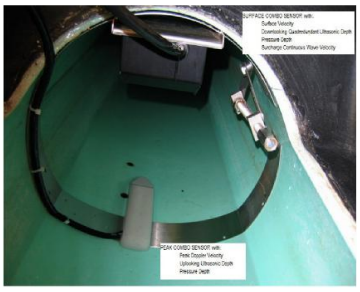
Installation

Installation of flow monitoring equipment typically proceeds in four steps. First, the site is investigated for safety and to determine physical and hydraulic suitability for the flow monitoring equipment. Second, the equipment is physically installed at the selected location. Third, the monitor is tested to assure proper operation of the velocity and depth of flow sensors and verify that the monitor clock is operational and synchronized to the master computer clock. Fourth, the depth and velocity sensors are confirmed and line confirmations are performed. A typical flow monitor installation is shown in Figure 2.1.
The installations depicted in Figures 2.1 are typical for circular or oval pipes up to approximately 104-inches in diameter or height. In installations into pipes 42-inches or less in diameter, depth and velocity sensors are mounted on an expandable stainless steel ring and installed one to two pipe diameters upstream of the pipe/manhole connection in the incoming sewer pipe. This reduces the affects of turbulence and backwater caused by the connection. In pipes larger than 42 inches in diameter, a special installation is made using two sections of the ring installed one to two feet upstream of the pipe/manhole connection; one bolted to the crown of the pipe for the depth sensor, and the other bolted to the bottom of the pipe (bolts are usually placed just above the water line) to hold the velocity sensor.

Figure 2.1 Typical Installation

Large Pipe (> 42" Diameter)

Small Pipe (8" to 42" Diameter)



Data Collection, Confirmation, and Quality Assurance

During the monitoring period, field crews visit each monitoring location weekly to retrieve data, verify proper monitor operation, and document field conditions. The following quality assurance steps are taken to assure the integrity of the data collected:

- **Measure Power Supply:** The monitor is powered by a dry cell battery pack. Power levels are recorded and battery packs replaced, if necessary. A separate battery provides back-up power to memory, which allows the primary battery to be replaced without the loss of data.
- **Perform Pipe Line Confirmations and Confirm Depth and Velocity:** Once equipment and sensor installation is accomplished, a member of the field crew descends into the manhole to perform a field measurement of depth and velocity to confirm they are in agreement with the monitor. Since the ADS V-3 velocity sensor measures peak velocity in the wetted cross-sectional area of flow, velocity profiles are also taken to develop a relationship between peak and average velocity in lines that meet the hydraulic criteria.
- **Measure Silt Level:** During site confirmation, a member of the field crew descends into the manhole and measures and records the depth of silt at the bottom of the pipe. This data is used to compute the true area of flow.
- **Confirm Monitor Synchronization:** The field crew checks the flow monitor's clock for accuracy.
- **Upload and Review Data:** Data collected by the monitor is uploaded and reviewed for comparison with previous data. All readings are checked for consistency and screened for deviations in the flow patterns, which indicate system anomalies or equipment failure.

Data Analysis and Presentation

Data Analysis

A flow monitor is typically programmed to collect data at either 15-minute or 5-minute intervals throughout the monitoring period. The monitor stores raw data consisting of (1) the air range (distance from sensor to top of flow) for each active ultrasonic depth sensor pair and (2) the peak velocity. If the monitor is equipped with a pressure sensor, then a depth reading from this sensor may also be stored. When the field personnel collects the data, the air range is converted to depth data based on the pipe height and physical offset (distance from the top of the pipe to the surface of the ultrasonic sensor). The data is imported into ADS's proprietary software and is examined by a data analyst to verify its integrity. The data analyst also reviews the daily field reports and site visit records to identify conditions that would affect the collected data. Velocity profiles and the line confirmation data developed by the field personnel are reviewed by the data analyst to identify inconsistencies and verify data integrity. Velocity profiles are reviewed and an average to peak velocity ratio is calculated for the site. This ratio is used in converting the peak velocity measured by the sensor to the average velocity used in the Continuity equation. The data analyst selects which ultrasonic pairs and/or depth sensor entity will be used to calculate the final depth information. Silt levels present at each site visit are reviewed and representative silt levels established.

Selections for the above parameters can be constant or can change during the monitoring period. While the data analysis process is described in a linear manner, it often requires an iterative approach to accurately complete.

Data Presentation

This type of flow monitoring project generates a large volume of data. To facilitate review of the data, results have been provided in graphical and tabular formats. The flow data is presented graphically in the form of scattergraphs and hourly averaged hydrographs. Tables are provided in daily average format. These tables show the flow rate for each day, along with the daily minimum and maximums (5 minute interval basis), the times they were observed, the total daily flow, and total flow for the month (or monitoring period). The following explanation of terms may aid in interpretation of the tables and hydrographs.

DFINAL - Final calculated depth measurement (in inches)
QFINAL - Final calculated flow rate (in MGD)

VFINAL - Final calculated flow velocity (in feet per second)

REPORT TOTAL - Total volume of flow recorded for the indicated time period (in MG)
AVERAGE - The average depth, velocity, and flow observed over the period indicated.

MINIMUM - The minimum depth, velocity, and flow observed over the period. Derived from 5-minute interval data points.
MAXIMUM - The maximum depth, velocity, and flow observed over the period indicated. Derived from 5-minute interval data points.

Site Commentary

Site Information

MI_61-197	
Pipe Dimensions (in)	10.13
Silt Level	0

Overview

Site MI_61-197 functioned in sub critical flow regime and operates in a normal free flow condition during the period Thursday, January 21, 2016 to Thursday, July 21, 2016. Flow depth and velocity measurements recorded by the flow monitor are consistent with field confirmations conducted to date and support the relative accuracy of the flow monitor at this location.

Observations

Average flow depth, velocity, and quantity data observed during Thursday, January 21, 2016 to Thursday, July 21, 2016 , along with observed minimum and maximum data, are provided in the following table. The minimum and maximum data points reported below are based on 5 minute data intervals. Based on the average recorded depth of 2.77 , this site flows at approximately 27% full.

Observed Flow Conditions			
Item	Depth (in)	Velocity (ft/s)	Quantity (MGD)
Average	2.77	2.77	0.111
Minimum	1.38	0.26	0.008
Maximum	6.18	6.18	0.584
Time of Minimum	7/4/2016 4:50 AM	7/19/2016 3:20 AM	7/19/2016 3:20 AM
Time of Maximum	7/19/2016 1:50 PM	1/21/2016 11:55 AM	6/30/2016 1:00 PM

Data Quality

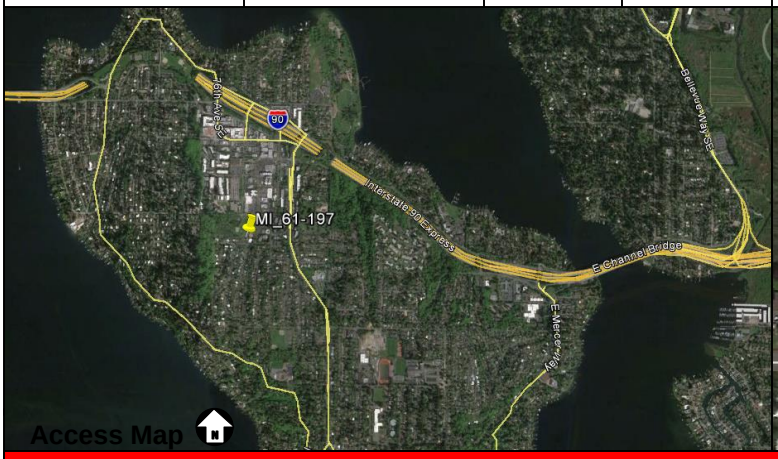
Data uptime observed during the Thursday, January 21, 2016 to the Thursday, July 21, 2016 monitoring period is provided in the table below. Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Percent Uptime	
Depth (mm)	100
Velocity (m/s)	100
Quantity (l/s)	100

ADS Site Report

Quality Form

Project Name: Mercer Island TFM	**City / State:** Mercer Island, WA	**FM Initials:** SW	
Site Name: MI_61-197	**Monitor Series:** Flowshark AG	**Monitor S/N:**	21482
Address/Location: Site is located within Mercerdale Park 153.00' North of 7719 SE 34th St		**Manhole #:**	61-197
		GPS Coordinates:	47.580334° , -122.234807°
		Pipe Height:	10.13"
Access: Drive / Walk	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Width:**	10.00"
		IP Address:	166.213.6.142



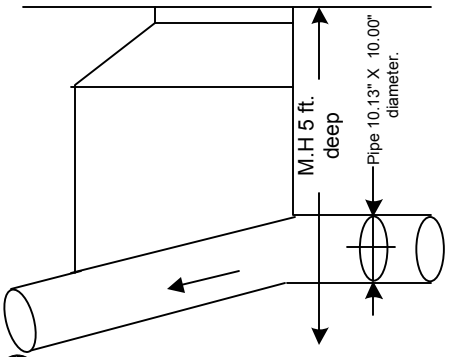
Investigation Information:

Date/Time of Investigation:	01/08/2016 @ 12:10
Site Hydraulics:	Smooth, slightly draws down through M/H chamber
Upstream Input: (L/S, P/S)	None
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not Investigated
Depth of Flow:	2.80" +/- 0.25"
Range (Air DOF):	7.20" +/- 0.25"
Peak Velocity:	1.87 fps
Silt:	0.00"

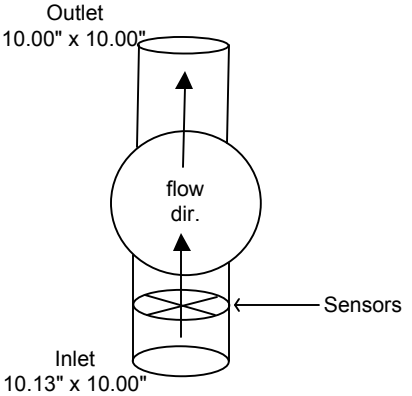
Manhole Information:

Manhole Depth:	5'				
Manhole Material / Condition	Concrete / Good				
Pipe Material / Condition:	VCP / Good				
Mini System Character:	Residential [X]	Commercial [ ]	Industrial [ ]	Trunk [ ]	
Telephone Information:	Does not apply				
Access Pole #:	Does not apply				
Distance From Manhole:	Does not apply	Feet			
Road Cut Length:	Does not apply	Feet			
Trench Length:	Does not apply	Feet			

Other Information:



Cross Section



Planar

Installation Information	
Installation Type:	Standard Ring
Sensors Devices:	Ultrasonic Depth, Doppler Velocity, Pressure Depth
Surcharge Height:	0.50'
Rain Guage Zone:	N/A

Backup	Yes	No	?	Distance
Trunk	[ ]	[X]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

Site Installed 01/08/2016

SCATTERGRAPH REPORT

MI_61-197

Flow Monitor

MI_61-197

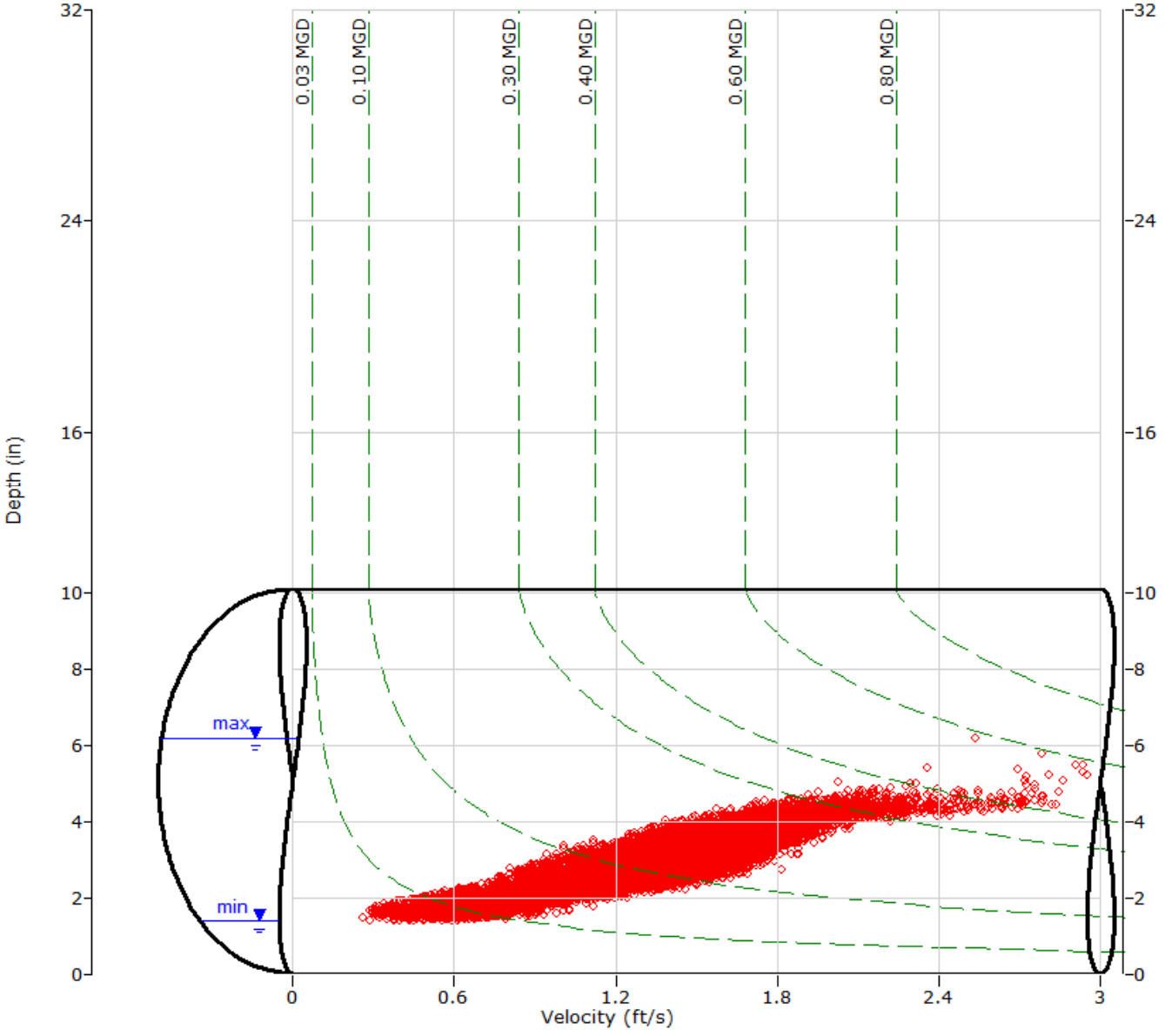
Pipe Height
10.13 in

Report Period

1/21/2016
To
7/21/2016

Legend

- Depth - Velocity
- Iso-Q™
- Silt
- Min-Max Depth



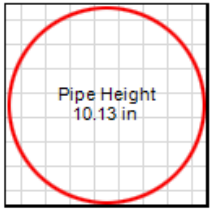
ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

MI_61-197

Flow Monitor

MI_61-197

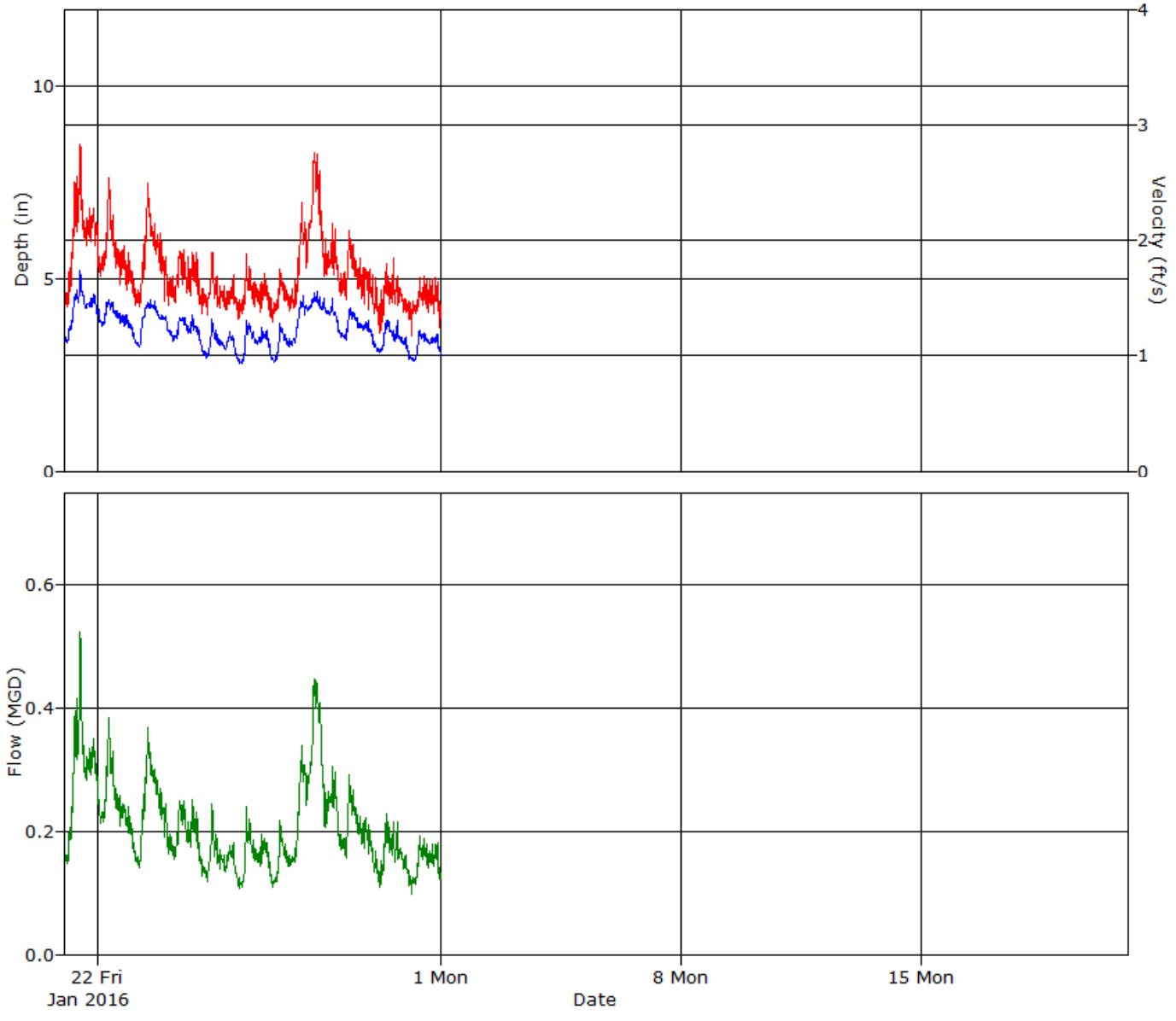


Report Period

1/21/2016
To
1/31/2016

Legend

- Depth
- Velocity
- Quantity



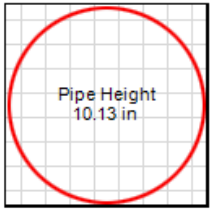
ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

MI_61-197

Flow Monitor

MI_61-197

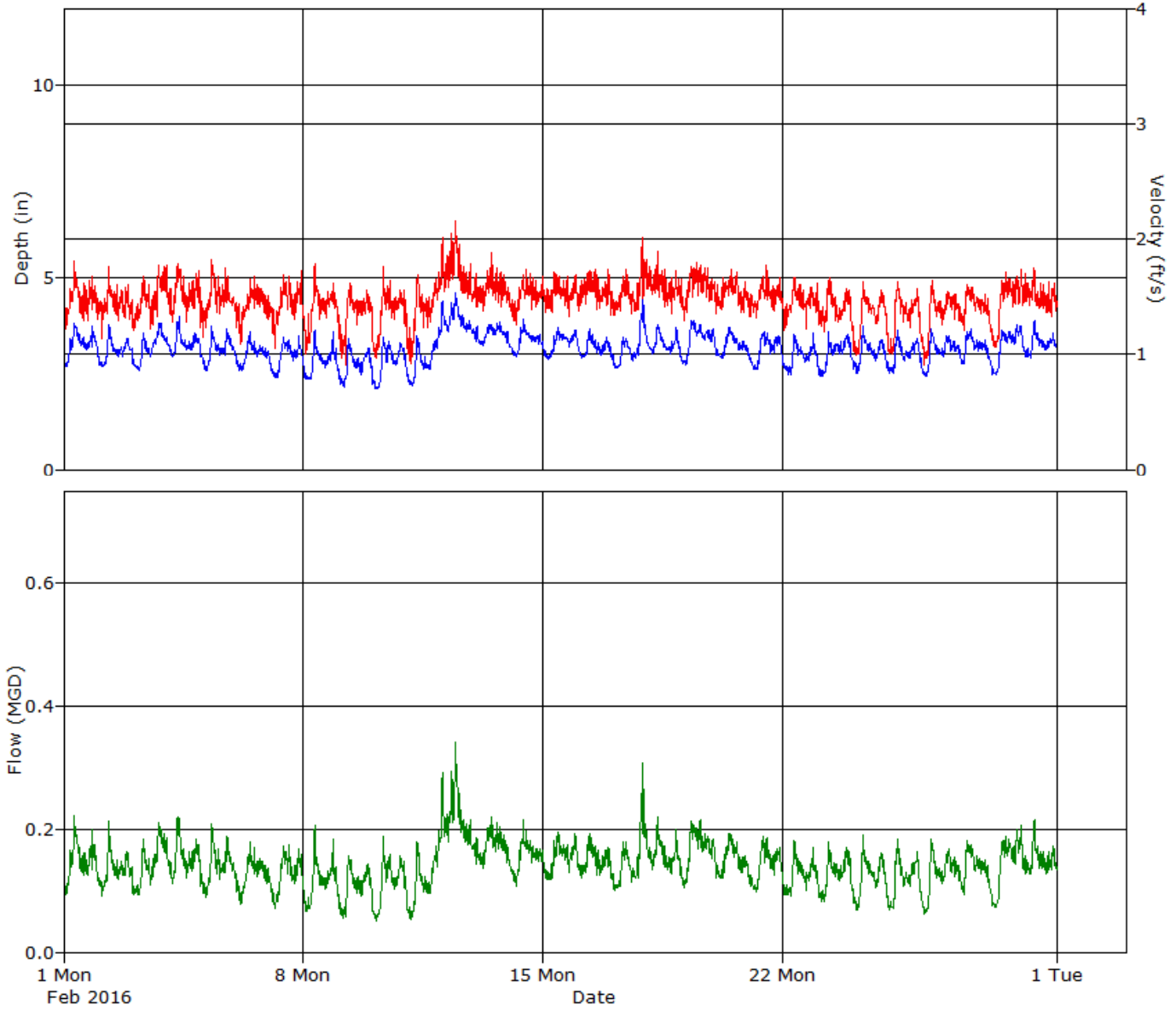


Report Period

2/1/2016
To
2/29/2016

Legend

- Depth
- Velocity
- Quantity



ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

MI_61-197

Flow Monitor

MI_61-197

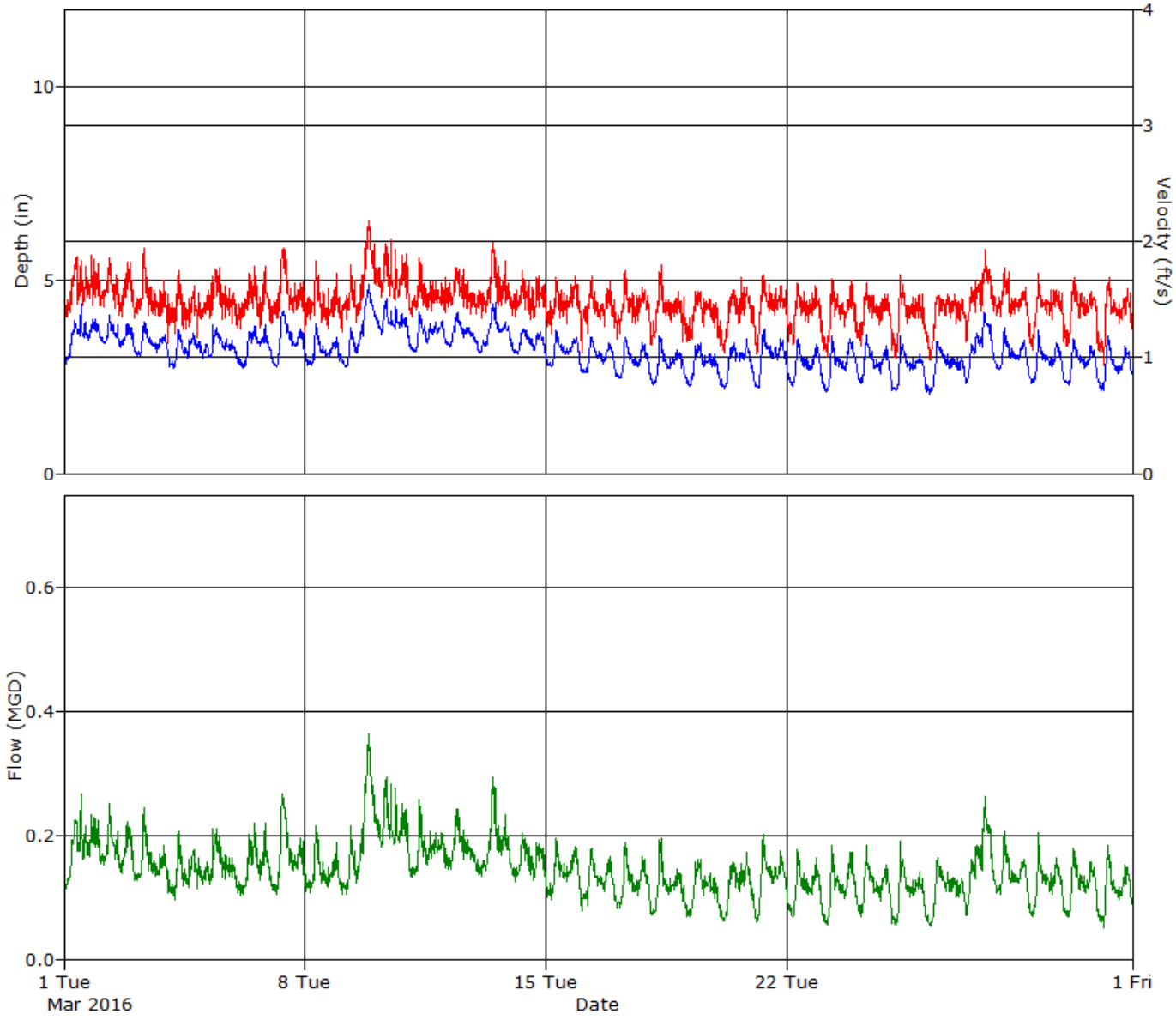
Pipe Height
10.13 in

Report Period

3/1/2016
To
3/31/2016

Legend

- Depth
- Velocity
- Quantity



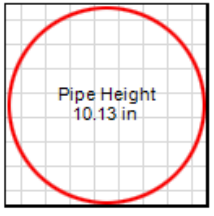
ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

MI_61-197

Flow Monitor

MI_61-197

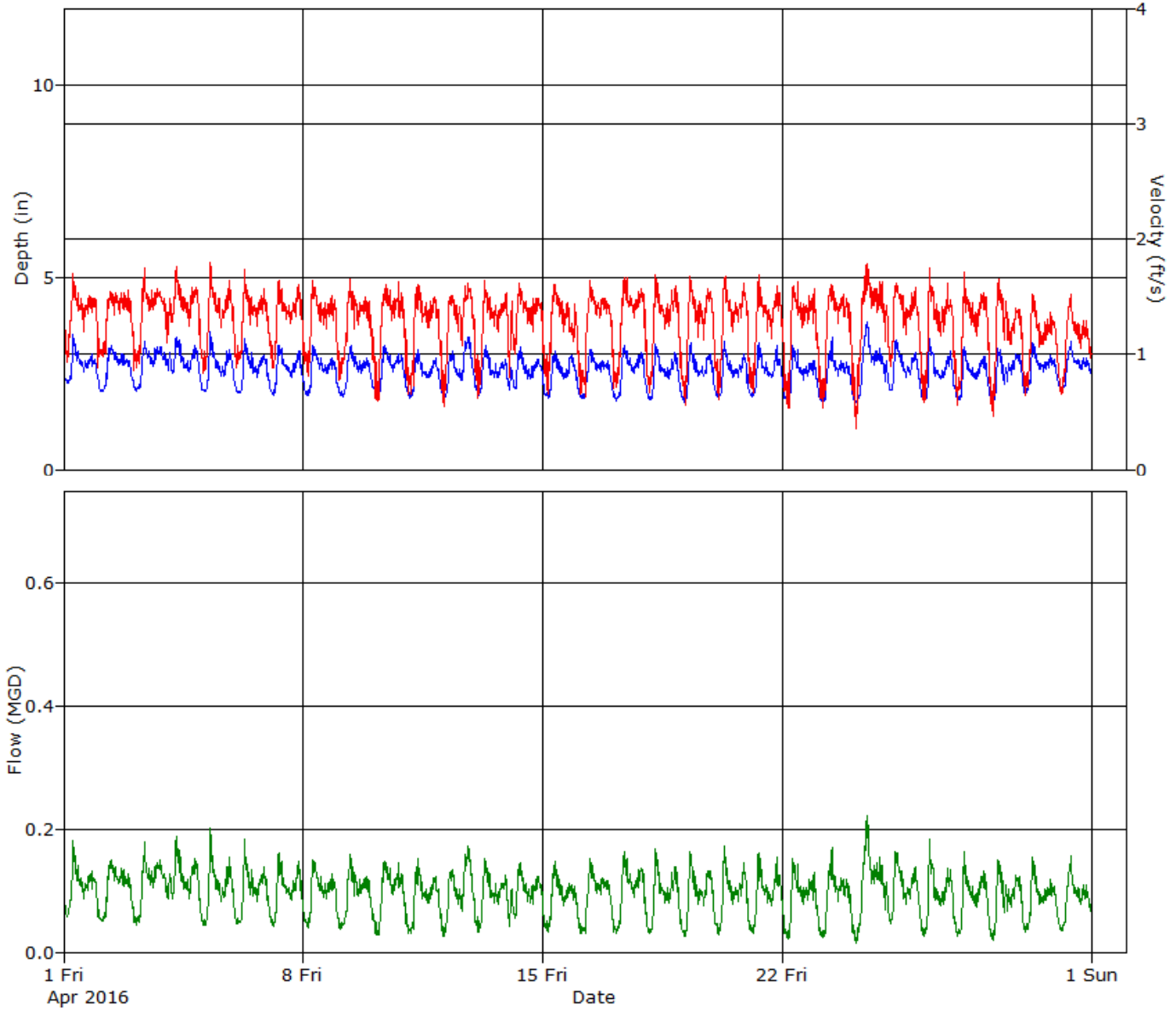


Report Period

4/1/2016
To
4/30/2016

Legend

- Depth
- Velocity
- Quantity



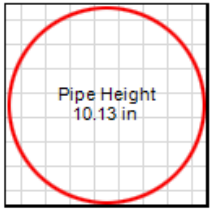
ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

MI_61-197

Flow Monitor

MI_61-197

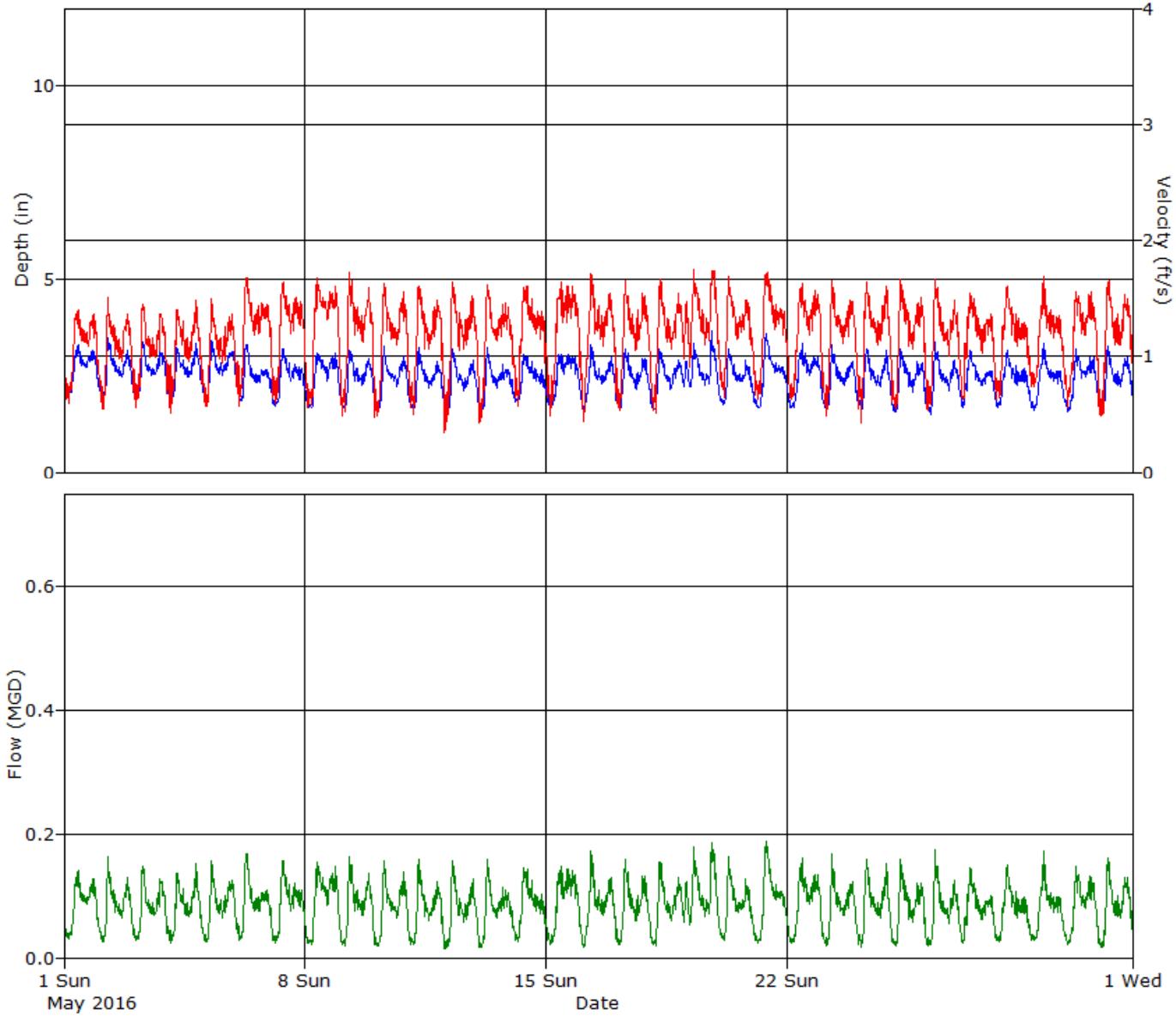


Report Period

5/1/2016
To
5/31/2016

Legend

- Depth
- Velocity
- Quantity



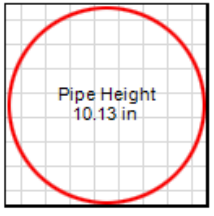
ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

MI_61-197

Flow Monitor

MI_61-197

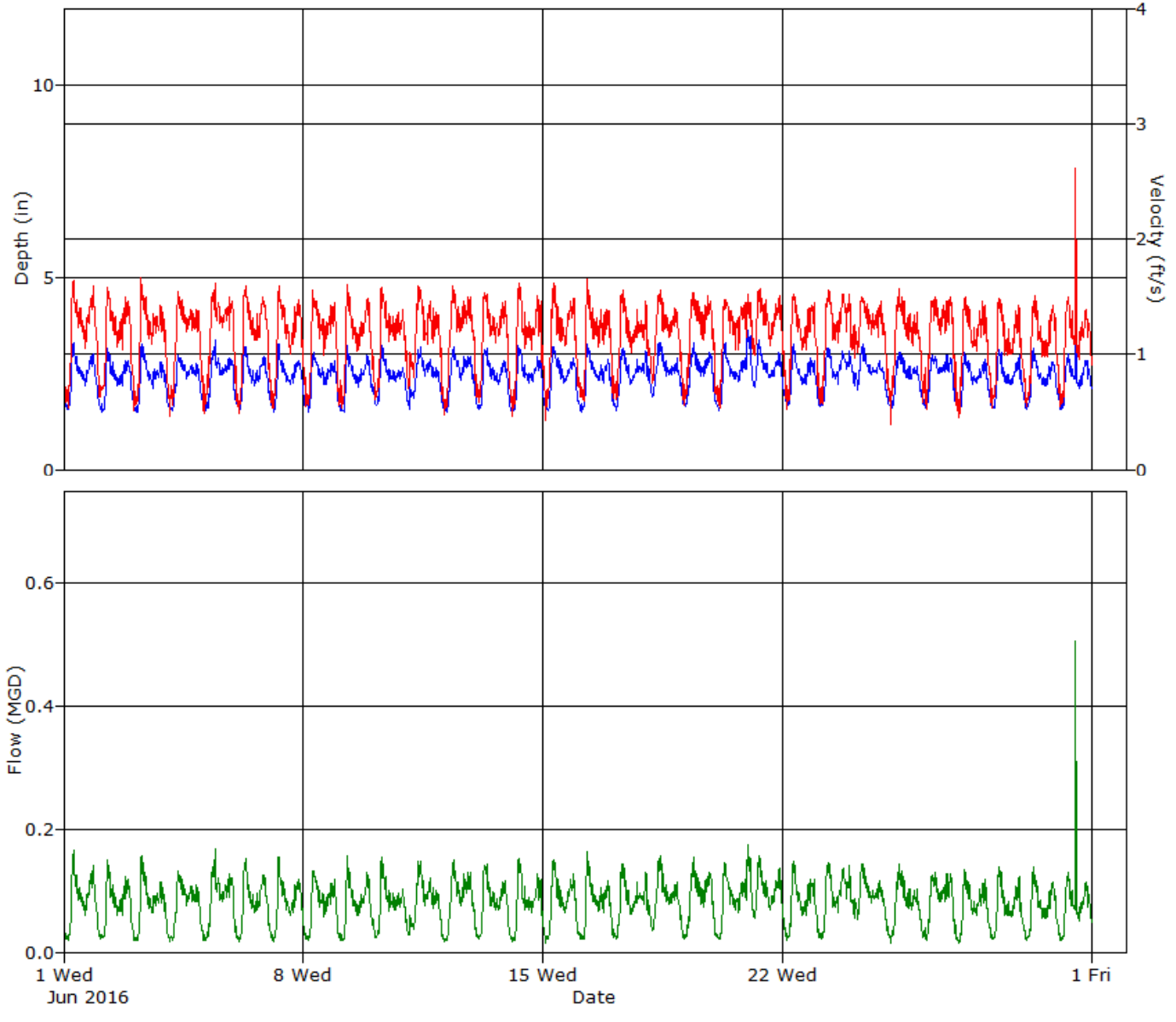


Report Period

6/1/2016
To
6/30/2016

Legend

- Depth
- Velocity
- Quantity



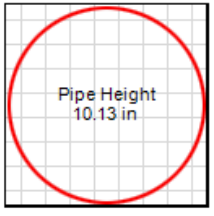
ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

MI_61-197

Flow Monitor

MI_61-197

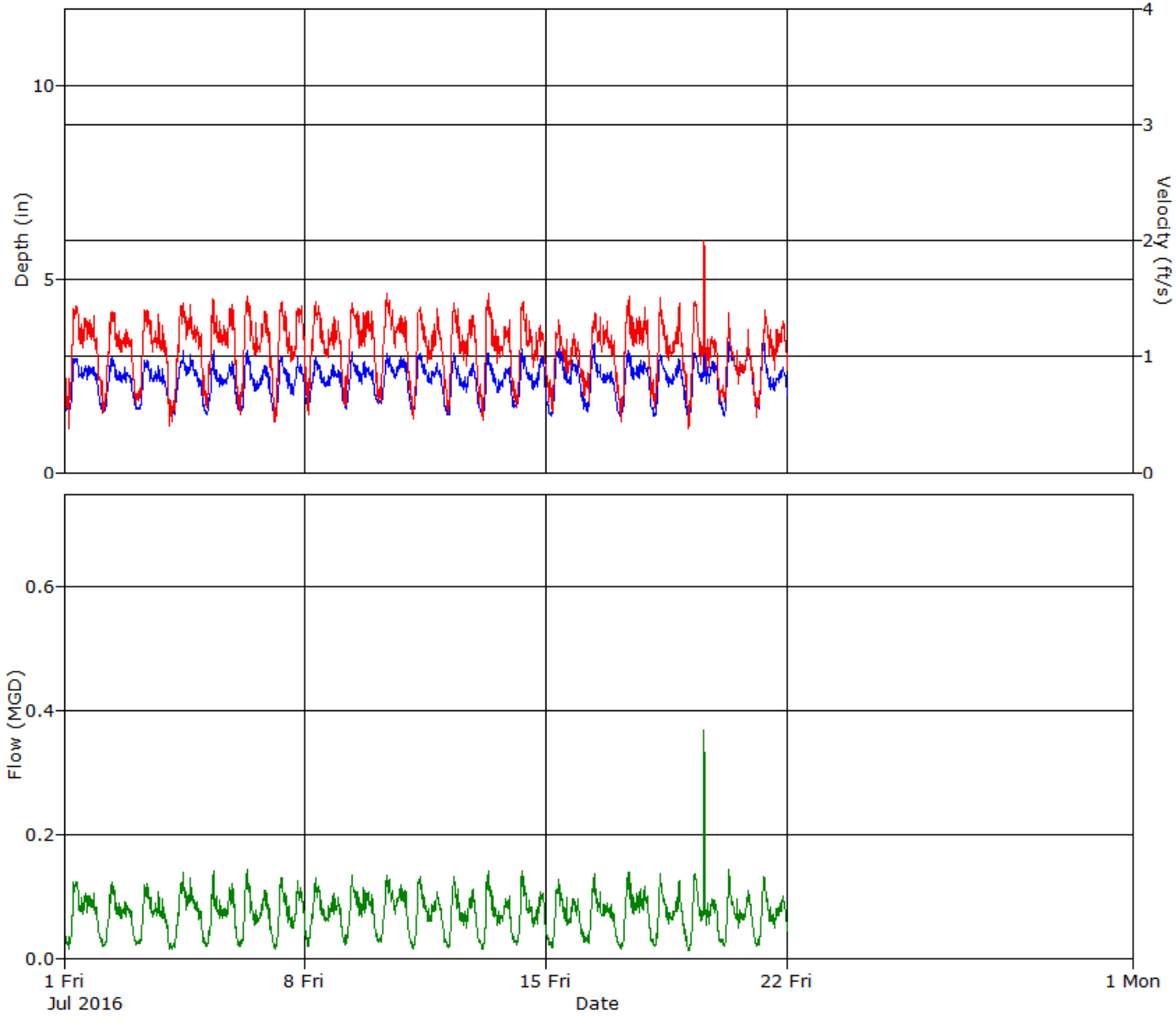


Report Period

7/1/2016
To
7/21/2016

Legend

- Depth
- Velocity
- Quantity



ADS ENVIRONMENTAL SERVICES

Daily Tabular Report For The Period 1/21/2016 - 7/21/2016

MI_61-197, Pipe Height: 10.13 in

Daily Tabular Report

Date	Depth (in)					Velocity (ft/s)					Quantity (MGD - Total ft3)						Rain (in)
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
1/21/2016	02:45	3.28	11:30	5.28	4.22	02:35	1.28	11:55	2.95	2.04	02:00	0.133	11:30	0.552	0.293	39126	
1/22/2016	18:05	3.58	07:15	4.58	4.02	19:50	1.52	07:30	2.71	1.89	22:00	0.180	07:30	0.410	0.251	33532	
1/23/2016	04:30	3.13	13:35	4.56	3.93	03:10	1.33	11:05	2.59	1.84	04:30	0.130	11:05	0.394	0.239	31912	
1/24/2016	23:55	3.21	17:40	4.27	3.69	23:25	1.30	12:25	2.12	1.67	23:25	0.136	12:25	0.286	0.198	26407	
1/25/2016	03:55	2.85	07:40	4.06	3.32	01:10	1.22	08:00	1.98	1.53	04:25	0.108	07:50	0.258	0.157	20978	
1/26/2016	03:15	2.71	09:25	4.01	3.34	02:40	1.19	07:40	1.96	1.54	02:40	0.095	07:40	0.256	0.159	21277	
1/27/2016	03:10	2.79	23:55	4.71	3.46	02:25	1.15	22:50	2.42	1.59	02:25	0.096	22:50	0.352	0.176	23490	
1/28/2016	23:55	3.76	09:40	4.74	4.24	14:35	1.59	06:55	2.84	2.07	14:40	0.201	07:25	0.466	0.304	40573	
1/29/2016	05:20	3.30	08:55	4.38	3.76	21:10	1.30	07:35	2.16	1.69	05:20	0.147	07:35	0.296	0.205	27390	
1/30/2016	04:35	3.01	10:15	4.02	3.45	23:30	1.10	14:20	1.91	1.51	05:55	0.103	10:15	0.251	0.163	21726	
1/31/2016	04:40	2.81	08:55	3.83	3.27	03:30	1.07	09:10	1.83	1.47	03:30	0.091	09:10	0.226	0.148	19779	
2/1/2016	02:00	2.64	07:50	3.93	3.27	01:35	1.08	07:45	1.96	1.47	01:35	0.080	07:45	0.236	0.148	19849	
2/2/2016	03:30	2.63	07:45	3.89	3.10	02:55	1.10	07:40	1.91	1.45	02:55	0.081	07:40	0.239	0.135	17991	
2/3/2016	05:20	2.53	20:35	4.00	3.17	01:50	1.07	19:00	1.88	1.48	02:40	0.081	19:00	0.232	0.143	19099	
2/4/2016	04:55	2.83	09:15	4.15	3.29	13:40	1.08	08:50	1.91	1.53	04:10	0.097	07:40	0.236	0.154	20638	
2/5/2016	03:35	2.54	07:35	3.96	3.12	02:05	1.12	07:45	1.93	1.48	02:05	0.084	07:35	0.236	0.140	18698	
2/6/2016	04:35	2.51	10:15	3.77	3.01	03:30	1.03	11:35	1.79	1.43	04:35	0.073	10:45	0.193	0.128	17121	
2/7/2016	04:50	2.29	20:45	3.65	2.94	03:50	1.03	14:10	1.85	1.45	03:50	0.068	14:10	0.197	0.126	16883	
2/8/2016	01:40	2.23	20:35	3.89	2.82	01:50	0.94	08:05	1.82	1.40	02:45	0.062	20:35	0.223	0.116	15478	
2/9/2016	03:25	2.07	07:25	3.71	2.74	03:10	0.86	09:20	1.75	1.36	03:10	0.050	09:20	0.174	0.108	14397	
2/10/2016	04:15	2.03	07:45	3.56	2.81	03:30	0.92	07:45	1.81	1.36	03:35	0.049	07:45	0.203	0.113	15103	
2/11/2016	02:10	2.13	22:45	3.76	2.84	02:55	0.80	23:50	1.87	1.38	02:55	0.046	23:50	0.211	0.117	15604	
2/12/2016	23:55	3.35	10:30	4.72	3.89	22:05	1.28	10:45	2.37	1.72	21:55	0.145	10:45	0.363	0.219	29222	
2/13/2016	06:10	3.15	17:15	4.00	3.53	06:25	1.22	12:00	1.97	1.57	06:25	0.119	15:45	0.236	0.174	23302	
2/14/2016	04:55	2.90	09:50	4.08	3.35	02:40	1.12	15:10	1.81	1.50	05:00	0.099	09:50	0.230	0.155	20719	
2/15/2016	03:25	2.83	10:30	3.85	3.30	06:45	1.20	16:50	1.88	1.53	02:45	0.101	10:30	0.222	0.155	20747	
2/16/2016	23:55	2.83	08:25	3.77	3.19	00:55	1.21	10:05	1.87	1.55	23:05	0.112	10:05	0.210	0.150	19995	
2/17/2016	04:10	2.58	21:50	4.53	3.16	16:55	1.20	21:45	2.08	1.52	02:05	0.091	21:50	0.317	0.147	19683	
2/18/2016	17:45	2.92	08:25	4.04	3.29	18:00	1.21	07:50	1.93	1.60	18:00	0.112	08:25	0.252	0.161	21503	
2/19/2016	03:25	2.62	07:30	4.00	3.39	04:45	1.21	12:15	1.92	1.58	04:45	0.098	09:45	0.238	0.167	22324	
2/20/2016	03:30	2.79	10:10	3.82	3.23	01:05	1.20	15:55	1.90	1.53	05:20	0.107	10:00	0.211	0.150	20078	
2/21/2016	04:25	2.55	11:05	3.70	3.12	05:30	1.16	12:30	1.90	1.51	05:30	0.085	09:15	0.214	0.142	18933	
2/22/2016	05:10	2.34	20:45	3.73	2.96	00:55	1.08	13:30	1.75	1.45	03:10	0.082	08:15	0.195	0.127	17008	
2/23/2016	03:40	2.33	07:55	3.72	3.03	04:50	1.14	08:30	1.83	1.41	02:35	0.074	08:05	0.196	0.128	17131	
2/24/2016	04:25	2.38	08:10	3.78	3.05	01:25	0.95	07:30	1.67	1.33	04:25	0.062	08:10	0.201	0.123	16385	
2/25/2016	01:55	2.36	08:40	3.71	3.00	02:10	0.94	08:15	1.70	1.34	01:55	0.063	08:40	0.192	0.120	16106	
2/26/2016	03:50	2.34	07:55	3.70	3.05	03:05	0.84	07:40	1.68	1.34	04:05	0.058	07:55	0.194	0.124	16584	
2/27/2016	05:40	2.66	11:25	3.69	3.18	06:40	1.17	01:20	1.65	1.43	06:40	0.088	11:20	0.189	0.138	18493	
2/28/2016	04:15	2.39	19:35	3.98	3.20	04:15	0.99	20:05	1.84	1.43	04:15	0.064	22:45	0.226	0.142	19012	
2/29/2016	02:55	2.87	07:45	3.92	3.27	19:45	1.21	07:45	1.80	1.50	04:45	0.113	07:45	0.230	0.149	19957	
3/1/2016	01:10	2.78	12:00	4.51	3.57	01:30	1.14	12:05	2.15	1.59	01:45	0.103	12:05	0.317	0.181	24194	
3/2/2016	15:55	3.19	07:45	4.19	3.58	16:15	1.18	08:20	1.94	1.59	16:15	0.118	07:30	0.264	0.180	24018	
3/3/2016	04:25	2.97	08:10	3.99	3.36	01:40	1.14	07:30	1.95	1.50	01:40	0.109	07:30	0.253	0.157	20949	
3/4/2016	05:00	2.67	07:25	3.85	3.22	01:05	1.02	07:45	1.79	1.42	04:45	0.088	07:25	0.216	0.140	18663	
3/5/2016	05:05	2.95	07:30	3.99	3.31	16:25	1.17	13:25	1.88	1.49	05:20	0.110	07:30	0.241	0.152	20316	
3/6/2016	04:40	2.64	20:05	4.00	3.29	02:35	1.11	20:15	1.92	1.48	02:40	0.094	20:05	0.238	0.150	20049	

Date	Depth (in)					Velocity (ft/s)					Quantity (MGD - Total ft3)						Rain (in)
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
3/7/2016	04:20	2.70	08:45	4.30	3.41	22:55	1.08	09:15	2.09	1.54	04:20	0.088	08:10	0.287	0.165	22072	
3/8/2016	01:40	2.76	07:50	4.02	3.16	16:30	1.12	07:30	1.94	1.47	16:30	0.100	07:30	0.226	0.140	18776	
3/9/2016	03:15	2.73	20:10	5.03	3.59	00:50	1.16	20:30	2.29	1.61	05:00	0.096	20:30	0.402	0.189	25214	
3/10/2016	23:50	3.51	08:40	4.78	3.95	11:05	1.35	11:50	2.19	1.70	11:05	0.168	08:40	0.324	0.220	29397	
3/11/2016	03:40	3.10	07:40	4.24	3.61	00:40	1.23	09:00	1.89	1.53	02:00	0.122	07:40	0.260	0.175	23449	
3/12/2016	04:50	3.23	10:05	4.29	3.62	23:20	1.25	10:55	1.91	1.55	23:20	0.127	08:55	0.256	0.178	23855	
3/13/2016	02:05	3.10	12:25	4.48	3.66	03:25	1.22	12:25	2.11	1.58	03:25	0.120	12:25	0.322	0.185	24773	
3/14/2016	23:55	2.95	09:30	3.87	3.39	01:55	1.17	09:30	1.84	1.51	01:55	0.111	09:30	0.231	0.158	21126	
3/15/2016	03:10	2.71	07:05	3.77	3.17	00:55	1.13	19:55	1.87	1.47	00:55	0.091	06:45	0.203	0.141	18848	
3/16/2016	00:55	2.58	06:45	3.60	3.01	00:55	1.01	07:15	1.79	1.43	00:55	0.072	07:15	0.196	0.128	17136	
3/17/2016	01:00	2.41	07:15	3.62	2.92	01:15	1.06	06:35	1.83	1.45	01:15	0.072	06:35	0.200	0.125	16679	
3/18/2016	01:25	2.27	06:40	3.70	2.84	00:15	1.03	08:05	1.84	1.41	01:45	0.064	06:40	0.211	0.117	15655	
3/19/2016	03:45	2.23	11:10	3.50	2.81	01:55	1.05	09:10	1.71	1.38	02:35	0.065	11:10	0.177	0.113	15086	
3/20/2016	03:55	2.11	19:30	3.49	2.86	03:35	0.94	15:35	1.75	1.39	03:35	0.057	19:40	0.182	0.117	15689	
3/21/2016	03:00	2.17	08:05	3.77	3.01	02:30	0.92	08:30	1.86	1.44	02:30	0.055	06:55	0.209	0.130	17403	
3/22/2016	03:40	2.20	07:00	3.58	2.83	04:00	1.00	07:25	1.72	1.40	04:00	0.060	06:50	0.188	0.116	15508	
3/23/2016	02:35	2.09	06:35	3.71	2.85	03:45	0.93	07:25	1.78	1.37	03:45	0.051	06:35	0.209	0.116	15481	
3/24/2016	03:25	2.28	06:40	3.62	2.87	04:40	1.02	07:05	1.79	1.40	03:15	0.065	07:05	0.202	0.117	15688	
3/25/2016	00:45	2.10	06:35	3.63	2.75	02:45	0.95	06:35	1.76	1.37	03:15	0.054	06:35	0.203	0.109	14586	
3/26/2016	02:35	2.01	08:40	3.48	2.76	03:10	0.87	08:20	1.72	1.36	03:35	0.048	08:40	0.181	0.109	14628	
3/27/2016	03:45	2.25	16:45	4.32	3.25	03:55	1.08	17:30	1.99	1.53	03:55	0.065	16:45	0.269	0.155	20664	
3/28/2016	02:30	2.65	07:05	3.88	3.08	23:45	1.16	06:50	1.84	1.49	23:45	0.090	06:50	0.221	0.137	18357	
3/29/2016	03:40	2.28	06:40	3.90	2.91	02:20	0.99	06:50	1.78	1.42	02:20	0.065	06:50	0.217	0.123	16386	
3/30/2016	04:00	2.17	07:45	3.60	2.87	04:05	1.03	07:05	1.76	1.40	03:35	0.063	07:05	0.193	0.119	15865	
3/31/2016	03:15	2.06	07:05	3.71	2.78	04:00	0.83	08:00	1.83	1.37	04:00	0.044	07:05	0.196	0.112	14909	
4/1/2016	02:25	2.18	07:15	3.57	2.73	02:10	0.80	06:50	1.74	1.36	02:10	0.050	06:45	0.189	0.107	14324	
4/2/2016	04:05	2.01	09:40	3.30	2.68	00:20	0.75	21:20	1.69	1.35	04:05	0.048	09:25	0.167	0.104	13934	
4/3/2016	02:55	2.00	09:05	3.35	2.75	01:40	0.76	09:05	1.78	1.36	02:50	0.040	09:05	0.184	0.110	14756	
4/4/2016	23:50	2.26	09:35	3.62	2.86	23:40	1.01	06:55	1.77	1.43	23:50	0.063	07:00	0.193	0.120	16029	
4/5/2016	02:25	2.02	06:45	3.59	2.65	01:30	0.76	06:45	1.90	1.33	03:40	0.039	06:45	0.215	0.103	13763	
4/6/2016	01:25	1.98	06:50	3.57	2.62	01:05	0.77	06:45	1.80	1.33	01:05	0.039	06:50	0.189	0.100	13362	
4/7/2016	02:50	1.91	06:20	3.33	2.61	02:35	0.84	06:50	1.74	1.33	02:45	0.041	06:35	0.169	0.100	13311	
4/8/2016	02:55	1.90	06:40	3.31	2.59	03:15	0.63	06:50	1.66	1.31	03:15	0.031	06:40	0.163	0.097	12992	
4/9/2016	03:40	1.86	09:20	3.30	2.57	00:50	0.64	08:45	1.75	1.29	01:35	0.032	08:45	0.176	0.095	12689	
4/10/2016	02:55	1.85	09:25	3.31	2.59	04:20	0.38	18:35	1.70	1.27	04:20	0.017	09:25	0.160	0.096	12774	
4/11/2016	02:00	1.84	08:25	3.22	2.49	01:40	0.51	08:20	1.73	1.25	01:40	0.025	08:20	0.166	0.088	11825	
4/12/2016	01:45	1.88	19:45	3.53	2.63	02:30	0.46	19:40	1.67	1.28	02:30	0.021	19:40	0.180	0.100	13303	
4/13/2016	04:10	1.90	08:10	3.32	2.54	03:05	0.57	06:50	1.69	1.27	03:05	0.030	08:10	0.160	0.092	12290	
4/14/2016	00:40	2.04	07:50	3.23	2.59	00:30	0.68	07:35	1.71	1.34	00:30	0.036	07:05	0.159	0.098	13123	
4/15/2016	03:50	1.81	08:00	3.16	2.51	03:25	0.59	08:45	1.71	1.25	03:25	0.029	08:35	0.160	0.089	11911	
4/16/2016	03:15	1.82	08:15	3.17	2.52	02:30	0.50	09:05	1.66	1.27	02:30	0.022	08:55	0.157	0.092	12278	
4/17/2016	03:05	1.75	09:10	3.27	2.56	04:30	0.65	10:50	1.72	1.31	03:05	0.028	09:05	0.167	0.097	13024	
4/18/2016	02:55	1.77	06:40	3.35	2.52	01:30	0.57	06:40	1.74	1.28	01:30	0.026	06:40	0.179	0.093	12424	
4/19/2016	02:50	1.73	06:55	3.43	2.53	03:40	0.47	06:55	1.73	1.27	03:40	0.022	06:55	0.184	0.094	12511	
4/20/2016	03:15	1.84	06:35	3.39	2.53	02:50	0.44	08:05	1.77	1.29	02:50	0.020	06:40	0.181	0.094	12544	
4/21/2016	02:10	1.88	06:35	3.36	2.55	00:50	0.59	07:20	1.78	1.29	00:50	0.029	06:35	0.174	0.094	12595	
4/22/2016	02:45	1.73	10:25	3.50	2.49	03:25	0.39	10:20	1.82	1.26	03:25	0.016	10:25	0.176	0.090	12048	
4/23/2016	03:55	1.72	10:15	3.55	2.48	02:00	0.34	10:05	1.68	1.25	02:00	0.015	10:10	0.182	0.090	11980	
4/24/2016	04:15	1.66	11:20	3.94	2.71	03:15	0.32	10:25	1.91	1.30	03:15	0.014	11:20	0.237	0.109	14514	
4/25/2016	04:15	2.02	07:00	3.58	2.67	02:30	0.75	20:35	1.69	1.34	03:55	0.038	07:00	0.187	0.103	13810	
4/26/2016	02:20	1.85	06:40	3.48	2.52	03:00	0.43	06:40	1.80	1.25	03:00	0.020	06:40	0.195	0.091	12229	
4/27/2016	04:10	1.78	07:25	3.21	2.49	01:55	0.44	06:50	1.72	1.26	01:55	0.021	06:50	0.165	0.090	11998	
4/28/2016	03:15	1.75	07:45	3.20	2.54	03:10	0.32	06:40	1.71	1.20	03:10	0.013	06:40	0.164	0.088	11797	
4/29/2016	02:00	1.92	06:40	3.40	2.64	01:50	0.57	07:55	1.60	1.14	01:55	0.028	07:55	0.164	0.088	11710	
4/30/2016	01:55	2.05	09:30	3.40	2.65	03:30	0.55	09:30	1.56	1.12	03:30	0.029	09:30	0.164	0.086	11541	

Date	Depth (in)					Velocity (ft/s)					Quantity (MGD - Total ft3)						Rain (in)
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
5/1/2016	03:10	1.97	09:35	3.33	2.70	03:50	0.51	08:55	1.45	1.09	03:50	0.027	09:40	0.145	0.087	11609	
5/2/2016	03:15	1.87	08:25	3.52	2.64	02:55	0.40	06:55	1.57	1.07	02:55	0.019	06:55	0.166	0.083	11096	
5/3/2016	03:25	1.89	06:45	3.45	2.62	02:30	0.39	07:15	1.52	1.06	02:30	0.018	06:50	0.158	0.081	10890	
5/4/2016	03:20	1.89	20:00	3.49	2.62	03:05	0.41	20:00	1.61	1.08	03:05	0.019	20:00	0.176	0.083	11061	
5/5/2016	04:10	1.87	06:40	3.53	2.67	02:00	0.38	06:55	1.57	1.07	04:10	0.017	06:55	0.172	0.084	11257	
5/6/2016	02:35	1.85	07:15	3.33	2.48	02:20	0.40	06:50	1.72	1.25	02:20	0.019	07:15	0.173	0.088	11732	
5/7/2016	03:25	1.67	09:10	3.29	2.44	02:15	0.39	09:05	1.76	1.23	02:15	0.017	09:10	0.167	0.086	11545	
5/8/2016	02:15	1.66	09:00	3.19	2.51	02:15	0.38	09:15	1.79	1.27	02:15	0.014	09:00	0.160	0.093	12458	
5/9/2016	03:05	1.64	06:35	3.23	2.43	01:30	0.31	06:35	1.79	1.22	01:30	0.013	06:35	0.176	0.085	11426	
5/10/2016	03:05	1.63	07:15	3.35	2.43	02:45	0.31	08:00	1.75	1.17	03:40	0.012	07:15	0.169	0.082	10920	
5/11/2016	02:35	1.65	06:55	3.38	2.39	03:20	0.34	06:55	1.66	1.16	03:20	0.014	06:55	0.174	0.080	10630	
5/12/2016	01:55	1.61	06:40	3.28	2.36	02:30	0.29	06:40	1.74	1.15	02:30	0.011	06:40	0.174	0.078	10431	
5/13/2016	03:20	1.50	07:15	3.33	2.36	03:25	0.31	07:20	1.70	1.17	03:25	0.011	07:20	0.166	0.079	10519	
5/14/2016	02:10	1.77	13:55	3.12	2.42	04:15	0.49	11:00	1.72	1.22	04:15	0.022	11:00	0.159	0.083	11158	
5/15/2016	04:15	1.67	10:15	3.17	2.50	02:30	0.30	10:15	1.71	1.24	02:30	0.012	10:15	0.163	0.091	12160	
5/16/2016	03:00	1.51	07:05	3.31	2.46	02:25	0.34	07:05	1.75	1.23	02:25	0.013	07:05	0.178	0.087	11689	
5/17/2016	03:20	1.68	07:30	3.32	2.44	02:35	0.39	06:30	1.66	1.18	02:35	0.016	06:45	0.168	0.083	11054	
5/18/2016	03:55	1.60	06:30	3.32	2.41	04:30	0.38	07:25	1.73	1.18	04:30	0.014	07:25	0.164	0.082	10905	
5/19/2016	04:45	2.11	19:05	3.87	2.69	03:55	0.82	19:15	1.84	1.37	03:55	0.048	19:05	0.204	0.107	14299	
5/20/2016	03:20	1.71	07:10	3.34	2.43	03:50	0.60	07:25	1.69	1.23	03:50	0.025	07:15	0.171	0.085	11337	
5/21/2016	04:20	1.62	09:05	3.68	2.52	01:50	0.46	11:00	1.77	1.24	01:50	0.019	09:05	0.198	0.093	12397	
5/22/2016	04:00	1.66	10:10	3.45	2.51	02:15	0.49	10:10	1.75	1.22	02:15	0.019	10:10	0.188	0.090	12069	
5/23/2016	02:50	1.60	06:30	3.36	2.41	02:55	0.36	06:40	1.73	1.19	02:55	0.014	06:40	0.179	0.082	10977	
5/24/2016	04:05	1.63	06:40	3.33	2.42	03:05	0.40	06:45	1.70	1.20	03:05	0.016	06:40	0.172	0.083	11158	
5/25/2016	02:50	1.54	06:40	3.33	2.39	02:15	0.40	07:10	1.68	1.18	02:15	0.015	06:40	0.170	0.081	10842	
5/26/2016	03:50	1.49	06:55	3.47	2.39	03:00	0.35	06:55	1.77	1.17	03:00	0.013	06:55	0.192	0.080	10714	
5/27/2016	02:15	1.65	06:55	3.33	2.44	02:10	0.50	09:00	1.60	1.19	02:10	0.021	08:00	0.153	0.082	10971	
5/28/2016	02:15	1.67	08:55	3.25	2.39	03:25	0.48	08:55	1.70	1.17	03:25	0.019	08:55	0.168	0.079	10534	
5/29/2016	03:55	1.61	10:15	3.46	2.38	02:10	0.66	10:15	1.81	1.18	02:10	0.025	10:15	0.195	0.080	10659	
5/30/2016	02:50	1.55	09:05	3.19	2.42	03:20	0.44	09:00	1.66	1.18	03:20	0.017	09:00	0.158	0.083	11095	
5/31/2016	03:25	1.51	06:45	3.38	2.41	02:25	0.31	06:40	1.67	1.18	02:25	0.011	06:40	0.170	0.083	11034	
6/1/2016	03:25	1.50	07:05	3.34	2.44	03:10	0.38	06:45	1.72	1.20	03:10	0.014	07:05	0.174	0.085	11312	
6/2/2016	03:55	1.48	06:40	3.27	2.35	00:55	0.56	07:05	1.63	1.17	03:05	0.021	07:10	0.158	0.078	10494	
6/3/2016	03:20	1.48	06:35	3.38	2.37	01:35	0.31	06:20	1.87	1.16	01:35	0.012	06:20	0.176	0.079	10534	
6/4/2016	04:30	1.47	08:05	3.08	2.36	02:40	0.33	08:05	1.61	1.16	02:40	0.013	08:05	0.148	0.078	10480	
6/5/2016	03:40	1.51	10:10	3.57	2.44	02:20	0.31	10:40	1.67	1.19	02:20	0.012	10:10	0.186	0.085	11359	
6/6/2016	02:50	1.51	07:45	3.26	2.40	02:50	0.40	07:55	1.66	1.16	02:50	0.013	07:45	0.157	0.081	10779	
6/7/2016	03:40	1.48	06:45	3.37	2.38	03:05	0.31	07:05	1.71	1.15	03:05	0.010	06:45	0.164	0.079	10506	
6/8/2016	03:55	1.50	07:00	3.06	2.37	02:40	0.36	06:45	1.69	1.15	02:40	0.013	06:45	0.145	0.078	10403	
6/9/2016	04:20	1.47	06:30	3.27	2.38	00:40	0.41	06:35	1.68	1.14	03:45	0.015	06:35	0.166	0.078	10472	
6/10/2016	03:30	1.62	07:50	3.35	2.40	02:20	0.52	06:20	1.66	1.16	02:50	0.021	08:00	0.160	0.079	10527	
6/11/2016	02:15	1.51	10:10	3.35	2.45	01:15	0.64	10:30	1.69	1.19	01:55	0.023	10:30	0.167	0.083	11125	
6/12/2016	02:20	1.49	09:05	3.35	2.44	03:35	0.33	19:05	1.70	1.17	03:35	0.011	09:05	0.164	0.084	11243	
6/13/2016	02:50	1.55	06:40	3.22	2.39	03:35	0.45	20:30	1.65	1.17	03:35	0.017	06:40	0.155	0.080	10646	
6/14/2016	03:05	1.51	06:30	3.31	2.39	02:20	0.30	06:45	1.69	1.14	02:20	0.011	06:45	0.165	0.079	10540	
6/15/2016	03:10	1.49	06:45	3.34	2.42	02:05	0.37	20:40	1.75	1.16	02:05	0.013	08:00	0.165	0.082	10907	
6/16/2016	02:35	1.50	06:45	3.32	2.40	04:25	0.48	06:45	1.75	1.15	04:25	0.016	06:45	0.179	0.080	10644	
6/17/2016	03:25	1.49	07:00	3.29	2.45	01:40	0.50	07:00	1.59	1.14	03:20	0.017	07:00	0.160	0.081	10772	
6/18/2016	04:50	1.85	09:50	3.49	2.60	05:05	0.70	09:50	1.67	1.22	05:05	0.033	09:50	0.182	0.091	12184	
6/19/2016	03:20	1.59	09:30	3.45	2.50	02:15	0.41	09:45	1.62	1.18	02:15	0.017	09:30	0.159	0.086	11518	
6/20/2016	02:40	1.51	23:25	3.63	2.49	03:50	0.39	23:25	1.71	1.18	03:50	0.014	23:25	0.197	0.086	11485	
6/21/2016	03:55	2.09	00:55	3.52	2.70	03:35	0.90	07:05	1.69	1.30	03:35	0.051	21:15	0.170	0.101	13546	
6/22/2016	02:55	1.65	07:00	3.28	2.42	02:55	0.38	07:15	1.59	1.15	02:55	0.014	07:00	0.156	0.079	10612	
6/23/2016	02:15	1.59	07:10	3.28	2.53	02:45	0.44	08:20	1.70	1.21	02:45	0.018	08:20	0.159	0.090	12009	
6/24/2016	23:50	2.02	08:10	3.34	2.60	02:05	0.94	08:10	1.64	1.27	23:55	0.050	08:10	0.168	0.093	12487	

Date	Depth (in)					Velocity (ft/s)					Quantity (MGD - Total ft3)						Rain (in)
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
6/25/2016	03:45	1.56	10:55	3.18	2.39	03:25	0.34	11:30	1.68	1.14	03:25	0.012	11:30	0.161	0.078	10383	
6/26/2016	04:10	1.56	10:25	3.14	2.43	04:15	0.49	10:25	1.65	1.18	04:15	0.017	10:25	0.155	0.083	11063	
6/27/2016	03:25	1.49	07:00	3.10	2.35	03:35	0.31	19:40	1.57	1.12	03:35	0.011	07:20	0.143	0.075	10021	
6/28/2016	03:40	1.53	21:15	3.27	2.36	02:05	0.38	07:55	1.69	1.07	02:05	0.014	07:55	0.151	0.072	9598	
6/29/2016	02:15	1.54	07:05	3.24	2.36	02:15	0.45	21:25	1.59	1.09	02:15	0.015	07:00	0.143	0.073	9765	
6/30/2016	02:20	1.54	13:00	5.77	2.40	01:50	0.47	12:55	2.93	1.13	01:50	0.017	13:00	0.584	0.081	10856	
7/1/2016	01:50	1.56	08:05	3.13	2.41	03:15	0.31	08:45	1.49	1.11	03:15	0.011	08:05	0.137	0.076	10182	
7/2/2016	04:35	1.51	09:35	3.12	2.32	02:55	0.46	10:40	1.43	1.04	03:00	0.016	09:35	0.133	0.068	9090	
7/3/2016	02:55	1.57	08:20	3.09	2.30	02:10	0.55	09:25	1.55	1.05	02:55	0.022	09:25	0.136	0.068	9027	
7/4/2016	04:50	1.38	11:15	3.35	2.36	01:25	0.32	10:35	1.60	1.07	03:50	0.011	11:15	0.157	0.074	9875	
7/5/2016	03:20	1.44	08:00	3.23	2.30	03:50	0.52	07:45	1.57	1.10	03:50	0.017	08:10	0.144	0.071	9527	
7/6/2016	04:00	1.57	07:55	3.20	2.32	03:05	0.36	08:55	1.58	1.10	03:05	0.013	07:45	0.148	0.072	9634	
7/7/2016	02:50	1.48	18:30	3.08	2.34	03:25	0.30	20:30	1.55	1.11	03:25	0.010	07:30	0.137	0.074	9843	
7/8/2016	02:05	1.58	07:05	3.09	2.40	02:20	0.40	07:00	1.55	1.13	02:20	0.014	07:20	0.140	0.076	10141	
7/9/2016	04:10	1.62	08:20	3.17	2.44	03:25	0.45	21:25	1.54	1.15	04:05	0.018	08:20	0.139	0.079	10583	
7/10/2016	02:55	1.74	08:50	3.19	2.47	03:25	0.47	08:30	1.60	1.13	03:25	0.021	08:50	0.153	0.080	10684	
7/11/2016	03:20	1.47	07:55	3.25	2.41	03:20	0.43	07:55	1.61	1.06	03:20	0.014	07:55	0.159	0.073	9791	
7/12/2016	03:40	1.45	07:20	3.18	2.30	04:10	0.38	07:55	1.61	1.07	03:50	0.012	07:55	0.149	0.070	9341	
7/13/2016	03:45	1.41	06:50	3.21	2.30	02:50	0.35	07:30	1.62	1.06	02:50	0.011	07:40	0.147	0.069	9233	
7/14/2016	01:15	1.61	06:45	3.36	2.41	04:25	0.52	06:45	1.56	1.05	02:45	0.021	06:45	0.161	0.072	9679	
7/15/2016	03:40	1.45	06:40	3.33	2.44	04:05	0.45	09:05	1.41	0.97	04:05	0.015	09:05	0.139	0.068	9101	
7/16/2016	05:00	1.56	08:50	3.47	2.38	05:30	0.51	09:40	1.51	1.06	05:30	0.021	09:40	0.156	0.071	9442	
7/17/2016	03:10	1.44	09:45	3.31	2.39	03:45	0.36	09:45	1.65	1.09	03:45	0.011	09:45	0.167	0.075	10069	
7/18/2016	03:15	1.42	06:45	3.16	2.35	03:15	0.51	07:15	1.52	1.05	03:15	0.016	07:25	0.141	0.070	9364	
7/19/2016	02:50	1.39	13:50	6.18	2.46	03:20	0.26	13:50	2.54	1.03	03:20	0.008	13:50	0.579	0.077	10325	
7/20/2016	04:10	1.43	07:50	3.56	2.58	04:20	0.46	07:25	1.51	0.91	04:20	0.014	07:25	0.151	0.069	9225	
7/21/2016	03:40	1.55	07:55	3.56	2.39	02:30	0.39	08:30	1.50	1.02	02:30	0.014	07:55	0.154	0.069	9191	

Report Summary For The Period 1/21/2016 - 7/21/2016

	Depth (in)	Velocity (ft/s)	Quantity (MGD - Total ft3)
Total			2719283
Avg	2.77	1.31	0.111

Site Commentary

Site Information

MI_61-908	
Pipe Dimensions (in)	9.88
Silt Level	0

Overview

Site MI_61-908 operates in critical flow regime and displayed a hydraulic shift at higher depths during the period Thursday, January 21, 2016 to Thursday, July 21, 2016. Flow depth and velocity measurements recorded by the flow monitor are consistent with field confirmations conducted to date and support the relative accuracy of the flow monitor at this location.

Observations

Average flow depth, velocity, and quantity data observed during Thursday, January 21, 2016 to Thursday, July 21, 2016 , along with observed minimum and maximum data, are provided in the following table. The minimum and maximum data points reported below are based on 5 minute data intervals. Based on the average recorded depth of 2.48 , this site flows at approximately 25% full.

Observed Flow Conditions			
Item	Depth (in)	Velocity (ft/s)	Quantity (MGD)
Average	2.48	2.48	0.126
Minimum	1.13	0.30	0.007
Maximum	14.20	14.20	1.137
Time of Minimum	7/17/2016 4:05 AM	6/3/2016 3:35 AM	6/3/2016 3:35 AM
Time of Maximum	2/3/2016 2:00 PM	4/13/2016 1:40 PM	2/3/2016 2:00 PM

Data Quality

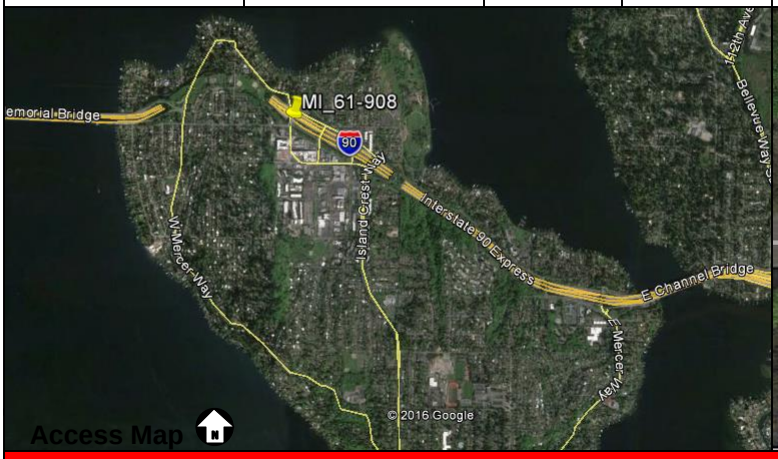
Data uptime observed during the Thursday, January 21, 2016 to the Thursday, July 21, 2016 monitoring period is provided in the table below. Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

Percent Uptime	
Depth (mm)	100
Velocity (m/s)	100
Quantity (l/s)	100

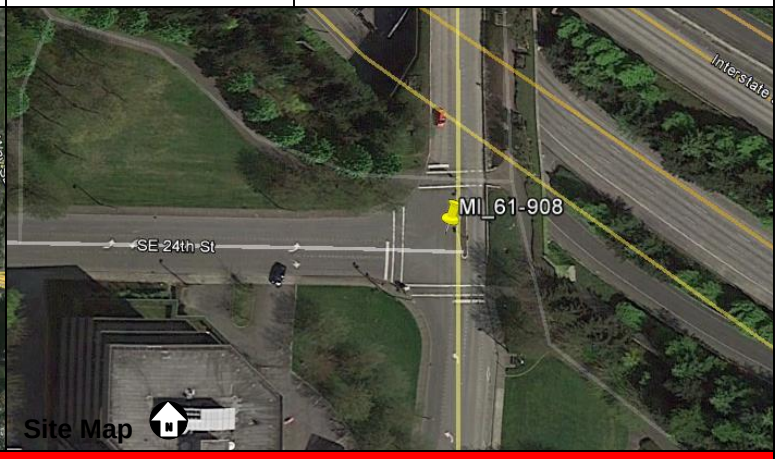
ADS Site Report

Quality Form

Project Name: Mercer Island TFM	**City / State:** Mercer Island, WA	**FM Initials:** SW	
Site Name: MI_61-908	**Monitor Series:** Flowshark AG	**Monitor S/N:**	21006
Address/Location: Site is located within Intersection of SE 24th St and 76th Ave SE		**Manhole #:**	61-908
		GPS Coordinates:	47.589175°, -122.237738°
		Pipe Height:	9.88"
Access: Drive / Walk	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Width:**	9.75"
		IP Address:	166.213.6.134



Access Map



Site Map

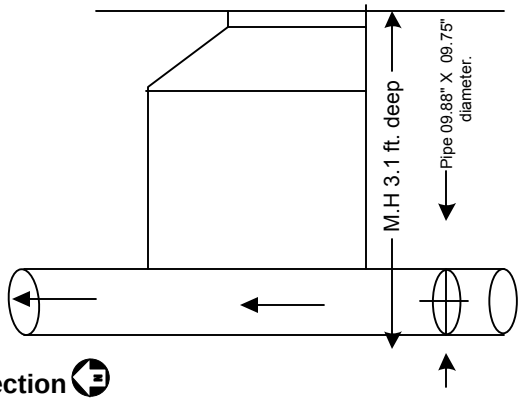
Investigation Information:

Date/Time of Investigation:	01/08/2016 @ 9::00
Site Hydraulics:	Smooth, slight ripples
Upstream Input: (L/S, P/S)	None
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not Investigated
Depth of Flow:	2.33" +/- 0.25"
Range (Air DOF):	7.55" +/- 0.25"
Peak Velocity:	1.88 fps
Silt:	0.00"

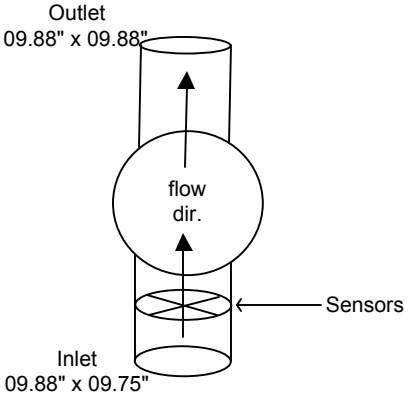
Manhole Information:

Manhole Depth:	3.1'				
Manhole Material / Condition	Concrete / Good				
Pipe Material / Condition:	VCP / Good				
Mini System Character:	Residential [X]	Commercial [X]	Industrial [ ]	Trunk [ ]	
Telephone Information:	Does not apply				
Access Pole #:	Does not apply				
Distance From Manhole:	Does not apply	Feet			
Road Cut Length:	Does not apply	Feet			
Trench Length:	Does not apply	Feet			

Other Information:



Cross Section



Planar

Installation Information	
Installation Type:	Standard Ring
Sensors Devices:	Ultrasonic Depth, Doppler Velocity, Pressure Depth
Surcharge Height:	0.00'
Rain Guage Zone:	N/A

Backup	Yes	No	?	Distance
Trunk	[ ]	[X]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

Site Installed 01/08/2016

SCATTERGRAPH REPORT

MI_61-908

Flow Monitor

MI_61-908

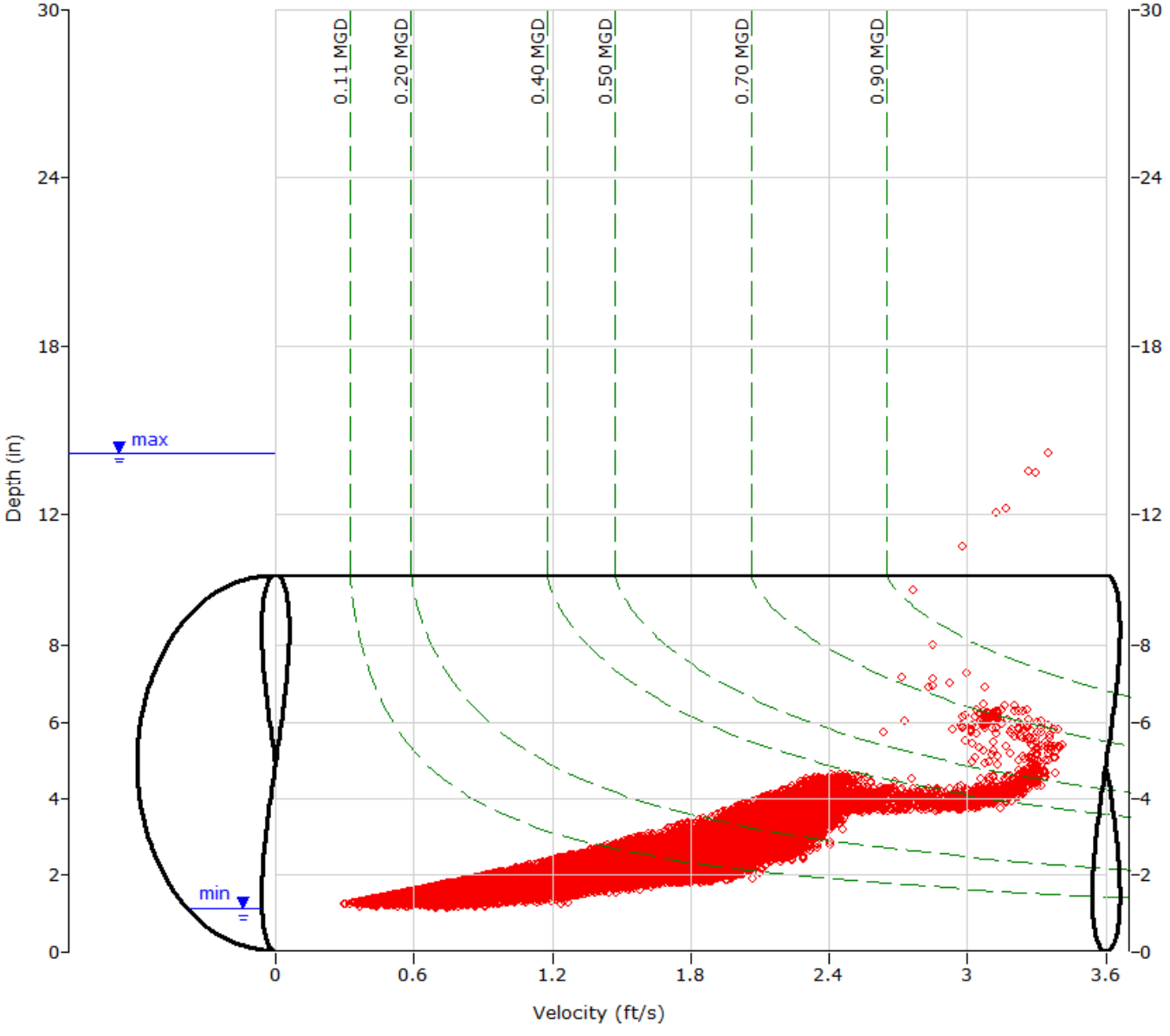
Pipe Height
9.88 in

Report Period

1/21/2016
To
7/21/2016

Legend

- Depth - Velocity
- Iso-Q™
- Silt
- Min-Max Depth



ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

MI_61-908

Flow Monitor

MI_61-908

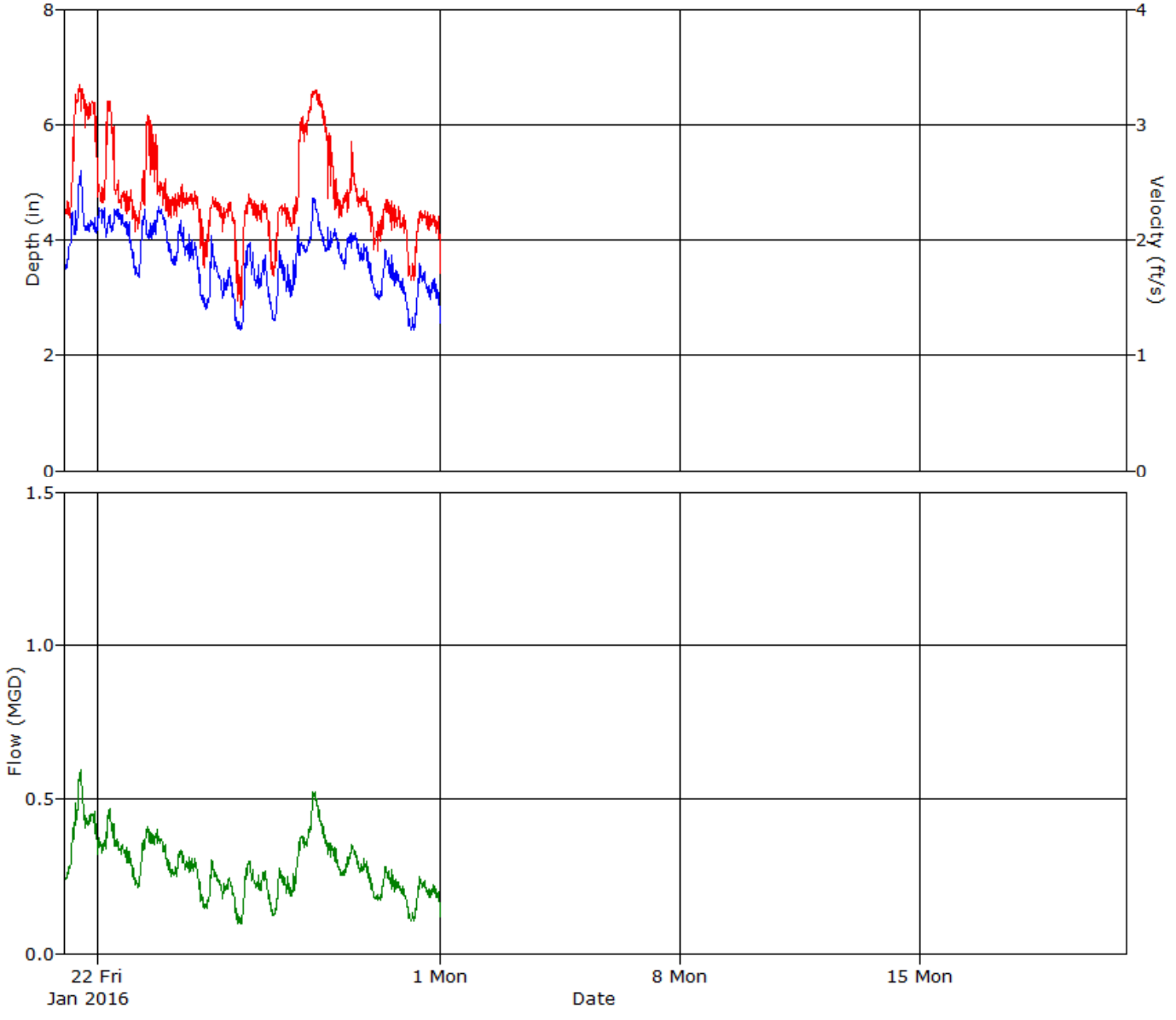
Pipe Height
9.88 in

Report Period

1/21/2016
To
1/31/2016

Legend

- Depth
- Velocity
- Quantity



ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

MI_61-908

Flow Monitor

MI_61-908

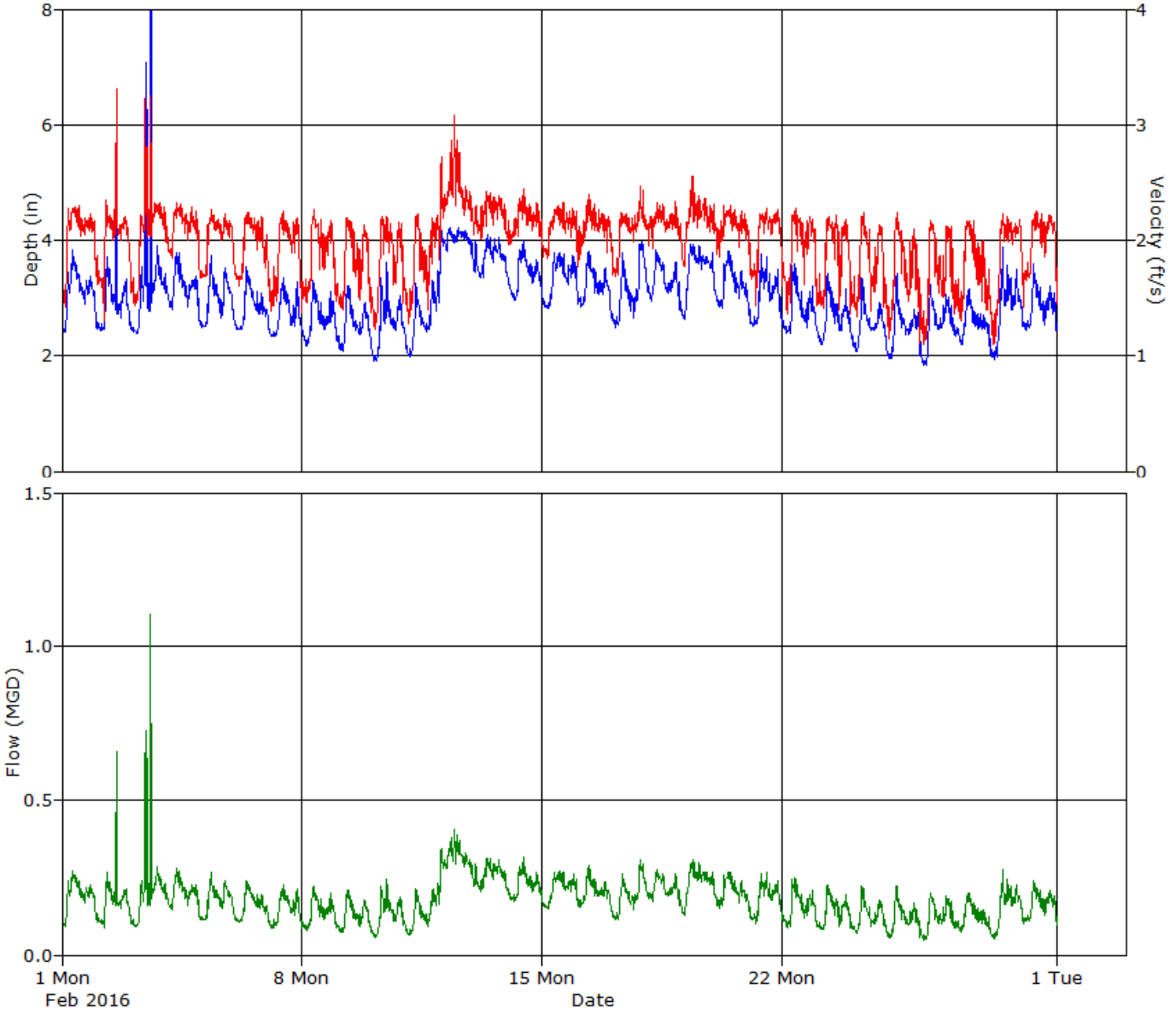
Pipe Height
9.88 in

Report Period

2/1/2016
To
2/29/2016

Legend

- Depth
- Velocity
- Quantity



ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

MI_61-908

Flow Monitor

MI_61-908

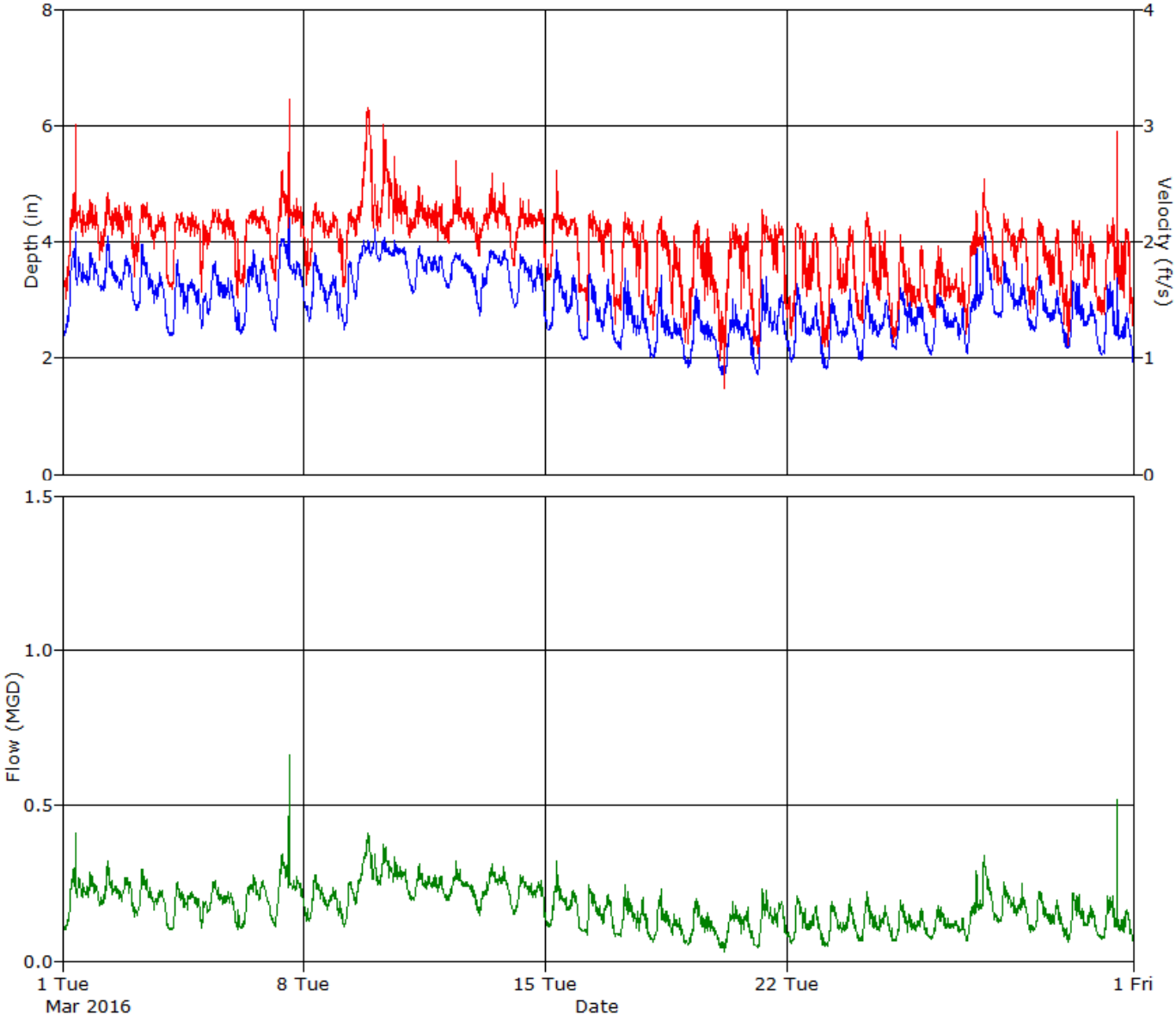
Pipe Height
9.88 in

Report Period

3/1/2016
To
3/31/2016

Legend

- Depth
- Velocity
- Quantity



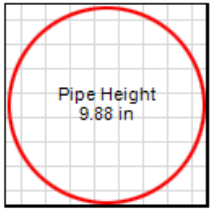
ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

MI_61-908

Flow Monitor

MI_61-908

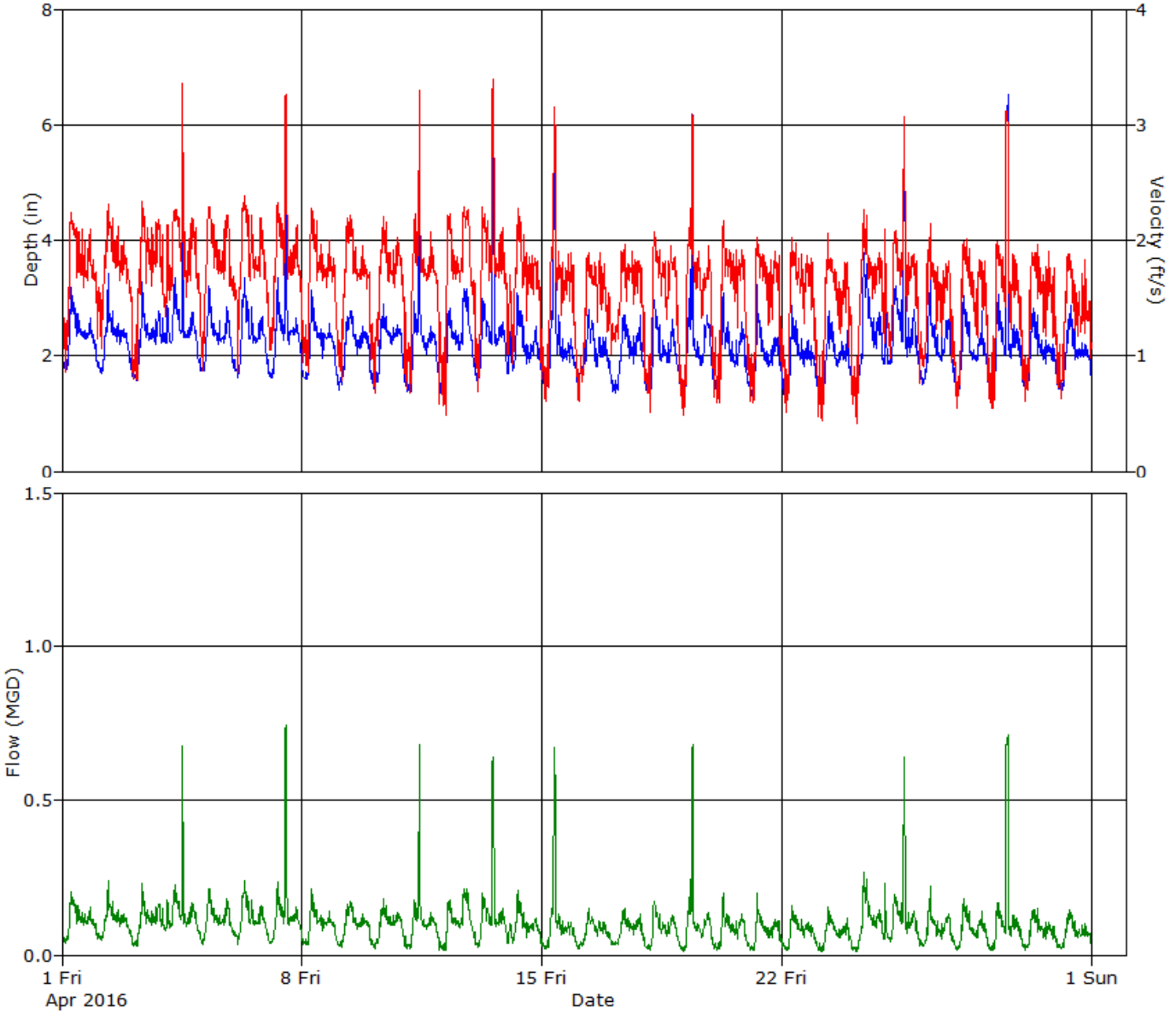


Report Period

4/1/2016
To
4/30/2016

Legend

- Depth
- Velocity
- Quantity



ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

MI_61-908

Flow Monitor

MI_61-908

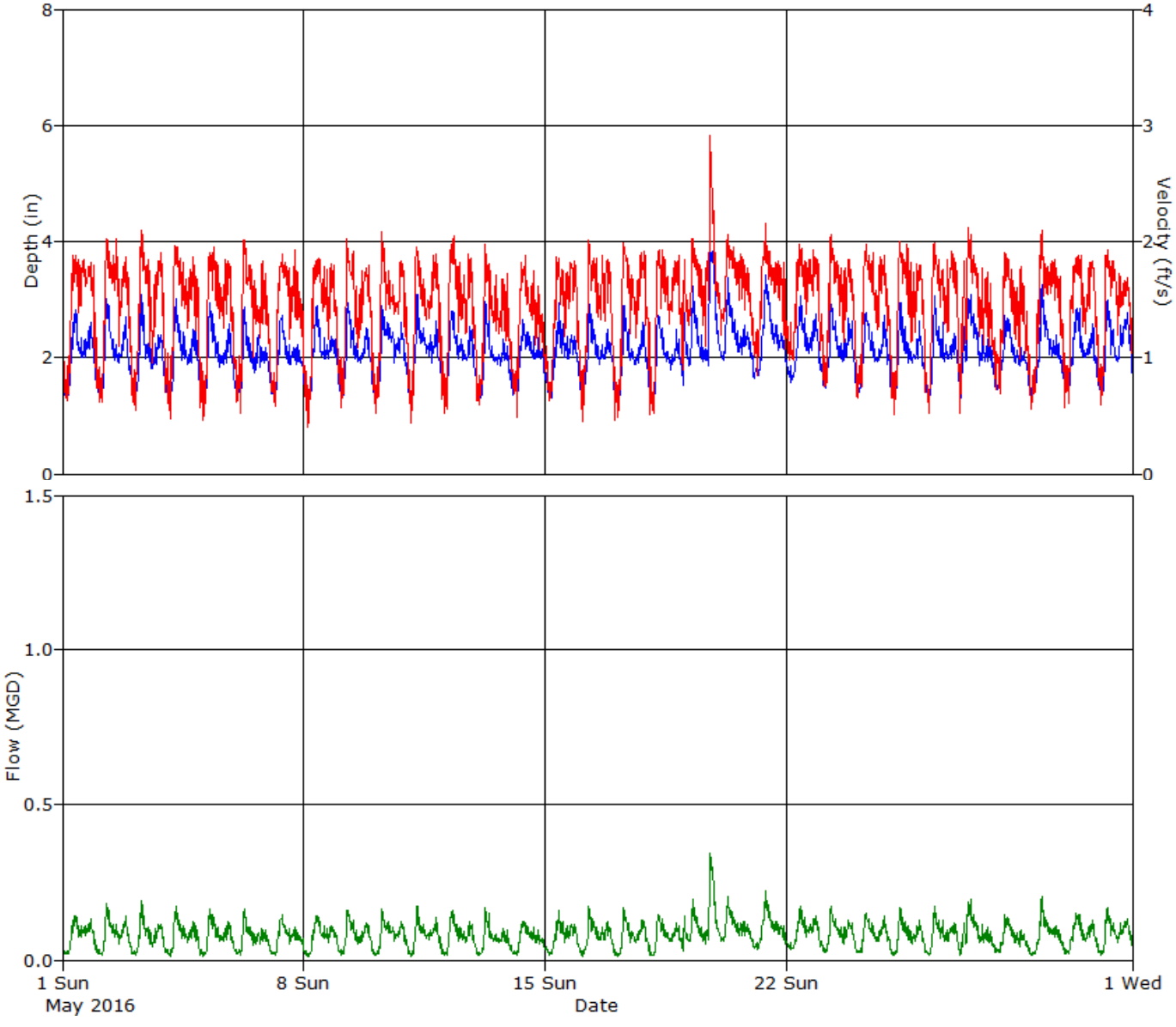
Pipe Height
9.88 in

Report Period

5/1/2016
To
5/31/2016

Legend

- Depth
- Velocity
- Quantity



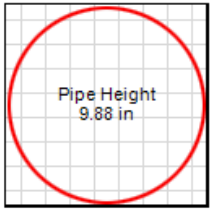
ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

MI_61-908

Flow Monitor

MI_61-908

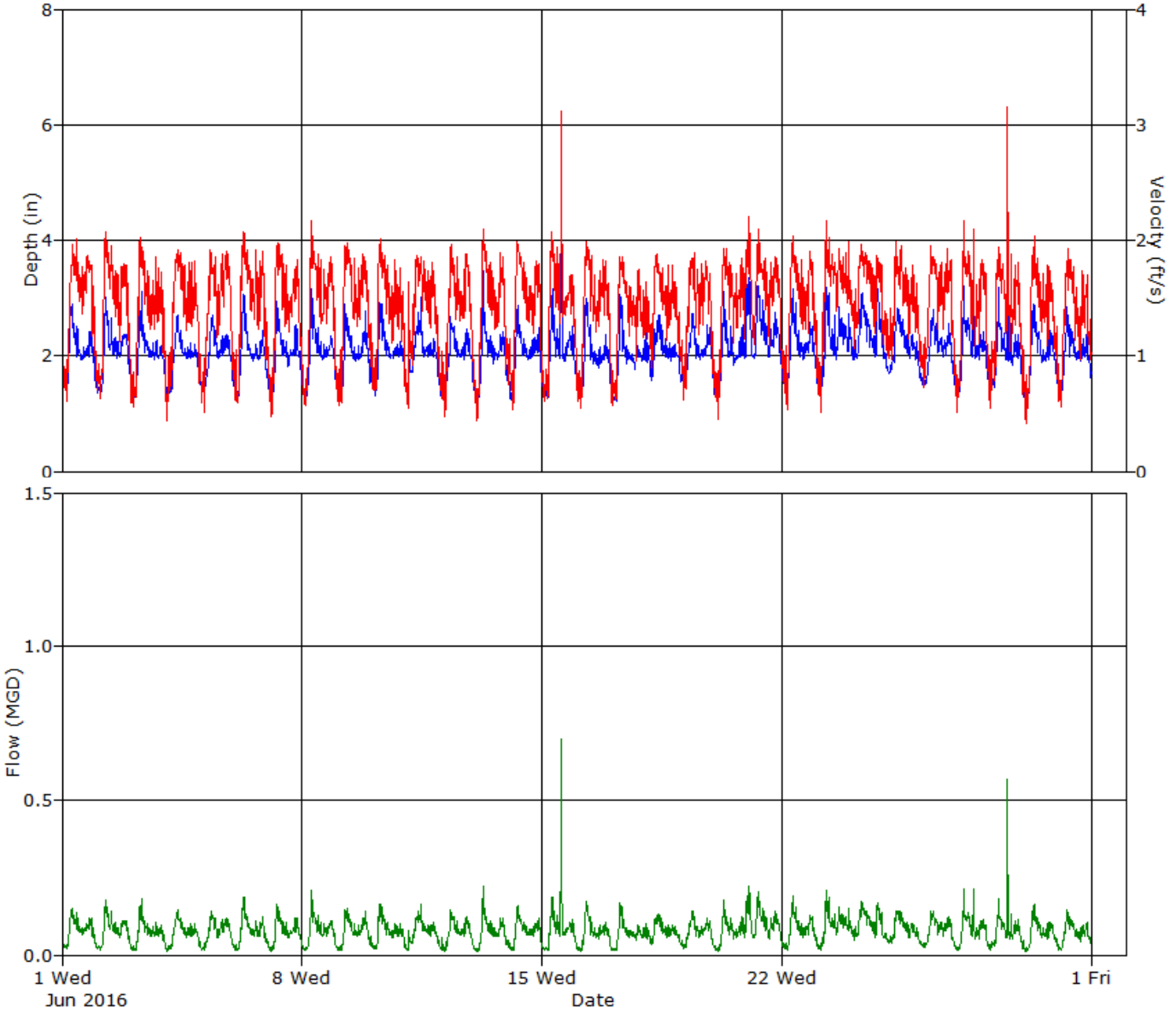


Report Period

6/1/2016
To
6/30/2016

Legend

- Depth
- Velocity
- Quantity



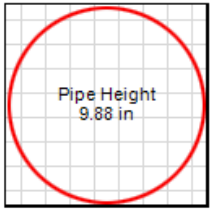
ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

MI_61-908

Flow Monitor

MI_61-908

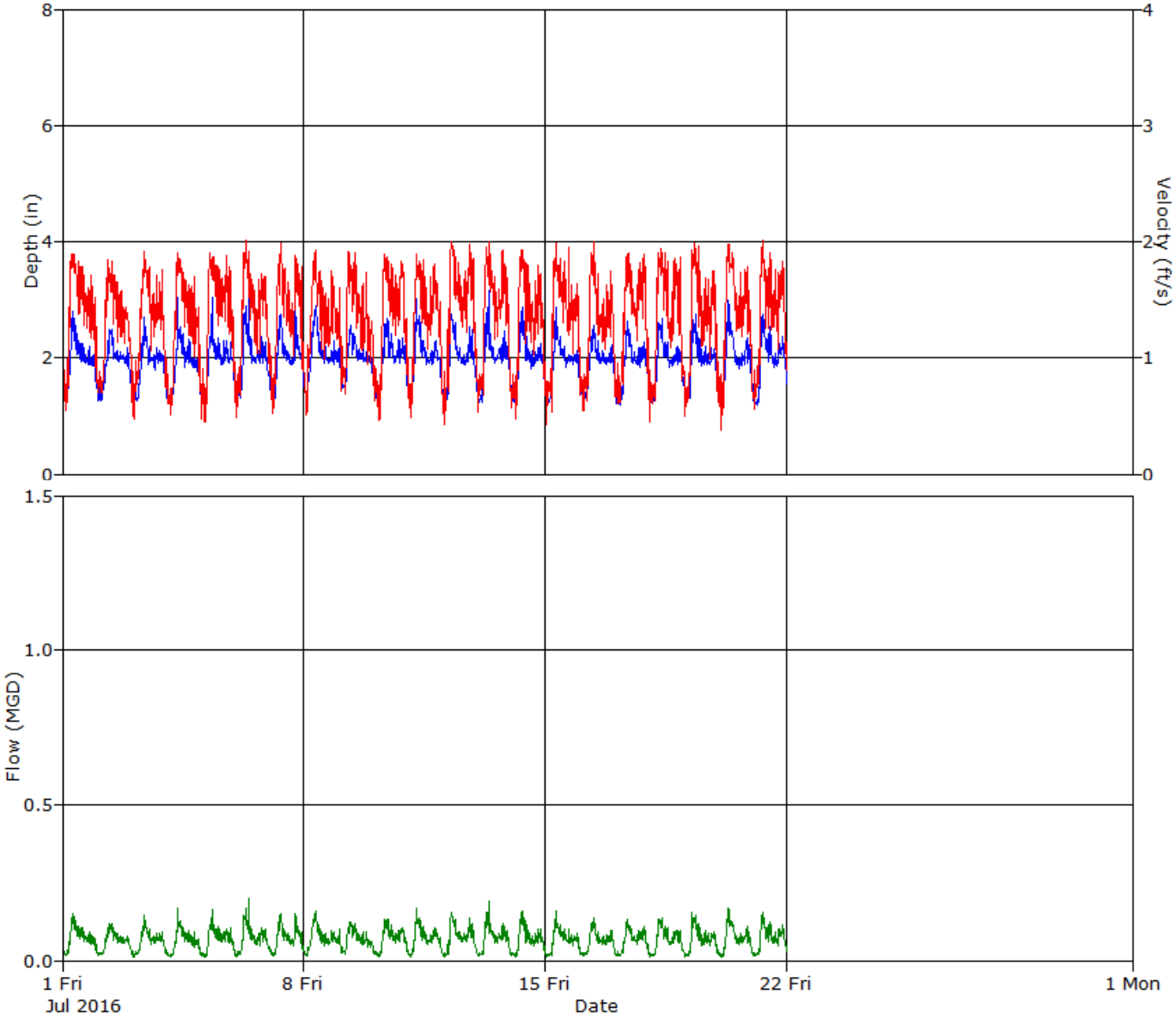


Report Period

7/1/2016
To
7/21/2016

Legend

- Depth
- Velocity
- Quantity



ADS ENVIRONMENTAL SERVICES

Daily Tabular Report For The Period 1/21/2016 - 7/21/2016

MI_61-908, Pipe Height: 9.880001 in

Daily Tabular Report

Date	Depth (in)					Velocity (ft/s)					Quantity (MGD - Total ft3)						Rain (in)
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
1/21/2016	00:15	3.46	12:35	5.50	4.24	04:00	2.12	10:50	3.38	2.90	01:15	0.234	11:55	0.625	0.409	54617	
1/22/2016	23:55	3.73	08:35	4.62	4.31	21:05	2.13	08:45	3.25	2.53	23:55	0.270	08:35	0.502	0.358	47854	
1/23/2016	04:45	3.30	08:50	4.62	4.08	04:25	1.99	10:30	3.17	2.50	04:25	0.202	16:05	0.449	0.331	44278	
1/24/2016	23:40	3.20	10:20	4.51	3.82	23:55	1.88	06:25	2.72	2.32	23:55	0.183	10:50	0.373	0.282	37666	
1/25/2016	04:15	2.73	08:50	4.31	3.25	01:40	1.55	12:40	2.44	2.18	02:20	0.129	08:50	0.345	0.213	28534	
1/26/2016	01:55	2.43	08:45	4.14	3.22	03:55	1.22	09:35	2.47	2.11	03:55	0.080	08:45	0.324	0.209	27897	
1/27/2016	04:10	2.56	20:40	4.26	3.33	02:40	1.45	23:20	3.10	2.24	02:40	0.106	23:15	0.391	0.231	30874	
1/28/2016	02:20	3.70	07:25	4.85	4.10	22:20	2.15	08:00	3.34	2.95	22:35	0.277	07:25	0.548	0.394	52696	
1/29/2016	23:10	3.26	09:25	4.24	3.80	23:15	1.92	10:10	2.88	2.36	23:15	0.193	09:35	0.370	0.285	38061	
1/30/2016	23:20	2.84	13:20	4.03	3.30	04:05	1.75	14:00	2.50	2.16	04:05	0.156	14:00	0.311	0.216	28838	
1/31/2016	05:00	2.41	09:40	3.88	3.00	23:40	1.49	12:35	2.33	2.04	23:40	0.099	09:40	0.273	0.180	24104	
2/1/2016	01:15	2.34	07:45	3.97	3.13	02:50	1.24	11:55	2.46	2.06	01:05	0.080	11:55	0.299	0.194	25926	
2/2/2016	03:55	2.39	14:20	5.77	2.95	05:15	1.24	14:10	3.34	2.03	05:15	0.081	14:20	0.675	0.179	23979	
2/3/2016	02:35	2.37	14:00	14.20	3.41	00:05	1.29	14:00	3.35	2.09	01:15	0.085	14:00	1.137	0.228	30531	
2/4/2016	05:00	2.76	08:40	4.11	3.21	04:40	1.62	08:40	2.40	2.13	04:45	0.128	08:40	0.321	0.205	27355	
2/5/2016	02:00	2.43	08:35	4.11	2.98	00:20	1.58	08:15	2.33	2.02	02:00	0.107	08:35	0.309	0.178	23751	
2/6/2016	05:55	2.40	09:10	3.85	2.84	04:00	1.43	10:35	2.32	1.97	04:00	0.092	09:10	0.265	0.162	21616	
2/7/2016	01:45	2.27	12:50	3.56	2.72	23:35	1.24	09:50	2.29	1.89	02:25	0.080	12:50	0.249	0.147	19597	
2/8/2016	03:35	2.16	07:15	3.45	2.64	00:10	1.32	08:35	2.37	1.88	02:15	0.075	08:35	0.239	0.140	18778	
2/9/2016	04:05	2.04	08:10	3.42	2.55	03:10	1.31	10:45	2.30	1.80	03:45	0.069	08:10	0.231	0.128	17176	
2/10/2016	04:35	1.83	11:15	4.09	2.57	02:25	1.13	07:05	2.30	1.82	04:35	0.053	11:15	0.284	0.133	17719	
2/11/2016	03:20	1.94	23:15	3.61	2.64	02:30	1.12	08:45	2.34	1.83	02:30	0.055	23:10	0.251	0.138	18483	
2/12/2016	00:00	3.12	12:35	4.34	4.01	00:05	1.75	10:25	3.20	2.42	00:05	0.164	12:35	0.452	0.314	41957	
2/13/2016	05:15	3.29	14:40	4.25	3.71	23:45	1.76	15:00	2.58	2.23	23:45	0.177	15:00	0.342	0.260	34783	
2/14/2016	05:05	2.92	10:40	4.10	3.40	00:05	1.75	10:30	2.51	2.17	02:25	0.162	10:40	0.331	0.226	30250	
2/15/2016	03:35	2.79	08:10	3.91	3.34	03:40	1.63	11:05	2.42	2.13	03:40	0.132	11:35	0.292	0.217	28980	
2/16/2016	23:40	2.70	07:15	4.02	3.22	01:40	1.57	09:05	2.50	2.12	23:40	0.135	07:15	0.319	0.205	27401	
2/17/2016	03:10	2.47	20:05	4.02	3.11	01:35	1.51	20:35	2.57	2.08	02:40	0.106	20:20	0.315	0.194	25953	
2/18/2016	23:55	2.90	08:35	3.94	3.33	05:00	1.84	12:35	2.52	2.17	05:00	0.167	08:35	0.313	0.219	29252	
2/19/2016	02:25	2.61	09:25	4.01	3.47	02:25	1.70	07:40	2.81	2.19	02:25	0.122	07:40	0.340	0.235	31463	
2/20/2016	05:35	2.76	08:10	4.08	3.25	03:30	1.70	07:15	2.54	2.14	03:30	0.140	07:15	0.328	0.209	27887	
2/21/2016	02:55	2.47	09:20	3.87	3.02	05:25	1.29	09:40	2.38	2.03	23:45	0.087	12:35	0.283	0.182	24306	
2/22/2016	05:10	2.31	06:40	3.84	2.82	05:00	1.23	09:45	2.38	1.95	03:45	0.077	06:35	0.280	0.159	21264	
2/23/2016	02:30	2.17	07:25	3.58	2.67	23:35	1.21	07:00	2.24	1.87	04:50	0.073	07:25	0.249	0.142	18936	
2/24/2016	02:00	2.03	07:20	3.50	2.55	03:45	1.22	08:40	2.32	1.79	03:45	0.062	07:20	0.236	0.127	17017	
2/25/2016	02:55	1.90	07:30	3.48	2.50	02:00	0.98	08:15	2.32	1.73	02:00	0.048	07:30	0.241	0.120	16090	
2/26/2016	02:45	1.81	08:00	3.30	2.52	03:00	0.80	21:20	2.24	1.72	03:00	0.035	08:00	0.214	0.122	16328	
2/27/2016	05:20	2.14	10:10	3.24	2.57	05:20	1.04	09:25	2.25	1.75	05:20	0.057	10:15	0.214	0.126	16793	
2/28/2016	04:00	1.89	10:05	4.03	2.77	04:35	0.94	10:00	2.28	1.85	03:15	0.044	10:00	0.294	0.152	20303	
2/29/2016	23:50	2.36	07:40	3.83	2.84	23:50	1.27	12:05	2.35	1.99	23:50	0.079	07:40	0.280	0.164	21860	
3/1/2016	01:15	2.33	09:10	4.36	3.31	00:25	1.25	09:05	3.10	2.10	00:35	0.079	09:10	0.446	0.215	28713	
3/2/2016	02:55	3.09	07:20	4.14	3.46	02:00	1.74	07:25	2.55	2.18	03:00	0.167	07:25	0.331	0.232	30960	
3/3/2016	23:25	2.70	07:50	4.11	3.23	02:15	1.57	08:30	2.56	2.11	03:30	0.125	08:30	0.326	0.205	27410	
3/4/2016	02:00	2.35	08:10	3.78	3.00	04:05	1.53	10:45	2.43	2.04	02:00	0.098	07:55	0.270	0.180	24127	
3/5/2016	01:05	2.43	10:20	3.83	3.12	00:25	1.41	08:20	2.39	2.11	01:10	0.101	10:20	0.278	0.196	26179	
3/6/2016	04:05	2.34	14:25	4.06	3.14	00:40	1.31	14:25	2.41	2.05	00:40	0.088	14:25	0.317	0.194	25922	

Date	Depth (in)					Velocity (ft/s)					Quantity (MGD - Total ft3)						Rain (in)
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
3/7/2016	03:40	2.42	13:45	5.86	3.44	03:40	1.64	13:40	3.25	2.19	03:40	0.106	13:40	0.676	0.238	31830	
3/8/2016	03:05	2.58	07:10	3.94	3.15	01:50	1.50	14:25	2.42	2.09	01:30	0.119	07:10	0.303	0.197	26308	
3/9/2016	03:45	2.43	20:05	4.17	3.40	03:15	1.41	20:05	3.22	2.29	04:25	0.097	20:05	0.439	0.244	32680	
3/10/2016	23:50	3.50	01:15	4.30	3.84	03:10	1.97	08:30	3.06	2.37	03:10	0.225	08:30	0.434	0.290	38785	
3/11/2016	05:10	3.06	07:45	4.01	3.55	20:35	1.96	07:45	2.56	2.22	02:55	0.185	07:45	0.331	0.244	32631	
3/12/2016	23:50	3.05	10:25	3.87	3.50	01:55	1.84	09:30	3.01	2.20	23:20	0.170	09:30	0.370	0.238	31845	
3/13/2016	02:25	2.70	10:15	3.96	3.50	01:10	1.75	10:15	2.90	2.21	02:10	0.141	10:15	0.369	0.240	32069	
3/14/2016	23:50	2.62	06:20	3.97	3.32	02:20	1.59	06:10	2.70	2.14	02:20	0.132	06:20	0.327	0.216	28870	
3/15/2016	23:05	2.38	07:55	3.92	2.98	23:40	1.43	07:50	2.91	2.06	23:05	0.092	07:50	0.357	0.181	24165	
3/16/2016	23:35	2.29	06:10	3.72	2.76	23:45	1.18	08:50	2.45	1.94	23:45	0.071	06:10	0.258	0.154	20622	
3/17/2016	23:40	2.10	06:45	3.82	2.62	22:40	1.22	06:45	2.35	1.88	22:40	0.073	06:45	0.284	0.139	18583	
3/18/2016	02:40	1.96	07:55	3.80	2.46	02:25	1.06	07:55	2.38	1.75	02:30	0.051	07:55	0.286	0.119	15885	
3/19/2016	02:55	1.78	07:40	3.74	2.36	02:15	0.96	14:50	2.40	1.69	02:15	0.045	07:40	0.259	0.109	14602	
3/20/2016	02:50	1.66	11:40	3.21	2.33	03:55	0.73	11:35	2.24	1.72	03:50	0.029	11:40	0.208	0.110	14671	
3/21/2016	02:55	1.68	09:00	3.66	2.56	03:00	0.76	06:40	2.42	1.82	03:00	0.030	06:40	0.269	0.134	17854	
3/22/2016	02:45	1.91	06:25	3.73	2.50	03:10	0.93	11:25	2.31	1.75	03:10	0.045	06:25	0.248	0.122	16365	
3/23/2016	02:20	1.72	19:15	3.44	2.45	03:30	0.90	19:45	2.24	1.72	00:05	0.039	19:15	0.233	0.117	15697	
3/24/2016	03:10	1.90	07:20	3.45	2.54	03:10	1.10	07:20	2.39	1.73	03:10	0.050	07:20	0.252	0.123	16440	
3/25/2016	03:15	2.13	06:45	3.41	2.66	01:30	1.08	06:45	2.25	1.59	01:30	0.060	06:45	0.234	0.119	15947	
3/26/2016	04:30	2.04	12:25	3.27	2.58	04:55	1.09	12:25	2.17	1.59	04:55	0.062	12:25	0.213	0.114	15210	
3/27/2016	04:35	2.06	17:00	4.25	3.03	03:50	1.19	16:25	2.65	1.89	03:45	0.062	16:25	0.348	0.175	23342	
3/28/2016	23:40	2.51	05:55	4.12	3.03	23:40	1.30	05:55	2.33	1.95	23:40	0.088	05:55	0.313	0.174	23284	
3/29/2016	23:45	2.34	07:30	4.07	2.80	00:20	1.31	06:10	2.25	1.80	23:45	0.086	07:30	0.297	0.145	19412	
3/30/2016	02:40	2.13	08:55	4.00	2.68	03:10	1.07	13:25	2.24	1.77	03:10	0.059	08:55	0.282	0.135	18074	
3/31/2016	23:55	1.90	12:55	5.67	2.55	23:55	0.99	12:55	3.36	1.80	23:55	0.045	12:55	0.677	0.131	17495	
4/1/2016	02:10	1.67	06:50	3.49	2.35	03:30	0.77	06:30	2.27	1.73	02:15	0.032	09:00	0.219	0.111	14870	
4/2/2016	03:30	1.61	08:15	3.97	2.27	03:30	0.74	08:15	2.38	1.78	03:30	0.027	08:15	0.303	0.108	14470	
4/3/2016	01:45	1.54	08:25	4.05	2.28	02:20	0.64	08:25	2.47	1.72	01:45	0.023	08:25	0.324	0.108	14377	
4/4/2016	23:25	1.83	12:30	5.91	2.54	00:30	1.21	12:35	3.39	1.91	23:40	0.065	12:30	0.710	0.138	18453	
4/5/2016	03:00	1.67	07:30	3.26	2.31	02:35	0.72	07:00	2.34	1.79	02:35	0.029	07:30	0.222	0.113	15104	
4/6/2016	02:55	1.58	08:55	3.84	2.34	03:00	0.74	09:05	2.55	1.84	03:00	0.028	09:05	0.289	0.118	15838	
4/7/2016	00:55	1.58	12:35	6.45	2.48	02:15	0.91	12:10	3.38	1.83	02:15	0.036	12:40	0.750	0.139	18554	
4/8/2016	03:30	1.52	07:50	3.38	2.21	02:20	0.62	06:35	2.37	1.67	02:20	0.021	07:50	0.233	0.099	13290	
4/9/2016	01:45	1.38	11:20	3.25	2.17	03:25	0.64	09:20	2.29	1.66	03:25	0.020	11:20	0.219	0.097	12912	
4/10/2016	01:55	1.39	07:10	3.24	2.16	02:15	0.50	13:50	2.32	1.62	02:15	0.016	07:10	0.220	0.095	12684	
4/11/2016	01:40	1.35	10:15	7.27	2.22	01:30	0.45	09:55	3.32	1.66	03:45	0.013	10:15	0.803	0.109	14596	
4/12/2016	01:50	1.31	18:25	3.54	2.26	04:20	0.42	19:25	2.37	1.69	04:20	0.012	18:25	0.245	0.108	14496	
4/13/2016	02:25	1.50	13:25	5.57	2.40	03:20	0.66	13:40	3.41	1.77	03:25	0.023	13:40	0.646	0.132	17591	
4/14/2016	00:00	1.67	06:35	3.95	2.17	00:40	0.69	07:10	2.54	1.65	00:40	0.026	07:10	0.318	0.095	12654	
4/15/2016	03:05	1.39	08:55	6.15	2.23	03:50	0.51	08:05	3.19	1.57	03:50	0.016	09:00	0.686	0.108	14435	
4/16/2016	02:15	1.38	16:00	2.86	2.05	01:40	0.50	16:55	2.05	1.43	01:40	0.015	08:40	0.165	0.077	10281	
4/17/2016	03:25	1.25	16:10	2.97	2.03	23:30	0.60	09:55	2.27	1.54	23:30	0.021	09:55	0.184	0.082	10936	
4/18/2016	02:35	1.27	05:45	3.30	2.04	03:15	0.44	05:45	2.29	1.51	03:15	0.011	05:45	0.228	0.083	11052	
4/19/2016	02:25	1.32	09:00	6.20	2.25	04:15	0.43	08:30	3.11	1.55	04:15	0.012	08:25	0.686	0.110	14687	
4/20/2016	01:50	1.28	06:40	3.70	2.02	02:20	0.50	06:40	2.42	1.53	02:20	0.014	06:40	0.281	0.082	11009	
4/21/2016	01:00	1.27	06:05	3.67	1.98	04:15	0.46	06:05	2.28	1.49	03:50	0.013	06:05	0.261	0.078	10388	
4/22/2016	01:05	1.26	06:50	3.36	1.96	04:00	0.44	09:40	2.27	1.48	04:00	0.012	07:25	0.206	0.076	10125	
4/23/2016	02:55	1.15	08:45	3.42	1.92	03:05	0.39	07:50	2.29	1.40	03:15	0.009	07:50	0.208	0.070	9412	
4/24/2016	03:50	1.22	08:35	3.92	2.27	03:45	0.31	09:10	2.40	1.52	03:45	0.007	08:35	0.297	0.102	13631	
4/25/2016	23:50	1.76	13:35	6.29	2.51	03:50	0.83	12:40	3.18	1.69	03:50	0.037	13:35	0.700	0.129	17182	
4/26/2016	01:45	1.50	07:25	3.76	2.15	02:55	0.62	07:25	2.34	1.47	02:55	0.022	07:25	0.278	0.085	11358	
4/27/2016	03:40	1.33	07:05	3.66	2.09	00:50	0.50	10:25	2.36	1.46	00:50	0.015	07:05	0.262	0.082	10984	
4/28/2016	02:30	1.33	13:35	6.96	2.37	02:40	0.41	12:20	3.13	1.54	02:40	0.011	13:35	0.729	0.124	16595	
4/29/2016	02:10	1.38	10:10	3.38	2.05	02:00	0.47	10:10	2.11	1.44	02:00	0.014	10:10	0.216	0.078	10430	
4/30/2016	02:50	1.37	12:15	3.17	2.00	03:10	0.50	07:50	1.99	1.35	03:10	0.015	08:25	0.171	0.071	9482	

Date	Depth (in)					Velocity (ft/s)					Quantity (MGD - Total ft3)						Rain (in)
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
5/1/2016	02:50	1.31	09:30	3.09	2.05	02:50	0.45	06:50	2.03	1.45	02:50	0.012	06:50	0.176	0.080	10659	
5/2/2016	01:45	1.24	06:35	3.61	2.08	01:45	0.40	06:35	2.32	1.48	01:45	0.010	06:35	0.261	0.083	11156	
5/3/2016	02:40	1.37	07:35	3.58	2.01	01:35	0.46	07:20	2.43	1.43	01:35	0.013	07:35	0.264	0.077	10294	
5/4/2016	02:20	1.22	05:55	3.53	2.04	03:25	0.32	07:15	2.11	1.45	03:25	0.008	05:55	0.227	0.080	10688	
5/5/2016	01:55	1.23	06:05	3.53	2.02	02:55	0.42	09:30	2.27	1.41	02:55	0.011	06:05	0.233	0.077	10272	
5/6/2016	04:20	1.32	06:25	3.06	1.97	01:45	0.40	07:15	2.40	1.39	01:45	0.011	07:15	0.196	0.072	9576	
5/7/2016	02:55	1.32	08:30	2.95	1.96	01:20	0.42	17:45	2.05	1.40	01:20	0.012	08:30	0.159	0.072	9598	
5/8/2016	02:45	1.26	09:20	2.99	2.02	02:35	0.37	17:55	2.11	1.37	02:35	0.010	09:20	0.154	0.074	9940	
5/9/2016	03:15	1.30	06:00	3.19	2.05	02:00	0.45	06:00	2.39	1.40	03:20	0.013	06:00	0.226	0.077	10302	
5/10/2016	01:30	1.29	05:50	3.18	2.12	02:40	0.41	05:50	2.40	1.42	02:40	0.012	05:50	0.227	0.082	10921	
5/11/2016	02:15	1.26	06:30	3.19	2.10	03:05	0.37	06:45	2.06	1.40	03:05	0.010	06:45	0.188	0.079	10624	
5/12/2016	01:50	1.34	08:15	3.11	2.06	03:05	0.41	08:10	2.32	1.43	03:05	0.011	06:50	0.189	0.079	10532	
5/13/2016	01:25	1.25	06:55	3.19	1.97	01:10	0.38	06:20	2.01	1.32	01:10	0.010	06:25	0.180	0.068	9102	
5/14/2016	01:25	1.27	16:00	2.84	1.99	04:15	0.44	15:45	2.05	1.30	04:15	0.011	18:25	0.158	0.068	9098	
5/15/2016	04:20	1.29	09:35	3.00	2.03	02:20	0.48	07:45	1.97	1.39	02:20	0.013	09:35	0.166	0.075	10059	
5/16/2016	02:20	1.26	06:10	3.07	2.05	02:20	0.37	09:30	2.21	1.44	02:20	0.009	06:10	0.181	0.079	10524	
5/17/2016	01:20	1.22	06:20	3.33	2.00	00:35	0.36	06:20	2.17	1.43	00:35	0.009	06:20	0.218	0.077	10271	
5/18/2016	02:20	1.16	06:40	3.00	1.97	00:25	0.40	09:25	2.20	1.44	00:25	0.010	06:15	0.179	0.075	10061	
5/19/2016	04:00	1.77	18:20	4.04	2.53	15:40	0.94	18:20	3.02	1.75	15:40	0.043	18:20	0.395	0.129	17291	
5/20/2016	03:40	1.93	06:50	3.51	2.37	23:35	1.03	07:00	2.17	1.66	23:35	0.052	07:00	0.230	0.106	14204	
5/21/2016	01:45	1.60	08:05	3.58	2.31	03:50	0.67	09:25	2.24	1.57	03:50	0.025	08:05	0.240	0.100	13360	
5/22/2016	03:00	1.54	09:40	3.33	2.19	23:15	0.72	08:35	2.07	1.54	01:50	0.028	09:40	0.208	0.090	12082	
5/23/2016	03:00	1.42	07:00	3.22	2.13	03:00	0.52	06:45	2.15	1.50	03:00	0.016	06:45	0.193	0.086	11486	
5/24/2016	01:45	1.35	06:40	3.02	2.08	03:15	0.49	08:40	2.35	1.48	03:15	0.015	08:40	0.177	0.082	10930	
5/25/2016	02:50	1.28	07:30	3.30	2.04	02:00	0.41	11:55	2.29	1.46	02:00	0.011	07:30	0.195	0.079	10621	
5/26/2016	03:15	1.28	06:50	3.52	2.05	02:55	0.40	06:25	2.03	1.46	02:55	0.011	06:50	0.217	0.080	10724	
5/27/2016	01:10	1.28	07:40	3.68	2.20	00:35	0.46	07:40	2.69	1.48	00:35	0.012	07:40	0.310	0.088	11817	
5/28/2016	01:45	1.41	07:30	3.02	2.01	04:15	0.50	07:30	2.33	1.36	01:20	0.016	07:30	0.205	0.072	9569	
5/29/2016	03:05	1.25	09:40	3.56	2.08	03:05	0.32	09:40	2.33	1.42	03:05	0.008	09:40	0.257	0.081	10860	
5/30/2016	01:30	1.43	11:40	3.19	2.09	03:55	0.50	12:40	2.05	1.44	03:55	0.015	11:40	0.185	0.081	10810	
5/31/2016	02:30	1.36	06:35	3.10	2.18	02:40	0.47	05:25	2.15	1.44	02:40	0.013	05:25	0.192	0.086	11434	
6/1/2016	03:45	1.43	07:00	2.99	2.06	01:10	0.58	10:15	2.14	1.48	01:10	0.019	07:50	0.178	0.080	10735	
6/2/2016	04:00	1.30	05:50	3.29	2.07	01:10	0.51	06:15	2.11	1.46	01:10	0.014	05:50	0.199	0.081	10856	
6/3/2016	03:35	1.22	07:35	3.63	2.02	03:35	0.30	07:35	2.18	1.39	03:35	0.007	07:35	0.246	0.075	10019	
6/4/2016	01:35	1.26	08:15	2.86	1.97	01:45	0.37	10:45	2.20	1.41	01:45	0.010	08:45	0.160	0.073	9714	
6/5/2016	02:45	1.32	08:20	2.85	2.01	03:25	0.44	06:25	2.06	1.42	03:25	0.012	08:20	0.162	0.076	10099	
6/6/2016	01:25	1.21	07:40	3.42	2.01	03:10	0.39	07:40	2.26	1.44	03:10	0.010	07:40	0.235	0.078	10413	
6/7/2016	02:20	1.24	06:30	3.27	2.00	02:25	0.35	08:00	2.13	1.41	02:25	0.009	06:30	0.197	0.075	10061	
6/8/2016	02:50	1.27	06:55	3.71	2.02	02:45	0.43	06:55	2.58	1.42	02:45	0.011	06:55	0.301	0.077	10280	
6/9/2016	03:25	1.21	07:15	3.46	2.00	01:25	0.40	07:15	2.27	1.44	01:25	0.010	07:15	0.240	0.077	10228	
6/10/2016	04:15	1.24	05:35	3.73	2.03	00:55	0.53	05:35	2.23	1.40	02:50	0.016	05:35	0.262	0.076	10099	
6/11/2016	01:20	1.25	11:05	3.52	2.04	02:15	0.46	09:05	2.02	1.41	01:50	0.012	11:05	0.213	0.076	10114	
6/12/2016	03:35	1.20	07:45	3.18	1.96	04:40	0.40	08:55	2.31	1.36	04:40	0.011	07:45	0.199	0.071	9492	
6/13/2016	00:50	1.24	06:30	3.90	2.00	02:40	0.36	06:30	2.20	1.38	02:40	0.009	06:30	0.275	0.075	9966	
6/14/2016	02:05	1.21	07:20	3.20	2.01	03:40	0.39	07:15	2.15	1.42	03:40	0.010	07:15	0.180	0.076	10176	
6/15/2016	03:05	1.20	13:25	6.32	2.14	01:30	0.48	13:15	3.18	1.43	04:00	0.014	13:20	0.706	0.092	12364	
6/16/2016	03:05	1.20	05:50	3.34	1.96	03:10	0.32	07:00	2.27	1.41	03:10	0.008	07:00	0.227	0.073	9732	
6/17/2016	04:00	1.14	07:30	3.57	1.95	01:25	0.39	07:30	2.00	1.35	01:25	0.009	07:30	0.221	0.070	9301	
6/18/2016	04:55	1.49	09:10	3.35	2.11	04:55	0.58	07:25	2.07	1.47	04:55	0.019	09:10	0.190	0.080	10668	
6/19/2016	03:05	1.47	09:25	2.91	2.03	03:10	0.54	10:05	1.99	1.41	03:10	0.017	09:30	0.156	0.074	9945	
6/20/2016	01:25	1.17	06:50	3.70	2.07	02:35	0.40	06:50	2.20	1.45	02:35	0.010	06:50	0.255	0.082	10933	
6/21/2016	23:40	1.59	07:20	3.55	2.40	23:15	0.85	07:20	2.41	1.61	23:45	0.035	07:20	0.265	0.107	14256	
6/22/2016	01:00	1.41	07:00	3.63	2.12	03:25	0.50	07:00	2.35	1.43	03:25	0.015	07:00	0.266	0.082	10951	
6/23/2016	01:50	1.30	06:20	3.70	2.23	02:40	0.47	06:20	2.64	1.54	03:35	0.014	06:20	0.306	0.095	12726	
6/24/2016	02:15	1.84	07:25	3.33	2.39	15:55	0.84	18:10	2.22	1.58	15:55	0.037	18:10	0.224	0.103	13829	

Date	Depth (in)					Velocity (ft/s)					Quantity (MGD - Total ft3)						Rain (in)
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
6/25/2016	03:15	1.60	08:50	2.95	2.16	02:55	0.67	07:15	2.28	1.46	02:55	0.025	07:15	0.184	0.084	11176	
6/26/2016	02:40	1.41	09:10	2.92	2.08	02:30	0.54	07:45	2.24	1.47	02:30	0.017	07:45	0.184	0.081	10763	
6/27/2016	02:30	1.19	07:00	3.66	2.09	02:30	0.42	07:00	2.57	1.42	02:30	0.010	07:00	0.294	0.081	10782	
6/28/2016	01:40	1.29	12:50	5.93	2.10	01:30	0.51	12:45	3.30	1.42	01:35	0.016	12:50	0.653	0.086	11547	
6/29/2016	04:00	1.16	07:05	3.07	2.01	01:50	0.37	08:15	2.35	1.35	03:10	0.008	07:05	0.184	0.073	9779	
6/30/2016	02:30	1.19	07:00	3.00	2.02	01:55	0.34	08:05	2.28	1.34	01:55	0.009	08:05	0.174	0.071	9528	
7/1/2016	03:10	1.23	08:35	3.31	1.98	02:30	0.35	08:35	2.11	1.39	02:30	0.009	08:35	0.210	0.072	9662	
7/2/2016	01:15	1.23	09:25	2.68	1.89	01:00	0.36	06:50	2.06	1.30	01:00	0.009	09:25	0.135	0.063	8384	
7/3/2016	02:25	1.21	09:10	2.87	1.87	02:05	0.33	09:15	2.02	1.29	02:05	0.008	09:15	0.162	0.063	8363	
7/4/2016	02:40	1.20	08:05	3.38	1.90	02:35	0.38	08:00	2.02	1.30	02:35	0.010	08:05	0.203	0.065	8634	
7/5/2016	00:50	1.20	08:10	3.61	1.95	03:45	0.33	14:10	2.02	1.37	03:45	0.008	08:10	0.219	0.071	9431	
7/6/2016	04:00	1.25	09:30	3.62	1.99	04:10	0.43	07:30	2.15	1.36	00:40	0.012	09:30	0.234	0.072	9668	
7/7/2016	03:55	1.24	18:00	2.92	1.98	02:40	0.38	08:00	2.22	1.37	02:40	0.010	08:00	0.179	0.071	9556	
7/8/2016	01:30	1.27	08:10	3.06	2.05	01:55	0.42	08:05	2.06	1.35	01:55	0.011	08:10	0.184	0.073	9791	
7/9/2016	04:10	1.42	08:20	2.70	2.00	05:00	0.50	06:15	2.01	1.34	05:00	0.015	11:25	0.140	0.069	9202	
7/10/2016	02:25	1.28	09:45	2.86	1.97	04:30	0.38	21:05	1.96	1.33	04:30	0.010	08:15	0.148	0.070	9298	
7/11/2016	01:30	1.20	05:50	3.39	2.00	01:50	0.39	05:50	2.08	1.37	01:50	0.010	05:50	0.214	0.073	9766	
7/12/2016	01:15	1.23	06:50	2.98	1.97	03:10	0.34	06:50	2.16	1.41	03:10	0.009	06:50	0.187	0.075	9960	
7/13/2016	02:25	1.19	08:20	3.69	1.95	01:20	0.40	18:55	2.17	1.36	01:20	0.010	08:20	0.249	0.070	9423	
7/14/2016	02:25	1.21	06:55	3.35	1.95	01:40	0.36	08:10	2.02	1.32	01:40	0.009	06:55	0.202	0.068	9135	
7/15/2016	02:00	1.18	07:40	3.07	1.93	00:35	0.40	07:35	2.22	1.36	00:35	0.010	07:35	0.183	0.069	9188	
7/16/2016	02:40	1.23	09:45	2.69	1.89	03:25	0.40	09:45	2.07	1.28	03:25	0.011	09:45	0.155	0.063	8378	
7/17/2016	04:05	1.13	08:05	2.80	1.88	02:55	0.38	08:05	2.19	1.33	02:55	0.009	08:05	0.173	0.065	8736	
7/18/2016	02:50	1.17	09:20	2.97	1.92	00:40	0.40	06:20	2.08	1.36	02:05	0.010	06:20	0.166	0.069	9226	
7/19/2016	01:15	1.15	06:00	3.09	1.93	01:05	0.40	07:55	2.35	1.33	01:05	0.010	06:00	0.202	0.068	9059	
7/20/2016	02:15	1.16	07:25	3.42	1.96	03:50	0.37	09:45	2.10	1.35	03:50	0.009	07:25	0.207	0.071	9491	
7/21/2016	02:50	1.15	07:40	3.04	1.97	00:35	0.37	07:25	2.20	1.38	00:35	0.009	07:25	0.192	0.073	9702	

Report Summary For The Period 1/21/2016 - 7/21/2016

	Depth (in)	Velocity (ft/s)	Quantity (MGD - Total ft3)
Total			3092452
Avg	2.48	1.69	0.126

Site Commentary

Site Information

MI_S11	
Pipe Dimensions (in)	24.38
Silt Level	0

Overview

Site MI_S11 functioned in a sub critical flow regime and operates in a normal free flow condition during the period Thursday, January 21, 2016 to Thursday, July 21, 2016. Flow depth and velocity measurements recorded by the flow monitor are consistent with field confirmations conducted to date and support the relative accuracy of the flow monitor at this location.

Observations

Average flow depth, velocity, and quantity data observed during Thursday, January 21, 2016 to Thursday, July 21, 2016 , along with observed minimum and maximum data, are provided in the following table. The minimum and maximum data points reported below are based on 5 minute data intervals. Based on the average recorded depth of 8.28 , this site flows at approximately 34% full.

Observed Flow Conditions			
Item	Depth (in)	Velocity (ft/s)	Quantity (MGD)
Average	8.28	8.28	0.610
Minimum	5.32	0.35	0.121
Maximum	13.81	13.81	1.912
Time of Minimum	7/7/2016 4:00 AM	5/30/2016 3:45 AM	7/7/2016 4:00 AM
Time of Maximum	6/23/2016 10:35 AM	6/23/2016 10:30 AM	6/23/2016 10:30 AM

Data Quality

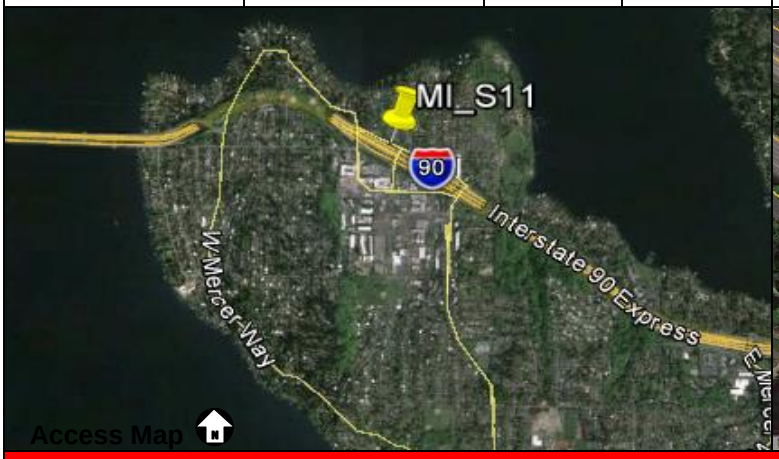
Data uptime observed during the Thursday, January 21, 2016 to the Thursday, July 21, 2016 monitoring period is provided in the table below. Based upon the quality and consistency of the observed flow depth and velocity data, the Continuity equation was used to calculate flow rate and quantities during the monitoring period.

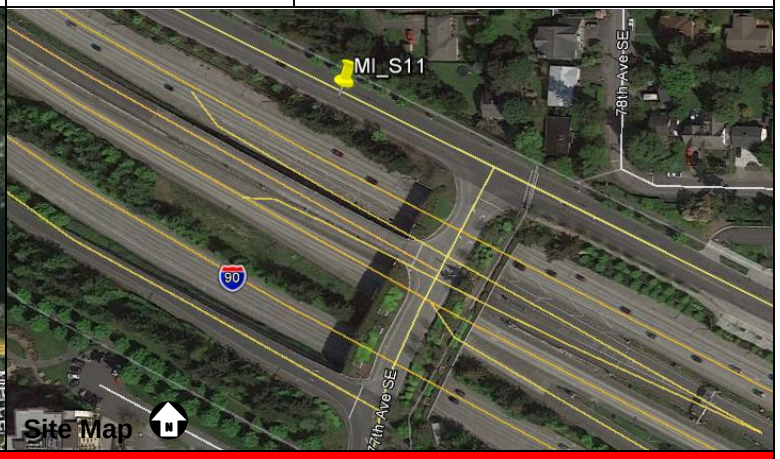
Percent Uptime	
Depth (mm)	100
Velocity (m/s)	100
Quantity (l/s)	100

ADS Site Report

Quality Form

Project Name: Mercer Island TFM	**City / State:** Mercer Island, WA	**FM Initials:** SW	
Site Name: MI_S-11	**Monitor Series:** Flowshark AG	**Monitor S/N:**	21479
Address/Location: Site is located on North bound left lane of N Mercer Way (Closest instersection 77th Ave SE and N Mercer Way)		**Manhole #:**	MI_S-11
		GPS Coordinates:	47.589436°, -122.235152°
		Pipe Height:	24.38"
Access: Drive / Walk	**Type of System:** Sanitary [X] Storm [ ] Combined [ ]	**Pipe Width:**	24.50"
		IP Address:	166.213.6.134





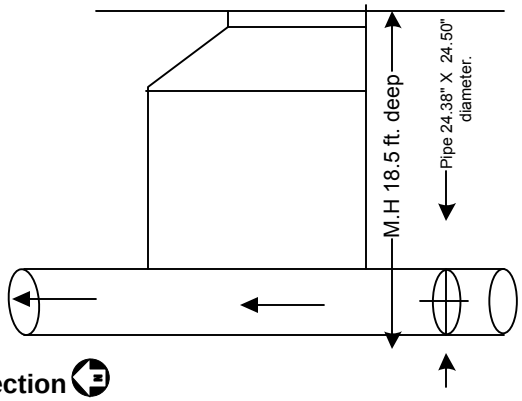
Investigation Information:

Date/Time of Investigation:	02/25/2016 @ 13::00
Site Hydraulics:	Laminar Flow
Upstream Input: (L/S, P/S)	None
Upstream Manhole:	Not Investigated
Downstream Manhole:	Not Investigated
Depth of Flow:	7.11" +/- 0.13"
Range (Air DOF):	17.27"+/- 0.13"
Peak Velocity:	1.11 fps
Silt:	0.00"

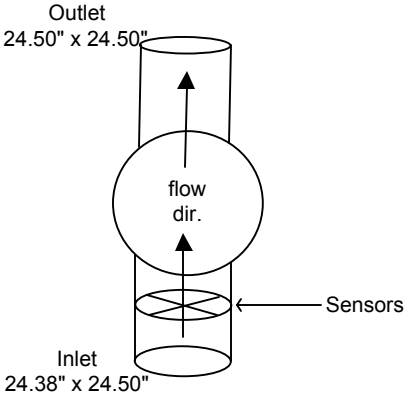
Manhole Information:

Manhole Depth:	18.5'				
Manhole Material / Condition	Concrete / Good				
Pipe Material / Condition:	VCP / Good				
Mini System Character:	Residential [X]	Commercial [X]	Industrial [ ]	Trunk [ ]	
Telephone Information:	Does not apply				
Access Pole #:	Does not apply				
Distance From Manhole:	Does not apply	Feet			
Road Cut Length:	Does not apply	Feet			
Trench Length:	Does not apply	Feet			

Other Information:



Cross Section



Planar

Installation Information	
Installation Type:	Standard Ring
Sensors Devices:	Ultrasonic Depth, Doppler Velocity, Pressure Depth
Surcharge Height:	0.00'
Rain Guage Zone:	N/A

Backup	Yes	No	?	Distance
Trunk	[ ]	[X]	[ ]	
Lift / Pump Station	[ ]	[X]	[ ]	
WWTP	[ ]	[X]	[ ]	
Other	[ ]	[X]	[ ]	

Additional Site Information / Comments:

Site Installed 02/25/2016

SCATTERGRAPH REPORT

MI_S11

Flow Monitor

MI_S11

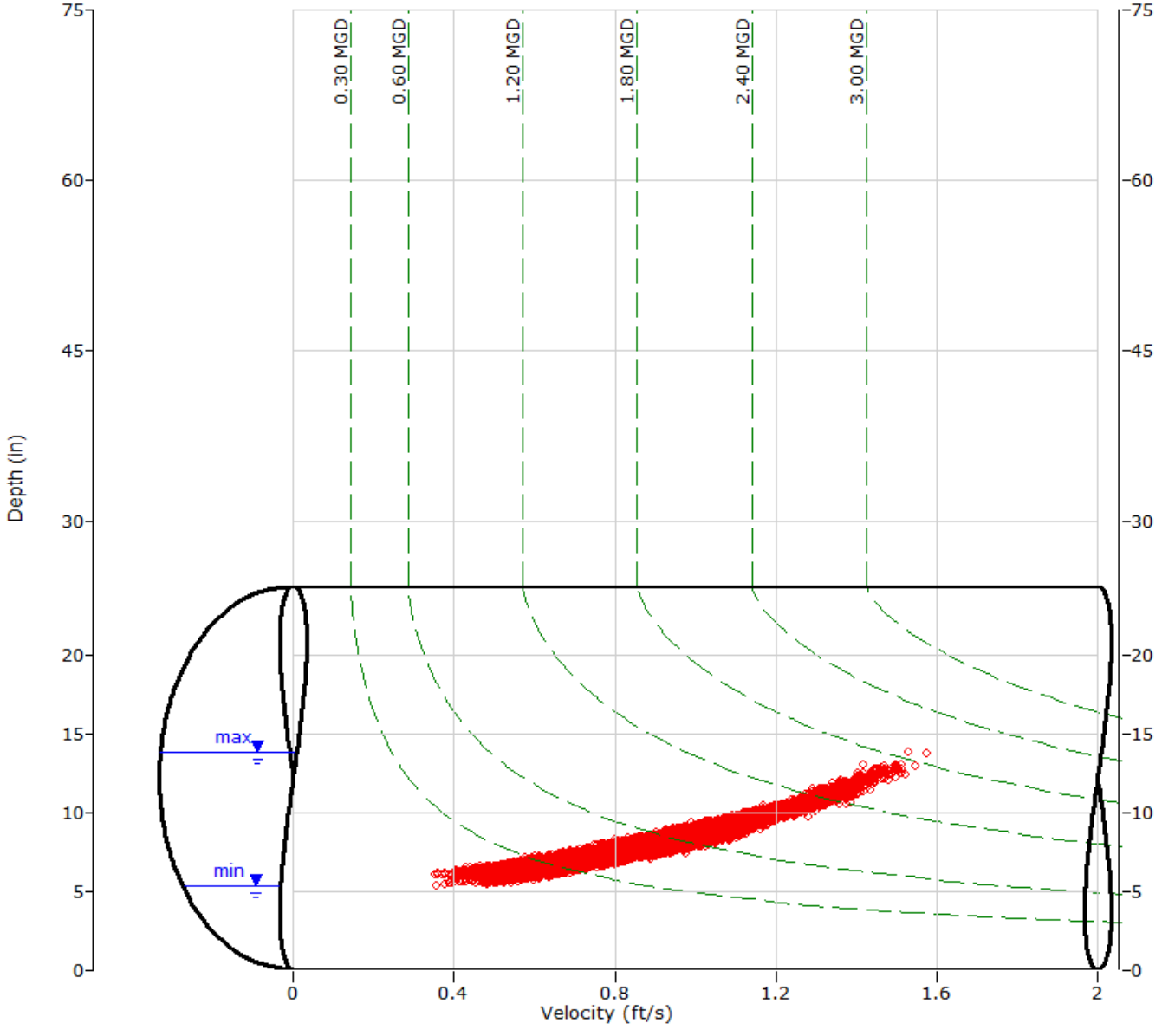
Pipe Height
24.38 in

Report Period

1/21/2016
To
7/21/2016

Legend

- Depth - Velocity
- Iso-Q™
- Silt
- Min-Max Depth



ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

MI_S11

Flow Monitor

MI_S11

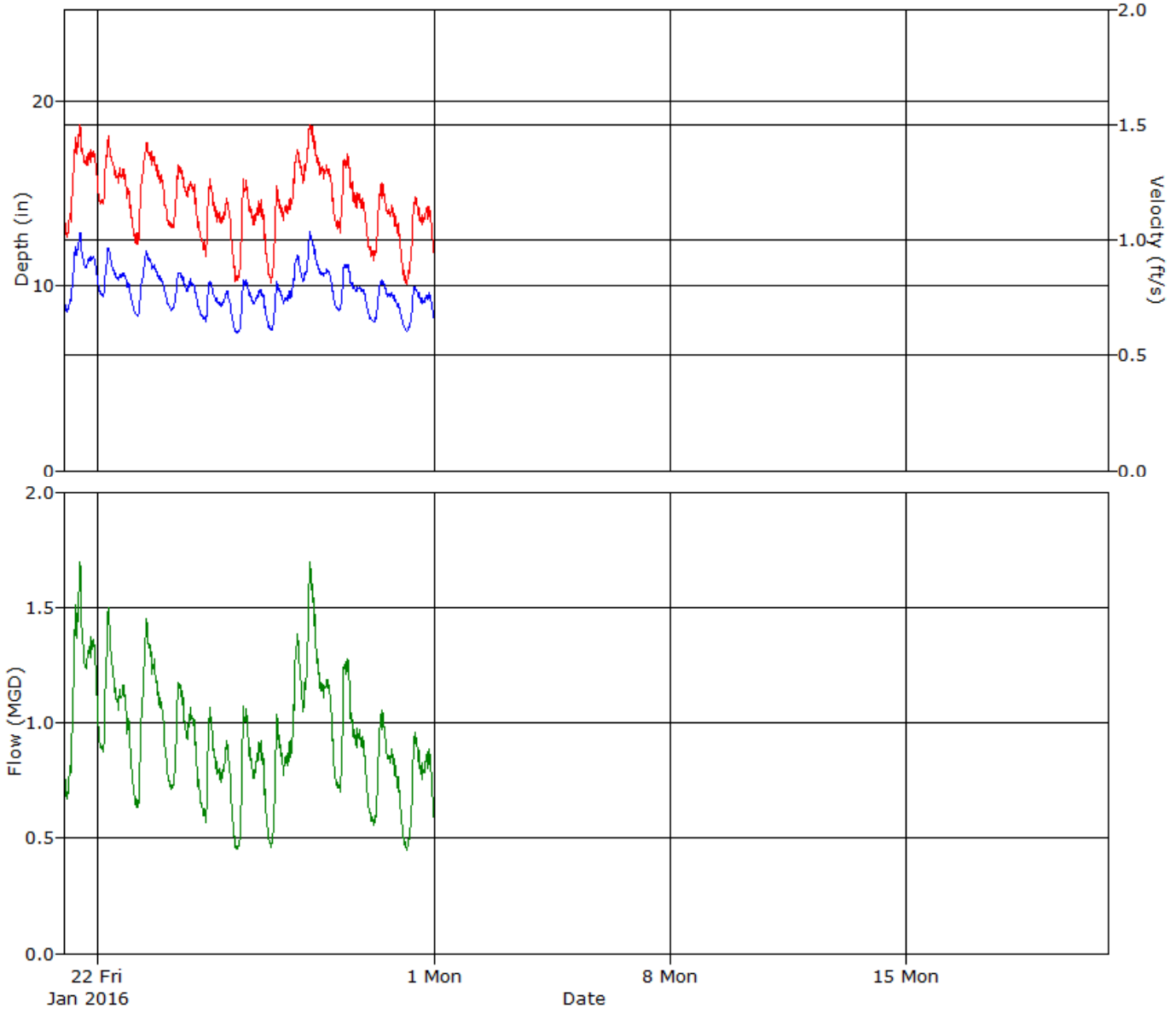
Pipe Height
24.38 in

Report Period

1/21/2016
To
1/31/2016

Legend

- Depth
- Velocity
- Quantity



ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

MI_S11

Flow Monitor

MI_S11

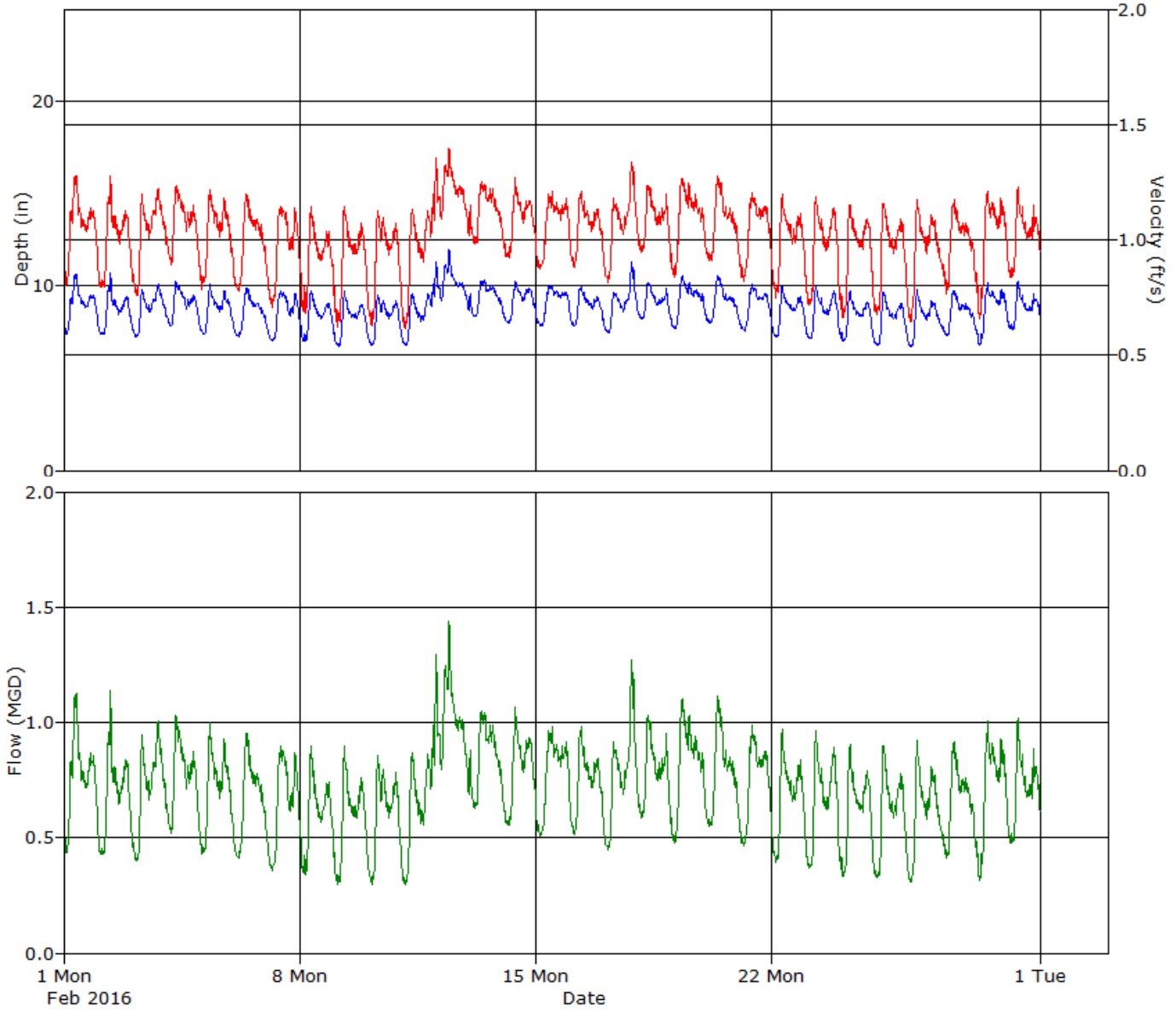
Pipe Height
24.38 in

Report Period

2/1/2016
To
2/29/2016

Legend

- Depth
- Velocity
- Quantity



ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

MI_S11

Flow Monitor

MI_S11

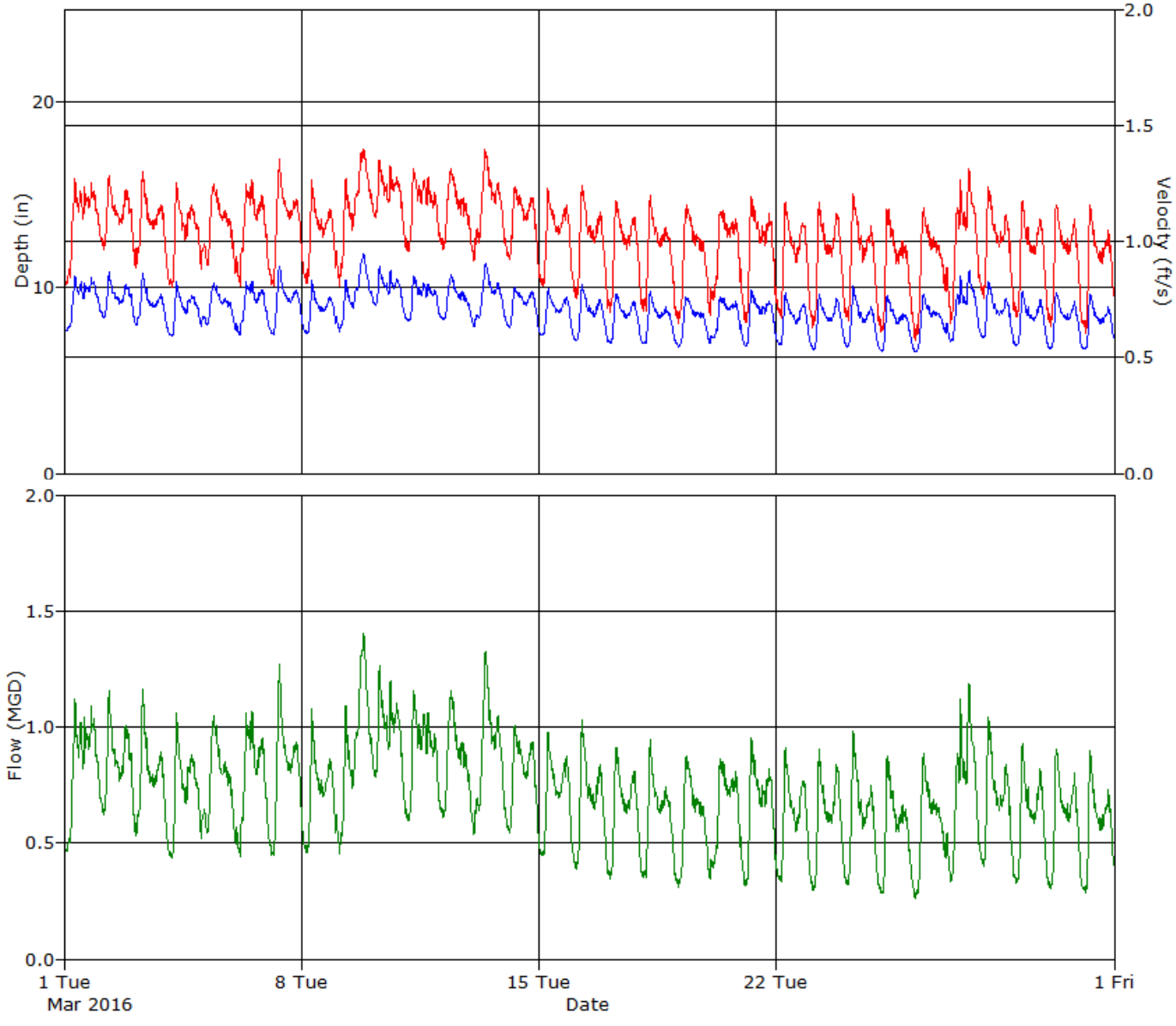
Pipe Height
24.38 in

Report Period

3/1/2016
To
3/31/2016

Legend

- Depth
- Velocity
- Quantity



ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

MI_S11

Flow Monitor

MI_S11

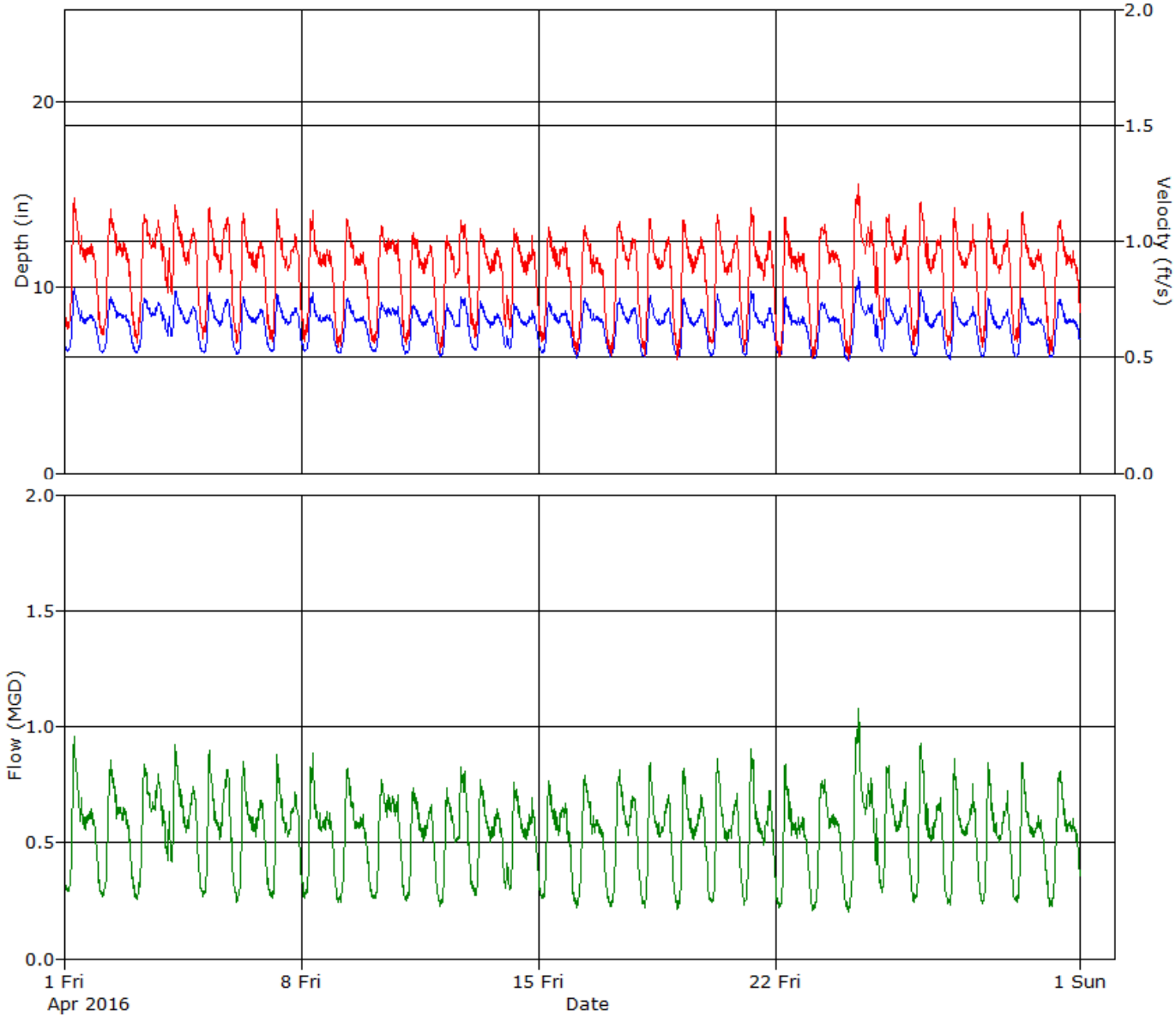
Pipe Height
24.38 in

Report Period

4/1/2016
To
4/30/2016

Legend

- Depth
- Velocity
- Quantity



ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

MI_S11

Flow Monitor

MI_S11

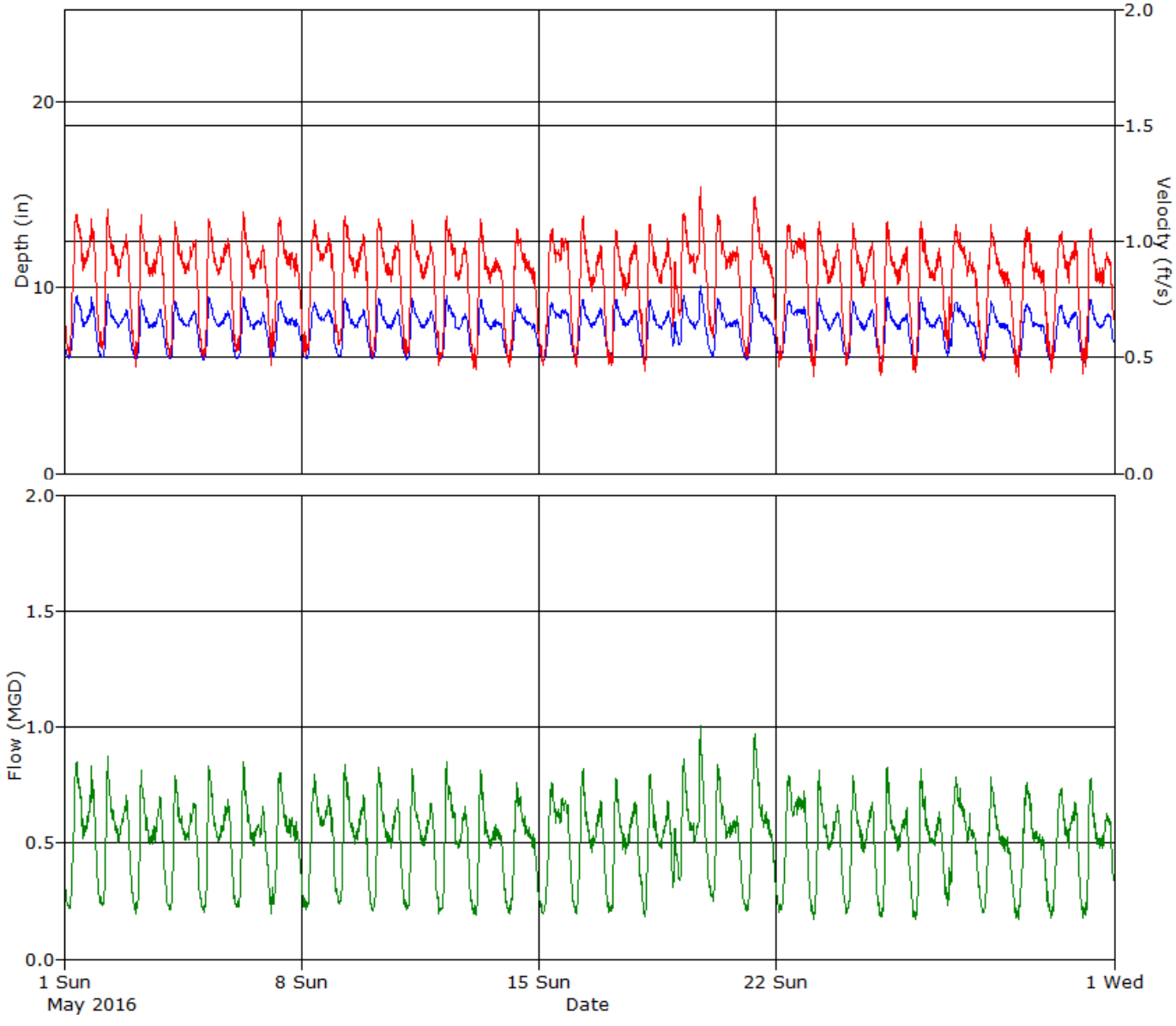
Pipe Height
24.38 in

Report Period

5/1/2016
To
5/31/2016

Legend

- Depth
- Velocity
- Quantity



ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

MI_S11

Flow Monitor

MI_S11

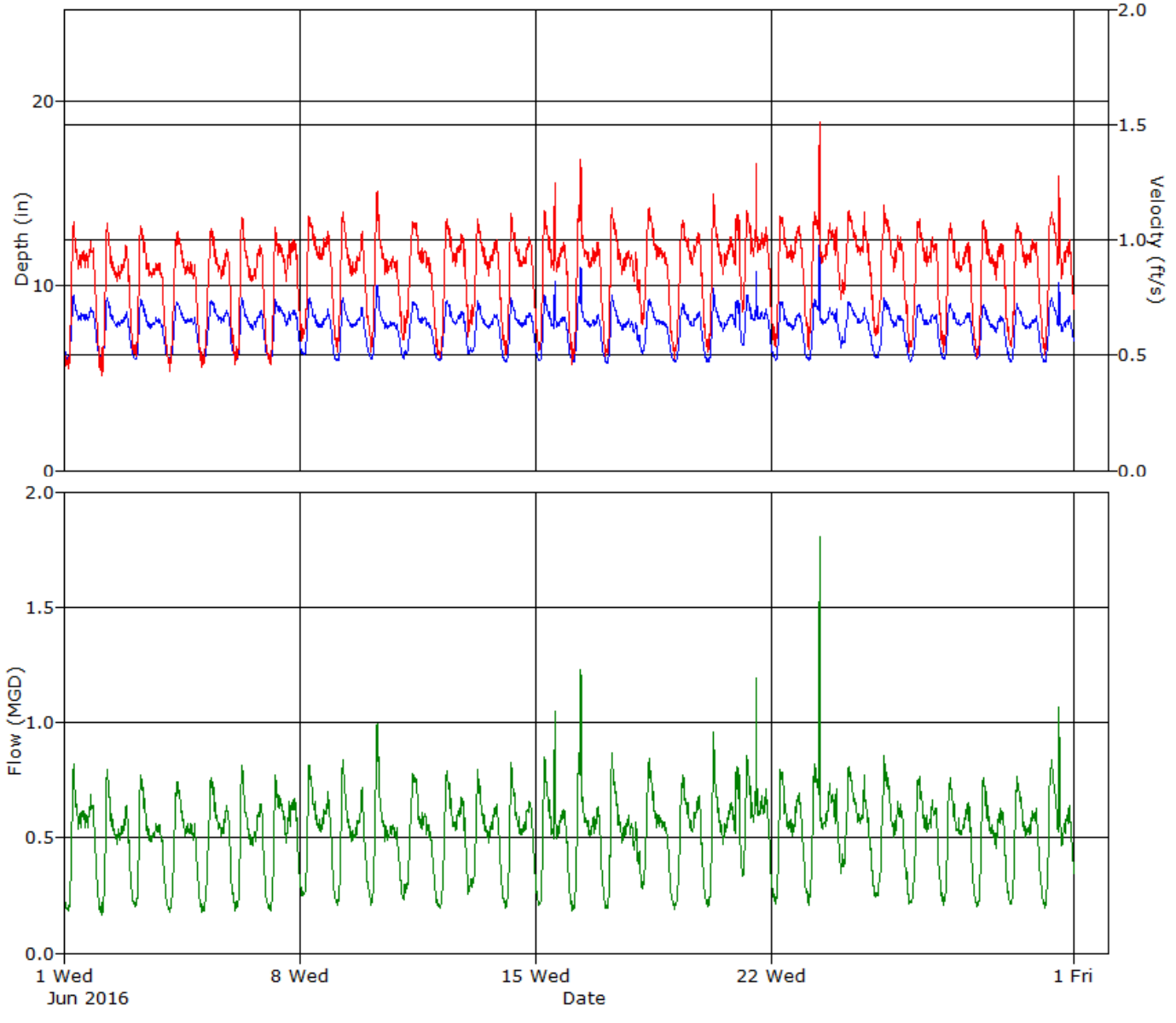
Pipe Height
24.38 in

Report Period

6/1/2016
To
6/30/2016

Legend

- Depth
- Velocity
- Quantity



ADS ENVIRONMENTAL SERVICES

HYDROGRAPH REPORT

MI_S11

Flow Monitor

MI_S11

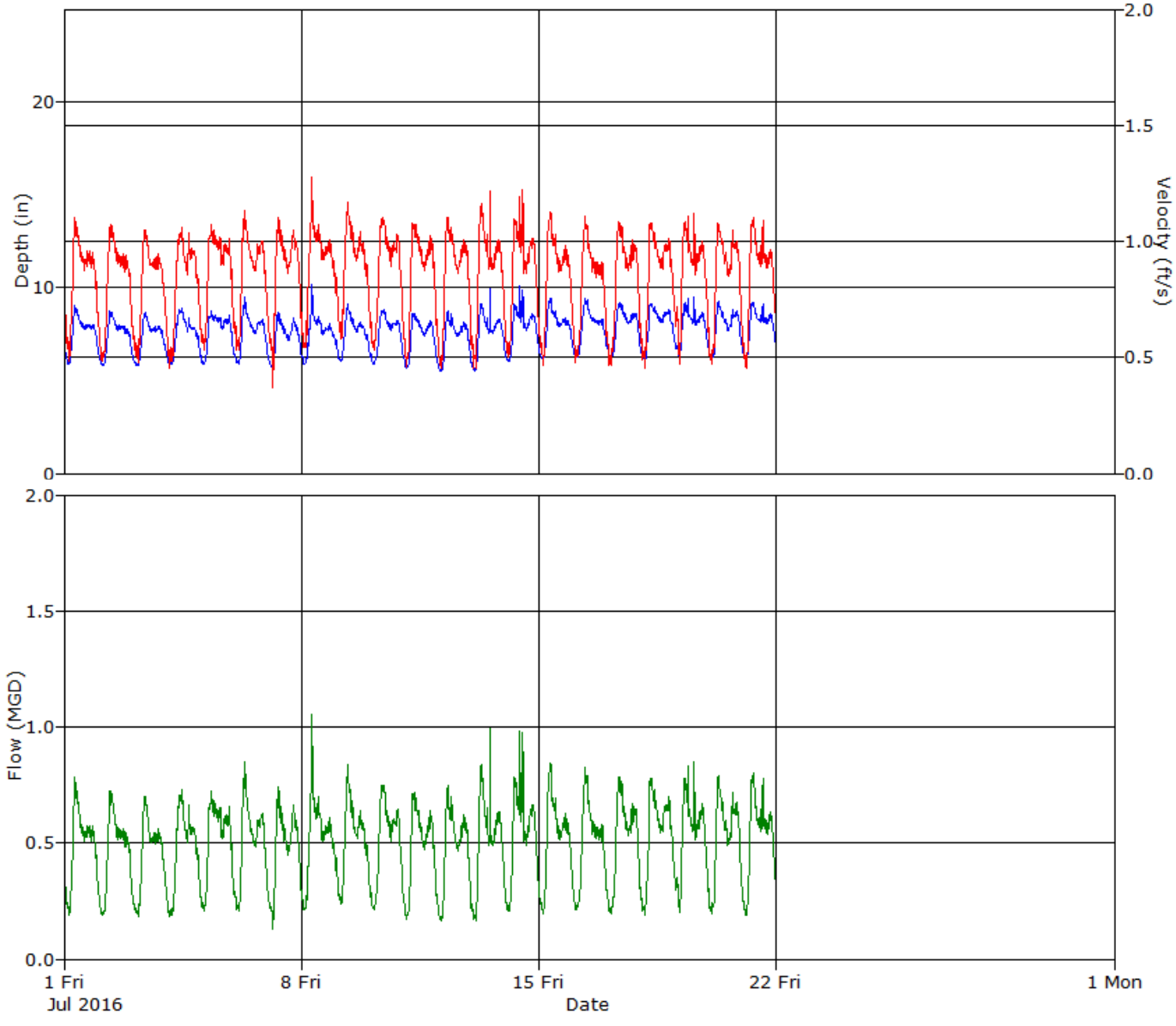
Pipe Height
24.38 in

Report Period

7/1/2016
To
7/21/2016

Legend

- Depth
- Velocity
- Quantity



ADS ENVIRONMENTAL SERVICES

Daily Tabular Report For The Period 1/21/2016 - 7/21/2016

MI_S11, Pipe Height: 24.38 in

Daily Tabular Report

Date	Depth (in)					Velocity (ft/s)					Quantity (MGD - Total ft3)						Rain (in)
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
1/21/2016	02:10	8.57	11:55	13.00	10.88	02:00	1.00	12:00	1.51	1.29	02:00	0.661	12:00	1.720	1.194	159576	
1/22/2016	04:05	9.43	07:55	12.09	10.48	01:55	1.13	07:45	1.48	1.27	23:55	0.850	07:45	1.523	1.103	147415	
1/23/2016	05:25	8.36	10:45	11.93	10.25	03:25	0.96	11:35	1.44	1.24	04:15	0.619	10:50	1.468	1.055	140999	
1/24/2016	05:00	8.69	10:45	10.76	9.72	02:50	1.02	10:05	1.33	1.18	05:20	0.692	10:05	1.187	0.931	124428	
1/25/2016	05:25	8.04	08:00	10.33	9.13	04:00	0.92	08:20	1.27	1.10	05:25	0.562	08:20	1.077	0.794	106132	
1/26/2016	04:00	7.47	07:55	10.39	9.06	03:10	0.80	07:50	1.30	1.06	03:40	0.439	07:50	1.107	0.770	102981	
1/27/2016	03:40	7.59	22:40	11.78	9.41	03:35	0.80	22:10	1.40	1.11	03:55	0.448	22:40	1.395	0.851	113759	
1/28/2016	23:40	9.70	07:35	12.93	11.08	23:40	1.16	06:50	1.52	1.34	23:40	0.907	07:40	1.697	1.250	167075	
1/29/2016	04:05	8.69	09:05	11.23	9.82	05:10	1.01	10:40	1.39	1.18	05:10	0.690	10:40	1.298	0.945	126345	
1/30/2016	04:40	8.01	10:35	10.36	9.15	03:10	0.90	11:50	1.26	1.07	04:45	0.550	10:35	1.070	0.782	104498	
1/31/2016	04:25	7.52	10:10	10.01	8.86	05:00	0.79	10:30	1.21	1.02	05:00	0.438	10:30	0.982	0.719	96084	
2/1/2016	02:00	7.36	09:30	10.71	9.06	01:40	0.78	08:00	1.30	1.07	02:00	0.424	09:25	1.154	0.772	103183	
2/2/2016	03:55	7.37	09:35	10.77	8.71	04:35	0.77	09:25	1.29	1.01	04:35	0.423	09:35	1.157	0.694	92803	
2/3/2016	04:10	7.19	19:40	10.17	8.79	03:35	0.74	19:05	1.24	1.03	03:35	0.387	19:25	1.019	0.719	96068	
2/4/2016	05:05	7.80	07:55	10.36	9.05	04:45	0.87	07:55	1.26	1.08	04:45	0.505	07:55	1.078	0.772	103246	
2/5/2016	03:40	7.35	08:00	10.14	8.73	02:15	0.76	08:00	1.24	1.03	02:15	0.418	08:00	1.026	0.707	94504	
2/6/2016	04:30	7.22	10:45	9.91	8.57	02:55	0.77	10:00	1.21	1.00	04:30	0.399	10:05	0.965	0.671	89672	
2/7/2016	04:35	7.01	11:10	9.76	8.52	04:25	0.68	11:40	1.16	0.97	04:25	0.341	11:05	0.902	0.647	86481	
2/8/2016	03:10	6.96	08:10	9.79	8.38	02:15	0.66	08:05	1.17	0.93	02:15	0.333	08:05	0.916	0.604	80711	
2/9/2016	03:50	6.75	08:05	9.77	8.23	02:45	0.58	08:05	1.17	0.92	02:45	0.274	08:05	0.922	0.590	78933	
2/10/2016	03:50	6.74	08:10	9.54	8.31	03:10	0.59	08:00	1.14	0.93	03:10	0.284	08:00	0.863	0.601	80304	
2/11/2016	04:40	6.77	23:20	10.15	8.41	03:30	0.58	23:15	1.21	0.94	03:30	0.277	23:20	1.006	0.622	83117	
2/12/2016	23:55	9.16	10:40	11.99	10.27	00:05	1.06	10:35	1.44	1.23	05:15	0.774	10:35	1.479	1.038	138768	
2/13/2016	05:05	8.33	12:00	10.38	9.42	03:55	0.96	09:10	1.28	1.13	05:25	0.616	12:00	1.095	0.855	114289	
2/14/2016	04:55	7.97	09:55	10.35	9.16	05:35	0.88	09:50	1.28	1.09	05:35	0.531	09:55	1.091	0.792	105843	
2/15/2016	03:25	7.81	10:00	10.03	9.13	01:50	0.84	12:40	1.22	1.07	04:05	0.497	12:40	0.997	0.779	104174	
2/16/2016	03:55	7.79	08:50	10.02	8.93	04:30	0.85	08:50	1.22	1.06	04:30	0.499	08:50	0.996	0.745	99623	
2/17/2016	03:40	7.48	20:45	11.36	9.02	03:50	0.81	20:45	1.35	1.07	03:50	0.445	20:45	1.298	0.770	102916	
2/18/2016	04:10	8.17	08:25	10.30	9.15	03:55	0.93	07:55	1.25	1.09	03:55	0.577	08:25	1.055	0.795	106296	
2/19/2016	03:55	7.64	08:45	10.60	9.29	03:25	0.83	09:35	1.29	1.10	03:55	0.466	08:45	1.118	0.821	109713	
2/20/2016	04:25	8.00	10:15	10.61	9.15	04:20	0.89	09:55	1.29	1.08	04:20	0.534	09:55	1.132	0.789	105414	
2/21/2016	05:15	7.54	10:55	10.14	8.92	05:00	0.79	10:55	1.22	1.04	05:00	0.446	10:55	1.012	0.738	98714	
2/22/2016	03:50	7.20	08:15	10.06	8.65	03:15	0.74	08:20	1.20	1.00	03:20	0.390	08:15	0.980	0.677	90490	
2/23/2016	03:10	7.10	08:25	10.05	8.61	02:35	0.69	08:25	1.21	0.98	03:10	0.355	08:25	0.993	0.665	88878	
2/24/2016	04:00	6.99	08:40	9.79	8.39	03:20	0.63	08:10	1.16	0.95	03:20	0.316	08:40	0.918	0.623	83297	
2/25/2016	03:40	6.78	08:25	9.68	8.27	03:20	0.64	08:45	1.20	0.95	03:20	0.305	08:45	0.927	0.610	81549	
2/26/2016	03:40	6.67	08:00	9.84	8.28	02:55	0.61	08:00	1.20	0.95	02:55	0.292	08:00	0.952	0.614	82116	
2/27/2016	05:05	7.27	10:00	9.79	8.53	04:55	0.76	09:35	1.18	1.00	04:55	0.403	10:00	0.931	0.663	88577	
2/28/2016	04:55	6.78	10:35	10.15	8.74	04:55	0.63	10:30	1.23	1.01	04:55	0.300	10:30	1.019	0.703	93966	
2/29/2016	03:10	7.61	08:00	10.34	8.78	03:15	0.81	08:20	1.24	1.02	03:15	0.460	08:00	1.038	0.702	93857	
3/1/2016	01:55	7.65	07:55	10.67	9.46	01:10	0.79	07:55	1.29	1.10	01:10	0.451	07:55	1.143	0.845	112967	
3/2/2016	03:55	8.38	08:00	10.88	9.47	04:15	0.95	07:55	1.32	1.12	04:20	0.612	07:55	1.195	0.851	113810	
3/3/2016	03:40	7.98	08:10	10.81	9.17	03:20	0.87	07:40	1.32	1.08	03:20	0.522	07:40	1.184	0.791	105716	
3/4/2016	04:20	7.41	07:50	10.34	8.81	02:45	0.79	07:55	1.26	1.04	04:55	0.430	07:55	1.067	0.722	96539	
3/5/2016	01:10	7.86	10:05	10.33	9.04	01:05	0.87	10:00	1.28	1.07	01:10	0.510	10:00	1.087	0.768	102710	
3/6/2016	04:45	7.43	09:10	10.36	9.10	04:45	0.78	13:25	1.29	1.08	04:45	0.425	13:25	1.094	0.785	104969	

Date	Depth (in)					Velocity (ft/s)					Quantity (MGD - Total ft3)						Rain (in)
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
3/7/2016	04:15	7.49	08:50	11.16	9.22	04:15	0.78	08:50	1.37	1.09	04:15	0.430	08:50	1.285	0.808	108074	
3/8/2016	04:05	7.52	07:50	10.41	8.82	03:40	0.80	07:45	1.27	1.04	03:40	0.442	07:45	1.085	0.722	96535	
3/9/2016	03:30	7.61	20:25	11.88	9.64	03:30	0.79	18:10	1.41	1.14	03:30	0.444	20:25	1.437	0.907	121247	
3/10/2016	05:20	9.01	07:45	11.16	9.99	03:55	1.09	07:25	1.38	1.22	05:20	0.772	07:25	1.282	0.991	132533	
3/11/2016	04:35	8.17	07:50	10.67	9.50	03:55	0.92	07:45	1.33	1.16	03:55	0.573	07:45	1.170	0.885	118334	
3/12/2016	04:40	8.26	10:00	10.71	9.38	05:10	0.95	09:55	1.34	1.14	05:10	0.596	09:55	1.190	0.857	114619	
3/13/2016	02:25	7.86	10:30	11.35	9.50	02:35	0.89	10:20	1.40	1.16	02:35	0.526	10:25	1.331	0.892	119298	
3/14/2016	03:35	7.86	07:20	10.05	9.09	23:50	0.89	07:40	1.25	1.10	03:55	0.537	07:55	1.016	0.791	105687	
3/15/2016	02:15	7.42	07:15	9.95	8.71	03:55	0.78	06:35	1.24	1.03	03:55	0.434	06:40	0.987	0.706	94404	
3/16/2016	02:45	7.11	07:05	10.16	8.60	02:15	0.74	06:50	1.26	1.01	02:15	0.379	07:10	1.043	0.682	91126	
3/17/2016	02:40	6.96	06:55	9.68	8.44	02:45	0.67	08:05	1.20	0.97	02:45	0.335	07:30	0.924	0.643	85897	
3/18/2016	03:15	6.93	07:10	9.87	8.34	04:25	0.66	07:10	1.22	0.96	04:25	0.332	07:10	0.976	0.623	83303	
3/19/2016	03:15	6.75	09:25	9.52	8.23	03:10	0.62	09:05	1.17	0.94	03:10	0.295	09:05	0.887	0.599	80066	
3/20/2016	01:45	7.01	08:35	9.54	8.46	01:50	0.64	09:05	1.16	0.96	01:50	0.321	09:05	0.879	0.637	85117	
3/21/2016	02:20	6.86	07:10	9.92	8.54	02:15	0.64	06:55	1.20	0.97	02:15	0.310	07:10	0.962	0.653	87318	
3/22/2016	03:15	6.92	07:10	9.78	8.30	02:45	0.65	07:00	1.18	0.94	02:45	0.328	07:10	0.923	0.609	81398	
3/23/2016	03:40	6.64	07:00	9.68	8.27	02:10	0.58	07:05	1.18	0.94	02:10	0.277	07:05	0.914	0.605	80858	
3/24/2016	03:00	6.75	07:05	10.13	8.29	04:10	0.63	07:00	1.23	0.94	04:10	0.304	07:00	1.016	0.609	81358	
3/25/2016	03:25	6.55	07:05	9.67	8.10	02:20	0.59	06:50	1.17	0.90	02:20	0.276	07:05	0.896	0.564	75370	
3/26/2016	02:35	6.51	09:30	9.67	8.14	02:40	0.54	08:50	1.15	0.90	02:40	0.250	08:55	0.895	0.568	75979	
3/27/2016	04:05	7.07	17:10	11.01	8.92	03:50	0.60	17:10	1.34	1.01	03:50	0.312	17:10	1.239	0.727	97245	
3/28/2016	02:55	7.30	06:55	10.32	8.68	03:35	0.73	06:55	1.26	1.00	03:35	0.390	06:55	1.065	0.682	91232	
3/29/2016	02:35	6.85	07:00	9.83	8.33	03:25	0.64	07:05	1.19	0.95	03:25	0.311	07:05	0.942	0.614	82074	
3/30/2016	03:15	6.71	07:20	9.80	8.27	03:20	0.61	07:15	1.18	0.94	03:20	0.288	07:15	0.918	0.603	80565	
3/31/2016	03:10	6.65	07:10	9.72	8.14	04:05	0.58	07:10	1.19	0.91	04:05	0.275	07:10	0.929	0.573	76581	
4/1/2016	02:50	6.59	07:10	9.98	8.14	02:00	0.60	07:35	1.20	0.91	03:30	0.281	07:35	0.970	0.575	76807	
4/2/2016	03:25	6.50	09:40	9.50	8.06	02:15	0.58	09:30	1.14	0.89	03:20	0.261	09:40	0.869	0.554	74002	
4/3/2016	03:30	6.43	09:05	9.51	8.19	04:20	0.53	09:35	1.15	0.90	04:20	0.241	09:35	0.870	0.580	77554	
4/4/2016	23:55	7.11	06:45	9.86	8.41	23:55	0.72	06:50	1.17	0.95	23:55	0.369	06:50	0.931	0.620	82911	
4/5/2016	03:25	6.51	07:10	9.79	8.15	02:35	0.58	06:55	1.17	0.90	02:40	0.262	07:10	0.925	0.575	76845	
4/6/2016	03:10	6.36	06:40	9.69	8.05	02:30	0.52	06:40	1.17	0.87	02:30	0.230	06:40	0.912	0.545	72849	
4/7/2016	03:05	6.53	06:40	9.72	8.11	03:45	0.54	06:40	1.16	0.88	03:45	0.246	06:40	0.909	0.550	73589	
4/8/2016	02:05	6.56	08:25	9.80	8.06	01:55	0.54	08:20	1.14	0.87	01:55	0.252	08:20	0.904	0.540	72136	
4/9/2016	01:55	6.44	09:05	9.46	7.97	01:55	0.51	09:00	1.11	0.85	01:55	0.226	09:00	0.837	0.521	69680	
4/10/2016	03:00	6.56	09:00	9.38	8.06	03:45	0.54	08:55	1.09	0.86	04:20	0.247	08:55	0.810	0.538	71976	
4/11/2016	01:45	6.42	07:20	9.07	7.92	01:50	0.54	07:15	1.04	0.85	01:50	0.240	07:20	0.742	0.514	68673	
4/12/2016	02:55	6.24	17:25	9.52	8.06	02:55	0.49	18:15	1.12	0.86	02:55	0.209	17:25	0.845	0.543	72552	
4/13/2016	03:45	6.56	07:05	9.28	7.96	03:45	0.55	06:45	1.07	0.86	03:45	0.251	06:55	0.780	0.522	69774	
4/14/2016	03:45	6.67	07:00	9.22	8.01	04:10	0.61	07:00	1.08	0.87	03:45	0.288	07:00	0.784	0.533	71292	
4/15/2016	02:55	6.48	07:40	9.20	8.01	04:00	0.52	07:15	1.07	0.86	04:00	0.239	07:40	0.776	0.531	70982	
4/16/2016	03:25	6.20	08:45	9.46	7.95	01:35	0.49	08:45	1.08	0.83	03:20	0.208	08:45	0.818	0.509	67990	
4/17/2016	03:10	6.21	09:40	9.45	7.98	03:45	0.48	09:25	1.11	0.85	03:45	0.209	09:40	0.830	0.526	70299	
4/18/2016	03:40	6.24	07:05	9.61	7.98	03:40	0.48	06:55	1.13	0.86	03:40	0.205	07:05	0.856	0.530	70827	
4/19/2016	03:35	6.22	06:50	9.43	7.98	03:30	0.46	06:40	1.11	0.86	03:30	0.198	06:40	0.831	0.532	71105	
4/20/2016	02:55	6.33	07:05	9.72	7.97	02:55	0.53	07:05	1.12	0.86	02:55	0.231	07:05	0.875	0.530	70910	
4/21/2016	02:55	6.34	07:05	9.91	8.05	01:55	0.48	06:35	1.16	0.87	01:55	0.211	07:05	0.919	0.543	72650	
4/22/2016	02:10	6.33	07:00	9.58	7.88	03:50	0.47	07:00	1.13	0.84	03:50	0.207	07:00	0.865	0.511	68354	
4/23/2016	04:25	6.11	10:40	9.25	7.82	02:05	0.46	08:40	1.08	0.84	02:35	0.196	10:40	0.794	0.509	68042	
4/24/2016	03:40	6.04	11:00	10.57	8.20	04:25	0.45	10:50	1.26	0.90	04:25	0.183	10:50	1.085	0.590	78894	
4/25/2016	03:20	6.56	06:45	9.45	8.15	03:10	0.60	06:35	1.12	0.91	03:10	0.276	08:25	0.843	0.575	76920	
4/26/2016	01:50	6.29	06:50	9.90	8.00	02:20	0.52	06:40	1.20	0.88	02:20	0.226	06:50	0.959	0.549	73422	
4/27/2016	03:35	6.13	06:40	9.62	7.90	01:45	0.53	06:35	1.16	0.87	03:05	0.228	06:35	0.887	0.530	70909	
4/28/2016	03:10	6.25	07:10	9.50	7.91	02:45	0.54	06:50	1.14	0.87	03:10	0.231	06:50	0.862	0.531	70922	
4/29/2016	02:30	6.25	06:55	9.47	7.86	03:45	0.53	07:05	1.14	0.86	03:45	0.230	07:05	0.852	0.519	69317	
4/30/2016	02:15	6.27	09:10	9.43	7.85	02:10	0.51	10:00	1.11	0.85	02:10	0.218	10:00	0.825	0.513	68541	

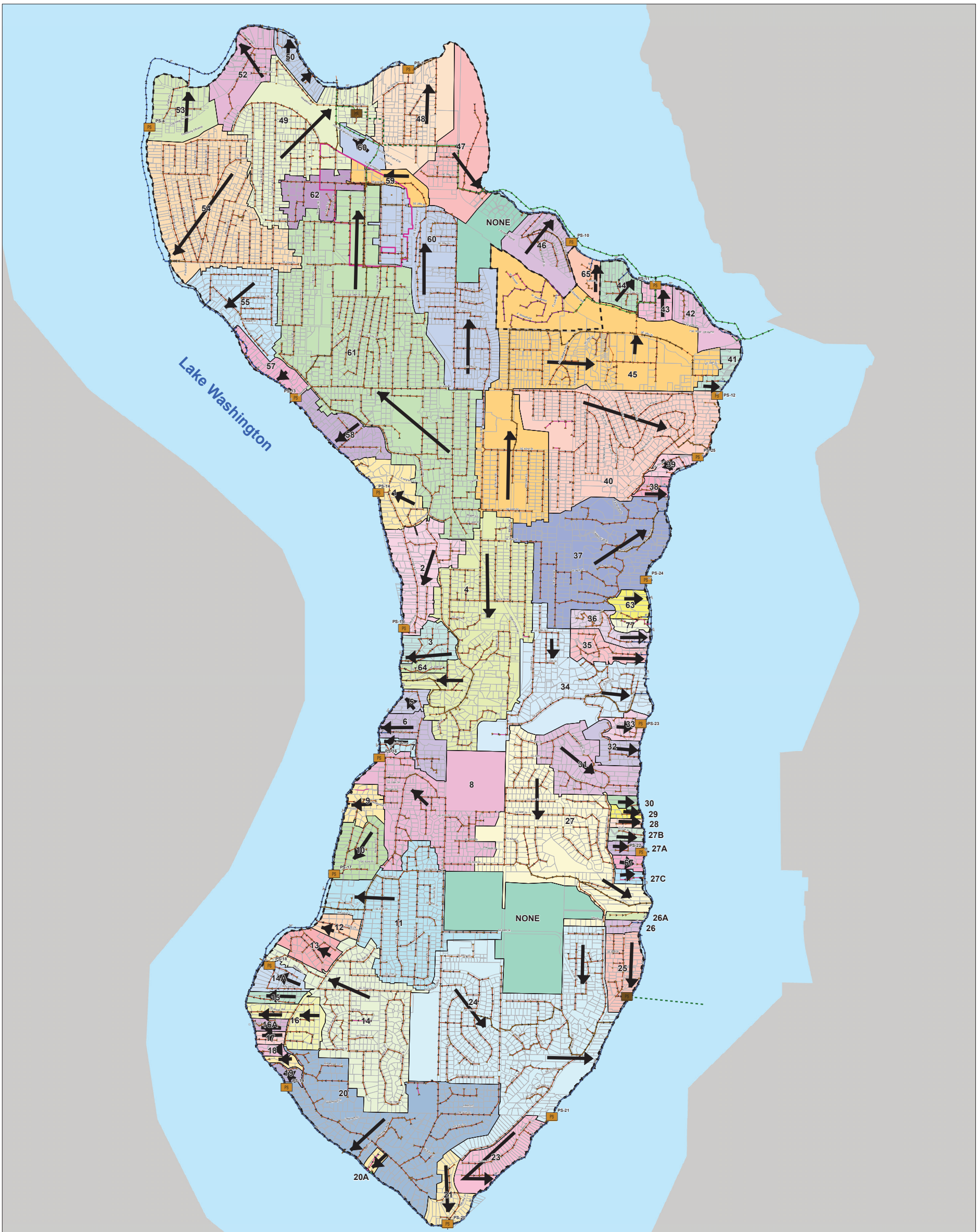
Date	Depth (in)					Velocity (ft/s)					Quantity (MGD - Total ft3)						Rain (in)
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
5/1/2016	03:40	6.21	19:45	9.78	8.00	04:00	0.47	19:40	1.20	0.87	04:00	0.200	19:40	0.939	0.545	72842	
5/2/2016	03:45	6.20	07:10	9.68	7.91	03:00	0.51	07:05	1.14	0.86	03:00	0.218	07:10	0.891	0.527	70485	
5/3/2016	02:55	6.17	06:40	9.40	7.84	02:55	0.43	06:40	1.14	0.84	02:55	0.180	06:40	0.850	0.506	67677	
5/4/2016	02:40	6.12	06:40	9.29	7.86	02:45	0.46	06:30	1.09	0.84	02:45	0.192	06:45	0.803	0.511	68338	
5/5/2016	02:55	6.09	06:45	9.55	7.90	03:05	0.46	06:45	1.11	0.85	03:05	0.191	06:45	0.848	0.519	69315	
5/6/2016	02:35	6.20	07:05	9.53	7.89	02:00	0.50	07:00	1.14	0.85	02:00	0.211	07:00	0.870	0.519	69317	
5/7/2016	02:45	6.17	09:20	9.34	7.82	02:40	0.46	09:15	1.12	0.85	02:45	0.194	09:15	0.825	0.508	67975	
5/8/2016	03:55	6.16	09:25	9.29	7.91	01:55	0.48	09:25	1.10	0.86	01:55	0.208	09:25	0.811	0.526	70339	
5/9/2016	03:40	6.26	07:00	9.56	7.92	02:45	0.53	06:55	1.14	0.86	02:45	0.231	06:55	0.867	0.527	70505	
5/10/2016	02:25	6.13	06:55	9.54	7.87	02:45	0.46	06:55	1.14	0.84	02:45	0.190	06:55	0.867	0.512	68436	
5/11/2016	02:50	6.14	06:45	9.42	7.86	01:55	0.47	06:50	1.10	0.84	02:50	0.200	06:50	0.825	0.506	67679	
5/12/2016	02:35	6.12	06:55	9.68	7.87	01:55	0.42	07:05	1.13	0.84	01:55	0.179	06:55	0.871	0.512	68444	
5/13/2016	02:45	6.13	06:55	9.40	7.76	03:30	0.40	06:45	1.10	0.81	03:30	0.171	07:40	0.819	0.483	64564	
5/14/2016	02:45	6.10	08:45	9.16	7.73	03:20	0.41	09:40	1.07	0.80	03:20	0.173	08:45	0.765	0.478	63850	
5/15/2016	03:40	6.04	09:05	9.23	7.88	02:35	0.45	09:00	1.07	0.83	03:40	0.182	09:05	0.773	0.509	68090	
5/16/2016	02:50	6.15	07:30	9.37	7.97	02:50	0.43	07:50	1.14	0.82	02:50	0.179	07:50	0.837	0.508	67850	
5/17/2016	02:25	6.29	06:50	9.37	7.97	02:30	0.43	07:05	1.08	0.81	02:30	0.187	07:05	0.807	0.502	67076	
5/18/2016	02:40	6.06	07:00	9.42	7.86	04:00	0.42	07:00	1.11	0.83	04:00	0.176	07:00	0.833	0.502	67140	
5/19/2016	03:40	6.91	19:00	10.18	8.28	00:00	0.66	18:50	1.24	0.94	04:25	0.328	19:00	1.024	0.602	80410	
5/20/2016	03:50	6.26	07:15	9.49	7.88	03:25	0.54	07:05	1.13	0.88	03:55	0.235	07:15	0.854	0.531	70938	
5/21/2016	03:30	6.10	09:20	10.03	7.98	04:10	0.46	09:20	1.21	0.86	04:10	0.197	09:20	0.990	0.537	71768	
5/22/2016	02:25	6.26	10:40	9.32	8.01	02:35	0.45	08:50	1.09	0.85	02:35	0.192	10:40	0.796	0.530	70898	
5/23/2016	03:30	6.06	07:05	9.46	7.82	03:15	0.36	07:05	1.11	0.82	03:15	0.148	07:05	0.838	0.493	65952	
5/24/2016	03:05	6.19	06:55	9.30	7.84	02:30	0.44	06:45	1.09	0.82	02:30	0.186	06:55	0.800	0.498	66550	
5/25/2016	02:45	6.15	07:15	9.61	7.85	02:15	0.40	06:55	1.09	0.82	02:35	0.173	07:15	0.836	0.496	66258	
5/26/2016	03:05	5.94	07:05	9.52	7.79	01:35	0.39	07:00	1.10	0.81	01:35	0.158	07:05	0.832	0.489	65375	
5/27/2016	02:15	6.32	08:15	9.26	7.99	02:10	0.52	08:00	1.09	0.86	02:10	0.225	08:00	0.798	0.529	70774	
5/28/2016	03:10	6.07	08:55	9.36	7.66	03:45	0.41	08:55	1.12	0.80	03:45	0.170	08:55	0.832	0.470	62776	
5/29/2016	04:00	5.95	10:05	9.19	7.62	04:25	0.36	09:00	1.08	0.79	04:25	0.147	10:05	0.781	0.465	62124	
5/30/2016	03:30	5.96	10:40	9.16	7.75	03:45	0.35	10:35	1.07	0.82	03:45	0.142	10:40	0.771	0.488	65188	
5/31/2016	02:55	5.95	07:25	9.38	7.81	02:05	0.41	06:40	1.08	0.81	02:05	0.169	07:25	0.796	0.487	65092	
6/1/2016	02:35	6.04	07:10	9.56	7.92	03:30	0.41	07:05	1.11	0.82	03:30	0.172	07:05	0.848	0.506	67643	
6/2/2016	02:40	6.03	07:15	9.42	7.78	02:45	0.37	07:05	1.11	0.80	02:45	0.150	07:05	0.827	0.482	64458	
6/3/2016	02:55	5.99	07:20	9.33	7.74	04:00	0.46	06:40	1.11	0.81	04:00	0.189	06:40	0.814	0.483	64578	
6/4/2016	03:05	5.97	08:40	9.27	7.72	02:25	0.42	08:40	1.06	0.79	04:05	0.171	08:40	0.777	0.472	63144	
6/5/2016	03:30	5.94	09:10	9.30	7.79	02:55	0.43	09:10	1.07	0.80	04:30	0.171	09:10	0.787	0.481	64351	
6/6/2016	02:25	5.94	07:10	9.39	7.74	03:55	0.39	07:45	1.13	0.82	02:20	0.158	07:10	0.829	0.488	65179	
6/7/2016	03:35	5.95	06:55	9.35	7.92	02:40	0.44	06:55	1.07	0.84	03:05	0.177	06:55	0.793	0.515	68902	
6/8/2016	03:50	6.23	07:05	9.41	7.83	02:40	0.54	06:20	1.12	0.89	03:00	0.236	07:25	0.830	0.535	71492	
6/9/2016	03:45	5.92	07:10	9.40	7.74	02:55	0.49	07:00	1.13	0.86	02:55	0.195	07:00	0.837	0.509	68062	
6/10/2016	03:05	5.98	07:15	10.14	7.71	03:25	0.46	07:15	1.24	0.85	03:25	0.185	07:15	1.026	0.503	67212	
6/11/2016	02:25	6.01	09:40	9.19	7.71	01:50	0.54	09:00	1.10	0.86	02:10	0.222	09:00	0.796	0.506	67690	
6/12/2016	03:40	5.91	09:25	9.35	7.72	04:25	0.45	09:25	1.12	0.84	04:25	0.178	09:25	0.831	0.503	67292	
6/13/2016	01:15	6.20	07:00	9.22	7.77	02:30	0.57	08:10	1.12	0.88	01:20	0.248	07:00	0.803	0.518	69227	
6/14/2016	02:45	5.87	06:50	9.39	7.73	02:45	0.48	07:05	1.14	0.86	02:45	0.188	07:05	0.846	0.510	68157	
6/15/2016	02:40	5.94	14:15	10.32	7.83	02:55	0.51	14:20	1.27	0.88	03:10	0.202	14:20	1.071	0.531	71003	
6/16/2016	02:20	5.87	08:40	11.10	7.78	02:15	0.46	08:15	1.36	0.86	02:15	0.180	08:40	1.252	0.524	70007	
6/17/2016	03:20	5.80	06:45	9.59	7.68	02:10	0.46	06:45	1.16	0.86	04:05	0.181	06:45	0.893	0.505	67513	
6/18/2016	04:20	6.34	09:10	9.35	7.85	04:10	0.59	09:00	1.17	0.91	04:10	0.263	09:00	0.857	0.541	72363	
6/19/2016	03:15	5.84	09:00	9.10	7.65	03:00	0.46	09:00	1.12	0.86	03:00	0.181	09:00	0.801	0.505	67551	
6/20/2016	03:15	5.80	07:15	10.18	7.80	02:05	0.49	07:15	1.29	0.88	02:05	0.192	07:15	1.074	0.531	70946	
6/21/2016	04:15	6.77	13:50	10.82	8.28	04:30	0.67	13:45	1.35	0.96	04:30	0.323	13:50	1.203	0.617	82417	
6/22/2016	03:20	5.98	07:25	9.21	7.72	02:50	0.52	06:45	1.12	0.90	03:15	0.209	07:25	0.814	0.529	70684	
6/23/2016	02:50	5.93	10:35	13.81	8.01	02:55	0.50	10:30	1.57	0.93	02:50	0.198	10:30	1.912	0.582	77738	
6/24/2016	02:20	6.65	07:50	9.22	8.02	02:20	0.70	06:50	1.15	0.95	02:20	0.324	07:20	0.825	0.583	77904	

Date	Depth (in)					Velocity (ft/s)					Quantity (MGD - Total ft3)						Rain (in)
	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Time	Min	Time	Max	Avg	Total	Total
6/25/2016	03:35	6.08	09:00	9.49	7.77	02:55	0.53	08:45	1.16	0.89	02:55	0.221	09:00	0.867	0.528	70634	
6/26/2016	03:20	5.85	09:10	9.12	7.68	02:35	0.49	10:00	1.12	0.86	03:50	0.200	09:10	0.797	0.506	67646	
6/27/2016	02:30	6.01	07:10	9.08	7.78	02:35	0.49	07:50	1.11	0.85	03:05	0.199	07:50	0.793	0.507	67815	
6/28/2016	02:45	5.99	07:25	9.07	7.67	02:45	0.44	07:00	1.11	0.85	02:45	0.176	07:30	0.781	0.496	66330	
6/29/2016	03:00	5.82	07:45	9.21	7.63	03:00	0.48	07:40	1.10	0.87	03:00	0.186	07:45	0.802	0.504	67403	
6/30/2016	03:40	5.84	13:20	10.29	7.75	03:45	0.48	13:20	1.30	0.87	03:45	0.187	13:20	1.097	0.522	69812	
7/1/2016	03:50	5.83	07:40	9.05	7.61	03:50	0.46	07:35	1.11	0.85	03:50	0.180	07:35	0.784	0.492	65792	
7/2/2016	03:10	5.81	08:30	8.83	7.41	02:50	0.45	09:35	1.10	0.83	02:50	0.173	10:10	0.757	0.465	62215	
7/3/2016	03:10	5.75	09:55	8.73	7.32	04:10	0.46	09:20	1.07	0.81	04:10	0.180	09:55	0.717	0.449	59983	
7/4/2016	03:30	5.79	11:35	8.95	7.46	03:10	0.44	11:40	1.09	0.82	03:10	0.175	11:50	0.759	0.466	62321	
7/5/2016	02:40	5.81	08:25	8.79	7.67	03:35	0.50	08:20	1.08	0.88	03:35	0.193	08:25	0.735	0.514	68733	
7/6/2016	03:50	5.86	08:20	9.60	7.65	03:50	0.48	08:10	1.17	0.87	03:50	0.188	08:20	0.894	0.509	68097	
7/7/2016	04:00	5.32	08:00	8.79	7.34	04:00	0.36	08:00	1.14	0.87	04:00	0.121	08:00	0.776	0.479	64091	
7/8/2016	01:55	5.79	07:50	10.23	7.61	03:10	0.49	07:35	1.28	0.91	03:10	0.195	07:50	1.067	0.527	70495	
7/9/2016	04:10	6.03	08:55	9.17	7.59	04:25	0.53	08:45	1.17	0.90	04:45	0.218	08:55	0.847	0.518	69307	
7/10/2016	02:50	5.81	09:40	8.89	7.54	03:30	0.50	09:10	1.12	0.88	03:30	0.198	09:40	0.770	0.502	67172	
7/11/2016	02:35	5.66	08:05	8.72	7.42	02:35	0.44	08:05	1.10	0.86	02:35	0.163	08:05	0.745	0.484	64652	
7/12/2016	02:55	5.39	08:00	8.97	7.35	04:00	0.39	07:50	1.13	0.86	04:00	0.140	07:50	0.784	0.478	63942	
7/13/2016	02:50	5.42	13:50	10.61	7.59	02:20	0.42	13:50	1.38	0.88	02:20	0.152	13:50	1.218	0.512	68395	
7/14/2016	02:45	5.97	11:00	10.56	7.87	02:15	0.47	10:55	1.38	0.88	02:15	0.194	10:55	1.198	0.538	71956	
7/15/2016	03:15	6.08	09:00	9.54	7.88	03:10	0.44	08:25	1.17	0.86	03:10	0.182	09:00	0.893	0.522	69814	
7/16/2016	03:15	6.21	09:10	9.48	7.88	02:20	0.46	09:10	1.13	0.82	03:00	0.202	09:10	0.853	0.500	66876	
7/17/2016	04:00	6.18	10:10	9.28	7.90	02:10	0.43	09:05	1.10	0.84	02:40	0.185	09:40	0.808	0.512	68503	
7/18/2016	04:15	5.78	08:10	9.28	8.02	03:50	0.42	08:10	1.12	0.86	03:50	0.173	08:10	0.823	0.540	72128	
7/19/2016	04:05	6.11	14:10	9.81	8.02	03:55	0.44	14:10	1.25	0.88	03:55	0.186	14:10	0.989	0.545	72797	
7/20/2016	01:40	6.08	17:40	9.35	7.91	02:40	0.43	17:40	1.14	0.85	02:40	0.179	17:40	0.844	0.522	69745	
7/21/2016	03:15	6.09	08:20	9.30	7.95	03:15	0.43	07:45	1.13	0.85	03:15	0.177	07:45	0.829	0.527	70439	

Report Summary For The Period 1/21/2016 - 7/21/2016

	Depth (in)	Velocity (ft/s)	Quantity (MGD - Total ft3)
Total			14927080
Avg	8.28	0.93	0.610

APPENDIX G – HYDRUALIC MODELING



Legend

- Manhole
- King County Pump Station
- Mercer Island Pump Station

Gravity Main by Diameter

- 10" or Larger
- 8"
- 6" or Smaller
- Pressurized Main

- GIS Pipe Flow Direction

Other System Pipe Ownership

- Shorewood
- Private
- King County
- Lakeline Gravity Main

- Town Center Outline
- Service Area Boundary
- Sewer Basins

Exhibit B
Sanitary Sewer Collection System Overview
General Sewer Plan Update
City of Mercer Island

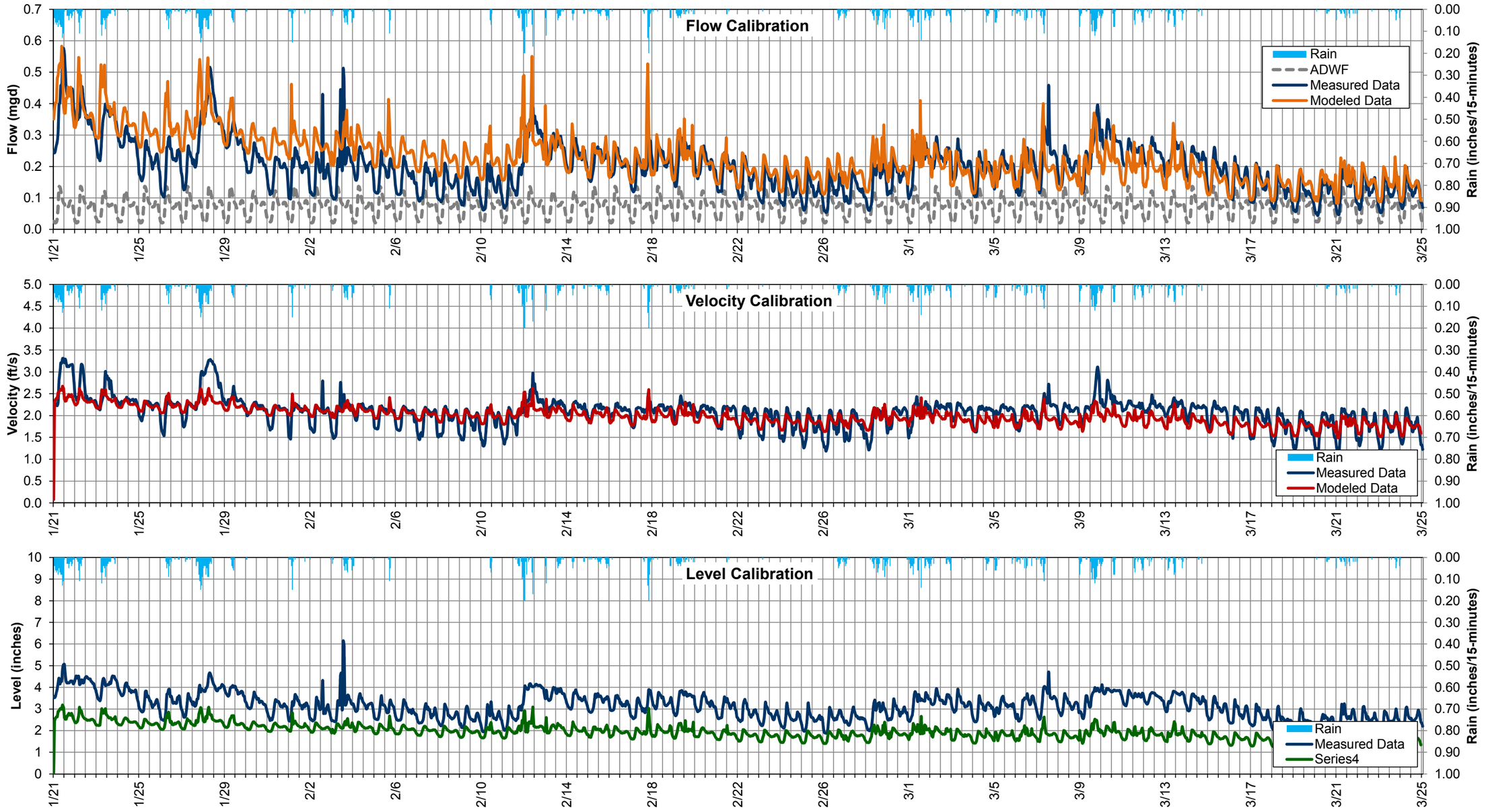
Table 2 WET WEATHER FLOW CALIBRATION
General Sewer Plan
City of Mercer Island

Meter Number	Pipe Diameter (in)	Storm 1 (1/21/2016-2/2/2016)									Storm 2 (2/10/2016-2/24/2016)										Storm 3 (2/27/2016-3/19/2016)								
		Measured Data[1]			Modeled Data[2]			Percent Error[3]			Measured Data[1]				Modeled Data[2]						Measured Data[1]			Modeled Data[2]			Percent Error[3]		
		Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Flow (%)	Peak Flow (%)	Max Level (inch)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Velocity (ft/s)	Avg. Level (in)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Flow (%)	Peak Flow (%)	Max Level (inch)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Level (in)	Avg. Flow (%)	Peak Flow (%)	Max Level (inch)
Site 1	33	0.27	0.58	3.6	0.33	0.58	2.2	23.4%	1.2%	-2.5	0.20	0.39	2.06	3.1	0.22	0.55	2.0	12.2%	42.3%	-2.0	0.19	0.46	3.1	0.19	0.41	1.9	-3.6%	-10.6%	-2.9
Site 2	18	0.91	1.66	9.7	1.02	1.61	1.2	12.4%	-3.0%	-3.3	0.75	1.37	1.05	9.0	0.86	1.61	1.1	13.7%	17.0%	-2.2	0.77	1.39	9.0	0.82	1.37	1.1	6.2%	-1.1%	-2.4
Site 3	12	0.20	0.47	3.6	0.25	0.45	1.7	28.2%	-3.6%	-0.6	0.15	0.31	1.50	3.2	0.16	0.38	1.5	7.9%	21.0%	-0.7	0.16	0.35	3.3	0.15	0.30	1.5	-2.9%	-13.0%	-1.0

Notes:
1. Source: City of Medford 2016 Temporary Flow Monitoring Program, ADS
2. Average flows are calculated from flow monitoring data. Maximum flow values are hourly peaks. Averages were adjusted to account for data not recorded.
3. Percent Difference = (Modeled - Measured)/Measured*100.

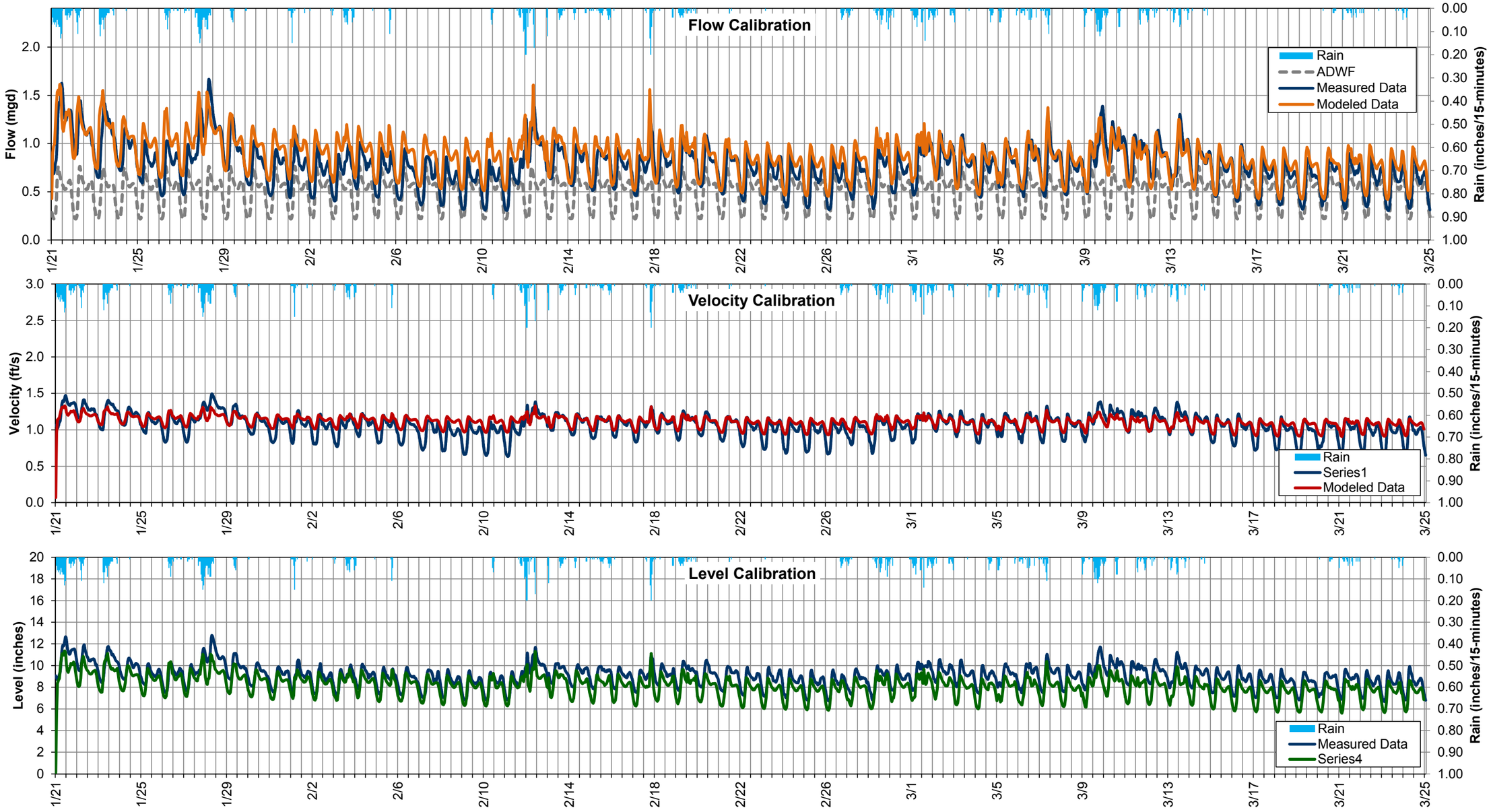
FLOW MONITORING Site 1 WET WEATHER FLOW CALIBRATION
General Sewer Plan
City of Mercer Island

Location:
Pipeline diameter: 33"
City Manhole ID: MI_61-908
Model Mahhole ID: MI_61-909
Silt Level at Site: "



FLOW MONITORING Site 2 WET WEATHER FLOW CALIBRATION
General Sewer Plan
City of Mercer Island

Location:
Pipeline diameter: 18"
City Manhole ID: MI_S11
Model Mahhole ID: MI_S12
Silt Level at Site: "



FLOW MONITORING Site 3 WET WEATHER FLOW CALIBRATION
General Sewer Plan
City of Mercer Island

Location:
Pipeline diameter: 12"
City Manhole ID: MI_61-197
Model Mahhole ID: MI_61-198
Silt Level at Site: "

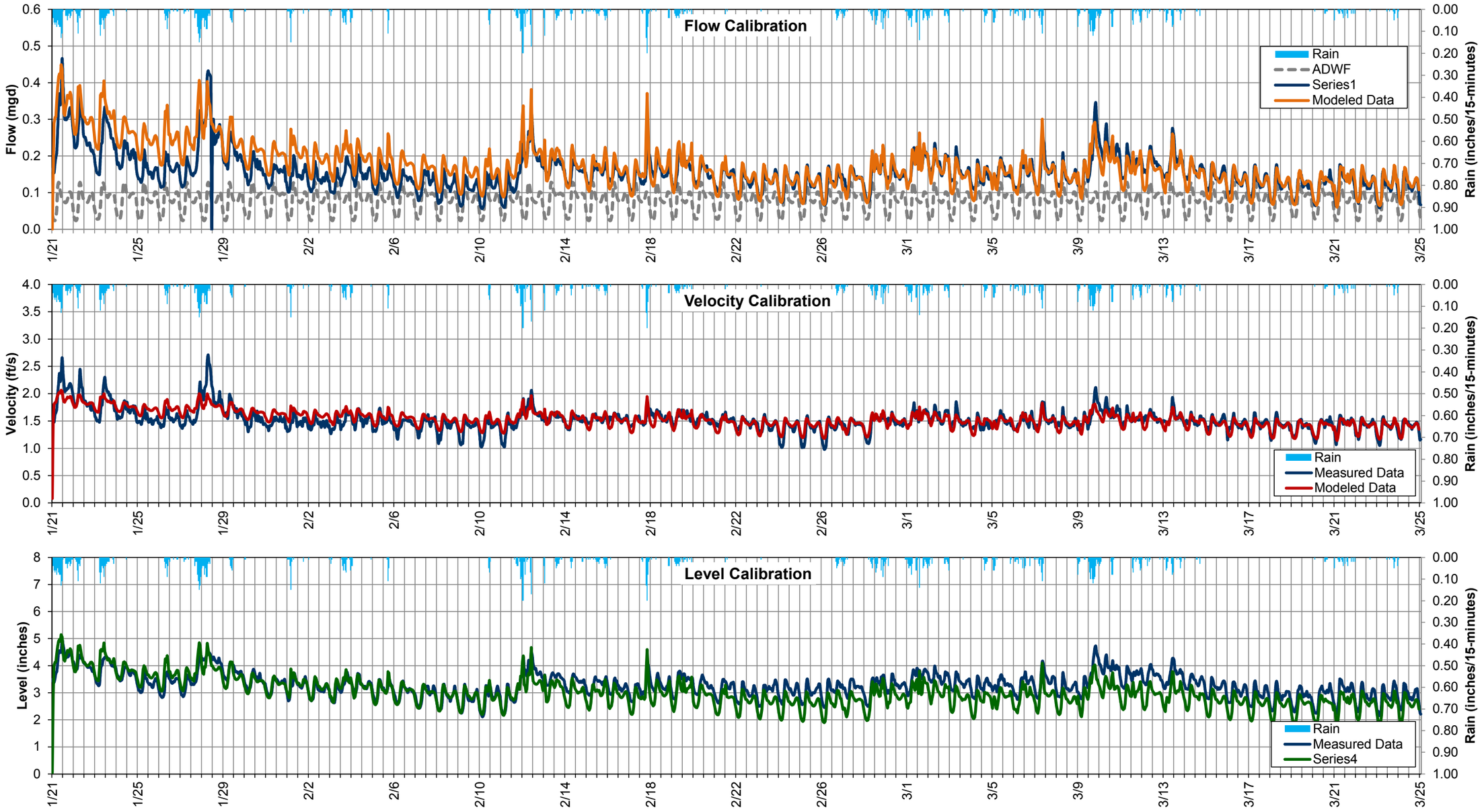


Table 1 Dry Weather Flow Calibration Results
General Sewer Plan
City of Mercer Island

Meter Number	Pipe Diameter (in)	Weekday Dry Weather Flow						Weekend Dry Weather Flow						Average Dry Weather Flow[4]		
		Measured Data[1]		Modeled Data[2]		Percent Error[3]		Measured Data[1]		Modeled Data[2]		Percent Error[3]				
		Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Flow (%)	Peak Flow (%)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Flow (mgd)	Peak Flow (mgd)	Avg. Flow (%)	Peak Flow (%)	Measured ADWF (mgd)	Modeled ADWF (mgd)	Percent Difference (%)
Site 1	9.88	0.074	0.136	0.073	0.134	-1.4%	-1.3%	0.071	0.122	0.073	0.125	3.1%	2.6%	0.073	0.073	-0.2%
Site 2	24.38	0.511	0.762	0.504	0.753	-1.3%	-1.2%	0.499	0.753	0.502	0.759	0.7%	0.8%	0.507	0.503	-0.7%
Site 3	10.13	0.077	0.128	0.080	0.130	4.2%	1.0%	0.082	0.128	0.080	0.124	-1.7%	-2.8%	0.078	0.080	2.5%

Notes:

1. Source: City of Mercer Island Temporary Flow Monitoring Program, ADS
2. Average flow, level, and velocity are calculated from weekday/weekend dry weather flow monitoring data. Maximum flow values are hourly peaks corresponding to either weekend or weekday confitions, as appropriate.
3. Percent Difference = (Modeled - Measured)/Measured*100.
4. Average Dry Weather Flow = (5*Weekday Dry Weather Flow + 2*Weekend Dry Weather Flow)/7

City of Mercer Island

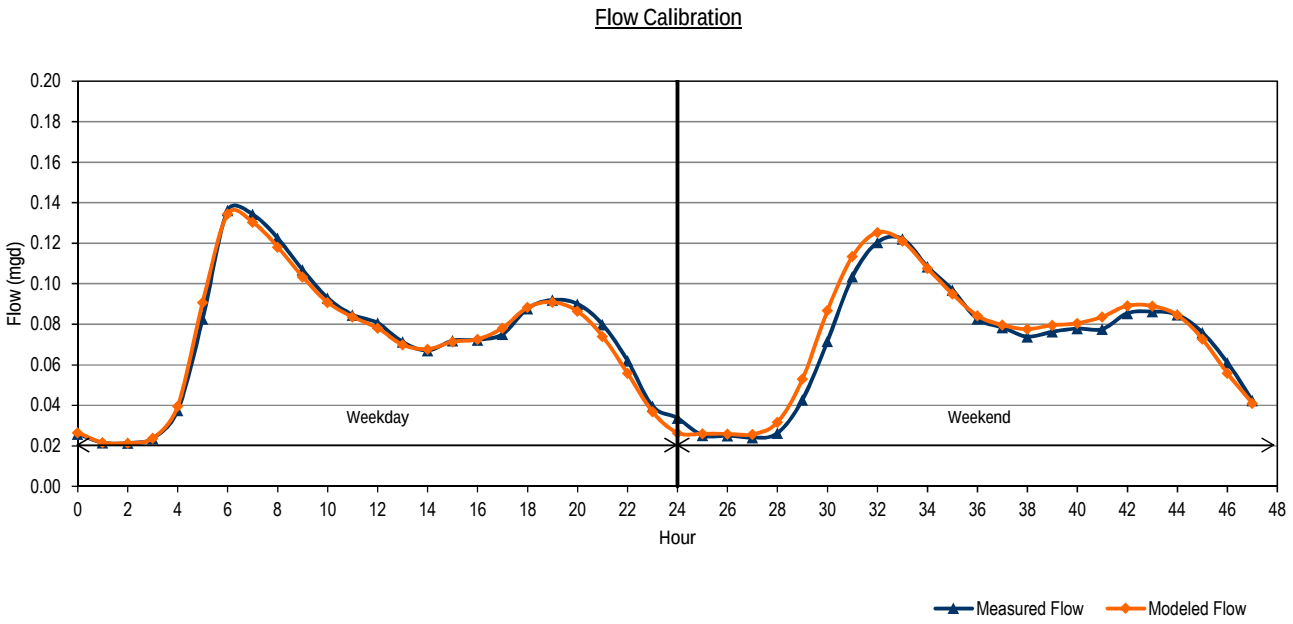
General Sewer Plan

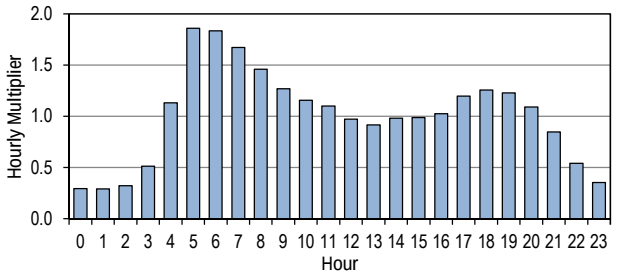
FLOW MONITORING SITE 01 - MI_61-908 DRY WEATHER FLOW CALIBRATION

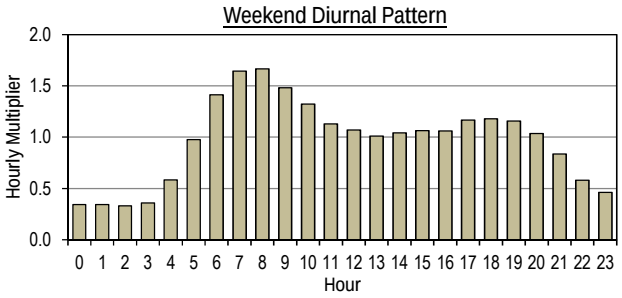
	Hour	Measured Data Flow (mgd)	Modeled Data Flow (mgd)	Diurnal Initial Curve
Weekday	0	0.03	0.03	0.29
	1	0.02	0.02	0.29
	2	0.02	0.02	0.32
	3	0.02	0.02	0.51
	4	0.04	0.04	1.13
	5	0.08	0.09	1.86
	6	0.14	0.13	1.83
	7	0.13	0.13	1.67
	8	0.12	0.12	1.46
	9	0.11	0.10	1.27
	10	0.09	0.09	1.16
	11	0.08	0.08	1.10
	12	0.08	0.08	0.97
	13	0.07	0.07	0.92
	14	0.07	0.07	0.98
	15	0.07	0.07	0.99
	16	0.07	0.07	1.03
	17	0.08	0.08	1.20
	18	0.09	0.09	1.26
	19	0.09	0.09	1.23
	20	0.09	0.09	1.09
	21	0.08	0.07	0.85
	22	0.06	0.06	0.54
	23	0.04	0.04	0.35
Weekend	24	0.03	0.03	0.34
	25	0.03	0.03	0.34
	26	0.03	0.03	0.33
	27	0.02	0.03	0.36
	28	0.03	0.03	0.58
	29	0.04	0.05	0.98
	30	0.07	0.09	1.41
	31	0.10	0.11	1.64
	32	0.12	0.13	1.67
	33	0.12	0.12	1.48
	34	0.11	0.11	1.32
	35	0.10	0.10	1.13
	36	0.08	0.08	1.07
	37	0.08	0.08	1.01
	38	0.07	0.08	1.04
	39	0.08	0.08	1.06
	40	0.08	0.08	1.06
	41	0.08	0.08	1.17
	42	0.09	0.09	1.18
	43	0.09	0.09	1.16
	44	0.08	0.08	1.04
	45	0.08	0.07	0.83
	46	0.06	0.06	0.58
	47	0.04	0.04	0.46
Average				
Weekday		0.074	0.073	1.01
Weekend		0.071	0.073	0.97
ADWF[1]		0.073	0.073	1.00
% Error				
Weekday			-1.4%	
Weekend			3.1%	

Note:

1. ADWF = (5xWeekday Average + 2xWeekend Average)/7







City of Mercer Island

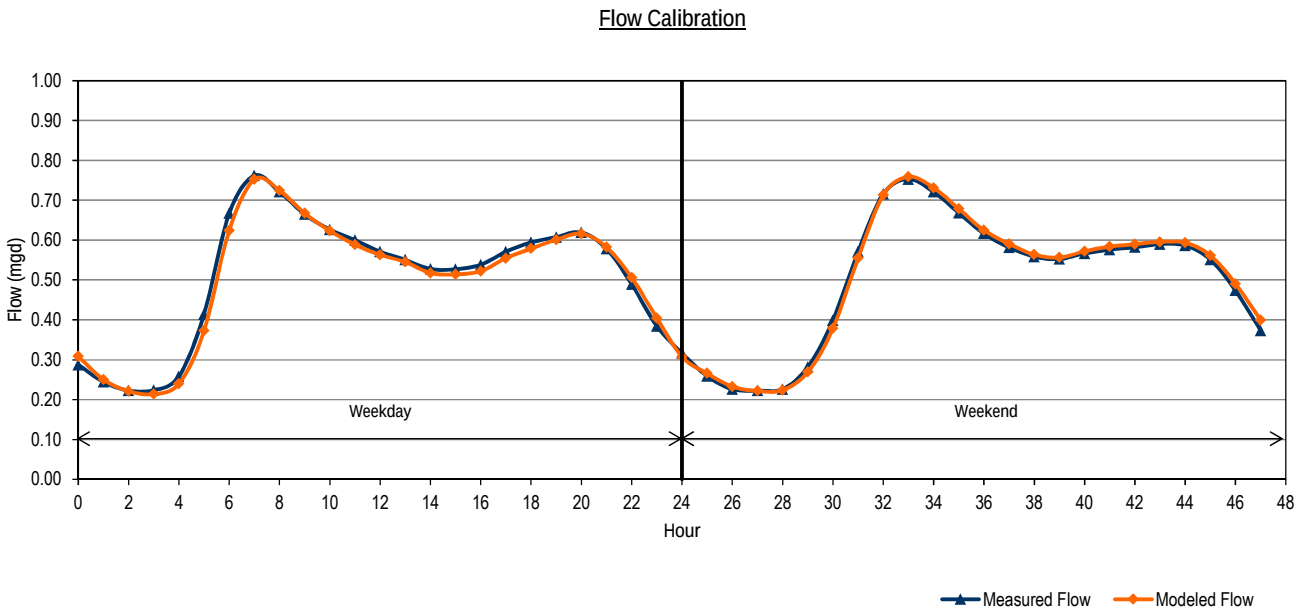
General Sewer Plan

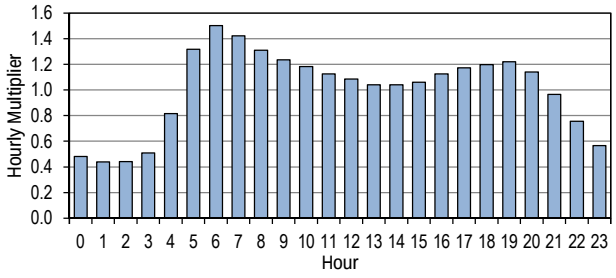
FLOW MONITORING SITE 02 - MI_S11 DRY WEATHER FLOW CALIBRATION

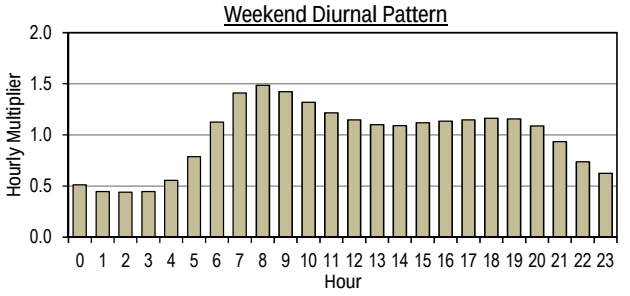
	Hour	Measured Data Flow (mgd)	Modeled Data Flow (mgd)	Diurnal Initial Curve
Weekday	0	0.29	0.31	0.48
	1	0.24	0.25	0.44
	2	0.22	0.22	0.44
	3	0.22	0.21	0.51
	4	0.26	0.24	0.82
	5	0.41	0.37	1.32
	6	0.67	0.62	1.50
	7	0.76	0.75	1.42
	8	0.72	0.72	1.31
	9	0.67	0.67	1.24
	10	0.63	0.62	1.18
	11	0.60	0.59	1.13
	12	0.57	0.56	1.09
	13	0.55	0.55	1.04
	14	0.53	0.52	1.04
	15	0.53	0.51	1.06
	16	0.54	0.52	1.13
	17	0.57	0.55	1.17
	18	0.59	0.58	1.20
	19	0.61	0.60	1.22
	20	0.62	0.62	1.14
	21	0.58	0.58	0.97
	22	0.49	0.51	0.76
	23	0.38	0.40	0.57
Weekend	24	0.32	0.31	0.51
	25	0.26	0.27	0.45
	26	0.23	0.23	0.44
	27	0.22	0.22	0.45
	28	0.23	0.22	0.56
	29	0.28	0.27	0.79
	30	0.40	0.38	1.13
	31	0.57	0.56	1.41
	32	0.72	0.71	1.48
	33	0.75	0.76	1.42
	34	0.72	0.73	1.32
	35	0.67	0.68	1.22
	36	0.62	0.63	1.15
	37	0.58	0.59	1.10
	38	0.56	0.56	1.09
	39	0.55	0.56	1.12
	40	0.57	0.57	1.14
	41	0.58	0.58	1.15
	42	0.58	0.59	1.16
	43	0.59	0.60	1.16
	44	0.59	0.59	1.09
	45	0.55	0.56	0.93
	46	0.47	0.49	0.74
	47	0.37	0.40	0.62
Average				
Weekday		0.511	0.504	1.01
Weekend		0.499	0.502	0.98
ADWF[1]		0.507	0.503	1.00
% Error				
Weekday			-1.3%	
Weekend			0.7%	

Note:

1. ADWF = (5xWeekday Average + 2xWeekend Average)/7



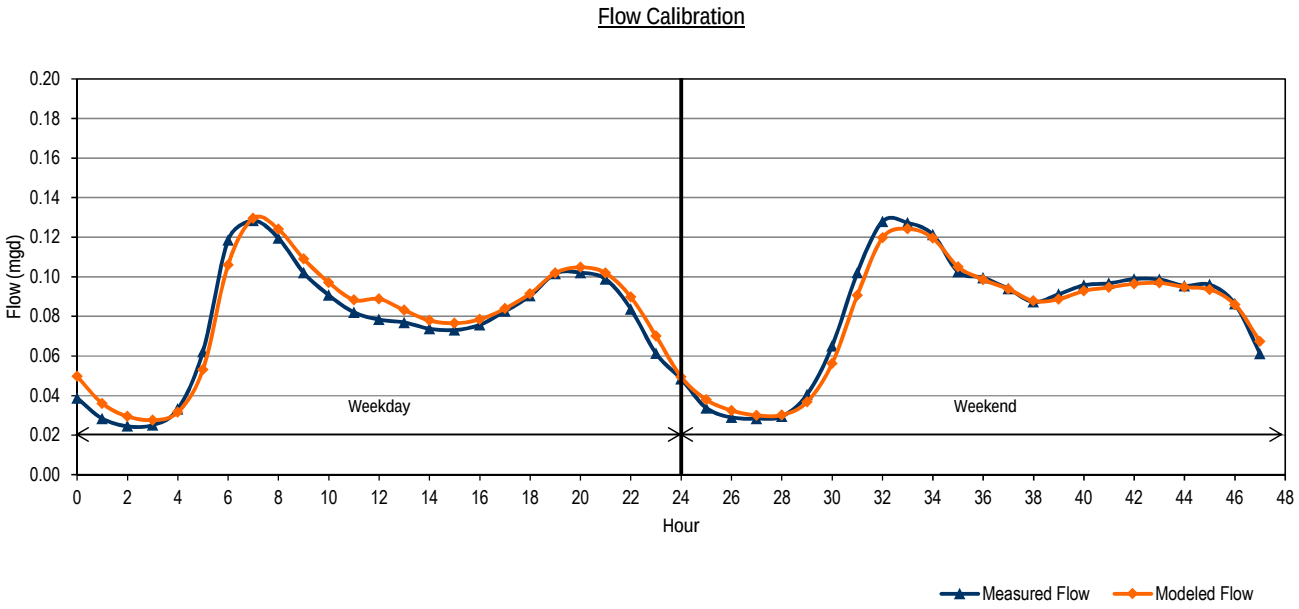


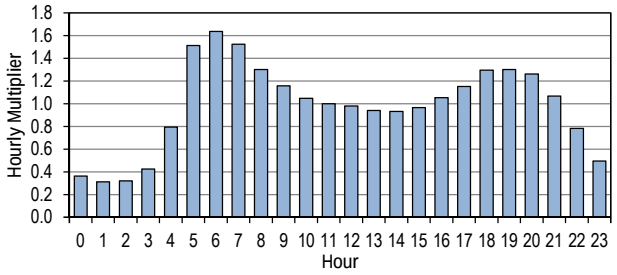


City of Mercer Island
General Sewer Plan
FLOW MONITORING SITE 03 - MI_61-197 DRY WEATHER FLOW CALIBRATION

	Hour	Measured Data Flow (mgd)	Modeled Data Flow (mgd)	Diurnal Initial Curve
Weekday	0	0.04	0.05	0.36
	1	0.03	0.04	0.31
	2	0.02	0.03	0.32
	3	0.03	0.03	0.42
	4	0.03	0.03	0.79
	5	0.06	0.05	1.51
	6	0.12	0.11	1.64
	7	0.13	0.13	1.52
	8	0.12	0.12	1.30
	9	0.10	0.11	1.16
	10	0.09	0.10	1.05
	11	0.08	0.09	1.00
	12	0.08	0.09	0.98
	13	0.08	0.08	0.94
	14	0.07	0.08	0.93
	15	0.07	0.08	0.97
	16	0.08	0.08	1.05
	17	0.08	0.08	1.15
	18	0.09	0.09	1.30
	19	0.10	0.10	1.30
	20	0.10	0.10	1.26
	21	0.10	0.10	1.07
	22	0.08	0.09	0.78
	23	0.06	0.07	0.49
Weekend	24	0.05	0.05	0.43
	25	0.03	0.04	0.37
	26	0.03	0.03	0.36
	27	0.03	0.03	0.38
	28	0.03	0.03	0.52
	29	0.04	0.04	0.83
	30	0.07	0.06	1.30
	31	0.10	0.09	1.63
	32	0.13	0.12	1.62
	33	0.13	0.12	1.55
	34	0.12	0.12	1.31
	35	0.10	0.11	1.27
	36	0.10	0.10	1.20
	37	0.09	0.09	1.11
	38	0.09	0.09	1.16
	39	0.09	0.09	1.22
	40	0.10	0.09	1.23
	41	0.10	0.09	1.26
	42	0.10	0.10	1.26
	43	0.10	0.10	1.22
	44	0.10	0.09	1.22
	45	0.10	0.09	1.10
	46	0.09	0.09	0.78
	47	0.06	0.07	0.62
Average				
Weekday		0.077	0.080	0.98
Weekend		0.082	0.080	1.04
ADWF[1]		0.078	0.080	1.00
% Error				
Weekday			4.2%	
Weekend			-1.7%	

Note:
1. ADWF = (5xWeekday Average + 2xWeekend Average)/7





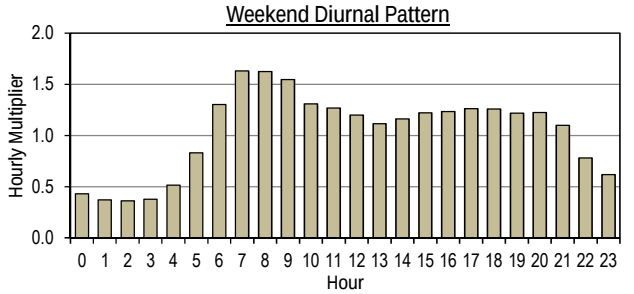


Table 1 Flow Monitoring Tributary Areas by Land Use
General Sewer Plan
City of Mercer Island

Land Use Classification	Stories	Total (acres)	Basin 1	Basin 2	Basin 3
Multi-family Residential	5	1.4	0.0	1.4	0.0
Multi-family Residential	4	14.4	0.0	14.4	0.0
Multi-family Residential	3	19.0	1.9	17.2	0.0
Multi-family Residential	2	0.4	0.0	0.4	0.0
Commercial	5	2.3	1.4	0.9	0.0
Commercial	4	0.2	0.0	0.2	0.0
Commercial	3	1.4	0.0	1.4	0.0
Commercial	2	8.0	0.0	8.0	0.0
Commercial	1	26.3	1.7	24.7	0.0
Mixed-Use	5	9.4	2.9	6.5	0.0
Mixed-Use	4	0.5	0.0	0.5	0.0
Single Family Residential	N/A	369.1	52.7	181.0	135.3
Public/Quasi-Public	N/A	21.4	0.0	12.7	8.7
Park/Open Space	N/A	40.2	0.0	27.7	12.4
Parking/Vacant	N/A	7.7	0.6	7.1	0.0
		521.7	**61.2**	**304.1**	**156.4**

Notes:

Table 2 Wastewater Flow factors by Basin
General Sewer Plan
City of Mercer Island

Land Use Classification	Stories	Total (gpad)	Basin 1	Basin 2	Basin 3
Multi-family Residential	5	7,500		7,500	
Multi-family Residential	4	6,000		6,000	
Multi-family Residential	3	4,500	4,500	4,500	
Multi-family Residential	2	3,000	3,000	3,000	
Multi-family Residential	1		1,500	1,500	
Commercial	5	4,690	4,500	5,000	
Commercial	4	4,000	3,600	4,000	
Commercial	3	3,000	2,700	3,000	
Commercial	2	2,290	1,800	2,300	
Commercial	1	990	900	1,000	
Mixed-Use	5	12,070	10,000	13,000	
Mixed-Use	4	10,400	8,000	10,400	
Mixed-Use	1		2,000	2,600	
Single Family Residential	N/A	530	530	540	520
Public/Quasi-Public	N/A	1,000	1,000	1,000	1,000
Park/Open Space	N/A	0	0	0	0
Parking/Vacant	N/A	0	0	0	0

Table 3 Existing ADWF by Flow Monitoring Basin Tributaries and Land Use
General Sewer Plan
City of Mercer Island

Land Use Classification	Stories	Total (mgd)	Basin 1	Basin 2	Basin 3
Multi-family Residential	5	0.010	0.000	0.010	0.000
Multi-family Residential	4	0.086	0.000	0.086	0.000
Multi-family Residential	3	0.086	0.008	0.077	0.000
Multi-family Residential	2	0.001	0.000	0.001	0.000
Commercial	6	0.000	0.000	0.000	0.000
Commercial	5	0.011	0.007	0.004	0.000
Commercial	4	0.001	0.000	0.001	0.000
Commercial	3	0.004	0.000	0.004	0.000
Commercial	2	0.018	0.000	0.018	0.000
Commercial	1	0.026	0.001	0.025	0.000
Mixed-Use	6	0.000	0.000	0.000	0.000
Mixed-Use	5	0.113	0.029	0.085	0.000
Mixed-Use	4	0.005	0.000	0.005	0.000
Single Family Residential	N/A	0.196	0.028	0.098	0.070
Public/Quasi-Public	N/A	0.021	0.000	0.013	0.009
Park/Open Space	N/A	0.000	0.000	0.000	0.000
Parking/Vacant	N/A	0.000	0.000	0.000	0.000
Total (mgd)		**0.580**	**0.073**	**0.427**	**0.079**
Measured ADWF (mgd)		**0.580**	**0.073**	**0.429**	**0.078**
% Difference		**-0.1%**	**0.1%**	**-0.4%**	**0.8%**
Flow Isolation			**=Basin 1'**	**=Basin 2 - Basin 3'**	**=Basin 3'**

Table 4 Wastewater Flow Balance Summary
General Sewer Plan
City of Mercer Island

Land Use	Stories	Developed Area (acres)	Wastewater Flow Factor (gpad)	Existing ADWF (mgd)
Multi-family Residential	5	1.4	7,500	0.010
Multi-family Residential	4	14.4	6,000	0.086
Multi-family Residential	3	19.0	4,500	0.086
Multi-family Residential	2	0.4	3,000	0.001
Commercial	5	2.3	4,690	0.011
Commercial	4	0.2	4,000	0.001
Commercial	3	1.4	3,000	0.004
Commercial	2	8.0	2,290	0.018
Commercial	1	26.3	990	0.026
Mixed-Use	5	9.4	12,070	0.113
Mixed-Use	4	0.5	10,400	0.005
Single Family Residential	N/A	369.1	530	0.196
Public/Quasi-Public	N/A	21.4	1,000	0.021
Park/Open Space	N/A	40.2	0	0.000
Parking/Vacant	N/A	7.7	0	0.000
			Total Estimated ADWF =	**0.58**
			Measured ADWF[(2)] =	**0.58**
			% Difference[(3)] =	**-0.3%**

APPENDIX H – PUMP STATION CONDITION AND ACCESSIBILITY ASSESSMENT

City of Mercer Island

Pump Station Condition Assessment

Pump Station #1

Pump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	Dennis Baker	11/3/2015	Vaughn	7.5	-	6 to 10 years	4	
		Components		**Rating**	**Observations**		**Yes No N/A**	
		Corrosion		3	Running at Inspection		yes	
		Packing Gland/Seal		3	Oil OK at Inspection		yes	
		Bearing		3	All Safety Guards Present		yes	
		Oil Seal		3	Unusual Smell or Heat		no	
		Pump Shaft		3	Pump Cavitation		no	
		Couplings		3	Excessive Noise		no	
		Structural Integrity		3	Excessive Vibration		no	
		Pipe Alignment		3	Missing Components		no	
		Isolation Valves		4	Leaks		no	
		Belt/Chain						

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	Dennis Baker	11/3/2015	Knife			2 to 5 years	4	Knife valve needs to be exercised every three months.
		Components		**Rating**	**Observations**		**Yes No N/A**	
		Corrosion		4	Operating at Inspection		yes	
		Packing Gland		4	Lubrication Oil OK at Inspect.			
		Support		3	All Safe Guards Present		yes	
		Functional		4	Unusual Smell of Heat		no	
		Manual Operator		4	Valve Isolates (Holds)		yes	
		Actuator			Excessive Noise		no	
		Structural Integrity		3	Excessive Vibration		no	
		Pipe Alignment		3	Missing Components		no	
					Cavitation		no	

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	Dennis Baker	11/3/2015	Plug	4		2 to 5 years	4	Plug valve needs to be exercised every three months.
		Components		**Rating**	**Observations**		**Yes No N/A**	
		Corrosion		4	Operating at Inspection		yes	
		Packing Gland		4	Lubrication Oil OK at Inspect.			
		Support		3	All Safe Guards Present		yes	
		Functional		4	Unusual Smell of Heat		no	
		Manual Operator		4	Valve Isolates (Holds)		yes	
		Actuator			Excessive Noise		no	
		Structural Integrity		3	Excessive Vibration		no	
		Pipe Alignment		3	Missing Components		no	
					Cavitation		no	

City of Mercer Island
Pump Station Condition Assessment

Pump Station #1

Pump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	Dennis Baker	11/3/2015	Cornell	2		2 to 5 years	4	

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal		Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	no
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	Dennis Baker	11/3/2015	Knife			2 to 5 years	4	Knife valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	Dennis Baker	11/3/2015	Plug			2 to 5 years	4	Plug valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes
Actuator		Excessive Noise	yes
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Pump Station #1

Pump 3	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
							0	N/A

Components	Rating	Observations	Yes No N/A
Corrosion		Running at Inspection	
Packing Gland/Seal		Oil OK at Inspection	
Bearing		All Safety Guards Present	
Oil Seal		Unusual Smell or Heat	
Pump Shaft		Pump Cavitation	
Couplings		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
Isolation Valves		Leaks	
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake							0	

Components	Rating	Observations	Yes No N/A
Corrosion		Operating at Inspection	
Packing Gland		Lubrication Oil OK at Inspect.	
Support		All Safe Guards Present	
Functional		Unusual Smell of Heat	
Manual Operator		Valve Isolates (Holds)	
Actuator		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
		Cavitation	

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet							0	

Components	Rating	Observations	Yes No N/A
Corrosion		Operating at Inspection	
Packing Gland		Lubrication Oil OK at Inspect.	
Support		All Safe Guards Present	
Functional		Unusual Smell of Heat	
Manual Operator		Valve Isolates (Holds)	
Actuator		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
		Cavitation	

City of Mercer Island
Pump Station Condition Assessment

Pump Station #1

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/3/2015			6 to 25 years	5	
	Components		Rating	Components		Rating	Comments
	Fire Protection		3	Water Supply		5	This pump station has no running water
	Security		3	Electricity		3	
	Lighting		3	Gas			
	Internal Paint		3	Sanitary Plumbing			
	External Paint		4	I & C Control			
	Floor Finish		4				
	Wall Finish		4				

Wetwell Condition	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/3/2015			11 to 20 years	5	
	Components		Rating	Components		Rating	Comments
	External Condition		4	Lid		5	The vent system needs to be updated. The wet well lid needs to be repaired. The light in wet well needs to be removed.
	Floats		4	Isolation Valve			
	Internal Condition		4	Safety		4	
	Structural Integrity		3	Security		4	
	Overflow Basket/Weir Box		4				
	Internal Ladder		4				
	Vent		5				

Hyd. Grad. M/H Cond.	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
						0	
	Components		Rating	Comments			
	Lid			N/A Does not exist.			
	Ladder						
	Weir						
	Soil Vent Trench						
	Internal Condition						

City of Mercer Island
Pump Station Condition Assessment

Pump Station #1

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/3/2015			6 to 25 years	5	

Components	Rating	Components	Yes No N/A	Comments
Foundation	3	Entry Alarm Operational	yes	Ventilation fails due to no fresh air inlet
Columns		Telemetry Monitoring Active	yes	
Floor Finish	4	Fire Pro. System Active	no	
Ladder	3	Fire Ext. Present/Cert. Current	yes	
Roof	4			
External Wall	4			
Internal Wall	3			
External Door/Hatch	4			
Grating	4			
Internal Partition	4			
Ceiling	4			
Ventilation	5			
Heating				
Cooling				
Communication	3			

Sump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/3/2015				0 to 1 year	4	Sump Pump system is 1.5 plumbing & needs replaced. Electrical outlets need to be raised & separated.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	yes
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

City of Mercer Island

Pump Station Condition Assessment

Pump Station #1

Sump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/3/2015				0 to 1 year	4	Sump Pump system is 1.5 plumbing & needs replaced. Electrical outlets need to be raised & separated.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	yes
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

City of Mercer Island
Pump Station Condition Assessment

Pump Station #4

Pump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	10/21/2015	WEMCO	60		5 to 10 years	2	WEMCO-HIDROSTAL Screw Centrifugal pump is the whole discription of this submersible sewage pump.
		Components		**Rating**	**Observations**		**Yes No N/A**	
		Corrosion		2	Running at Inspection		yes	
		Packing Gland/Seal		2	Oil OK at Inspection			
		Bearing		2	All Safety Guards Present		yes	
		Oil Seal		2	Unusual Smell or Heat		no	
		Pump Shaft		2	Pump Cavitation		no	
		Couplings		2	Excessive Noise		no	
		Structural Integrity		2	Excessive Vibration		no	
		Pipe Alignment		2	Missing Components		no	
		Isolation Valves		2	Leaks		no	
		Belt/Chain						

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	10/21/2015					0	No inlet valves are in place with this submersible pump system.
		Components		**Rating**	**Observations**		**Yes No N/A**	
		Corrosion			Operating at Inspection			
		Packing Gland			Lubrication Oil OK at Inspect.			
		Support			All Safe Guards Present			
		Functional			Unusual Smell of Heat			
		Manual Operator			Valve Isolates (Holds)			
		Actuator			Excessive Noise			
		Structural Integrity			Excessive Vibration			
		Pipe Alignment			Missing Components			
					Cavitation			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	10/21/2015		2	2009-2010	5 to 25 years	2	
		Components		**Rating**	**Observations**		**Yes No N/A**	
		Corrosion		2	Operating at Inspection		yes	
		Packing Gland		2	Lubrication Oil OK at Inspect.		yes	
		Support		2	All Safe Guards Present		yes	
		Functional		2	Unusual Smell of Heat		no	
		Manual Operator		2	Valve Isolates (Holds)		yes	
		Actuator		2	Excessive Noise		no	
		Structural Integrity		2	Excessive Vibration		no	
		Pipe Alignment		2	Missing Components		no	
					Cavitation		no	

City of Mercer Island
Pump Station Condition Assessment

Pump Station #4

Pump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	10/21/2015	WEMCO			5 to 25 years	2	WEMCO-HIDROSTAL Screw Centrifugal pump is the whole discription of this submersible sewage pump.
		Components		**Rating**	**Observations**		**Yes No N/A**	
		Corrosion		2	Running at Inspection		yes	
		Packing Gland/Seal		2	Oil OK at Inspection		yes	
		Bearing		2	All Safety Guards Present		yes	
		Oil Seal		2	Unusual Smell or Heat		no	
		Pump Shaft		2	Pump Cavitation		no	
		Couplings		2	Excessive Noise		no	
		Structural Integrity		2	Excessive Vibration		no	
		Pipe Alignment		2	Missing Components		no	
		Isolation Valves		2	Leaks		no	
		Belt/Chain						

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	10/21/2015					0	No inlet valves are in place with this submersible pump system.
		Components		**Rating**	**Observations**		**Yes No N/A**	
		Corrosion			Operating at Inspection			
		Packing Gland			Lubrication Oil OK at Inspect.			
		Support			All Safe Guards Present			
		Functional			Unusual Smell of Heat			
		Manual Operator			Valve Isolates (Holds)			
		Actuator			Excessive Noise			
		Structural Integrity			Excessive Vibration			
		Pipe Alignment			Missing Components			
					Cavitation			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	10/21/2015			2009-2010	5 to 25 years	2	
		Components		**Rating**	**Observations**		**Yes No N/A**	
		Corrosion		2	Operating at Inspection		yes	
		Packing Gland		2	Lubrication Oil OK at Inspect.		yes	
		Support		2	All Safe Guards Present		yes	
		Functional		2	Unusual Smell of Heat		no	
		Manual Operator		2	Valve Isolates (Holds)		yes	
		Actuator		2	Excessive Noise		no	
		Structural Integrity		2	Excessive Vibration		no	
		Pipe Alignment		2	Missing Components		no	
					Cavitation		no	

City of Mercer Island
Pump Station Condition Assessment

Pump Station #4

Pump 3	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	10/21/2015	WEMCO			5 to 25 years	2	WEMCO-HIDROSTAL Screw Centrifugal pump is the whole discription of this submersible sewage pump.
		Components		**Rating**	**Observations**		**Yes No N/A**	
		Corrosion		2	Running at Inspection		yes	
		Packing Gland/Seal		2	Oil OK at Inspection		yes	
		Bearing		2	All Safety Guards Present		yes	
		Oil Seal		2	Unusual Smell or Heat		no	
		Pump Shaft		2	Pump Cavitation		no	
		Couplings		2	Excessive Noise		no	
		Structural Integrity		2	Excessive Vibration		no	
		Pipe Alignment		2	Missing Components		no	
		Isolation Valves		2	Leaks		no	
		Belt/Chain						

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	10/21/2015					0	No inlet valves are in place with this submersible pump system.
		Components		**Rating**	**Observations**		**Yes No N/A**	
		Corrosion			Operating at Inspection			
		Packing Gland			Lubrication Oil OK at Inspect.			
		Support			All Safe Guards Present			
		Functional			Unusual Smell of Heat			
		Manual Operator			Valve Isolates (Holds)			
		Actuator			Excessive Noise			
		Structural Integrity			Excessive Vibration			
		Pipe Alignment			Missing Components			
					Cavitation			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	10/21/2015			2009-2010	5 to 25 years	2	
		Components		**Rating**	**Observations**		**Yes No N/A**	
		Corrosion		2	Operating at Inspection		yes	
		Packing Gland		2	Lubrication Oil OK at Inspect.		yes	
		Support		2	All Safe Guards Present		yes	
		Functional		2	Unusual Smell of Heat		no	
		Manual Operator		2	Valve Isolates (Holds)		yes	
		Actuator		2	Excessive Noise			
		Structural Integrity		2	Excessive Vibration			
		Pipe Alignment		2	Missing Components			
					Cavitation			

City of Mercer Island
Pump Station Condition Assessment

Pump Station #4

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	10/21/2015		2009-2010	5 to 25 years	3	
	Components		**Rating**	**Components**		**Rating**	**Comments**
	Fire Protection		2	Water Supply		2	
	Security		2	Electricity		3	
	Lighting		2	Gas			
	Internal Paint		2	Sanitary Plumbing			
	External Paint		2	I & C Control			
	Floor Finish		2				
	Wall Finish		2				

Wetwell Condition	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	10/21/2015		2009-2010	5 to 25 years	2	
	Components		**Rating**	**Components**		**Rating**	**Comments**
	External Condition		2	Lid		2	This wetwell is deep & must be entered once a year minum for cleaning & pulling the pumps. A large crane is used to pull pumps due to size & weight. The WEMCO tech is on site for inspection of these pumps. The tech meggars the pumps & checks oil.
	Floats		2	Isolation Valve		2	
	Internal Condition		2	Safety		2	
	Structural Integrity		2	Security		2	
	Overflow Basket/Weir Box						
	Internal Ladder		2				
	Vent		2				

Hyd. Grad. M/H Cond.	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	10/21/2015				0	
	Components		**Rating**	**Comments**			
	Lid			This pump Station does not have a Hydraulic Gradient Manhole (HGMH)			
	Ladder						
	Weir						
	Soil Vent Trench						
	Internal Condition						

City of Mercer Island
Pump Station Condition Assessment

Pump Station #4

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	10/21/2015		2009-2010	5 to 25 years	3	

Components	Rating	Components	Yes No N/A	Comments
Foundation	2	Entry Alarm Operational	yes	A carbon filter system is part of the wetwell ventilation & odor control. The carbon is replaced once a year. The blower unit was designed for two belts but the way it was installed one belt is all that fits the fan assembly. It is a must that a machinist review the blower & rebuild for a two belt system. The blower motor is 5 hp. The blower is run by a VFD unit.
Columns	2	Telemetry Monitoring Active	yes	
Floor Finish	2	Fire Pro. System Active		
Ladder	2	Fire Ext. Present/Cert. Current	yes	
Roof	2			
External Wall	2			
Internal Wall	2			
External Door/Hatch	2			
Grating	2			
Internal Partition	2			
Ceiling	2			
Ventilation	3			
Heating	2			
Cooling	2			
Communication	2			

Sump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	10/21/2015					0	No sump pumps are used at this pump station. All drains go to the wetwell.

Components	Rating	Observations	Yes No N/A
Corrosion		Running at Inspection	
Packing Gland/Seal		Oil OK at Inspection	
Bearing		All Safety Guards Present	
Oil Seal		Unusual Smell or Heat	
Pump Shaft		Pump Cavitation	
Couplings		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
Isolation Valves		Leaks	
Sump Pit			
Electrical Outlets			
Check Valves			

City of Mercer Island
Pump Station Condition Assessment

Pump Station #4

Sump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	10/21/2015					0	No sump pumps are used at this pump station. All drains go to the wetwell.

Components	Rating	Observations	Yes No N/A
Corrosion		Running at Inspection	
Packing Gland/Seal		Oil OK at Inspection	
Bearing		All Safety Guards Present	
Oil Seal		Unusual Smell or Heat	
Pump Shaft		Pump Cavitation	
Couplings		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
Isolation Valves		Leaks	
Sump Pit			
Electrical Outlets			
Check Valves			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #10

Pump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/10/2015	Vaughn	7.5		6 to 10 years.	4	

Components	Rating	Observations	Yes No N/A
Corrosion	3	Running at Inspection	yes
Packing Gland/Seal	3	Oil OK at Inspection	yes
Bearing	3	All Safety Guards Present	yes
Oil Seal	3	Unusual Smell or Heat	no
Pump Shaft	3	Pump Cavitation	no
Couplings	3	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	no
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/10/2015	Knife			2 to 5 years	4	Knife valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/10/2015	Plug	4		2 to 5 years	4	Plug valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island
Pump Station Condition Assessment

Pump Station #10

Pump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/10/2015	Vaughn	7.5		6 to 10 years.	4	This pump has a oil leak on the ajustment plate from lower seal.

Components	Rating	Observations	Yes No N/A
Corrosion	3	Running at Inspection	yes
Packing Gland/Seal	3	Oil OK at Inspection	yes
Bearing	3	All Safety Guards Present	yes
Oil Seal	3	Unusual Smell or Heat	no
Pump Shaft	3	Pump Cavitation	no
Couplings	3	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/10/2015	Knife			2 to 5 years.	4	Knife valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/10/2015	Plug			2 to 5 years	4	

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island
Pump Station Condition Assessment

Pump Station #10

Pump 3	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
							0	N/A

Components	Rating	Observations	Yes No N/A
Corrosion		Running at Inspection	
Packing Gland/Seal		Oil OK at Inspection	
Bearing		All Safety Guards Present	
Oil Seal		Unusual Smell or Heat	
Pump Shaft		Pump Cavitation	
Couplings		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
Isolation Valves		Leaks	
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake							0	

Components	Rating	Observations	Yes No N/A
Corrosion		Operating at Inspection	
Packing Gland		Lubrication Oil OK at Inspect.	
Support		All Safe Guards Present	
Functional		Unusual Smell of Heat	
Manual Operator		Valve Isolates (Holds)	
Actuator		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
		Cavitation	

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet							0	

Components	Rating	Observations	Yes No N/A
Corrosion		Operating at Inspection	
Packing Gland		Lubrication Oil OK at Inspect.	
Support		All Safe Guards Present	
Functional		Unusual Smell of Heat	
Manual Operator		Valve Isolates (Holds)	
Actuator		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
		Cavitation	

City of Mercer Island
Pump Station Condition Assessment

Pump Station #10

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/10/2015			6 to 25 years.	5	
	Components		Rating	Components		Rating	Comments
	Fire Protection		3	Water Supply		5	Water supply is limited to an unknow source.
	Security		3	Electricity		3	Wash down pump is a gould GT-07.
	Lighting		4	Gas			
	Internal Paint		4	Sanitary Plumbing			
	External Paint		4	I & C Control			
	Floor Finish		4				
	Wall Finish		4				

Wetwell Condition	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/10/2015			11 to 20 years.	4	
	Components		Rating	Components		Rating	Comments
	External Condition		4	Lid		4	Remove root mass from wetwell wall & repair. Replace float system & relocate transducer. Repair wet well lid & install new seal.
	Floats		4	Isolation Valve			
	Internal Condition		4	Safety		4	
	Structural Integrity		4	Security		4	
	Overflow Basket/Weir Box		4				
	Internal Ladder						
	Vent		4				

Hyd. Grad. M/H Cond.	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/10/2015			2 to 5 years.	4	
	Components		Rating	Comments			
	Lid		4	This pump station does not have an (HGMH). A overflow manhole is used to recycle waste water back to wet well			
	Ladder						
	Weir						
	Soil Vent Trench						
	Internal Condition		4				

City of Mercer Island
Pump Station Condition Assessment

Pump Station #10

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/10/2015			6 to 25 years.	4	

Components	Rating	Components	Yes No N/A	Comments
Foundation	4	Entry Alarm Operational	yes	Rebuild fan system. Install new fresh air inlet & mushroom. The fan system is 6 inch pipe.
Columns		Telemetry Monitoring Active	yes	
Floor Finish	4	Fire Pro. System Active	no	
Ladder	3	Fire Ext. Present/Cert. Current	yes	
Roof	4			
External Wall	4			
Internal Wall	4			
External Door/Hatch	4			
Grating	4			
Internal Partition	4			
Ceiling	4			
Ventilation	4			
Heating				
Cooling				
Communication	3			

Sump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/10/2015				2 to 5 years.	4	Sump pit has a leak due to poor cement work. Leak is coming from lake. The sump system is 1.25 plumbing. This system needs rebuilt & brass check valves put in place.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	yes
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

City of Mercer Island
Pump Station Condition Assessment

Pump Station #10

Sump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/10/2015				2 to 5years.	4	The second sump pump is not located in sump pit. In past it has been recommended that both sump pumps be placed in sump pit.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	no
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

City of Mercer Island

Pump Station Condition Assessment

Pump Station #11

Pump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	10/28/2015	Vaughn	10		2 to 5 years.	4	This Vaughn chopper pump was installed in 2009. This pump is the primary pump in a two pump station.

Components	Rating	Observations	Yes No N/A
Corrosion	3	Running at Inspection	yes
Packing Gland/Seal	3	Oil OK at Inspection	yes
Bearing	3	All Safety Guards Present	yes
Oil Seal	3	Unusual Smell or Heat	no
Pump Shaft	3	Pump Cavitation	no
Couplings	3	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	no
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	10/28/2015	Knife			2 to 5 years.	4	Knife valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	no
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #11

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	10/28/2015	Plug	4		2 to 5 years.	4	Plug valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	no
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Pump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	10/28/2015	Cornell	10		2 to 5 years.	4	Pump#2 is used as a standby pump only. On inspection day this pump had lost prime & had cavitation issues. The check valve had rocks & debri in the valve body. This pump needs to be put back in rotation. This is the only true lift station on mercer island.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	no
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	yes
Couplings	4	Excessive Noise	yes
Structural Integrity	3	Excessive Vibration	yes
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #11

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	10/28/2015	Knife			2 to 5 years.	4	Knife valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	10/28/2015	Plug			2 to 5 years.	4	Plug valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Pump Station #11

Pump 3	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
							0	

Components	Rating	Observations	Yes No N/A
Corrosion		Running at Inspection	
Packing Gland/Seal		Oil OK at Inspection	
Bearing		All Safety Guards Present	
Oil Seal		Unusual Smell or Heat	
Pump Shaft		Pump Cavitation	
Couplings		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
Isolation Valves		Leaks	
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake							0	

Components	Rating	Observations	Yes No N/A
Corrosion		Operating at Inspection	
Packing Gland		Lubrication Oil OK at Inspect.	
Support		All Safe Guards Present	
Functional		Unusual Smell of Heat	
Manual Operator		Valve Isolates (Holds)	
Actuator		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
		Cavitation	

City of Mercer Island

Pump Station Condition Assessment

Pump Station #11

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet							0	

Components	Rating	Observations	Yes No N/A
Corrosion		Operating at Inspection	
Packing Gland		Lubrication Oil OK at Inspect.	
Support		All Safe Guards Present	
Functional		Unusual Smell of Heat	
Manual Operator		Valve Isolates (Holds)	
Actuator		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
		Cavitation	

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
						5	

Components	Rating	Components	Rating	Comments
Fire Protection	3	Water Supply	5	Pump station has no water supply for washdown. A 100 gal tank with air gap could be installed to supply water for cleaning.
Security	3	Electricity	3	
Lighting	4	Gas		
Internal Paint	4	Sanitary Plumbing		
External Paint	4	I & C Control		
Floor Finish	4			
Wall Finish	4			

Wetwell Condition	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	10/28/2015			2 to 5 years.	4	

Components	Rating	Components	Rating	Comments
External Condition	4	Lid	4	Float system needs to be replaced. Attach transducer longer lags. Wet well has severe concrete fail. East side of wet well is weeping lake water & gravel from the cement walls is falling in to inlet channels. This gravel is going into both pumps.
Floats	4	Isolation Valve		
Internal Condition	4	Safety	4	
Structural Integrity	4	Security	4	
Overflow Basket/Weir Box	4			
Internal Ladder	0			
Vent	0			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #11

Hyd. Grad. M/H Cond.	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	10/28/2015				0	

Components	Rating	Comments
Lid		This pump station does not have an HGMH.
Ladder		
Weir		
Soil Vent Trench		
Internal Condition		

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	10/28/2015			6 to 25 years.	4	

Components	Rating	Components	Yes No N/A	Comments
Foundation	4	Entry Alarm Operational	yes	This pump station has channels in the floor which need to be filled in & coated. The eletrical conduit has rusted out coming in to the dry well. This issue needs to be resolved. A new 6 inch fresh air inlet needs to be installed in dry well structure. Both mushrooms need to be raised 3 feet.
Columns		Telemetry Monitoring Active	yes	
Floor Finish	4	Fire Pro. System Active	no	
Ladder	4	Fire Ext. Present/Cert. Current	yes	
Roof	4			
External Wall	4			
Internal Wall	4			
External Door/Hatch	4			
Grating	4			
Internal Partition	4			
Ceiling	4			
Ventilation	4			
Heating				
Cooling				
Communication	3			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #11

Sump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	10/28/2015				2 to 5 years.	4	This sump pump system has 1 pump in sump pit. It has been recommended that both sump pumps be in sump pit.

Components	Rating	Observations	Yes No N/A
Corrosion	3	Running at Inspection	yes
Packing Gland/Seal	3	Oil OK at Inspection	
Bearing	3	All Safety Guards Present	yes
Oil Seal	3	Unusual Smell or Heat	no
Pump Shaft	3	Pump Cavitation	no
Couplings	3	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	3	Leaks	yes
Sump Pit	3		
Electrical Outlets	4		
Check Valves	4		

Sump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	1028/2015				2 to 5 years.	4	This sump pump system has 1 pump in sump pit. It has been recommended that both sump pumps be in sump pit. Both check valves need to be replaced with brass checks.

Components	Rating	Observations	Yes No N/A
Corrosion	3	Running at Inspection	yes
Packing Gland/Seal	3	Oil OK at Inspection	
Bearing	3	All Safety Guards Present	yes
Oil Seal	3	Unusual Smell or Heat	no
Pump Shaft	3	Pump Cavitation	no
Couplings	3	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	3	Leaks	yes
Sump Pit	3		
Electrical Outlets	4		
Check Valves	4		

City of Mercer Island

Pump Station Condition Assessment

Flush Station #12

Pump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	12/7/2015	Marathon	3		2 to 5 years	3	The flush pump at pump station #12 is only run on Tuesday. This pump pushes lake water towards pump station #11. This section of lakeline has sags which hold grease & debri. In the past the flush pump was run everyday of the week to help with odor & move the sewage thru the lakeline. The flushpump should be returned to a everyday cycle.

Components	Rating	Observations	Yes No N/A
Corrosion	3	Running at Inspection	yes
Packing Gland/Seal	3	Oil OK at Inspection	
Bearing	3	All Safety Guards Present	yes
Oil Seal	3	Unusual Smell or Heat	no
Pump Shaft	3	Pump Cavitation	no
Couplings	3	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	3	Leaks	yes
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	12/7/2015	Knife			2 to 5 years.	4	The valve treads on the inlet Knife valve have been duct taped. At a later visit the tape will be removed & valve exercised. The Knife valve appears to be in good shape.

Components	Rating	Observations	Yes No N/A
Corrosion	3	Operating at Inspection	Open
Packing Gland	3	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	Open
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Flush Station #12

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	12/7/2015	Knife	4		2 to 5 years	4	The knife valve on the outlet valve moves but needs to be exercised every three months. Both knife valves are hard to exercise due to grate placement. A long valve key will help with this issue.

Components	Rating	Observations	Yes No N/A
Corrosion	3	Operating at Inspection	yes
Packing Gland	3	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	3	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Pump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
							0	

Components	Rating	Observations	Yes No N/A
Corrosion		Running at Inspection	
Packing Gland/Seal		Oil OK at Inspection	
Bearing		All Safety Guards Present	
Oil Seal		Unusual Smell or Heat	
Pump Shaft		Pump Cavitation	
Couplings		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
Isolation Valves		Leaks	
Belt/Chain			

City of Mercer Island

Pump Station Condition Assessment

Flush Station #12

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake							0	

Components	Rating	Observations	Yes No N/A
Corrosion		Operating at Inspection	
Packing Gland		Lubrication Oil OK at Inspect.	
Support		All Safe Guards Present	
Functional		Unusual Smell of Heat	
Manual Operator		Valve Isolates (Holds)	
Actuator		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
		Cavitation	

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet							0	

Components	Rating	Observations	Yes No N/A
Corrosion		Operating at Inspection	
Packing Gland		Lubrication Oil OK at Inspect.	
Support		All Safe Guards Present	
Functional		Unusual Smell of Heat	
Manual Operator		Valve Isolates (Holds)	
Actuator		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
		Cavitation	

City of Mercer Island

Pump Station Condition Assessment

Flush Station #12

Pump 3	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
							0	

Components	Rating	Observations	Yes No N/A
Corrosion		Running at Inspection	
Packing Gland/Seal		Oil OK at Inspection	
Bearing		All Safety Guards Present	
Oil Seal		Unusual Smell or Heat	
Pump Shaft		Pump Cavitation	
Couplings		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
Isolation Valves		Leaks	
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake							0	

Components	Rating	Observations	Yes No N/A
Corrosion		Operating at Inspection	
Packing Gland		Lubrication Oil OK at Inspect.	
Support		All Safe Guards Present	
Functional		Unusual Smell of Heat	
Manual Operator		Valve Isolates (Holds)	
Actuator		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
		Cavitation	

City of Mercer Island

Pump Station Condition Assessment

Flush Station #12

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet							0	

Components	Rating	Observations	Yes No N/A
Corrosion		Operating at Inspection	
Packing Gland		Lubrication Oil OK at Inspect.	
Support		All Safe Guards Present	
Functional		Unusual Smell of Heat	
Manual Operator		Valve Isolates (Holds)	
Actuator		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
		Cavitation	

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	12/7/2015			5 to 25 years	5	

Components	Rating	Components	Rating	Comments
Fire Protection	3	Water Supply		The lighting in this station has failed. This flush station does not need a washdown pump. No sewage passes thru the pump.
Security	3	Electricity	3	
Lighting	5	Gas		
Internal Paint	3	Sanitary Plumbing		
External Paint	3	I & C Control		
Floor Finish	3			
Wall Finish	3			

Wetwell Condition	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	12/7/2015				0	

Components	Rating	Components	Rating	Comments
External Condition		Lid		This flush station has no wetwell.
Floats		Isolation Valve		
Internal Condition		Safety		
Structural Integrity		Security		
Overflow Basket/Weir Box				
Internal Ladder				
Vent				

City of Mercer Island

Pump Station Condition Assessment

Flush Station #12

Hyd. Grad. M/H Cond.	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	12/7/2015				0	

Components	Rating	Comments
Lid		This flush station has no Hydraulic Gradient Manhole (HGMH).
Ladder		
Weir		
Soil Vent Trench		
Internal Condition		

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	12/7/2015			5 to 25 years	3	

Components	Rating	Components	Yes No N/A	Comments
Foundation	3	Entry Alarm Operational	no	Flush station#12 is in good shape & with slight improvements it will be good to go. This station is the only active pump station which is not on the modern telemetry system.
Columns		Telemetry Monitoring Active	no	
Floor Finish	3	Fire Pro. System Active	no	
Ladder	3	Fire Ext. Present/Cert. Current	yes	
Roof	3			
External Wall	3			
Internal Wall	3			
External Door/Hatch	3			
Grating	3			
Internal Partition	3			
Ceiling	3			
Ventilation	3			
Heating				
Cooling				
Communication	3			

City of Mercer Island

Pump Station Condition Assessment

Flush Station #12

Sump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	12/7/2015				2 to 5 years	3	The flush station has only one sump pump. In the future one more sump pump should be added as a a backup.

Components	Rating	Observations	Yes No N/A
Corrosion	3	Running at Inspection	yes
Packing Gland/Seal	3	Oil OK at Inspection	
Bearing	3	All Safety Guards Present	yes
Oil Seal	3	Unusual Smell or Heat	no
Pump Shaft	3	Pump Cavitation	no
Couplings	3	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	3	Leaks	no
Sump Pit	3		
Electrical Outlets	3		
Check Valves	3		

Sump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
							0	

Components	Rating	Observations	Yes No N/A
Corrosion		Running at Inspection	
Packing Gland/Seal		Oil OK at Inspection	
Bearing		All Safety Guards Present	
Oil Seal		Unusual Smell or Heat	
Pump Shaft		Pump Cavitation	
Couplings		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
Isolation Valves		Leaks	
Sump Pit			
Electrical Outlets			
Check Valves			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #13

Pump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	10/27/2015	Cornell	5		2 to 5 years	4	

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/27/2015	Knife			2 to 5 years	4	Knife valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes
Actuator		Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
		Cavitation	no

Pump Station #13

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	10/27/2015	Gate	4		2 to 5 years	4	Gate valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes
Actuator		Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
		Cavitation	no

Pump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	10/27/2015	Cornell	5		2 to 5 years	4	

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #13

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	10/27/2015	Knife			2 to 5 years	4	Knife valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	yes
Manual Operator	4	Valve Isolates (Holds)	yes
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	10/27/2015	Gate			2 to 5 years	4	Gate valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #13

Pump 3	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	10/27/2015	Flush Pump			2 to 5 years	4	The flush pump in this station is valved in a way that it can send water to wet well or straight into lake line. The flush pump has a problem with high amps & the impellar seems to need to be pulled & repaired. The lake water source may be a problem if the inlet is restricted.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain	4		

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	10/27/2015	Gate			2 to 5 years	4	Gate valve needs to be exercised every three months. This gate valve is chain driven & is hard to operate.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Pump Station #13

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	10/27/2015	Gate			2 to 5 years	4	Gate valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	yes
		Cavitation	no

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating
	D Baker	10/27/2015			6 to 25 years	5

Components	Rating	Components	Rating	Comments
Fire Protection	3	Water Supply	5	Wash down pump needs to be installed (Gould GT-07).
Security	3	Electricity	4	
Lighting	3	Gas		
Internal Paint	4	Sanitary Plumbing		
External Paint	4	I & C Control		
Floor Finish	4			
Wall Finish	5			

Wetwell Condition	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating
	D Baker	10/27/2015			6 to 25 years	4

Components	Rating	Components	Rating	Comments
External Condition	4	Lid	4	The grate & landing in wet well needs to be removed. Float system needs to be replaced & transducer moved. Wet well lid needs to be cleaned & exercised.
Floats	4	Isolation Valve		
Internal Condition	4	Safety	4	
Structural Integrity	4	Security	4	
Overflow Basket/Weir Box	4			
Internal Ladder	4			
Vent				

City of Mercer Island

Pump Station Condition Assessment

Pump Station #13

Hyd. Grad. M/H Cond.	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	10/27/2015				0	

Components	Rating	Comments
Lid		Hydraulic Graient Manhole (HGMH) does not exsit at this station.
Ladder		
Weir		
Soil Vent Trench		
Internal Condition		

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	10/27/2015			6 to 25 years	5	

Components	Rating	Components	Yes No N/A	Comments
Foundation	4	Entry Alarm Operational	yes	
Columns		Telemetry Monitoring Active	yes	
Floor Finish	5	Fire Pro. System Active	no	
Ladder	4	Fire Ext. Present/Cert. Current	yes	
Roof	4			
External Wall	4			
Internal Wall	4			
External Door/Hatch	4			
Grating	4			
Internal Partition	4			
Ceiling	4			
Ventilation	4			
Heating				
Cooling				
Communication	3			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #13

Sump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	10/27/2015				0 to 1 year	4	Sump pump system needs to be rebuilt & replumbed with brass check valves (1.25) Sump pit has to be cleaned & sealed when floor trenches are concreted.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	yes
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

Sump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	10/27/2015				0	4	Sump pump Has failed & will be replaced.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	no
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	no
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

City of Mercer Island

Pump Station Condition Assessment

Pump Station #14

Pump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	10/27/2015	FLYGT/NP3085	3		5 to 10 years	2	The FLYGT submersible pump is put on a yearly P.M. to be pulled & inspected.

Components	Rating	Observations	Yes No N/A
Corrosion	2	Running at Inspection	Yes No N/A
Packing Gland/Seal	2	Oil OK at Inspection	
Bearing	2	All Safety Guards Present	yes
Oil Seal	2	Unusual Smell or Heat	no
Pump Shaft	2	Pump Cavitation	no
Couplings	2	Excessive Noise	no
Structural Integrity	2	Excessive Vibration	no
Pipe Alignment	2	Missing Components	no
Isolation Valves	2	Leaks	no
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	10/27/2015					0	There is no inlet valve for this submersible pump.

Components	Rating	Observations	Yes No N/A
Corrosion		Operating at Inspection	
Packing Gland		Lubrication Oil OK at Inspect.	
Support		All Safe Guards Present	
Functional		Unusual Smell of Heat	
Manual Operator		Valve Isolates (Holds)	
Actuator		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
		Cavitation	

City of Mercer Island

Pump Station Condition Assessment

Pump Station #14

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	10/27/2015	Plug	2		5 to 25 years	2	The plug valve is located in same vault as the Apco swing check valve with air cushion cylinder. The plug valve must be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	2	Operating at Inspection	yes
Packing Gland	2	Lubrication Oil OK at Inspect.	
Support	2	All Safe Guards Present	yes
Functional	2	Unusual Smell of Heat	no
Manual Operator	2	Valve Isolates (Holds)	yes
Actuator		Excessive Noise	no
Structural Integrity	2	Excessive Vibration	no
Pipe Alignment	2	Missing Components	no
		Cavitation	no

Pump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	10/27/2015	FLYGT/NP3085			5 to 10 years	2	The FLYGT submersible pump is put on a yearly P.M. to be pulled & inspected. Submersible pump #2 has a flush valve which cycles for about 1 minute before pump starts pumping down. This valve uses the fluids in wetwell to stir wetwell & breakup grease.

Components	Rating	Observations	Yes No N/A
Corrosion	2	Running at Inspection	yes
Packing Gland/Seal	2	Oil OK at Inspection	
Bearing	2	All Safety Guards Present	yes
Oil Seal	2	Unusual Smell or Heat	no
Pump Shaft	2	Pump Cavitation	no
Couplings	2	Excessive Noise	no
Structural Integrity	2	Excessive Vibration	no
Pipe Alignment	2	Missing Components	no
Isolation Valves	2	Leaks	no
Belt/Chain			

Pump Station #14

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	10/27/2015					0	There is no inlet valve for this submersible pump.

Components	Rating	Observations	Yes No N/A
Corrosion		Operating at Inspection	
Packing Gland		Lubrication Oil OK at Inspect.	
Support		All Safe Guards Present	
Functional		Unusual Smell of Heat	
Manual Operator		Valve Isolates (Holds)	
Actuator		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
		Cavitation	

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	10/27/2015	Plug			5 to 25 years	0	The plug valve is located in same vault as the Apco swing check valve with air cushion cylinder. The plug valve must be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion		Operating at Inspection	
Packing Gland		Lubrication Oil OK at Inspect.	
Support		All Safe Guards Present	
Functional		Unusual Smell of Heat	
Manual Operator		Valve Isolates (Holds)	
Actuator		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
		Cavitation	

City of Mercer Island

Pump Station Condition Assessment

Pump Station #14

Pump 3	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
							0	

Components	Rating	Observations	Yes No N/A
Corrosion		Running at Inspection	
Packing Gland/Seal		Oil OK at Inspection	
Bearing		All Safety Guards Present	
Oil Seal		Unusual Smell or Heat	
Pump Shaft		Pump Cavitation	
Couplings		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
Isolation Valves		Leaks	
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake							0	

Components	Rating	Observations	Yes No N/A
Corrosion		Operating at Inspection	
Packing Gland		Lubrication Oil OK at Inspect.	
Support		All Safe Guards Present	
Functional		Unusual Smell of Heat	
Manual Operator		Valve Isolates (Holds)	
Actuator		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
		Cavitation	

City of Mercer Island

Pump Station Condition Assessment

Pump Station #14

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet							0	

Components	Rating	Observations	Yes No N/A
Corrosion		Operating at Inspection	
Packing Gland		Lubrication Oil OK at Inspect.	
Support		All Safe Guards Present	
Functional		Unusual Smell of Heat	
Manual Operator		Valve Isolates (Holds)	
Actuator		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
		Cavitation	

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	10/27/2015			5 to 25 years	3	

Components	Rating	Components	Rating	Comments
Fire Protection	2	Water Supply	3	This pump station does not have a dry pit. All controls are in a cabinet on surface above & north of wetwell. The water for cleaning of wetwell & struture is from sewer crew jet truck. The valve pits are self draining into wetwell tru a rubber check valve (duck bill).
Security	2	Electricity	2	
Lighting	2	Gas		
Internal Paint		Sanitary Plumbing		
External Paint		I & C Control		
Floor Finish				
Wall Finish				

Wetwell Condition	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	10/27/2015			5 to 25 years	2	

Components	Rating	Components	Rating	Comments
External Condition	2	Lid	2	This pump station has no overflow system. The wetwell has a platform mid way down the wetwell wall. The platform is used for cleaning the wetwell & pulling & installing the FLYGT pumps. The fluid levels are read by a SIEMENS hydroranger 200 system.
Floats	2	Isolation Valve		
Internal Condition	2	Safety	2	
Structural Integrity	2	Security	2	
Overflow Basket/Weir Box				
Internal Ladder	2			
Vent	2			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #14

Hyd. Grad. M/H Cond.	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	10/27/2015			5 to 25 years	4	

Components	Rating	Comments
Lid	3	Hydraulic Gradient Manhole (HGMH) Is used as a overflow system. When lakeline will not handle pump flows fluids are returned to south side of wetwell.
Ladder	4	
Weir	4	
Soil Vent Trench	4	
Internal Condition	4	

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker`	10/27/2015			5 to 25 years	2	

Components	Rating	Components	Yes No N/A	Comments
Foundation	2	Entry Alarm Operational	yes	This pump station was finished in 2015. Pump Station #14 is located in a street end park.
Columns		Telemetry Monitoring Active	yes	
Floor Finish	2	Fire Pro. System Active	no	
Ladder	2	Fire Ext. Present/Cert. Current	yes	
Roof	2			
External Wall	2			
Internal Wall	2			
External Door/Hatch	2			
Grating	2			
Internal Partition	2			
Ceiling	2			
Ventilation	2			
Heating				
Cooling				
Communication	2			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #14

Sump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	10/27/2015	Tsurumi			1 to 5years	2	The only sump pump system at this pump station is located in generator vault in roadway. Generator was updated at same time as Pump station #14. This sump pump system should have a second pump installed in the future.

Components	Rating	Observations	Yes No N/A
Corrosion	2	Running at Inspection	yes
Packing Gland/Seal	2	Oil OK at Inspection	
Bearing	2	All Safety Guards Present	yes
Oil Seal	2	Unusual Smell or Heat	no
Pump Shaft	2	Pump Cavitation	no
Couplings	2	Excessive Noise	no
Structural Integrity	2	Excessive Vibration	no
Pipe Alignment	2	Missing Components	no
Isolation Valves	2	Leaks	no
Sump Pit	2		
Electrical Outlets	2		
Check Valves	2		

Sump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
							0	

Components	Rating	Observations	Yes No N/A
Corrosion		Running at Inspection	
Packing Gland/Seal		Oil OK at Inspection	
Bearing		All Safety Guards Present	
Oil Seal		Unusual Smell or Heat	
Pump Shaft		Pump Cavitation	
Couplings		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
Isolation Valves		Leaks	
Sump Pit			
Electrical Outlets			
Check Valves			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #15

Pump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/10/2015	Cornell	5	3081	2 to 5 years	4	

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	no
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/10/2015	Gate			2 to 5 years.	4	The check valve on pump #1 has a proximity switch. Gate valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	4	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #15

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/10/2015	Gate	4		2 to 5 years.	4	Gate valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	4	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Pump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/10/2015	Cornell	5	2520	2 to 5 years.	4	This pump has slight bearing noise & has a vibration issue.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	yes
Structural Integrity	3	Excessive Vibration	yes
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	no
Belt/Chain			

Pump Station #15

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/10/2015	Gate			2 to 5 years.	4	The check valve on pump #1 has a proximity switch. Gate valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/10/2015	Gate			2 to 5 years.	4	Gate valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #15

Pump 3	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/10/2015	AUWA			2 to 5 years.	0	This is a flush station. An actuator & butterfly valve have replaced the old compressor & valve unit. The clock needs replaced to unable flush valve to function.

Components	Rating	Observations	Yes No N/A
Corrosion		Running at Inspection	
Packing Gland/Seal		Oil OK at Inspection	
Bearing		All Safety Guards Present	
Oil Seal		Unusual Smell or Heat	
Pump Shaft		Pump Cavitation	
Couplings		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
Isolation Valves		Leaks	
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/10/2015	Gate			2 to 5 years	4	Inlet valve leaks even when closed.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	4	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator	3	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Pump Station #15

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/10/2015	Gate			2 to 5 years	4	

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	4	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating
	D Baker	11/10/2015			6 to 25 years.	4

Components	Rating	Components	Rating	Comments
Fire Protection	3	Water Supply	3	Wash down pump is a Gould GT-07.
Security	3	Electricity	3	
Lighting	3	Gas		
Internal Paint	4	Sanitary Plumbing		
External Paint	4	I & C Control		
Floor Finish	4			
Wall Finish	4			

Wetwell Condition	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating
	D Baker	11/10/2015			11 to 20 years.	5

Components	Rating	Components	Rating	Comments
External Condition	4	Lid	4	The float system for this pump station needs replaced. Transducer needs relocated. Ladder & all unused pipes need to be removed. The overflow basket needs to be replaced.
Floats	4	Isolation Valve		
Internal Condition	4	Safety	3	
Structural Integrity	4	Security	3	
Overflow Basket/Weir Box	4			
Internal Ladder	5			
Vent	4			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #15

Hyd. Grad. M/H Cond.	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/10/2015			11 to 20 years.	0	

Components	Rating	Comments
Lid		The hydraulic gradient manhole (HGMH) at this pump station is buried & needs to be raised.
Ladder		
Weir		
Soil Vent Trench		
Internal Condition		

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/10/2015			6 to 25 years.	4	

Components	Rating	Components	Yes No N/A	Comments
Foundation	4	Entry Alarm Operational	yes	
Columns		Telemetry Monitoring Active	yes	
Floor Finish	4	Fire Pro. System Active	no	
Ladder	4	Fire Ext. Present/Cert. Current	yes	
Roof	4			
External Wall	4			
Internal Wall	4			
External Door/Hatch	4			
Grating	4			
Internal Partition	4			
Ceiling	4			
Ventilation	4			
Heating				
Cooling				
Communication	3			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #15

Sump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/10/2015				0 to 1 year.	4	Sump pump system is 1.5 size plumbing. Pump system should be rebuilt with new plumbing and brass check valves. Sump pit needs to be cleaned & sealed.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	no
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

Sump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/10/2015				0 to 1 year.	4	

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	no
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

City of Mercer Island

Pump Station Condition Assessment

Pump Station #16

Pump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	10/28/2015	Cornell	7.5		1 to 5 years	4	The corrosion on the bottom of frame & top of volute has heavily rusted metal & needs sandblasted & repaired. Frame, seal & rubber coupling need rebuilt to restore pump to normal operation.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	10/28/2015	Gate			1 to 2 years	4	The inlet valve needs to be replaced. Check valve on this pump has a proximity switch.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	4	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #16

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	10/28/2015	Gate	4		1 to 2 years	4	The outlet valve needs to be replaced.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	4	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
		Cavitation	no

Pump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	10/28/2015	Cornell	7.5		1 to 5 years	4	The corrosion on the bottom of frame & top of volute has heavily rusted metal & needs sandblasted & repaired. Frame, seal & rubber coupling need rebuilt to restore pump to normal operation. This pump does not have a gasket & the frame has rusted to the volute.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #16

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	10/28/2015	Gate			1 to 2 years	4	The inlet valve needs to be replaced. Check valve on this pump has a proximity switch.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	4	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	no
Actuator		Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
		Cavitation	no

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	10/28/2015	Gate			1 to 2 years	4	The outlet valve needs to be replaced.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	4	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	no
Actuator		Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #16

Pump 3	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	10/28/2015	Cornell			1 to 5 years	4	The corrosion on the bottom of frame & top of volute has heavily rusted metal & needs sandblasted & repaired. Frame, seal & rubber coupling need rebuilt to return pump to normal operation.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	10/28/2015	Gate			1 to 2 years	4	The inlet valve needs to be replaced. Check valve on this pump has a proximity switch.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	4	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	no
Actuator	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
		Cavitation	no

Pump Station #16

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	10/28/2015	Gate			1 to 2 years	4	The outlet valve needs to be replaced.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	4	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	no
Actuator	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
		Cavitation	no

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	10/28/2015			6 to 25 years	4	

Components	Rating	Components	Rating	Comments
Fire Protection	3	Water Supply	4	This pump station has a Gould GT-07 washdown pump. Water for washdown & flushing system come from lake.
Security	3	Electricity	3	
Lighting	3	Gas		
Internal Paint	4	Sanitary Plumbing		
External Paint	4	I & C Control		
Floor Finish	4			
Wall Finish	4			

Wetwell Condition	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	10/28/2015			6 to 25 years	5	

Components	Rating	Components	Rating	Comments
External Condition	4	Lid	4	Wet well needs ladder removed & all unused plumbing. Place transducer in better location. Overflow basket has to be replaced to work properly.
Floats	4	Isolation Valve	4	
Internal Condition	4	Safety	3	
Structural Integrity	4	Security	3	
Overflow Basket/Weir Box	4			
Internal Ladder	5			
Vent	4			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #16

Hyd. Grad. M/H Cond.	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	10/28/2015			6 to 25 years	4	

Components	Rating	Comments
Lid	4	The outside of the hydraulic gradent manhole should be concreted to improve structure.
Ladder	4	
Weir	4	
Soil Vent Trench		
Internal Condition	4	

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	10/28/2015			6 to 25 years	4	

Components	Rating	Components	Yes No N/A	Comments
Foundation	4	Entry Alarm Operational	yes	This pump station is used to house a bioxide system. This system must by improved or moved out of this pump station. The bioxide is spilling on the pumps & causing corrosion.
Columns		Telemetry Monitoring Active	yes	
Floor Finish	4	Fire Pro. System Active	no	
Ladder	4	Fire Ext. Present/Cert. Current	yes	
Roof	4			
External Wall	4			
Internal Wall	4			
External Door/Hatch	4			
Grating	4			
Internal Partition	4			
Ceiling	4			
Ventilation	4			
Heating				
Cooling				
Communication	3			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #16

Sump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	10/28/2015				0 to 1 year	4	The electrical outlets need to be raised to insure safe operation of sump pumps. The sump pump system should be replumbed & brass check valves installed. Sump pit needs cleaned & sealed.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	no
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

Sump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	10/28/2015				0 to 1year	4	Sump #2 had failed on day of inspection. Replumb sump pipe 1.5

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	no
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	no
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

City of Mercer Island

Pump Station Condition Assessment

Pump Station #17

Pump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/4/2015	Cornell	7.5	11738	2 to 5 years	4	

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/4/2015	Gate			2 to 5 years	4	Main discharge valve for header system is stuck open. The inlet & check valve leak. Check valve has a proximity switch. Gate valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

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Pump Station Condition Assessment

Pump Station #17

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/4/2015	Gate	4		2 to 5 years	4	Outlet gate valve needs to be exercised every three months. This valve leaks.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Pump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/4/2015	Cornell	7.5	12404	2 to 5 years	4	Pump seal is leaking & is coated in grease. This pump has no wear ring in the volute & needs to be replaced. Check valve on pump#2 has a proximity switch

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #17

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/4/2015	Gate			2 to 5 years	4	The inlet valve on pump#2 leaks bad. The check valve on this pump has a proximity switch. The inlet valve on this pump needs to be exercised every three months. If exercising fails valve will be replaced.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	4	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/4/2015	Gate			2 to 5 years	4	Outlet valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	4	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #17

Pump 3	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/4/2015	Cornell		10324	2 to 5 years	4	Pump#3 seal had a slight leak on day of inspection. Check valve #3 has a proximity switch.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	yes
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/4/2015	Gate			2 to 5 years	4	The inlet valve needs to be exercised every three months. The exercise may help with leaking issue.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #17

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/4/2015	Gate			2 to 5 years	4	The check valve on this pump has a proximity switch. The oulet gate valve needs to be exercised every three months. This valve leaks.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating
	D Baker	11/4/2015			5 to 25 years	4

Components	Rating	Components	Rating	Comments
Fire Protection	3	Water Supply	4	Wash down pump is a Gould GT-07. Inlet valve for wash down pump is covered in corrosion, should be replaced.
Security	3	Electricity	3	
Lighting	3	Gas		
Internal Paint	4	Sanitary Plumbing		
External Paint	4	I & C Control		
Floor Finish	4			
Wall Finish	4			

Wetwell Condition	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating
	D Baker	11/4/2015			5 to 25 years	4

Components	Rating	Components	Rating	Comments
External Condition	4	Lid	4	Float system needs replaced. Transducer should be relocated. Remove ladder & all unused plumbing. Repair Or replace over flow basket.
Floats	4	Isolation Valve		
Internal Condition	4	Safety	3	
Structural Integrity	4	Security	3	
Overflow Basket/Weir Box	4			
Internal Ladder	4			
Vent				

City of Mercer Island

Pump Station Condition Assessment

Pump Station #17

Hyd. Grad. M/H Cond.	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/4/2015			5 to 25 years	4	

Components	Rating	Comments
Lid	4	Hydraulic Gradient Manhole (HGMH) is buried & will be located & dug up. Ratings are from past survey.
Ladder	4	
Weir	4	
Soil Vent Trench		
Internal Condition	4	

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/4/2015			5 to 25 years	4	

Components	Rating	Components	Yes No N/A	Comments
Foundation	4	Entry Alarm Operational	yes	The vent system exhaust outlet must be raised up three feet . The fresh air inlet mushroom must be rasied up three feet.
Columns		Telemetry Monitoring Active	yes	
Floor Finish	4	Fire Pro. System Active	no	
Ladder	4	Fire Ext. Present/Cert. Current	yes	
Roof	4			
External Wall	4			
Internal Wall	4			
External Door/Hatch	4			
Grating	4			
Internal Partition	4			
Ceiling	4			
Ventilation	4			
Heating				
Cooling				
Communication	3			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #17

Sump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/4/2015				1 to 2 years	4	Sump pump system needs rebuilt & Brass check valves installed.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

Sump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/4/2015				1 to 2 years	4	Sump #2 failed on day of inspection. Electrical outlets for both sump pumps need to be raised.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	no
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	no
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

City of Mercer Island

Pump Station Condition Assessment

Pump Station #18

Pump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/4/2015	Cornell	7.5		2 to5 years	4	This pump was pulled on day of inspection. The wear rings & impellar show normal signs of wear. This pump has been pulled many times in the past months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	yes
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves		Leaks	yes
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/4/2015	Gate			2 to 5 years	4	The inlet valve & check valve both leak. The inlet valve has air bubbling thru seal around valve stem. The valves need to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	4	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #18

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	1/4/2015		4		2 to 5 years	4	The outlet valve leaks. This valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Pump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/4/2015	Cornell	7.5		2 to 5 years	4	This pump was pulled on day of inspection. The wear rings & impellar show normal signs of wear. This pump has been pulled many times in the past months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	yes
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #18

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/4/2015	Gate			2 to 5 years	4	The inlet valve & check valve both leak. The inlet valve has air bubbling thru seal around valve stem. The valves need to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/4/2015	Gate			2 to 5 years	4	The outlet valve leaks. This valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	Yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #18

Pump 3	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/4/2015	Cornell			2 to 5 years	4	This pump was pulled on day of inspection. The wear rings & impellar show normal signs of wear. This pump has been pulled many times in the past months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	no
Oil Seal	4	Unusual Smell or Heat	yes
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	3	Leaks	yes
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/4/2015	Gate			2 to 5 years	4	The inlet valve & check valve both leak. The inlet valve has air bubbling thru seal around valve stem. The valves need to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island
Pump Station Condition Assessment

Pump Station #18

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/4/2015	Gate			2 to5 years	4	The outlet valve leaks. This valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating
	D Baker	11/4/2015			5 to 25 years	5

Components	Rating	Components	Rating	Comments
Fire Protection	3	Water Supply	5	No wash down system is in place in this pump station. A 100 gal tank with a air gap would help. Install a Gould GT-07 wash down pump & plumb a hose bib.
Security	3	Electricity	3	
Lighting	4	Gas		
Internal Paint	4	Sanitary Plumbing		
External Paint	4	I & C Control		
Floor Finish	4			
Wall Finish	4			

Wetwell Condition	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating
	D Baker	11/4/2015			5 to 25 years	5

Components	Rating	Components	Rating	Comments
External Condition	4	Lid	4	Wetwell ladder & all unused plumbing in wetwell needs to be removed. Overflow basket should be replaced. The lid to wetwell should be replaced & raised 2 to 3 feet To avoid flood plain. The vent trench for pressure & odor must be replaced Or a carbon filter installed.
Floats	3	Isolation Valve		
Internal Condition	4	Safety	3	
Structural Integrity	4	Security	3	
Overflow Basket/Weir Box	4			
Internal Ladder	5			
Vent	5			

City of Mercer Island
Pump Station Condition Assessment

Pump Station #18

Hyd. Grad. M/H Cond.	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/4/2015			5 to 25 years	4	

Components	Rating	Comments
Lid	4	The hydraulic gradient manhole must be raised 2 to 3 feet & lid replaced with locking cover. This would place the lid above present flood plain.
Ladder	4	
Weir	4	
Soil Vent Trench		
Internal Condition	4	

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/4/2015			5 to 25 years	4	

Components	Rating	Components	Yes No N/A	Comments
Foundation	4	Entry Alarm Operational	yes	The hatch for entry into pump station must be raised 2 to 3 three feet to be above flood plain. The ladder must be remounted to dry pit wall to be more secure. The ventilation system is not providing sufficent fresh air into pump station. New control & communications have been install in this station in 2015. The communications are relayed by a wireless system with external anntena.
Columns		Telemetry Monitoring Active	yes	
Floor Finish	4	Fire Pro. System Active	no	
Ladder	4	Fire Ext. Present/Cert. Current	yes	
Roof	4			
External Wall	4			
Internal Wall	4			
External Door/Hatch	4			
Grating	4			
Internal Partition	4			
Ceiling	4			
Ventilation	4			
Heating				
Cooling				
Communication	3			

City of Mercer Island
Pump Station Condition Assessment

Pump Station #18

Sump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/4/2015				0 to1 year	4	Sump pump must be replaced & replumbed with brass check valve. The electrical outlet for this pump needs to be raised & separate from other sump pump. Sump pit must be cleaned & sealed.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	yes
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

Sump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/4/2015				0 to 1 year	4	Sump pump must be replaced & replumbed with brass check valve. The electrical outlet for this pump needs to be raised & separate from other sump pump. Sump pit must be cleaned & sealed.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	no
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	yes
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

City of Mercer Island

Pump Station Condition Assessment

Pump Station #19

Pump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/18/2015	Cornell	10	16148	2 to 5 years	4	In 2015 frame, upper bearing,seal & rubber transfer coupling were rebuilt.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	3	Oil OK at Inspection	
Bearing	3	All Safety Guards Present	yes
Oil Seal	3	Unusual Smell or Heat	no
Pump Shaft	3	Pump Cavitation	no
Couplings	3	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	no
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/18/2015	Gate			2 to 5 years	4	Inlet valve leaks. This valve must be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	4	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #19

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/18/2015	Gate	4		2 to 5 years	4	Outlet valve & check valve leak. The outlet valve must be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	4	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Pump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/18/2015	cornell	10	14621	2 to 5 years	4	The frame,upper bearing, seal & rubber transfer coupling need rebuilt. The rebuilt would help the pump preform better.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #19

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/18/2015	Gate			2 to 5 years	4	Inlet valve leaks. This valve must be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/18/2015	Gate			5 to 25 years	3	On discharge side of pump #2 check valve & outlet valve were replaced 2015. Also main discharge valve for whole pump system was replaced.

Components	Rating	Observations	Yes No N/A
Corrosion	2	Operating at Inspection	yes
Packing Gland	2	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	2	Unusual Smell of Heat	no
Manual Operator	2	Valve Isolates (Holds)	yes
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #19

Pump 3	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/18/2015	Cornell			2 to 5 years	4	The frame,upper bearing, seal & rubber transfer coupling need rebuilt. The rebuilt would help the pump preform better.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/18/2015	Gate			2 to 5 years	4	Inlet valve leaks. This valve must be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #19

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/18/2015	Gate			2 to 5 years	4	Outlet valve & check valve leak. The outlet valve must be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/18/2015			5 to 25 years	4	

Components	Rating	Components	Rating	Comments
Fire Protection	3	Water Supply	4	New Gould GT-07 washdown pump installed 9/9/2015. The water from flush system which comes from lake feeds washdown pump. This pump station has an old flush system which will be updated in the future. A butterfly valve & actuator with clock will be part of the update.
Security	3	Electricity	3	
Lighting	4	Gas		
Internal Paint	4	Sanitary Plumbing		
External Paint	4	I & C Control		
Floor Finish	4			
Wall Finish	4			

Wetwell Condition	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/18/2015			5 to 25 years	5	

Components	Rating	Components	Rating	Comments
External Condition	4	Lid	4	The vent trench for the wetwell was damaged years ago. On the day of inspection pressure in wetwell & odor was bad. The Wetwell ladder & all unused plumbing will be removed from wetwell. Floats & transducer will be relocated & secured. Overflow basket needs replaced.
Floats	3	Isolation Valve		
Internal Condition	4	Safety	3	
Structural Integrity	4	Security	3	
Overflow Basket/Weir Box	4			
Internal Ladder	5			
Vent	5			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #19

Hyd. Grad. M/H Cond.	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/18/2015			5 to 25 years	5	

Components	Rating	Comments
Lid	4	Hydraulic Gradient Manhole (HGMH) is buried due to odor issues. Between the (HGMH) & discharge sewer pipe from pump station the system has started to vent thru the ground. This is a issue which will be repaired. The lines from pump station & (HGMH) will be inspected by CCTV.
Ladder	4	
Weir	4	
Soil Vent Trench	5	
Internal Condition	4	

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/18/2015			5 to 25 years	4	

Components	Rating	Components	Yes No N/A	Comments
Foundation	4	Entry Alarm Operational	yes	The North side of pump station has issues with drainage. This must be resolved. The landscape will be rebuilt after all projects are completed. Access to this pump station is over rough ground & backyards. The city has a boat dock which could be rebuilt & used.
Columns		Telemetry Monitoring Active	yes	
Floor Finish	4	Fire Pro. System Active	no	
Ladder	4	Fire Ext. Present/Cert. Current	yes	
Roof	4			
External Wall	4			
Internal Wall	4			
External Door/Hatch	4			
Grating	4			
Internal Partition	4			
Ceiling	4			
Ventilation	4			
Heating				
Cooling				
Communication	3			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #19

Sump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/18/2015	Tsurumi			1 to 5 years	4	Sump pump #1 was replaced on 9/9/2015. this sump system was replumbed with brass check valve & new float. The electrical outlet still must be raised & separated from other sump pump.

Components	Rating	Observations	Yes No N/A
Corrosion	2	Running at Inspection	yes
Packing Gland/Seal	2	Oil OK at Inspection	yes
Bearing	2	All Safety Guards Present	yes
Oil Seal	2	Unusual Smell or Heat	no
Pump Shaft	2	Pump Cavitation	no
Couplings	2	Excessive Noise	no
Structural Integrity	2	Excessive Vibration	no
Pipe Alignment	2	Missing Components	no
Isolation Valves	2	Leaks	no
Sump Pit	2		
Electrical Outlets	4		
Check Valves	2		

Sump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/18/2015	Tsurumi			1 to 5 years	4	Sump pump #2 was replaced on 9/9/2015. this sump system was replumbed with brass check valve & new float. The electrical outlet still must be raised & separated from other sump pump.

Components	Rating	Observations	Yes No N/A
Corrosion	2	Running at Inspection	yes
Packing Gland/Seal	2	Oil OK at Inspection	yes
Bearing	2	All Safety Guards Present	yes
Oil Seal	2	Unusual Smell or Heat	no
Pump Shaft	2	Pump Cavitation	no
Couplings	2	Excessive Noise	no
Structural Integrity	2	Excessive Vibration	no
Pipe Alignment	2	Missing Components	no
Isolation Valves	2	Leaks	no
Sump Pit	2		
Electrical Outlets	4		
Check Valves	2		

City of Mercer Island

Pump Station Condition Assessment

Pump Station #20

Pump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/3/2015	Cornell	10	16529	2 to 5 years	4	Pump has corrosion from boxide system in pump station.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/3/2015	Gate			2 to 5 years	4	Inlet & check valve both leak. Check valve has a proximity switch. Valves need to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #20

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/3/2015	Gate	4		2 to 5 years	4	Outlet valve leaks. Valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
		Cavitation	no

Pump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/3/2015	Cornell	10	15831	2 to 5 years	4	Pump has corrosion from boxide system in pump station.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #20

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/3/2015	Gate			2 to 5 years	4	Inlet & check valve both leak. Check valve has a proximity switch. Valves need to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/3/2015	Gate			2 to 5 years	4	Outlet valve leaks. Valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #20

Pump 3	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/3/2015	Cornell		16770	2 to 5 years	4	Pump has corrosion from boxide system in pump station.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/3/2015	Gate			2 to 5 years	4	Inlet & check valve both leak. Check valve has a proximity switch. Valves need to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Pump Station #20

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/3/2015	Gate			2 to 5years	4	Outlet valve leaks. Valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating
	D Baker	11/3/2015			5 to 25 years	4

Components	Rating	Components	Rating	Comments
Fire Protection	3	Water Supply	3	Gould GT-07 wash down pump is used to clean pump station.
Security	3	Electricity	3	
Lighting	4	Gas		
Internal Paint	4	Sanitary Plumbing		
External Paint	4	I & C Control		
Floor Finish	4			
Wall Finish	4			

Wetwell Condition	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating
	D Baker	11/3/2015			5 to 25 years	5

Components	Rating	Components	Rating	Comments
External Condition	4	Lid	4	Replace float system & place transducer for better cleaning. Remove ladder & all unused plumbing. Walls in wetwell will need to be be rebuilt. Basket on overflow should be replaced.
Floats	4	Isolation Valve		
Internal Condition	4	Safety	3	
Structural Integrity	4	Security	3	
Overflow Basket/Weir Box	4			
Internal Ladder	5			
Vent				

City of Mercer Island

Pump Station Condition Assessment

Pump Station #20

Hyd. Grad. M/H Cond.	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/3/2015			5 to 25 years	0	

Components	Rating	Comments
Lid		Hydraulic Gradient Manhole (HGMD) was located on the day of inspection. The the (HGMH) will be raised & new locking lid & ring will be installed.
Ladder		
Weir		
Soil Vent Trench		
Internal Condition		

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/3/2015			5 to 25 years	4	

Components	Rating	Components	Yes No N/A	Comments
Foundation	4	Entry Alarm Operational	yes	This pump station has a bioxide tank & pump system which must be updated or removed. The bioxide has created corrosion issues on metal surfaces inside the dry pit at this pump station. The ventilation system in this station must be upgraded.
Columns		Telemetry Monitoring Active	yes	
Floor Finish	4	Fire Pro. System Active	no	
Ladder	4	Fire Ext. Present/Cert. Current	yes	
Roof	4			
External Wall	4			
Internal Wall	4			
External Door/Hatch	4			
Grating	4			
Internal Partition	4			
Ceiling	4			
Ventilation	4			
Heating				
Cooling				
Communication	3			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #20

Sump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/3/2015				1 to 2 years	4	Sump pump system needs updated & brass check valves installed. The electrical outlets must be raised & updated.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	yes
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

Sump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/3/2015				1 to 2 years	4	Sump pump system needs updated & brass check valves installed. The electrical outlets must be raised & updated.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	yes
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

City of Mercer Island

Pump Station Condition Assessment

Pump Station #21

Pump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/9/2015	Cornell	10	18349	2 to 5 years	4	

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/9/2015	Gate			2 to 5 years	4	Inlet & check valves both leak. Valves need to be exercised every three months. Check valve slams shut due to high pressure in wetwell.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Pump Station #21

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/9/2015	Gate	4		2 to 5 years	4	Outlet valve leaks. Valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Pump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/9/2015	Cornell	10	16497	2 to 5 years	4	

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #21

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/9/2015	Gate			2 to 5 years	4	Inlet & check valves both leak. Valves need to be exercised every three months. Check valve slams shut due to high pressure in wetwell.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/9/2015	Gate			2 to 5 years	4	Outlet valve leaks. Valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #21

Pump 3	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/9/2015	Cornell		17075	2 to 5 years	4	

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/9/2015	Gate			2 to 5 years	4	Inlet & check valves both leak. Valves need to be exercised every three months. Check valve slams shut due to high pressure in wetwell.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #21

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/9/2015	Gate			2 to 5 years	4	Outlet valve leaks. Valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating
	D Baker	11/9/2015			2 to 5 years	4

Components	Rating	Components	Rating	Comments
Fire Protection	3	Water Supply	3	Wash down system has a newer Gould GT-07 pump. Large chunks of paint litter the floor of dry pit.
Security	3	Electricity	3	
Lighting	4	Gas		
Internal Paint	4	Sanitary Plumbing		
External Paint	4	I & C Control		
Floor Finish	4			
Wall Finish	4			

Wetwell Condition	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating
	D Baker	11/9/2015			5 to 25 years	5

Components	Rating	Components	Rating	Comments
External Condition	4	Lid	4	Wetwell has severe pressure issue which had been addressed in the past but has failed. The floats & transducer need to be relocated. Overflow basket needs to be replaced. The ladder & all unused plumbing must be removed.
Floats	3	Isolation Valve		
Internal Condition	4	Safety	3	
Structural Integrity	4	Security	3	
Overflow Basket/Weir Box	4			
Internal Ladder	4			
Vent	5			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #21

Hyd. Grad. M/H Cond.	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/9/2015			5 to 25 years	0	

Components	Rating	Comments
Lid		Hydraulic Gradient Manhole (HGMH) Must be raised & new locking lid & ring Installed. The vent trench from wetwell to (HGMH) must be rebuilt to help reduce pressure in wetwell & Dry pit.
Ladder		
Weir		
Soil Vent Trench		
Internal Condition		

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/9/2015			5 to 25 years	4	

Components	Rating	Components	Yes No N/A	Comments
Foundation	4	Entry Alarm Operational	yes	Top of pump station structure is cement with a wood deck attached. The wood deck over wetwell is rotting & starting to come apart.
Columns		Telemetry Monitoring Active	yes	
Floor Finish	4	Fire Pro. System Active	no	
Ladder	3	Fire Ext. Present/Cert. Current	yes	
Roof	4			
External Wall	4			
Internal Wall	4			
External Door/Hatch	4			
Grating	3			
Internal Partition	4			
Ceiling	4			
Ventilation	4			
Heating				
Cooling				
Communication	3			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #21

Sump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/9/2015				0 to 1 year	4	Sump pump system is failing. Back pressure from wetwell is causing checks on sump pumps to break. Rebuild sump pump system with brass check valves & replumb. This sump pump system is 1.5 inch plumbing. Electrical outlets must be raised for operator safety.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes & no
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	yes
Pump Shaft	4	Pump Cavitation	yes
Couplings	4	Excessive Noise	yes
Structural Integrity	4	Excessive Vibration	yes
Pipe Alignment	4	Missing Components	yes
Isolation Valves	4	Leaks	yes
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

Sump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/9/2015				0 to 1 year	4	Sump pump system is failing. Back pressure from wetwell is causing checks on sump pumps to break. Rebuild sump pump system with brass check valves & replumb. This sump pump system is 1.5 inch plumbing. Electrical outlets must be raised for operator safety.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	yes
Pump Shaft	4	Pump Cavitation	yes
Couplings	4	Excessive Noise	yes
Structural Integrity	4	Excessive Vibration	yes
Pipe Alignment	4	Missing Components	yes
Isolation Valves	4	Leaks	yes
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

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Pump Station Condition Assessment

Pump Station #22

Pump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/9/2015	Cornell	7.5	19059	2 to 5 years	4	Pump #1 had a slight electrical smell at time of inspection. This pump was pulled because of vibration & heat buildup. The impellar & wear rings looked good & pump was not plugged.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	yes
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	yes
Structural Integrity	3	Excessive Vibration	yes
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/9/2015	Gate			2 to 5 years	4	Inlet & check valves both leak. The check valve has a proximity switch. The inlet valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #22

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/9/2015	Gate	4		2 to 5 years	4	Outlet valve leaks. The outlet valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Pump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/9/2015	Cornell	7.5	20334	2 to 5 years	5	Seal on pump #2 shaft had failed on day of inspection. Seal was washed down & still failed. This pump was pulled due to a plug. The impellar & wear rings were in good shape.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	5	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	yes
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #22

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/9/2015	Gate			2 to 5 years	4	Inlet & check valves both leak. The check valve has a proximity switch. The inlet valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	yes
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/9/2015	Gate			0	5	Outlet valve leaks. The valve has failed in the open position. This valve will be replaced.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	no
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	5	Valve Isolates (Holds)	no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #22

Pump 3	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D baker	11/9/2015	Cornell		19460	2 to 5 years	4	

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	no
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/9/2015	Gate			2 to 5 years	4	Inlet & check valves both leak. The check valve has a proximity switch. The inlet valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #22

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/9/2015	Gate			2 to 5 years	4	Main discharge valve is stuck open. After valve is free to move in future the valve will be exercised every three months. The outlet valve for pump #3 leaks.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating
	D baker	11/9/2015			5 to 25 years	4

Components	Rating	Components	Rating	Comments
Fire Protection	3	Water Supply	3	This pump station has a newer Gould GT-07 wash down pump. Water from old flush system is used to supply washdown pump for cleaning dry pit floor.
Security	3	Electricity	3	
Lighting	3	Gas		
Internal Paint	4	Sanitary Plumbing		
External Paint	4	I & C Control		
Floor Finish	4			
Wall Finish	4			

Wetwell Condition	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating
	D Baker	11/9/2015			5 to 25 years	5

Components	Rating	Components	Rating	Comments
External Condition	4	Lid	5	Float system will be replaced & transducer relocated. Lid to wetwell needs new seal or replacement. Ladder & all unused plumbing to be removed. Overflow basket to be replaced. This wetwell has a severe pressure issue & is causing damage to wetwell.
Floats	4	Isolation Valve		
Internal Condition	4	Safety	4	
Structural Integrity	4	Security	4	
Overflow Basket/Weir Box	4			
Internal Ladder	5			
Vent	5			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #22

Hyd. Grad. M/H Cond.	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/9/2015			5 to 25 years	5	

Components	Rating	Comments
Lid	4	Hydraulic Gradient Manhole (HGMH) has pressure issues from vent trench not working. This causes odor for homeowners in area of pump station. The vent trench will be be replaced to reduce pressure.
Ladder	4	
Weir	4	
Soil Vent Trench	5	
Internal Condition	4	

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/9/2015			5 to 25 years	4	

Components	Rating	Components	Yes No N/A	Comments
Foundation	4	Entry Alarm Operational	yes	Fan discharge needs to be raised 3 feet to avoid water runoff coming into station & causing fan to fail. The area around pump station will have many projects. When they are all completed area will be restored.
Columns		Telemetry Monitoring Active	yes	
Floor Finish	4	Fire Pro. System Active	no	
Ladder	4	Fire Ext. Present/Cert. Current	yes	
Roof	4			
External Wall	4			
Internal Wall	4			
External Door/Hatch	4			
Grating	3			
Internal Partition	4			
Ceiling	4			
Ventilation	4			
Heating				
Cooling				
Communication	3			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #22

Sump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/9/2015				0 to 1 year	4	Sump pump system should be rebuilt before it fails. The sump system needs to be upgraded to brass checks & a total replumb. The electical outlets must be raised & placed on separate Breakers.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	yes
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

Sump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/9/2015				0 to 1 year	4	Sump pump system should be rebuilt before it fails. The sump system needs to be upgraded to brass checks & a total replumb. The electical outlets must be raised & placed on separate Breakers.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	yes
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

City of Mercer Island

Pump Station Condition Assessment

Pump Station #23

Pump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/3/2015	Cornell	7.5	15641	2 to 5 years	4	

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal		Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/3/2015	Gate			2 to 5 years	4	The inlet & check valve both leak. The check valve has a proximity switch. These valves need to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #23

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/3/2015	Gate	4		2 to 5 years	4	Outlet valve leaks. This outlet valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Pump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/3/2015	Cornell	7.5	18583	2 to 5 years	4	Pump #2 was pulled on day of inspection. Impellar is in good shape & wear rings seem to be fine. A binding issue was found with pump & two hoists had to be used to pull pump.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #23

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/3/2015	Gate			2 to 5 years	4	The inlet & check valve both leak. The check valve has a proximity switch. These valves need to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/3/2015	Gate			2 to 5 years	4	Outlet valve leaks. This outlet valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #23

Pump 3	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/3/2015	Cornell		16597	2 to 5 years	5	Pump #3 was pulled 2 weeks before inspection. The seal was leaking on day of inspection. There seems to be upper bearing noise & slight shaft vibration. The marathon motor smelled like it has light eletrical issues. Impellar & wear rings look ok.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	yes
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	yes
Structural Integrity	3	Excessive Vibration	yes
Pipe Alignment	3	Missing Components	no
Isolation Valves	5	Leaks	yes
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/3/2015	Gate			zero	5	Pump #3 inlet valve has failed. The inspection crew tried many times to just move the valve. The valve will be replaced when the projects list is complete & three man crew is available.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	Stuck open
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	5	Unusual Smell of Heat	no
Manual Operator	5	Valve Isolates (Holds)	no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Pump Station #23

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/3/2015	Gate			2 to 5 years	4	Outlet valve leaks. This outlet valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating
	D Baker	11/3/2015			5 to 25 years	4

Components	Rating	Components	Rating	Comments
Fire Protection	3	Water Supply	4	Hatch switch for lighting bad. Washdown pump is a Gould GT-07 this pump uses lake water for station cleaning.
Security	3	Electricity	3	
Lighting	4	Gas		
Internal Paint	4	Sanitary Plumbing		
External Paint	4	I & C Control		
Floor Finish	4			
Wall Finish	4			

Wetwell Condition	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating
	D Baker	11/3/2015			5 to 25 years	5

Components	Rating	Components	Rating	Comments
External Condition	4	Lid	5	The wetwell lid does not lock down. The float system must be replaced & transducer moved. Remove ladder & all unused plumbing before in falls into wetwell & goes tru pumps. The wet well walls are showing heavy signs of exposed rock & crumbling cement.
Floats	4	Isolation Valve		
Internal Condition	4	Safety	4	
Structural Integrity	4	Security	4	
Overflow Basket/Weir Box	4			
Internal Ladder	5			
Vent	5			

Pump Station #23

Hyd. Grad. M/H Cond.	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/3/2015			5 to 25 years	0	

Components	Rating	Comments
Lid		The Hydraulic Gradient Manhole (HGMH) is buried in side walk & will be raised & repaired.
Ladder		
Weir		
Soil Vent Trench		
Internal Condition		

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/3/2015			5 to 25 years	4	

Components	Rating	Components	Yes No N/A	Comments
Foundation	3	Entry Alarm Operational	yes	Ventilation system needs to be improved.
Columns		Telemetry Monitoring Active	yes	The fresh air inlet needs to be raised three
Floor Finish	4	Fire Pro. System Active	no	feet & fan exhaust raised three feet.
Ladder	3	Fire Ext. Present/Cert. Current	yes	
Roof	3			
External Wall	4			
Internal Wall	3			
External Door/Hatch	4			
Grating	4			
Internal Partition	4			
Ceiling	3			
Ventilation	4			
Heating				
Cooling				
Communication	3			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #23

Sump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/3/2015				0 to 1 year	4	The sump pump system needs replumbed with new pumps, brass checks & new floats. The electrical outlets need raised.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	yes
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

Sump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/3/2015				0 to 1 year	4	The sump pump system needs replumbed with new pumps, brass checks & new floats. The electrical outlets need raised.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	yes
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

City of Mercer Island

Pump Station Condition Assessment

Pump Station #24

Pump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/9/2015	Cornell	3	21535	2 to 5 years	4	

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	Yes No N/A
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/9/2015	Gate			2 to 5 years	4	Inlet & check valve leak. The inlet valve does not close completely with out heavy force. Check valve has a new upgraded limit switch. Both inlet & check valve must be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Pump Station #24

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/9/2015	Gate	4		2 to 5 years	4	Outlet valve does not close with out heavy force. Valve must be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Pump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/9/2015	Cornell	3	18819	2 to 5 years	4	The seal on pump #2 has a slight leak which causes odor.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	yes
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

Pump Station #24

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/9/2015	Gate			2 to 5 years	4	Inlet & check valve leak. The inlet valve does not close completely with out heavy force. Check valve has a new upgraded limit switch. Both inlet & check valve must be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/9/2015	Gate			2 to 5 years	4	Outlet valve does not close with out heavy force. Valve must be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Pump Station #24

Pump 3	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/9/2015	Vaughn			5 to 10 years	4	

Components	Rating	Observations	Yes No N/A
Corrosion	3	Running at Inspection	yes
Packing Gland/Seal	3	Oil OK at Inspection	
Bearing	3	All Safety Guards Present	yes
Oil Seal	3	Unusual Smell or Heat	no
Pump Shaft	3	Pump Cavitation	no
Couplings	3	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	no
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/9/2015	Gate			2 to 5 years	4	Inlet & check valve leak. The inlet valve does not close completely with out heavy force. Check valve has a new upgraded limit switch. Both inlet & check valve must be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Pump Station #24

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/9/2015	Gate			2 to 5 years	4	Outlet valve does not close with out heavy force. Valve must be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating
	D Baker	11/9/2015			5 to 25 years	4

Components	Rating	Components	Rating	Comments
Fire Protection	3	Water Supply	4	The washdown pump is a Teel pump which uses water from lake for cleaning of pump station. The electrical system has issues with water in conduit system.
Security	3	Electricity	4	
Lighting	4	Gas		
Internal Paint	4	Sanitary Plumbing		
External Paint	4	I & C Control		
Floor Finish	4			
Wall Finish	4			

Wetwell Condition	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating
	D Baker	11/9/2015			5 to 25 years	4

Components	Rating	Components	Rating	Comments
External Condition	3	Lid	3	The float system was upgraded in 2015 with the new telemetry & control upgrade. The ladder & all unused plumbing should be removed. Overflow basket will need replaced.
Floats	2	Isolation Valve		
Internal Condition	3	Safety	3	
Structural Integrity	3	Security	3	
Overflow Basket/Weir Box	4			
Internal Ladder	4			
Vent	4			

Pump Station #24

Hyd. Grad. M/H Cond.	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/9/2015			5 to 25 years	5	

Components	Rating	Comments
Lid	4	The Hydraulic Gradient Manhole (HGMH) is located in a walk way just west of pump station. The wetwell vents back to (HGMH) & uses bolt holes in lid to relieve pressure . In the past a filter had been placed in this structure for odor control.
Ladder	4	
Weir	4	
Soil Vent Trench	5	
Internal Condition	4	

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/9/2015			5 to 25 years	4	

Components	Rating	Components	Yes No N/A	Comments
Foundation	3	Entry Alarm Operational	yes	The ventilation system needs to be upgraded to provide more fresh air inside pump station dry pit.
Columns		Telemetry Monitoring Active	yes	
Floor Finish	4	Fire Pro. System Active	no	
Ladder	3	Fire Ext. Present/Cert. Current	yes	
Roof	4			
External Wall	4			
Internal Wall	4			
External Door/Hatch	3			
Grating	3			
Internal Partition	3			
Ceiling	3			
Ventilation	4			
Heating				
Cooling				
Communication	3			

Pump Station #24

Sump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/9/2015				0 to 1 year	4	The sump pump system is 1.5 inch plumbing. This system needs upgraded with new pumps, new floats & brass check valves. The sump pit needs cleaned & sealed. The electrical outlets need to be rasied & placed on separate breakers.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	yes
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

Sump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/9/2015				0 to 1 year	4	The sump pump system is 1.5 inch plumbing. This system needs upgraded with new pumps, new floats & brass check valves. The sump pit needs cleaned & sealed. The electrical outlets need to be rasied & placed on separate breakers.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	yes
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	yes
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

City of Mercer Island

Pump Station Condition Assessment

Pump Station #25

Pump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/10/2015	Vaughn	7.5		5 to 10 years	4	The hour meter should be changed to reflect accurate hours on Vaughn pump. The pump should have a pressure gauge on the inlet side & outlet side of pump.

Components	Rating	Observations	Yes No N/A
Corrosion	3	Running at Inspection	yes
Packing Gland/Seal	2	Oil OK at Inspection	
Bearing	2	All Safety Guards Present	yes
Oil Seal	2	Unusual Smell or Heat	no
Pump Shaft	2	Pump Cavitation	no
Couplings	2	Excessive Noise	no
Structural Integrity	2	Excessive Vibration	no
Pipe Alignment	2	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/10/2015	Gate			2 to 5 years	4	Inlet & check valve leak. Check valve has a proximity switch. The inlet valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	Yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #25

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/10/2015	Gate	4		2 to 5 years	4	Outlet valve leaks & needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Pump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/10/2015	Vaughn	7.5		5 to 10 years	4	The hour meter should be changed to reflect accurate hours on Vaughn pump. The pump should have a pressure gauge on the inlet side & outlet side of pump.

Components	Rating	Observations	Yes No N/A
Corrosion	3	Running at Inspection	yes
Packing Gland/Seal	2	Oil OK at Inspection	
Bearing	2	All Safety Guards Present	yes
Oil Seal	2	Unusual Smell or Heat	no
Pump Shaft	2	Pump Cavitation	no
Couplings	2	Excessive Noise	no
Structural Integrity	2	Excessive Vibration	no
Pipe Alignment	2	Missing Components	no
Isolation Valves	4	Leaks	yes
Belt/Chain			

Pump Station #25

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake	D Baker	11/10/2015	Gate			2 to 5 years	4	Inlet & check valve leak. Check valve has a proximity switch. The inlet valve needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet	D Baker	11/10/2015	Gate			2 to 5 years	4	Outlet valve leaks & needs to be exercised every three months.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Operating at Inspection	yes
Packing Gland	4	Lubrication Oil OK at Inspect.	
Support	3	All Safe Guards Present	yes
Functional	4	Unusual Smell of Heat	no
Manual Operator	4	Valve Isolates (Holds)	yes & no
Actuator		Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
		Cavitation	no

City of Mercer Island

Pump Station Condition Assessment

Pump Station #25

Pump 3	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
							0	

Components	Rating	Observations	Yes No N/A
Corrosion		Running at Inspection	
Packing Gland/Seal		Oil OK at Inspection	
Bearing		All Safety Guards Present	
Oil Seal		Unusual Smell or Heat	
Pump Shaft		Pump Cavitation	
Couplings		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
Isolation Valves		Leaks	
Belt/Chain			

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Intake							0	

Components	Rating	Observations	Yes No N/A
Corrosion		Operating at Inspection	
Packing Gland		Lubrication Oil OK at Inspect.	
Support		All Safe Guards Present	
Functional		Unusual Smell of Heat	
Manual Operator		Valve Isolates (Holds)	
Actuator		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
		Cavitation	

Pump Station #25

Valve	Assessor	Date	Make/Type	Size	Year Made	Life Expectancy	Overall Rating	Comments
Outlet							0	

Components	Rating	Observations	Yes No N/A
Corrosion		Operating at Inspection	
Packing Gland		Lubrication Oil OK at Inspect.	
Support		All Safe Guards Present	
Functional		Unusual Smell of Heat	
Manual Operator		Valve Isolates (Holds)	
Actuator		Excessive Noise	
Structural Integrity		Excessive Vibration	
Pipe Alignment		Missing Components	
		Cavitation	

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/10/2015			5 to 25 years	4	

Components	Rating	Components	Rating	Comments
Fire Protection	3	Water Supply	3	A new Gould GT-07 washdown pump was installed mid summer. The water for cleaning of pump station is pulled from lake tru old flush system.
Security	3	Electricity	3	
Lighting	3	Gas		
Internal Paint	4	Sanitary Plumbing		
External Paint	4	I & C Control		
Floor Finish	4			
Wall Finish	4			

Wetwell Condition	Assessor	Date	Size	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/10/2015			5 to 25 years	5	

Components	Rating	Components	Rating	Comments
External Condition	3	Lid	4	The float system must be upgraded to a new float system. The transducer needs to be relocated. The ladder & all unused plumbing will be removed from wetwell. The overflow basket needs replaced. Remove root mass from wetwell & repair cement wall. Vent trench for wetwell has failed & wetwell has
Floats	4	Isolation Valve		
Internal Condition	3	Safety	3	
Structural Integrity	3	Security	3	
Overflow Basket/Weir Box	4			
Internal Ladder	4			
Vent	5			

City of Mercer Island

Pump Station Condition Assessment

Pump Station #25

Hyd. Grad. M/H Cond.	Assessor	Date	Size	Year Made	Life Expectancy		
	D Baker	11/10/2015				0	

Components	Rating	Comments
Lid		This pump station does not have a Hydraulic Gradient Manhole (HGMH)
Ladder		
Weir		
Soil Vent Trench		
Internal Condition		

Structure Condition	Assessor	Date	Type	Year Made	Life Expectancy	Overall Rating	
	D Baker	11/10/2015			5 to 25 years	4	

Components	Rating	Components	Yes No N/A	Comments
Foundation	4	Entry Alarm Operational	yes	The ventilation system needs upgraded. The air inlet & air outlet need to be raised 3 feet or better to avoid debri entering fan system.
Columns		Telemetry Monitoring Active	yes	
Floor Finish	4	Fire Pro. System Active	no	
Ladder	3	Fire Ext. Present/Cert. Current	yes	
Roof	4			
External Wall	4			
Internal Wall	4			
External Door/Hatch	3			
Grating	4			
Internal Partition	4			
Ceiling	4			
Ventilation	4			
Heating				
Cooling				
Communication	3			

City of Mercer Island

Pump Station Condition Assessment

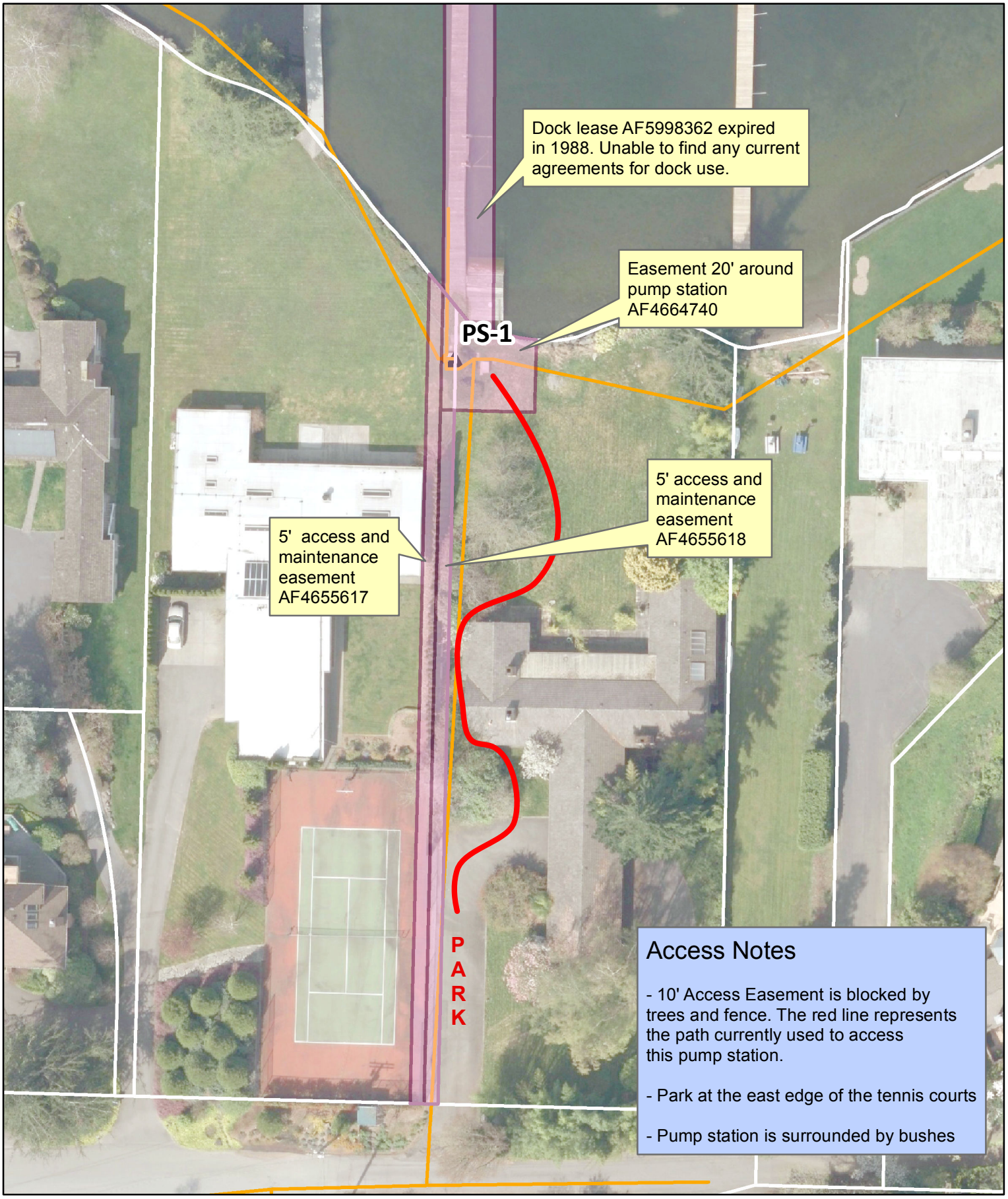
Pump Station #25

Sump 1	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/10/2015				1 to 5 years	4	Sump pump #1 was replaced mid summer when washdown pump was installed. The sump pump system needs to be replumbed with new floats & brass check valves.

Components	Rating	Observations	Yes No N/A
Corrosion	3	Running at Inspection	yes
Packing Gland/Seal	3	Oil OK at Inspection	
Bearing	3	All Safety Guards Present	yes
Oil Seal	3	Unusual Smell or Heat	no
Pump Shaft	3	Pump Cavitation	no
Couplings	3	Excessive Noise	no
Structural Integrity	3	Excessive Vibration	no
Pipe Alignment	3	Missing Components	no
Isolation Valves	4	Leaks	yes
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

Sump 2	Assessor	Date	Make/Model	HP	Hours	Life Expectancy	Overall Rating	Comments
	D Baker	11/10/2015				zero	4	The #2 sump pump had failed on the day of inspection. The electrical outlets for both sump pumps must be placed on separate breakers & raised. The sump pit needs to be cleaned & sealed.

Components	Rating	Observations	Yes No N/A
Corrosion	4	Running at Inspection	no
Packing Gland/Seal	4	Oil OK at Inspection	
Bearing	4	All Safety Guards Present	yes
Oil Seal	4	Unusual Smell or Heat	no
Pump Shaft	4	Pump Cavitation	no
Couplings	4	Excessive Noise	no
Structural Integrity	4	Excessive Vibration	no
Pipe Alignment	4	Missing Components	no
Isolation Valves	4	Leaks	yes
Sump Pit	4		
Electrical Outlets	4		
Check Valves	4		

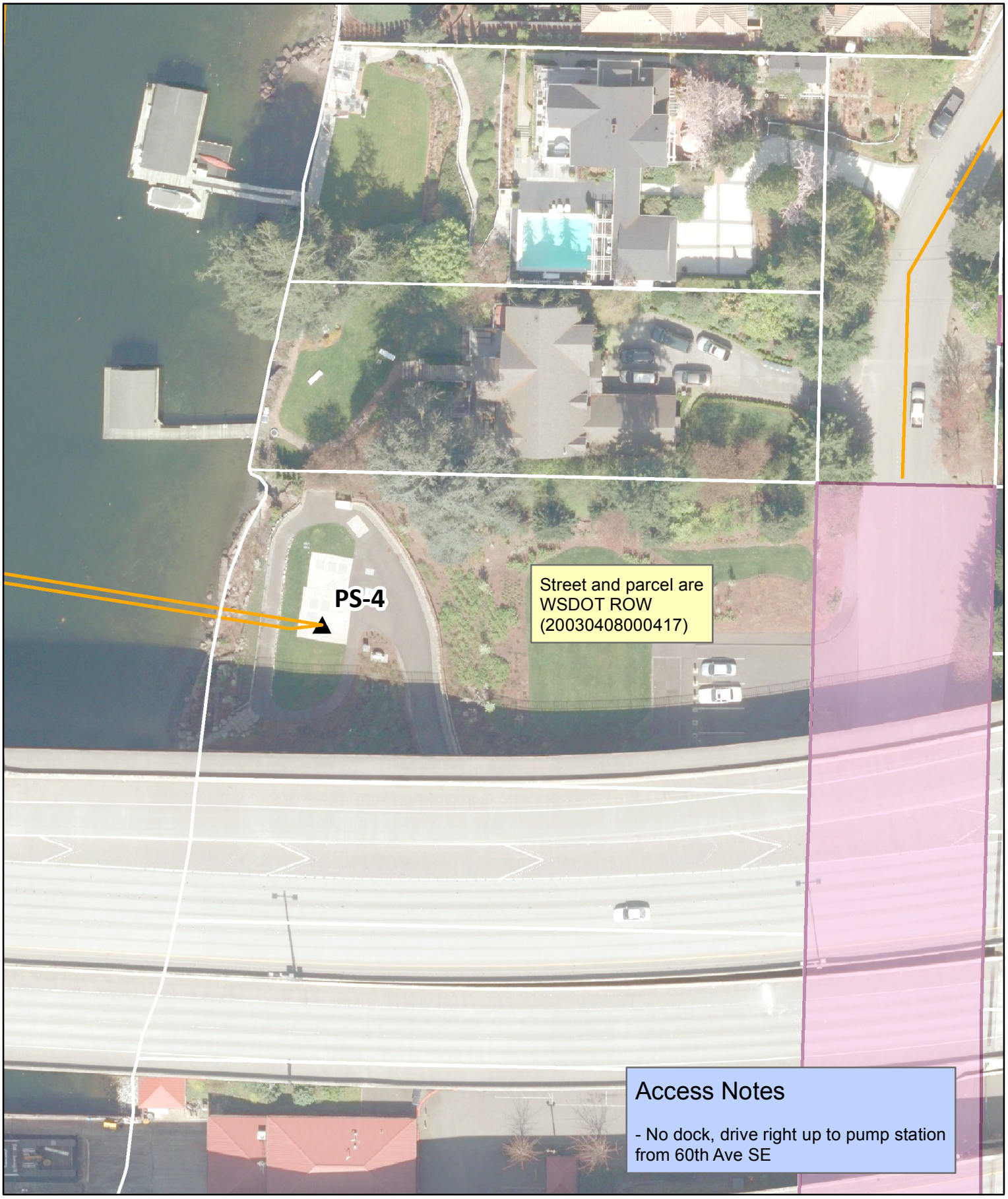


Pump Station Easements
Parcels
Sewer Main

0 15 30 60 90 Ft

Pump Station 1

N

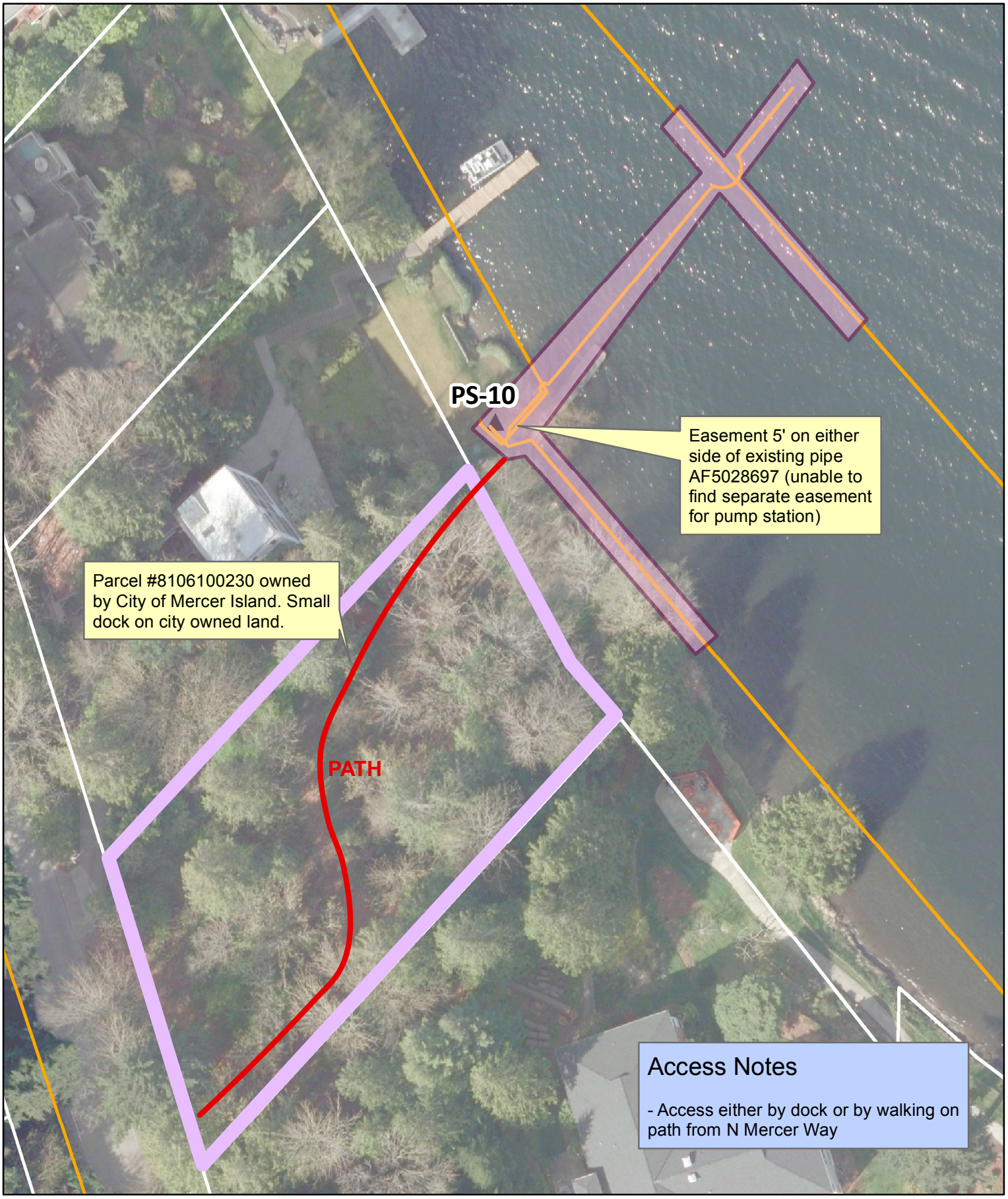


Pump Station Easements
Parcels
Sewer Main

0 15 30 60 90 Ft

Pump Station 4

N



Pump Station 10

Pump Station Easements
Parcels
Sewer Main

0 5 10 20 30 Ft

Pump Station 11

N

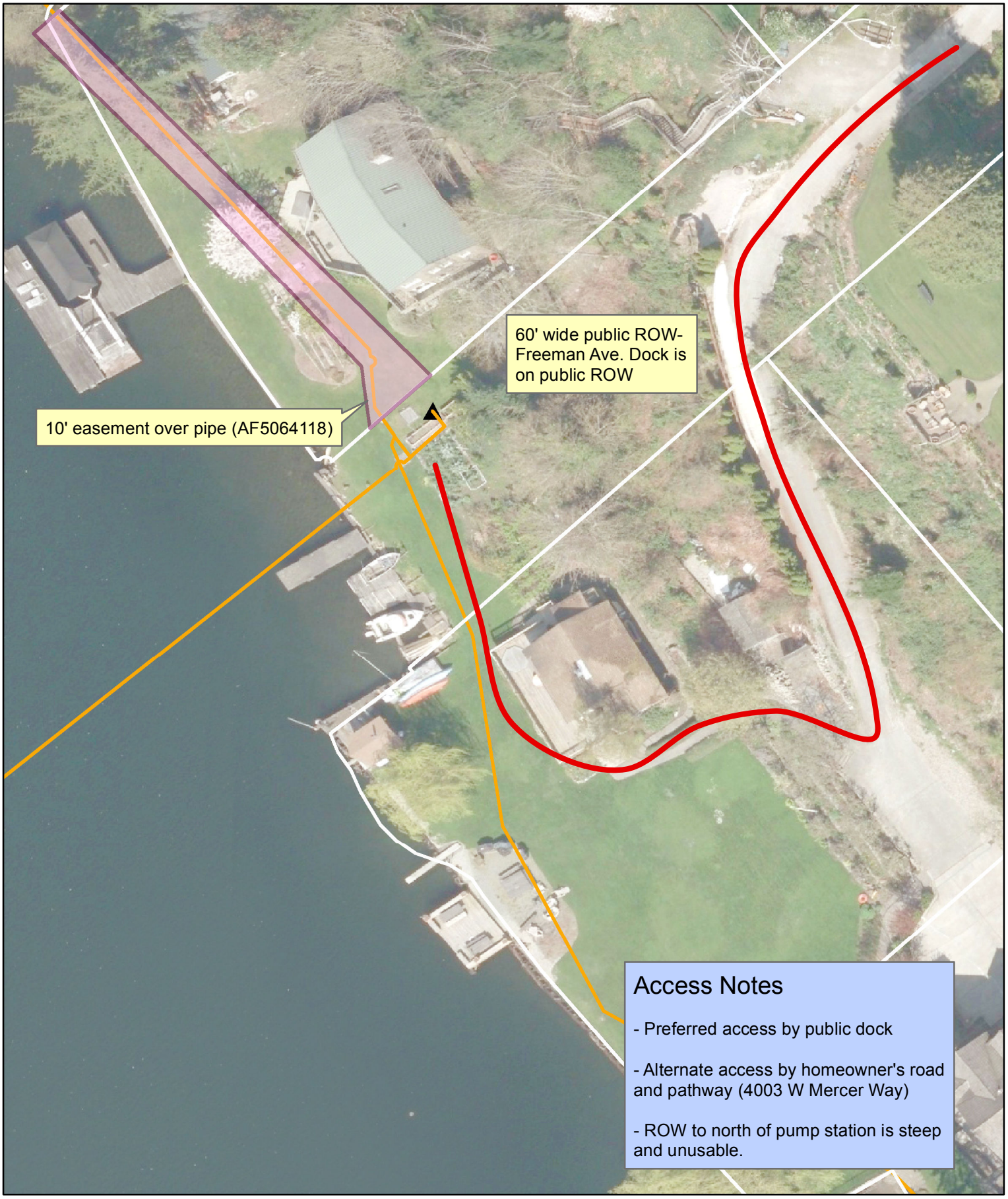
Pump Station Easements
Parcels
Sewer Main

0 12.5 25 50 75 Ft

Pump Station 12

IGS Information & Geographic Services

N



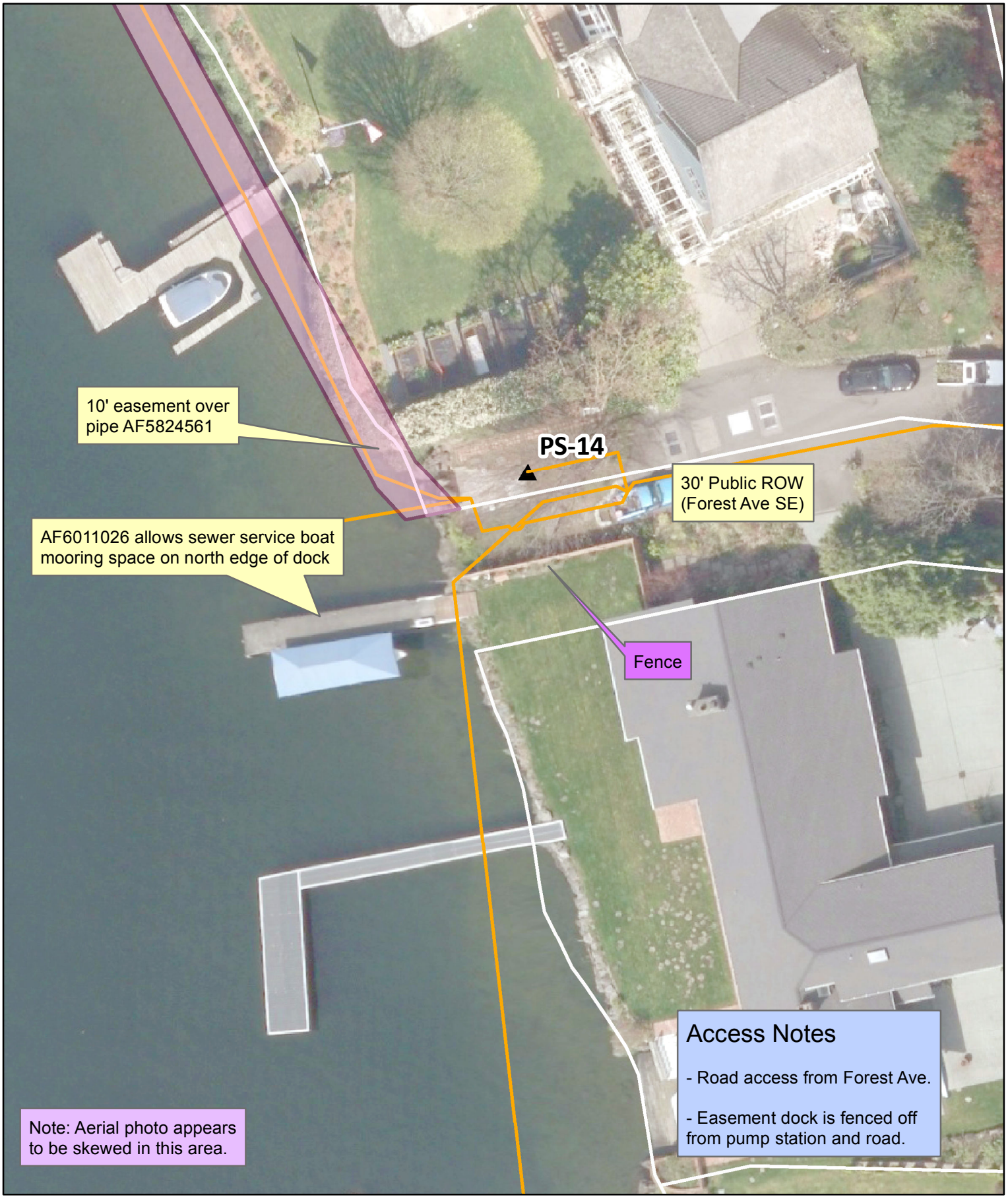
Pump Station Easements
Parcels
Sewer Main

0 12.5 25 50 75 Ft

Pump Station 13

IGS Information & Geographic Services

N

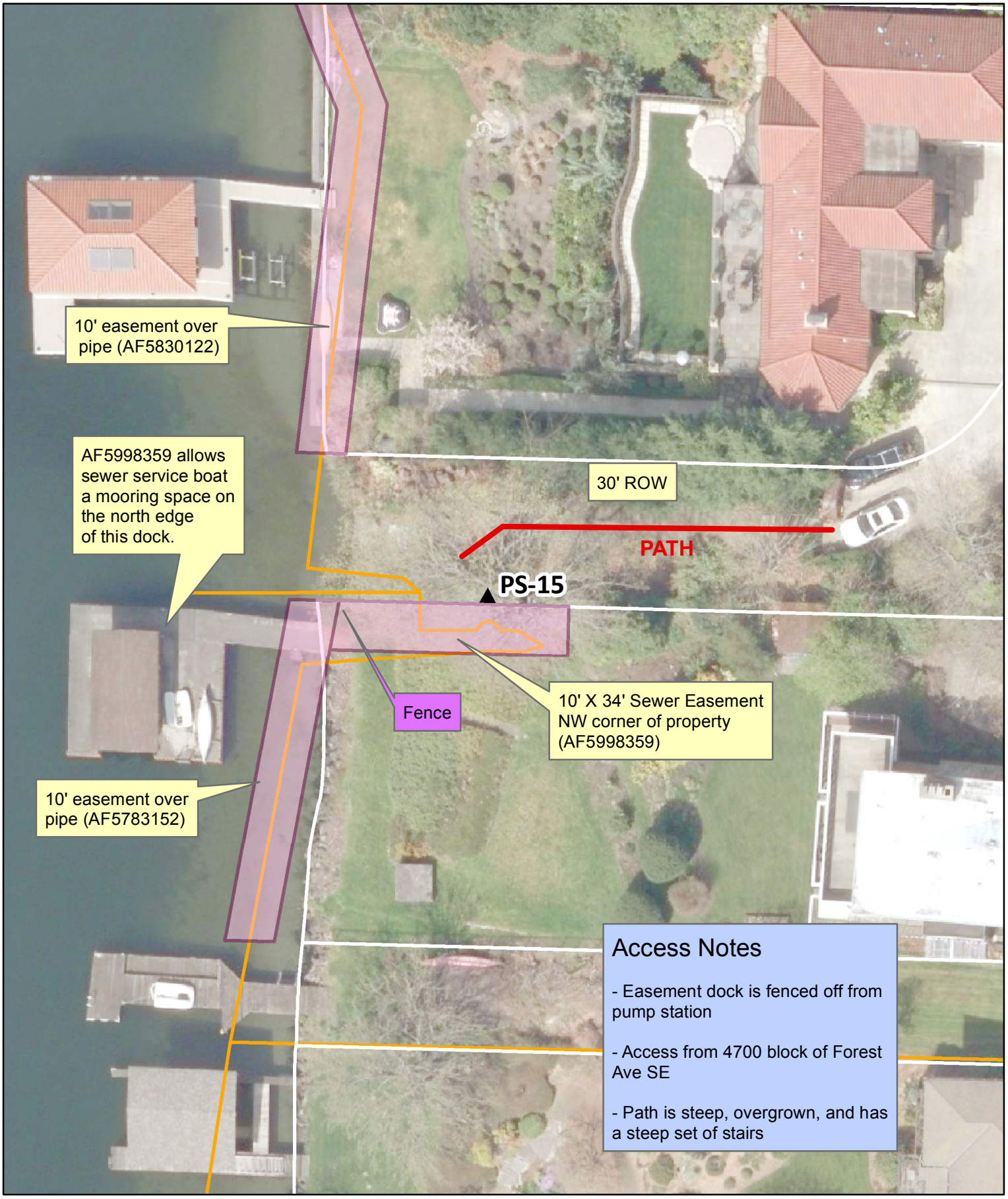


Pump Station Easements
Parcels
Sewer Main

0 5 10 20 30 Ft

Pump Station 14

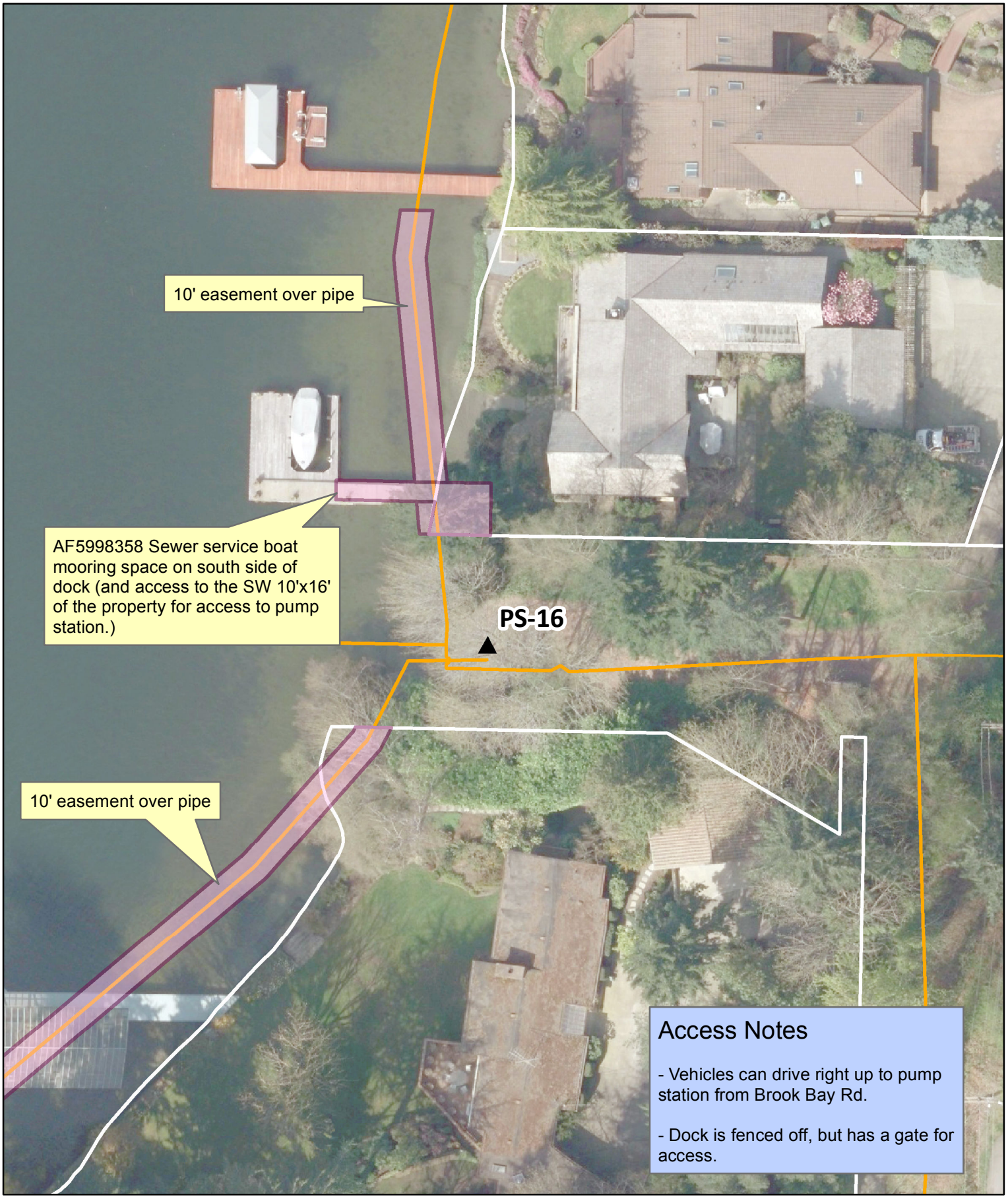
N



Pump Station Easements
Parcels
Sewer Main
0 5 10 20 30 Ft

Pump Station 15

N



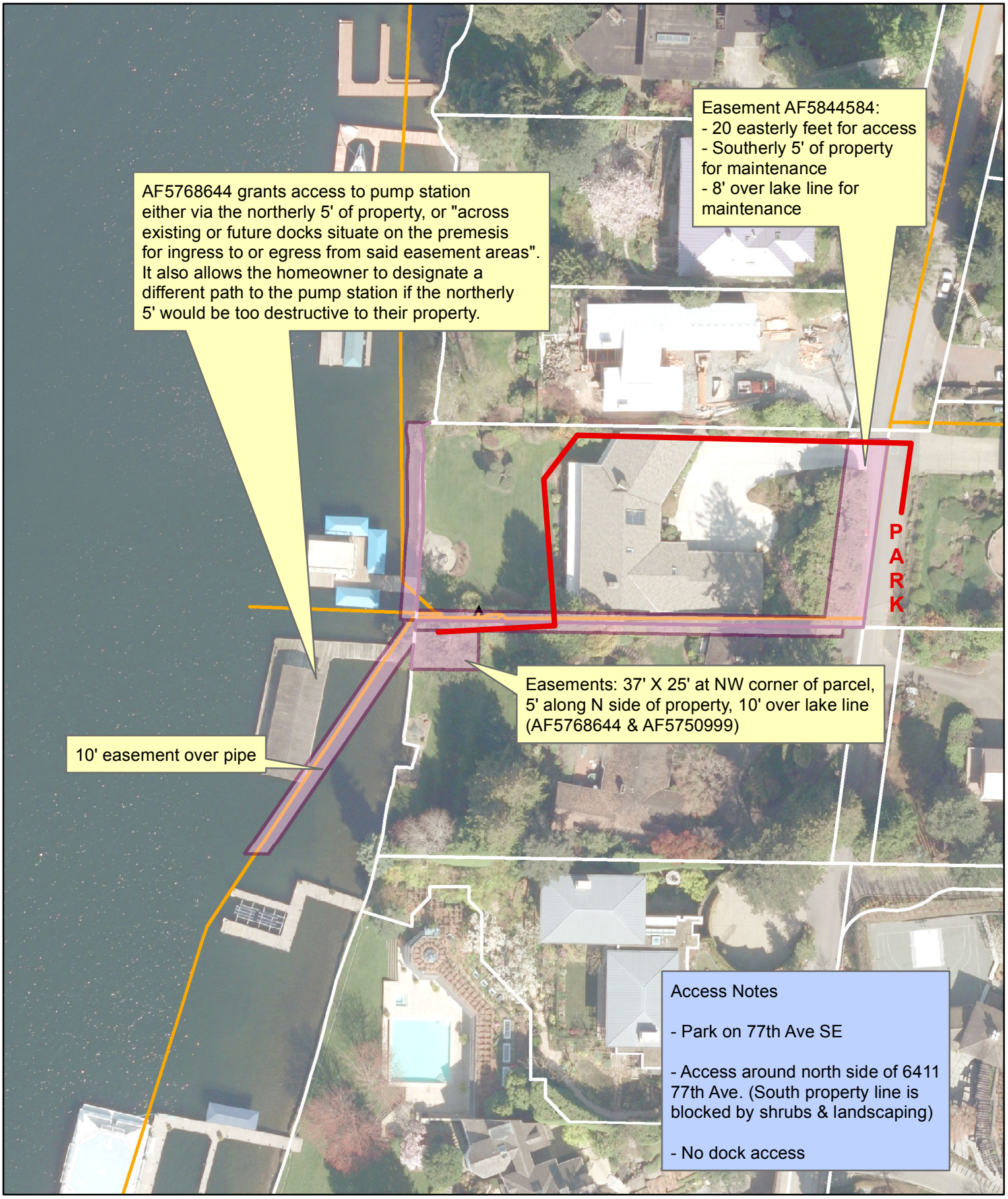
Pump Station Easements
Parcels
Sewer Main

0 12.5 25 50 75 Ft

Pump Station 16

IGS Information & Geographic Services

N



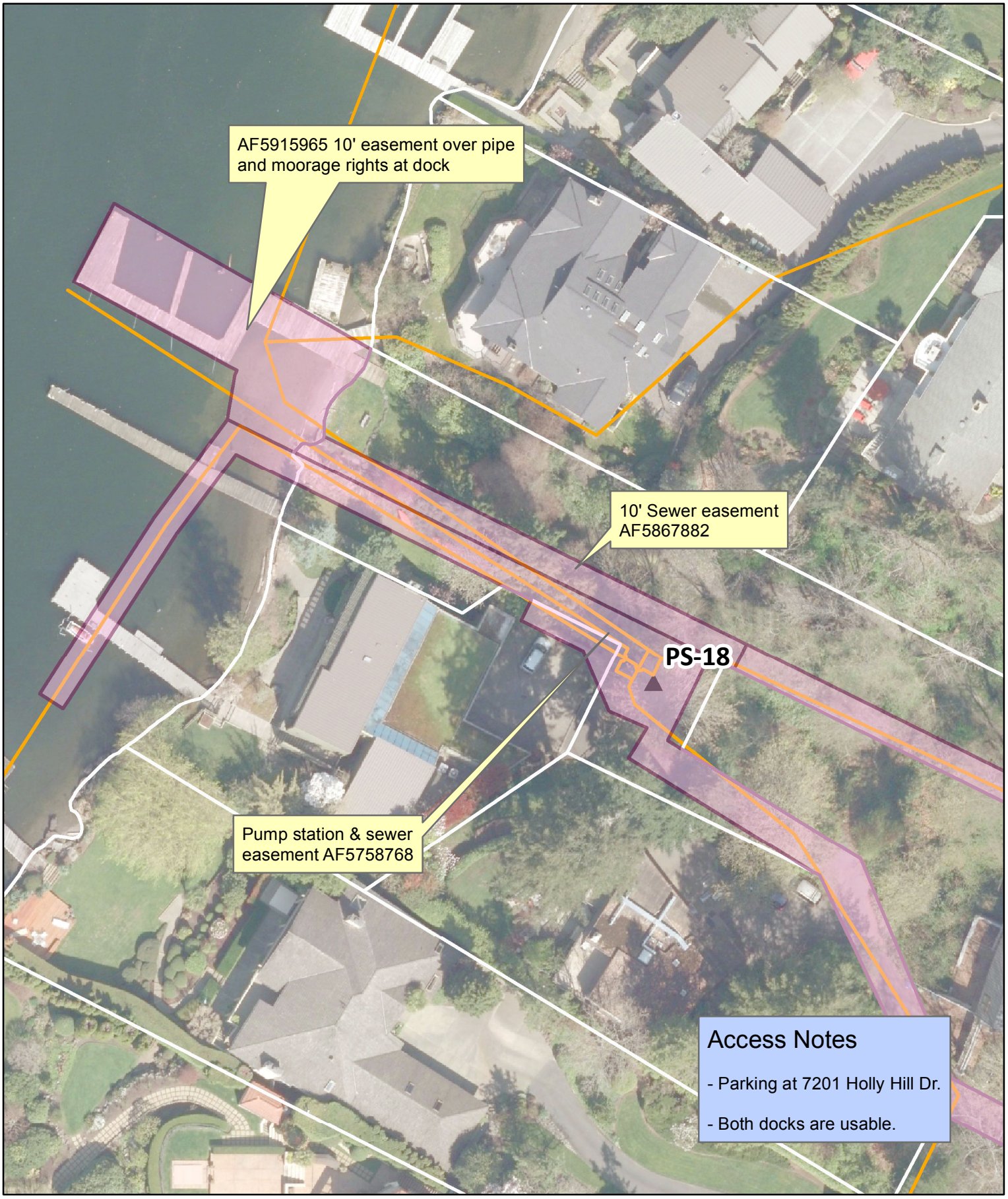
Pump Station Easements
Parcels
Sewer Main

0 20 40 80 120 Ft

Pump Station 17

IGS Information & Geographic Services

N



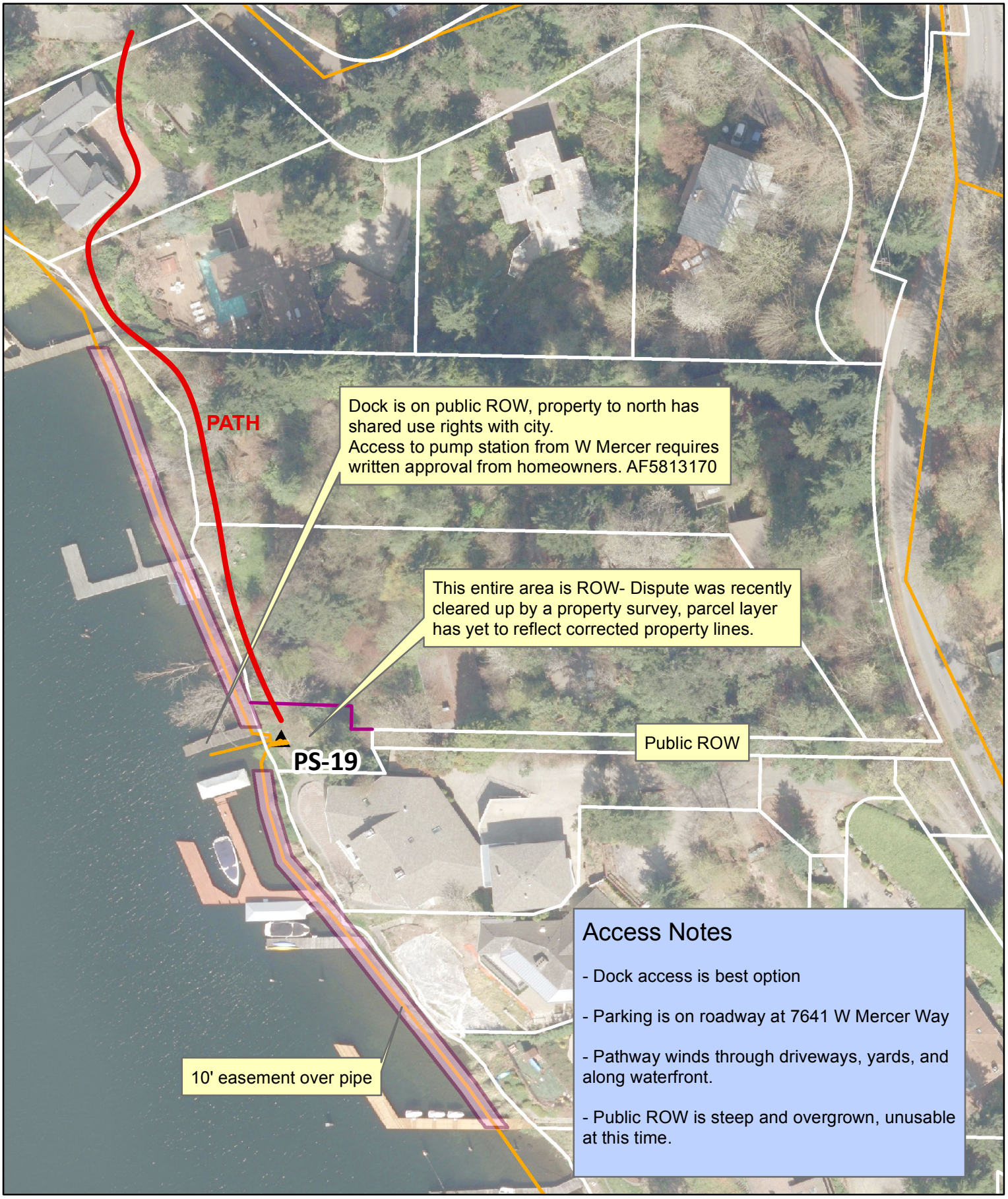
Pump Station Easements
Parcels
Sewer Main

0 15 30 60 90 Ft

Pump Station 18

IGS Information & Geographic Services

N



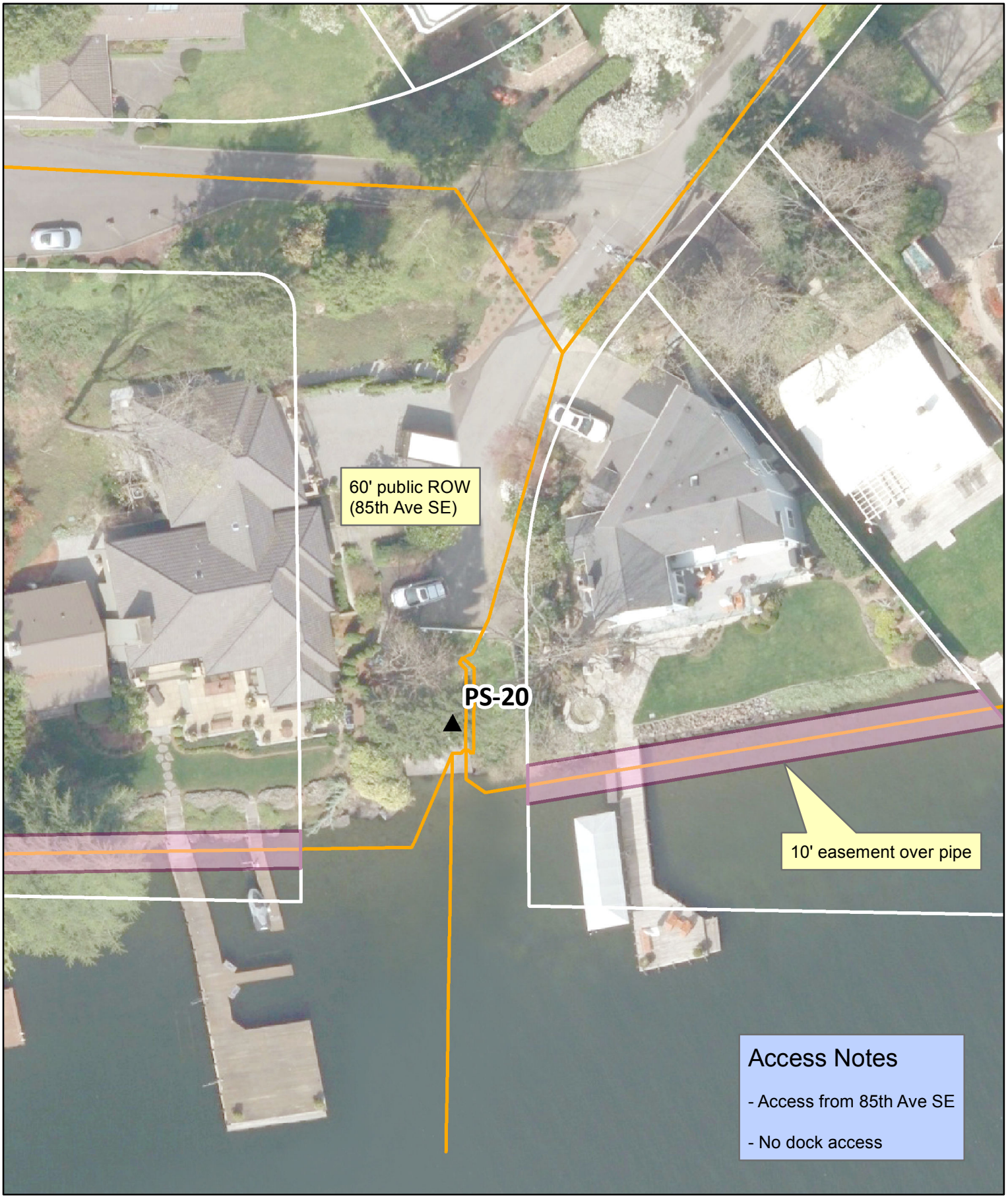
Pump Station Easements
Parcels
Sewer Main

0 20 40 80 120
Ft

Pump Station 19

IGS Information & Geographic Services

N

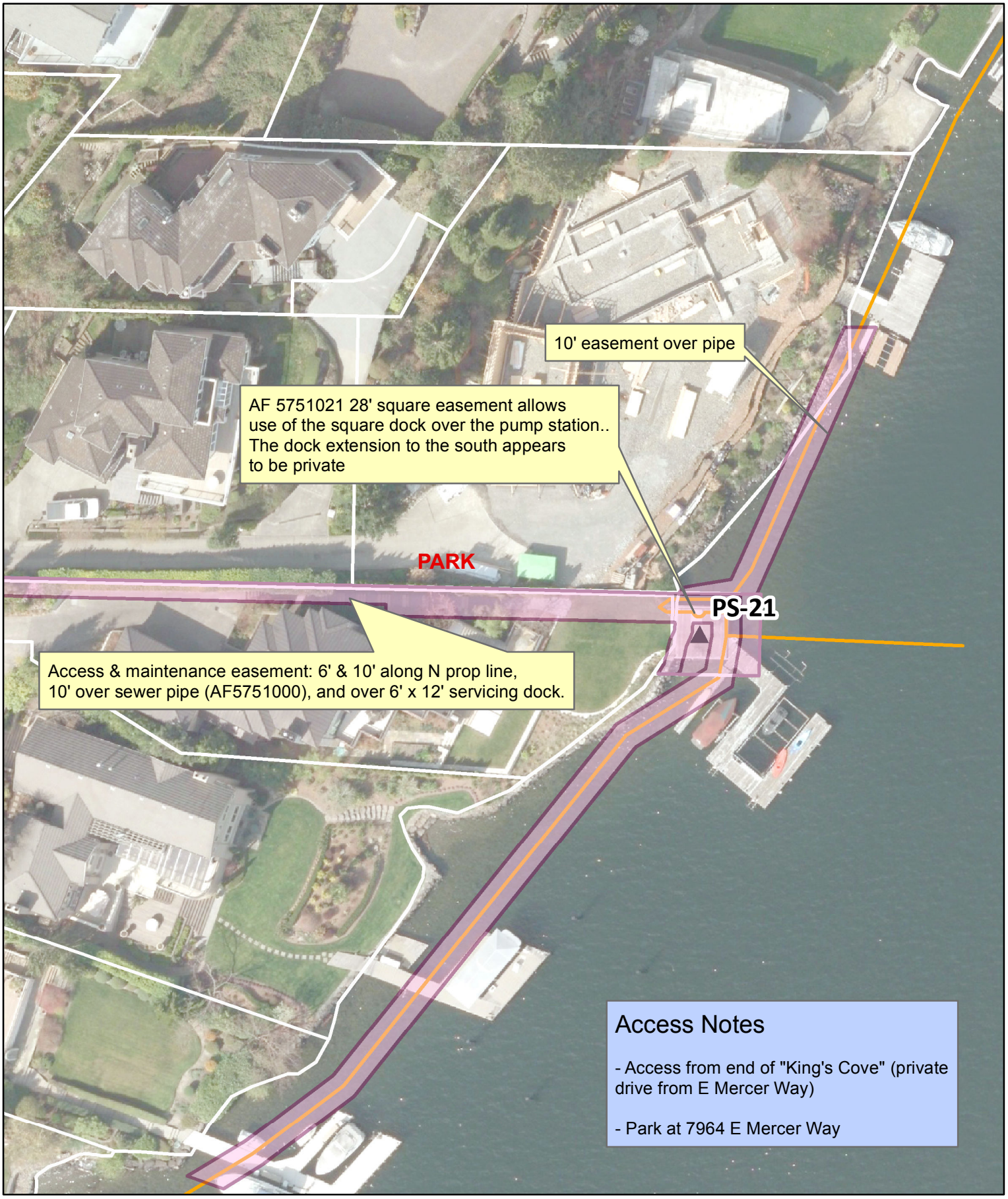


Pump Station Easements
Parcels
Sewer Main

0 10 20 40 60 Ft

Pump Station 20

N



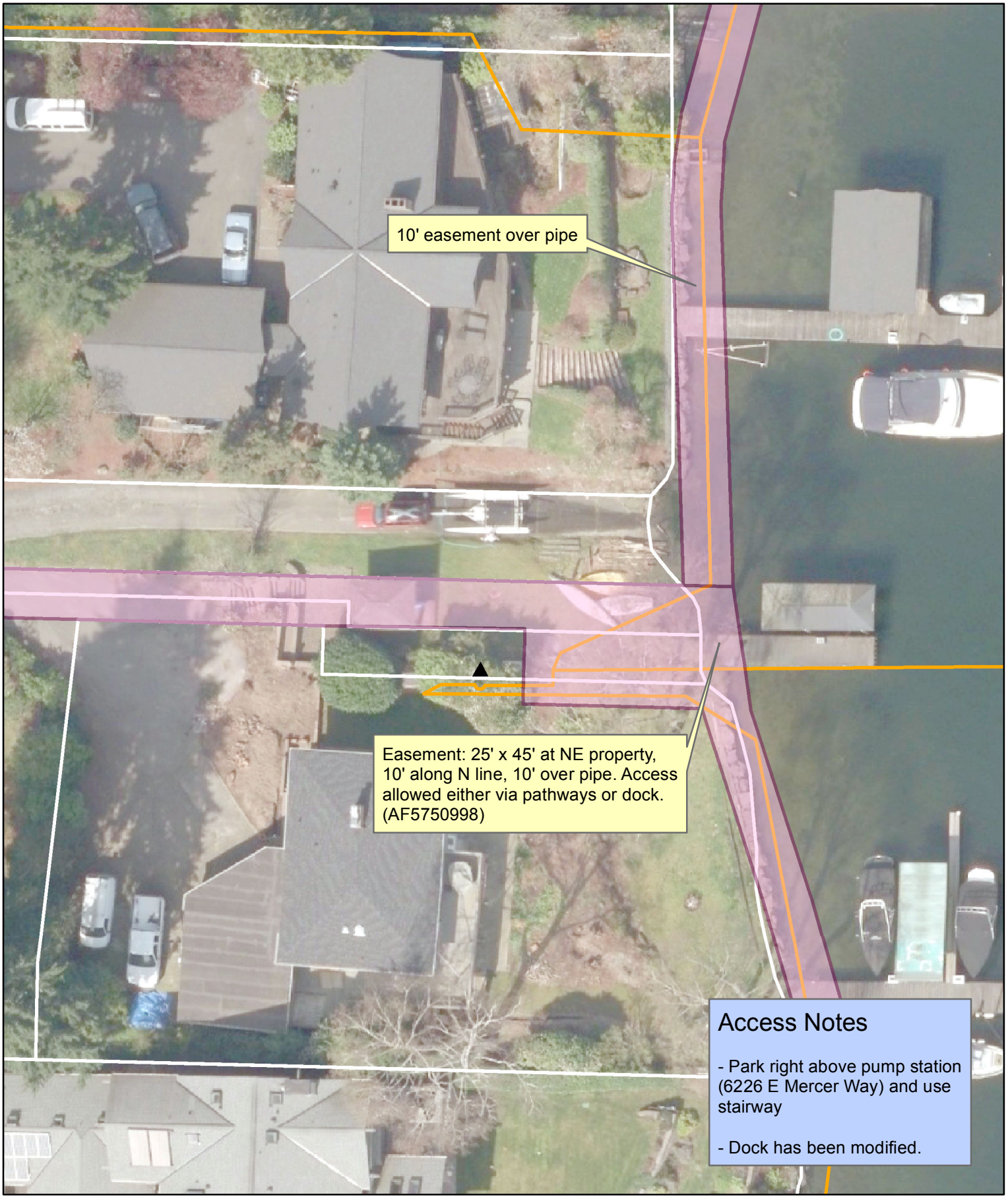
Pump Station Easements
Parcels
Sewer Main

0 15 30 60 90 Ft

Pump Station 21

IGS Information & Geographic Services

N

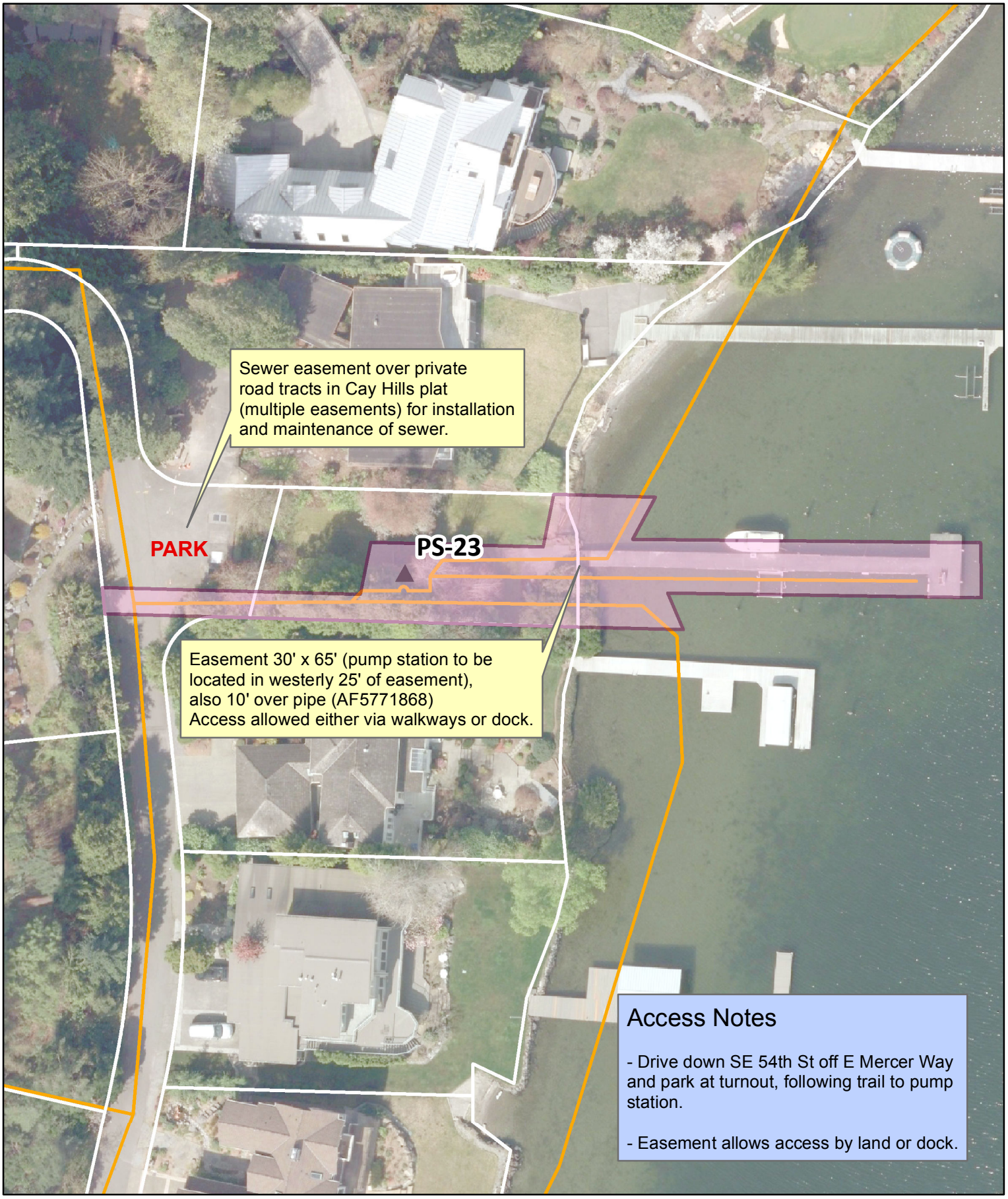


Pump Station Easements
Parcels
Sewer Main
0 5 10 20 30 Ft

Pump Station 22

IGS Information & Geographic Services

N



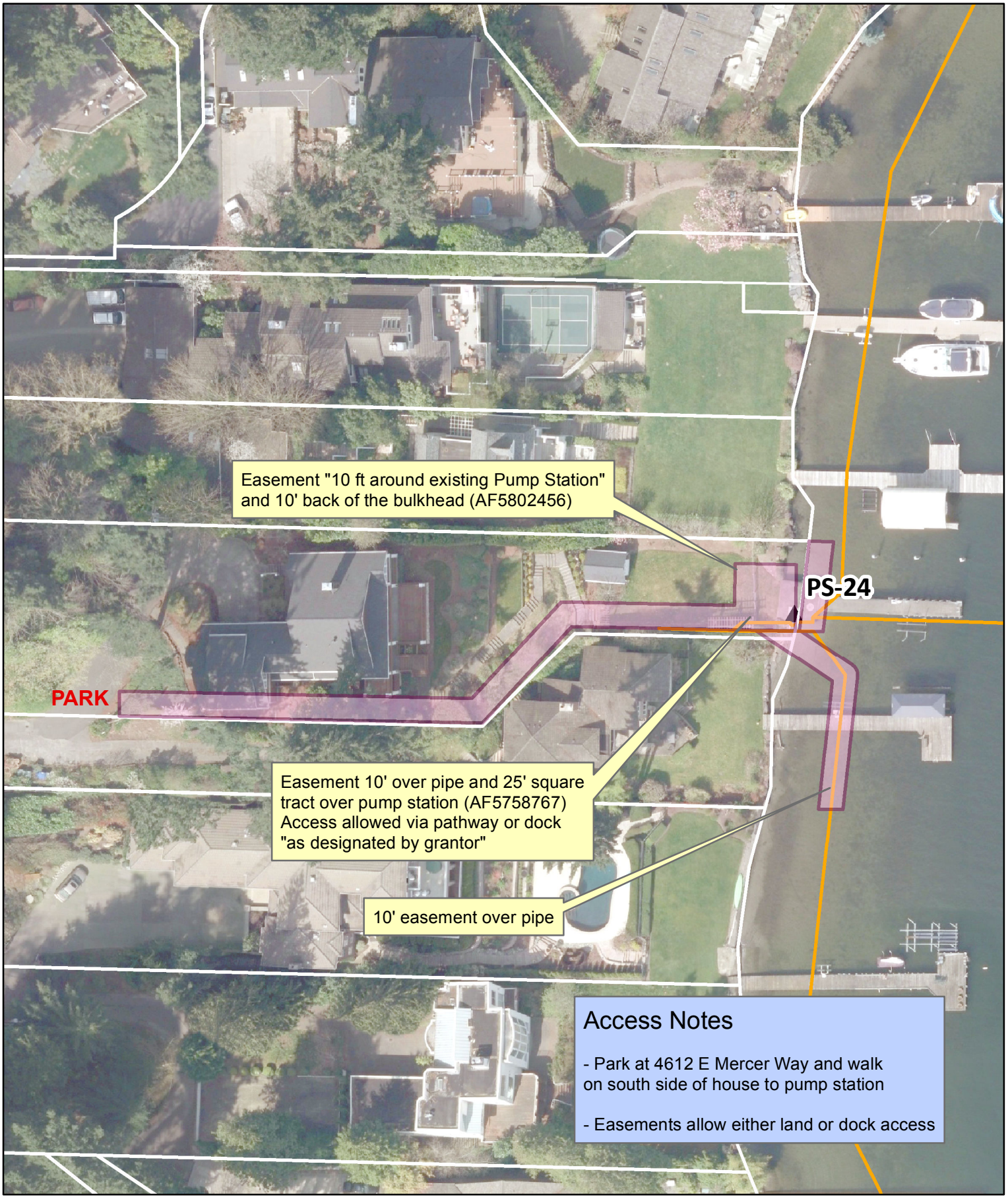
Pump Station Easements
Parcels
Sewer Main

0 15 30 60 90 Ft

Pump Station 23

IGS Information & Geographic Services

N

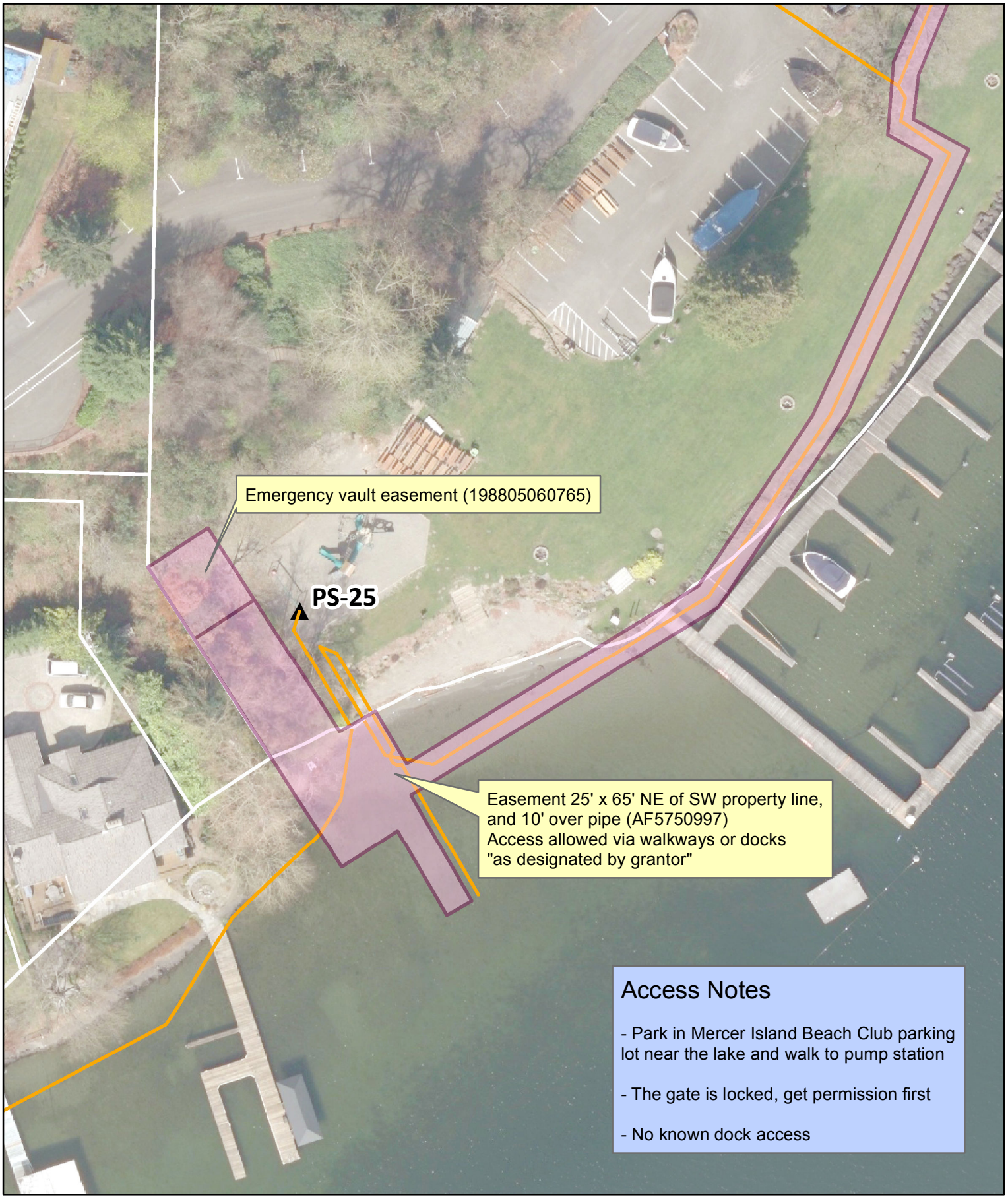


Pump Station Easements
Parcels
Sewer Main

0 15 30 60 90 Ft

Pump Station 24

N



Pump Station 25

Pump Station Easements
Parcels
Sewer Main

0 15 30 60 90 Ft

N

APPENDIX I – 2018 SEWER RATES

2018 UTILITY RATES

Water	CCF	Rate ($/CCF)	Effective Date
Single Family Residences	0 - 10 CCF	$ 3.86	
	11 - 20 CCF	$ 6.53	
	21-30 CCF	$ 7.84	
	Over 30 CCF	$ 10.54	
Multi-family Residences	All Usage	$ 5.72	
Commercial	Winter use	$ 3.55	Oct 1 - May 31
	Summer use	$ 8.83	June 1 - Sept 30
Irrigation	Winter use	$ 5.31	Oct 1 - May 31
	Summer use	$ 11.17	June 1 - Sept 30

Water Conservation Surcharge:	CCF	Rate ($/CCF)	Effective Date
Single Family Residences	0 - 20 CCF	$ -	
	21-30 CCF	$ 0.10	June 1 - Sept 30
	Over 30 CCF	$ 0.30	June 1 - Sept 30

King County Sewage Treatment		Rate
Single Family Residences	Fixed charge per dwelling	$88.44
Multi-family Residences	Actual water consumption	$5.90 / CCF
Commercial	Actual water consumption	$5.90 / CCF

Sewer Line Maintenance			Rate
Single Family Residences	Base Charge	$41.76	
based on average winter water usage*	Over 6 CCF		$6.96 / CCF
Multi-family Residences	Actual water consumption		$6.96 / CCF
Commercial	Actual water consumption		$6.96 / CCF
Billing Cost	Fixed charge per account		$8.15

Average winter water usage is based on the average water used during the current winter months of December through March or January through April, depending on billing cycle.

Storm Drain		Rate
Single family residence - per residence	per residence	$33.59
Commercial and Multi-family	per measured impervious surface unit	$33.59

Emergency Medical Services		Rate
Single family residence	per residence	$9.14
Multi-family residence	per number of units	$9.14
Commercial	per business	$9.14
Public Schools	per school	$9.14
Other Public Entities	per entity	$9.14
Residential Board & Care and 24 Hour Nursing:	Availability Rate - per ESU	$9.14
	Demand Rate - per EMS Call	$0.00

Bi-Monthly Meter Charge	Rate
Meter Size (All Customer Classes)	
3/4 Inch or Smaller	$ 32.53
1 Inch	$ 81.33
1-1/2 Inch	$ 162.65
2 Inch	$ 260.24
3 Inch	$ 520.48
4 Inch	$ 813.25