FINAL REPORT

# City of Millersburg
# Sanitary Sewer System Master Plan

*Prepared for*

City of Millersburg

March 2017

ch2m

2020 SW 4th Avenue, Suite 300
Portland, Oregon 97201-4973

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# Acronyms and Abbreviations

| | |
|---|---|
| A-M WRF | Albany-Millersburg Water Reclamation Facility |
| City | City of Millersburg |
| DEQ | Oregon Department of Environmental Quality |
| EPA | U.S. Environmental Protection Agency |
| ft | foot |
| ft/s | feet per second |
| GIS | geographical information system |
| gpm | gallons per minute |
| I-5 | Interstate 5 |
| N/A | not applicable |
| NOAA | National Oceanic and Atmospheric Administration |
| NPDES | National Pollutant Discharge Elimination System |
| O&M | operations and maintenance |
| RDII | rainfall-dependent infiltration and inflow |
| SSO | sanitary sewer overflow |
| SSOAP | Sanitary Sewer Overflow Analysis and Planning |
| TBD | to be determined |
| TDH | total dynamic head |
| UH | unit hydrograph |

# Executive Summary

## Introduction

The purpose of this master plan is to assess City of Millersburg sanitary sewer system needs and recommend system improvements to enable the City to continue providing reliable service, protect the public, protect the environment, meet regulatory requirements, and support the long-term goals of the community. This master plan does the following:

- Estimates growth in the service area and associated peak flows to plan for future community needs
- Develops hydraulic modeling to assess existing and future system capacity deficiencies
- Recommends projects that meet current and future capacity needs and address operations and maintenance (O&M) issues
- Recommends improvements to the City's O&M strategy and policy
- Develops a 20-year capital improvement plan that optimizes the City's infrastructure reliability
- Estimates implementation costs and outlines a suggested implementation schedule

## Existing System Description and Study Area Land Use and Population

The sanitary sewer system consists of approximately 23 miles of pipeline including approximately 20 miles of gravity sewers and 3 miles of force main. The gravity sewer pipes range in diameter from 6 to 36 inches. The smallest force main pipes are 4 inches in diameter and the largest are 12 inches. The system includes five active pump stations. The system conveys wastewater to the Albany-Millersburg Water Reclamation Facility (A-M WRF) for treatment.

The study area encompasses nearly 2,900 acres. Approximately 800 of these acres, which include wetlands and creeks in the northern portion of the study area, Talking Waters Garden, and the portion of the International Paper site west of the railroad tracks, will not be developed in the future. The remaining 2,100 acres are expected to be developed in the future based on zoning. The largest zone category, rural residential, composes approximately 46 percent of the total service area. The second most common zone is heavy industrial at 33 percent.

Based on Portland State University Population Research Center census data and growth trends, the City of Millersburg 2016 population is estimated at 1,686. Currently, there are 484 acres zoned for residential use remaining to be developed. The City expects Millersburg to be built out using minimum 10,000-square-foot lots. Assuming 2.5 people per household, this results in the City adding 5,271 people by buildout. Using this method, the buildout population is estimated to be 6,957.

## Analysis of Existing Flows and Precipitation Data

Sanitary sewer system flow monitoring data and local precipitation data were collected to develop existing system loading for development of a hydraulic model of the sewer system and to identify variability in the existing system from rainfall-dependent infiltration and inflow (RDII).

The City of Millersburg operates four sanitary sewer system flow monitors at the following locations: parking lot of Duraflake Company, 1600 Old Salem Road, Willamette Industries, and Waverly Avenue, North of the A-M WRF. Two additional temporary flow monitors were installed to collect flow data needed to characterize system performance: the first off Morningstar Road NE near the Morningstar pump station in the north part of the collection system, and the second south of Conser Road. The flow monitors were installed on December 11, 2015, and flow monitoring data were collected between December 15, 2015, and March 2, 2016. Precipitation data were obtained from an existing gage operated by the City of Albany at the A-M WRF.

The U.S. Environmental Protection Agency (EPA) Sanitary Sewer Overflow Analysis and Planning (SSOAP) Toolbox was used to evaluate flow monitoring data to derive existing system dry weather loading, diurnal patterns, and wet weather parameters for integration into the hydraulic model.

# Planning Criteria

The State of Oregon has acknowledged the improbability of designing and constructing collection systems capable of preventing SSOs for all storm events; however, it determined that all wastewater collection systems should be designed for and capable of conveying storm events up to a particular size. DEQ has decided to consider the 5-year, 24-hour storm between November 1 and May 21 and the 10-year, 24-hour storm event between May 22 and October 31. In the Willamette Valley, the 5-year storm that includes groundwater infiltration (between November 1 and May 21) flows is typically greater and is therefore used in this case.

To assess specific system elements, the following criteria were used to identify hydraulic capacity deficiencies:

- Maximum freeboard at a manhole is less than 3 feet from ground surface and the pipe is surcharged during the design event.
- Force main water velocity exceeds 7 feet per second.
- Pump station capacity with largest pump out of service does not meet the influent peak flow rate.

Analysis of the collection system was conducted using RDII flows produced by a design storm developed for this master plan. For this plan, the design storm has at least a 5-year return interval with a 24-hour precipitation depth. Design storm selection dictates the level of protection from potential overflows that the associated improvements will provide.

DEQ requires that pump stations be evaluated based on capacity with the largest pump out of service (firm capacity).

# Development and Calibration of Collection System Model

A hydraulic model was constructed with current geographical information system (GIS) information for pipe size, length, geometry, and invert data and imported into XPSWMM, a fully dynamic hydraulic model that solves the complete dynamic wave equations for gradually varied flow and can simulate backwater, surcharging, split flows, looped connections, and various hydraulic appurtenances that typically occur in sewer collection systems—such as pump stations and weirs.

The model identifiers for pipelines and manholes remained consistent with the GIS unique identifiers to maintain a direct link between the model and GIS. Only pipelines 8 inches and larger were imported to the model. Pump station information was incorporated into the model based on as-built drawings showing wet well dimensions and control settings and pump curves provided by the City.

Existing system dry weather loading was developed from flow monitoring data. Dry weather flows were estimated per acre loading rates from current flow monitoring data. All system loadings were scaled to flow rates established during dry weather conditions at the flow monitoring locations to incorporate wastewater generation and groundwater infiltration.

Model calibration was performed to develop an estimate of flows for dry and wet weather conditions. Model parameters were adjusted such that flow meter data collected matched the modeled results within a reasonable tolerance during dry periods and wet weather events. The calibrated model was used to estimate the influence of wet weather RDII in the system for the 5-year, 24-hour design storm.

# Characterization of Existing System Capacity Deficiencies

Using the XPSWMM collection system model, an assessment was performed to identify existing sanitary sewer system capacity deficiencies. Because of system changes currently in process, two existing-condition scenarios were simulated: (1) existing conditions as of June 2016 and (2) existing conditions after pump station improvements and approval of Duraflake process wastewater discharge

Concurrent with development of this master plan, improvements to the ATI and Morningstar pump stations are being designed to address maintenance and operation issues. At present, both of these pump stations have a stacked-can design with a wet well under the dry well. These pump stations use a vacuum-prime system. Because of the solids in the sewer, there are maintenance issues related to unplugging the priming system. Both of these pump stations have been known to overflow—usually because of a power outage. The pump station improvements should be complete by the end of 2017, so an additional existing model simulation was created to take those improvements into consideration.

Also, at present, no industrial users discharge process wastewater to the sanitary sewer system. Industrial users are only permitted to discharge domestic wastewater. Duraflake, however, recently received approval to discharge up to 8,000 gallons per day (gpd) of process wastewater to the sanitary sewer. Therefore, the second scenario accounts for this.

Existing conditions modeling results are summarized in Table ES-1.

Table ES-1. Existing Conditions Hydraulic Capacity Modeling Results

| Existing Condition Scenario | Hydraulic Capacity Modeling Results |
|---|---|
| Existing conditions as of today | Pipelines meet capacity criteria. Morningstar pump station currently does not have sufficient firm capacity to meet the peak flows. Additionally, the ATI pump station is at firm capacity. |
| Existing conditions after pump station improvements and approval of Duraflake process wastewater discharge | Pipelines meet capacity criteria. Pump stations will have adequate firm capacity. |

# Characterization of Future System Capacity Deficiencies

For this master plan, two future planning horizons were modeled: 20 years and buildout.

It was assumed for the 20-year model simulation that north of Conser Road ½ of the undeveloped residentially-zoned parcels would be developed and ½ of the industrially-zoned parcels would develop. South of Conser Road, ½ of the undeveloped residentially-zoned parcels would be developed. No new heavy industrial flows would be generated south of Conser Road in the next 20 years.

The buildout conditions model was divided into two scenarios: (1) without heavy industrial flows and (2) with heavy industrials flows. Most of the heavy industry is south of Conser Road and does not contribute flow in the 20-year scenario. For the first buildout scenario, the entire service area is assumed to be developed with the exception of heavy industrial users. For the second buildout scenario, the entire service area is assumed to be developed with heavy industrial flows added until a collection system pipe surcharges.

Future conditions modeling results are summarized in Table ES-2.

Table ES-2. Future Conditions Hydraulic Capacity Modeling Results

| Future Condition Scenario | Hydraulic Capacity Modeling Results |
|---|---|
| 20-year | Pipelines meet capacity criteria. Morningstar pump station will not have sufficient firm capacity to meet the projected peak flows. ATI will be at firm capacity. |
| Buildout without Heavy Industrial Flows | Pipelines meet capacity criteria. Morningstar, Millersburg, ATI pump stations will not have sufficient firm capacity to meet the projected peak flows. The Morningstar force main peak velocity will exceed 7 feet per second. |
| Buildout with Heavy Industrial Flows | System is able to accept additional 630 gpm before any pipe surcharges. Heavy industrial flows may be added to (1) the main trunk running from Conser Road along the train tracks to ATI pump station, (2) the collection pipes near Arnold Road, and (3) the collection pipes along Nygren Road, but the added flow should not surpass 630 gpm without increasing the capacity of the main trunk pipeline and potentially the ATI pump station. Although the City's collection system is capable of conveying heavy industrial flow, the model should be updated with each additional new industrial discharge to verify no deficiency is created. |

# Development and Evaluation of Capital Improvement Projects

Capital improvement projects were developed to address capacity deficiencies (as identified by the hydraulic analyses for the existing and 20-year future conditions) and to address O&M issues identified by operations staff.

Capital improvement projects were developed to upgrade the pump stations with potential capacity deficiency issues. RDII reduction was not considered a viable option in this instance because both Morningstar and ATI pump stations have operational problems. Even with RDII reduction, pump station improvements would still need to take place, so the decision to improve the design and expand capacity was made. Also, it was not found practical to bypass the capacity-deficient pump stations. The pump station capacity improvements were developed in conjunction with necessary operations and maintenance improvements as identified by operations staff.

Projects were developed for the ATI and Morningstar pump stations. The projects for each pump station were developed to be implemented in two phases because pumps have a 20-year design life and to ensure better pump efficiencies during the useful life of the pump station.

# Recommended Plan

The recommended plan is summarized in Table ES-3 with cost estimates and a suggested implementation schedule.

Table ES-3. Recommended Projects, Cost Estimates, and Suggested Implementation Schedule

| Project | Estimated Costs[a] | Suggested Year to Implement |
|---|---|---|
| ATI Pump Station Upgrades: alter configuration and install higher capacity pumps; install new generator onsite | $650,000 | 2017 |
| ATI Pump Station Pump Replacement: install higher capacity pumps | $66,500 | TBD[b] |
| Morningstar Pump Station Upgrades: alter configuration and install higher capacity pumps; install generator onsite | $750,000 | 2017 |

Table ES-3. Recommended Projects, Cost Estimates, and Suggested Implementation Schedule

| Project | Estimated Costs[a] | Suggested Year to Implement |
|---|---|---|
| Morningstar Pump Station Pump Impeller Size Increase: overhaul pumps and install a larger impeller | $32,000 | TBD[b] |
| Collection System Condition Assessment | $106,000 | 2026 |
| Expand Sewer Collection System to Unserved Parts of City | TBD[c] | TBD[b] |

[a] These planning-level cost estimates were developed for construction, planning, design, and services during construction of the recommended projects. They are Class 4, planning-level cost estimates as established by the American Association of Cost Engineers with an expected accuracy range of -20 to -30 percent and +30 to +50 percent.

[b]Suggested year depends on future flows.

[c]Developers to pay expenses related to expansion

TBD = to be determined.

SECTION 1

# Introduction

## 1.1 Purpose

The purpose of this master plan is to assess City of Millersburg sanitary sewer system needs and recommend system improvements to enable the City to continue providing reliable service, meet regulatory requirements, protect the public, protect the environment, and support the long-term goals of the community. This master plan does the following:

- Estimates growth in the service area and associated peak flows to plan for future community needs
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## 1.2 Intended Readers

This master plan was written for the following readers:

- Managers and staff of City of Millersburg to document the overall plan
- Members of the public to provide a better understanding of City of Millersburg services and responsibilities, ongoing operations and maintenance activities, facility condition, and recommended concepts to meet current and future needs and requirements
- Subsequent engineering study and design teams for successful project implementation

## 1.3 Organization of the Master Plan

This master plan is organized to present the logical development of recommended projects to maintain and improve the sanitary sewer system in keeping with Oregon Department of Environmental Quality *Guidelines for the Preparation of Facilities Plans and Environmental Reviews for Community Wastewater Projects* (DEQ, 2005).

Section 2 describes the existing wastewater collection system facilities and outlines current and future land use characteristics in the service area, which are used in the development of the hydraulic model for current and future flows. Section 3 analyzes existing flows and precipitation data and describes additional flow monitoring that was performed to facilitate development of this plan and used to calibrate the hydraulic model. Section 4 describes the performance criteria and design storm that were used to assess the sanitary sewer system capacity. Section 5 outlines development of the hydraulic model and the calibration and validation steps to determine whether the model sufficiently reflects the way the sanitary sewer system handles flow.

Sections 6 and 7 analyze modeling results for existing and future conditions and identifies existing and potential system capacity deficiencies.

Section 8 outlines the development and evaluation of projects to address capacity deficiencies and operation and maintenance issues identified by City of Millersburg operation staff. In conclusion, Section 9 describes the recommended projects and provides planning-level cost estimates with suggested implementation schedules.

# Existing System Description and Study Area Land Use and Population

## 2.1 Existing System Description

The City's original sewage collection system was constructed in 1979 and consisted of approximately 3 miles of main line serving southern Millersburg. Over the next 30 years the system was expanded to support northern Millersburg. Previously, all residential area had individual septic systems. The system collects domestic wastewater generated by the inhabitants of the City of Millersburg and the employees of existing industries in the service area. The service area lies between Interstate 5 (I-5) and the north/south railroad tracks. The area reaches north of Millersburg Drive NE and south to approximately Knox Butte Avenue NE. As shown in Figure 2-1, the existing wastewater collection system serves the developed areas of Millersburg.

The system consists of approximately 23 miles of pipeline including approximately 20 miles of gravity sewers and 3 miles of force main. The gravity sewer pipes range in diameter from 6 to 36 inches. The smallest force main pipes are 4 inches in diameter and the largest are 12 inches. Table 2-1 shows the total lengths of pipe for each pipe diameter present in the system.

Table 2-1. Pipe Diameter Data

| Diameter (inches) | Total Length of Gravity and Force Main Pipe (feet) |
|---|---|
| 2 | 294 |
| 4 | 1,519 |
| 6 | 2,930 |
| 8 | 78,460 |
| 12 | 9,201 |
| 15 | 2,974 |
| 16 | 4,821 |
| 18 | 6,265 |
| 20 | 116 |
| 21 | 13,326 |
| 24 | 1,717 |
| 36 | 262 |
| Total Length | 121,884 |
| Total Length (miles) | 23 |

The Cities of Millersburg and Albany have an intergovernmental agreement (IGA) for sanitary sewer service since 1996 and wastewater treatment since 2007. The IGA establishes cost sharing for capital construction costs and operating costs for wastewater and sewer facilities and each City's responsibilities.

The Millersburg sanitary sewer system includes six pump stations. Five are located within the service area. As part of the IGA, Albany operates and maintains these five pump stations, which are publicly owned. Two are in the northern half of the service area, and three are in the southern half. The sixth pump station is not located in the service area, but at the Albany-Millersburg Water Treatment Plant. The firm capacities and construction years of the pump stations are shown in Table 2-2, which also provides alternate pump station names and the City of Albany pump station numbers for cross reference. A force main from each pump station discharges into gravity sewers and eventually convey flow to the Albany-Millersburg Water Reclamation Facility (A-M WRF) and Talking Waters Garden for treatment.

The A-M WRF was constructed jointly by the Cities of Albany and Millersburg and began operations in 2009. Its peak wet weather capacity is 68 million gallons per day (mgd) and its average dry day capacity is 12.3 mgd. It uses activated sludge process to provide secondary wastewater treatment. Talking Waters Garden provides additional natural treatment to remove nutrients and lower the temperature of A-M WRF effluent. The A-M WRF is located at the southwest tip of the service area on Waverly Drive NE in Albany, Oregon. Although the A-M WRF is jointly owned, Albany holds the National Pollutant Discharge Elimination System (NPDES) permit. Operational costs are divided between the two cities based on wastewater generation into A-M WRF. Flow monitor MI_05 (see Section 3.2.1.) measures the amount of flow to A-M WRF and the City of Millersburg pays the City of Albany accordingly.

Table 2-2. Pump Station Summary

| Pump Station Name | Alternate Pump Station Name | City of Albany Pump Station Number | Firm Capacity | Construction Year |
|---|---|---|---|---|
| ATI | Wah Chang; Murder Creek | 12 | 1,300 gpm at 47 ft TDH | 1979 |
| Burkhart | | 15 | 250 gpm at 25 ft TDH | 1986 |
| Morningstar | Millers Cemetery Road | 17 | 750 gpm at 90 ft TDH | 1985 |
| Millersburg Drive | Crooks Creek | 18 | 450 gpm at 51 ft TDH | 1992 |
| Truax Creek | | 16 | Not In Service | 1986 |
| Albany-Millersburg Water Treatment Plant | | N/A | - | 2006 |

ft = foot.

gpm = gallons per minute.

TDH = total dynamic head.

# 2.2 Land Use

The study area encompasses nearly 2,900 acres. Approximately 800 of these acres will not be developed in the future. These areas include:

- Wetlands and creeks in the northern portion of the study area.
- Talking Waters Garden site.
- International Paper site, which includes a paper mill (removed), treatment lagoons, and a landfill. It is unlikely that the treatment lagoons and landfill will be developed, but will be converted to wetlands and covered in place, respectively.

The remaining 2,100 acres are expected to be developed in the future based on zoning. For this planning effort, these acres were divided into nine basins similar to those delineated in the 1981 *City of Millersburg, Oregon, Master Sanitary Sewer Plan* (CH2M HILL, 1981). The boundaries of the basins are largely based on gravity flow directions in the sewers. The basins and zoning areas are shown on the map provided in Figure 2-2.

Existing land use consists of the following ten zones:

- Commercial Center (CC)
- Public (PUB)
- Heavy Industrial (HI)
- Rural Residential with Minimum Size 2.5 Acres (RR2.5)
- Rural Residential with Minimum Size 10 Acres (RR10)
- Limited Industrial/Commercial (LIC)
- Limited Industrial (LI)
- Urban Residential (UR)
- Green (GRN)
- Water (WATER)

The largest zone category, rural residential (RR2.5 and RR10), composes approximately 46 percent of the total developable area (areas that are developed or will be developed in the future). The second most common zone is heavy industrial at 33 percent. The land use designations of areas currently developed or planned to be developed are summarized in Table 2-3 for the nine basins.

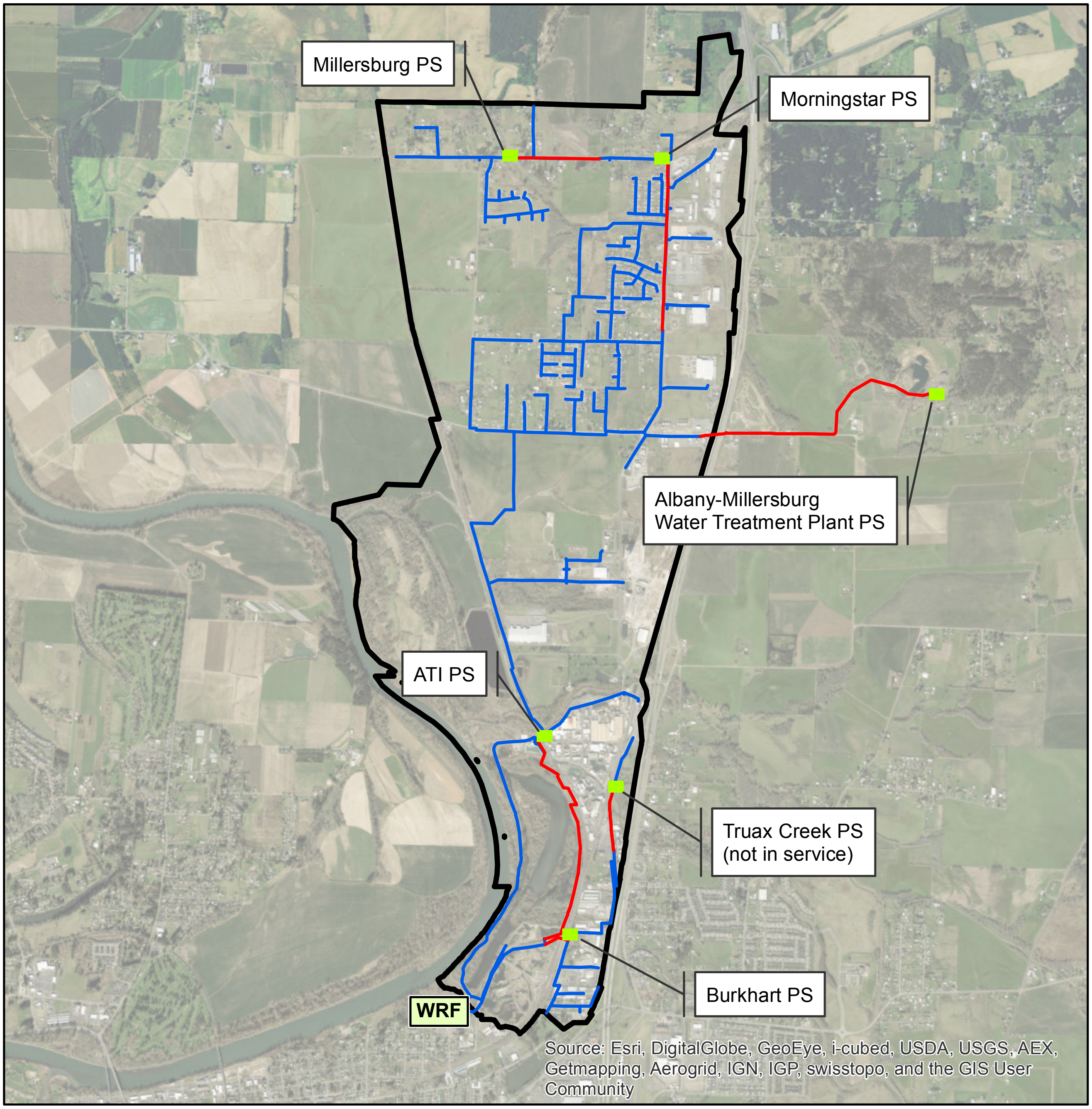
Table 2-3. Land Use Designation by Basin of Areas Currently Developed or to Be Developed in the Future

| | Basin | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Zone** | **A** | **B** | **C** | **D** | **E** | **F** | **G** | **H** | **I** | **Total** |
| Commercial Center | 0 | 8 | 2 | 0 | 10 | 0 | 0 | 0 | 3 | 24 |
| Public | 3 | 0 | 12 | 0 | 0 | 1 | 0 | 16 | 0 | 32 |
| Heavy Industrial | 0 | 0 | 0 | 27 | 4 | 1 | 437 | 150 | 72 | 691 |
| Rural Residential RR2.5 | 101 | 132 | 45 | 0 | 72 | 120 | 0 | 0 | 0 | 471 |
| Rural Residential RR10 | 299 | 127 | 0 | 0 | 0 | 62 | 0 | 0 | 0 | 489 |
| Limited Industrial/Commercial | 0 | 49 | 0 | 0 | 0 | 0 | 0 | 0 | 89 | 138 |
| Limited Industrial | 0 | 168 | 67 | 13 | 0 | 0 | 0 | 0 | 0 | 248 |
| Urban Residential | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 11 |
| Green | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Water | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 403 | 485 | 127 | 40 | 86 | 184 | 437 | 166 | 175 | 2,103 |

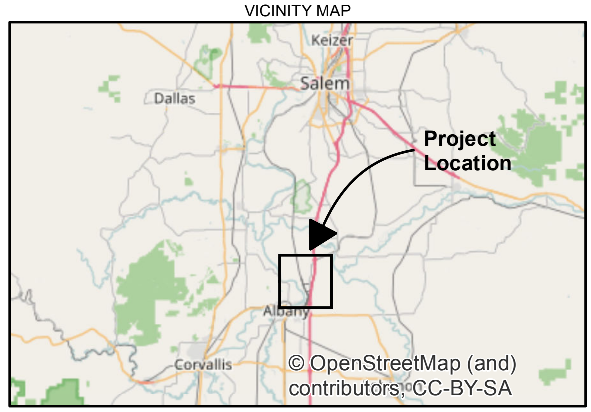
## 2.3 Population

The population of Millersburg has grown faster than predicted in previous years. Based on Portland State University Population Research Center (PRC) census data, the City grew 104.1 percent over 10 years from 2000 to 2010. During this period, the population grew from 651 to 1,329 people with an average annual growth rate of 7.4 percent. Based on PRC 2010 to 2015 population data (Portland State University, 2016), a 5-year growth rate for the City was calculated to be 21.9 percent. The 2015 PRC projection for Millersburg is 1,620. Continuing the trend from the previous 5 years, the 2016 population is estimated at 1,686.

Currently, there are 971 developable acres zoned for residential use. 487 of these acres have already been developed, leaving 484 acres to be developed. According to discussions with the City, the City expects Millersburg to be built out using minimum 10,000-square-foot lots. Assuming 2.5 people per household, this results in the City adding 5,271 people by buildout. Using this method, the buildout population is estimated to be 6,957.




VICINITY MAP



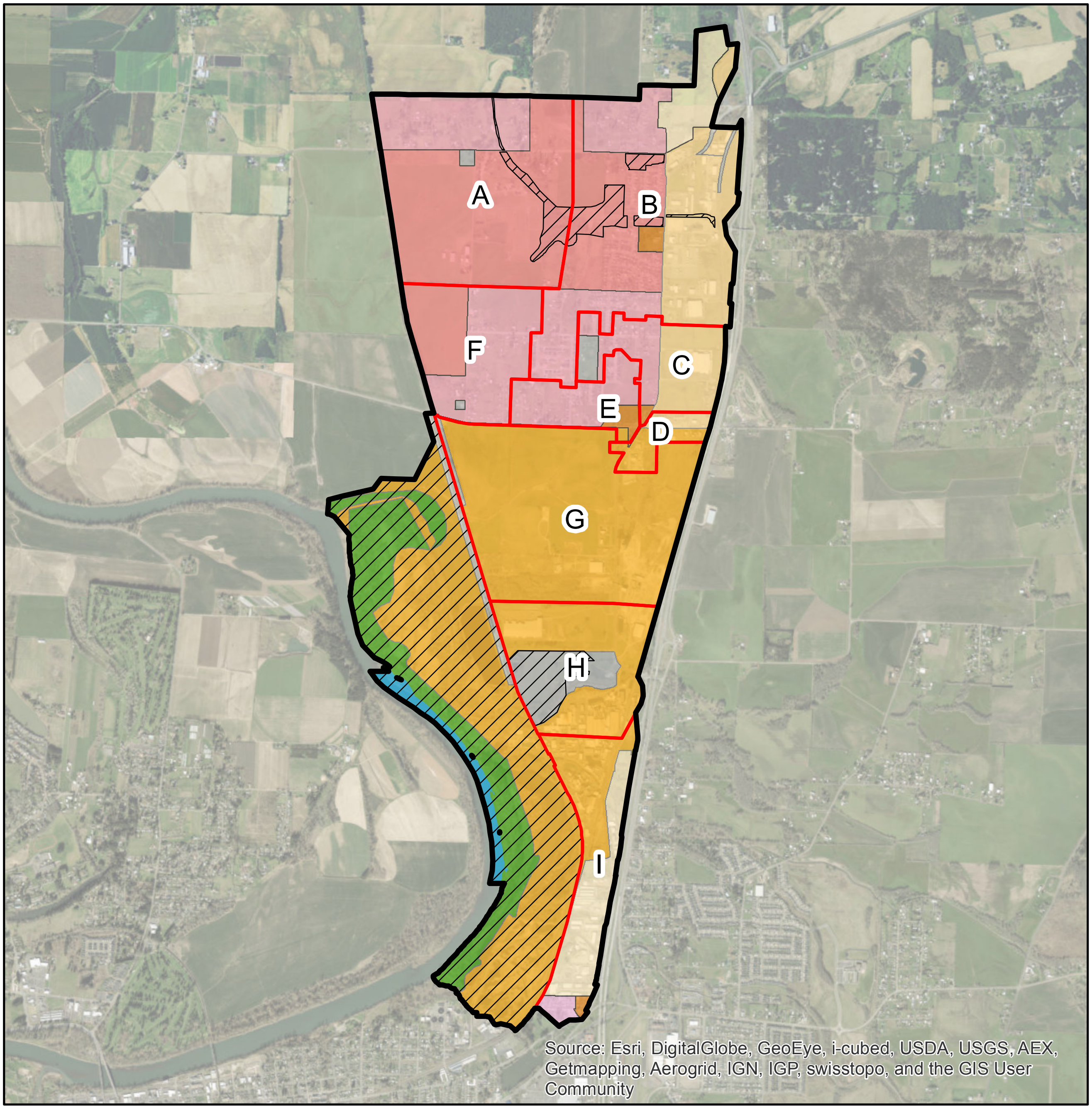

## Legend

- **WRF** Albany-Millersburg Water Reclamation Facility
- Pump Station
- Force Main
- Gravity Sewer
- City Limits

N

0 2,000 4,000 8,000 Feet

**FIGURE 2-1**
**Existing System**




**Legend**

- City Limits
- Basins
- Area Not Developed in Future

**ZONING**

- Green (GRN)
- Commercial Center (CC)
- Heavy Industrial (HI)
- Limited Industrial (LI)
- Limited Industrial/Commerical (LIC)
- Rural Residential 10UC (RR10)
- Rural Residential 2.5UC (RR2.5)
- Urban Residential (UR)
- Public (PUB)
- Water (WATER)

N

0 2,000 4,000 8,000 Feet

VICINITY MAP

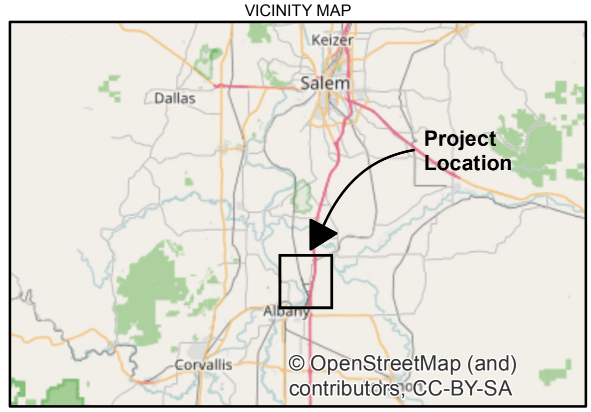



**FIGURE 2-2**
**Land Use**

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# Analysis of Existing Flows and Precipitation Data

## 3.1 Introduction

An important objective of wastewater collection system flow monitoring is to assess total wet and dry weather flows to the A-M WRF. Collection systems designed to convey wastewater also convey a certain quantity of rainfall-dependent infiltration and inflow (RDII), which leaks into the system through defects such as cracked or broken pipes, defected pipe joints, poorly constructed lateral service connections, and possibly through cross connections with the stormwater system or other direct connections from foundation or roof drains. RDII is the flow entering the sewer system as a direct result of rain. RDII increases total flow volume and peak flow, and consists of two components: infiltration, which slowly percolates into the collection system; and inflow, which reaches a peak shortly after rainfall intensity is greatest and falls off rapidly when rain subsides. Collection system RDII increases the cost of operation and can lead to overloaded pipes and pump stations, which can lead to overflows of raw sewage into the streets or nearby bodies of water, creating a health and environmental hazard.

Infiltration and inflow contributions may be assessed by analyzing the relationship between collection system flow and rainfall. Collection systems show an increase in flow during periods of heavy rain and high groundwater. Flow monitoring data are used to quantify RDII and to identify its general area of origin. Infiltration may be distinguished from inflow by examining the response time of system flow following a rainfall event. Comparison of collection system monitoring records before and after system rehabilitation can be used to assess the effectiveness of RDII reduction efforts.

## 3.2 Flow Monitoring

### 3.2.1 Existing Flow Monitoring

The City of Millersburg operates four sanitary sewer system flow monitors, as listed in Table 3-1. Three of them measure domestic wastewater discharges from three industries in the service area (these discharges do not include process wastewater). Process wastewater is treated onsite and discharges to the Talking Waters Garden. The fourth is located immediately upstream of the A-M WRF. This monitor captures flow from the entire system. The monitoring locations are shown in Figure 3-1.

Table 3-1. Existing City of Millersburg Sanitary Sewer System Flow Monitors

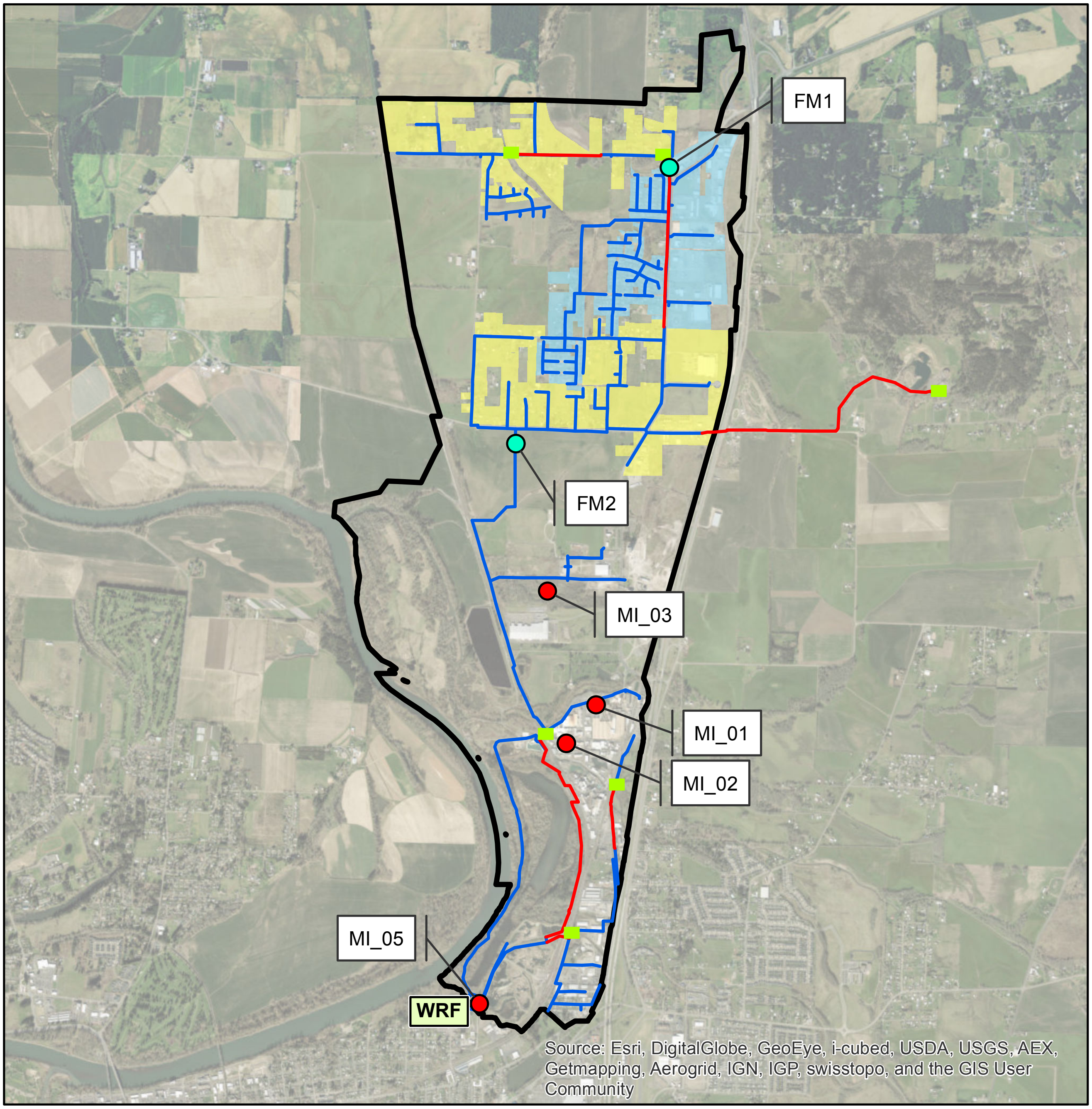
| Flow Monitor ID | Location | Type of Flow Measured |
|---|---|---|
| MI_01 | Parking lot of Duraflake Company | Domestic wastewater from Georgia Pacific and Duraflake |
| MI_02 | 1600 Old Salem Road | Domestic wastewater from ATI |
| MI_03 | Willamette Industries | Domestic wastewater from SRC, Camco, and International Paper |
| MI_05 | Waverly Avenue, North of A-M WRF | Wastewater from entire sanitary sewer system |

### 3.2.2 Additional Flow Monitoring

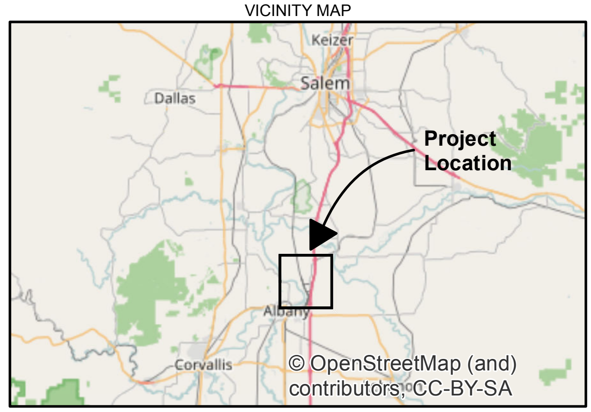
To collect additional flow monitoring data, two sanitary sewer flow monitors were installed: the first (FM1) off Morningstar Road NE near the Morningstar pump station in the north part of the collection system, and the second (FM2) south of Conser Road. The locations are shown in Figure 3-1, which also identifies areas contributing to FM1 or both FM1 and FM2. Contributing areas were identified based on active water billing records, and, for those tax lots (parcels) that did not have billing records because they were using well water instead, the City identified which ones discharge to the sanitary sewer system.

The flow monitors were installed by SFE Global, a company specializing in underground infrastructure assessment, monitoring, and environmental data management. The flow monitors had custom 600 millimeter compound weirs with concrete inflow and outflow pipes of 15 inches at Morningstar Road and 21 inches at Conser Road.

The flow monitors were installed on December 11, 2015, and flow monitoring data were collected between December 15, 2015, and March 2, 2016. Flows at these monitors are compared with rainfall in Figures 3-2 and 3-3.




VICINITY MAP




## Legend

WRF Albany-Millersburg Water Reclamation Facility

Pump Station

Force Main

Gravity Sewer

City Limits

### Additional Flow Monitor Contributing Areas

Area Contributing to FM1 and FM2

Area Contributing to FM2

Existing Monitor Location

Additional Monitor Location

N

0 2,000 4,000 8,000 Feet

**FIGURE 3-1**
**Flow Monitoring Locations**

ch2m

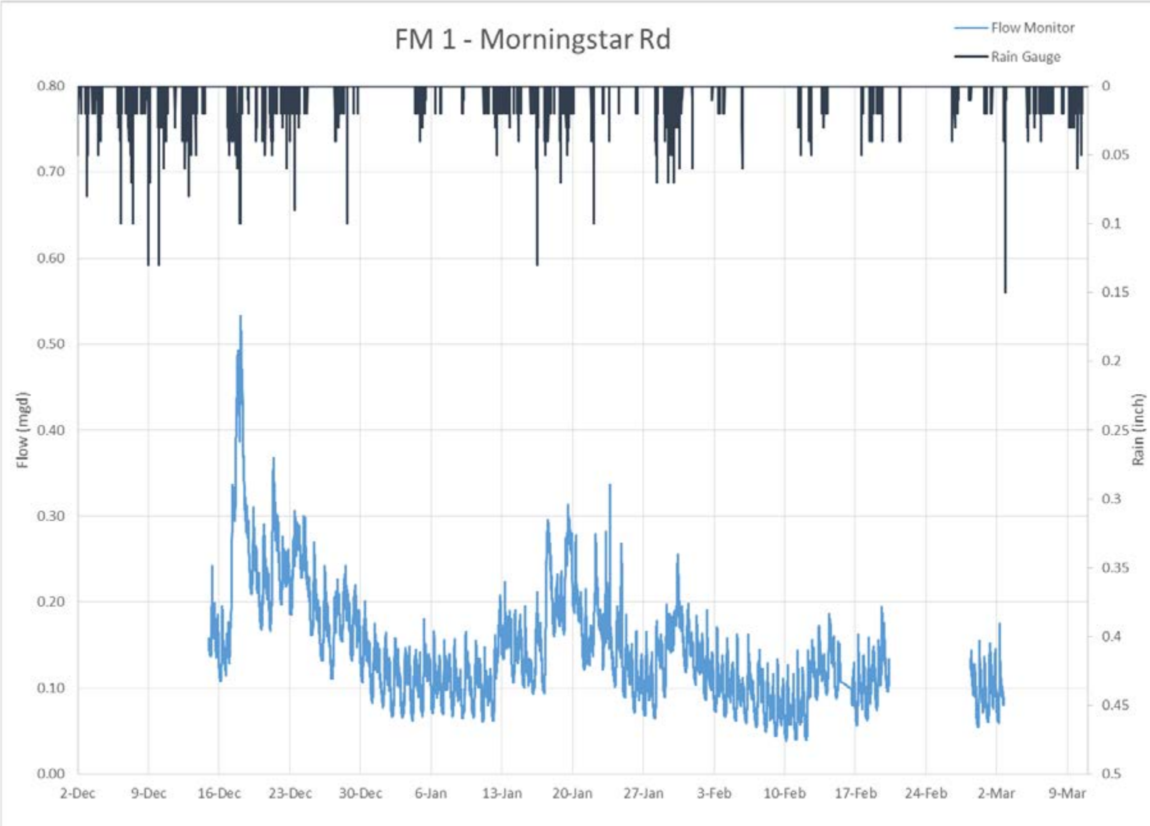



Figure 3-2. FM1 Flow Monitoring Data

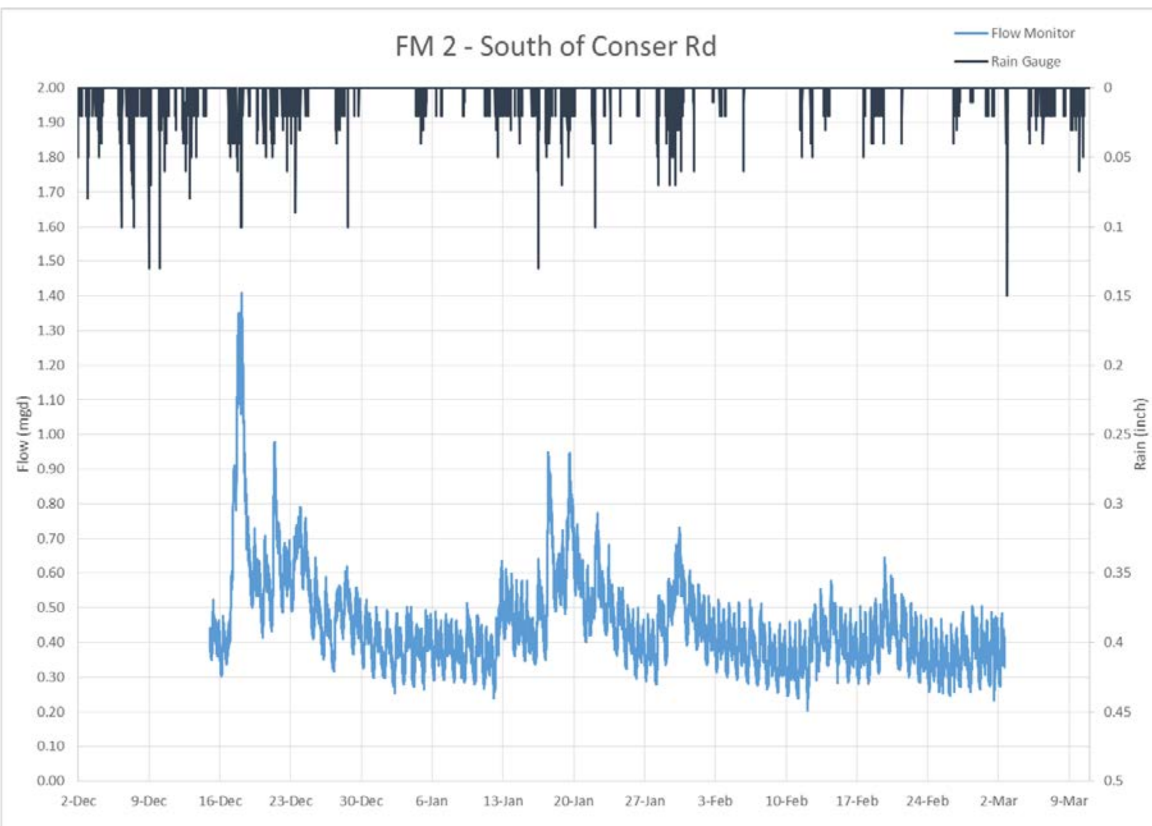



Figure 3-3. FM2 Flow Monitoring Data

# 3.3 Existing Flows

The City's MI_05 flow monitoring data are summarized in Table 3-2. Measurements of depth, flow, and velocity were provided at 5 minute intervals for a 6 month period from October 2015 to March 2016. The largest flow readings were recorded in December 2015.

Table 3-2. Flow Monitoring Data for MI_05
*mgd*

| Month | Maximum Instantaneous | Maximum Hour | Maximum Day |
|---|---|---|---|
| October 2015 | 0.858 | 0.658 | 0.355 |
| November 2015 | 0.983 | 0.571 | 0.376 |
| December 2015 | 1.931 | 1.518 | 1.050 |
| January 2016 | 1.130 | 0.969 | 0.784 |
| February 2016 | 0.900 | 0.659 | 0.513 |
| March 2016 | 1.288 | 0.945 | 0.750 |

Data from FM1 and FM2 were collected every 5 minutes from the monitors from mid December 2015 through early March 2016. Data collected included the flowrate and water level. During high periods of rain there were corresponding increases in flow at both monitors. The highest flows were in December at both monitors. Tables 3-3 and 3-4 summarize the flow statistics for FM1 and FM2, respectively.

Table 3-3. Flow Monitoring Data for FM1
*mgd*

| Month | Maximum Instantaneous | Maximum Hour | Maximum Day |
|---|---|---|---|
| December 2015[a] | 0.533 | 0.494 | 0.356 |
| January 2016 | 0.337 | 0.300 | 0.243 |
| February 2016 | 0.195 | 0.173 | 0.132 |
| March 2016[b] | 0.175 | 0.152 | 0.096 |

[a] Data available only for 12/16/2015–12/31/2015.

[b] Data available only for 3/1/2016–3/2/2016.

Table 3-4. Flow Monitoring Data for FM2
*mgd*

| Month | Maximum Instantaneous | Maximum Hour | Maximum Day |
|---|---|---|---|
| December 2015[a] | 1.410 | 1.348 | 0.916 |
| January 2016 | 0.949 | 0.934 | 0.713 |
| February 2016 | 0.644 | 0.606 | 0.455 |
| March 2016[b] | 0.489 | 0.463 | 0.364 |

[a] Data available only for 12/15/2015–12/31/2015.

[b] Data available only for 3/1/2016–3/2/2016.

# 3.4 Precipitation

Precipitation in the Willamette Valley can be heavy at times and can lead to very wet winter months. Most precipitation falls between the months of November to March; however, there can still be significant rain events in other months. There is no precipitation gage within City limits with an extensive period of record to confirm these trends. A survey of nearby gages was done to identify potential gages.

The National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information has a precipitation gage nearby in Corvallis. This gage (Gage Station 351862) was selected because of its close proximity to the study area, similarities in climatological behaviors, quality of data, and its length of data available. The annual average over the past 30 years is 42.30 inches of rainfall. Table 3-5 summarizes the historic monthly rainfall data over the 30 year period from 1986 to 2015 for Corvallis.

Table 3-5. Study Area Precipitation 1986–2015
*Corvallis Station (inches)*

| | | | Average Number of Days | | | |
|---|---|---|---|---|---|---|
| **Month** | **Mean** | **24-hour Maximum Precipitation** | **≥ 0.01"** | **≥ 0.1"** | **≥ 0.5"** | **≥ 1.0"** |
| January | 6.49 | 4.02 | 20.7 | 12.4 | 4.2 | 1.3 |
| February | 4.76 | 3.26 | 17.2 | 10.1 | 3.3 | 0.9 |
| March | 4.83 | 2.07 | 19.3 | 11.4 | 2.8 | 0.6 |
| April | 2.98 | 1.30 | 16.5 | 9.1 | 1.2 | 0.1 |
| May | 2.40 | 1.11 | 13.3 | 6.8 | 1.2 | 0.1 |
| June | 1.32 | 0.89 | 8.1 | 4.1 | 0.5 | 0.0 |
| July | 0.41 | 1.26 | 2.8 | 1.0 | 0.2 | 0.0 |
| August | 0.47 | 1.02 | 3.5 | 1.4 | 0.2 | 0.0 |
| September | 1.38 | 2.94 | 6.3 | 3.3 | 0.7 | 0.2 |
| October | 3.11 | 2.00 | 13.5 | 7.0 | 2.0 | 0.3 |
| November | 6.55 | 4.45 | 20.6 | 13.2 | 4.6 | 1.3 |
| December | 7.61 | 3.43 | 21.5 | 13.5 | 5.8 | 1.8 |
| **Total** | **42.30** | **N/A** | **163.2** | **93.3** | **26.7** | **6.8** |

Source: NOAA Applied Climate Information Systems, Gage Station 351862.

Two existing precipitation gages utilized as part of this study: one at the Morningstar pump station (Morningstar) and the other at the A-M WRF. Throughout the period of record (October 1, 2015, to March 20, 2016), Morningstar reported significantly less precipitation than A-M WRF. Precipitation data were also obtained from two nearby gages owned and operated by the City of Albany (Gages Charlotte and Broadway). Based on that data, it was determined that Morningstar was malfunctioning, so its data were disregarded. Instantaneous rainfall data from A-M WRF are shown as part of Figures 3-2 and 3-3. The precipitation data for A-M WRF during the monitoring period are summarized in Table 3-6. Through the period of record for this study, the total monthly precipitation was greater than average historical monthly precipitation at the Corvallis gage for December and January. As discussed in Section 5.3, the peak storm observed occurred in the month of December.

Table 3-6. Summary of A-M WRF Precipitation Data
*Inches*

| Month | Total Precipitation | 24-hour Maximum Precipitation | Daily Average |
|---|---|---|---|
| October 2015 | 3.38 | 1.71 | 0.109 |
| November 2015 | 3.86 | 1.69 | 0.129 |
| December 2015 | 12.9 | 2.32 | 0.416 |
| January 2016 | 7.89 | 1.19 | 0.255 |
| February 2016 | 1.92 | 0.45 | 0.083 |
| March 2016* | 5.37 | 1.08 | 0.269 |

* Data available only for 3/1/2016–3/20/2016.

## 3.5 Analysis

Flow monitoring data were used to identify flow components including dry weather flow and RDII contributions during wet weather conditions. Flow monitoring data were used to develop existing system loading for the City's hydraulic model update and to identify variability in the existing system from RDII.

The U.S. Environmental Protection Agency (EPA) Sanitary Sewer Overflow Analysis and Planning (SSOAP) Toolbox is an industry standard software developed by EPA to estimate RDII used in capacity analyses. The EPA SSOAP Toolbox was used in this master plan to evaluate flow monitoring data to derive existing system dry weather loading, diurnal patterns, and wet weather parameters for integration into the hydraulic model.

### 3.5.1 Dry Weather Flow

Dry weather flow consists of wet season (winter) flows occurring during dry weather. It is assumed that no RDII contributes to these flows, and that it generally fluctuates on an observed diurnal pattern that depends on land use. Wet season dry weather flow usually includes infiltration from high groundwater conditions in portions of the collection system.

To construct the collection system model, dry weather flow must be distributed into the pipe network. Since flow monitoring data are only available for a few locations, indirect methods were used to assign flows at the parcel level. Water billing records were provided for November 2015 through February 2016. Because lawn irrigation is unlikely during this time of year, water billing records were assumed to equal wastewater generation. Some areas of the system have individual drinking water wells and connections to the sanitary sewer. Those parcels were assumed to produce the same amount of wastewater per unit as the rest of the system.

For the existing condition, each parcel was assigned an associated manhole that indicates where the flow from that parcel would be loaded into the model. The flow at each monitor was proportioned among each loading manhole based on the ratio of water demand (determined from billing records) assigned to that manhole to the total water demand in that sewershed. This method of flow distribution also applies to the groundwater infiltration that occurs from the high groundwater conditions during the wet season.

EPA SSOAP Toolbox was used to identify dry periods during the period of record. February 8 and 9 were the driest stretch of days available and used for dry weather analysis. A summary of the flow during that period is shown in Table 3-7.

Table 3-7. Dry Weather Flow Summary
*mgd*

| Flow Monitor | Maximum | Average | Minimum |
|---|---|---|---|
| FM1 | 0.13 | 0.07 | 0.04 |
| FM2 | 0.44 | 0.34 | 0.26 |
| MI_05 | 0.46 | 0.37 | 0.26 |

### 3.5.2 Wet Weather Flow

Wet weather flow adds RDII to wet season dry weather flow to determine peak sewer flows in order to identify potential capacity deficiencies. As with dry weather flow, monitoring data are available at discrete points and must be used to characterize and then distribute RDII across the sewershed for a design event that was not measured in the field. For this project, the RTK unit hydrograph (UH) method was used to determine the unique sewer system response to rainfall for each sewershed. This response is a function of total rainfall volume and contributing area to the sewer. By convention, it is assumed that only a portion of the total sewershed land area that receives rainfall contributes flow into the sewer system. For this master plan, the contributing sewershed area was assumed to include a 25-foot buffer around each collection pipe.

# Planning Criteria

## 4.1 Design Standards

The Oregon Department of Environmental Quality (DEQ) currently regulates sanitary sewer overflows (SSO) in coordination with NPDES permits and according to bacteria specifications of state water quality regulations.

The State of Oregon has acknowledged the improbability of designing and constructing collection systems capable of preventing SSOs for all storm events; however, it determined that all wastewater collection systems should be designed for and capable of conveying storm events up to a particular size. DEQ has decided to consider the 5-year, 24-hour storm between November 1 and May 21 and the 10-year, 24-hour storm event between May 22 and October 31. In the Willamette Valley, the 5-year storm that includes groundwater infiltration (between November 1 and May 21) flows is typically greater and is therefore used in this case.

To assess specific system elements, the following criteria were used to identify hydraulic capacity deficiencies:

- Maximum freeboard at a manhole is less than 3 feet from ground surface and the pipe is surcharged during the design event.
- Force main water velocity exceeds 7 feet per second (ft/s).
- Pump station capacity with largest pump out of service does not meet the influent peak flow rate.

## 4.2 Design Storm

Analysis of the collection system was conducted using RDII flows produced by a design storm developed for this master plan. For this plan, the design storm has a 5-year return interval with a 24-hour precipitation depth. Design storm selection dictates the level of protection from potential overflows that the associated improvements will provide. According to the *Precipitation-Frequency Atlas of the Western United States* (NOAA, 1973), the design storm should have a 24-hour depth equal to 3 inches.

The design storm was developed using the Soil Conservation Service 24-hour type 1A rainfall distribution (NRCS, 1986). Figure 4-1 shows the cumulative and instantaneous rainfall distribution for a type 1A rainfall event.

This design storm is similar and slightly more conservative than the design storm used by the City of Albany when it updated its collection system model in 2014 (CH2M HILL). The City of Albany used a design storm with a 24-hour depth equal to 2.86 inches and a type 1A distribution.

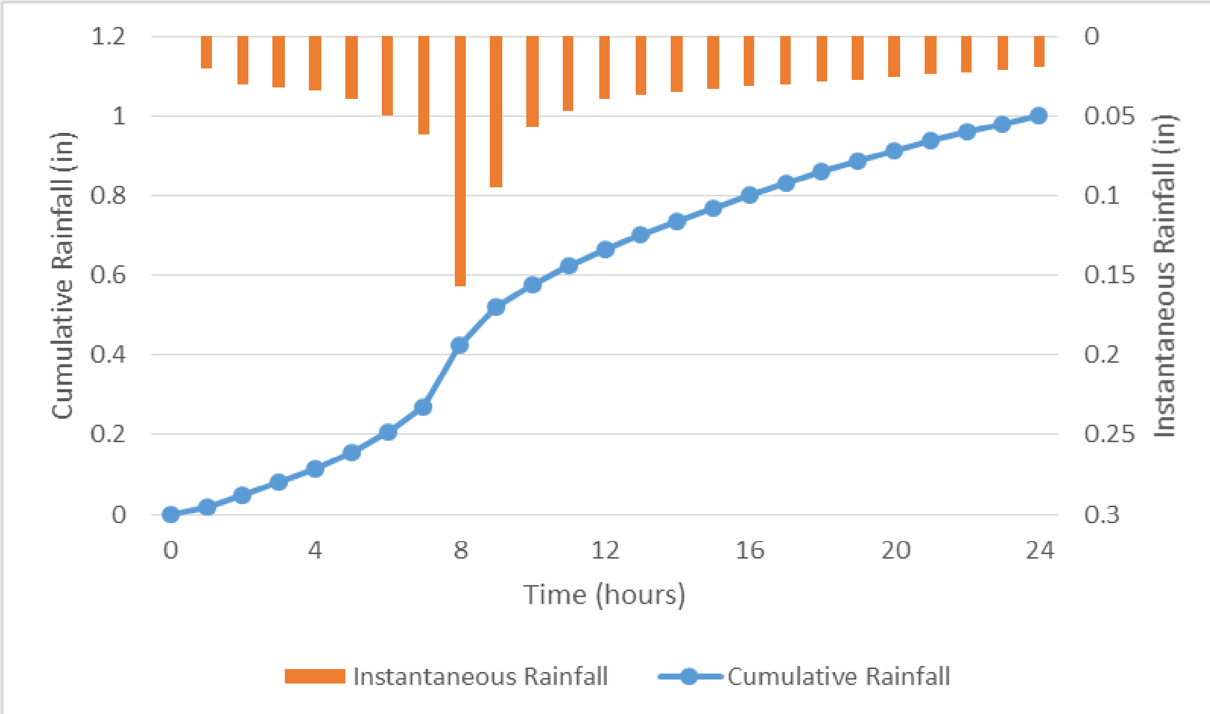



Figure 4-1. Type 1A Cumulative Rainfall Distribution

To take into consideration antecedent rainfall, precipitation data from the A-M WRF gage from December 9 to 16, 2015, was inserted before the design storm. Additional rainfall from December 18 to 20, 2015, was inserted after the design storm. These added rainfall periods were the same rainfall that surrounded the calibration event. Figure 4-2 shows all the data used to simulate the design storm event.

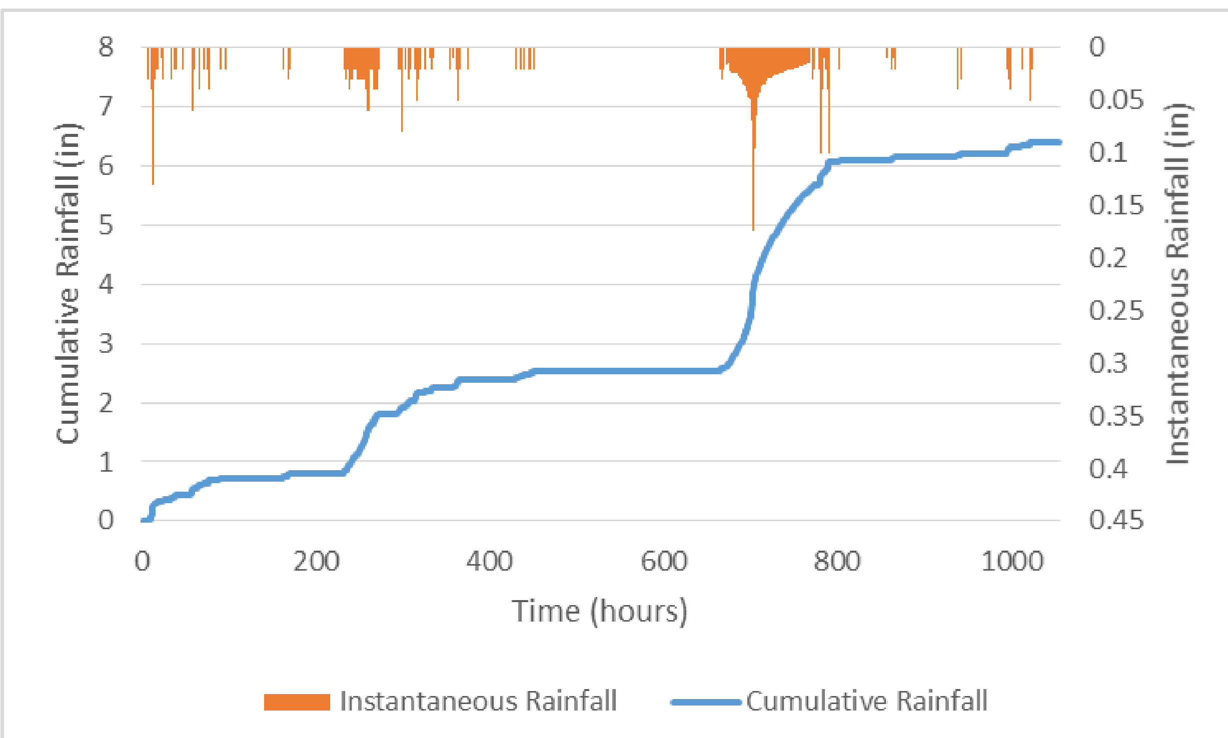



Figure 4-2. Rainfall Data Used for the Design Storm Simulation

# Development and Calibration of Collection System Model

## 5.1 Introduction

Computer modeling was conducted to simulate the hydraulic interactions that occur under a variety of scenarios within the City's collection system network.

Using the model, the City can evaluate the effects of extended storm events in small time-increments. The model provides the capability to simulate what would happen in the system at different locations at any given time. The model is also used to evaluate the effectiveness of proposed collection system improvements.

## 5.2 Development of Model

A hydraulic model was constructed with current geographical information system (GIS) information for pipe size, length, geometry, and invert data and imported into XPSWMM. XPSWMM is a fully dynamic model that solves the complete dynamic wave equations for gradually varied flow. It can simulate backwater, surcharging, split flows, looped connections, and various hydraulic appurtenances that typically occur in sewer collection systems—such as pump stations and weirs.

The model identifiers for pipelines and manholes remained consistent with the GIS unique identifiers to maintain a direct link between the model and GIS. Only pipelines 8 inches and larger were imported to the model. Gravity pipes contributing to the Truax pump station are not being used and not included in the model. Additionally, the abandoned Truax pump station was not modeled. Pump station information was incorporated into the model based on as-built drawings showing wet well dimensions and control settings and pump curves provided by the City. Figure 5-1 shows the modeled pipes, force mains, and pump stations.

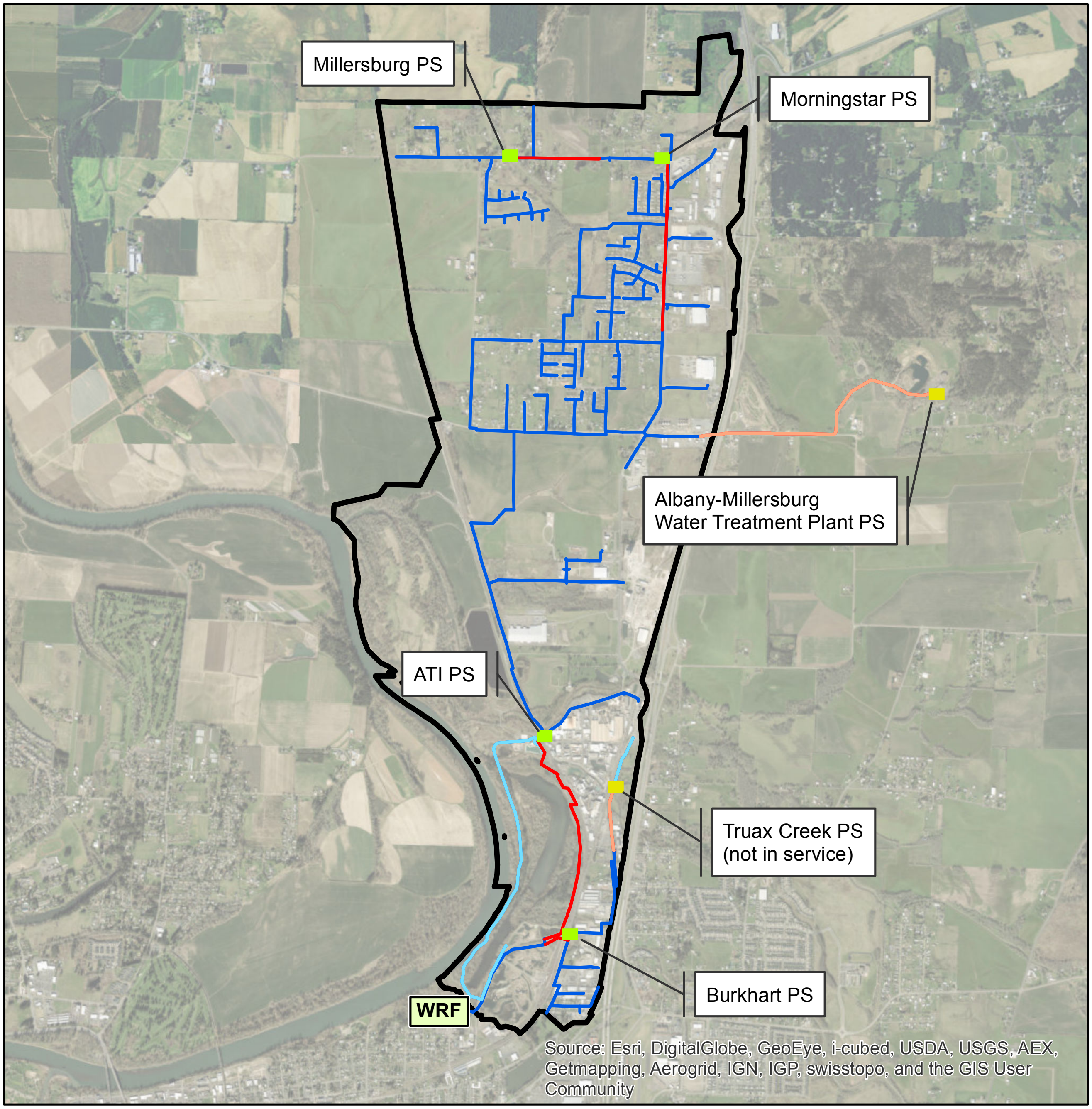
Existing system dry weather loading was developed from flow monitoring data. Dry weather flows were estimated per acre loading rates from current flow monitoring data. All system loadings were scaled to flow rates established during dry weather conditions at the flow monitoring locations to incorporate wastewater generation and groundwater infiltration.

## 5.3 Calibration of Model

Model calibration was performed to develop an estimate of flows for dry and wet weather conditions. Model parameters were adjusted such that flow meter data collected matched the modeled results within a reasonable tolerance during dry periods and wet weather events.

The model was calibrated to three flow monitoring locations (FM1, FM2, and MI_05) to represent system response and geographical variability. The calibrated model was used to estimate the influence of wet weather RDII in the system for the 5-year, 24-hour design storm. The model uses the RTK UH to estimate RDII flow into a sewer system. A RTK UH set contains up to three such hydrographs: one for a short-, intermediate-, and long-term response. Each UH is defined by three parameters. The R parameter represents the fraction of rainfall volume that enters the sewer system, T represents the time from the onset of rainfall to the peak of the UH in hours, and K represents the ratio of time to recession of the UH to the time to peak. Calibration of the collection system model involves adjusting the short-, medium-, and long-term RTK hydrologic parameters for each flow monitor basin until they come as close as possible to replicating the observed flows at each flow monitor from the 2015 calibration storm.

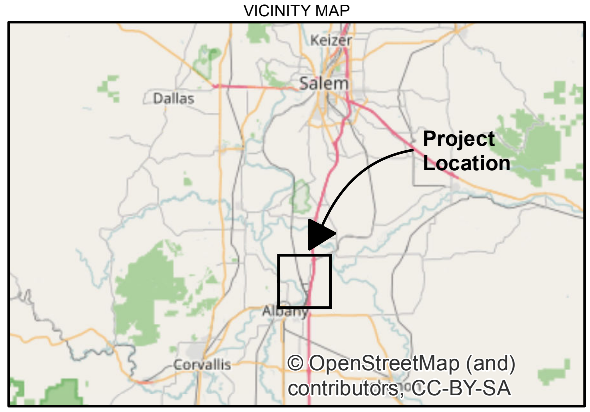
For this study, the model was calibrated using the December 17, 2015, storm event, which had a maximum 24-hour depth of 2.32 inches. This was the largest storm event for which both precipitation and flow monitoring data were available. To account for antecedent rainfall conditions in the model, 7 days before December 17 were simulated in the model. Additionally, 3 days following December 17 were also included. See Figures 5-2, 5-3, and 5-4 for a comparison of the observed and simulated flows at FM1, FM2, and MI_05, respectively (note: flow units are in cubic feet per second).




## Legend

- WRF Albany-Millersburg Water Reclamation Facility
- Modeled Pump Station
- Unmodeled Pump Station
- Unmodeled Force Main
- Modeled Force Main
- Unmodeled Gravity Sewer
- Modeled Gravity Sewer
- City Limits

VICINITY MAP




N

0 2,000 4,000 8,000 Feet

**FIGURE 5-1**
**Modeled System**

ch2m

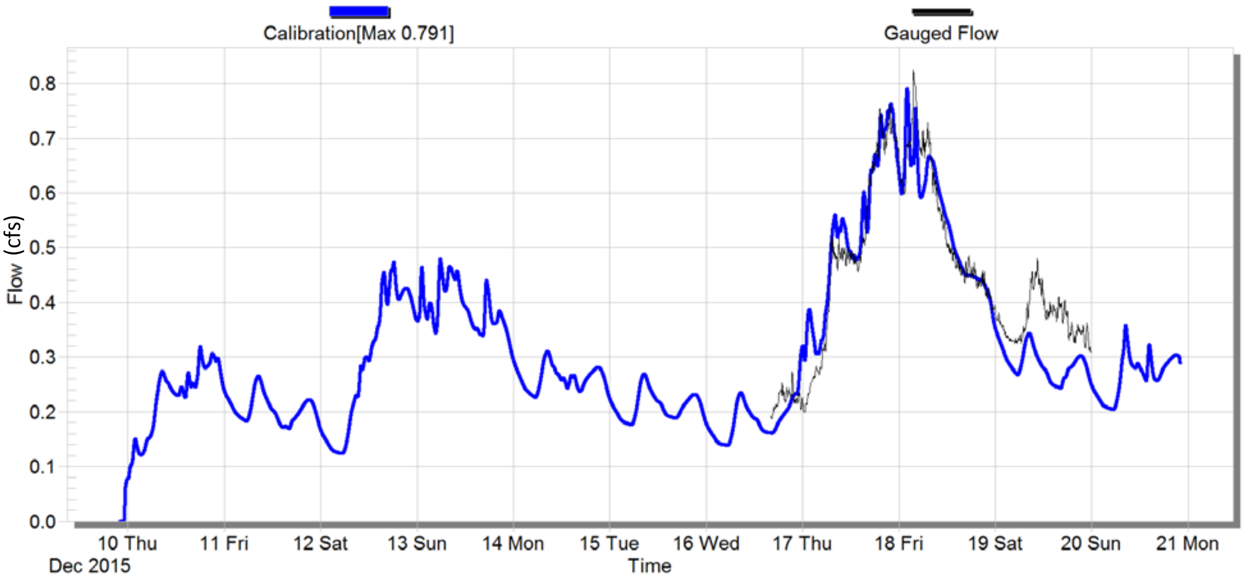



Figure 5-2. Flow Monitor FM1 during Model Calibration

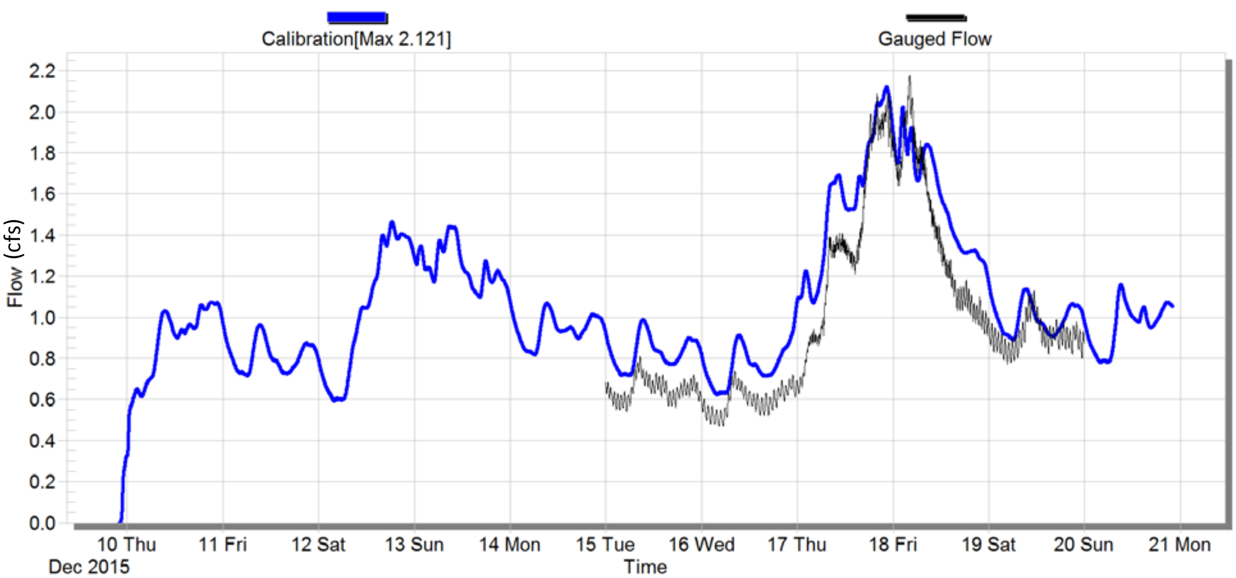



Figure 5-3. Flow Monitor FM2 during Model Calibration

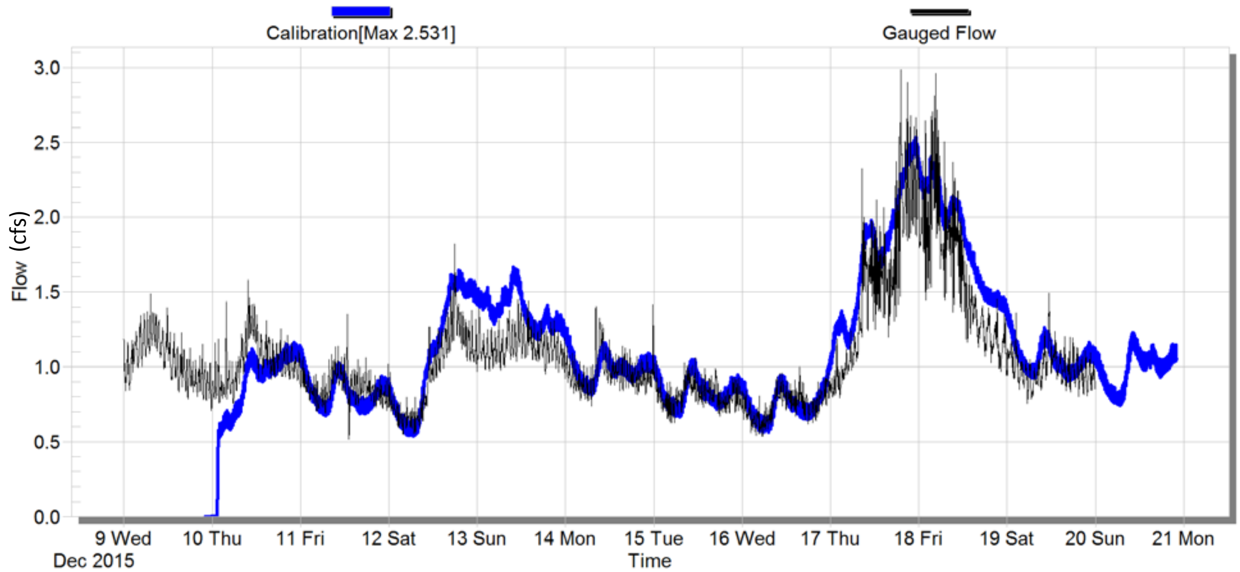



Figure 5-4. Flow Monitor MI_05 during Model Calibration

# 5.4 Validation of Model

Model validation was performed using the same RTK and model parameters but using a different storm event. The purpose of this exercise was to demonstrate that the calibrated model could effectively predict the peak flow of another large storm event.

For this master plan, the January 19, 2016, event was used. This event had the second largest 24-hour peak rainfall where both precipitation and flow data were available. The peak 24-hour depth was 1.19 inches. Similar to the calibration event, the observed 7 days before and 3 days after the event were also simulated in the model. The model results indicate that the calibrated Millersburg model is able to effectively predict the peak flow magnitudes during large rainfall events. See Figures 5-5, 5-6, and 5-7 for a comparison of the observed and simulated flows at FM1, FM2, and MI_05, respectively (note: flow units are in cubic feet per second).

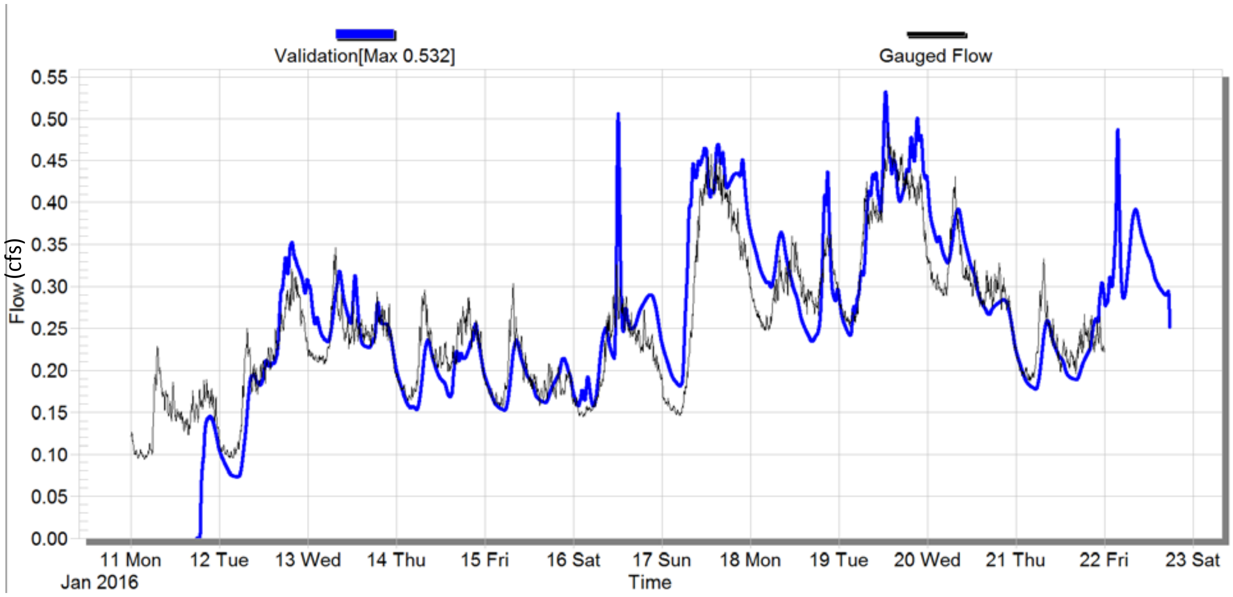



Figure 5-5. Flow Monitor FM1 during Model Validation

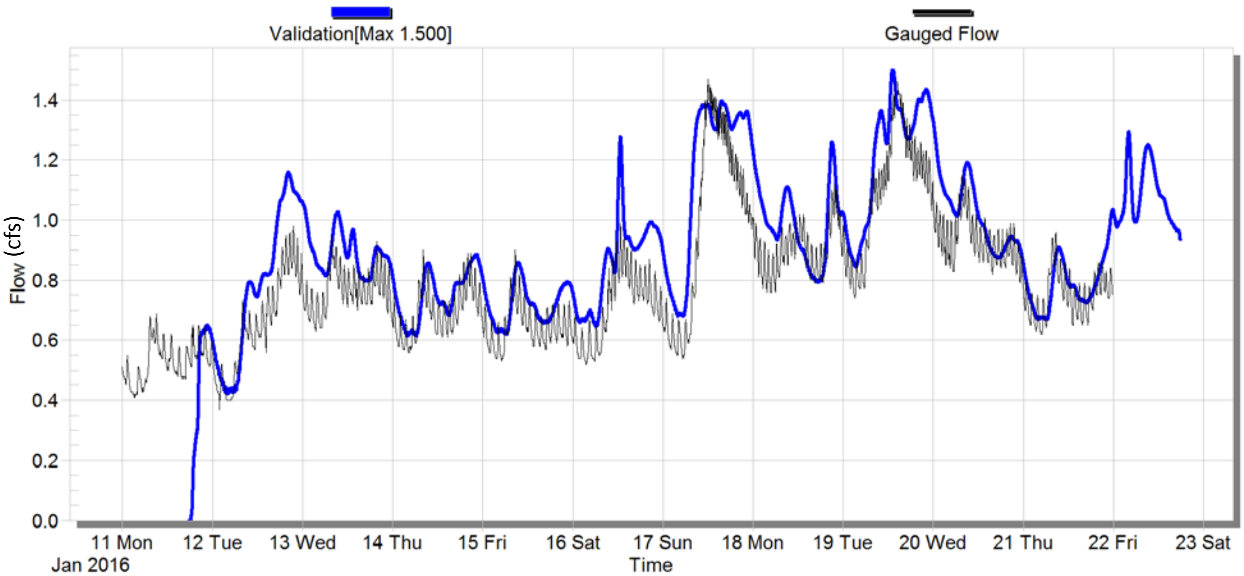



Figure 5-6. Flow Monitor FM2 during Model Validation

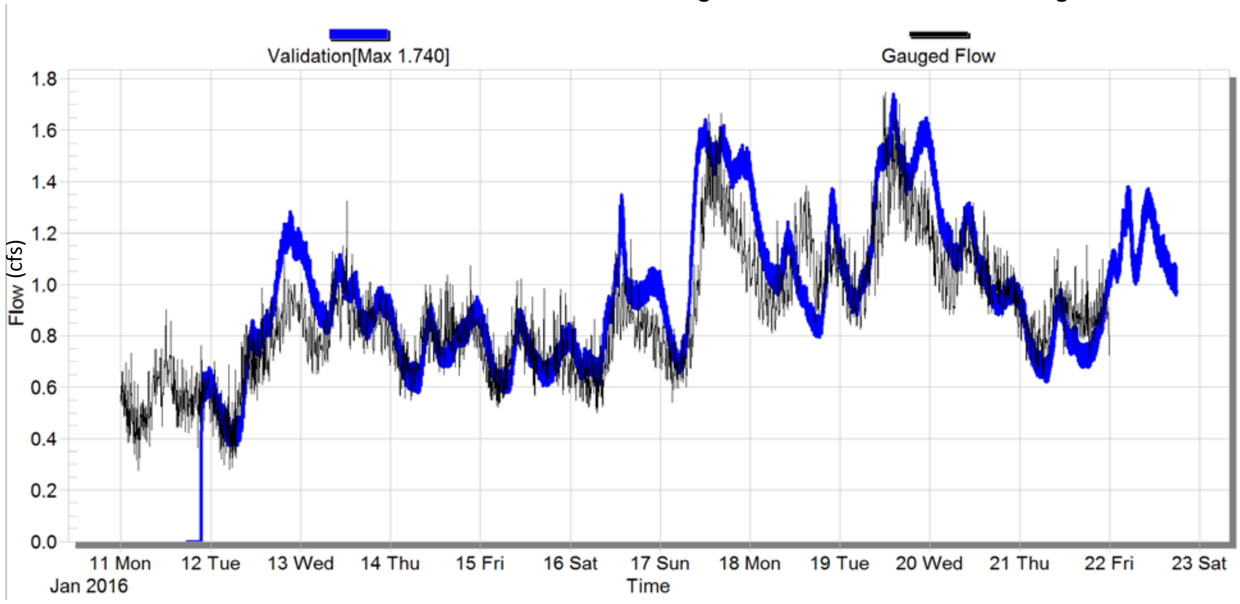



Figure 5-7. Flow Monitor MI_05 during Model Validation

# Characterization of Existing System Capacity Deficiencies

## 6.1 Introduction

Using the XPSWMM collection system model described in Section 5, an assessment was performed to identify existing sanitary sewer system capacity deficiencies. Figure 6-1 identifies the Millersburg parcels that were modeled for existing conditions. Because of system changes currently in process, two existing-condition scenarios were simulated: (1) existing conditions as of June 2016 and (2) existing conditions after pump station improvements and approval of Duraflake process wastewater discharge

Concurrent with development of this master plan, improvements to the ATI and Morningstar pump stations are being designed to address maintenance and operation issues. At present, both of these pump stations have a stacked-can design with a wet well under the dry well. These pump stations use a vacuum-prime system. Because of the solids in the sewer, there are maintenance issues related to unplugging the priming system. Both of these pump stations have been known to overflow—usually because of a power outage. The pump station improvements should be complete by 2017, so an additional existing model simulation was created to take those improvements into consideration.

Also, at present, no industrial users discharge process wastewater to the sanitary sewer system. Industrial users are only permitted to discharge domestic wastewater. Duraflake, however, recently received approval to discharge up to 8,000 gallons per day (gpd) of process wastewater to the sanitary sewer. Therefore, the second scenario accounts for this.

## 6.2 Collection System

Modeling results showed that no pipes or manholes surcharge for the two existing-condition scenarios. Therefore, no capacity deficiencies were identified for the gravity flow pipelines for existing conditions.

## 6.3 Pump Stations

DEQ requires that pump stations be evaluated based on capacity with the largest pump out of service (firm capacity). The modeling results for first scenario (existing conditions as of June 2016) indicate that one pump station, Morningstar, currently does not have sufficient firm capacity to meet the peak flows using that criterion. Additionally, the ATI pump station is at firm capacity. See Table 6-1 for a summary of the existing pump station firm capacities and peak flows associated with the first scenario. Peak flow is calculated from the capacity assessment model output, and firm capacity is based on the capacity of existing pumps at each pump station.

No force main velocities reached 7 ft/s and no deficiencies were identified.

Table 6-1. Existing Conditions Pump Station Summary

| Pump Station Name | Pump Station Number | Peak Pump Station Influent Flow (gpm) | Firm Capacity (gpm)* | Meets Firm Capacity Requirements? |
|---|---|---|---|---|
| ATI | 12 | 1,227 | 1,300 | Yes |
| Burkhart | 15 | 127 | 250 | Yes |
| Morningstar | 17 | 821 | 750 | No |
| Millersburg | 18 | 254 | 450 | Yes |

*Firm capacity equals capacity with the largest pump out of service.

The modeling results for the second scenario (after completion of the pump station improvements and approval of Duraflake process wastewater discharge) indicate that all the pump stations will have adequate firm capacity. See Table 6-2 for a summary of the pump station firm capacity after Morningstar and ATI improvements.

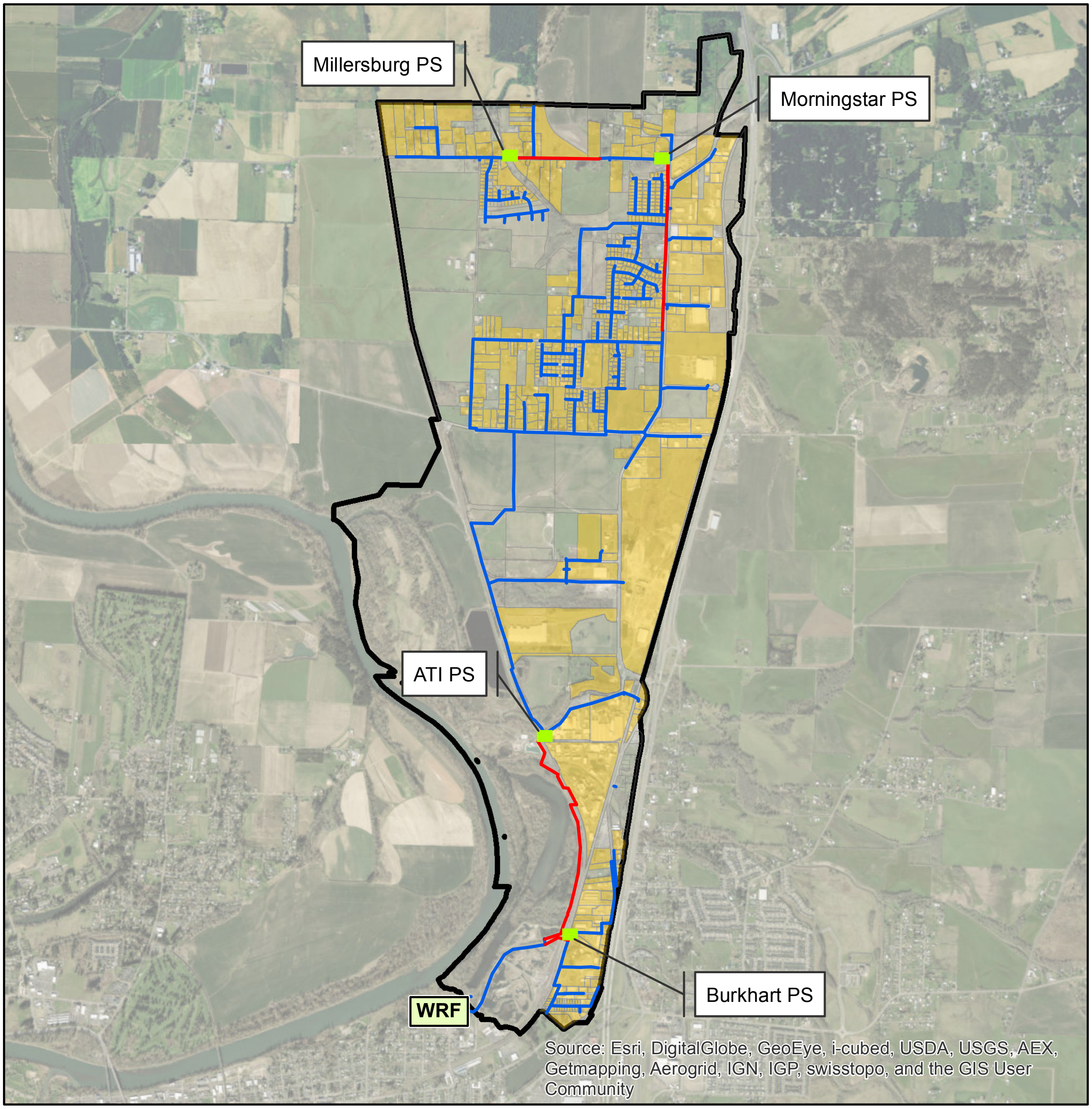
Table 6-2. Existing Conditions Pump Station Summary after Morningstar and ATI Improvements

| Pump Station Name | Pump Station Number | Peak Pump Station Influent Flow (gpm) | Firm Capacity (gpm)* | Meets Firm Capacity Requirements? |
|---|---|---|---|---|
| ATI | 12 | 1,265 | 1,577 | Yes |
| Burkhart | 15 | 127 | 250 | Yes |
| Morningstar | 17 | 820 | 951 | Yes |
| Millersburg | 18 | 254 | 450 | Yes |

*Firm capacity equals capacity with the largest pump out of service. Firm capacity of ATI and Morningstar Pump Stations reflect 2017 planned upgrades.

## 6.4 Treatment Plant

During the design storm, the first scenario (existing conditions as of June 2016) modeling results showed a peak flow of 1,300 gpm (1.87 mgd) and the second scenario (existing conditions after pump station improvements and approval of Duraflake process wastewater discharge) modeling results showed a peak flow of 1,414 gpm (2.04 mgd). The model did not simulate the A-M WRF and its response to the design storm.




**Legend**

WRF Albany-Millersburg Water Reclamation Facility

Modeled Pump Station

Modeled Force Main

Modeled Gravity Sewer

**Model Scenario**

Noncontributing Parcels

Existing Model Scenario

City Limits

N

0 2,000 4,000 8,000 Feet

VICINITY MAP

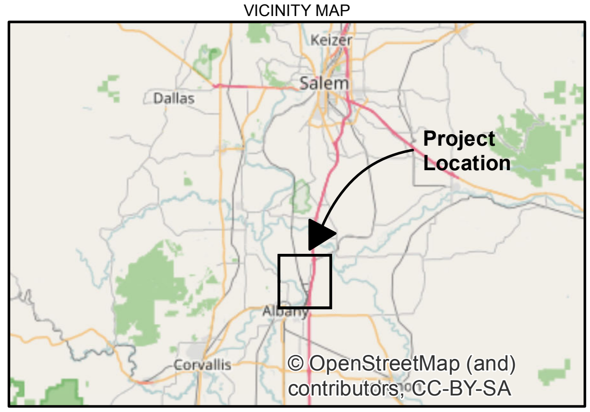



**FIGURE 6-1**
**Existing Scenario Parcels**

ch2m

# Characterization of Future System Capacity Deficiencies

## 7.1 Introduction

For this master plan, two future planning horizons were modeled: 20 years and buildout. Figure 7-1 shows the parcels that are added for each planning horizon.

The City developed a map of areas that are currently being developed or will be developed in the near future. Based on those areas, it was assumed for the 20-year model simulation that north of Conser Road ½ of the undeveloped residentially-zoned parcels would be developed and ½ of the industrially-zoned parcels would develop. (As shown in Figure 7-1, Conser Road runs east and west through the City.) South of Conser Road, ½ of the undeveloped residentially-zoned parcels would be developed. No new heavy industrial flows would be generated south of Conser Road in the next 20 years. The sewer collection system will need to be expanded to serve the undeveloped areas in the northwest portion of the study area. Service will be extended along Woods Road. Two connections will be needed – one at Alexander Lane extending north and one at Millersburg Drive extending south (shown on Figure 7-1). The uneven topography prevents one single connection serving the entire area.

The buildout conditions model was divided into two scenarios: (1) without heavy industrial flows and (2) with heavy industrials flows. Most of the heavy industry is south of Conser Road and does not contribute flow in the 20-year scenario. For the first buildout scenario, the entire service area is assumed to be developed with the exception of heavy industrial users. For the second buildout scenario, the entire service area is assumed to be developed with heavy industrial flows added until a collection system pipe surcharges.

## 7.2 Flow Projections

Dry weather flows from FM2 were used to create flow projections. FM2 collects wastewater from residential users and some domestic water from industrial users (see Figure 3-1). The average dry weather flow for FM2 was divided by the FM2 collection area to develop a flow per acre relationship. This relationship was applied to any developed parcels in the 20-year and buildout scenarios to project future dry weather flows.

## 7.3 Future System Capacity Deficiencies

### 7.3.1 20-year Condition

Modeling results were that no pipes or manholes surcharge for the 20-year condition. Therefore, no capacity deficiencies were identified for the gravity flow pipelines.

The modeling results indicate that one pump station, Morningstar, will not have sufficient firm capacity to meet the projected 20-year condition peak flows. ATI is also at its firm capacity. Table 7-1 summarizes the modeling results for the 20-year condition.

No force main velocities reached 7 ft/s and no deficiencies were identified.

During the design storm, the model showed a peak flow of 1,734 gpm (2.50 mgd). The model did not simulate the A-M WRF and its response to the design storm.

Table 7-1. 20-year Condition Pump Station Summary

| Pump Station Name | Pump Station Number | Peak Pump Station Influent Flow (gpm) | Firm Capacity (gpm)* | Meets Firm Capacity Requirements? |
|---|---|---|---|---|
| ATI | 12 | 1,577 | 1,577 | Yes |
| Burkhart | 15 | 126 | 250 | Yes |
| Morningstar | 17 | 1,017 | 951 | No |
| Millersburg | 18 | 384 | 450 | Yes |

*Firm capacity (capacity with the largest pump out of service) of ATI and Morningstar pump stations reflect 2017 planned upgrades.

### 7.3.2 Buildout Condition

The buildout conditions model was divided into two scenarios: (1) without heavy industrial flows and (2) with heavy industrials flows. These are discussed separately below.

### 7.3.3 Buildout Condition without Heavy Industrial Flows

Modeling results were that no pipes or manholes surcharge for the buildout condition without heavy industrial flows. Therefore, no capacity deficiencies were identified for the gravity flow pipelines.

The modeling results indicate that three pump stations, Morningstar, Millersburg, and ATI, will not have sufficient firm capacity to meet the projected peak flows for the buildout condition without heavy industrial flows. Table 7-2 summarizes the modeling results for the buildout condition with heavy industrial flows.

During peak conditions, the velocity in the Morningstar pump station force main reached 8.2 ft/s and is considered deficient. No other force mains reached the 7 ft/s threshold.

During the design storm, the model showed a peak flow of 2,110 gpm (3.04 mgd). The model did not simulate the A-M WRF and its response to the design storm.

Table 7-2. Buildout Condition without Heavy Industrial Flows Pump Station Summary

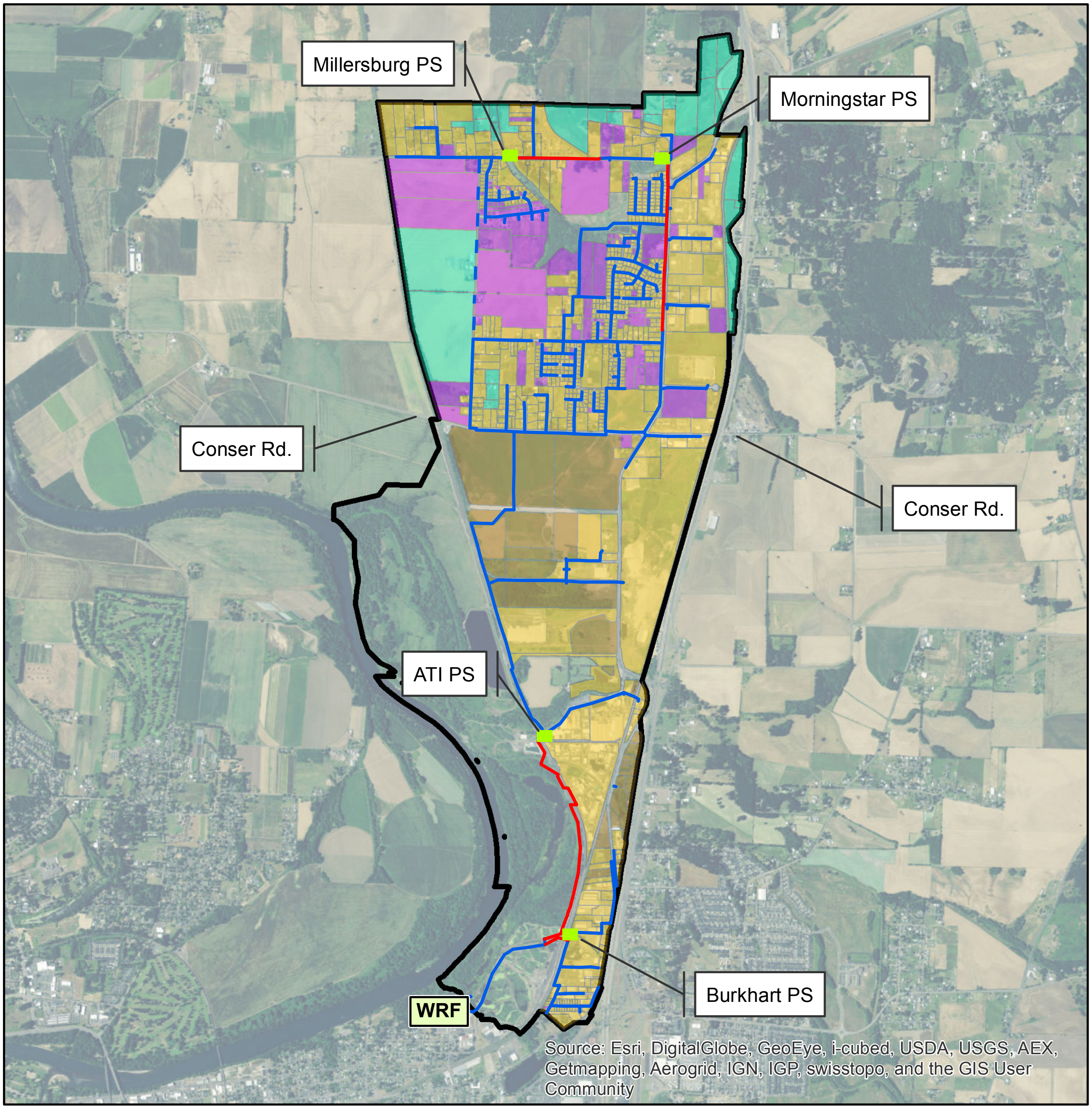
| Pump Station | PS # | Peak PS Influent Flow (gpm) | Firm Capacity (gpm)* | Meets Firm Capacity Requirements? |
|---|---|---|---|---|
| ATI | 12 | 1,903 | 1,577 | No |
| Burkhart | 15 | 127 | 250 | Yes |
| Morningstar | 17 | 1292 | 951 | No |
| Millersburg | 18 | 550 | 450 | No |

* Firm Capacity of ATI and Morningstar Pump Stations reflect 2017 planned upgrades.

### 7.3.4 Buildout Condition with Heavy Industrial Flows

For the buildout scenario with heavy industrial flows, the model was able to accept 630 additional gallons per minute before any pipe was surcharging. Because of their proximity to heavy industrial areas, three pipelines segments were analyzed for remaining capacity to accept heavy industrial flows in the future: (1) the main trunk running from Conser Road along the train tracks to ATI pump station, (2) the collection pipes near Arnold Road, and (3) the collection pipes along Nygren Road. Figure 7-2 shows these three segments as well as the remaining capacity in each. Heavy industrial flows may be added to any of these segments, but the added flow should not surpass 630 gpm without increasing the capacity of the main trunk pipeline. This increase in flow will impact the design of the ATI pump station in the future. Although the City's collection system is capable of conveying heavy industrial flow, the model should be updated with each additional new industrial discharge to verify no deficiency is created.

During the design storm, the model showed a peak flow of 2,802 gpm (4.04 mgd). The model did not simulate the A-M WRF and its response to the design storm.




## Legend

WRF Albany-Millersburg Water Reclamation Facility

Modeled Pump Station

Modeled Force Main

Modeled Gravity Sewer

Future Gravity Sewer

## Model Scenario Parcels

Existing

20-yr

Buildout

Buildout Heavy Industrial Flows

City Limits

0 2,000 4,000 8,000 Feet

VICINITY MAP

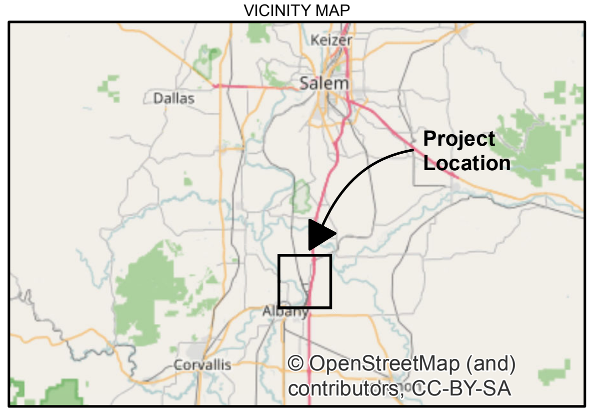
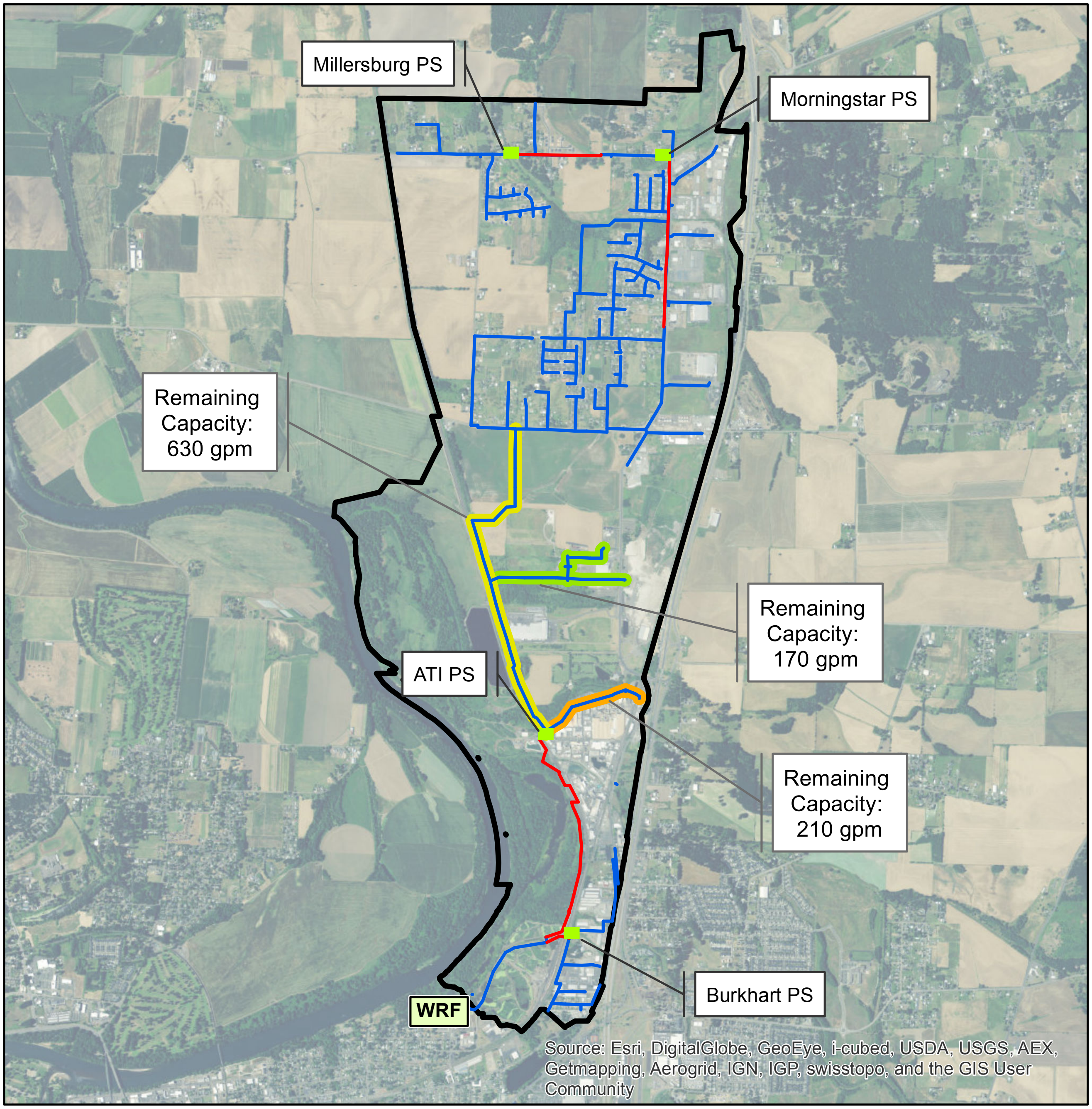
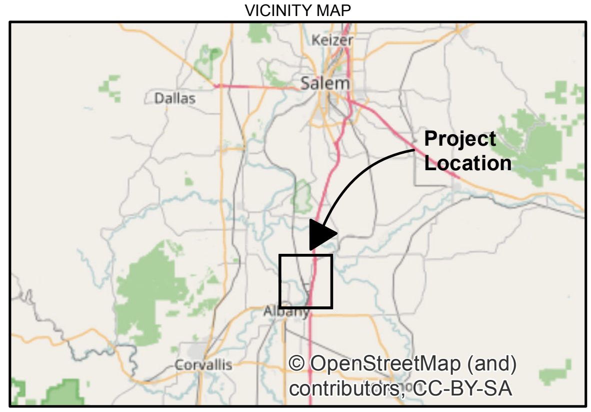



**FIGURE 7-1**
**Future Scenario Parcels**

ch2m




VICINITY MAP




## Legend

- **WRF** Albany-Millersburg Water Reclamation Facility
- Modeled Pump Station
- Modeled Force Main
- Modeled Gravity Sewer
- City Limits

N

0 2,000 4,000 8,000 Feet

**FIGURE 7-2**
**Remaining Capacity for Heavy Industrial Flow**

ch2m

# Development and Evaluation of Capital Improvement Projects

## 8.1 Introduction

Capital improvement projects were developed to address capacity deficiencies (as identified by the hydraulic analyses for the existing and 20-year future conditions described in Sections 6 and 7) and to address O&M issues identified by operations staff. The capacity deficiencies are summarized in Table 8-1.

Table 8-1. Summary of Sanitary Sewer System Capacity Deficiencies
*XPSWMM Hydraulic Modeling Results*

| | Capacity Deficiency? | | |
|---|---|---|---|
| **System Component** | **Existing Conditions** | **Existing Conditions with Pump Station Improvements and Addition of Duraflake Process Flows** | **20-year Future Conditions** |
| Gravity pipelines | No | No | No |
| Force mains | No | No | No |
| ATI pump station | No | No | No* |
| Burkhart pump station | No | No | No |
| Morningstar pump station | **Yes** | No | **Yes** |
| Millersburg pump station | No | No | No |

*Although technically the ATI pump station has firm capacity, improvements will be needed near the end of the 20-year planning horizon; see Section 8.2.2.

Capital improvement projects were developed to upgrade the pump stations with potential capacity deficiency issues. RDII reduction was not considered a viable option in this instance because both Morningstar and ATI pump stations have operational problems. Even with RDII reduction, pump station improvements would still need to take place, so the decision to improve the design and expand capacity was made. Also, it was not found practical to bypass the capacity-deficient pump stations. The pump station capacity improvements were developed in conjunction with necessary operations and maintenance improvements as identified by operations staff.

Projects were developed for the ATI and Morningstar pump stations. The projects for each pump station were developed to be implemented in two phases because pumps have a 20-year design life and to size the pumps for more efficient electricity usage during the useful life of the pump station.

## 8.2 ATI Pump Station Capital Improvement Projects

### 8.2.1 ATI Pump Station Upgrades

ATI pump station also has a stacked-can design with a wet well under the dry well that uses a vacuum-prime system. Because of the solids in the sewer, there are numerous maintenance issues related to unplugging the priming system. Improvements at ATI will include a new configuration and higher capacity pumps. A new generator will be installed onsite for power outages.

### 8.2.2 ATI Pump Station Pump Replacement

Near the end of the 20-year planning horizon, ATI will no longer have sufficient firm capacity. The pumps will need to be replaced with 1,930 gpm capacity pumps.

## 8.3 Morningstar Pump Station Capital Improvement Projects

### 8.3.1 Morningstar Pump Station Upgrades

The Morningstar pump station does not currently have sufficient firm capacity to convey peak flows. Additionally, Morningstar has a stacked-can design with a wet well under the dry well that use a vacuum-prime system. Because of the solids in the sewer, there are numerous maintenance issues related to unplugging the priming system. This pump station is considered the highest priority by operations staff. Improvements at Morningstar will include a new configuration and higher capacity pumps. A generator will be installed onsite for power outages.

### 8.3.2 Morningstar Pump Station Pump Impeller Size Increase

Near the end of the 20-year planning horizon, Morningstar will no longer have sufficient firm capacity. At this point, the pumps will be overhauled and a larger impeller will be installed. The new impeller will increase the pump capacity to 1,290 gpm.

# Recommended Plan

## 9.1 Introduction

This section outlines recommended improvements to the wastewater collection and transmission system. This section includes recommendations as capital improvement projects, changes to system management, and changes to the operation and maintenance of the system. A schedule for implementation is also provided.

## 9.2 Capital Improvement Projects

Recommended capital improvement projects are summarized in Table 9-1.

Table 9-1. Recommended Capital Improvement Projects

| Project | Description |
|---|---|
| ATI Pump Station Upgrades* | Alter configuration and install higher capacity pumps. Install new generator onsite. |
| ATI Pump Station Pump Replacement | Install higher capacity pumps. |
| Morningstar Pump Station Upgrades* | Alter configuration and install higher capacity pumps. Install generator onsite. |
| Morningstar Pump Station Pump Impeller Size Increase | Overhaul pumps and install a larger impeller. |

*To be completed in 2017.

## 9.3 Condition Assessment

Most of the gravity pipelines in the system have not been recently inspected. Figure 9-1 shows the age of the system. Assuming the design life for gravity pipes in the system is 75 years, it will be necessary to start replacing pipes no later than 2054. A tiered approach to additional inspections may be warranted to reduce closed-circuit television (CCTV) inspection costs for recently uninspected pipelines starting in 2026. A desktop investigation of existing information in the vicinity of uninspected pipelines followed by a pole camera survey from existing manholes would limit the extent and cost of CCTV inspections.

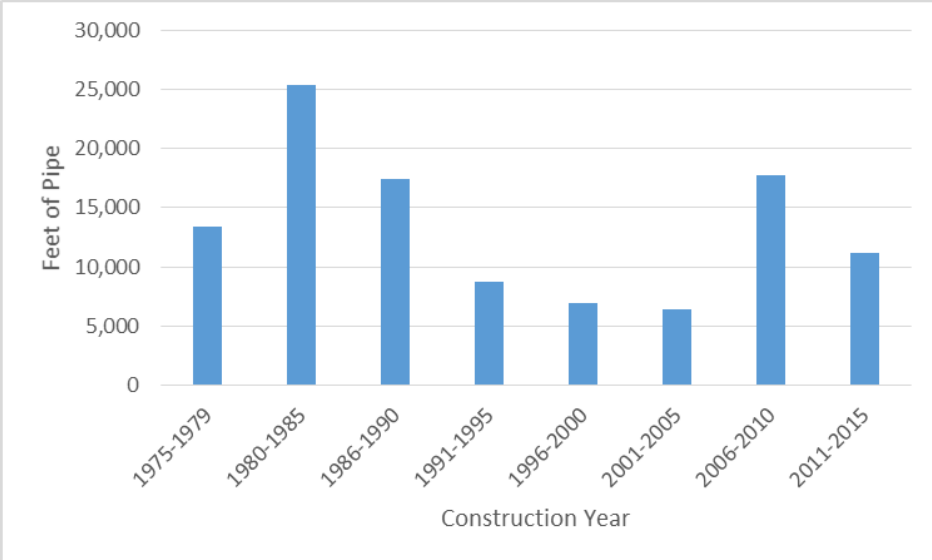



Figure 9-1. Collection System Age

Assuming at replacement cost of $350 per linear foot of pipe, replacing all the pipes in the collection system will cost over $42 million. After the collection system inspection, the City should start to collect a nominal amount of money each year to eventually start slowly replacing the existing pipes.

## 9.4 Cost Estimates and Implementation Schedule

Planning-level cost estimates were developed for construction, planning, design, and services during construction of the recommended projects. They are Class 4, planning-level cost estimates as established by the American Association of Cost Engineers, which include preliminary estimates used for conceptual screening and assumes a project definition maturity level below 2 percent. The expected accuracy range is -20 to -30 percent on the low end, and +30 to +50 percent on the high end, meaning the actual cost should fall in the range of 30 percent below the estimate to 50 percent above the estimate. The recommended project cost estimates are shown in Table 9-2 with a suggested implementation schedule.

Table 9-2. Recommended Project Cost Estimates and Suggested Implementation Schedule

| Project | Estimated Costs | Suggested Year to Implement |
|---|---|---|
| ATI Pump Station Upgrades | $650,000 | 2017 |
| ATI Pump Station Pump Replacement | $66,500 | TBD* |
| Morningstar Pump Station Upgrades | $750,000 | 2017 |
| Morningstar Pump Station Pump Impeller Size Increase | $32,000 | TBD* |
| Collection System Condition Assessment | $106,000 | 2026 |
| Expand Sewer Collection System to Unserved Parts of City | TBD^ | TBD* |

*Suggested year depends on future flows.

^Developers to pay expenses related to expansion

TBD = to be determined.

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