Provo City

Sewer System Evaluation and Capacity Assurance Plan (SECAP)

July 2016 Update

provo
PUBLIC WORKS
WATER RESOURCES

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System Evaluation and Capacity Assurance Plan

Introduction

Provo City is a Municipal Corporation established in Utah under the Utah State Code. Provo City provides sewage collection and treatment within its municipal boundary, to a few users in south Orem, and to one industrial user outside the city limits.

A System Evaluation and Capacity Assurance Plan (SECAP) is required as part of the Utah Sewer Management Program General Permit for permittees with 2000 or more connections. The SECAP provides a methodology to evaluate, plan and schedule system repairs, improvements and capital projects in order to ensure capacity and minimize the potential for overflows. Provo City believes that one of the keys to preventing sanitary sewer overflows is to evaluate system capacity and to monitor flows throughout the system in order to ensure that capacities are not exceeded.

Requirements

Per Utah Administrative Code R317-801, the SECAP shall include the following:

(a) an evaluation of the wastewater collection system's existing hydraulic capacity using historical information such as flow, system records, current zoning, local development options, and maintenance records;

(b) identification of system deficiencies; and,

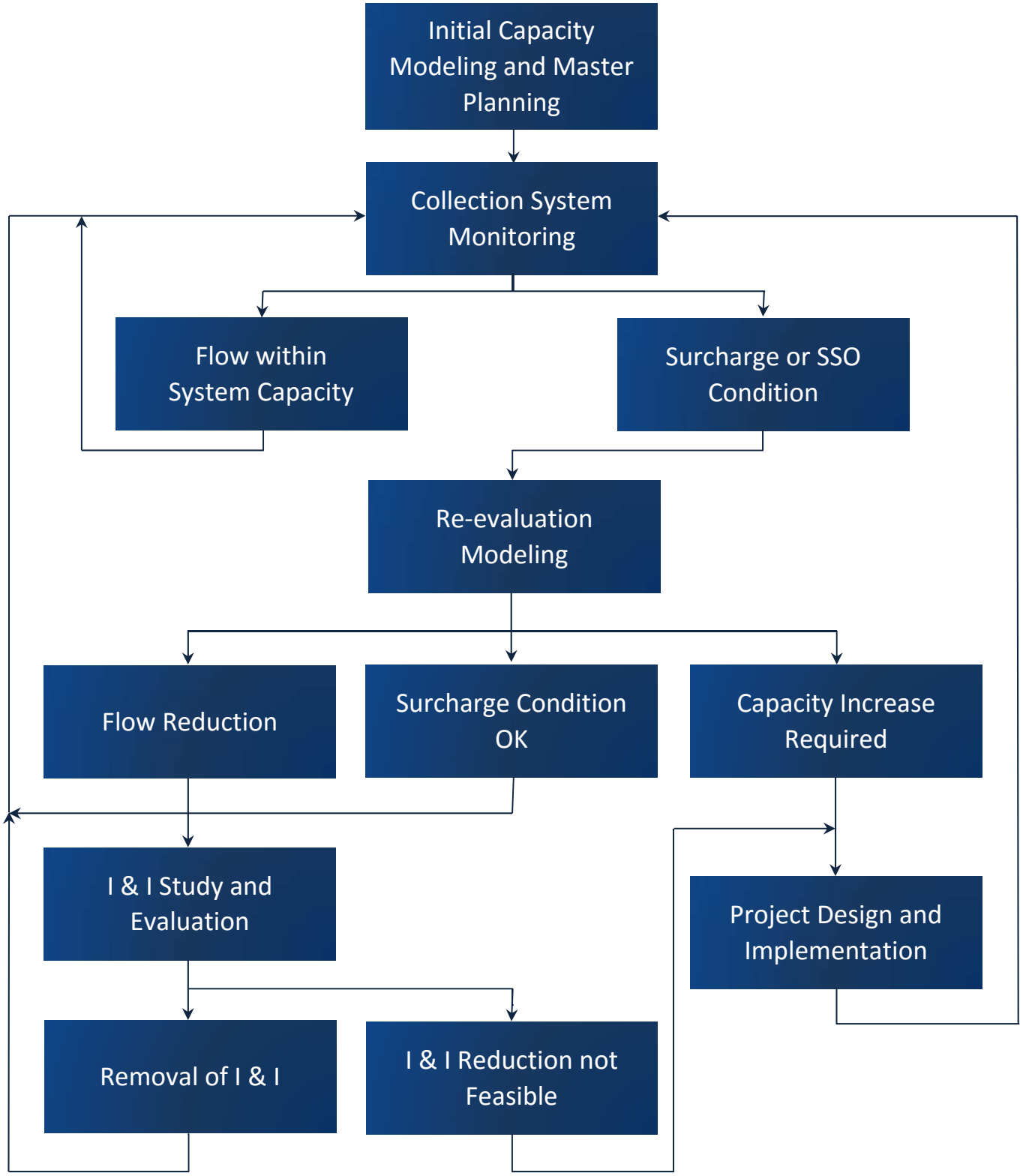
(c) a CIP that includes an appropriate model for the system that can be used to evaluate the hydraulic conditions in the system and identify existing and forecast future deficiencies to provide hydraulic capacity such as for future dry weather peak flow conditions, as well as the appropriate design for storm or wet weather events. The CIP shall establish a short and long term schedule to address the deficiencies and conditions identified, including a priority list, alternative analysis, and schedule for recommended upgrades. The CIP shall include increases in pipe size, I/I reduction plans, increases in pumping capacities and/or redundancies, storage capacity increases and recommended trunk line cleaning schedules or other monitoring activities. The CIP shall identify the sources of funding. The schedule shall be reviewed and adjusted yearly.

SECAP Components

The following elements are all part of Provo City SECAP program.

1) Initial Capacity Modeling and Master Planning
2) Flow Monitoring
3) Surcharge Flow Analysis
4) Re-evaluation Modeling and Analysis
5) Flow Reduction Evaluation and Implementation
6) Capacity Increase Evaluation and Implementation

The actual implementation process associated with each of the elements above is shown in the figure below. This flow chart process forms the backbone of the SECAP.



CAPACITY EVALUATION MODELING AND MASTER PLANNING

As part of preparation of the Wastewater Collection System Master Plan, Provo City has performed an analysis and modeling of the transmission backbone of its collection system. A detailed explanation of the hydraulic model, evaluation criteria, model results and recommended Capital Improvement Projects based on the full system evaluation are included in the Master Plan. A summary of the model and master plan is included below.

SEWER SYSTEM OVERVIEW

Provo City's wastewater collection serves approximately 43.6 square miles within its municipal boundary. The service area includes a few users in south Orem and one industrial user outside the city limits. The configuration of Provo's system in January of 2016 is as follows:

- Total miles of sewer pipe – 306.4 (260.6 Public, 45.8 Private)
- Total miles of sewer pipe larger than 8" – 74.1 (70.3 Public, 3.8 Private)
- Total miles of forced sewer – 6.1 (4.7 Public, 1.4 Private)
- Manholes – 6,201
- City lift stations – 13
- Private lift stations – 9

All of the City's wastewater is treated at the WWTP located at 1685 South East Bay Boulevard. The plant was placed into operation in 1956 and was expanded in 1978. The plant has a maximum-month average day capacity of 21 mgd and a peak hour capacity of 42 mgd. Construction of the sewer collection system began in earnest in 1955 with the construction of the Wastewater Reclamation Plant. Much of the system is older pipe with only 30% constructed in the last 30 years.

Provo City crews are responsible for operation and maintenance of the public mainline and manholes. Property owners are responsible for laterals from the mainline connection to the building. Private systems are maintained by the respective property owner, management company or Home Owners Association from their connection to the city main.

SEWER MODEL

As part of the master plan, the transmission backbone for Provo City was modeled to determine capacity for current and future development. The system modeling will be updated as repairs are completed, new large developments come online, monitoring results show substantial changes from assumptions or previous monitoring, when the general plan is revised or when other significant changes occur in the system.

MASTER PLAN

The most recent version of the Master Plan was completed in 2010 with some portions updated in 2013. This document is a living and working reference city staff, administration and elected officials to use in

planning and decision making for system upgrades, rehabilitation and capital improvements. Some of the information from the master plan is included herein. The master plan will be updated as conditions warrant reevaluation and pertinent parts will be included in this document.

FLOW MONITORING

Flow measurement on a city-wide basis was completed as part of the 2002 Wastewater Collection System Master Plan and on the west side in 2009. This monitoring and subsequent modeling show that the existing system has adequate capacity including allowance for Inflow and Infiltration.

MONITORING FOR MASTER PLANNING

Bowen, Collins & Associates contracted with ADS Environmental Services (ADS) in November 2000 and JUB Engineering (JUB) in October 2008 to perform temporary flow monitoring at select locations throughout the Provo City sewer system. Flow monitoring was performed to accomplish three major goals:

1. Provide general system flow data to be used for model calibration;
2. Provide data to develop input hydrographs and estimate average sewage production for different types of land use; and
3. Provide data for cursory infiltration analysis.

Temporary flow monitors were installed by ADS in 26 manholes in 2000 to continuously monitor sewer discharges over a seven-day period. Twelve additional temporary flow monitors were required in 2008 to obtain calibration data for Provo's Westside not included in the ADS flow monitoring. The locations of the flow monitors are shown in Figure 3-1 of the Master Plan. The selection of the flow monitoring locations was guided by the goals listed above. The majority of the monitors were placed on large mains to capture general flow patterns throughout the system. The flow monitoring data was then used in the calibration of a hydraulic computer model of the sewer system. The remaining monitors were placed on small lines serving small areas with relatively uniform land use (i.e. low density residential, high density residential, commercial, etc.). By isolating different types of land use, the results from these monitors were used to estimate sewer production patterns for each type of land use.

The ADS flow monitors were installed on November 9, 2000 and flows were monitored from November 10, 2000 through November 16, 2000. The Westside flow monitors were installed between October 15, 2008 and October 29, 2008. No storms occurred during either collection period so that all monitored flow can be assumed to be groundwater infiltration or domestic flow. ADS flow monitoring was conducted at 15-minute time intervals, while the Westside flow monitoring was monitored at 6-minute time intervals. The 6-minute interval was used because of the many lift stations on Provo's west side. In order to capture the pumping cycles properly, these shorter intervals were necessary. Values of velocity, water depth, and instantaneous flow were recorded to accomplish the goals discussed above.

Flow monitoring was conducted during the fall for two reasons. First, domestic sewer flow production patterns can be more closely observed when sewer flow monitoring is performed during the period of lowest infiltration. In the fall, groundwater levels are generally low and infiltration is at its lowest annual level. A second reason for choosing this time period was to try to avoid inflow from precipitation. If monitoring can occur during a dry period, inflow can be neglected. For the ADS monitoring, there was

some snow fall, but temperatures prevented this precipitation from melting. Inflow was therefore considered to be negligible.

During the seven-day ADS flow-monitoring period, values of velocity, water depth, and instantaneous flow were recorded at 15-minute intervals for each location. The tables below summarize the results of the flow monitoring for major trunk lines in the system. More detailed monitoring information is in the Master Plan.

Summary of Flow Monitoring Results for Provo City Trunk Lines (ADS 2000)

Trunk Line	Maximum Observed Instantaneous Flow (mgd)	Minimum Observed Instantaneous Flow (mgd)	Average Observed Flow (mgd)	% Plant Flow [1]	% Service Area
Eastside	5.93	1.39	3.28	20.7	14.8
Southeast	0.91	0.04	0.38	2.4	12.0
Westside	7.77	3.42	5.63	35.5	34.5
Freedom	8.04	3.54	5.87	37.1	28.2
Industrial [2]	NA	NA	0.68	4.3	10.5
Total (as measured at the WWTP)	23.00	9.40	15.84	100.0	100.0

[1] Based on average observed flow during the flow monitoring period

[2] Flows were not monitored on the Industrial Trunk Line. Average flow in this trunk line was calculated as the difference between the average flows measured at the plant and the sum of average flows in the other four trunk lines.

Summary of Westside Flow Monitoring Results (October 15-29, 2008)

Location	Diameter (in)	Max d/D	Ave d/D	Min d/D	Max Flow (mgd)	Max Velocity (ft/s)
W1	36	0.59	0.43	0.32	5.22	2.28
W2	36	0.49	0.39	0.29	5.32	2.47
W3	24	0.51	0.42	0.33	5.37	5.20
W4	18	0.80	0.38	0.13	3.44	3.74
W5	12.2	0.54	0.46	0.41	0.39	1.35
W6	18	0.62	0.44	0.26	1.30	1.91
W7	24	0.41	0.33	0.25	3.24	4.47
W8	12	0.92	0.48	0.26	0.50	2.57
W9	7.8	0.29	0.15	0.03	0.05	1.04
W10	12	0.91	0.57	0.44	0.50	1.51
W11	12	1.03	0.52	0.27	0.50	2.42
W12	11.7	0.57	0.48	0.39	0.28	1.01
Westside					5.22	

d – Depth in pipe
D – Diameter of pipe

Permanent Flow Monitors

Permanent flow meters are located at the influent to the Wastewater Reclamation Facility, Provo City Lift Stations (4), Brigham Young University (19), Pacific States Pipe, Utah Railway, and the State Hospital.

Ongoing Flow Monitoring

Flow monitoring is also performed periodically by Provo City staff using portable meters. Provo currently owns two portable meters. Locations for placement of the portable meters are those deemed the highest priority/concern by the Water Resources Staff. Locations may be selected based on the following or other relevant criteria:

- Locations with upcoming or recently completed Capital Improvement Projects
- Locations with sanitary sewer overflows potentially due to capacity issues.
- Locations where significant growth is occurring or will soon occur
- Locations with known or suspected Infiltration and Inflow
- Large users who may significantly impact the system
- Areas where calibration is needed

Portable flow meters are calibrated at the time of usage. Fixed meters are calibrated yearly. In addition to flow monitoring, a visual inspection program is in place in concurrence with the manhole inspections, cleaning and CCTV activities. Further evaluation is completed for manholes that show signs of surcharge.

SURCHARGE FLOW ANALYSIS

If any collection subsystem is identified as having any of the following problems the system will be evaluated to determine future action. These problems are:

1) Sanitary Sewer Overflow to the Environment
2) Sanitary Sewer Break Remaining in the Trench
3) Basement Backup
4) Observed Subsystem Surcharging

The flow evaluation may result in multiple conclusions, some of which may require further action. Possible conclusions and their further action are listed below. This list is not inclusive nor does it require the specific action detailed. These are given as possible examples and will be used by Provo City to determine correct future action.

FLOW REDUCTION EVALUATION

If excessive flows are identified during the surcharge analysis, the solution may be to proceed with an inflow and infiltration study with the ultimate goal of reducing flows. These flow reductions may be achieved by reconstruction of specific areas, internal spot repairs, removing illegal storm water or sump pump connections from homes or storm water systems, and system grouting. Tools used in flow reduction may include extensive in line camera inspection, testing, and increased inspection or flow monitoring.

Provo has been very proactive in addressing inflow and infiltration. Through the system-wide monitoring that was performed, areas of significant infiltration were identified. Subsequently, several lining and replacement projects have been completed to reduce infiltration. Ongoing flow monitoring and system inspection have verified the success of these efforts.

FOREIGN OBJECTS OR OBSTRUCTIONS

There are multiple foreign objects which may be found in sewers. These may include objects knocked into sewers during construction, illegally placed in sewer manholes, roots, grease and soaps, bellies in piping systems, etc. Each of these problems should be found during the backup investigation and a plan developed to insure the problem does not reoccur. Types of action may include increased cleaning frequency, spot repairs, greater pretreatment activity, lining of pipes, and other corrective actions which resolve the problem.

ALLOWABLE SURCHARGING

Some piping systems may be able to accept surcharges without creating problems. Such systems may be deep and surcharging occurs below the level of basements or manhole rims, or they may be in areas where there are no connections. In such cases the resolution of the observed surcharge may just be additional monitoring.

Revised System Modeling

Where piping system problems cannot be resolved in a less expensive way, the system may be further modeled to determine upgrade needs. Modeling includes known flow information and future projections. Since the system has been shown to have problems, further modeling should be more conservative in flow projections. Follow the guidelines given next for modeling revisions.

RE-EVALUATION MODELING AND ANALYSIS

When a subsystem needs demonstrate unresolvable problems by less costly means, the subsystem should be re-modeled and required action determined. Revised modeling may show that flow reduction may still be viable or it may show that the system can allow current surcharge conditions. Most likely, however, the modeling will normally form the basis for construction to enlarge the subsystem capacity. Most modeling will be completed by Provo City staff using commercially available software. However, Provo may also employ Engineering Consulting Firms using available software to assist with modeling needs.

It is important to insure the modeling is comprehensive and includes all the potential flow sources. While the current area zoning and land use planning should be used in the model development, Provo City staff will discuss the modeling results and effects of the possible zoning and land use changes with administration and officials as appropriate and will make recommendations to maintain system capacity. Where possible zoning changes appear likely, the model will be re-run with the revised zoning alternatives. Once a resolution has been selected, the resulting project should be placed on the capital improvement plan (CIP).

CAPACITY INCREASE EVALUATION AND IMPLEMENTATION

The capacity evaluation will be prioritized for areas that have potential to impact the environment due to overflow, backup, or surcharging. Details on prioritization are given in the next section.

Systems requiring additional capacity will be engineered for expansion by qualified Provo City staff or engineering consultants. Project design will be based on acceptable engineering standards and will comply with State of Utah regulations found in R317-3. Easements will be obtained, where needed and the design will include an analysis of the impact to other utilities in the vicinity. As appropriate, design review will be done by the applicable regulatory agency. A design report or subsystem modeling will be prepared for each project. Finalized projects are included on the CIP.

System Improvement Prioritization

System Improvement Prioritization

The priority for improvement should follow the following general guidelines:

High Priority Projects

When there is significant potential for sanitary sewer overflows, or frequent basement backups, the improvement should be considered a high priority and any available budget should be allocated to the project.

Medium Priority Projects

Where the problem is infrequent and the possibility exists that it may not repeat in the near future, the priority for correction is medium. Medium priority projects may be delayed until appropriate budget is available or the priority is adjusted to high priority. If an SSO or basement backup repeats in the same area, the priority will be immediately reevaluated.

Low Priority Projects

If the observed problem is infrequent, there is possibility that it may not repeat in the near future and the possibility that increased flow in the subsystem is low, the correct priority is low. Low priority projects will be placed in the budget process and evaluated against other needs. These projects will eventually be completed, but the work is not prioritized above plant and equipment needs.

CAPITAL IMPROVEMENT PLAN

The Capital Improvement Plan (CIP) is part of Provo City's budgeting process to insure sufficient revenue to address identified weaknesses in the sanitary sewer system.

The Utah General Permit has the following requirements for the CIP:

- The CIP shall establish a short and long term schedule to address the deficiencies and conditions identified, including a priority list, alternative analysis, and schedule for recommended upgrades.
- The CIP shall include increases in pipe size, I/I reduction plans, increases in pumping capacities and/or redundancies, storage capacity increases and recommended trunk line cleaning schedules or other monitoring activities.
- The CIP shall identify the sources of funding. The schedule shall be reviewed and adjusted yearly.

Larger items which have been identified as needing a structural fix are placed on the CIP list and the cost for each estimated. Sources of funding will be identified for all high priority projects so that SSO's or other failures do not re-occur. Forecasts of available funding for medium and low priority projects will be made to facilitate future revenue needs.

The approved CIP list as well as an explanation of budgeting, revenue streams and funding sources is included in Appendix B.

APPENDIX A
INFORMATION AND FIGURES FROM MASTER PLAN

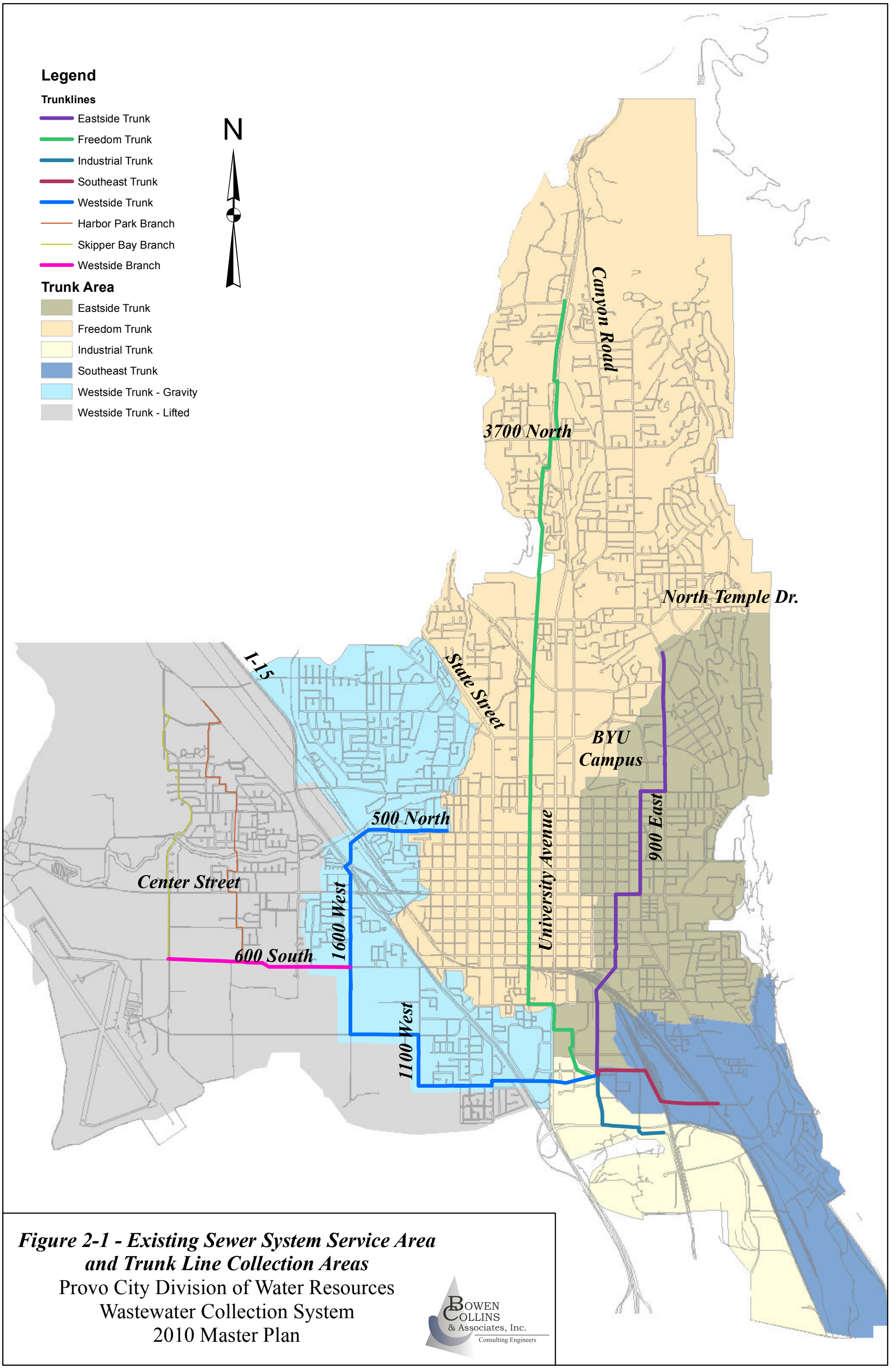


Figure 2-1 - Existing Sewer System Service Area and Trunk Line Collection Areas

Provo City Division of Water Resources
Wastewater Collection System
2010 Master Plan

Bowen Collins & Associates, Inc.
Consulting Engineers

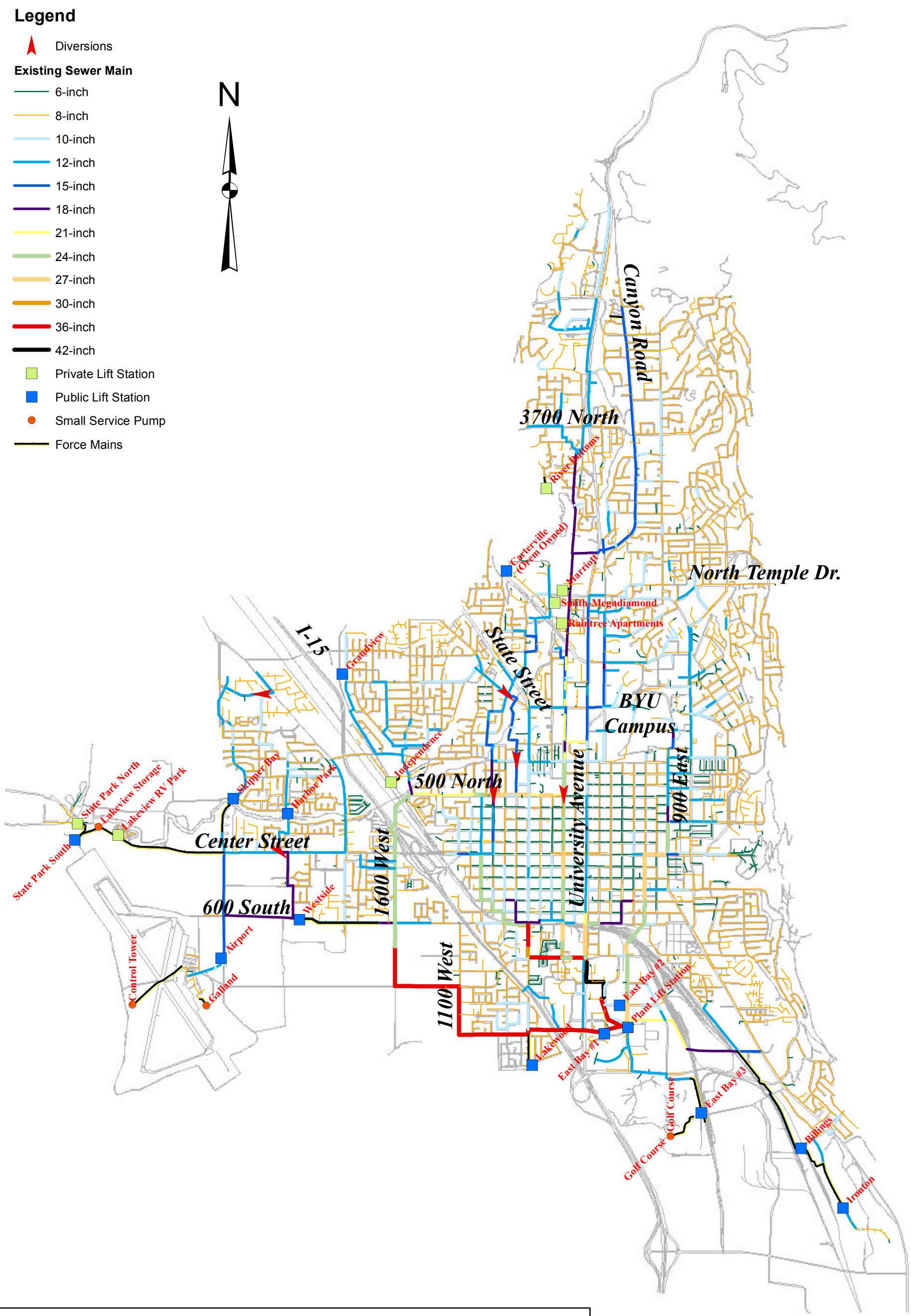


Figure 2-2 - Existing Wastewater Collection Facilities

Provo City Division of Water Resources
Wastewater Collection System
2010 Master Plan

BOWEN COLLINS & Associates, Inc.
Consulting Engineers

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Table 2-2
Existing Public Lift Stations

Lift Station	Address	Yr. Built (Refurbished)	Wet Well Volume (gallons)	Emergency Power (KW)	Pump (gpm)
Westside	2450 W. 560 S.	1963 (2000)	6,905	60	2,000
Harbor Park	2475 W. 350 N.	1977 (2005)	6,919	35	1,100
Skipper Bay	2995 W. Boat Harbor Dr.	1996	3,570	60	1,100
Ironton	2900 S. Mountain Vista Pkwy.	2005	2,872	130	557
East Bay I	1600 S. 180 E.	1985	740	N/A	500
East Bay II	1325 S. 290 E.	1988	1,650	20	500
East Bay III	2000 S. Kuhni Rd.	1989	1,167	20	500
Lakewood	470 W. Lakewood Dr.	1981 (Planned)	775	40	450
Airport	3110 W. 890 S.	1977	2,622	N/A	400
Billings	2040 E. Ironton Blvd.	1980	4,885	20	350
Plant	1500 S. 350 E.	1984	3,382	250[1]	340
State Park South	4200 W. 120 S.	1972	2,014	N/A	230
Grandview	2100 W. 1600 N.	1973	215	N/A	130

[1] Includes power for both Plant Lift Station and Headworks Bldg.

DIVERSIONS AND INTERCEPTORS

Provo City has constructed several diversions and interceptors in its collection system to optimize the flow capacity in its existing system. The purpose of these diversions or interceptors has been to reduce flow to the west side of Provo City where there is the most potential for growth while utilizing available capacity in sewer trunks to the east. These diversions are shown in Figure 2-2 and listed in Table 2-3 to identify the historic direction of flow compared to the current direction of flow.

Table 2-3
Provo City Diversions and Interceptors

Intersection	Historic Flow Direction	Current Flow Direction
500 North 800 West	West	50% to South
1390 North 2770 West	South	West
500 North Freedom Blvd (200 West)	West	South
800 North 600 West	West	South
Center Street 2650 West	West	South
Columbia Lane Riverside Drive	Southwest	Southeast

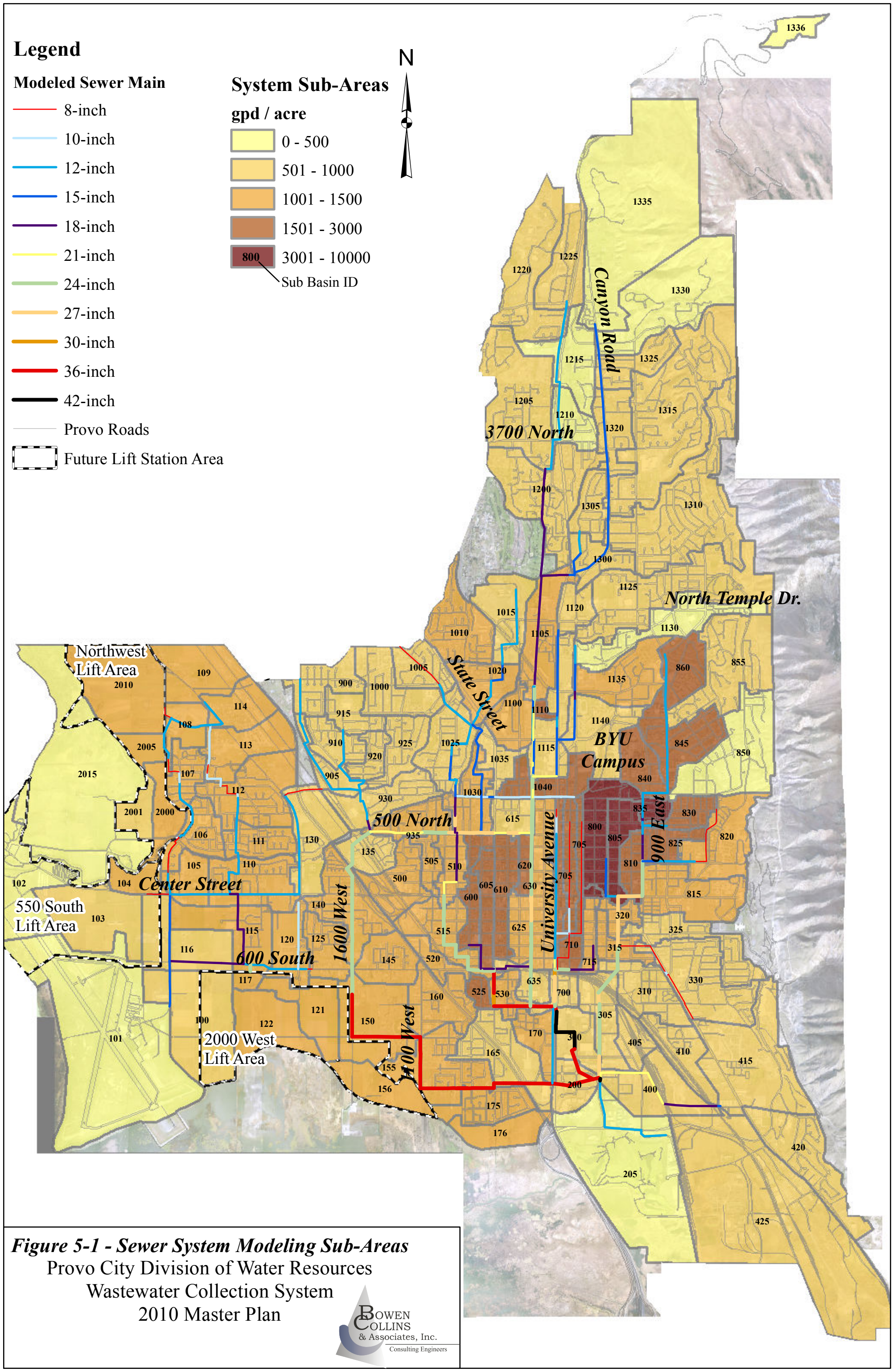

Figure 5-1 - Sewer System Modeling Sub-Areas
Provo City Division of Water Resources
Wastewater Collection System
2010 Master Plan

Bowen Collins & Associates, Inc.
Consulting Engineers

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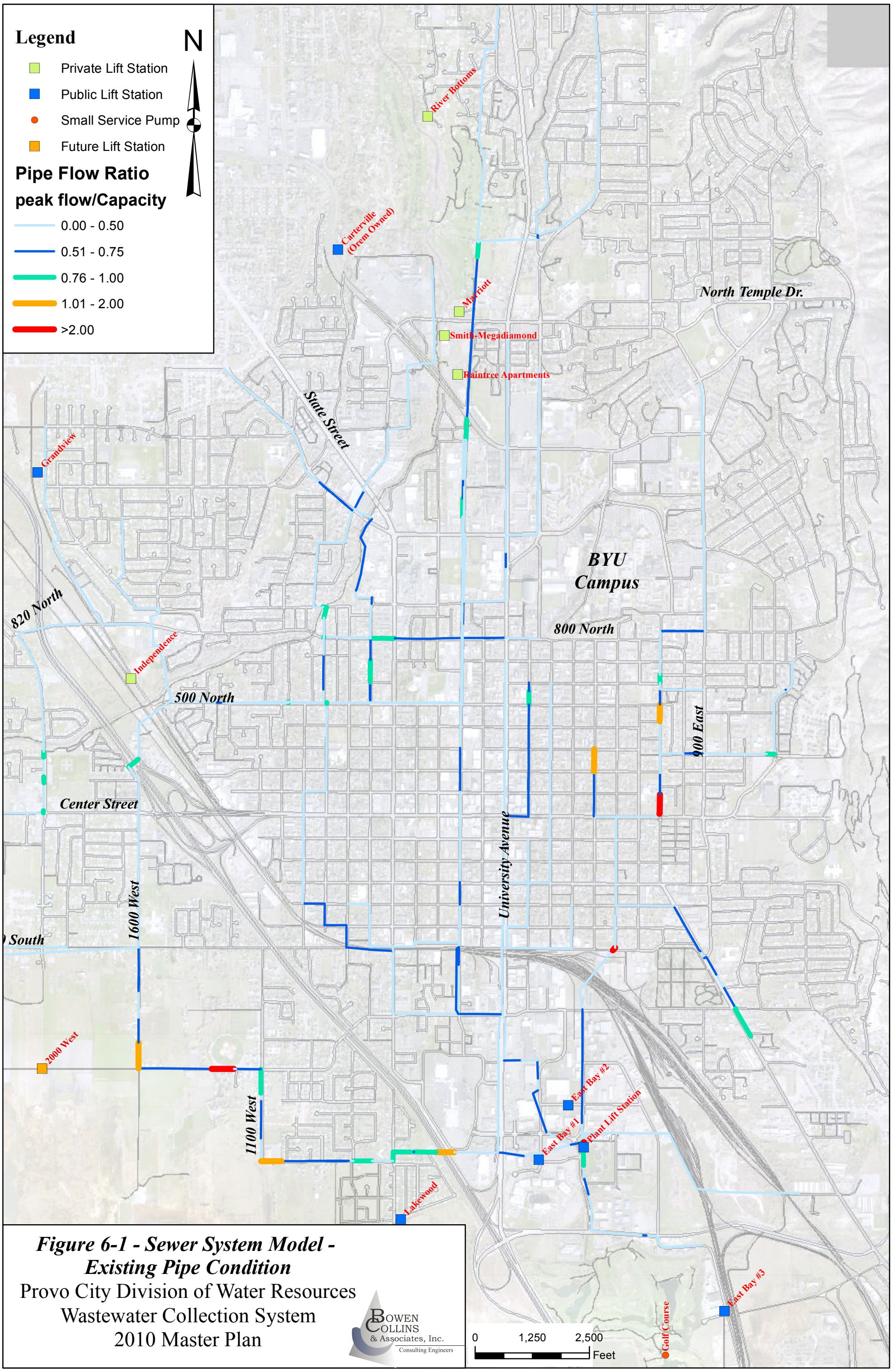

Figure 6-1 - Sewer System Model - Existing Pipe Condition

Provo City Division of Water Resources
Wastewater Collection System
2010 Master Plan

Bowen Collins & Associates, Inc.
Consulting Engineers

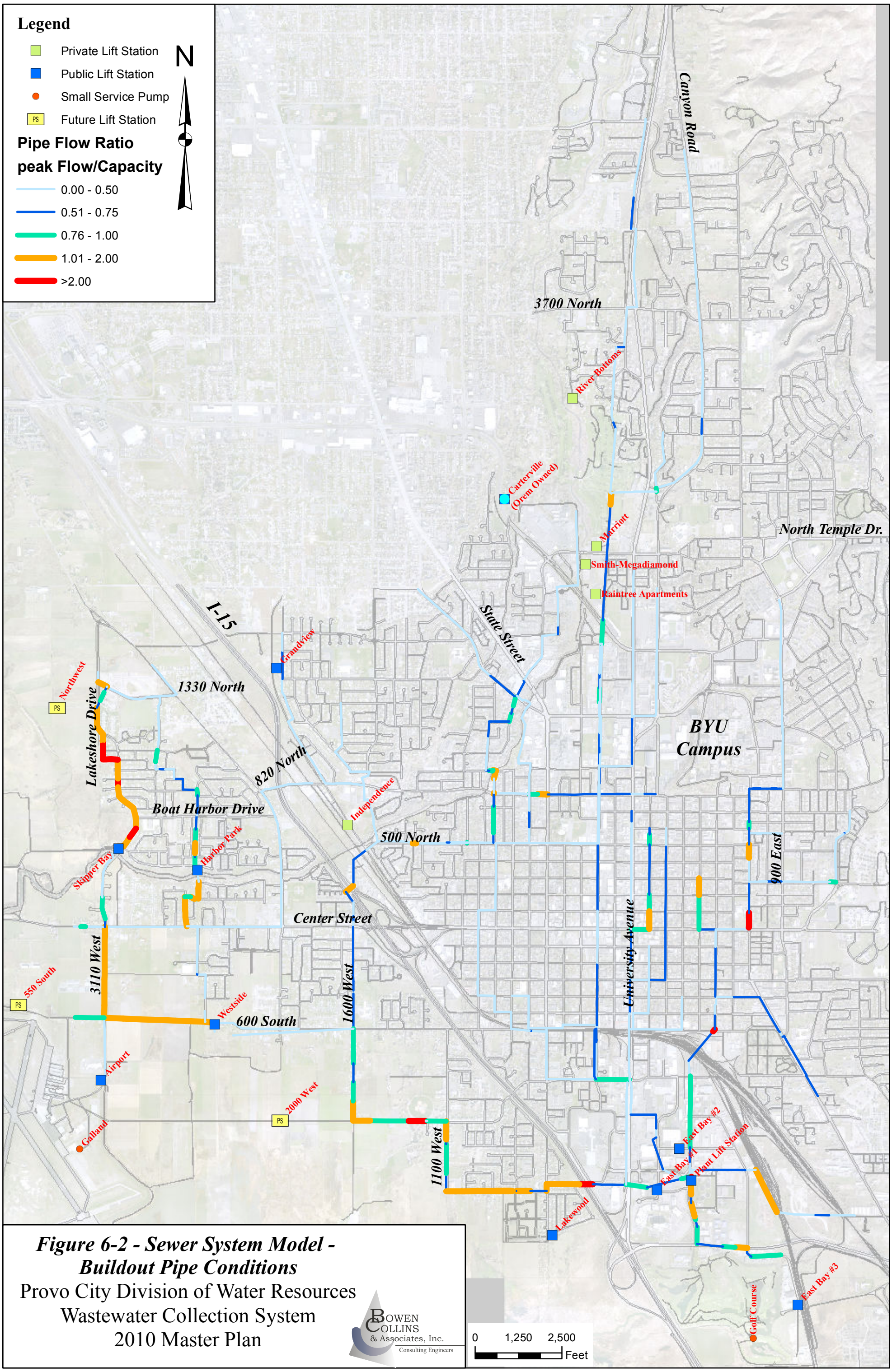

Figure 6-2 - Sewer System Model - Buildout Pipe Conditions

Provo City Division of Water Resources
Wastewater Collection System
2010 Master Plan

Bowen Collins & Associates, Inc.
Consulting Engineers

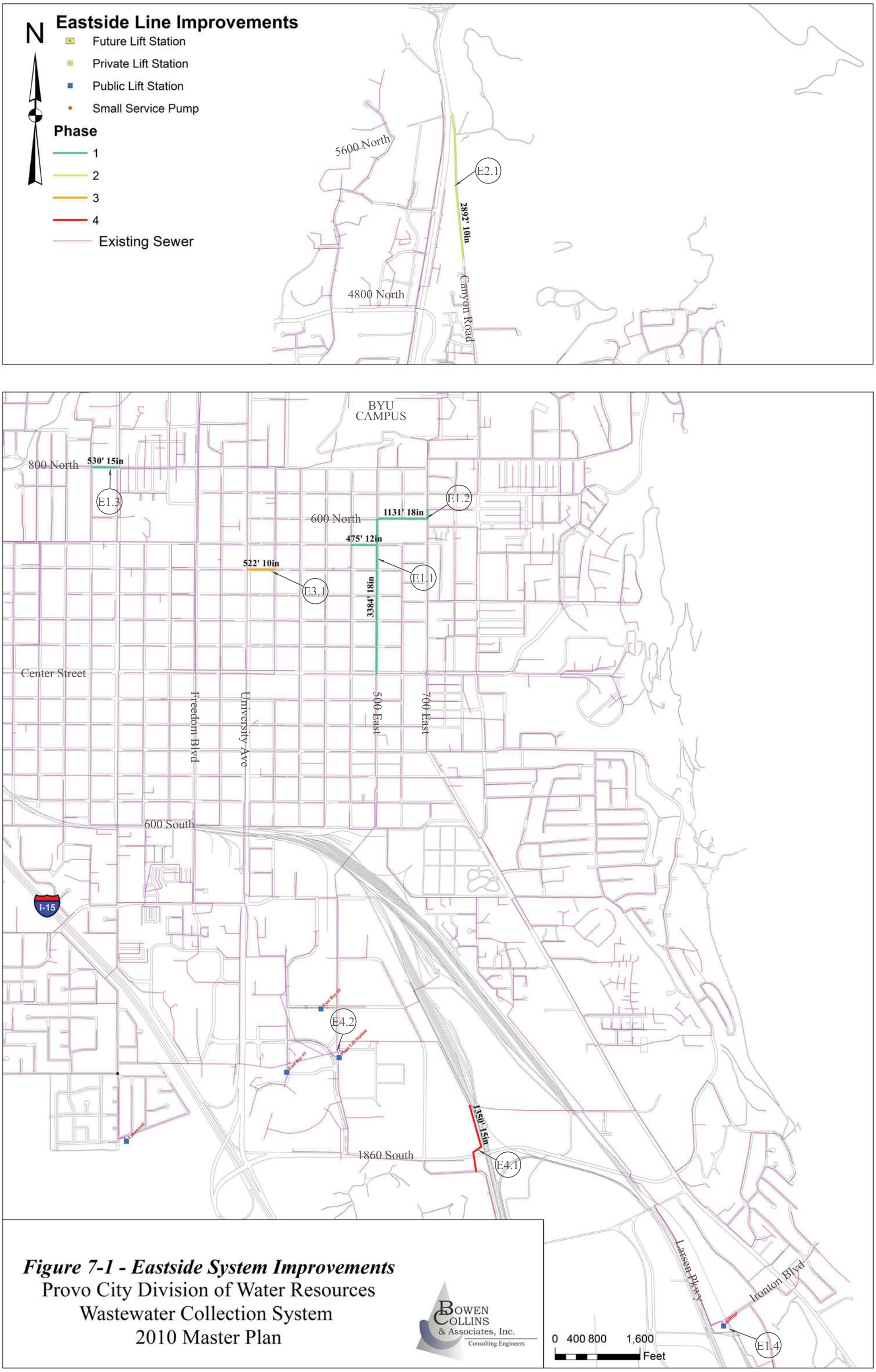

Figure 7-1 - Eastside System Improvements
Provo City Division of Water Resources
Wastewater Collection System
2010 Master Plan

BOWEN COLLINS & Associates, Inc.
Consulting Engineers

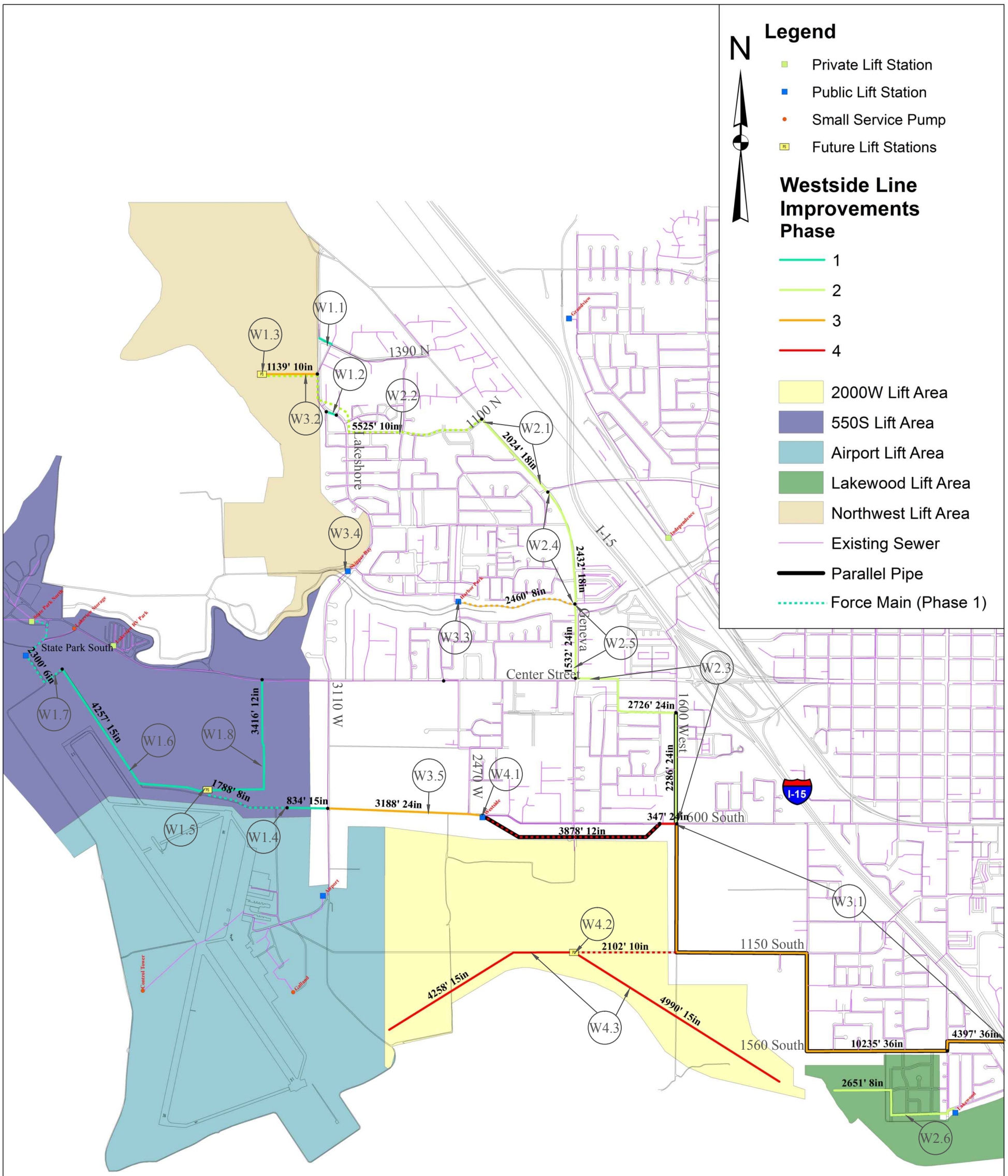

Figure 7-2 - Westside System Improvements

Provo City Division of Water Resources
Wastewater Collection System
2010 Master Plan

BOWEN COLLINS & Associates, Inc.
Consulting Engineers

APPENDIX B
CAPITAL IMPROVEMENT PROJECT LIST

FY 2016 Budget and Rates

In FY 2016 the Provo City Wastewater Collection Operating Budget is $973,408. This budget includes $90,000 appropriated annually for maintenance on the collection system. One of the ways this funding has been utilized is for lining projects that address infiltration problem areas as well as extending the life of both sewer lines and manholes. These funds have also been available to address unplanned repairs and enhancements that may not be specifically budgeted for in the capital improvement budget. All costs of the Provo Wastewater system, both operating and CIP, are funded through the wastewater utility rates charged monthly across the City. These rates are collected through a base charge per connection to the water system, which in FY 2016 is $7.31 per connection, and through a commodity or usage charge, which in FY 2016 is $2.00 per 1,000 gallons used (based on the winter average). The FY 2016 estimated revenue from these rates is $8,000,000.

Proposed Rate Increases

Two years ago the Public Works Department made a proposal to increase the wastewater utility rates over a five year period to fund capital improvements and anticipated growth in operating costs. After one year that plan was revised and a new five year proposal was presented. In the last two years the Provo Municipal Council has approved a 20% and a 24% increase to these rates. Proposed rate increases for the next four years would increase the rates by 19.8%, 14.5%, 19%, and 15%. This revenue will help keep up with regular maintenance on the collection system and provide funding for capital improvements identified in the Collection System Master Plan.

FY 2016 CIP

The FY 2016 Wastewater CIP Budget includes the following projects that address the collection system: $20,000 for miscellaneous collections and reclamation projects, $15,000 for sewer main oversizing, $25,000 for capital equipment, $60,000 for collection system rehabilitation, $130,000 for 300 South collection system rehabilitation, and $50,000 for lift station projects. This is in addition to $10 million dollars that was added to the CIP budget in FY 2015 through a $10 million bond to address CIP needs in the collection system and at the wastewater treatment plant.

The following table shows the proposed five year Wastewater CIP budget presented to the Municipal Council. Major projects addressing the collection system include:

- Annual appropriations for miscellaneous projects
- Sewer main oversizing
- Capital equipment
- Collection system rehabilitation
- Lift station improvements.

Funding is also planned for major investment in west side sewer lines and lift stations, Mt. Vista collection system improvements, University Avenue pipe bursting, a Riverside County Club 18” sewer main line, vehicle replacement, a new collection system master plan, and a parallel 36” west side sewer main. These improvements total over $18 million. This constitutes a significant investment in ensuring that deficiencies in the collection system are addressed in both the short and long term.

Funded Projects		FY 2016-2017 Estimate	FY 2017-2018 Estimate	FY 2018-2019 Estimate	FY 2019-2020 Estimate	FY 2020-2021 Estimate	Total
Funding Sources							
Transfers		$ 2,169,000	$ 3,625,000	$ 4,770,000	$ 6,120,000	$ 7,241,200	$ 23,925,200
Grants		-	-	-	-	-	-
Impact Fees		500,000	500,000	500,000	500,000	500,000	2,500,000
City Labor		-	-	-	-	-	-
Prior Year Carryover		-	-	-	-	-	-
CIP Fund Balance		-	-	-	-	-	-
New Year Budget		-	-	-	-	-	-
Total Funding Sources		**$ 2,669,000**	**$ 4,125,000**	**$ 5,270,000**	**$ 6,620,000**	**$ 7,741,200**	**$ 26,425,200**
Project Costs							
Project Description	**Priority Level**						
4505-Misc WWC & WRP	2	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 20,000	$ 100,000
4506-Overlay Roads WRP	2	-	400,000	300,000	-	-	700,000
4508-Sewer Main Oversizing	2	15,000	15,000	15,000	15,000	15,000	75,000
4514-Capital Equipment	2	25,000	25,000	25,000	25,000	25,000	125,000
4516-Collection System Rehab.	1	60,000	60,000	60,000	60,000	60,000	300,000
4523-Contingency	2	100,000	100,000	100,000	100,000	100,000	500,000
4549-West Side Sewer Lines	1	-	1,000,000	2,000,000	1,000,000	1,200,000	5,200,000
4555-Westside Lift Stations	2	500,000	-	-	-	1,200,000	1,700,000
Riverside Country Club 18" Sewer Main Line	2	250,000	250,000	-	-	-	500,000
4548-Nutrient Removal	1	200,000	200,000	-	-	-	400,000
Mt. Vista Collection System Improvements	2	400,000	400,000	400,000	-	-	1,200,000
4551-University Avenue Pipe Bursting	2	-	-	-	-	700,000	700,000
4552-Master Plan Projects	1	-	-	1,000,000	2,000,000	2,000,000	5,000,000
4542-Vehicle Replacement	2	-	155,000	150,000	300,000	-	605,000
4553-Sewer Lift Station Improvements	2	150,000	150,000	100,000	100,000	50,000	550,000
Parallel 36" West Side Sewer Main	1	-	1,000,000	1,000,000	3,000,000	2,000,000	7,000,000
Collection System Master Plan	2	100,000	100,000	100,000	-	-	300,000
Public Works Garage Remodel	3	25,000	250,000	-	-	-	275,000
4540-Roofing							-
4546-Reclamation Plant Master Plan							-
Additional Master Plan Projects (Funded)	1	824,000				371,200	1,195,200
Total Project Costs		**$ 2,669,000**	**$ 4,125,000**	**$ 5,270,000**	**$ 6,620,000**	**$ 7,741,200**	**$ 26,425,200**

Priority Levels: 1 - Critical Health and Safety **2** - Necessary Infrastructure **3** - Aspriational Projects

*2c Projects with conditional funding secured