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** Only included as large print in the Appendix.

Executive Summary



EXECUTIVE SUMMARY

ES.1 Scope and Purpose

In October 1997, CH2M HILL was authorized by the Roseburg Urban Sanitary Authority (RUSA) to provide engineering services for development of a Wastewater Collection System Master Plan. This master plan is intended to fulfill the planning requirement of Oregon Revised Statutes (ORS) 450.825 for the sanitary sewage collection system within the projected RUSA service area. CH2M HILL worked with the City of Roseburg and Douglas County planning departments to develop the population data for this master plan.

RUSA is a special District operating under ORS 450 and is responsible for the entire wastewater collection and treatment system, which was formerly under the jurisdiction of the City and the Sanitary Districts. This study reviewed the existing wastewater collection system and developed a wastewater collection system plan to serve the areas within the present Roseburg Urban Growth Boundary (UGB), as described in the City of Roseburg Comprehensive Plan, and the projected growth areas, to the year 2055. The UGB serves as the study area boundary as shown on Figure ES-1. (An enlarged version of this figure is available in the Appendix at the end of this report.) The study area can generally be described as that area within and around the City of Roseburg. Projected future growth areas are located east along Deer Creek, south along the South Umpqua River, the Calkins area to the west, the area to the west of the present UGB boundary, and east of Garden Valley Road.

The study provides opinions of costs for the recommended improvements that were developed in the master plan. The master plan provides RUSA with a plan to guide the future expansion of its wastewater collection system to meet the needs of the people of Roseburg through the next 50 years. The master plan should be reviewed and updated periodically to account for changes in the Comprehensive Land Use Plans, development patterns which differ from existing land use plans, location of “wet” type industries, changes in water use, and changes in technology, which affect the design, construction, and operation of wastewater systems.

ES.2 Basis

The 2003 Wastewater Collection System Master Plan for RUSA was developed to provide a flexible master plan for logical expansion, repair, and maintenance of the Roseburg area sewage collection system. The collection system includes gravity mainlines, interceptors, pump stations and forcemains. The master plan was developed based on the results of a computer simulation of the collection system performance for projected wastewater flow and infiltration/inflow (I/I).

Visual inspection of the collection system identified repair and maintenance projects that are included in the master plan to maintain the system integrity.

The current collection system was modeled for the 5-year winter flow for the years 2003, 2020, and ultimate build-out in 2055. The model simulation identified collection system areas that will need to be upsized to serve the projected future needs. The major trunk and main line extensions to serve existing unsewered areas within the projected service area are included in the model. The model will also provide the ability to evaluate the effect of future development on the collection system.

ES.3 Summary and Recommendations of Staged Improvements

The improvements identified in the master plan are divided into three stages for capital improvement planning purposes: Stage I (2003-2005), Stage II (2005-2015), and Stage III (2015-2055). The timing for constructing parallel sewers or replacement sewers needed to correct capacity deficiencies was estimated based on the percent of the projected need versus the flow capacity of the existing sewer. Any sewer estimated to be over 150 percent capacity will require a Stage II improvement and those with a capacity over 100 percent will require a Stage III improvement. Actual timing will depend on development and the results of I/I elimination. Construction of new sewers to serve areas outside of the UGB were staged to conform to projections of when the development would occur by the city and county planning staffs.

ES.3.1 Stage I (2003-2005) Improvements

The Stage I improvements include critical repair projects, capacity improvements and I/I detection and removal projects as outlined in Table ES-1. Project descriptions for each of the six Stage I improvements are included in Chapter 4.

Table ES-1
Stage I Project Descriptions
 RUSA Wastewater Collection System Master Plan

	Project	Description	Budget
I-1.	Saddle Butte Basin I/I Investigation	I/I source detection program	\$50,000
I-2.	Winchester Pump Station Improvements	Replace the sewage pumps and fittings	\$100,000
I-3.	Saddle Butte I&I Reduction Project	Rehabilitate sewers identified in source detection program (item I-2) *Cost Allowance	\$150,000*
I-4.	Elk Island Siphon	Clean and reline 12-siphon barrel or replace and upsize siphon (option)	\$100,000 \$500,000
I-5.	Fairgrounds, North Bank, & Wilbur No. 2 Pump Stations	Upgrade sewage pump stations to improve capacity and meet DEQ standards and electrical codes	\$30,000
*Seattle ENR construction cost index = 6636		Lowest Total	\$380,000

ES.3.2 Stage II (2005-2015) Improvements

The Stage II improvement projects include interceptor sewer capacity improvements, pump station upgrades, forcemain replacements and infiltration reduction projects (as shown in Table ES-2).

Table ES-2
Stage II Project Descriptions
 RUSA Wastewater Collection System Master Plan

Project		Description	Budget
II-1.	North Bank-Phase 1	Construct 48-inch interceptor from WWTP to Stewart Park	\$4,100,000
II-2.	North Bank- Phase 2	Construct 36-inch relief sewer from Stewart Park to Elk Island siphon	\$1,800,000
II-3.	Elk Island Siphon	Construct additional 30-inch siphon from Elk Island to Stevens St. (assumes project not selected in Stage I)	\$500,000
II-4.	Deer Creek Interceptor	Replace interceptor with larger capacity pipeline	\$550,000
II-5.	Highland Street Pump Station Forcemain	Upsize Highland Street forcemain to improve station capacity	\$200,000
II-6.	Winchester Forcemain	Replace 9000 feet of existing 12-inch forcemain	\$450,000
II-7.	Wilbur #1 and Loma Vista Pump Stations	Improve pumping capacities and rehabilitate electrical and instrumentation equipment	\$50,000
II-8.	Cloverdale Basin Capacity Improvements	Increase system capacity west of Airport Road and north of Garden Valley Boulevard	\$300,000
II-9.	Joseph St. Relining	Continue relining gravity sewer downstream of Winchester Pump Station forcemain	\$150,000
II-10.	Clay Sewer Replacement	Continue replacing clay sewer pipelines in the City to reduce groundwater infiltration	\$50,000 (annually)
Seattle ENR construction cost index = 6636		Total	\$8,150,000

ES.3.3 Stage III (2015-2055) Improvements

The Stage III improvement projects include constructing new interceptor sewers into unsewered basins outside the present RUSA service boundaries, upsizing capacity deficient pipelines, and rehabilitating concrete sewers (as shown in Table ES-3).

ES.4 Sources of Information

The following were used as primary sources of information for this study:

1. City of Roseburg Urban Area Comprehensive Plan.
2. "Roseburg Urban Sanitary Authority Master Sanitary Sewage Collection System Plan," 1985.
3. ADS Environmental Services Flow Monitoring Report, 1998.

Table ES-3
Stage III Project Descriptions
 RUSA Wastewater Collection System Master Plan

	Project	Description
III-1.	Garden Valley	Construct 30-inch interceptor, pump station and forcemain
III-2.	Fisher Road	Construct interceptors, pump stations, and forcemains
III-3.	Del Rio	Construct Del Rio Interceptor
III-4.	Wilbur	Construct Wilbur to Fisher Road Interceptor
III-5.	South Umpqua Interceptor	Construct interceptor south from Mill Street
III-6.	Capacity Improvements	Upsize pipelines with flows over 100 percent of capacity
III-7.	Concrete Sewer Rehabilitation or Replacement Program	Reline or replace older, deteriorated small-diameter non-reinforced concrete pipelines

ES.5 Report Organization

Tables and figures in this report are numbered consecutively within each section. Tables generally appear on the page following their first reference. For the most part, figures are placed at the ends of their respective chapters. The Table of Contents includes a complete list of tables and figures. Enlarged plots of several maps have been included in the Appendix for easier review.

ES.6 Acknowledgements

The courtesy and assistance we have received from the many individuals who contributed valuable information and support during the course of the study was most helpful. We greatly appreciate their efforts. We especially want to acknowledge the efforts of the following:

- The entire RUSA staff, especially Doug Zenor, General Manager; Ron Thames, Engineering and Operations Supervisor; and Dave Fromdahl, Information Systems Coordinator. Their efforts in compiling the sewer maps, as-built drawings and assistance with GIS mapping of the collection system were invaluable to the completion of this master plan.
- OMI WWTP staff for their work in providing flow data and validation for the sewer system hydraulic modeling.
- City of Roseburg and Douglas County Planning Department staff for their work in providing land use, zoning and population projection data that provided the basis for projected base wastewater flows in the RUSA system.

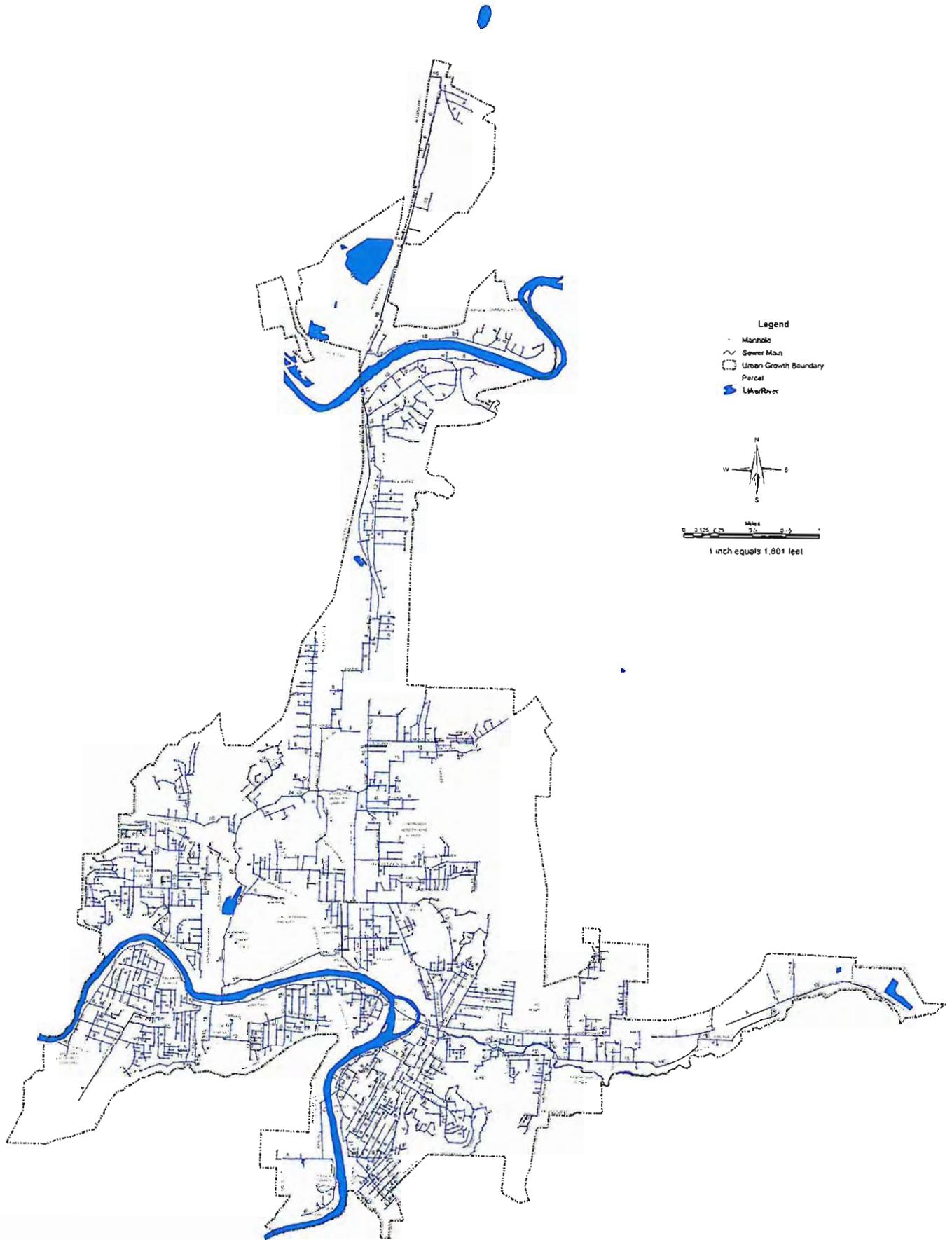


Figure ES-1
RUSA Service Area
 RUSA Wastewater Collection System Master Plan

Chapter 1

Existing Facilities



Chapter 1

EXISTING FACILITIES

1.1 Existing Collection System Inventory

An inventory of RUSA's collection system components, mainlines, interceptors, pump stations and forcemains, was conducted during this study. Table 1-1 presents an inventory summary developed from the geographic information system (GIS) mapping database. Gravity sewers, pressure mains, siphons, and manholes were identified separately. The RUSA system contains nearly 145 miles of pipeline and 3,181 manholes as well as a small number of miscellaneous vaults. The estimated replacement value of the pipe system is over \$50 million. RUSA also owns seven sewage pump stations and operates an additional station at the fairgrounds for Douglas County.

1.2 Collection System Mapping

CH2M HILL, along with RUSA staff, created a comprehensive GIS mapping system during this study. The electronic mapping system provides RUSA with tools that can be linked to the software used for closed caption television (CCTV) data collection and allows preparation of work orders for collection system maintenance staff. The information stored in the GIS database includes pipe size, length, invert elevations, manhole numbers and location. These attributes are overlaid on aerial photo backgrounds and parcel mapping. RUSA staff are able to query the map system from any computer networked with the GIS server. Files can be downloaded to laptop computers and used by field staff. Color maps can be plotted at any scale and level of detail desired. Figure 1-1 (an enlarged version of this figure is available in the Appendix at the end of this report) shows the areas included in the GIS mapping project. Figure 1-2 (an enlarged version of this figure is available in the Appendix at the end of this report) shows how the overall map system is divided into manageable map sizes for printable hard copy maps. Larger scale maps of Figures 1-1 and 1-2 are provided in the Appendix.

The GIS mapping was used as the basemap in the hydraulic model prepared for this study and discussed in Chapter 3. The model has over 32 miles of pipeline data that was provided by the GIS database.

1.3 Sewage Lift Station Evaluations

A comprehensive evaluation of all of RUSA's remote sewage pumping facilities was completed for this master plan. The evaluation is presented in the form of a Technical Memorandum (attached at the end of this chapter) that includes field observations and improvement recommendations for each station in the system. The influent pump station at the wastewater

treatment plant (WWTP) was not included in the evaluation, but will be addressed in the wastewater treatment facility plan.

Table 1-1
Pipe and Manhole Inventory
 RUSA Wastewater Collection System Master Plan

Pipe Diameter (inches)	Gravity Sewers		Pressure Sewers		Siphon	
	No. of Pipe Segments	Total Length (feet)	No. of Pipe Segments	Total Length (feet)	No. of Pipe Segments	Total Length (feet)
6	305	50,879	4	5,152		
8	2,159	459,255	3	3,249	1	120
10	202	49,890			2	547
12	138	32,791	6	9,203	2	1,297
14	3	773	5	4,002	2	1,223
15	84	21,495			1	429
16	10	1,699			1	382
18	92	21,275				
20	5	560				
21	27	7,219				
24	70	12,615			1	615
27	14	4,256				
30	11	1,894			2	1,296
36	59	14,474				
42	21	6,138				
Unidentified	360	48,766				
Total	3,560	733,979	18	21,606	12	5,909
Manholes Total	3,181					

Note: Totals based on GIS database

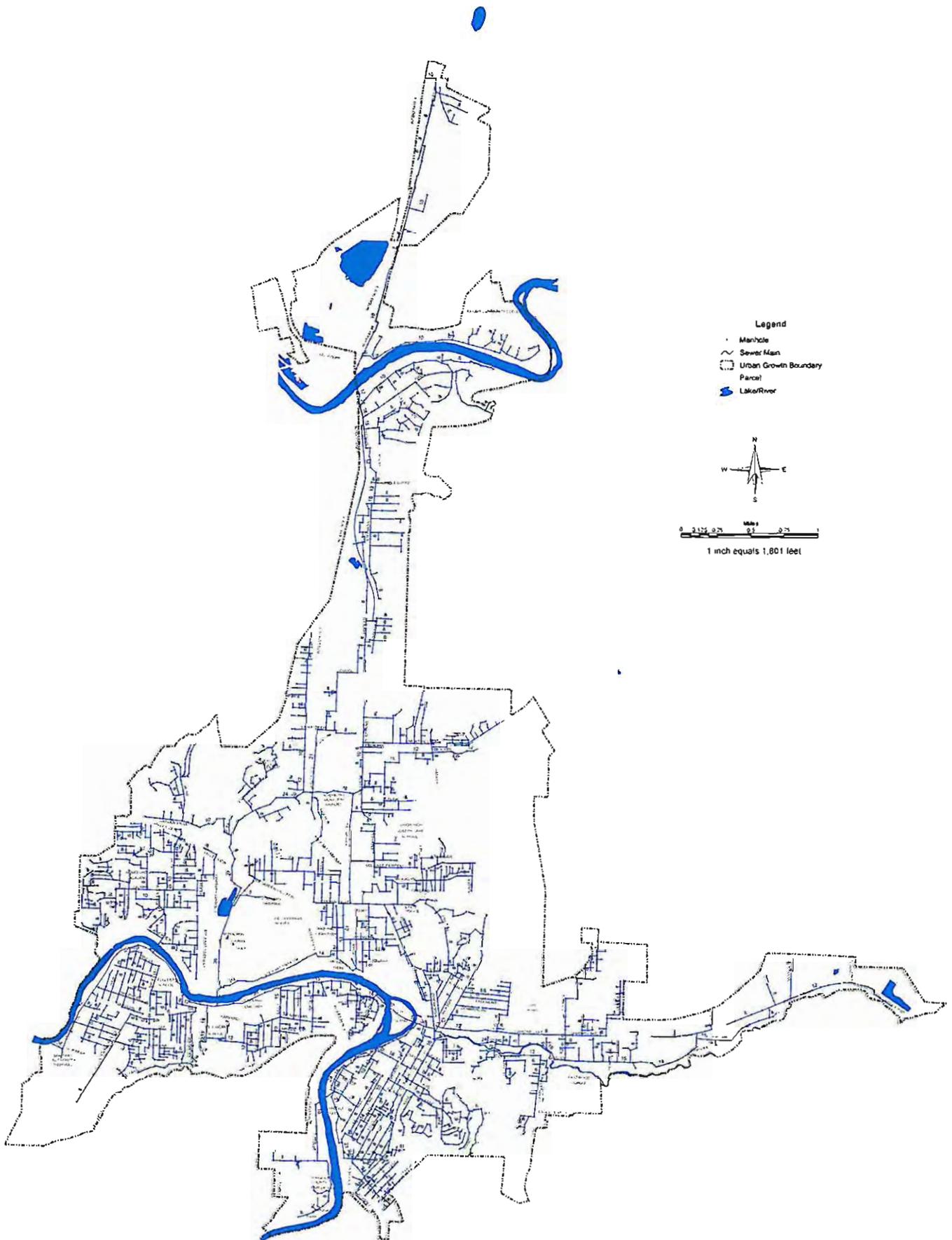


Figure 1-1
RUSA Service Area
 RUSA Wastewater Collection System Master Plan

Technical Memorandum

Wastewater Master Plan Sewage Lift Station Evaluations

Prepared for
Roseburg Urban Sanitary Authority

September 2004

Prepared by
CH2MHILL

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- A Reliability and Redundancy Requirements
- B Lift Station Evaluation Sheets

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- TM2-1 Lift Station Data
- TM4-1 Recommended Lift Station Improvements

Introduction

1.1 Purpose

The purpose of this chapter is to summarize the observations at March 2000 inspections of 7 of the 9 sewage lift stations maintained by the Roseburg Urban Sanitary Authority (RUSA), and to define short- and long-term lift station improvements to be recommended in the wastewater master plan.

1.2 Scope

The scope of work to be performed in this lift station evaluation report consists of the following subtasks:

- Conduct an evaluation of 7 of the 9 lift stations maintained by RUSA, to assess condition, reliability and capacity for future expansion.
- Establish redundancy/reliability criteria for wastewater lift stations and prepare a checklist to use during lift station site evaluations.
- Inspect the lift stations and document safety, structural, mechanical and control deficiencies. Identify electrical components for each station. Assess the potential for expanding the capacity of the lift station.
- Prepare a report that will summarize the observations and define short-term and long-term improvements. On the basis of existing pump data, identify the potential capacity of the lift stations.

Lift Stations Evaluated in this Report

RUSA maintains a total of 9 sewage lift stations. Of these stations, one is the influent pump station at the RUSA Wastewater Treatment Plant and one is the moth-balled old Winchester Station located adjacent to the operating Winchester station.

This evaluation includes the 7 remaining remote station in the collection system, and does not include the retired lift station at site of the Winchester Pump Station. The influent pump station will be discussed in the treatment plant facilities plan.

Level of Detail

This report is for master planning purposes, and presents general observations based on brief inspections of the stations. The report scope provides for documentation of observed operational deficiencies, and recommendations to correct the identified problems.

The scope does *not* provide for comprehensive structural, safety, pump, power or other analyses of any of the lift stations. This report does not constitute an exhaustive check of lift

station conformance with criteria used by the Occupational Safety and Health Association (OSHA), the National Electrical Code (NEC), Uniform Building Code (UBC), the state specialties code, or other agencies. Rather, this evaluation reflects the professional opinions and recommendations of qualified engineers with experience in sewage lift station design and operation in Oregon.

Reliability/Redundancy Criteria

The lift station evaluation scope includes establishing reliability/redundancy criteria with which to characterize each lift station's ability to operate with 1 criteria unit out of service. These criteria are contained in Attachment A.

1.3 Lift Station Evaluation Procedure

This section describes the procedures and criteria used to evaluate each lift station, and to identify deficiencies and needed improvements.

Lift station inspections were conducted on April 16, 2000, by Marv Murray and Jim McWade of CH2M HILL. Upon arrival at each station, the dry pit access door or hatch was opened, the air quality was checked, and personnel entered the dry pit. Structural and mechanical items were inspected, the pumps and controls were operated, and other observations were made.

For each station, an evaluation sheet was completed to contain the field data. Each evaluation sheet is a computer spreadsheet containing lift station data and an inspection checklist with a column containing field comments. Structural, process/mechanical, power, instrumentation/control, record keeping, safety, and expandability categories are provided. Attachment B of this report contains the evaluation sheets for the 7 lift stations that were inspected.

Following the field inspection, the data for each station were supplemented by as-built drawings, conversations with operators, photographs, and other information on file at the WWTP. The evaluation sheet and technical file for each station was then used to develop, Evaluation and Recommendations.

When stating his opinion that a deficiency is significant enough to require correction, the evaluating engineer uses his knowledge of standard design practice, experience with similar Oregon lift stations, and his knowledge of currently accepted lift station operation and maintenance (O&M) practices in Oregon. The following describes the criteria and considerations applied under the 7 categories contained in the evaluation sheet.

Structural

Visible portions of wet well and dry pit structures were checked for signs of stress or deterioration, location with respect to inflow, and flood risk based on the waterlines remaining from the record floods. Walls and floors were checked for moisture and corrosion. Wall pipes and other penetrations were inspected for cracks or leakage.

Doors, hatches, ladders and stairways were checked for significant deflection (1/100 of span or greater) under load, and evaluated for security against illegal entry.

Lifting eyes, beams, rails, hoists and other lifting equipment were visually compared against standard industry equipment.

Process/Mechanical

Pumps, piping, vacuum pumps, sump pump, ventilation fan, dehumidifier, heater, and other mechanical equipment were visually checked for installation and layout. Sewage pumps and valves were observed in operation to check for vibration, leakage and proper cycling. Vacuum pump, receiver and sump pump operation were visually checked.

Ventilation fan operation was qualitatively checked by observing the motor, fan and discharge, and estimating whether the air flow is sufficient to purge the entire dry pit (i.e., provide 1 air change) in 1 to 2 minutes, while the operator prepares for entry.

This criterion is safety oriented, and more conservative than the 15 air exchanges per hour minimum rate typically used in dry pit design, and the 6 exchanges per hour minimum required to meet NEC hazardous location criteria (see Section TM 3, Evaluation and Recommendations, for description of the NEC ventilation criterion).

Heaters and dehumidifiers were checked for satisfactory operation and installation.

Power

Power equipment was observed for apparent NEC violations, standby power provisions, and pumping capacity upgrade considerations. The station pump power system was checked for corrosion, moisture, shock hazard potential, clearances, and flood damage potential. Lights, outlets, and auxiliary equipment, including heater and dehumidifiers, were similarly observed.

Instrumentation and Control

Instrumentation and control (I&C) equipment was checked for proper installation and operation. The I&C equipment, including pump controllers, alarms and remote telemetry units (RTUs), was observed for corrosion, moisture, and flood damage potential.

Record Keeping

Lift station records were observed as to condition, location and effectiveness as a means of gathering and storing data and logging operator visits.

Safety

Only basic lift station safety features were observed during the visit, and the evaluations did not check compliance with all OSHA requirements. Safety provisions were compared against similar stations in other cities, and to design criteria contained in the Water Environment Federation manuals of practice for design of wastewater plants and pumping stations.

Lighting was observed for switch location and adequate illumination through the dry pit. The hatch, ladder and/or stairs were checked for rigidity and security against illegal entry. The floor was examined for presence of water, and other electrical safety provisions were noted.

Expandability

Each lift station was inspected for “expandability,” or ability to expand the station capacity in the future by (1) adding a third pump, or (2) replacing the 2 existing pumps with larger units. The available space, piping, wet well capacity and power feed capacity were considered to determine whether the station capacity could be increased.

General Observations

Because the majority of the lift stations operated by the RUSA are similarly constructed package dry pit/wet well facilities, general observations are made in this section to provide an overview of the stations and to avoid repetition of information in Section TM 3, Evaluation and Recommendations.

2.1 Structural

Key structural features of the lift stations are summarized in Table TM2-1, Lift Station Data. In describing the construction of the stations, it is convenient to refer to the following general descriptions:

1. The two vacuum-primed package lift stations are the Wilbur No. 1 and Wilbur No. 2 stations. These duplex stations are coated, corrosion-protected steel package units such as the Hydronix "Auto Prime." The pumps are vacuum-primed, provided with vacuum pumps, receivers and controls. The stations are constructed on top of 8-foot-diameter, precast concrete wet wells. Access to these stations is down a manway tube and ladder.

Both stations were constructed within the last 20 years. Despite periodic problems with vacuum leaks and line plugging in the vacuum systems, both stations are reliable, reasonable to maintain, and economically constructed.

For package lift stations constructed in recent years, more restrictive clearances from electrical equipment, and other electrical safeguards have been implemented to improve operator safety. Generally, recently constructed dry pits under 8 feet in diameter cannot be laid out to successfully meet the clearance requirements unless electrical equipment is relocated to grade above the station.

2. RUSA's two flooded suction, engineer-designed lift stations are the Winchester and Highland stations.

The Highland station is a flooded-suction, cast-in-place wet well and dry pit station designed by CH2M HILL and constructed in 1976. The station is provided with 3 close coupled vertical pumps. Access is provided by man-doors, circular stairs and hatches.

The Winchester facility was designed by CH2M HILL and constructed in 1991. This station consists of a near-surface motor floor, the pumps and motors are accessed by an aluminum hatch above a concrete dry pit. The wet well is accessed through a similar hatch above grade. Maintenance staff access is via man door and stairs.

3. RUSA has two submersible pump stations: one is the Loma Vista station and the other is the Fairgrounds station currently operated for Douglas County under a service agreement.

The Loma Vista station has two submersible sewage pumps installed in a precast concrete wet well. Access is provided by hatches located directly over the pumps. The pumps are removed by hoisting equip brought to the site during periodic maintenance visits. The controls for the station are housed in a stand alone panel located near the wet well.

The Fairgrounds station has two submersible sewage pumps installed in a coated steel wet well. Access is provided by hatches located directly over the pumps. The pumps are removed by hoisting equip brought to the site during periodic maintenance visits. The controls for the station are housed in a stand alone panel located adjacent to the pump access hatches.

The following general observations are based on the April 2000 on-site evaluation of the seven stations:

- **Structural Integrity** – Significant structural defects were not observed in any of the lift stations. Items that are not immediately significant but should be completed in the next 5 years are identified in Section TM 3, Evaluation and Recommendations.
- **Watertightness, Cracks, and Leakage** – Dry pit leakage caused by structural failure was not observed in any of the lift stations. Wall pipes were also in good condition.
- **Wet Well/Dry Pit Separation** – In the vacuum-primed stations, good seals are maintained on most penetrations between the wet well and the station, including the wet well access hatches, which are re-sealed with a flexible sealant each time they are opened.

TABLE TM2-1
Lift Station Data

Sewage Lift Station	Year	Wet Well		Dry Pit		Sewage Pumps				
		I.D. (feet)	Material	I.D. (feet)	Material	No. of Pumps	H.P.	Mfr.	Capacity (gpm)	RPM
Loma Vista ¹	1989	8	Concrete	N/A	N/A	2	20	ABS	240	1750
Fairgrounds ¹	1969	5.5	Steel	N/A	N/A	2	5	Hydromatic	300	1750
Highland ²	1976	7 X 17	Concrete	N/A	Concrete	3	75	Crane-Deming	1450	Variable
Winchester ³	1991	8.5 X 19	Concrete	N/A	Concrete	2	200	Allis Chalmers	2093	Variable
North Bank ⁴	1967	6	Concrete	6	Steel	2	20	Allis Chalmers	250	1750
Wilbur #1 ⁴	1986	8	Concrete	8	Steel	2	25	Crane-Deming	400	1750
Wilbur #2 ⁴	1986	8	Concrete	8	Steel	2	30	Crane-Deming	400	1750

Notes:

1. Submersible pumps in below grade wet well. Access is via wet well hatch covers.
2. Flooded-suction, engineered cast-in-place wet well with direct coupled motors. Access is via man-door and stairway.
3. Flooded-suction, engineered cast-in-place wet well-dry pit with motor floor above pump floor. Access is via man-doors, stairways and landings.
4. Vacuum-primed package pump station above precast concrete wet well. Access is via entry tube and ladder.

2.2 Process/Mechanical

Basic data on the lift station sewage pumps are contained in Table TM2-1, Lift Station Data, and in the individual lift station evaluation sheets in Section TM 3, Evaluation and Recommendations. General observations are:

- **Sewage Pumps** – In four of the lift stations, the pumps are vertical, direct-mounted, centrifugal, nonclog sewage pumps manufactured by Allis Chalmers and Crane-Deming. Of the remaining three, Loma Vista and Fairground are submersible type pumps. The Winchester station has vertical centrifugal pumps with drive shafts and motor floor above.
- **Vacuum Priming Equipment** – Two of the stations are duplex, vacuum-primed package lift stations constructed above precast concrete wet wells. Vacuum-primed stations were once popular because they are more economically constructed than wet well/dry pit stations.

Disadvantages of vacuum priming that have emerged over time include vacuum line plugging, hard-to-detect vacuum leaks, and dependency of the station on vacuum pumps, receivers and switches.

- **Air Compressors** – An air bubbler type level control system is provided in the North Bank station. This system requires high pressure air to operate the level control system. These systems are considered old technology and have typically been replaced with ultrasonic level sensor when the compressor system is no longer reliable.
- **Sump Pumps** – Stations are provided with dry pit sump pumps, typically 12-inch-diameter cans with a single sump pump and float switch. None of the stations have dry pit high level alarms. The sump pump must remove seal water, dehumidifier condensate, pump and valve leakage, and draindown when the pumps are opened up for servicing.
- **Ventilation Blowers** – Installed blowers are provided with switches at the manway hatch or door in all lift stations. Some fans appear to be undersized and in need of replacement. Good dry pit ventilation is a principal safety item. It is desirable for each station to be provided with a conservatively designed ventilation blower that operates automatically when the hatch is opened.
- **Dehumidifiers** – Portable, 120-volt dehumidifiers should be installed in most stations. Dehumidifiers should be plugged into outlets, and located on the station floor. Wall-mounted, direct wired dehumidifiers that are plumbed to the sump are preferred, although portable floor units plugged into non-GFCI outlets are acceptable.

2.3 Power

General observations of the lift station electrical power equipment are:

- **Overhead Lines and Transformers** – PP&L provides electric service to all of the lift stations. The electric service is either a dedicated overhead or underground service from the PP&L overhead distribution system. PP&L pole-mounted transformers and poles

that comprise the overhead distribution system are reasonably safe from vehicle damage.

- **Service Entrances** – At lift stations below- or partially below-grade, the service entrance equipment is mounted on a pole. This is the case for both overhead and underground services. At lift stations above-grade, the overhead or underground service is routed in conduit to the service entrance equipment inside the lift station.
- **Service Disconnects** – The service entrance equipment is accessible from grade and includes the meter enclosure for the PP&L meter, a main disconnect (fused switch or circuit breaker) and a manual transfer switch. The pole may be located adjacent to or physically away from the lift station on the lift station property. Service conductors are routed in conduit underground from the manual transfer switch enclosure to the lift station.
- **Motor Panels** – At lift stations below, motor starters are included in duplex pump control panels wall mounted inside the lift station. In some cases, telemetry/control equipment is individually wall mounted inside the lift station. At lift stations above grade, motor starters are provided in a motor control center lineup, in individual enclosures, or in a duplex pump control panel.
- **Conduit, J-Boxes, and Faceplates** – In all lift stations, rigid galvanized steel conduit is used with appropriate conduit fittings (condulets) and cast or sheet metal boxes and faceplates.
- **Lights** – In all lift stations, switched incandescent or fluorescent lights are used, as are appropriate for dry pit lighting. Installed lights in wet wells are usually not preferred, but if they are used, they should be rated for use in the appropriate hazardous location environment. No wet well lights were observed.
- **Outlets** – Outlets inside many of the lift stations are the non-GFCI receptacle type. For outlets powering equipment (heater, dehumidifier, etc.), hard wire connections to individual circuit breakers are preferred. Pump station outlets are not required to be provided with Ground Fault Circuit Interrupt (GFCI) devices, although GFCI receptacles are preferred for general purpose outlets in dry pits.
- **Control Panels** – In most lift stations, duplex pump control panels are provided with an ON/OFF/AUTO selector switch for each pump and an automatic alternator for operation of the pumps in the AUTO mode. In the AUTO mode, an ultrasonic wet well level sensing system or float switches provides relays and set points to cycle the pumps on and off.

2.4 Instrumentation and Control

Instrumentation and control (I&C) of the RUSA lift stations is monitored for alarms with remote telemetry units (RTUs) and level controllers. The equipment allows the system operators at the WWTP to monitor a 4-20 mA wet well level signal and various other alarms from each of the stations.

- **Remote Telemetry Units** – The RTUs in each lift station transmit lift station data to the WWTP control room via a 12-volt radio and an auto dial phone system. These units are well-known and reliable.
- **Remote Monitoring at WWTP** – The plant’s control system interfaces with the collection system RTU transmissions to provide remote monitoring of:
 - Lift station dry pit high level
 - Power fault
 - Pump fault
 - Alarm annunciation for high wet well level
- **Alarms** – Remote wet well high level alarms in all of the lift stations are provided via the level sensor and RTU.

2.5 Record Keeping

Observations regarding lift station log books and other records are:

- **Lift Station Log Books** – At each lift station, record keeping of the lift station conditions is limited to recording pump hours during each visit. A log book contains the date and pump hours. The pump logs are stored in a dedicated record keeping area.
- **Lift Station Records at the WWTP** – Operators at the plant maintain a set of notebooks for the lift stations that contain manufacturer’s data, pump manuals and other relevant data. Engineering drawings and O&M manuals are on file for all of the stations.

2.6 Safety

General observations regarding lift station safety are as follows:

- **Safety Procedures** – Operators are required to visit the lift stations with another operator, and to follow standard entry safety procedures.
- **Fall Protection** – In the deep vacuum-primed package stations and the flooded suction package stations, operators descend to the pump floor down a manway tube and vertical ladder. The underside of the manway lid is frequently provided with 2 ladder rungs to facilitate entry. Ladders in these stations are well-installed and of high quality.

The flooded-suction Highland, Winchester, and North Bank stations have satisfactory fall protection for dry pit entry. Stairways and landings for these stations are described in Section TM 3, Evaluation and Recommendations.
- **Gas Safety** – Operators are provided with 3-gas detectors that may be lowered into the stations prior to entry. Operators are trained in confined space entry and gas safety.

Ventilation fans are not critical lift station equipment, but they are a fundamental safety item that should receive the same maintenance and attention as the sewage pumps. Because, personnel gas detectors may occasionally be left back at the WWTP, the dry pit ventilation fans should be powerful units capable of purging the space of toxic gas in 1 to 2 minutes.

All lift stations have ventilation fans that can be manually or automatically switched on at the manway lid. Stations in need of ventilation fan service or replacement are noted in Section TM 3, Evaluation and Recommendations.

- **Lifting Equipment** – When a heavy pump or valve is removed from or installed in a station, there is frequently a person in the dry pit. In the event that the equipment falls, there is little maneuvering room in most of the package stations.

Unfortunately, this is a fact of life regarding package stations, and few improvements can be made. RUSA personnel use the following measures in lifting equipment in the sewage lift stations:

- When equipment and materials are hoisted from and into a station, personnel avoid having a person below the item.
- A redundant cable or chain is used on heavy equipment.
- When using a boom truck, an observer is positioned over the manway as the equipment is handled.
- Personnel never hoist equipment alone.

2.7 Expandability

Expandability refers to the degree to which a lift station has the available space, piping, wet well capacity, and power feed capacity to expand the station capacity in the future by (1) adding a third pump, or (2) replacing the 2 existing pumps with larger units.

General observations are as follows:

- **Adding a Third Pump** – All of the RUSA lift stations except for the Highland station are 2-pump stations that do not have sufficient space for a third pump. However, many of these stations can be equipped with larger drives.
- **Replacing 2 Existing Pumps with Larger Units** – With several exceptions, most of the RUSA's lift stations can be equipped with larger pumps. However, stations must first be pre-designed to determine pumping needs, wet well size and dry pit size. The design wet weather flow, the average dry weather flow, and force main hydraulics are used to define the maximum and minimum flow conditions.

The wet well size must be adequate to maintain the proper number of pump starts per hour during dry and wet conditions. If larger pumps are provided, additional wet well capacity may be required.

The dry pit size must be sufficient to house the needed pumps and drives, and to provide sufficient operator access and clearance from the control panels. As shown in Table TM2-1, Lift Station Data, 4 of the stations are 8-foot-diameter, and 1 station is 6-foot-diameter. In most cases, it is impractical to install drives larger than 25 hp in 6-foot-diameter package lift stations, or 75 hp in 8-foot-diameter stations. When drives of 75 horsepower or greater are installed in 8-foot-diameter stations, excess heat must usually be removed by larger ventilation systems, the control panel must be moved out of the dry pit to an above grade location.

Evaluation and Recommendations

This section provides basic data on each of the sewage lift stations. Each subsection includes a brief narrative description of the lift station and a section describing operational deficiencies and recommended corrective measures.

Subsection 3.1 below recommends system-wide measures to use the existing telemetry and computer system to remotely monitor and supervise system-wide lift station operation. Subsections 3.2 through 3.8 describe and evaluate the Lift Stations for structural, process/mechanical, power, instrumentation/control, record keeping and safety needs, and for future expansion potential.

In Section TM 4, the recommendations in this section are prioritized and listed in Table TM-3, Recommended Lift Station Improvements.

3.1 Lift Station Telemetry and Alarms

With the existing level controllers, remote telemetry units, and computer system, RUSA has limited supervisory control capability to remotely monitor the lift stations, and to provide timely alarm and response to equipment malfunctions. The installation of the more advanced acoustic level sensors and controllers would allow for closer monitoring of pumping rates and provide early indication of pump failures.

Remote Telemetry Units

The following system-wide measure is recommended:

- In each lift station, an effort should be made to secure RTU wiring against water damage, vandalism, and obstruction hazard. All RTU radios, battery chargers and batteries should be wall mounted on a secure bracket in an accessible location, so that no control or RTU equipment is positioned on pumps, piping or the floor. All RTU power and control cable should be installed in conduit. All cable and conduit penetrations of structures and panels should be sealed watertight as required by code.

Alarms

Remote monitoring and display capability of the following conditions would be advantageous:

Dry Pit High Level Alarms – Stations that would benefit from dry pit high level alarms are indicated in Section TM 3. Dry pit high level alarms are inexpensive and provide early warning of dry pit flooding from overtopping or piping failure. The following is recommended:

- Remote dry pit high level alarms should be provided in all lift stations *except for* the Loma Vista and Fairgrounds stations, which have at-grade controls that are not susceptible to flooding.

Wet Well Level Sensing – Current level sensing in most of the stations is by mercury float switch. The following is recommended:

- Convert the mercury float switches to ultrasonic level control to reduce maintenance and improve reliability.

Illegal Entry Alarms – Illegal entry alarms reduce RUSA's liability for accidents occurring when unauthorized persons enter lift stations. In other cities, Illegal Entry alarms are standardly used in lift stations because persons have broken into stations to steal or vandalize equipment, or for reasons that cannot be explained. It is recommended to:

- Provide hatch limit switches, keyed disconnect, remote contacts and interface with the RTU to alarm ILLEGAL ENTRY in all of the stations to the plant computer.

3.2 Loma Vista Lift Station

Description

The Loma Vista lift station serves a residential district (Loma Vista Subdivision) that continues to expand. Constructed in 1989, the facility is a submersible type pump station in a pre-cast concrete wet well.

The station contains 2 20-horsepower submersible pumps, each rated for 240 gallons per minute.

The 8-foot-diameter wet well is accessed through a metal hatch near the center of the wet well.

The electrical and instrumentation devices are located in a free standing panel adjacent to the wet well.

Evaluation and Recommendations

Structural

Overall structural condition appears satisfactory for continued use and future upgrade as described below.

Process/Mechanical

Overall mechanical system appear to operate as designed. Access to the check valves is difficult since they are inside the wet well rather than install in an external vault. One of the pumps was not properly seated on the base in the wet well causing some discharge flow to recirculate in the wet well. This situation could be remedied by pull the pumps and cleaning the seating surface and resetting the pump.

Power

National Electrical Code

There are no apparent NEC violations.

Standby Power

There is no standby power, but there is a plug for a portable generator that is stored at the WWTP.

Pumping Capacity Upgrade Considerations

Larger capacity pumps could be install at this station.

Instrumentation and Control

Overall I&C equipment appears satisfactory. The control panels are mounted on a sheet of painted plywood which will eventually need replacement. It is recommended that the replacement be with metal struts and aluminum sheeting.

Record Keeping

Lift station records are maintained at the RUSA WWTP. Lift station log maintenance is satisfactory.

Safety

Recommended measures to enhance station safety are:

Consider moving valve out of wet well to eliminate the confined space entry issue when servicing the valves.

Expandability

Large capacity pumps could be installed in the station as growth outpaces the capacity of this station.

3.3 Highland Station

Description

The Highland lift station serves the area north of the south Umpqua River and east of Interstate 5.

Constructed in 1976 and updated in 2000, the facility is a wetpit/dry pit type pump station.

The station contains three 75-horsepower frame-mounted centrifugal pumps, each rated for 1,450 gallons per minute.

Evaluation and Recommendations**Structural**

Overall structural condition appears to be in good condition.

Process/Mechanical

Overall mechanical system is in good condition other than some minor pump seal leakage.

Power

National Electrical Code

There are no apparent NEC violations.

Standby Power

There is standby generator at this station that is in good condition.

Pumping Capacity Upgrade Considerations

Larger capacity pumps could be install at this station. It is recommended that immersible type pumps be installed at the time of replacement. Since the motors need to be installed in the dry pit where a pipe failure could flood the station, immersible motors would continue to operate without damage or interruption.

Instrumentation and Control

The I&C equipment is in good condition. New adjustable speed drives for the pumps were recently installed.

Record Keeping

Lift station records are maintained at the RUSA WWTP. Lift station log maintenance is satisfactory.

Safety

Recommended measures to enhance station safety are:

Consider replacing the spiral stairs to the pump room.

Expandability

Larger capacity pumps could be installed in the station as growth outpaces the capacity of the existing pumps. The forcemain may be the only limiting factor in expansion.

3.4 Fairgrounds Station

Description

The Fairgrounds lift station serves the Douglas county Fairground and the surrounding area that is located across the South Umpqua River from the nearest gravity sewer. The station discharges to the South Umpqua Interceptor near Templin Street. The station is owned by the County and operated under a service contract with RUSA. This situation complicated the upgrading of the station because of the financial responsibility question raised when improvements are recommended rather than absolutely required.

Constructed in 1969, the facility is a submersible type pump station in a pre-cast concrete wet well.

The station contains 2 5-horsepower submersible pumps, each rated for 300 gallons per minute.

The 5'-6' diameter wet well is accessed through a metal hatch near the center of the wet well.

The electrical and instrumentation devices are located in a panel attached to the wet well.

Evaluation and Recommendations

Structural

Overall structural condition appears rather rough with significant rust showing on the inside of the metal wet well. This condition will be difficult to repair because it requires bypassing the station for a long period of time while the metal is prepared and painted.

Process/Mechanical

Overall mechanical system appear to operate as designed. Access to the check valves is difficult since they are inside the wet well rather than install in an external vault.

Power

National Electrical Code

There are no apparent NEC violations.

Standby Power

There is no standby power connection. A receptacle should be installed to allow a portable generator to be connected to the station.

Pumping Capacity Upgrade Considerations

Larger capacity pumps could be install at this station.

Instrumentation and Control

Overall I&C equipment appears satisfactory. The control panel is mounted directly on the metal wet well cover. This situation allows the panel to sway whenever there is heavy wind or someone leans against the panel. The panel is also located directly next to the wet well opening which make it impossible to safely open the wet well and the panel at the same time. The panel should be remounted adjacent to the wet well on it's own support system.

Record Keeping

Lift station records are maintained at the RUSA WWTP. Lift station log maintenance is satisfactory.

Safety

Recommended measures to enhance station safety are:

Consider moving valve out of wet well to eliminate the confined space entry issue when servicing the valves.

Expandability

Large capacity pumps could be installed in the station as growth outpaces the capacity of this station.

3.5 Winchester Station

Description

The Winchester lift station is located adjacent to Hwy 99 and the North Umpqua River. The station was constructed in 1991 to replace an adjacent package station. The package station is still in place and moth-balled for emergency backup to the new station.

The station contains two 200-horsepower pumps, each rated for 2093 gallons per minute at a total dynamic head of 236 feet.

Evaluation and Recommendations

Structural

Overall structural condition is good. The station structure appears to be satisfactory for continued use.

Process/Mechanical

The existing pumps are experiencing extreme vibration that cause pump seals to fail periodically. The vibration continues to break pump mounting bolts and damage the surrounding concrete pump bases. Noise levels are extremely high in the pump room. The pumps are showing signs of extreme wear on the impellers and the pump volutes. The adjacent check valves are also showing signs of vibration damage.

The existing pumps need to be replaced soon. The existing pumps are no longer available and parts are limited. A different type of pump should be considered for this station. The current 2 vane impeller design is the cause of much of the vibration.

Power

National Electrical Code

There are identified NEC violations.

Standby Power

A large standby mobile generator is connected to the station.

Instrumentation and Control

Pump controls and remote telemetry are satisfactory.

Record Keeping

Lift station records are maintained at the RUSA WWTP. Lift station log maintenance is satisfactory.

Safety

Recommended measures to enhance station safety are:

None

Expandability

The existing dry pit cannot accommodate 3 pumps, however, the station is sufficiently large to accommodate 2 new, larger pumps. The expansion of the station is currently limited by the capacity of the 12-inch forcemain. Any capacity increases will likely include forcemain improvements.

3.6 North Bank Station

Description

The North Bank lift station is located near the Winchester Dam on the North Umpqua River. Constructed in 1967, the facility is a vacuum-primed package pump station over a pre-cast concrete wet well.

The station contains two 20-horsepower pumps, each rated for 250 gallons per minute.

The 6-foot-diameter coated steel package dry pit is located adjacent to the 8-foot-diameter concrete wet well. The dry pit is accessed by climbing a ladder to a narrow platform surrounding the elevated dry pit, then through a manway tube and ladder. The wet well is accessed through a manhole opening.

Evaluation and Recommendations

Structural

Overall structural condition is good. The station structure have very limited clearance for man access and maintenance activities.

Process/Mechanical

The existing pumps, motors, and other appurtenances are in working condition. The pumps are 36 years old and are well beyond their expected service life. There is not room to upsize the pumps in this station.

Power

National Electrical Code

There are several NEC violations. The station does not have ground fault protection on its 110 volt convenience outlet. Outlet should be replaced with GFIC unit. The station has less than the required distance between piping and the face of the electrical panel.

Standby Power

The manual transfer switch is provided for connection to a mobile engine generator set during a service outage.

Pumping Capacity Upgrade Considerations

The 2 existing 20-horsepower pump motors can be increased in size up to 25-horsepower using the NEMA size 2 motor starters. With new NEMA size 3 motor starters, existing pump motors could be replaced with motors rated up to 50 horsepower. The power service, main disconnect, manual transfer switch, main circuit breaker, motor starter circuit

breakers, and motor conductor current ratings should be checked before any increase in horsepower to verify they have capacity for the increase in motor current.

Instrumentation and Control

Pump controls and remote telemetry are satisfactory.

Record Keeping

Lift station records are maintained at the RUSA WWTP. Lift station log maintenance is satisfactory.

Safety

Recommended measures to enhance station safety are:

Replace access ladders to the power panel and the lift station

Expandability

The existing 8-foot-diameter dry pit cannot accommodate larger pumps because of the limited space in the dry pit. A new station, submersible type pump station similar to the Loma Vista station could be constructed at this site and improve reliability. This station is very close to the North Umpqua River where equipment failure would quickly turn into a sewage spill into the river.

3.7 Wilbur No. 1 Station

Description

The Wilbur #1 lift station is located within the boundaries a of commercial sales facility. Constructed in 1986, the facility is a vacuum-primed package pump station over a pre-cast concrete wet well.

The station contains 2 25-horsepower pumps, each rated for 400 gallons per minute at a total dynamic head of 88 feet.

The 8-foot-diameter coated steel package dry pit is located on top of the 8-foot-diameter wet well. The dry pit is accessed through a manway tube and ladder. The wet well is accessed through a sealed manway opening in the dry pit floor.

Evaluation and Recommendations

Structural

Overall structural condition is good. The station structure appears to be satisfactory for continued use.

Process/Mechanical

- The existing pumps, motors, vacuum pumps and other appurtenances are in good condition.

Power

National Electrical Code

There is one NEC violations. The station does not have ground fault protection on its 110 volt convenience outlet. Outlet should be replaced with GFIC unit.

Standby Power

The manual transfer switch is provided for connection to a mobile engine generator set during a service outage.

Instrumentation and Control

Pump controls and remote telemetry are satisfactory.

Record Keeping

Lift station records are maintained at the RUSA WWTP. Lift station log maintenance is satisfactory.

Safety

Recommended measures to enhance station safety are:

Replace ventilation fan to increase air flow.

Expandability

The existing 8-foot-diameter dry pit cannot contain 3 pumps, however, the station is sufficiently large to accommodate 2 new, larger pumps.

3.8 Wilbur No. 2 Station

Description

The Wilbur #2 lift station is located within the boundaries of an commercial furniture production facility. Constructed in 1986, the facility is a vacuum-primed package pump station over a pre-cast concrete wet well.

The station contains two 30-horsepower pumps, each rated for 400 gallons per minute at a total dynamic head of 110 feet.

The 8-foot-diameter coated steel package dry pit is located on top of the 8-foot-diameter wet well. The dry pit is accessed through a manway tube and ladder. The wet well is accessed through a sealed manway opening in the dry pit floor.

Evaluation and Recommendations

Structural

Overall structural condition is good. The station structure appears to be satisfactory for continued use.

Process/Mechanical

The existing pumps, motors, vacuum pumps and other appurtenances are in good condition. The station is known to require both pumps to run during heavy rain events. The wet well high level is still reached with both pumps running. It is recommended to:

- Verify pump capacity by performing a draw-down test.
- Replace impeller if flow is less than 80 percent of design flow.
- Replace pumps with larger capacity if draw-down test shows pumps operating within acceptable range.

Power

National Electrical Code

There is one NEC violations. The station does not have ground fault protection on its 110 volt convenience outlet. Outlet should be replaced with GFIC unit.

Standby Power

The manual transfer switch is provided for connection to a mobile engine generator set during a service outage.

Pumping Capacity Upgrade Considerations

The 2 existing 30-horsepower pump motors can be increased in size using the existing motor starters. With the NEMA size 3 motor starters, existing pump motors could be replaced with motors rated up to 50 horsepower. The power service, main disconnect, manual transfer switch, main circuit breaker, motor starter circuit breakers, and motor conductor current ratings should be checked before any increase in horsepower to verify they have capacity for the increase in motor current.

Instrumentation and Control

Pump controls and remote telemetry are satisfactory.

Record Keeping

Lift station records are maintained at the RUSA WWTP. Lift station log maintenance is satisfactory.

Safety

Recommended measures to enhance station safety are:

Replace ventilation fan to increase air flow.

Expandability

The existing 8-foot-diameter dry pit cannot contain three pumps; however, the station is sufficiently large to accommodate two new, larger pumps.

SECTION TM 4

Summary of Lift Station Recommendations

Table TM4-1, Recommended Lift Station Improvements, is a summary of the recommended lift station capital improvements described in the preceding section.

Improvements are prioritized as low, moderate and high.

TABLE TM4-1
Recommended Lift Station Improvements

Sewage Lift Station	Recommendation	Priority		
		High	Moderate	Low
All Stations	Alarm – Dry Pit High Level		X	
	Alarm – Sewage Pump Fault		X	
	Alarm – Illegal Entry			X
Loma Vista	Move check valve outside wet well			X
Highland	Install pump alternator		X	
	Install trash rack in wet well			X
Fairgrounds	Relocate Electrical Panel	X		
	Relocate Check Valves			X
Winchester	Replace Pumps and check valves	X		
North Bank	Upgrade station or replace station	X		
	Upgrade electrical service	X		
	Improve access to station	X		
Wilbur No. 1	Install GFCI outlet	X		
	Upgrade ventilation	X		
Wilbur No. 2	Install larger capacity pumps	X		
	Repair pig launcher assembly			X
	Upgrade ventilation	X		

TM ATTACHMENT A

Reliability and Redundancy Requirements

Reliability and Redundancy Requirements

Reliability and redundancy criteria governing Oregon wastewater facilities are established in Oregon Administrative Rule 340-52 and the RUSA's National Pollutant Discharge Elimination System (NPDES) permit issued by Oregon Department of Environmental Quality (DEQ).

Because most of the lift stations maintained by RUSA are sited in areas where a short-term overflow would not permanently or unacceptably damage receiving waters, these stations are considered in the Oregon rules to be Class II installations.

RUSA's NPDES permit prohibits lift station overflows unless an upset as defined in 40 CFR 122.41(n) has occurred. This CFR section, and the General Conditions of the RUSA's NPDES permit, define an "upset" as follows:

"Upset means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation."

For a lift station to operate at peak conditions without overflows, the critical equipment (defined below) must be:

- *Reliable* as defined by applicable structural and safety codes, and accepted design practices;
- Provide with *redundant* (standby) equipment sufficient to operate at peak conditions with the largest lift out of service.

In evaluating a lift station for provisions to prevent overflows, reliability and redundancy criteria are used to determine whether the station capacity is adequate, and if sufficient standby units are provided.

Critical Equipment

Reliability and redundancy criteria are typically applied to critical items of equipment that must operate to avoid overflows to the environment. In general, lift stations should be provided with spares (redundant units) for all critical equipment.

In a sewage lift station, critical equipment items include pumps, drives, process piping, power supply, switchboards, MCCs, controllers and level measurement systems. For critical items, redundant units or an alternate means of operation must be provided such that the lift station can pass the design flow with the largest critical unit out of service. Under some conditions, uninstalled spare equipment is acceptable, if the equipment can be installed in a timely manner without resulting in an overflow.

Wet wells are also critical, but are extremely reliable. Redundant wet wells are not usually required in smaller lift stations, and single wet wells are typically acceptable if:

- The wet well configuration conforms with Hydraulic Institute Standards. Factors to be considered include wet well shape, operating volume; suction line size, material, submergence, proximity to the wet well walls, and distance to other suction lines; and the locations of the influent sewer and overflow pipes.
- Isolation valves are provided on the pump suction lines.
- The collection system has sufficient capacity to allow the wet well to be taken out of service during the dry weather months.

Noncritical Equipment

Noncritical items are units that are not required to operate in order to avoid overflows. If a unit is noncritical, providing a redundant unit is not required, but is sometimes advisable.

Noncritical equipment in a sewage lift station typically includes sample pumps, chemical feed systems, nonprocess piping, HVAC, lifting equipment and certain electrical and control systems. Although a unit may be noncritical, it may still be important to lift station operation. Noncritical items must be reliable as determined through operating experience and professional judgment.

Reliability/Redundancy Criteria

The following criteria should be applied in determining whether lift stations have adequate reliability/redundancy:

- Critical and noncritical equipment should be reliable, as determined by industry standards, regulatory requirements, experience and professional judgment.
- Critical equipment items should have sufficient capacity to pass the peak design flow with the largest unit out of service.
- Critical equipment should be configured such that, when the largest unit is removed from service, redundant equipment can be put online or an alternate means of operation can be provided.
- Critical equipment should be provided with a means of remote alarm annunciation when equipment has failed, to allow sufficient time for operators to place redundant units online in a timely manner.
- Wet wells are critical facilities and should be properly sized and configured to the influent and pumped flow.
- Dual wet wells are not required if a means of temporarily pumping is provided to allow servicing of single wet wells during dry weather months.
- Noncritical equipment items do not require that a redundant unit be provided.

TM ATTACHMENT B
Lift Station Evaluation Sheets

Lift Station Evaluation Sheets

Lift station inspections were conducted in April, 2000. For each lift station, an Evaluation Sheet was completed to contain lift station data, an inspection checklist, and field comments. The Evaluation Sheets are 3-page spreadsheets containing the field notes of the inspector.

Following the field inspection, the evaluation sheets were supplemented by As-Built drawings, conversations with operators, photographs, and other information on file at the wastewater plant. The Evaluation Sheet and technical file for each station was then used to develop this technical memorandum.

SEWAGE LIFT STATION EVALUATION

LIFT STATION NAME : LOMA VISTA

DATE INSPECTED: 4-16-00

INSPECTED BY: CH2MHILL

WET WELL INFORMATION

Construction Date: 1989

Wet Well Dimensions: 8' diameter X 13' deep

PUMP STATION INFORMATION

Package Manufacturer: TRIANGLE PUMP

PUMP INFORMATION

Manufacturer: ABS

Number of Pumps: 2

Horsepower: 20

Speed: 1750 rpm

Suction Dia.: 4-INCHES

Discharge Dia.: 4-INCHES

Design Capacity: 240 gpm @ 84' STATIC HEAD

Hr Meter: YES

Voltage: 230

No. Phases: 3

STRUCTURAL INSPECTION

Wet Well Structural Defects: NONE

Exterior Condition: GOOD

Interior Condition: N/A

Hatch & Ladder: NONE

Interior Moisture: N/A

House Keeping: GOOD

Flood Potential: N/A

MECHANICAL INSPECTION

Pump Type: SUBMERSIBLE CONSTANT SPEED CENTRIFUGAL

Operational Problems: PUMP RETRIEVAL HAMPERED BY CHECK VALVE LOCATION

Automatic Alternator: YES

Piping / Valve Condition: GOOD

Pressure Gauges: NO

Vacuum System: NO

Ventilation Fan: N/A

Dehumidifier: N/A

Heater : N/A

Sump Pump: N/A

POWER

Max No. Pumps: 2

Service: UNDERGROUND

Service Disconnect: YES

Service Voltage: 230

Phases : 3

Standby Power: NO

Generator Connection: YES

ELECTRICAL EQUIPMENT CONDITION

Electric Hazard During Flood: NO

Corrosion Areas: NONE

Moisture Areas: NONE

Wire Needing Conduit: NO

Wiring on Floor: N/A

J-Box Faceplates: OK

Lighting: OK

Outlet – Type/Height: NONE

Heater/Dehumidifier Mounting: NO

Radio/ Battery Charger Mounting: GOOD

INSTRUMENTATION & CONTROL

Pump Controller

Type: FIXED FLOATS

Display output: NONE

4-20 mA Output to RTU: No

Remote Telemetry Unit (RTU): Sensa phone

Pumps on/off: No

High Wet Well: Yes

Power Fault: Yes

Pump Fault: Yes

Dry Pit High Level: No

Illegal Entry: No

RECORDKEEPING

Condition of Pump Sta. Records: **PARTIAL**

Notebook: **NO**

Shelf or Bracket: **NONE**

Remote Record Keeping: **YES**

Level Control Parameters: **YES**

SAFETY

Ventilation Fan – Adequacy: **N/A**

Lighting: **OK**

Entry and Ladders/Stairs: **NONE**

Water on Floor: **N/A**

EXPANDIBILITY

Addition of Third Pump

Space: **NO**

Suction Wall Pipe: **NO**

Power: **NO**

Upgrade to Larger Pumps

Space: **YES**

Power: **YES**

MISC COMMENTS:

CHECK VALVES IN WET WELL ARE DIFFICULT TO ACCESS AND MAINTAIN.

SEWAGE LIFT STATION EVALUATION

LIFT STATION NAME : FAIRGROUNDS

DATE INSPECTED: 4-16-00

INSPECTED BY: CH2MHILL

WET WELL INFORMATION

Construction Date: 1969

Wet Well Dimensions: 5'-6" dia. X 14'(STEEL)

PUMP STATION INFORMATION

Package Manufacturer: HYDRONIXS

PUMP INFORMATION

Manufacturer: HYDROMATIC

Number of Pumps: 2

Horsepower: 5

Speed: 1750 rpm

Suction Dia.: 4-INCHES

Discharge Dia.: 4-INCHES

Design Flow: 300 GPM

Discharge Head: 40 feet

Hr Meter: YES

Voltage: 230

No. Phases: 3

STRUCTURAL INSPECTION

Wet Well Structural Defects: STEEL TANK IS CORRODED

Exterior Condition: NOT ABLE TO OBSERVE BURIED WET WELL EXTERIOR SURFACES

Interior Condition: ALL INTERIOR METALS HEAVILY CORRODED

Hatch & Ladder: WET WELL ACCESS DOORS ARE HEAVILY CORRODED-NO LADDER

Interior Moisture: N/A

House Keeping: N/A

Flood Potential: NONE

MECHANICAL INSPECTION

Pump Type: SUBMERSIBLE CONSTANT SPEED CENTRIFUGAL

Operational Problems: PUMPS DIFFICULT TO REMOVE ON CORRODED STEEL RAIL SYSTEM

Automatic Alternator: YES

Piping / Valve Condition: OK, CHECK VALVE INSIDE WET WELL

Pressure Gauges: NO

Vacuum System: N/A

Ventilation Fan: N/A

Dehumidifier: N/A

Heater : N/A

Sump Pump: N/A

POWER

Max No. Pumps: 2

Service: UNDERGROUND

Service Disconnect: YES

Service Voltage: 240

Phases : 3

Standby Power: NO

Generator Connection: NO

ELECTRICAL EQUIPMENT CONDITION

Electric Hazard During Flood: NO

Corrosion Areas: PANEL AND CONDUITS

Moisture Areas: NONE

Wire Needing Conduit: NO

Wiring on Floor: N/A

J-Box Faceplates: NONE

Lighting: NONE

Outlet – Type/Height: NONE

Heater/Dehumidifier Mounting: N/A

Radio/ Battery Charger Mounting: OK

INSTRUMENTATION & CONTROL

Pump Controller

Type; FLOAT SWITCHES

4-20 mA Output to RTU: No

Remote Telemetry Unit (RTU): Sensa phone

Pumps on/off: No

High Wet Well: Yes

Power Fault: Yes

Pump Fault: Yes

Dry Pit High Level: No

Illegal Entry: No

RECORDKEEPING

Condition of Pump Sta. Records: **NONE**

Notebook: **NO**

Shelf or Bracket: **NONE**

Remote Record Keeping: **YES**

Level Control Parameters: **FIXED FLOATS**

SAFETY

Ventilation Fan – Adequacy: **N/A**

Lighting: **NONE**

Entry and Ladders/Stairs: **NONE**

Water on Floor: **N/A**

EXPANDIBILITY

Addition of Third Pump

Space: **NO**

Suction Wall Pipe: **NO**

Power: **NO**

Upgrade to Larger Pumps

Space: **YES**

Power: **YES**

MISC COMMENTS:

Control panel is mounted directly to the light weight steel cover on the wet well.

Panel is not well support and susceptible to wind damage or vandalism.

Check valves are located inside wet well and difficult to maintain.

SEWAGE LIFT STATION EVALUATION

LIFT STATION NAME : HIGHLAND

DATE INSPECTED: 4-16-00

INSPECTED BY: CH2MHILL

WET WELL INFORMATION

Construction Date: 1976

Wet Well Dimensions: 7' X 17' X 7'

Gallons/Foot Depth: 890

Influent Height Above Invert: 8'

PUMP STATION INFORMATION

Package Manufacturer: N/A

PUMP INFORMATION

Manufacturer: CRANE-DEMING

Number of Pumps: 3

Suction Dia.: 6-INCHES

Discharge Dia.: 6-INCHES

Design Flow: 1,450 GPM

Horsepower: 75

Hr Meter: YES

Voltage: 480 - 3 Phase

STRUCTURAL INSPECTION

Wet Well Structural Defects: NONE

Exterior Condition: GOOD

Interior Condition: GOOD

Wet Well Hatch & Ladder Access: GOOD

Interior Moisture: NONE

House Keeping: GOOD

Flood Potential: NONE

MECHANICAL INSPECTION

Pump Type: VARIABLE SPEED CENTRIFUGAL

Operational Problems: SEAL LEAKS

Automatic Alternator: NO, MANUALLY ALTERNATED WEEKLY

Piping / Valve Condition: GOOD

Pressure Gauges: NO

Vacuum System: NONE

Ventilation Fan: GOOD CONDITION

Dehumidifier: NONE

Heater : GOOD CONDITION

Sump Pump: GOOD CONDITION

POWER

Max No. Pumps: 3

Service Over/underground: **OVERHEAD** Service Disconnect: **YES**Service Voltage: **480** Phases : 3Standby Power: **YES-NATURAL GAS FIRED GENERATOR**Generator Connection: **YES****ELECTRICAL EQUIPMENT CONDITION**Electric Hazard During Flood: **IF WATER DEPTH EXCEEDS 5' IN DRY PIT**Corrosion Areas: **NONE**Moisture Areas: **NONE**Wire Needing Conduit: **NO**Wiring on Floor: **NO**J-Box Faceplates: **OK**Lighting: **OK**Outlet – Type/Height: **STD. – 42 INCHES ABOVE FLOOR**Heater/Dehumidifier Mounting: **NO**Radio/ Battery Charger Mounting: **GOOD****INSTRUMENTATION & CONTROL**

Pump Controller

Type; **Ultra-sonic**Manufacture/Model: **Miltronics-Hydro ranger**Display Units: **Feet of Depth**4-20 mA Output to RTU: **No**Remote Telemetry Unit (RTU): **Sensa phone –Model 1104**Pumps on/off: **No**High Wet Well: **Yes**Power Fault: **Yes**Pump Fault: **Yes**Dry Pit High Level: **Yes**Illegal Entry: **No**

RECORDKEEPING

Condition of Pump Sta. Records: **Good**

Notebook: **Yes**

Shelf or Bracket: **Desk**

Remote Record Keeping: **Yes**

Standard Operating Procedures: **Yes**

Level Control Parameters: **Yes**

SAFETY

Ventilation Fan – Adequacy: **YES**

Lighting: **Good**

Entry and Ladders/Stairs: **Good-Spiral stairs should be replaced in the future**

Water on Floor: **Yes, lower level-pump - seal leakage**

EXPANDIBILITY

Addition of Fourth Pump

Space: **No**

Suction Wall Pipe: **No**

Power: **No**

Upgrade to Larger Pumps

Space: **Yes**

Power: **Yes**

MISC COMMENTS:

Needs trash rack in wet well to protect pumps from large debris.

Wet well accumulates large volumes of grease.

SEWAGE LIFT STATION EVALUATION

LIFT STATION NAME : WINCHESTER

DATE INSPECTED: 4-16-00

INSPECTED BY: CH2MHILL

WET WELL INFORMATION

Construction Date: 12/20/91

Wet Well Dimensions: 8.5' X 19' X 11.33' DEEP

Gallons/Foot Depth: 1,208

Influent Height Above Invert: VARIES

PUMP STATION INFORMATION

Package Manufacturer: N/A

PUMP INFORMATION

Manufacturer: ALLIS CHALMERS

Number of Pumps: 2

Suction Dia.: 8-INCHES

Discharge Dia.: 5-INCHES

Design Flow: 2,093 GPM

Design TDH: 236 FEET

Motor HP: 200

RPM: 1,750

Hr Meter: YES

Voltage: 480

Amp.: 220 @ 480 VOLTS

No. Phases: 3

STRUCTURAL INSPECTION

Wet Well Structural Defects: NONE

Exterior Condition: GOOD

Interior Condition: GOOD

Hatch & Ladder: PUMP ACCESS HATCH GOOD, NO LADDERS

Interior Moisture: MINOR LEAKAGE AROUND PUMP SEALS

House Keeping: SEWAGE ON FLOOR AROUND PUMPS FROM LEAKING SEALS

Flood Potential: NONE

MECHANICAL INSPECTION

Pump Type: VARIABLE SPEED CENTRIFUGAL

Operational Problems: SEVER VIBRATION CAUSES SEAL FAILURES AND SHEARS BOLTS ON PUMP CASING

Automatic Alternator: NOT OPERATIONAL AT TIME OF INSPECTION. ONE PUMP CYCLES UNTIL DAMAGED, THEN SECOND PUMP IS USED WHILE FIRST IS REPAIRED

Piping / Valve Condition: **GOOD**

Pressure Gauges: **YES**

Vacuum System: **NONE**

Ventilation Fan: **GOOD CONDITION** Dehumidifier: **NONE**

Heater : **GOOD CONDITION** Sump Pump: **GOOD CONDITION**

POWER

Max No. Pumps: **2 (ONE CURRENTLY)** Motor HP: **200**

Service Over / underground: **UNDERGROUND** Transformers: **PAD-MOUNTED**

Service Disconnect: **YES**

Service Voltage: **460** Phases : **3**

Standby Power: **YES-TRAILER MOUNTED**

Generator Connection: **YES**

ELECTRICAL EQUIPMENT CONDITION

Electric Hazard During Flood: **NO**

Corrosion Areas: **NONE**

Moisture Areas: **NONE**

Wire Needing Conduit: **NO**

Wiring on Floor: **NO**

J-Box Faceplates: **OK**

Lighting: **OK**

Outlet – Type/Height: **OK**

Heater /Dehumidifier Mounting: **N/A**

Radio/ Battery Charger Mounting: **GOOD**

INSTRUMENTATION & CONTROL

Pump Controller

 Type: **BUBBLER**

 Display Units: **Feet of Depth**

 4-20 mA Output to RTU: **No**

Remote Telemetry Unit (RTU): **Sensa phone –Model 1104**

Pumps on/off: **No**

High Wet Well: **Yes**

Power Fault: **Yes**

Pump Fault: **Yes**

Dry Pit High Level: **Yes**

Illegal Entry: **No**

RECORDKEEPING

Condition of Pump Sta. Records: **Good**

Metal Notebook: **N/A**

Shelf or Bracket: **Desk**

Remote Record Keeping: **Yes**

Standard Operating Procedures: **Yes**

Level Control Parameters: **Yes – FP-1**

SAFETY

Ventilation Fan – Adequacy: **Need to install odor scrubber on wet well vent**

Lighting: **Good**

Entry and Ladders/Stairs: **Good**

Water on Floor: **Yes, lower level-pump - seal leakage**

EXPANDIBILITY

Addition of Third Pump

Space: **No**

Suction Wall Pipe: **No**

Power: **No**

Upgrade to Larger Pumps

Space: **Yes**

Power: **Yes**

MISC COMMENTS:

Sever pump vibration is damaging pump shaft seals and pump mountings. Entire station experiences high levels of vibration during pumping cycle.

Extreme noise generated by pumps.

SEWAGE LIFT STATION EVALUATION

LIFT STATION NAME : NORTH BANK

DATE INSPECTED: 4-16-00

INSPECTED BY: CH2MHILL

WET WELL INFORMATION

Construction Date: 1967

Wet Well Dimensions: 6' diameter X 12'-9"

PUMP STATION INFORMATION

Package Manufacturer: Unknown

PUMP INFORMATION

Manufacturer: ALLIS CHALMERS

Number of Pumps: 2

Horsepower: 20

Speed: 1750 rpm

Suction Dia.: 8-INCH PIPE

Discharge Dia.: 6-INCH PIPE

Design Capacity: 250 gpm

Hr Meter: YES

Voltage: 230

No. Phases: 3

STRUCTURAL INSPECTION

Wet Well Structural Defects: NONE

Exterior Condition: NEEDS PAINTING

Interior Condition: GOOD

Hatch & Ladder: DIFFICULT ACCESS USING NARROW LADDER AND WALKWAY.
ELECTRICAL SERVICE EQUIPMENT ACCESS IS DANGEROUS DUE TO
INADEQUATE STAIRS AND LANDING.

Interior Moisture: NONE

House Keeping: GOOD

Flood Potential: YES, STATION IS LOCATED WITHIN THE NORTH UMPQUA RIVER
FLOOD PLAIN

MECHANICAL INSPECTION

Pump Type: CONSTANT SPEED CENTRIFUGAL

Operational Problems: NONE

Automatic Alternator: YES

Piping / Valve Condition: GOOD

Pressure Gauges: **NO**

Vacuum System: **YES**

Ventilation Fan: **OK**

Dehumidifier: **NONE**

Heater : **GOOD CONDITION**

Sump Pump: **GOOD CONDITION**

POWER

Max No. Pumps: **2**

Service: **OVERHEAD**

Service Disconnect: **YES**

Service Voltage: **230**

Phases : **3**

Standby Power: **NO**

Generator Connection: **YES**

ELECTRICAL EQUIPMENT CONDITION

Electric Hazard During Flood: **YES**

Corrosion Areas: **AUTOMATIC PHONE DIALER CABINET CORRODED**

Moisture Areas: **NONE**

Wire Needing Conduit: **NO**

Wiring on Floor: **NO**

J-Box Faceplates: **OK**

Lighting: **OK**

Outlet – Type/Height: **STD. – 72 INCHES ABOVE FLOOR**

Heater/Dehumidifier Mounting: **NO**

Radio/ Battery Charger Mounting: **GOOD**

INSTRUMENTATION & CONTROL

Pump Controller

Type: **BUBBLER TYPE**

Display output: **WATER DEPTH IN INCHES**

4-20 mA Output to RTU: **No**

Remote Telemetry Unit (RTU): **Sensa phone**

Pumps on/off: **No**

High Wet Well: **Yes**

Power Fault: **Yes**

Pump Fault: **Yes**

Dry Pit High Level: **Yes**

Illegal Entry: **No**

RECORDKEEPING

Condition of Pump Sta. Records: **NONE**

Notebook: **NO**

Shelf or Bracket: **NONE**

Remote Record Keeping: **YES**

Level Control Parameters: **YES**

SAFETY

Ventilation Fan – Adequacy: **OK**

Lighting: **OK**

Entry and Ladders/Stairs: **PIPING AND CONDUITS INTERFERE WITH ACCESS**

Water on Floor: **NO**

EXPANDIBILITY

Addition of Third Pump

Space: **NO**

Suction Wall Pipe: **NO**

Power: **NO**

Upgrade to Larger Pumps

Space: **NO**

Power: **NO**

MISC COMMENTS:

STATION ACCESS DOES NOT MEET CURRENT CODES.

**THIS STATION HAS EXCEEDED IT'S EXPECTED LIFE OF 30 YEARS AND SHOULD
BE CONSIDERED FOR UPGRADING.**

SEWAGE LIFT STATION EVALUATION

LIFT STATION NAME : Wilbur #1

DATE INSPECTED: 4-16-00

INSPECTED BY: CH2MHILL

WET WELL INFORMATION

Construction Date: 1986

Wet Well Dimensions: 8' diameter X 13'- 9"

PUMP STATION INFORMATION

Package Manufacturer: Triangle Pump

Model Name: Auto-Prime

PUMP INFORMATION

Manufacturer: CRANE-DEMING

Number of Pumps: 2

Horsepower: 25

Speed: 1750 rpm

Suction Dia.: 4-INCHES

Discharge Dia.: 4-INCHES

Design Flow: 400 GPM

Discharge Head: 88 feet

Hr Meter: YES

Voltage: 230

No. Phases: 3

STRUCTURAL INSPECTION

Wet Well Structural Defects: NONE

Exterior Condition: GOOD

Interior Condition: GOOD

Hatch & Ladder: WET WELL ACCESS IS THROUGH FLOOR OF PUMP CHAMBER

Interior Moisture: NONE

House Keeping: GOOD

Flood Potential: NONE

MECHANICAL INSPECTION

Pump Type: CONSTANT SPEED CENTRIFUGAL

Operational Problems: SEAL LEAKS

Automatic Alternator: YES

Piping / Valve Condition: GOOD

Pressure Gauges: NO

Vacuum System: YES

Ventilation Fan: GOOD CONDITION

Dehumidifier: YES

Heater : GOOD CONDITION

Sump Pump: GOOD CONDITION

POWER

Max No. Pumps: 2

Service: UNDERGROUND

Service Disconnect: YES

Service Voltage: 240

Phases : 3

Standby Power: NO

Generator Connection: YES

ELECTRICAL EQUIPMENT CONDITION

Electric Hazard During Flood: YES, NO GFCI OUTLETS

Corrosion Areas: NONE

Moisture Areas: NONE

Wire Needing Conduit: NO

Wiring on Floor: NO

J-Box Faceplates: OK

Lighting: OK

Outlet – Type/Height: STD. – 42 INCHES ABOVE FLOOR

Heater/Dehumidifier Mounting: NO

Radio/ Battery Charger Mounting: GOOD

INSTRUMENTATION & CONTROL

Pump Controller

Type; FLOAT SWITCHES

4-20 mA Output to RTU: No

Remote Telemetry Unit (RTU): Sensa phone –Model 1104

Pumps on/off: No

High Wet Well: Yes

Power Fault: Yes

Pump Fault: Yes

Dry Pit High Level: Yes

Illegal Entry: No

RECORDKEEPING

Condition of Pump Sta. Records: NONE

Notebook: NO

Shelf or Bracket: NONE

Remote Record Keeping: YES

Level Control Parameters: FIXED FLOATS

SAFETY

Ventilation Fan – Adequacy: FAN NOT MOVING AIR

Lighting: GOOD

Entry and Ladders/Stairs: OK

Water on Floor: NO

EXPANDIBILITY

Addition of Third Pump

Space: NO

Suction Wall Pipe: NO

Power: NO

Upgrade to Larger Pumps

Space: YES

Power: YES

MISC COMMENTS:

SEWAGE LIFT STATION EVALUATION

LIFT STATION NAME : Wilbur #2

DATE INSPECTED: 4-16-00

INSPECTED BY: CH2MHILL

WET WELL INFORMATION

Construction Date: 1986

Wet Well Dimensions: 8' diameter X 8'-3"

PUMP STATION INFORMATION

Package Manufacturer: Triangle Pump

Model Name: Auto-Prime

PUMP INFORMATION

Manufacturer: CRANE-DEMING

Number of Pumps: 2

Horsepower: 30

Speed: 1750 rpm

Suction Dia.: 4-INCHES

Discharge Dia.: 4-INCHES

Design Flow: 400 GPM

Discharge Head: 110 feet

Hr Meter: YES

Voltage: 230

No. Phases: 3

STRUCTURAL INSPECTION

Wet Well Structural Defects: NONE

Exterior Condition: GOOD

Interior Condition: GOOD

Hatch & Ladder: WET WELL ACCESS IS THROUGH FLOOR OF PUMP CHAMBER

Interior Moisture: NONE

House Keeping: GOOD

Flood Potential: NONE

MECHANICAL INSPECTION

Pump Type: CONSTANT SPEED CENTRIFUGAL

Operational Problems: SEAL LEAKS

Automatic Alternator: YES

Piping / Valve Condition: GOOD

Pressure Gauges: NO

Vacuum System: YES

Ventilation Fan: GOOD CONDITION

Dehumidifier: NONE

Heater : GOOD CONDITION

Sump Pump: GOOD CONDITION

Notebook: **NO**

Shelf or Bracket: **NONE**

Remote Record Keeping: **YES**

Level Control Parameters: **FIXED FLOATS**

SAFETY

Ventilation Fan – Adequacy: **NO, FAN NOT MOVING AIR**

Lighting: **GOOD**

Entry and Ladders/Stairs: **OK**

Water on Floor: **NO**

EXPANDIBILITY

Addition of Third Pump

Space: **NO**

Suction Wall Pipe: **NO**

Power: **NO**

Upgrade to Larger Pumps

Space: **YES**

Power: **YES**

MISC COMMENTS:

Pig launcher broken.

Air/vacuum relief valve is closed and not functioning.

Chapter 2

Projected Populations and Flows



Chapter 2

PROJECTED POPULATION AND FLOWS

2.1 Wastewater Flow Projections

Flow received by the collection system includes domestic sanitary flow, groundwater infiltration, and rainfall dependent infiltration and inflow (RDII). Analysis of the wastewater collection system required that accurate estimates of flows within the collection system were developed and that these flows were properly distributed throughout the collection system.

2.2 Flow and Rainfall Data

Estimates of the design flow (5-year, 24-hour, wet season flow) within the collection system were made for existing and future conditions. The estimates were based on available data from the following sources: a comprehensive flow monitoring study performed by ADS Environmental Services during December 1997 and January 1998, flow monitoring data at the WWTP, and rainfall data from the Oregon Climate Service.

2.3 Wet Season Average Base Flow

The wet season average base flow (ABF) was developed by selecting several days of flow data from a dry period (no precipitation) during the wet season study period. An ABF hydrograph, composed of sanitary flow and base groundwater infiltration, was developed based on treatment plant effluent flows. A composite 24-hour ABF hydrograph was created by determining the average flow for each hour from the effluent flow monitor data recorded over the dry days selected. The average base flow was used to determine the system-wide RDII contribution. Figure 2-1 shows the ABF pattern measured at the WWTP. The ABF was obtained by averaging flows for each hour during the period December 19 to December 28, 1999.

2.4 Rainfall Dependent Infiltration and Inflow

Flow measurements at the WWTP show the typical wastewater flow response to rainfall (see Figure 2-2). 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: inflow and infiltration. Inflow reaches a peak shortly after rainfall intensity is greatest and falls off rapidly when rain subsides. Infiltration response is typically slower than inflow, but extends over a greater length of time. The amount of infiltration and inflow is directly related to the intensity and volume of rainfall, as well as antecedent conditions (soil moisture, groundwater levels, etc.). Since the flow monitor at the WWTP directly measures total effluent flow, RDII may be estimated by subtracting ABF from the total plant flow.

2.5 1997-1998 Flow Monitoring

CH2MHILL hired ADS Environmental Services to install flow monitors at a total of twenty locations to identify specific sewer basins that contributed large quantities of RDII to the collection system. Figure 2-3 shows the locations of the flow monitors and the monitored subbasins. Although good quality data was obtained during the December 9 to January 12 study period, there were no significant rainfall events. The maximum 24-hour rainfall depth measured during the monitoring period was 0.67 inches. Table 2-1 lists RDII per developed acre estimated for the 5-year event. The areas of the system (flow monitor basins) which are the largest contributors of RDII to the collection system are categorized as having greater than 10,000 gallons per acre per day (gpad) of RDII per developed acre.

Table 2-1
Gallons Per Developed Acre Per Day Of RDII By Monitor Basin
 RUSA Wastewater Collection System Master Plan

RDII (gpad)	Monitor Basin
</=6,000	1,3,5,9,19
<6,000 </=10,000	2,6,10,12,17,18,VA
>10,000	4,7,8,11,13,14,15,16

2.6 Existing Design Flows

The 5-year, 24-hour rainfall depth of 3.2 inches for Roseburg was obtained from the NOAA Rainfall Frequency Atlas for the state of Oregon. Peak existing effluent flows at the RUSA WWTP were then plotted against the 24-hour recorded rainfall associated with the peak flow observations at the plant. Multiple rainfall depths and associated peak flows were plotted and an equation relating rainfall depth over 24 hours and peak treatment plant effluent flow was then obtained. The existing 5-year, 24-hour peak flow at the WWTP was then calculated by using the 5-year rainfall value (3.2 inches) in the equation and solving for the treatment plant flow. Figure 2-4 shows the trend line resulting from the plot of flow versus rainfall and the estimated 29.2-mgd plant flow corresponding to the 5-year storm.

2.7 Future Design Flows

Future flow estimates were developed for year 2020 and buildout conditions. For future conditions a value of 100 gallons per capita per day (gpcd) was used for additional domestic wastewater flow. Average wet season groundwater infiltration was estimated to be 136 gpcd based on treatment plant flow data. RDII was based on unsewered areas that will be developed in the future. It was assumed that an additional area of one-third acre would be developed for every 2.5 persons (one household was assumed to be equivalent to 2.5 persons) added to the population.

Population data are shown in Table 2-2 and land use designations for the 2020 and buildout conditions are shown in Figures 2-5 (an enlarged version of this figure is available in the Appendix at the end of this report) and 2-6. (An enlarged version of this figure is available in the Appendix at the end of this report.)

Table 2-2
Population Estimates
 RUSA Wastewater Collection System Master Plan

Year	Population	Developed Acres
Existing (1997/1998)	23,500	2,900
2020	35,500	4,065
Buildout	43,356	6,220

The future RDII rate of 2,000 gpad was then applied to the additional developed acres and added to the domestic wastewater flow to obtain the additional flow at the plant due to growth. This rate of RDII is typical of more recently developed areas and is assumed to be representative of conditions in growth basins given current construction techniques and pipe materials. Table 2-3 summarizes the 5-year peak flow estimates at the WWTP for each of the future land use scenarios.

Table 2-3
Peak Flow Estimates at the Wastewater Treatment Plant
 RUSA Wastewater Collection System Master Plan

Year	Peak Flow (mgd)
2002/2003	29.2
2020	34.0
Buildout	42.1

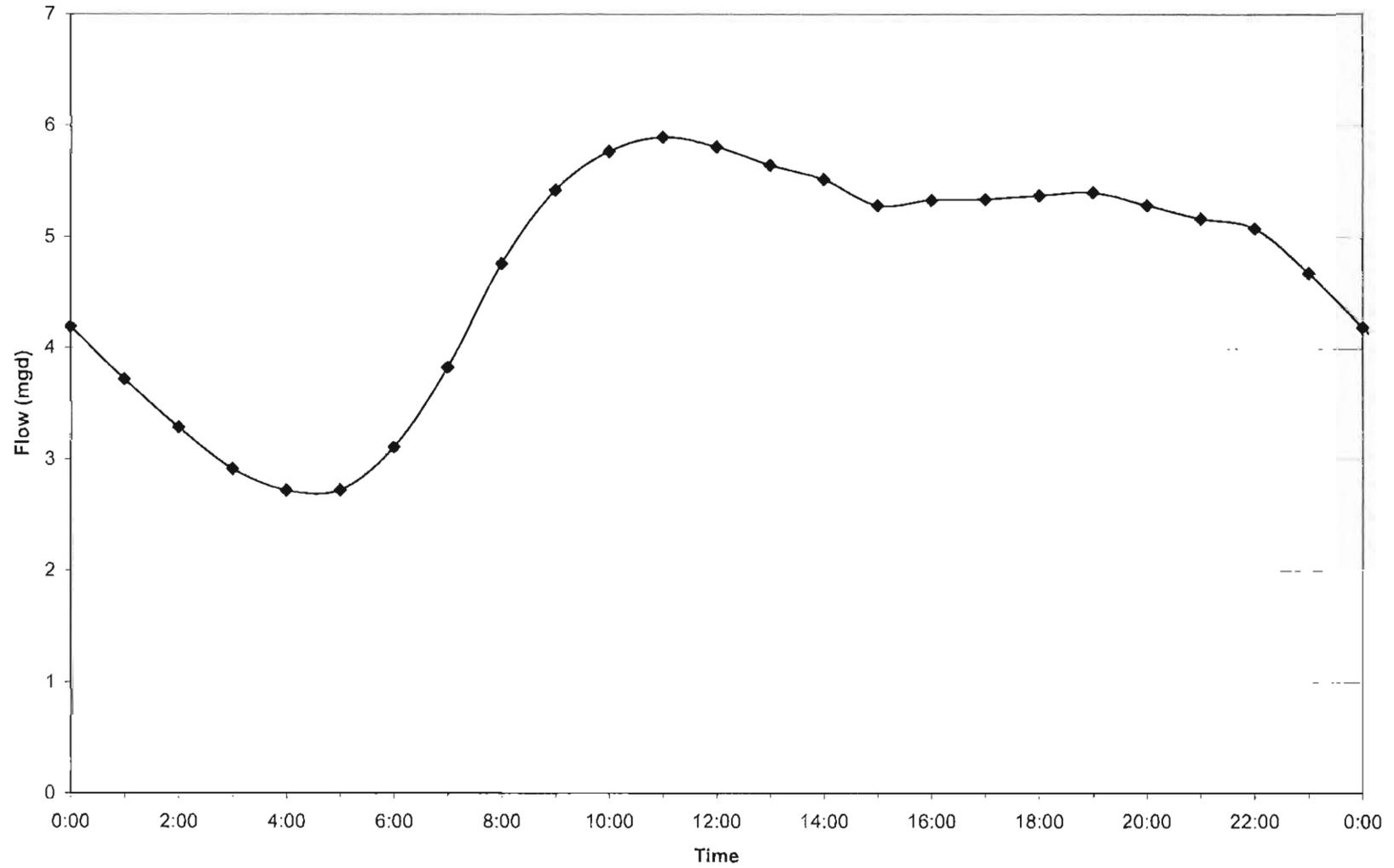


Figure 2-1
**Average Diurnal Base Sanitary Flow Pattern at
RUSA Wastewater Treatment Plant**
RUSA Wastewater Collection System Master Plan

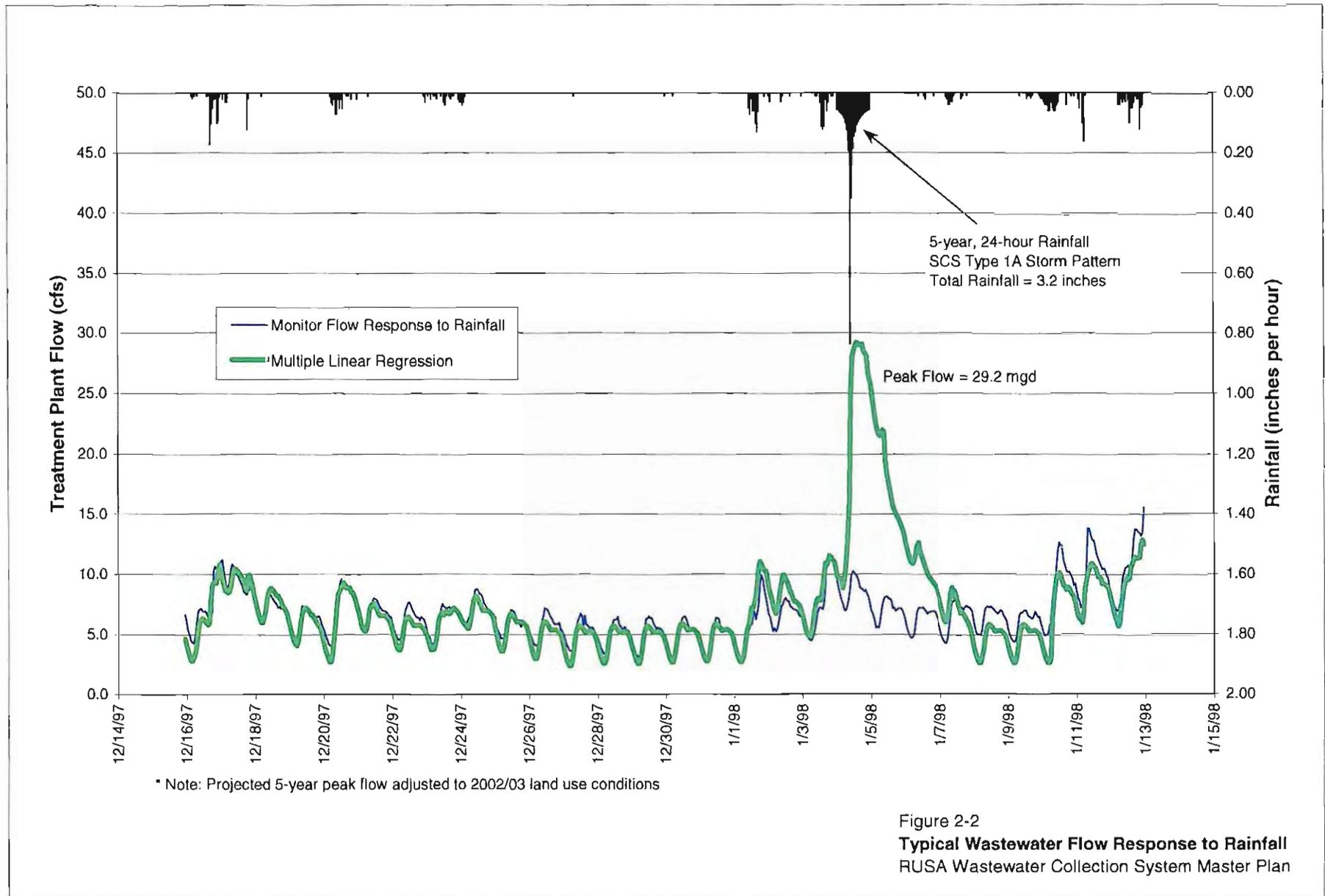
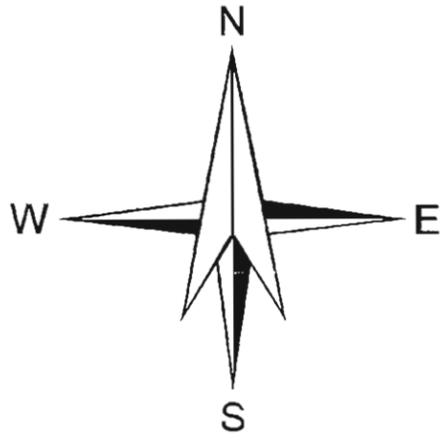


Figure 2-2
Typical Wastewater Flow Response to Rainfall
 RUSA Wastewater Collection System Master Plan



1 inch equals 4,300 feet

Legend

- Flow Monitor Location
- Manhole
- Sewer Main
- Urban Growth Boundary
- Lake/River

Monitor Basin

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18
- 19

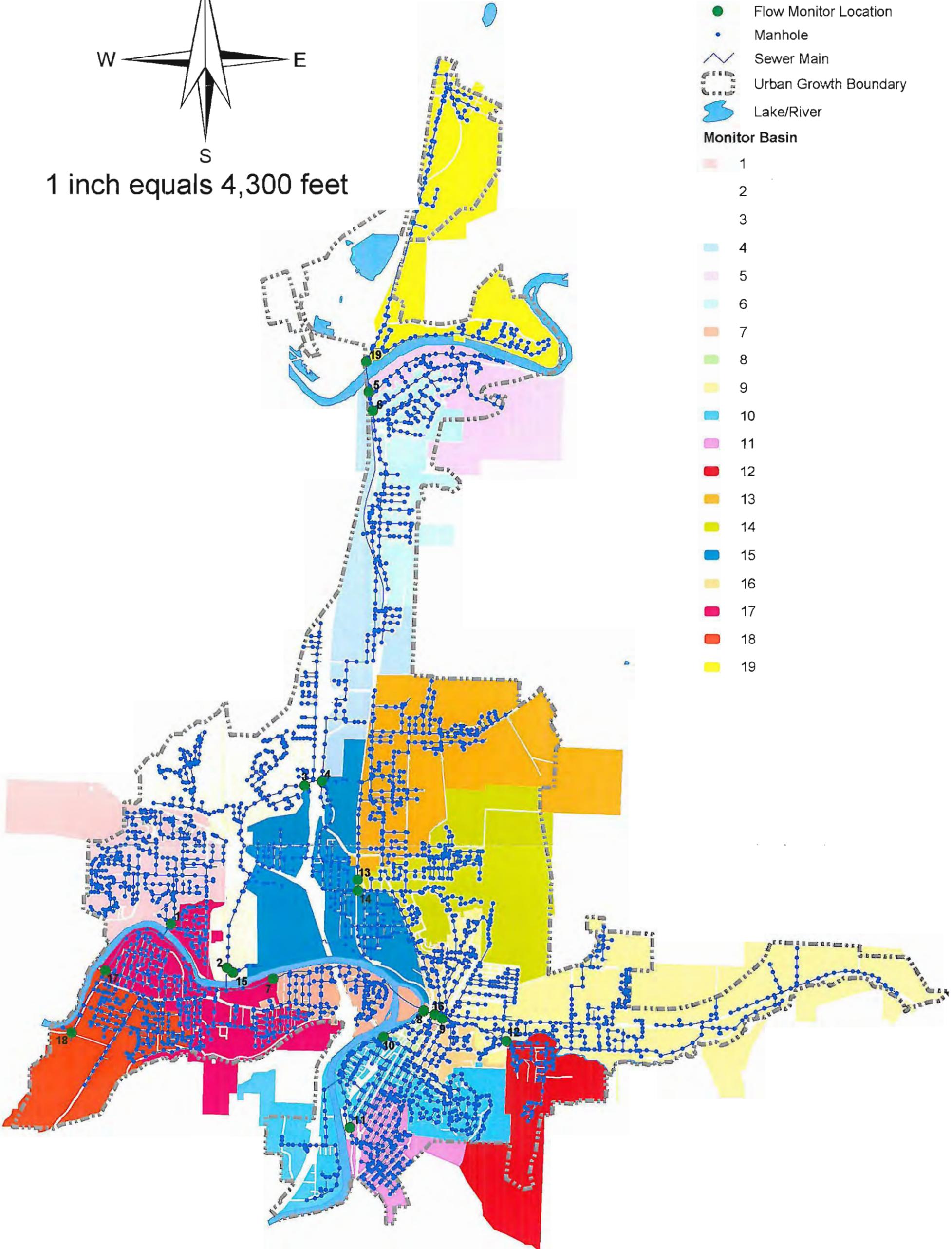


Figure 2-3
Locations of the Flow Monitors and the Monitored Subbasin
 RUSA Wastewater Collection System Master Plan

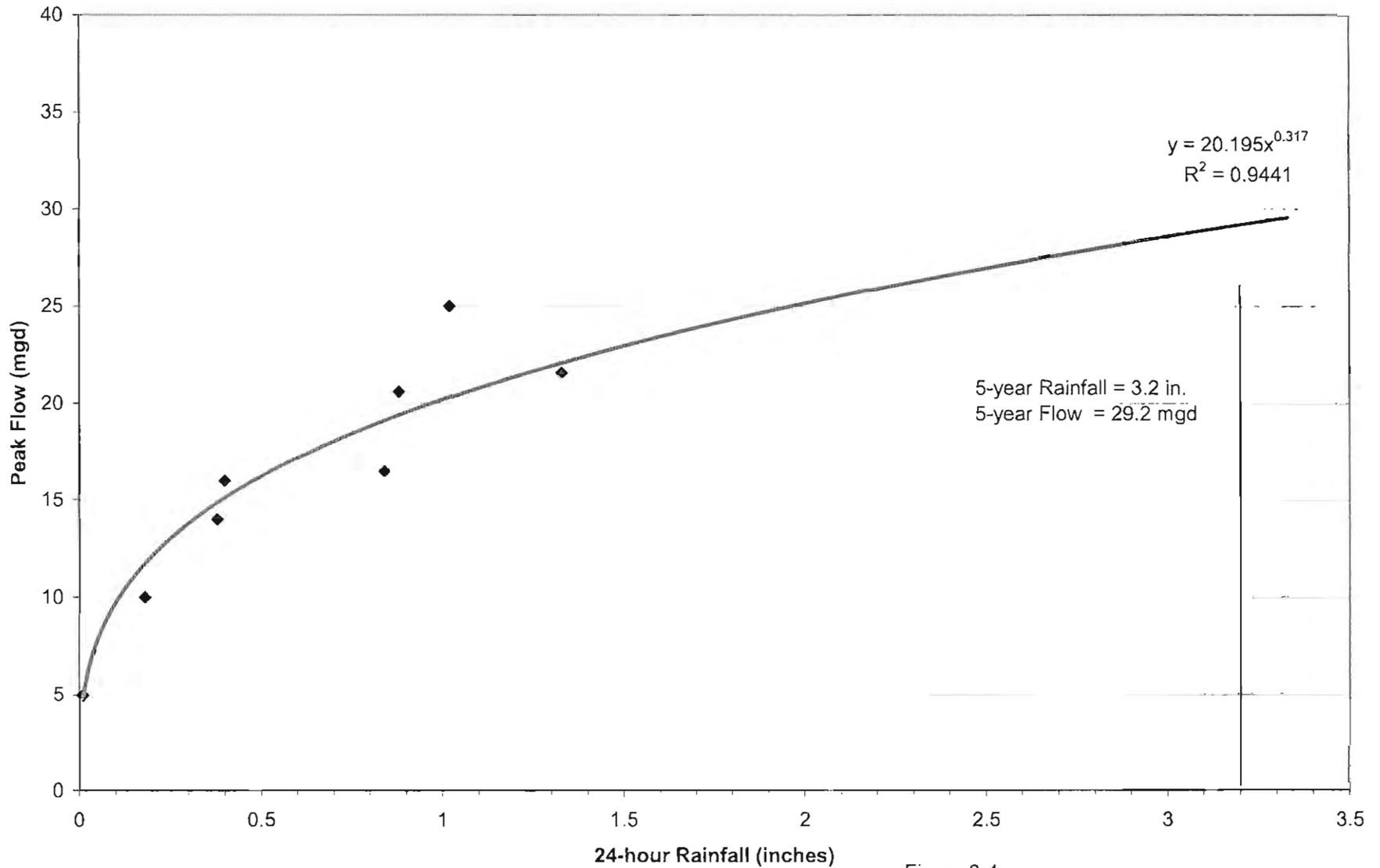
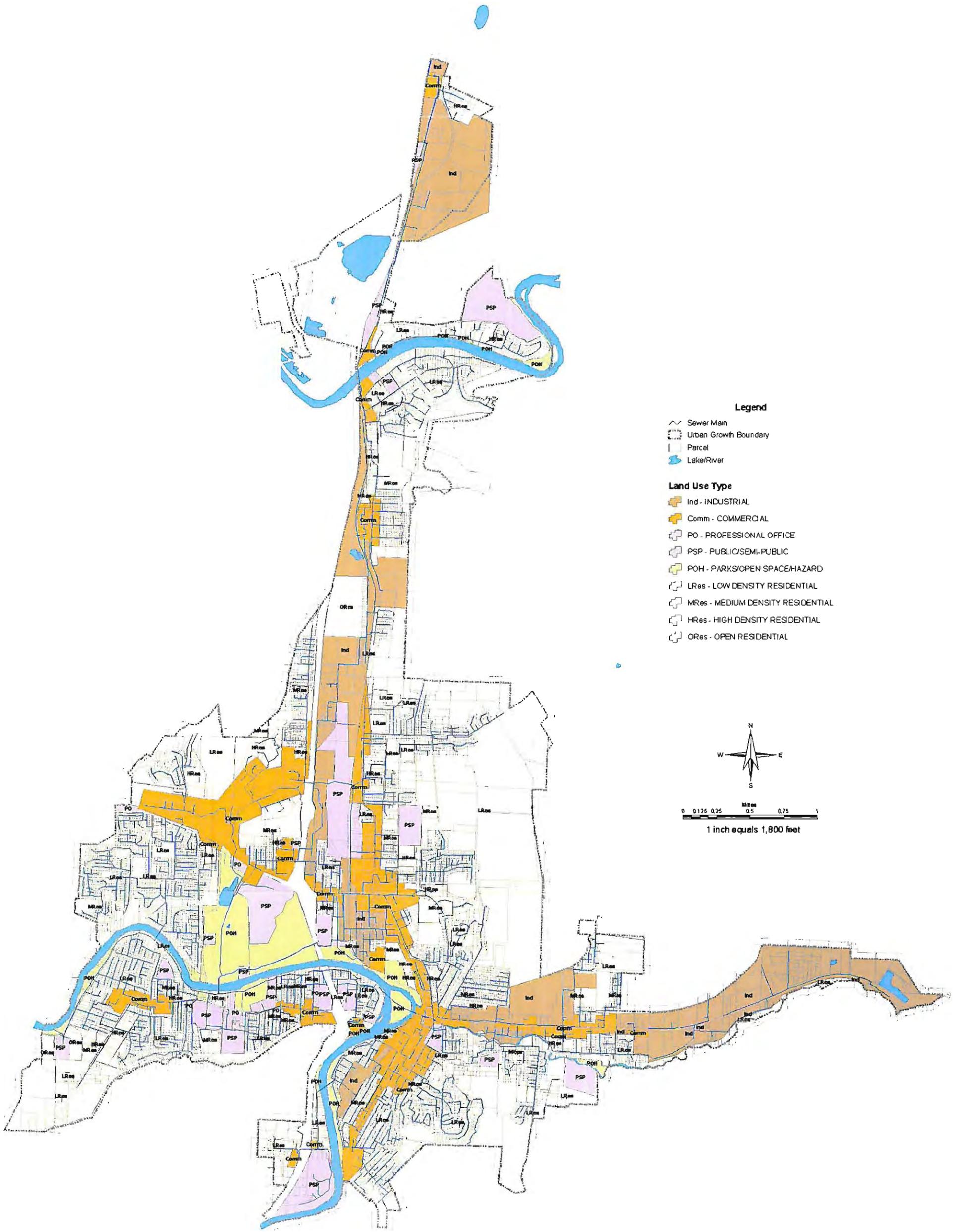


Figure 2-4
Flow vs. Rainfall for 5-Year Storm
RUSA Wastewater Collection System Master Plan



- Legend**
- Sewer Main
 - Urban Growth Boundary
 - Parcel
 - Lake/River
- Land Use Type**
- Ind - INDUSTRIAL
 - Comm - COMMERCIAL
 - PO - PROFESSIONAL OFFICE
 - PSP - PUBLIC/SEMI-PUBLIC
 - POH - PARKS/OPEN SPACE/HAZARD
 - LRes - LOW DENSITY RESIDENTIAL
 - MRes - MEDIUM DENSITY RESIDENTIAL
 - HRes - HIGH DENSITY RESIDENTIAL
 - ORes - OPEN RESIDENTIAL

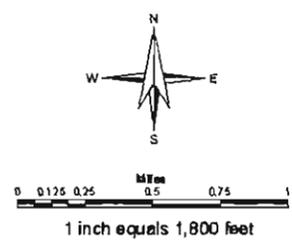
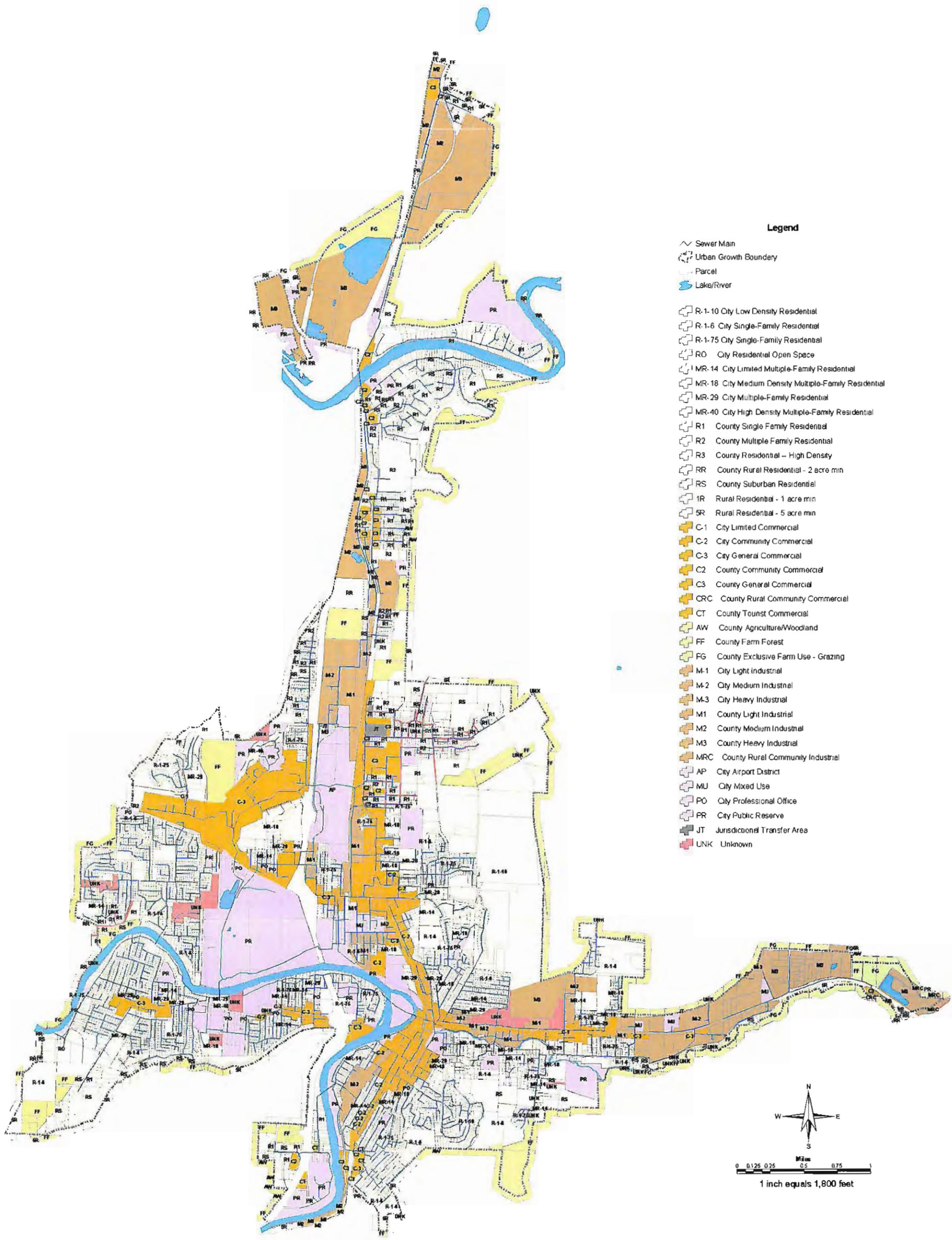


Figure 2-5
2020 Land Use
 RUSA Wastewater Collection System Master Plan



Legend

- ~ Sewer Main
- - - Urban Growth Boundary
- ▭ Parcel
- 🌊 Lake/River
- 🏠 R-1-10 City Low Density Residential
- 🏠 R-1-6 City Single-Family Residential
- 🏠 R-1-75 City Single-Family Residential
- 🏠 R0 City Residential Open Space
- 🏠 MR-14 City Limited Multiple-Family Residential
- 🏠 MR-18 City Medium Density Multiple-Family Residential
- 🏠 MR-29 City Multiple-Family Residential
- 🏠 MR-40 City High Density Multiple-Family Residential
- 🏠 R1 County Single Family Residential
- 🏠 R2 County Multiple Family Residential
- 🏠 R3 County Residential - High Density
- 🏠 RR County Rural Residential - 2 acre min
- 🏠 RS County Suburban Residential
- 🏠 1R Rural Residential - 1 acre min
- 🏠 5R Rural Residential - 5 acre min
- 🏠 C-1 City Limited Commercial
- 🏠 C-2 City Community Commercial
- 🏠 C-3 City General Commercial
- 🏠 C2 County Community Commercial
- 🏠 C3 County General Commercial
- 🏠 CRC County Rural Community Commercial
- 🏠 CT County Tounst Commercial
- 🏠 AW County Agriculture/Woodland
- 🏠 FF County Farm Forest
- 🏠 FG County Exclusive Farm Use - Grazing
- 🏠 M-1 City Light Industrial
- 🏠 M-2 City Medium Industrial
- 🏠 M-3 City Heavy Industrial
- 🏠 M1 County Light Industrial
- 🏠 M2 County Medium Industrial
- 🏠 M3 County Heavy Industrial
- 🏠 MRC County Rural Community Industrial
- 🏠 AP City Airport District
- 🏠 MU City Mixed Use
- 🏠 PO City Professional Office
- 🏠 PR City Public Reserve
- 🏠 JT Jurisdictional Transfer Area
- 🏠 UNK Unknown

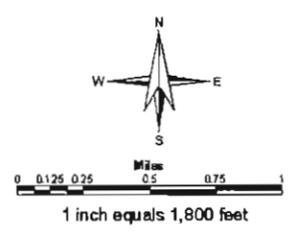


Figure 2-6
Buildout Land Use
 RUSA Wastewater Collection System Master Plan

Chapter 3

Collection System Capacity

Analysis and Modeling



Chapter 3

COLLECTION SYSTEM CAPACITY ANALYSIS AND MODELING

3.1 Hydraulic Model

A dynamic hydraulic model of the wastewater collection system was developed using MOUSE by DHI software. The model is capable of simulating backwater, surcharge, looped connections, reverse flow, and various hydraulic appurtenances that typically occur in wastewater collection systems, such as pump stations and weirs.

The basic information required for the hydraulic model includes:

A. Pipe Network Data

1. Pipe diameter
2. Manhole invert elevations
3. Manhole rim elevations
4. Pipe roughness
5. Location of manholes using Cartesian coordinates

B. Flow input data

1. Hydrograph (flow versus time) at each flow input location (manhole)

Model source data for the pipe network was created from GIS coverages of manholes and pipes. The data distinguished between manholes and pump stations and indicated whether pipes were pressure or gravity pipelines. Manhole data included a depth to invert but no ground elevation. Ground elevations were developed from an aerial photo Digital Terrain Model (DTM) adjusted using as-built data supplied by RUSA. As-built data was not available for every pipe invert location where the data quality was suspect. For these pipe segments the inverts were interpolated between segments where as-built data had been provided by RUSA. Figure 3-1 is a definition sketch showing some of the basic model input variables.

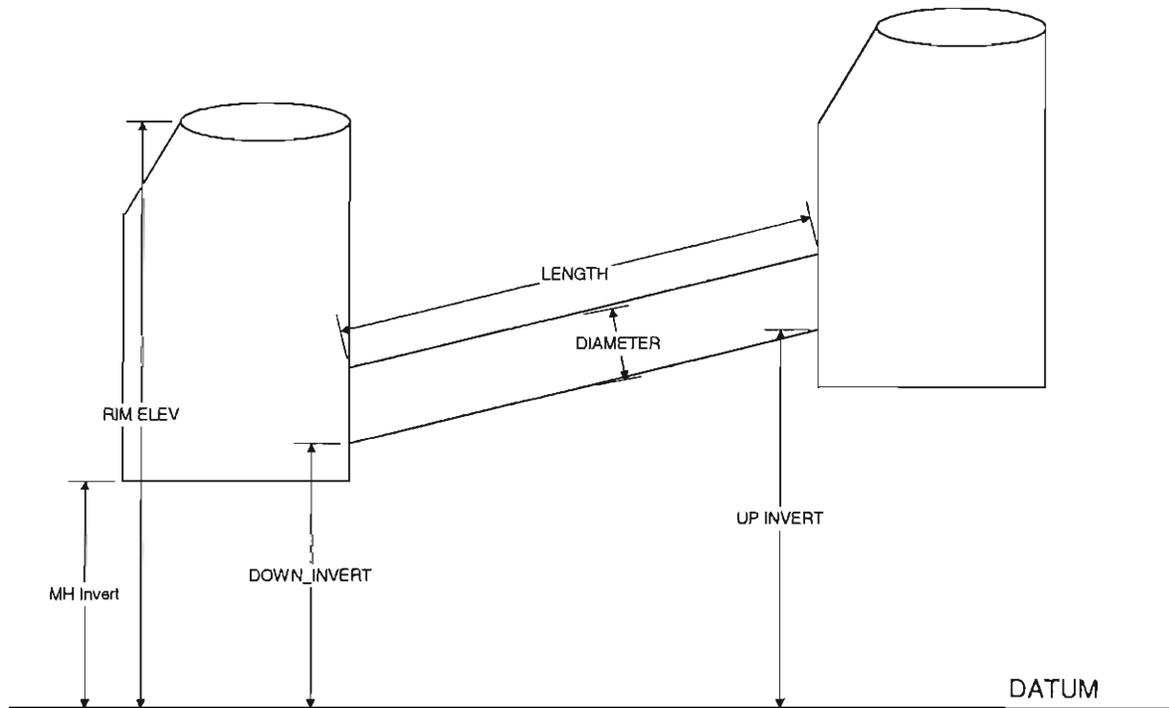


Figure 3-1
Model Input Parameters
 RUSA Wastewater Collection System Master Plan

The extent of the modeled system is shown in Figure 3-2. Pump stations were represented in the computer model because they are “in line” pump stations, linking large portions of the collection system together.

3.1.1 Flow Input and Distribution

Flow hydrographs are input to the computer model at manholes (model nodes). The area contributing to locations where temporary flow monitors were located were subdivided into smaller subbasins—groups of parcels contributing flow to a model flow input node (manhole). Peak flow estimates were developed from analysis of measured rainfall and flow at the WWTP. The distribution of that flow was based on the flow monitoring performed in the collection system. A further refinement of that distribution was achieved by determining the relative number of parcels and their size within each of the subbasins. Ultimately the flows estimated at the WWTP and initially distributed by monitor based were further divided and distributed to approximately 150 model nodes throughout the collection system. Therefore 150 parcel groups contribute flow to these nodes. This allows for more accurate evaluation the pipe network’s conveyance system capacity.

3.1.2 Existing Flows

Model calibration is performed using the data gathered at each of the 20 flow monitoring sites. These data provided the basis for determining the relative contribution of dry and wet weather flows from the 20 basins upstream of each of the monitor sites. The relative flow contribution observed during actual rainfall during the monitoring period was then used to estimate the contribution during the 5-year design storm event for each flow monitor basin. This calibration process resulted in an accurate distribution of flow within the collection system for the existing condition.

Base flow (or dry weather flow) was developed by analyzing several days of flow monitoring data from a dry period (no precipitation) during the winter study period. An ABF hydrograph, composed of sanitary flow and base groundwater infiltration, was developed for each monitor location. An ABF hydrograph for a 24-hour period was created by selecting the minimum flow for each hour from flow monitor data recorded over the dry days selected.

RDII, or wet weather flow, was based on hourly flow data at the WWTP and hourly rainfall data at the Roseburg airport. The 5-year rainfall for Roseburg is 3.2 inches according to the NOAA Rainfall Frequency Atlas for the state of Oregon. The 5-year peak flow was initially estimated at each monitor by developing a regression equation at each monitor location using the 1997 flow monitor data. The regression equation is simply an equation that calculates peak flow using rainfall as the input variable. This relationship between rainfall and flow is produced using the data collected at each monitoring location. The equation can then be used to predict peak flow from a monitoring basin by inputting the design rainfall event (5-year, 24-hour storm event).

However, because there were several significant I/I reduction projects completed in the system between the time when flow monitoring was performed (1998) and the timing of this report, the estimated 5-year peak flows were modified using the only location where hourly data is continuously gathered, which is at the WWTP. The elimination of directly connected inflow sources into the system, in addition to pipeline rehabilitation projects to the existing system, each contribute to reducing RDII. Therefore the WWTP flow data from late 2002 and early 2003 was analyzed to refine the projected peak flow from the 5-year design storm event. The results of this analysis and the estimate of peak flow at the plant for the 5-year event was described in Chapter 2 and shown in Figure 2-4.

The result of this analysis reduced the expected 5-year peak flow from the amount projected using the 1997 flow monitoring data. Existing RDII flows in the system were multiplied by a factor produced by the ratio of the current projection of peak flow for the existing system (29.2 mgd) to the higher peak flow generated from the 1997 monitoring data. The reduction in peak flow from the time the monitoring was performed to the present is an indicator that the system improvements performed since 1997 are having the positive impact of reducing peak wet-weather flows in the collection system. While wet-weather flow was modified using

2002/2003 data, base flow was not modified. This was considered acceptable due the magnitude of the base flow relative to the much larger wet weather flow rates.

3.1.3 Future Flows

Using population data within each flow monitoring basin, an existing domestic wastewater flow rate including a groundwater infiltration (GWI) component was produced on a per capita basis. This value is the existing per capita flow rate. Population was also related to developed acres by estimating the total existing developed acres from aerial photos and dividing by the total existing population. This establishes the means to estimate future additional base flow from additional developed acres. Future developed acres were derived from the projected future total population provided by the City and base flow was then produced using the future additional acres developed in each monitor basin. These values were further refined, similar to the existing base flow distribution, by using the estimated population growth within the 150 groups of parcels that contribute flow to manholes/model nodes. The future population estimates gave a target for the total future developed area within the UGB.

Wet weather flows also increase in the future as the area is developed. RDII in the system is typically not as severe from newly constructed sanitary sewer systems as they are from the existing, older system. However, as these systems age RDII may enter the system. Future RDII was also based on estimated future developed acres derived from the projected future total population. A peak rate of 2,000 gallons per developed acre per day was used for future RDII from the 5-year design storm. This additional RDII was added to the existing 5-year RDII.

An important assumption in this portion of the analysis is that existing RDII rates do not increase in the future. The only additional RDII in the system in the future condition scenarios is produced from additional developed area. The assumption that the existing RDII rates do not increase is based on the continued implementation of RUSA's program to reduce existing I/I. Typical elements of such a program are described in section 3.2.4 below.

3.2 Conveyance System Capacity Analysis

The wastewater collection system was evaluated for capacity limitations using the MOUSE hydraulic model. Model runs were performed for the existing condition (2002), and future years' 2020 and buildout conditions. Flows were compared to the existing system capacity which identified pipe deficiencies. Adjustments were then made to collection system pipe sizes, the model was run again and reviewed relative to the desired performance criteria. This process was repeated until no capacity criteria violations occurred.

3.2.1 Evaluation Criteria

The criteria used to determine whether a given pipe provided adequate conveyance capacity were as follows:

- The sewer manhole must not flood, or surcharge to a level greater than two feet below the ground surface during the 5-year peak flow. For shallow pipe with less than two feet of cover this requirement was not applied and the pipe was allowed to run full.
- Each pump station's firm pumping capacity must be greater than or equal to the 5-year peak flow.

3.2.2 Existing Conditions Capacity Analysis Results

The locations of pipe deficiencies are shown in Figure 3-3. (An enlarged version of this figure is available in the Appendix at the end of this report.) Projected pump station flows compared to the firm capacity are listed in Table 3-1.

Table 3-1

Pump Station Capacities and Peak 5-Year Existing Flow Rates RUSA Wastewater Collection System Master Plan

Lift Station ID	Firm Flow Capacity (mgd)	MOUSE Pump Link	5-Year Peak (mgd)
Winchester Pump Station	2.16	N10328-N11273	2.6
Highland Pump Station	3.30	1683-1857	5.2
Loma Vista Pump Station	0.35	Not modeled	—
Wilbur #1 Pump Station	0.58	55-61	0.30
Wilbur #2 Pump Station	0.43	N11234-N11187	0.19
North Bank Wilbur Pump Station	0.36	130-125	0.21
Fair Grounds Pump Station	0.43	Not modeled	—
Influent Pumps	30	G1216-2698	29.2

The pipe deficiencies shown in Figure 3-3 (an enlarged version of this figure is available in the Appendix at the end of this report) are located along the main trunkline that discharges to the plant and in several branches of the system. The hydraulic model estimates the hydraulic grade line (HGL) elevation required to create the head needed to convey the flow through the modeled pipe. The HGL is calculated even when it exceeds the ground surface elevation, which is the case in the main trunk line shown on Figure 3-4. The profile of the main trunk line and the HGL shown in Figure 3-4 shows the HGL elevation increasing significantly due to lack of capacity in the downstream system. The pipe branches discharging to this main line use the HGL elevation in the main line as a starting water surface elevation for their own HGL elevations. This backwater condition can result in a deficiency in a system branch even though it may have adequate local capacity to convey the peak flow.

The deficiencies shown in the system branches are due largely to backwater created in the downstream end of the system. Lack of capacity in the main trunkline creates deficiencies in

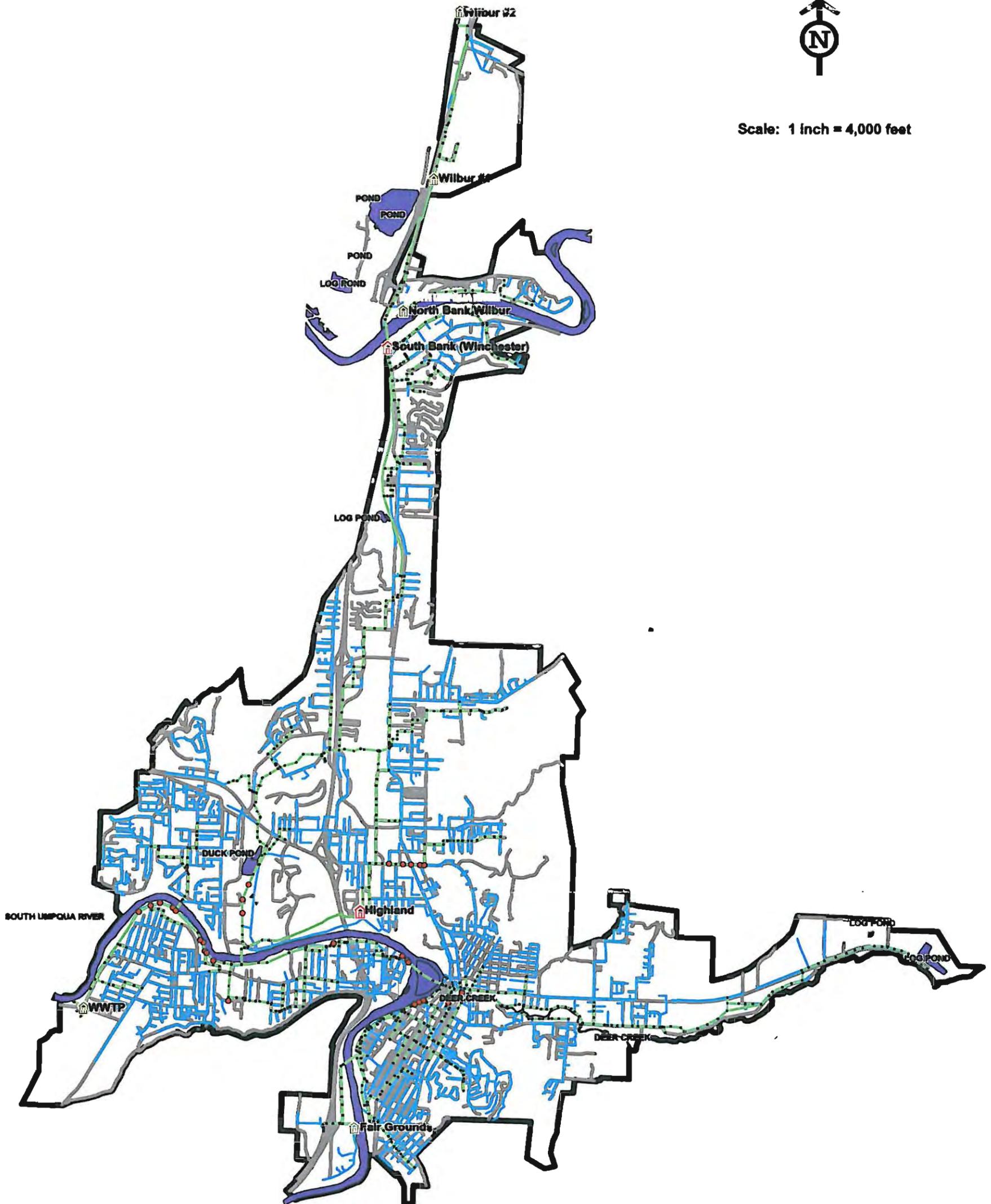
upstream reaches. In general, the deficiencies in all pipe branches that discharge to the main trunkline have adequate local capacity but fail the deficiency criteria due to the backwater from the downstream system. The one exception to this result is in the system upstream of the Highland Pump Station, which has inadequate local pipe capacity to convey the peak 5-year flow.

3.2.3 Future Conditions Capacity Analysis Results

The locations of the pipe deficiencies for the buildout condition are shown in Figure 3-5. (An enlarged version of this figure is available in the Appendix at the end of this report.) Similar to the existing condition, the backwater caused by inadequate capacity in the downstream portions of the main trunkline create deficiencies in the upstream branches. Figure 3-6 is a profile plot of the main trunkline and the associated HGL showing these high-water surface elevations. The amount of pipe in areas that indicated local capacity deficiencies for the existing condition (main trunkline and upstream of the Highland Pump Station) is greater under the increased flows associated with buildout conditions as expected. In addition, another system branch in the area adjacent to Stewart Park has deficiencies that are not due to backwater, but local capacity limitations.



Scale: 1 inch = 4,000 feet



Legend



Model Pipe



Urban Growth Boundary



Pump Station



Deficient Pump Station

Figure 3-3

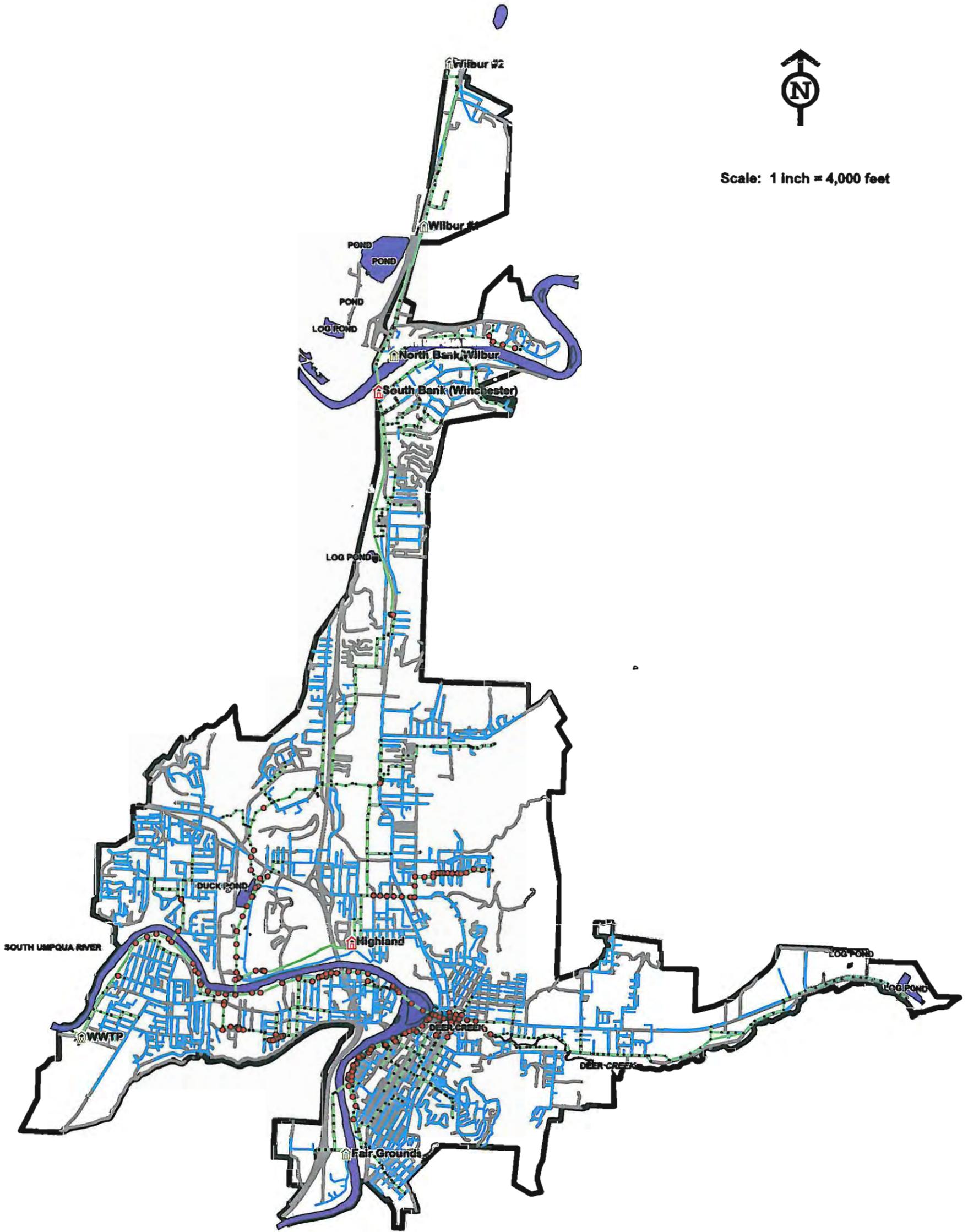
**Roseburg Urban Sanitary Authority
Comprehensive Master Plan**

Conveyance System Deficiencies





Scale: 1 inch = 4,000 feet



Legend

- Blue line: Model Pipe
- Green line: Model Pipe
- Red circle: Deficient Pump Station

- Black square: Urban Growth Boundary
- Green house icon: Pump Station
- Red house icon: Deficient Pump Station

Figure 3-5

**Roseburg Urban Sanitary Authority
Comprehensive Master Plan**

Conveyance System Deficiencies



Chapter 4

Collection System Improvements



Chapter 4

COLLECTION SYSTEM IMPROVEMENTS

4.1 System Improvements

The results of hydraulic modeling, physical investigations and staff interviews have produced a set of recommendations for RUSA staff that will be the guide for the next 50 years of operation of the wastewater collection system. The recommendations are presented here in a staged improvement plan that allows RUSA to formulate plans for completing the recommendations in an orderly manner. The plan will assist staff with annual budget preparation and staff needs.

Stage I projects are those that should be first priority for RUSA and completed prior to 2005. Stage II projects are related to increasing the existing systems' capacity and should be completed between the years of 2005 and 2015. The Stage III projects are primarily growth related and should be completed between 2015 and 2055 or as required to meet the increasing demands of growth inside the service area as it expands.

4.1.1 Existing System Improvement Requirements

There are a total of 27 pipe segments indicated for replacement with a larger pipe diameter for the existing 5-year peak flow conditions. The improvements are shown in Figure 4-1 (an enlarged version of this figure is available in the Appendix at the end of this report), and are required along the main trunkline and in the system branch upstream of the Highland Pump Station. The existing and required pipe sizes are labeled on this figure. The required pipe size is based on the buildout flows because the life of the pipeline will likely exceed the time to buildout.

4.1.2 Buildout Condition Improvement Requirements

There are a total of 91 pipe segments indicated for replacement with a larger pipe diameter for buildout flows. The improvements are shown in Figure 4-2 (an enlarged version of this figure is available in the Appendix at the end of this report), and are required along the main trunkline, in the system branch upstream of the Highland Pump Station, and in the area around Stewart Park. The existing and required pipe sizes are labeled on this figure. The largest required pipe size is 54 where the existing pipe diameters are between 36 and 42 inches. In general, 36 to 54-inch replacement pipe is required along the main trunkline and replaces pipes 24- to 42-inches in diameter.

4.1.3 RDII Reduction Best Management Practices

RUSA should continue or adopt RDII best management practices to meet permit requirements and achieve the desired wet weather flow control frequency (i.e., prevent SSOs during storms less than or equal to the estimated 24-hour storm with a 5-year return frequency). If RDII reduction best management practices are not employed, it is estimated that RDII volume could increase 5 to 15 percent. Significant flow rate increases would result in much higher total flow management costs. To avoid the potential cost consequences of allowing RDII to increase, a meaningful, funded system maintenance program employing RDII best management practices must be an integral part of the recommended plan for wet weather flow management. These practices are summarized as follows:

- Repair known structural problems
- Perform source identification activities
- CCTV inspection
- Smoke testing
- Perform source reduction activities based on inspection
- Disconnect roof drains
- Remove cross connections from storm drains
- Replace/line pipe in selected areas

In general, the inspections are performed during the winter months, which allows for the repair of identified deficiencies during the summer months.

4.2 Staged Improvement Plan

A compilation of the staged improvement plans for the next 50 years is presented in the executive summary. Figure 4-1 (an enlarged version of this figure is available in the Appendix at the end of this report) shows the location of the improvements recommended for the collection system for the next 50 years.

4.2.1 Stage

Each project's purpose and proposed plan of action is presented along with a budget level opinion of cost. The Stage I projects (outlined in Table 4-1) primarily focus on the immediate needs of the system. Project descriptions for Stage I improvements follow Table 4-3. Some of the projects will need further investigation to determine the extent of construction that is required to remedy the problem. The projects are prioritized so that the most critical projects are shown first and should be undertaken as soon as possible in order to prevent further damage to equipment or risk sewer backups or spills.

The Stage I improvement projects should be viewed as additional projects outside the ongoing, smaller I/I removal projects that RUSA typically undertakes each year. The small projects should

continue to be budgeted for at a similar level as in the past. These projects have shown a significant reduction in required emergency maintenance as well as reduced peak flow at the WWTP.

Table 4-1
Stage I Project Descriptions
 RUSA Wastewater Collection System Master Plan

	Project	Description	Budget
I-1.	Saddle Butte Basin I/I Investigation	I/I source detection program	\$50,000
I-2.	Winchester Pump Station Improvements	Replace the sewage pumps and fittings	\$100,000
I-3.	Saddle Butte I&I Reduction Project	Rehabilitate sewers identified in source detection program (item I-2) *Cost Allowance	\$150,000*
I-4.	Elk Island Siphon	Clean and reline 12-siphon barrel or replace and upsize siphon (option)	\$100,000 \$500,000
I-5.	Fairgrounds, North Bank, & Wilbur No. 2 Pump Stations	Upgrade sewage pump stations to improve capacity and meet DEQ standards and electrical codes	\$30,000
*Seattle ENR construction cost index = 6,636		Lowest Total	\$380,000

4.2.2 Stage II (2005-2015)

The Stage II improvement projects (shown in Table 4-2) include interceptor sewer capacity improvements, pump station upgrades, forcemain replacements and infiltration reduction projects.

Table 4-2
Stage II Project Descriptions
 RUSA Wastewater Collection System Master Plan

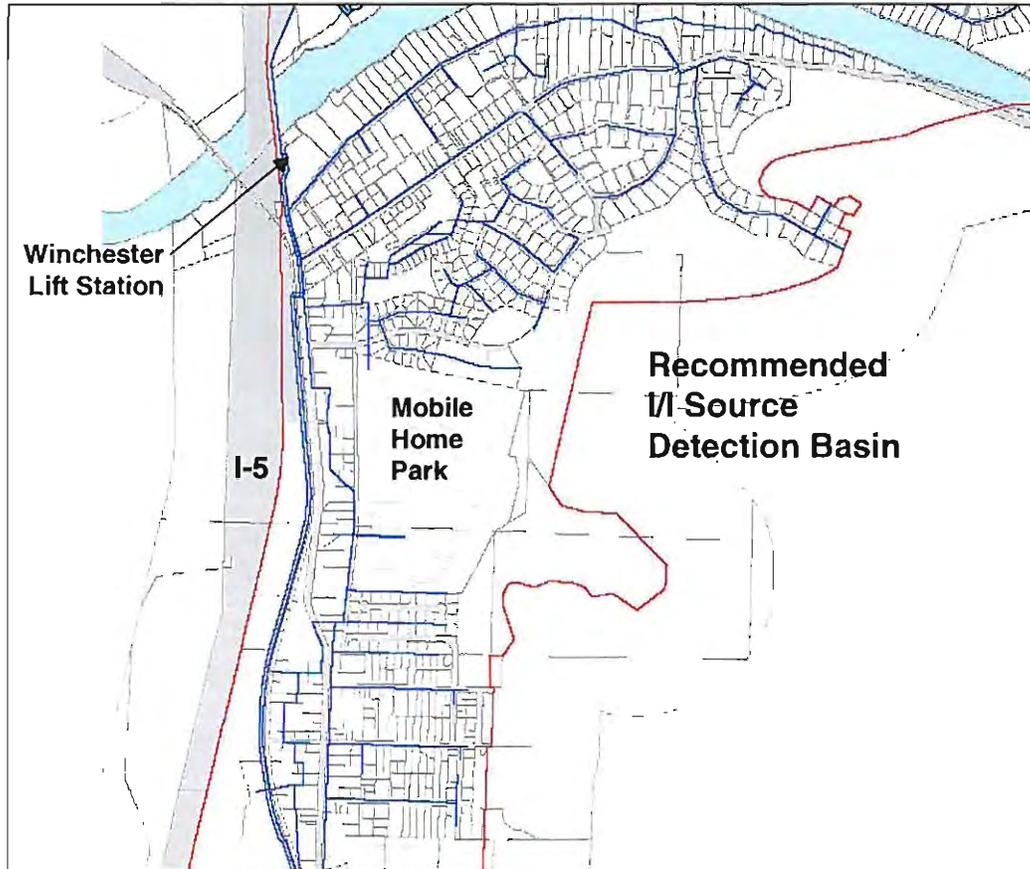
	Project	Description	Budget
II-1.	North Bank-Phase 1	Construct 48-inch interceptor from WWTP to Stewart Park	\$4,100,000
II-2.	North Bank- Phase 2	Construct 36-inch relief sewer from Stewart Park to Elk Island siphon	\$1,800,000
II-3.	Elk Island Siphon	Construct additional 30-inch siphon from Elk Island to Stevens St. (assumes project not selected in Stage I)	\$500,000
II-4.	Deer Creek Interceptor	Replace interceptor with larger capacity pipeline	\$550,000
II-5.	Highland Street Pump Station Forcemain	Upsize Highland Street forcemain to improve station capacity	\$200,000
II-6.	Winchester Forcemain	Replace 9000 feet of existing 12-inch forcemain	\$450,000
II-7.	Wilbur #1 and Loma Vista Pump Stations	Improve pumping capacities and rehabilitate electrical and instrumentation equipment	\$50,000
II-8.	Cloverdale Basin Capacity Improvements	Increase system capacity west of Airport Road and north of Garden Valley Boulevard	\$300,000
II-9.	Joseph St. Relining	Continue relining gravity sewer downstream of Winchester Pump Station forcemain	\$150,000
II-10.	Clay Sewer Replacement	Continue replacing clay sewer pipelines in the City to reduce groundwater infiltration	\$50,000 (annually)
Seattle ENR construction cost index = 6,636		Total	\$8,150,000

4.2.3 Stage III (2015-2055)

The Stage III improvement projects (shown in Table 4-3) include constructing new interceptor sewers into unsewered basins outside the present RUSA service boundaries, upsizing capacity deficient pipelines, and rehabilitating concrete sewers.

Table 4-3
Stage III Project Descriptions
 RUSA Wastewater Collection System Master Plan

Project		Description
III-1.	Garden Valley	Construct 30-inch interceptor, pump station and forcemain
III-2.	Fisher Road	Construct interceptors, pump stations, and forcemains
III-3.	Del Rio	Construct Del Rio Interceptor
III-4.	Wilbur	Construct Wilbur to Fisher Road Interceptor
III-5.	South Umpqua Interceptor	Construct interceptor south from Mill Street
III-6.	Capacity Improvements	Upsize pipelines with flows over 100 percent of capacity
III-7.	Concrete Sewer Rehabilitation or Replacement Program	Reline or replace older, deteriorated small-diameter non-reinforced concrete pipelines



PROJECT I-1: WINCHESTER/SADDLE BUTTE SEWER BASIN I/I SOURCE DETECTION PROGRAM

Project Description

This project will identify sources of I/I upstream of the Winchester Pump Station and south of the North Umpqua River. The flows from this basin were identified by the flow monitoring program to be extremely reactive to rainfall. This condition indicates that there are likely to be numerous direct stormwater connections to the sewer system. The monitoring also indicated that flows do not recede quickly after the rain event ends. This is indicative a sewer system that has a high level of groundwater infiltration.

Proposed Plan

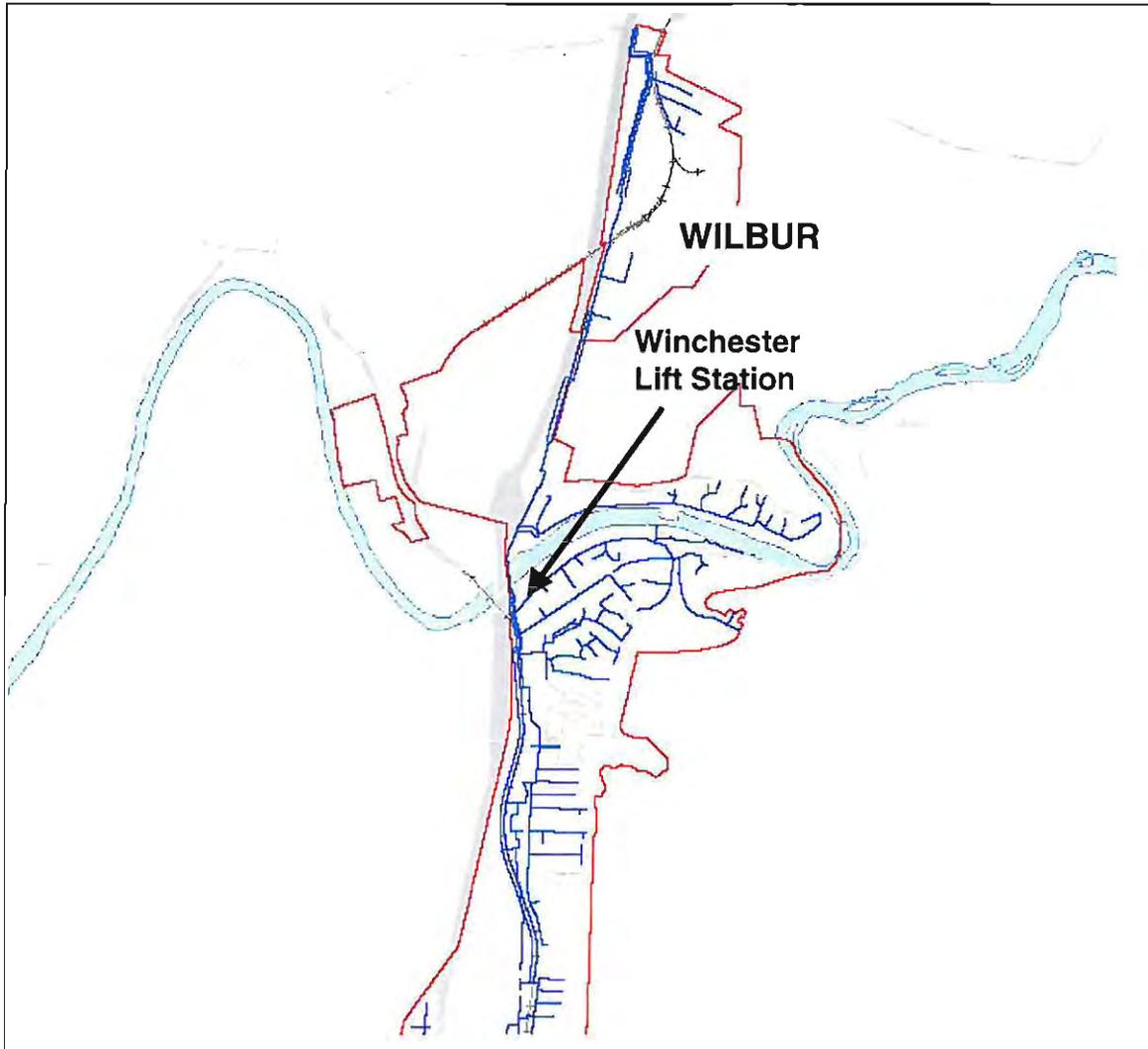
RUSA should undertake a comprehensive I/I source detection. The program should include smoke testing the entire basin to locate inflow sources. The program should also include

manhole inspections and inspection of the older pipelines with CCTV equipment. The data from this comprehensive investigation would be used to determine a cost-effective method for eliminating the extraneous flow from the basin. The smoke testing should be completed in the late summer to allow the ground to dry and “open up” as much as possible and allow smoke to seep to the surface over the damaged pipe segments. The CCTV could be started anytime, but would provide more information about the water tightness of the pipelines if it was performed during periods of high groundwater. All pipelines over ten years old should be CCTV inspected.

Opinion of Cost

This program could be executed by either using RUSA’s existing resources or by contracting out

to a company that specializes in this type of investigation. The typical cost of pipeline cleaning and CCTV inspection range between \$1.50 to \$2 per lineal foot of pipeline. The total cost of the CCTV program would be determined by the number of feet of pipelines over 10 years old that are in the basin and would be inspected. Smoke testing costs range from 25 cents to 35 cents a foot. It is recommended that the entire basin be smoke tested to verify that roof drains, area drains and foundations have not been connected to the sewer. A comprehensive inspection as described above could cost between \$35,000 and \$50,000.



PROJECT I-2: WINCHESTER PUMP STATION PUMP REPLACEMENT PROJECT AND FORCEMAIN INVESTIGATION

Project Description

The Winchester Pump Station is experiencing periodic pumping equipment damage and failure. The pump station evaluation conducted in April 2000 identified the problem as being extreme wear in the pump volutes and impellers. These pumps operated under a wide range of flows and at unusually high pressure, and have therefore reached the end of their useful and expected life. These pumps are not able to operate under the designed alternating scenario because one of the two pumps is usually being repaired while the other is required to cycle continually. Should the

operating pump experience a sudden failure while the offline pump is being repaired, the potential for sewage bypassing to the North Umpqua River is extremely high. The original manufacturer of these pumps no longer produces these units so replacement parts may no longer be available.

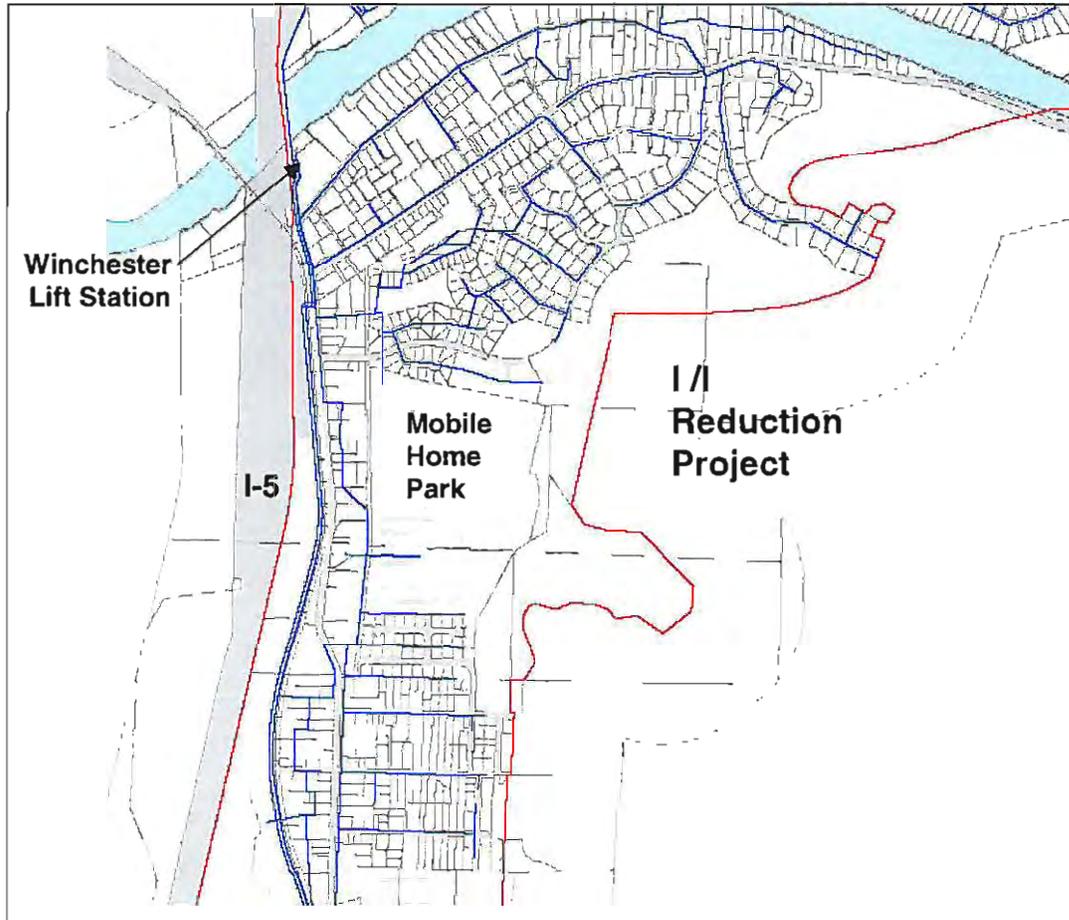
Proposed Plan

RUSA should undertake a replacement program for these pumps before they experience a dual failure. The pump drive motors and other support equipment was in satisfactory condition during the April 2000 inspection. Therefore only the pumps, drive shafts, and adjacent check valves

should need replacement. Some piping modifications may be necessary to accommodate a different pump configuration. The replacement project should take into account the expected flow ranges that the station will experience in the future. If a comprehensive I/I removal program is undertaken and successfully completed, peak flow will be reduced. Reduced flows will give the pump designers a wider selection of pump equipment. The narrower the range of flows that pumps must cover the more efficient the unit will be. The forcemain sizing should be reviewed along with the sizing of any new pumps. The forcemain was installed in 1965 and may be reaching its maximum capacity and useful structural life.

Opinion of Cost

This project could be completed by the WWTP staff but is likely more efficiently performed by a mechanical contractor. Assuming that this work would be performed by a contractor the expected costs range between \$75,000 and \$100,000 depending on the pumping equipment selected. Replacements costs for the forcemain could range from \$450,000 to \$550,000, depending on the final size and location.



PROJECT I-3: WINCHESTER/SADDLE BUTTE SEWER BASIN I/I REDUCTION PROJECT

Project Description

The Winchester/Saddle Butte Sewer Basin I/I Reduction Project is a sewer rehabilitation project focused on I/I removal. The project will correct system deficiencies identified in the source detection program discussed in project description I.2. The scope of construction and private sewer lateral repairs will be totally dependent on the findings of the source detection program.

Proposed Plan

RUSA should approach this I/I reduction project as a comprehensive rehabilitation. All sources, including house laterals, should be addressed. Manholes should be repaired or replaced and

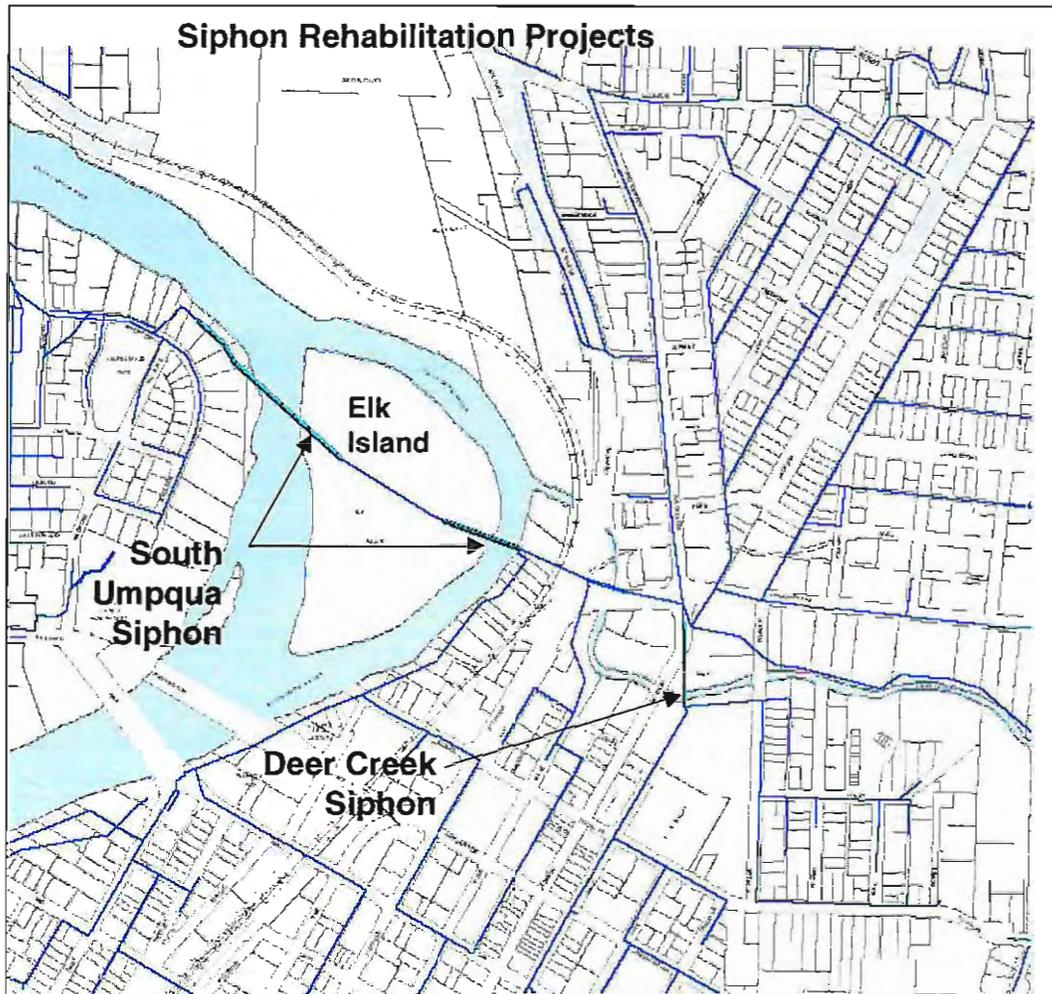
cleanouts should be installed at the interface between the private lateral and the RUSA-owned pipe. All defective pipelines should be relined or replaced depending on their condition. This comprehensive approach will maximize the I/I reduction and will help reduce the pumping capacity required at the nearby Winchester Pump Station.

Opinion of Cost

This program could be partially executed using RUSA's existing resources to fix inflow sources such as missing or damaged cleanouts and manhole repairs. Since the project will likely require trench excavation and other specialty technologies, like cured-in-place lining, it makes more sense to add the work that RUSA could

perform to the bigger project and allow RUSA's crew to perform their normal maintenance projects.

The cost of completing this project can not be determined at this time because it is fully dependent on the magnitude of the defects. For purposes of setting aside funds for this project a conservative budget of \$150,000 has been assumed.



PROJECT I-4: ELK ISLAND SIPHON REHABILITATION PROJECT

Project Description

All sanitary sewer flows on the east side the South Umpqua River south of Malheur Street and including the Diamond Lake, Deer Creek and City Center basins flow under the South Umpqua River through an inverted siphon. This siphon is often referred to as the Elk Island Siphon since it also crosses under the river at Elk Island. The siphon is made up of two barrels, one 12-inch diameter for low flows and one 30-inch diameter for high flows.

Under normal operation, all flows pass through only the 12-inch pipeline. This scenario allows the velocity of the flow to remain high and prevent deposition of heavy materials at the bottom of the inverted siphon. The larger 30-inch

pipeline only receives flow during a heavy rain event and will also have higher velocities because of the higher flow rates.

The smaller barrel has become plugged and is now forcing all flow through the larger siphon barrel. This situation presents two problems, the first is the loss of the ultimate capacity of the dual barrel siphon, the second is that during low summer flow periods the velocities in the 30-inch pipe drop to extremely low levels. Low velocities in this pipe will allow heavy solids to settle and could eventually plug the larger barrel as well. There is no bypass for this siphon and backed up flows would spill to the South Umpqua River at the upstream end of the siphon and along the Deer Creek Interceptor.

Proposed Plan

There are two approaches that can be taken to remedy this situation. The first would be to try to reopen the plugged barrel. This was attempted in the mid 1990's without success using conventional flushing equipment. The second approach would be to install a new siphon parallel to the existing pipe. Upsizing will be needed to meet projected long-range flows.

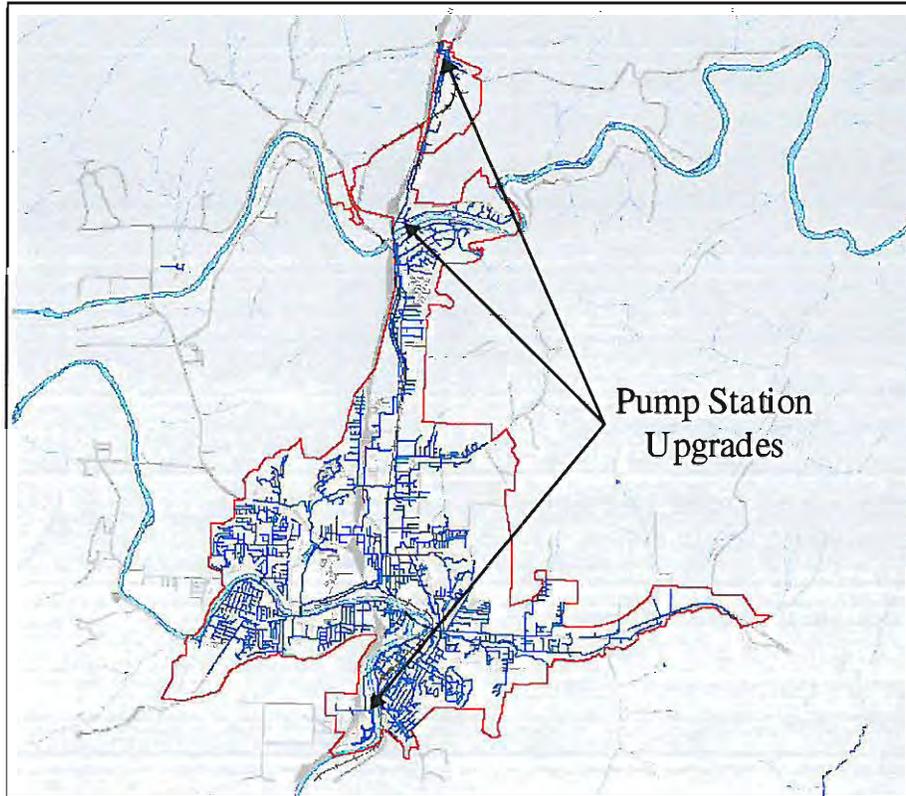
A specialized tunneling contractor should be retained to auger out the inside of the existing 12-inch siphon barrel. This auguring will likely further damage the already leaking siphon barrel and will require relining the barrel before putting it back into service.

The installation of a new parallel siphon will likely require the pipe to be installed using either a microtunneling operation or a directional drilling operation. New vaults and manholes will also need to be constructed at each end of the new pipe.

Opinion of Cost

Cleaning and relining the 12-inch siphon barrel, if feasible, could cost in the range of \$75,000 to \$100,000. A pre-design investigation would be required to reveal the feasibility of this method and probability of success. The cost of a pre-design investigation would cost approximately \$10,000.

The installation of a new siphon with one small and one larger barrel to meet future growth needs would cost in the range of \$500,000 depending on the volume of hard rock encountered in the boring operation. This cost does not include costs associated with design and permitting the project.



PROJECT I-5: NORTH BANK, WILBUR #2 AND FAIRGROUNDS PUMP STATION IMPROVEMENT PROJECTS

Project Description

This project will correct deficiencies noted in the pump station evaluation performed by CH2M HILL.

Proposed Plan

North Bank Pump Station

The North Bank Pump Station located on the north side of the North Umpqua River near the Winchester Dam needs to be upgraded. The station was built 36 years ago and has served RUSA fairly reliably. However, the station is showing signs of leakage in the metal pump chamber. Electrical equipment cabinets had moisture present at the time of inspection. The station is also equipped with a very old air-bubbler type of level control that can be a high-maintenance device. It requires installation

of a small air compressor in this very tight 6-foot diameter pump room.

Access to the station is difficult. It was built in the flood plain of the river and therefore requires an elevated access platform for entry. Electrical equipment has been mounted on another pole near the station. To access this equipment, the operator must climb a narrow ladder to a small platform. This situation is in violation of current OSHA and electrical codes and should be remedied.

Wilbur #2 Pump Station

The Wilbur #2 Pump Station was built in 1986 to serve the north end of Wilbur. This station has difficulty keeping pace with flows during heavy rain events. Both pumps are required to run to keep up with the high flows. Having both pumps running is a

violation of the DEQ rules of operation which require a standby pump always be available in case of a failure of the main pump. The station's pumps should be checked for pump capacity and if they are pumping at or near their rated capacity, they need to be upsized.

Poor ventilation was also observed during the inspection. Replacement of the exhaust fan is required to remedy the problem.

Fairgrounds Pump Station

The Fairgrounds Pump Station is not owned by RUSA, but RUSA has the responsibility of maintaining and operating the station. This station is 34 years old and is showing signs of severe corrosion in the wet well and electrical panel. The above-grade electrical panel is mounted directly on the metal cover over the wet well. This is a very flimsy arrangement that allows the cabinet to sway in a heavy wind or if something leans on the panel. The panel should be remounted on a set of steel poles buried next to the wet well.

Access to the check valves is very difficult at this station because they mount inside the 5'-5" diameter wet well. These check valves should be moved out of the wet well and into an adjacent valve vault.

Opinion of Cost

This program could be executed by either using RUSA's existing resources or hiring contractors. If all the tasks recommended were completed by a contractor, the costs would be around \$30,000.

Appendix

Oversized Plots

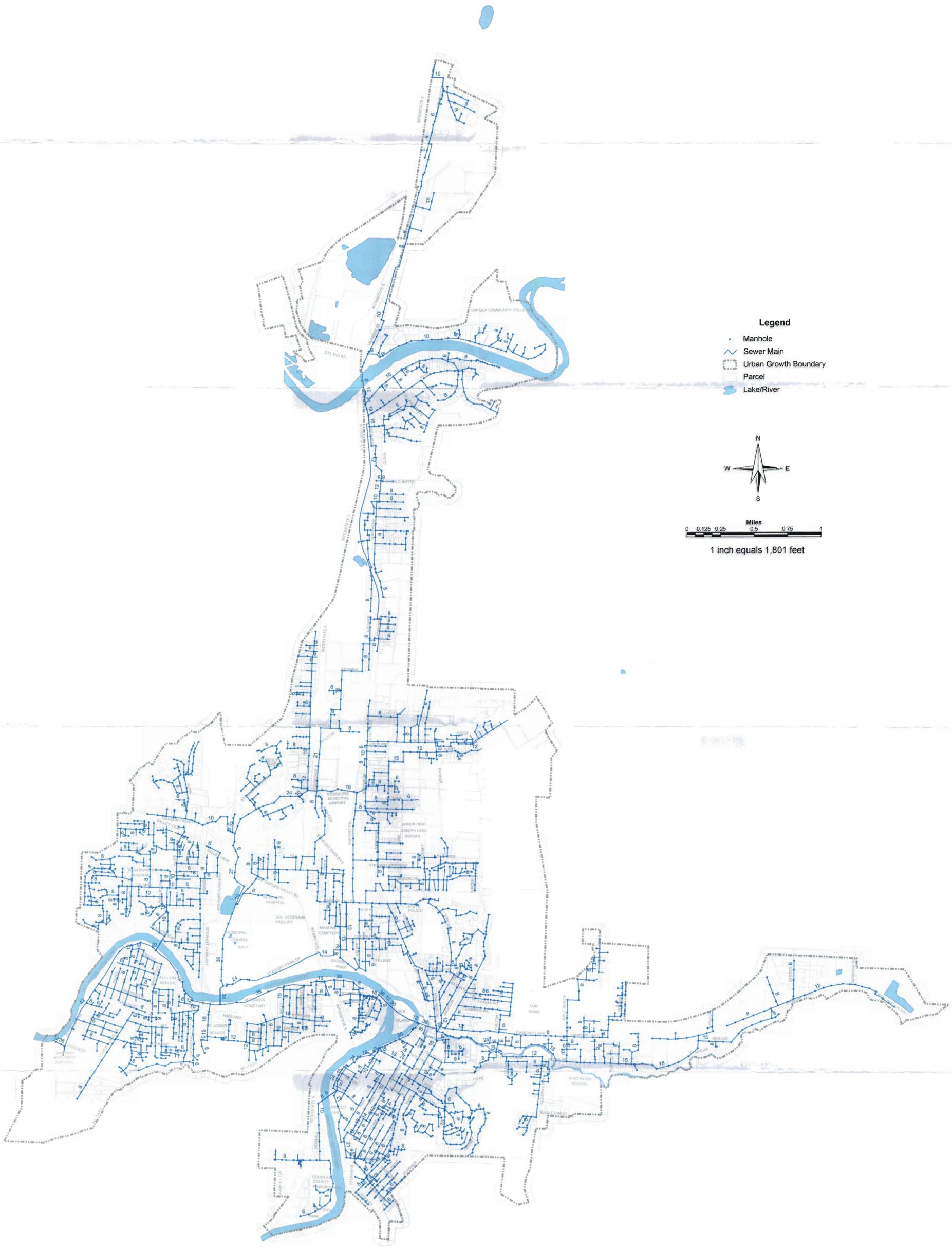
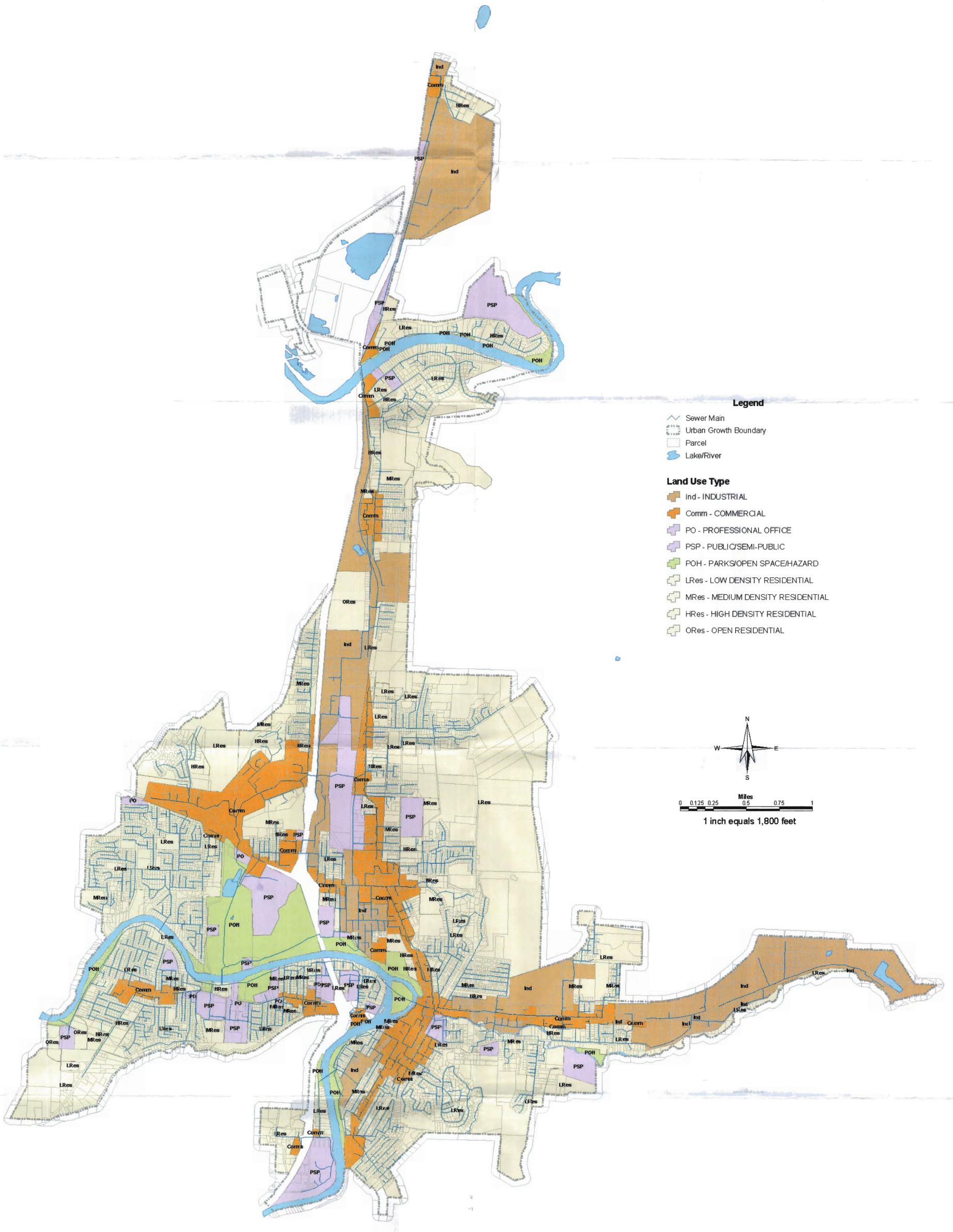


Figure ES-1/Figure 1-1
RUSA Service Area
 RUSA Wastewater Collection System Master Plan



- Legend**
- Sewer Main
 - Urban Growth Boundary
 - Parcel
 - Lake/River
- Land Use Type**
- Ind - INDUSTRIAL
 - Comm - COMMERCIAL
 - PO - PROFESSIONAL OFFICE
 - PSP - PUBLIC/SEMI-PUBLIC
 - POH - PARKS/OPEN SPACE/HAZARD
 - LRes - LOW DENSITY RESIDENTIAL
 - MRes - MEDIUM DENSITY RESIDENTIAL
 - HRes - HIGH DENSITY RESIDENTIAL
 - ORes - OPEN RESIDENTIAL

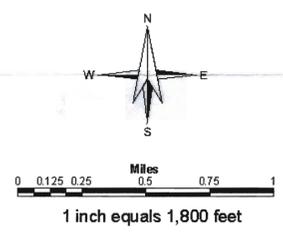


Figure 2-5
2020 Land Use
 RUSA Wastewater Collection System Master Plan

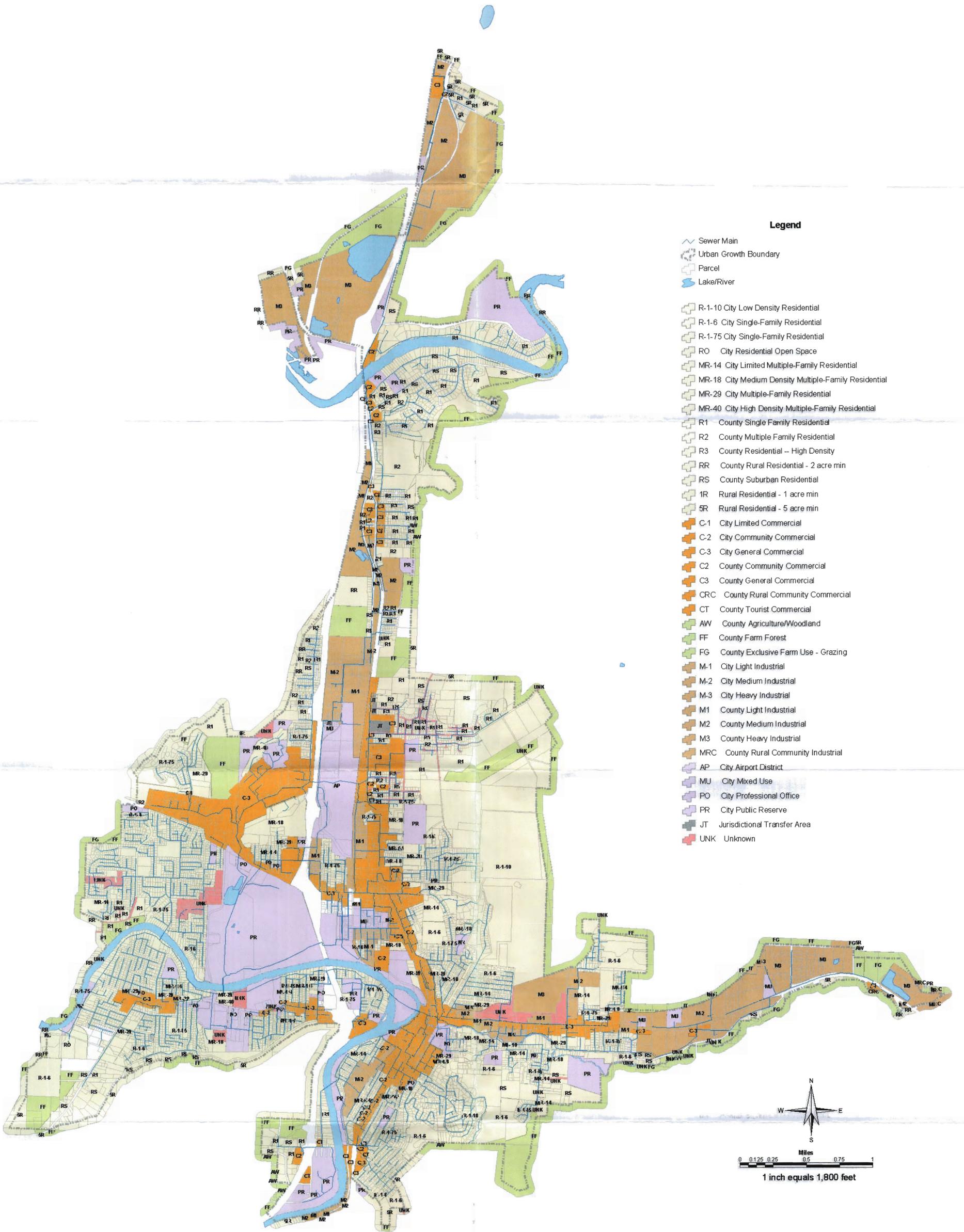
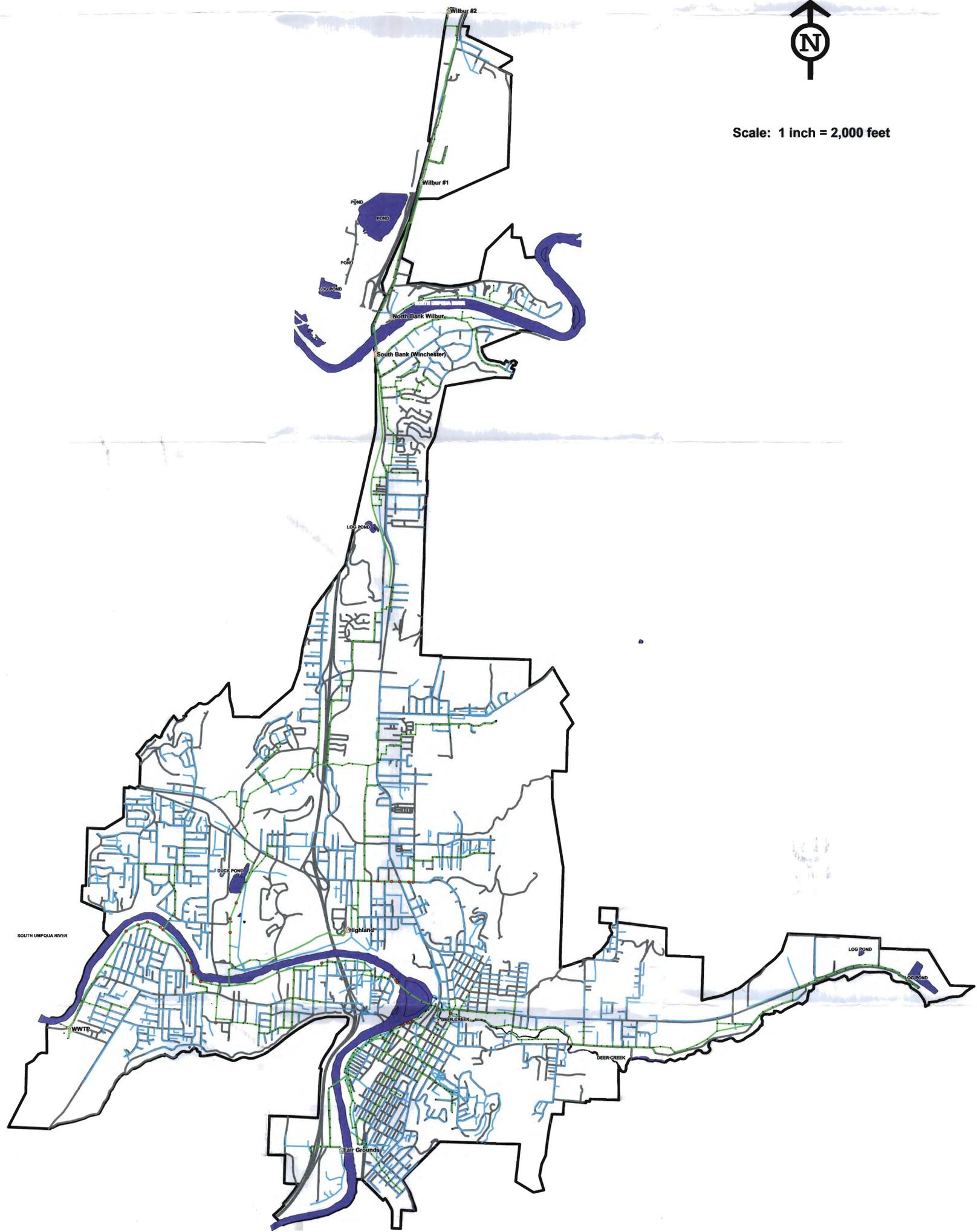


Figure 2-6
Buildout Land Use
 RUSA Wastewater Collection System Master Plan



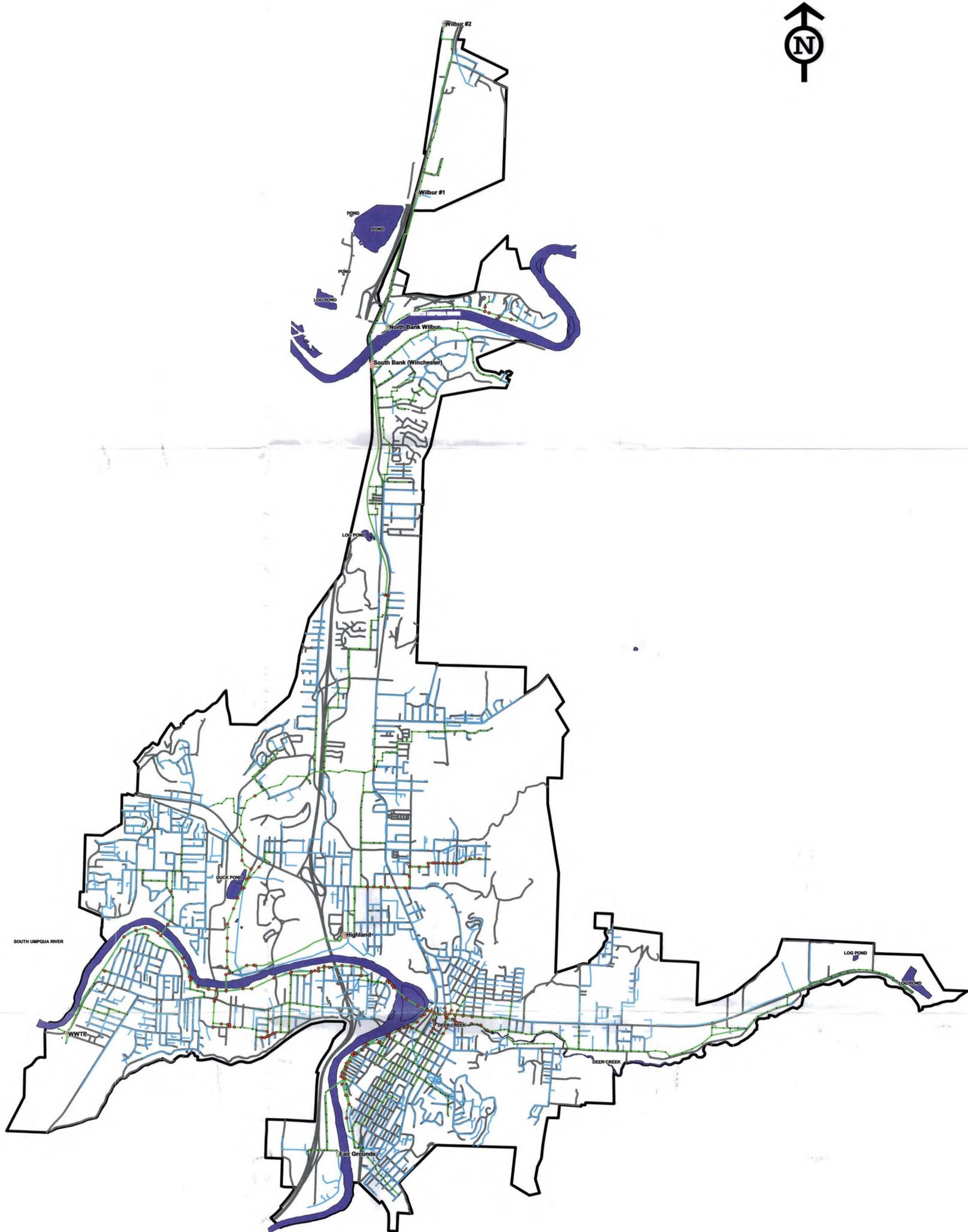
Scale: 1 inch = 2,000 feet

Legend

- Model Pipe
- Road
- Urban Growth Boundary
- Pump Station
- Deficient Pump Station

Figure 3-3
Pipe Deficiencies
5-year Design Flow, Existing Conditions
 RUSA Wastewater Collection System Master Plan





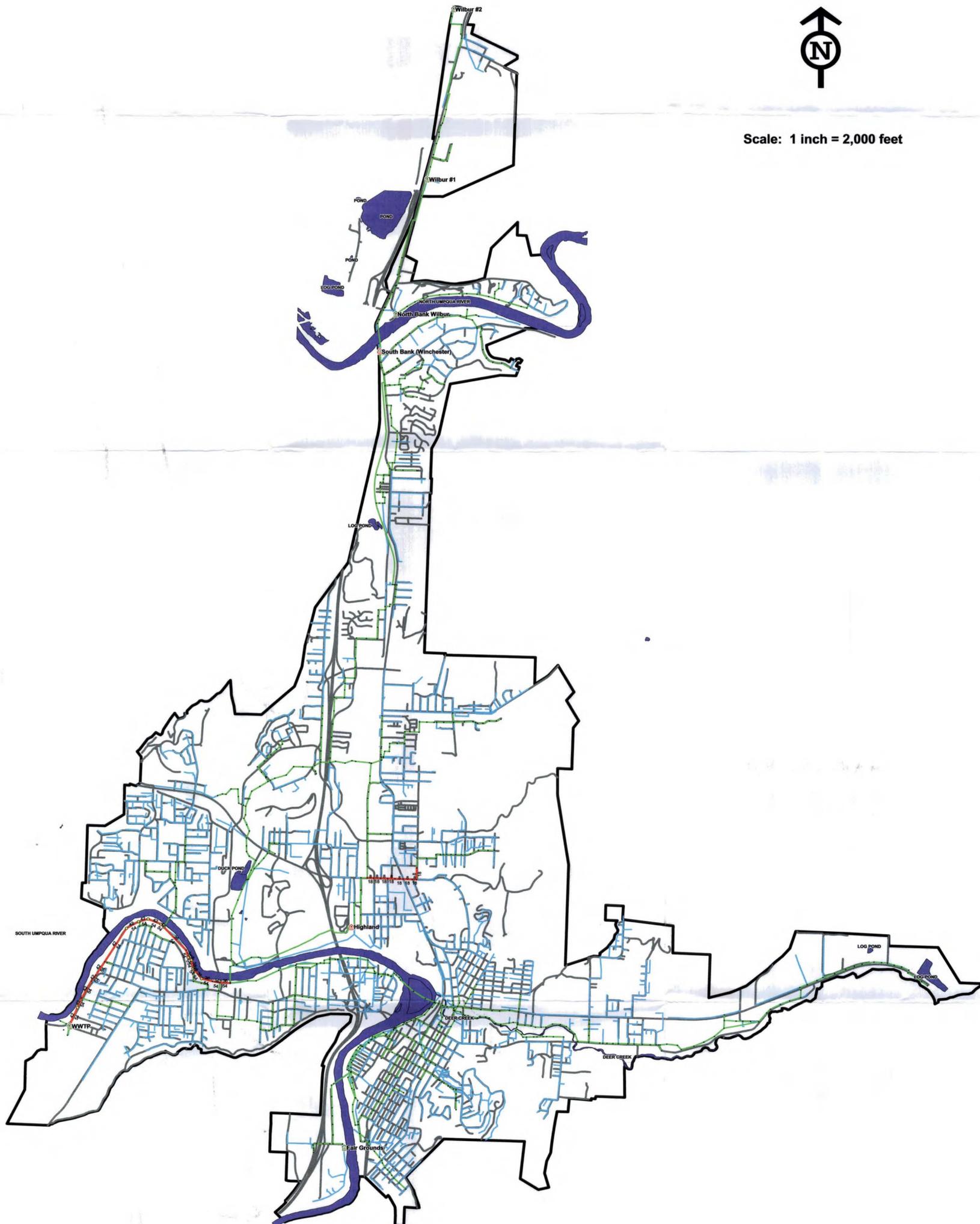
Legend

- Model Pipe
- Road
- Urban Growth Boundary
- Pump Station
- Deficient Pump Station

Figure 3-5
Pipe Deficiencies
 5-year Design Flow, Buildout Conditions
 RUSA Wastewater Collection System Master Plan



Scale: 1 inch = 2,000 feet



Legend

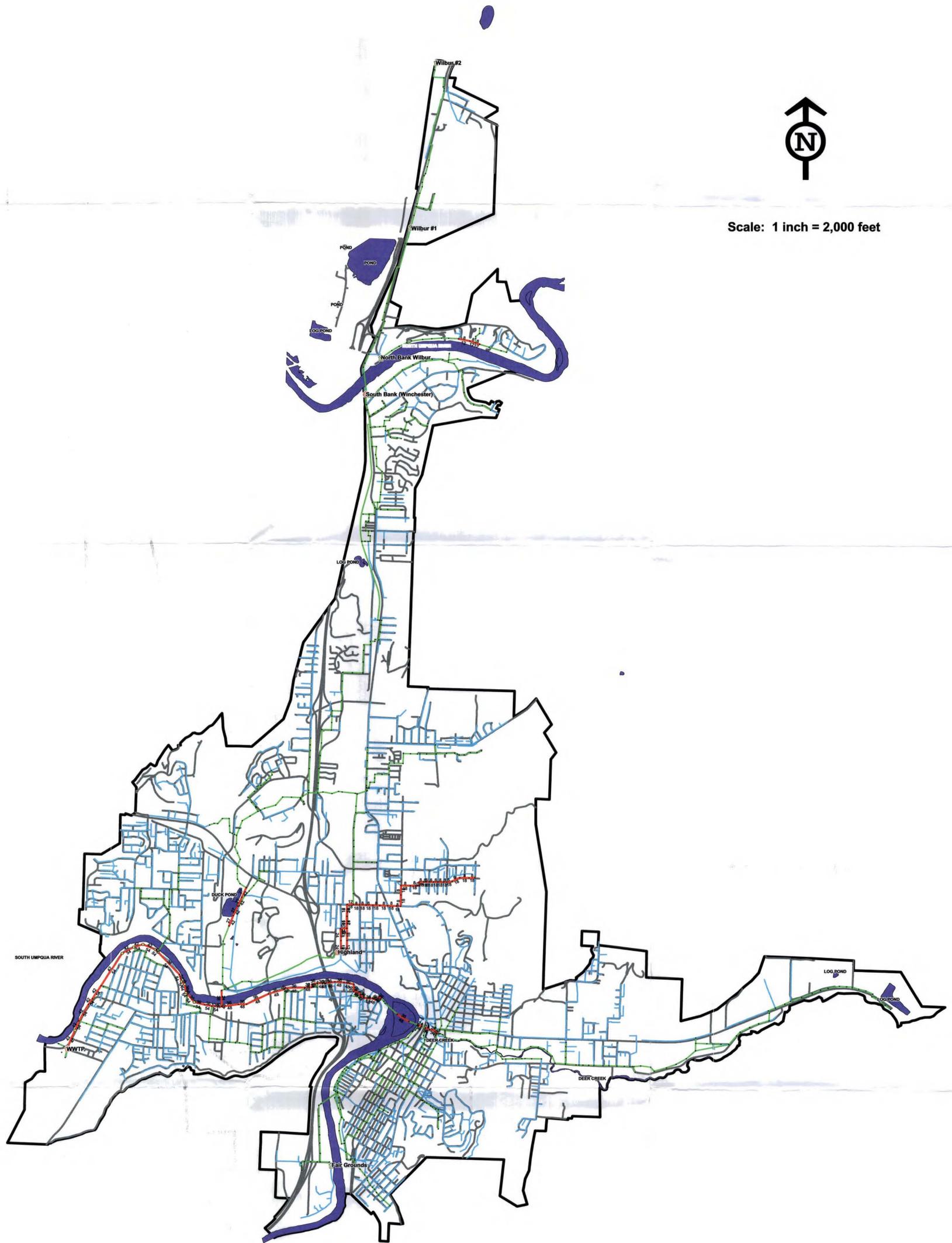
- | | | | |
|--|---------------------------------|--|---------------------------|
| | Sanitary Collection System Pipe | | Urban Growth Boundary |
| | Model Pipe | | Pump Station |
| | Improved Pipe | | Deficient Pump Station |
| | Road | | Ground Elevation Modified |

Figure 4-1

Pipe Improvements

5-year Design Flow, Existing Conditions

RUSA Wastewater Collection System Master Plan



Scale: 1 inch = 2,000 feet



Legend

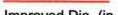
- | | | | |
|--|---------------------|---|---------------------------|
|  | Model Pipe |  | Urban Growth Boundary |
|  | Improved Pipe |  | Pump Station |
|  | Existing Dia. (in.) |  | Deficient Pump Station |
|  | Improved Dia. (in.) |  | Ground Elevation Modified |
|  | Road | | |

Figure 4-2

Pipe Improvements
5-year Design Flow, Buildout Conditions
 RUSA Wastewater Collection System Master Plan