APPENDIX A – URBAN RESERVE AREAS EVALUATION

TECHNICAL MEMORANDUM

Project: Collection System Master Plan

Client: City of Grants Pass

Title: Appendix A - Urban Reserve Areas Evaluation

1.0 INTRODUCTION

The City of Grants Pass (City) plans to serve the population within their Urban Reserve Areas (URA) by 2040. Boundaries for the City's URAs were adopted in 2014 and are shown in Figure 1. This Appendix (Appendix A) evaluates the impacts of connecting these URAs to the City's existing collection system.

2.0 LAND USE

Land use information is an integral component in estimating the amount of wastewater generated within any City. The type of land use in an area will affect the volume of the wastewater generated. Adequately estimating the generation of wastewater from various land use types is important in sizing collection system facilities.

The City has two development alternatives presented in Figure 2 (Alternative 1) and Figure 3 (Alternative 2).

Table 1 below provides a summary of the future land use categories and acreages for the Urban Reserve Areas. Tables 2 and 3 provide land use details for each URA.

Table 1 Land Use Summary - URAs
Wastewater Collection System Master Plan
City of Grants Pass

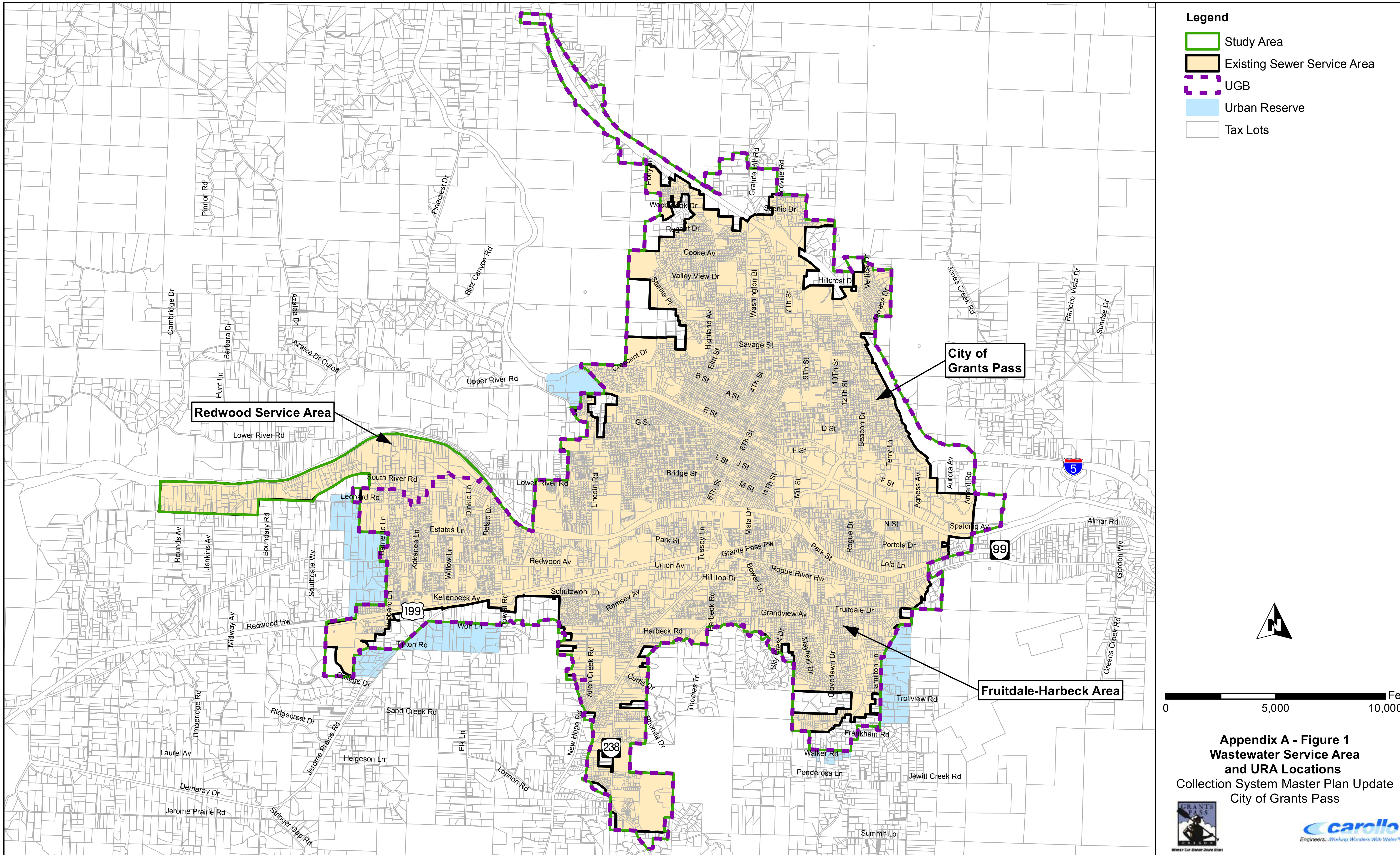
Concept Plan Designation	Description	Alternative 1 Acreage (acres)	Alternative 2 Acreage (acres)
Emp	Employment Area	50.9	46.9
Comm	Commercial	12.0	19.5
HRR	High-Rise Residential	30.0	24.3
HR	High-Density Residential	73.4	80.7
MR	Moderate-Density Residential	238.1	233.1
LR	Low-Density Residential	159.7	
Total (mgd)	**-**	**564.2**	**564.2**

Table 2 Alternative 1 Land Use Details - URAs
Wastewater Collection System Master Plan
City of Grants Pass

URA ID	Comm	Emp	HR	HRR	LR	MR	Total
J1.2					117.0		117.0
J1.3						15.5	15.5
S1.2	3.0		23.2			88.2	114.4
S1.3W		36.5					36.5
V2.2	9.0	14.3	50.2	30.0		73.1	176.6
W2/W3					42.8	12.2	54.9
Total	**12.0**	**50.9**	**73.4**	**30.0**	**159.7**	**238.1**	**564.2**

Table 3 Alternative 2 Land Use Details - URAs
Wastewater Collection System Master Plan
City of Grants Pass

URA ID	Comm	Emp	HR	HRR	LR	MR	Total
J1.2					117.0		117.0
J1.3						15.5	15.5
S1.2	3.0		23.2			88.2	114.4
S1.3W		36.5					36.5
V2.2	16.4	10.3	57.4	24.3		68.0	176.6
W2/W3					42.8	12.2	54.9
Total	**19.5**	**46.9**	**80.7**	**24.3**	**159.7**	**233.1**	**564.2**



Appendix A - Figure 1
Wastewater Service Area
and URA Locations
Collection System Master Plan Update
City of Grants Pass

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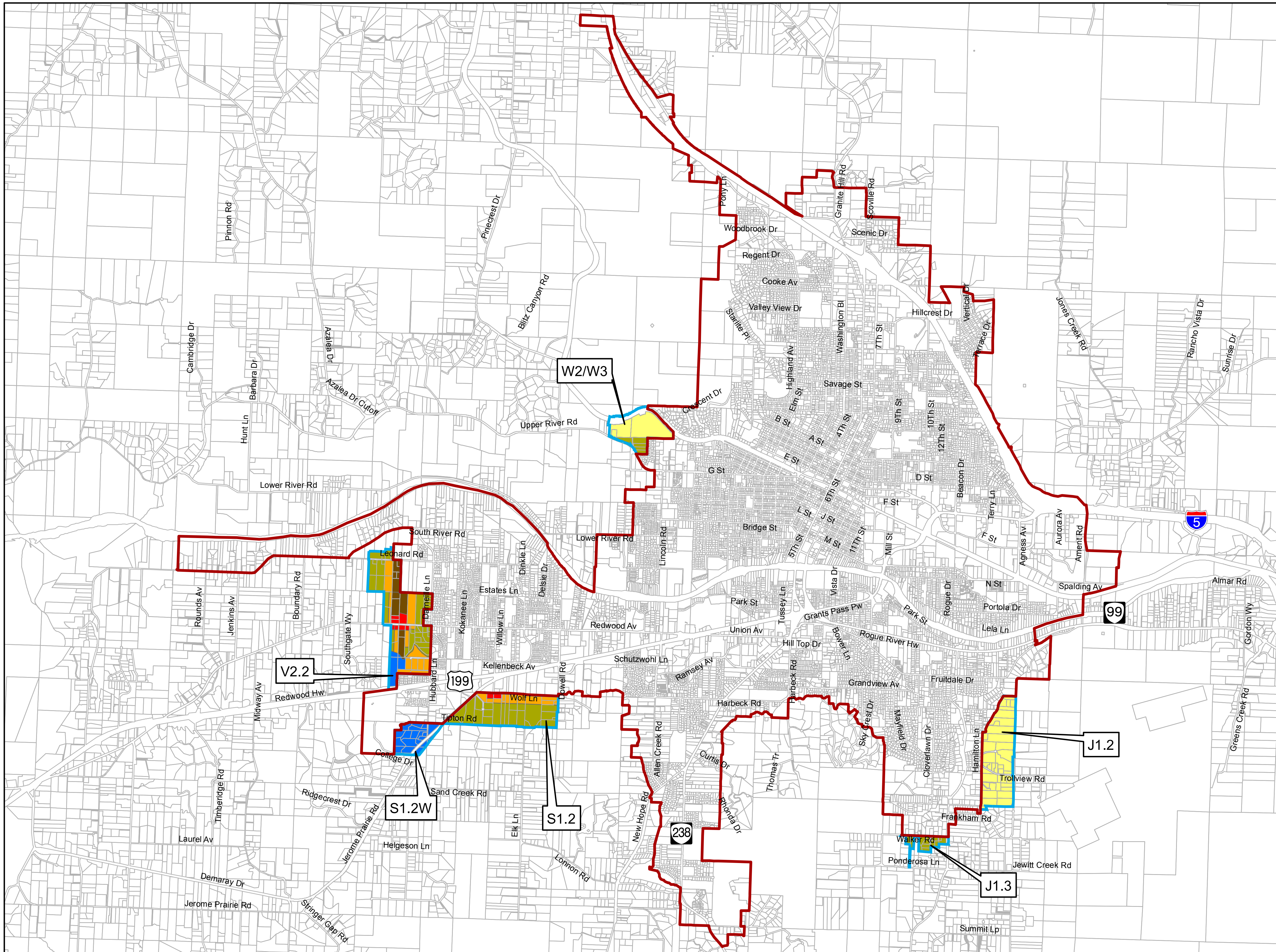

Legend

- Study Area Boundary
- Tax Lots
- Urban Reserve Areas

Concept Plan Designations

- Emp
- Comm
- HRR
- HR
- MR
- LR

Feet

0 4,000 8,000

Appendix A - Figure 2

URA Future Land Use – Alternative 1

Collection System Master Plan Update

City of Grants Pass

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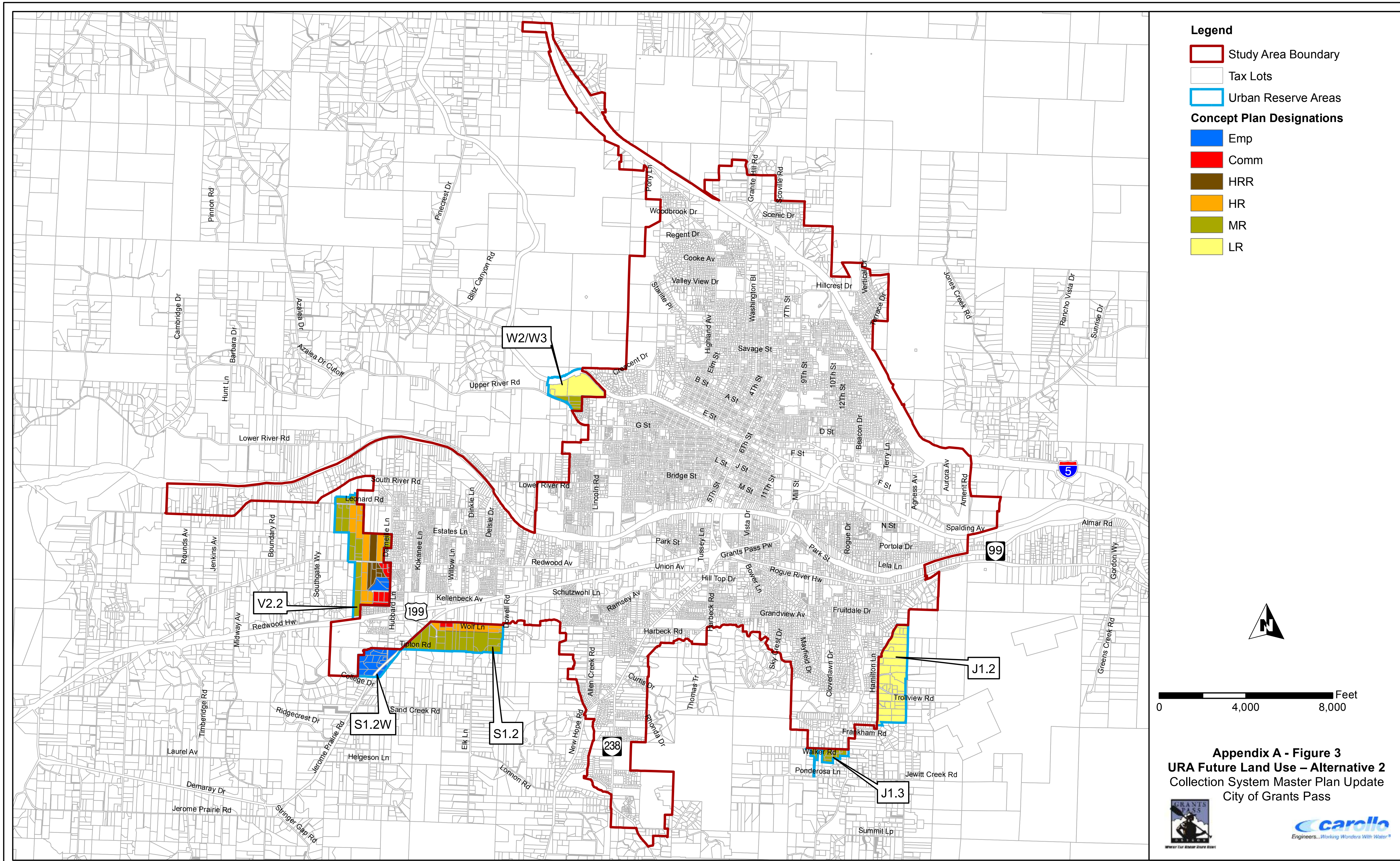


Appendix A - Figure 3
URA Future Land Use – Alternative 2
Collection System Master Plan Update
City of Grants Pass

3.0 FLOW PROJECTIONS

This section presents the methodology to project flows and projected wastewater flows for future conditions within the URAs.

3.1 Wastewater Flow Coefficients

As described in detail in Chapter 3 - Flow Projections, in order to develop wastewater flow projections and allocate future flows to the collection system, relationships, called wastewater flow factors are established based on the average wastewater flow generated for each existing land use type. The land use flow factors were established to project the estimated ADWF through build-out of the City's wastewater collection system and project future flows within the URA boundaries.

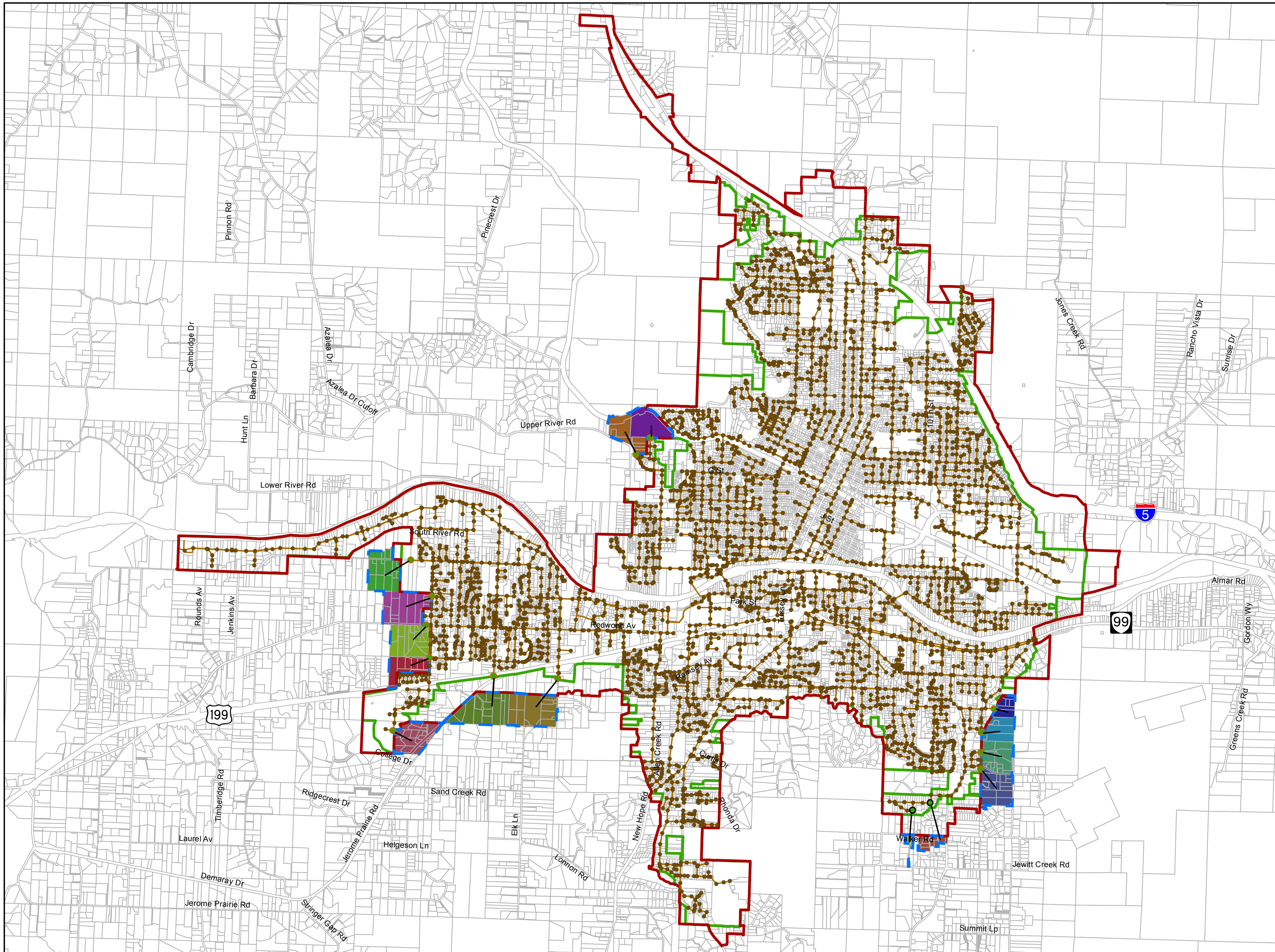
Table 4 summarizes the wastewater flow factors developed in Chapter 3 of this CSMP for the URAs land use types.

Table 4 URAs Wastewater Flow Factors
Wastewater Collection System Master Plan
City of Grants Pass

Concept Plan Designations	Planning Flow Factor (gpad)
Comm	1,050
Emp	1,080
HR	1,620
HRR	1,800
LR	960
MR	1,380

3.2 Future Customer Assumptions

As the URAs start developing, the City will need to expand its existing collection system to serve these new customers. Figure 4 shows the assumptions on where these areas are planned to be connected.



Legend

- Contributing Manholes
- Other Manholes
- Model Pipeline
- Urban Reserve Area
- Existing Sewer Service Area
- Study Area Boundary

N

0 5,000 10,000 Feet

Appendix A - Figure 4
URA Connection Assumptions
Collection System Master Plan Update
City of Grants Pass

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3.3 Projected Average Dry Weather Flows

The projected dry weather flows were developed based on the future land use maps presented above in this Appendix. Projected flows were generated using the flow factors developed in Chapter 3 - Flow Projections of this CSMP. Table 5 summarizes build-out flows for each URA for the two different development alternatives. The difference in projected between the two alternatives for Average Dry Weather Flow is only 0.002 mgd (0.3 percent).

Table 5 URAs Build-Out ADWF Projections
Wastewater Collection System Master Plan
City of Grants Pass

URA ID	Alternative 1 Build-out ADWF (mgd)	Alternative 2 Build-out ADWF (mgd)
J1.2	0.112	0.112
J1.3	0.021	0.021
S1.2	0.162	0.162
S1.3W	0.039	0.039
V2.2	0.261	0.259
W2/W3	0.058	0.058
Total (mgd)	**0.655**	**0.653**

3.4 Projected Wet Weather Flows

Projected wet weather flows are developed using the assumptions presented in Chapter 3 - Flow Projections.

To model I/I from new development in the future service area, a direct inflow technique is used. Instead of simulating I/I using an RDII unit hydrograph, I/I is simulated by assuming a constant I/I flow factor per acre of new development. I/I flow factors can range from 1,000 to 10,000 gpd/acre in the Northwest.

An I/I flow factor of 1,000 gpd/acre is a reasonable assumption for estimating I/I in areas of new development to reflect improved construction methods and integrity of new materials. Therefore, the generation constant used for new development areas was 1,000 gpd/acre.

Table 6 summarizes projected wet weather flows for each development alternative.

Table 6 URAs Build-Out Wet Weather Flows Projections
Wastewater Collection System Master Plan
City of Grants Pass

URA ID	Alternative 1 Build-out ADWF (mgd)	Alternative 2 Build-out ADWF (mgd)
J1.2	0.229	0.229
J1.3	0.037	0.037
S1.2	0.277	0.277
S1.3W	0.076	0.076
V2.2	0.438	0.436
W2/W3	0.113	0.113
Total (mgd)	**1.170**	**1.168**

3.5 Flow Projections Summary

This section summarizes the flow projection results developed in the above section and the impact of connecting all URAs on the peak flows at the WRP. Table 7 summarizes the flow projections in the long-term (Chapter 3) and with addition of URAs.

It is to be noted that all conditions reflect Peak Wet Weather Flow (PWWF) predictions for future development conditions, but with capacity bottlenecking minimized throughout the system. PWWFs from these scenarios more closely represent the wastewater inflows to the system and the potential future PWWFs to the WRP once necessary improvements are implemented.

Table 7 Existing and Projected Wastewater Flows to WRP
Wastewater Collection System Master Plan
City of Grants Pass

Planning Condition	Average Dry Weather Flow (ADWF) (mgd)	Peak Wet Weather Flow (PWWF) (mgd)	Peaking Factor (PWWF:ADWF)
Existing	5.2	27.2	5.2
Short-Term (2025)	7.0	32.9	4.7
Long-Term (2035)	9.1	37.6	4.1
Build-out with URA	9.7	39.0	4.0

Notes:

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

4.0 CAPACITY EVALUATION AND RECOMMENDED IMPROVEMENTS

This section describes the capacity analysis results of the City's collection system after all URAs are developed and connected. Chapter 5 - Collection System Analysis of this CSMP describes the capacity analysis of the system for existing, short-term, and long-term planning conditions without the URAs. The same methodology and assumptions are used in evaluating the impact of connecting the URAs to the City's collection system.

The updated and calibrated H2OMap SWMM hydraulic model was used to perform this analysis. Further details on the hydraulic model can be found in Chapter 5 (Section 5.2) and in Appendix E.

4.1 Performance Criteria

4.1.1 Design Storm

The hydraulic capacity analysis was performed using a customized 5-year, 24-hour design storm with antecedent rainfall. The design storm is discussed in Chapter 3 - Flow Projections.

4.1.2 Conveyance System

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

The maximum allowable d/D ratios for design flow conditions are summarized in Table 8. These design flow depths are relatively conservative and provide for some flexibility capacity if projected flows change as a result of modifications in flow generation assumptions or land uses.

Table 8 Flow Depth Criteria Used in Modeling
Wastewater Collection System Master Plan
City of Grants Pass

Existing Sewers	
Flow Condition	**Maximum Surcharge Depth**
Peak Wet Weather Flow (Design Flow)	Two feet above pipe crown in manhole
New Sewers	
Diameter	**Design Flow Maximum d/D Ratio**
Less than or equal to 15-inches	0.50
Greater than or equal to 18-inches	0.75

4.1.3 Lift Stations and Force Mains

According to City Sewer Standards and as presented in Chapter 2 – Policies and Criteria, pump capacity shall be provided to handle the ultimate peak flow, also known as the peak wet weather flow (PWWF), from a tributary area with the largest pump out of service. Therefore, the City's sewage lift stations should have sufficient firm capacity (capacity with the largest pump out of service) to pump the PWWF until the end of the planning period (2035).

The evaluation of existing force mains is based on a maximum pipe velocity of 9 feet per second (fps) as well as a pressure limitation of 200 feet (approximately 85 psi) at the pump station, as this upper limit encroaches on the need for series pumping systems. Beyond this natural pressure boundary of non-clog wastewater pumps, the availability of acceptable pumps is inconsistent.

4.2 Gravity Collection System Evaluation

The URAs system analysis was performed in a similar manner to the existing, 2025, and 2035 system analyses, which are presented in Chapter 5. The purpose of the URAs system evaluation is to verify that the system improvements were appropriately sized to convey build out PWWFs with URAs, and to identify potential additional improvements required to accommodate the additional flow from the URAs.

Figure 5 shows the additional locations of deficiencies due to the addition of the URA flows. The only additional deficiencies from the long-term are located in the vicinity of the Darneille Pump Station area.

Chapter 6 - CIP recommended Project 12 along Darneille Lane between SW Harvest Drive and the Darneille Pump Station. This project was required under Phase 3 to mitigate Long-Term deficiencies. Connecting the URAs in this area makes deficiencies worse, however, Project 12 was sized to also accommodate projected URA flows, and no additional improvement is recommended to accommodate projected URA flows.

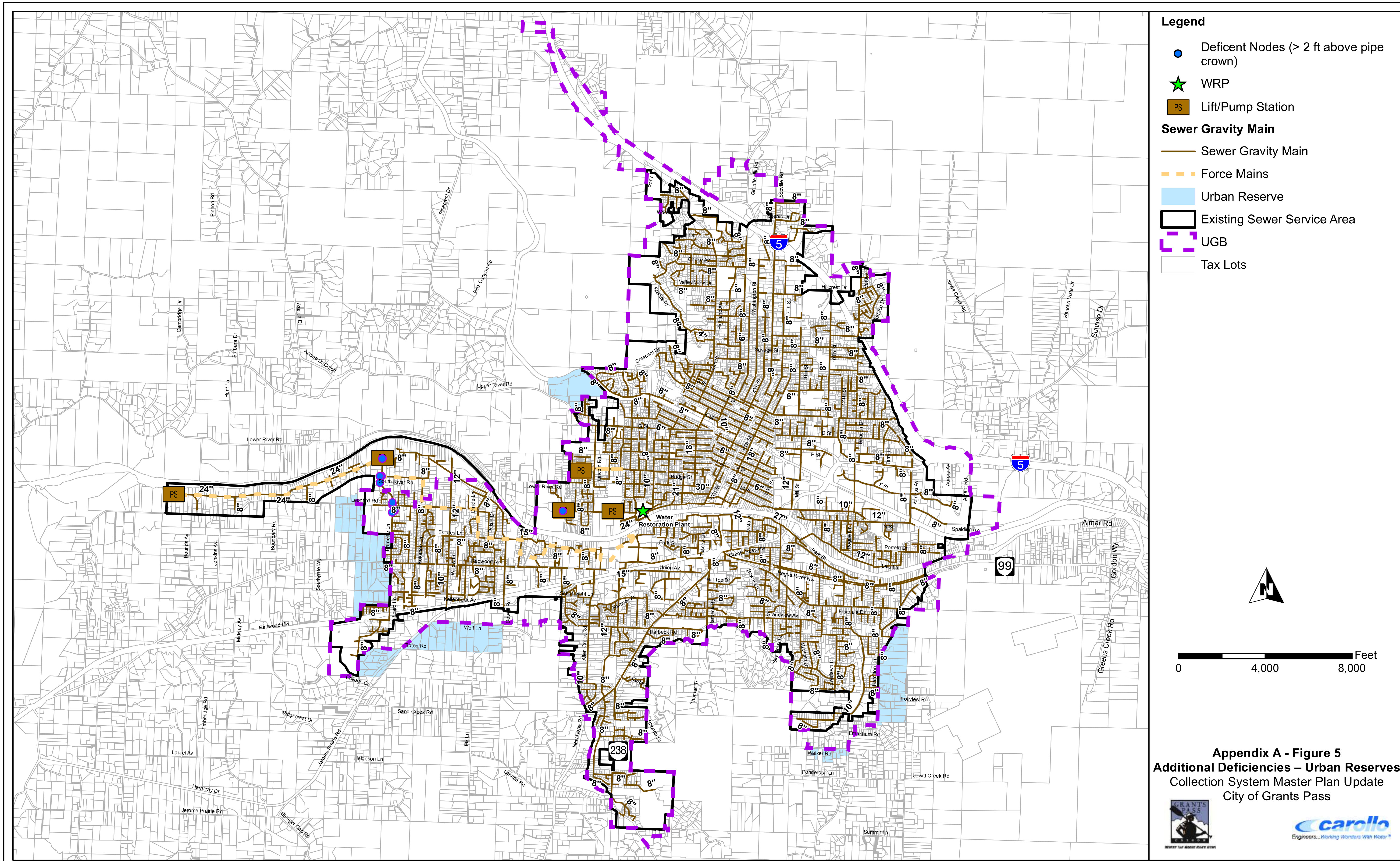
4.3 Pump Station Evaluation

Ensuring that pump stations have adequate capacity to convey peak flows is important for preventing unwanted wastewater overflows at pump stations. In accordance with the established planning criteria, the City's existing modeled lift stations were evaluated to determine if each one has available capacity to convey existing and future PWWFs. Lift stations with an influent PWWF above the existing firm capacity were flagged as deficient.

If a pump station has inadequate capacity to pump peak flows, the water level in the wet well may rise to the overflow point, discharging wastewater to stormwater collection systems that eventually discharge to water bodies. The following sections present the pump station capacity evaluation.

Table 9 summarizes the results of the lift station evaluation. Impact of the addition of the URAs to the collection system is considered insignificant for most pump station at the exception of the Darneille Pump Station.

The Daneille Pump Station is already significantly undersized under the previous planning conditions and by 2035, PWWF is projected to be twice as much as current pump station firm capacity. Adding the URA increases PWWF at the WRP to 8.51 mgd. This updated PWWF with URAs flow will need to be looked at during the Alternative Analysis recommended in Chapter 5. The Alternative Analysis will evaluate costs and other parameters in further detail to develop a recommended solution to the capacity limitations at the Darneille Pump Station.



Appendix A - Figure 5
Additional Deficiencies – Urban Reserves
Collection System Master Plan Update
City of Grants Pass

Table 9 Pump Station Evaluation - with and without URAs
Wastewater Collection System Master Plan
City of Grants Pass

Pump Station	Firm Capacity	Existing		Long-Term (2035) (Without URAs)		URAs (2040)	
		Modeled PWWF (mgd)	Deficiency	Modeled PWWF (mgd)	Deficiency	Modeled PWWF (mgd)	Deficiency
Bridge Street	0.94	0.48	0.46	0.92	0.02	0.94	0.00
Webster No. 1	0.14	0.28	-0.14	0.66	-0.52	0.67	-0.53
Webster No. 2	0.14	0.02	0.13	0.23	-0.09	0.24	-0.10
Darneille	4.20	6.10	-1.90	7.78	-3.58	8.51	-4.31
Redwood	0.48	0.52	-0.04	0.55	-0.07	0.56	-0.08

Notes:
(1) Assumes piping improvements upstream of each pump station is incorporated.
(2) Assumes Darneille and Redwood pump stations are working independently (no flow is diverted from Darneille to Redwood Pump Station).

5.0 URA EVALUATION SUMMARY

After performing the capacity with Urban Reserve Areas connected to the City's collection system, it was concluded that no additional improvements are required to accommodate additional flows from the URAs. Total PWWF for the Darneille Pump Station with URAs will need to be considered during the Alternatives Analysis but does not impact or change the preliminary options developed in Chapter 5 - Collection System Analysis.