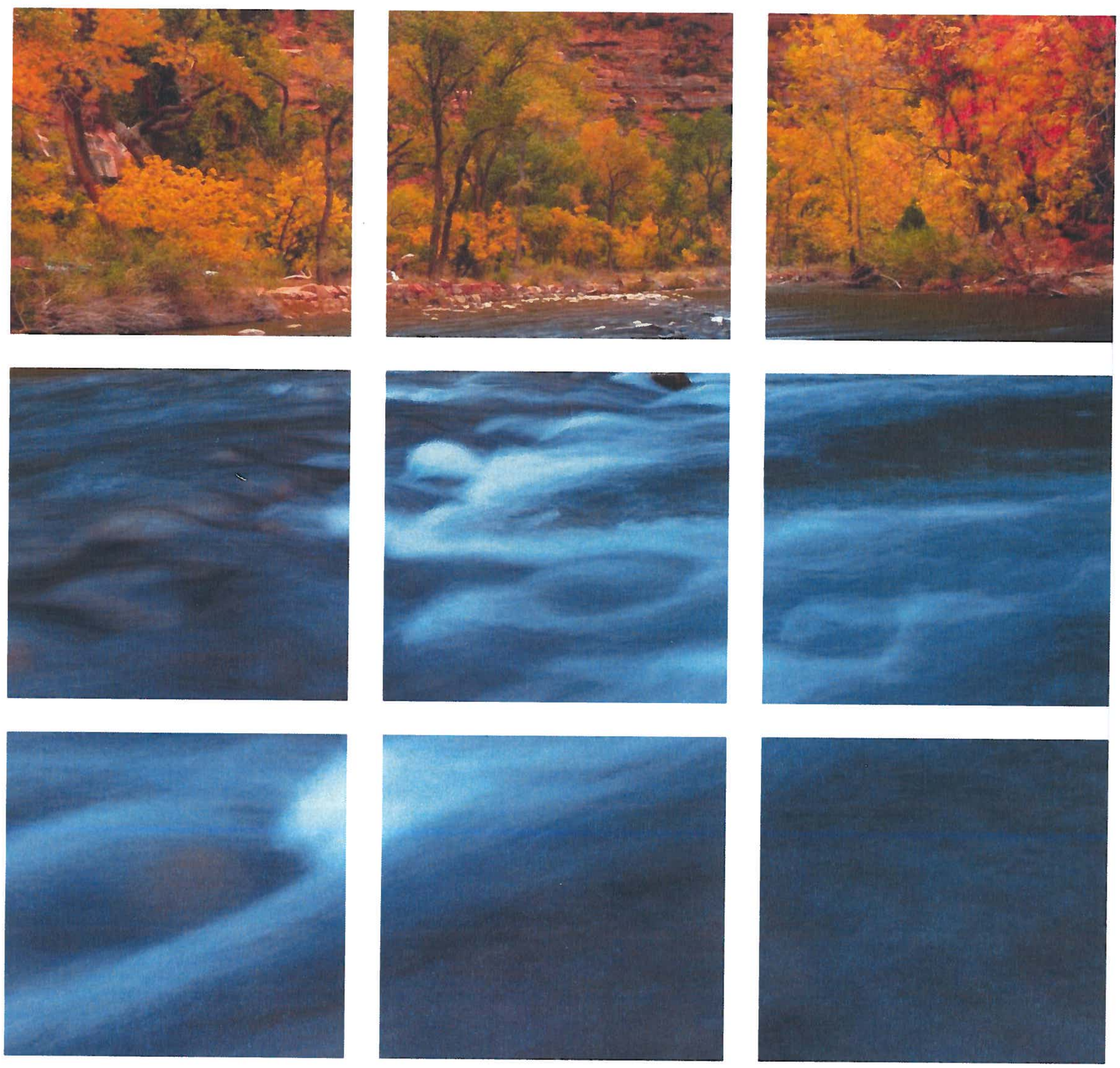
RPS Espey

Kyle Direct Water Reuse Feasibility Study

Final Report



TWDB Regional Facility Planning Grant
(Project Contract No. 114-831-1256)

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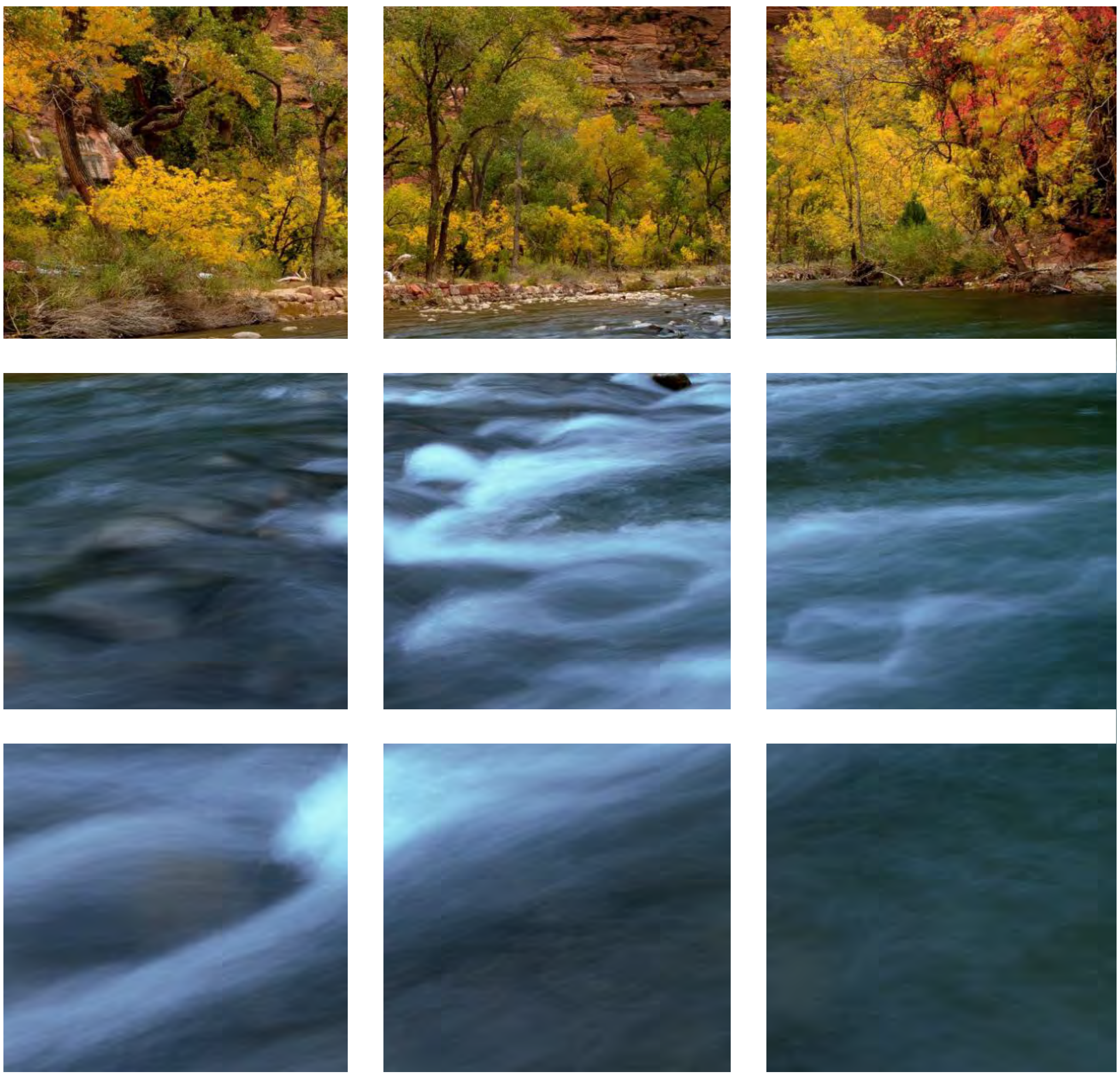

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Prepared by:

RPS Espey

2777 N. Stemmons Freeway, Suite 1102
Dallas, Texas 75207

T: (214) 951-0807
F: (214) 951-0906

Firm Registration F-293

December 7, 2012

Acknowledgements

This project was funded by the U.S. Bureau of Reclamation's Title XVI Water Reclamation and Reuse Program and by the Texas Water Development Board Regional Facilities Planning Grant Program.

Project Participants

This project was made possible through the participation and continued involvement of the following agencies:

City of Kyle Direct Water Reuse Feasibility Study

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1 Executive Summary

The City of Kyle (Kyle), as the study sponsor, engaged the participation of the Barton Springs/Edwards Aquifer Conservation District (BSEACD), the Plum Creek Watershed Partnership, Guadalupe-Blanco River Authority (GBRA), and the Texas State Soil and Water Conservation Board (TSSWCB), in conducting the City of Kyle Direct Water Reuse Feasibility Study (Study). The Study was made possible through funding by the Texas Water Development Board (TWDB) and the U.S. Department of Interior Bureau of Reclamation (Reclamation).

The purpose of this study is to evaluate the feasibility of developing reclaimed water for various public and private sector uses within the city and its utility service area during a twenty year planning period (2015-2035). The project scope includes tasks intended to provide a review of available data, identify potential reclaimed water users, develop conceptual treatment and transmission plans, evaluate costs, benefits, and environmental considerations, and to identify necessary steps for implementation. The Direct Water Reuse Feasibility Study includes the projected water demands for irrigation and potable water replacement and a recommended plan for a system that will meet the projected demands using reclaimed water.

1.1 Reclaimed Water Demand

The primary uses for reclaimed water in Kyle are for the irrigation of public and private parks, and public rights-of-way (ROW). Additionally, potential reclaimed water irrigation demands for future single-family development and for existing and future commercial development were also identified. The current use of potable water for ROW irrigation along Kyle Parkway and cooling makeup water for Seton Medical Center Hays can potentially be replaced with reclaimed water. As shown in Table 1-1, the total projected annual reclaimed water demand could exceed 430 million gallons for all identified uses by the year 2035.

While there are various new potential uses and users of reclaimed water considered in this study, reclaimed water has been in use in Kyle for over fourteen years. The owners of Plum Creek Golf Course have operated a reclaimed water system for golf course irrigation since 1998. This privately owned and operated system has pumping and transmission capacity that is suitable for the peak demand of the golf course with little surplus capacity. Even though the existing system is located across and near city parks, private ownership and limited capacity all but precludes the addition of users to the existing system. The system requires frequent maintenance in order to avoid service interruptions caused by clogged pumps. Expanding the availability and use of reclaimed water will require replacement of the existing system and operation as a public utility in conjunction with the water and wastewater utilities for financial efficiency.

1.2 Population Growth and Treated Wastewater Availability

Population projections developed for this study using the 2011 Region L Water Plan projections and the 2010 Census data indicate that the city's population can be expected to exceed 51,000 by the year 2035. The Kyle wastewater treatment plant (WWTP) presently discharges approximately 800 million gallons of treated effluent annually. Average wastewater flows are

Table 1-1: Reclaimed water demand.

Potential Reclaimed Water Use Location	Peak Reclaimed Water Demand (gpd)	Annual Reclaimed Water Demand (MG)
Cooling Makeup Water	51,061	11.33
Public Park Acreage	194,332	28.25
ROW Acreage	154,014	22.39
Private/HOA Park Acreage	379,496	55.17
Golf Course	752,397	109.39
Commercial Property	1,287,158	134.97
Single-Family Property	232,506	33.80
Schools	90,455	13.15
Future Parkland	161,089	23.42
TOTAL	**3,302,507**	**431.88**

projected to exceed 4 mgd by 2035, providing a firm source for reclaimed water that can keep pace with an increasing demand.

State regulations require that reclaimed water meet one of two sets of water quality parameters based on the location of the intended use. The more stringent water quality requirements for Type I are intended for reclaimed water use in locations where there is a high probability of public contact, such as athletic fields and school landscaping. The parameters for Type II reclaimed water were developed for applications where public access is controlled. Effluent water quality from the Kyle WWTP will not meet Type I quality standards without additional treatment. To reduce capital and operations costs, additional treatment can be provided to treat only the effluent volume that is intended to supply the reclaimed water system.

1.3 Reclaimed Water Project Benefits

Several benefits associated with developing a reclaimed water project are evaluated and discussed in Chapter 7. These include diversification of water supply sources, enhanced recreational opportunities, long-term sustainability of parks, reducing potable water demand, and reduced nutrient load in the Plum Creek watershed. Three of the key benefits are summarized below.

<u>Enhanced recreational opportunities</u>

The city's parks are presently maintained without supplemental irrigation of landscaping, playgrounds, or athletic fields. The prospect of developing reclaimed water for irrigation of city parks highlights a significant paradox in the economics of operating and maintaining city parks. Kyle's tremendous growth is due, in large part, to a reputation as a highly desirable and family oriented community in a rapidly growing region. Part of maintaining that desirability will be the city's ability to ensure that its infrastructure, particularly parks, is developed and maintained at levels of service that meet the needs and expectations of current and future residents. In its simplest form, this park irrigation dilemma presents the city with the choices of leaving the parks without irrigation, irrigating with potable water, or irrigating parks with reclaimed water.

At first glance, the option of leaving parks without irrigation appears to be the lowest cost alternative, but it does not address the loss of some uses during drought periods and a limited ability to restore overused areas or to boost community appeal. The alternative of irrigating parks using potable water will increase the level of service and costs during normal rainfall years, but will essentially become the no-irrigation alternative during drought periods when outdoor water use is restricted. This alternative also increases the city's overall demand for new water supplies that are developed at higher costs.

Reducing potable water demand

One way of minimizing the city's increasing costs of developing new water sources is to reduce the demand for potable water whenever possible. The total volume of potable water consumed for the irrigation of Kyle Parkway ROW and for irrigation and cooling makeup water for Seton Medical Center Hays exceeded 21 MG during year 2011. This volume represents as much as 1% of the city's projected HCPUA supply in 2018.

Nutrient reduction in the Plum Creek watershed

The potential impact of reducing the discharge of effluent from the WWTP on the Plum Creek watershed is discussed in Section 8.3 of the report. Reducing the volume of effluent discharged to Plum Creek during the summer months has the effect of reducing the discharge of nutrients to the watershed. In terms of ammonia (NH_3) removal, water reuse would remove over 3,800 pounds of ammonia per year in 2015, increasing to over 12,400 pounds per year in 2035.

1.4 Reclaimed Water Costs

As previously described, there are a number of benefits that can be attributed to the development of a reclaimed water system. Many of these are indirect benefits that are difficult to quantify in terms of cost, savings, or economic value. Table 1-2 summarizes the city's average cost for potable water from all sources during the 2015 – 2035 planning period and compares that cost to the cost of reclaimed water. Based on full utilization of the projected demands in the years beyond 2035, the cost of reclaimed water is estimated to be approximately $767.45 per AF compared to the average cost of $596.52 per AF for potable water. Following the end of debt service payments for the projected 2015 and 2025 debt issues for the reclaimed water system, the projected costs would decline to $288.32 per AF by the year 2040.

However, the cost of adding reclaimed water in the future should be compared with the marginal cost of water, that is, the change in potable water costs that results from the addition of one additional unit. In this case, the marginal cost of water in Kyle will be the cost of adding water from the Hays-Caldwell Public Utility Agency (HCPUA) at approximately $1,204 per AF instead of the average potable water cost of $596.52 per AF. Irrigation of new development after the HCPUA supply is available, for example, would be priced at $767.45 per AF for reclaimed water or $1,204 per AF for potable water in the year 2035.

Table 1-2: Projected water supply costs (2015 – 2040).

Year	Potable Water Demand (AF)	Average Potable Water Cost ($/AF)	Reclaimed Water Demand (AF)	Reclaimed Water Cost ($/AF)
2015	5,911.30	$ 374.03	354.9	$ 267.53
2020	6,936.67	$ 436.09	660.5	1,059.59
2025	7,596.75	$ 506.38	978.4	1,108.29
2030	8,256.86	$ 565.43	1,158.1	926.42
2035	8,652.81	$ 596.52	1,325.4	767.45

1.5 Recommended Reclaimed Water Implementation Plan

The recommended plan for implementation of a reclaimed water system includes phased construction of a central supply system and expansion into six service areas. Phasing of the system development is recommended to optimize system expansion based on actual reclaimed water demand. The recommended implementation plan includes:

Phase 1:

- Supplemental treatment of wastewater effluent to achieve Type I reclaimed water quality.
- Install a new reclaimed water pumping station at the Kyle WWTP.

Phase 2:

- Construction of transmission mains to storage at the Plum Creek Site 1 impoundment.
- Installation of a non-potable water pumping station at Site 1.

As demand increases, the first two phases would be followed by:

- Installation of transmission mains to each of remaining service areas.

The proposed project elements are summarized in Table 1-3 and shown in Figure 1-1.

Table 1-3: Reclaimed water infrastructure costs.

Project	Annual Demand (MG)	Capital Costs
Phase 1	115.63	$ 843,750
Phase 2	201.39	4,506,250
Plum Creek	278.58	375,000
Southeast	41.69	683,750
Northeast	29.58	417,500
West	19.60	1,385,000
N Comm	34.78	1,821,250
S Comm	27.65	1,032,500
TOTAL	**431.88**	**$11,065,000**

1.5.1 Recommended Administrative Actions

In addition to the construction of infrastructure to treat, store, and transmit reclaimed water, implementation of a reclaimed water project will require certain regulatory authorizations and the development of city policies and procedures as summarized below:

- Negotiate commitments from potential reclaimed water users.
- Amend the city's TPDES discharge permit to allow storage of reclaimed water at Site 1.
- Obtain a water rights permit amendment for Site 1 for a change of use from recreational/livestock to municipal and for the volume of water associated with this new use.
- Implement ordinances and incentives to encourage the development of reclaimed water for irrigation in new developments.
- Develop reclaimed water rates that encourage conversion of cooling towers.

1.5.2 Recommended Funding Strategies

The estimated unit cost for reclaimed water will vary over time according to annual debt service and water sales. Debt service costs can be minimized by combining local funding with federal and state funding opportunities. Interest rates for loans guaranteed by the State of Texas through existing TWDB funding programs should be compared with rates available to the city on the open market, but grant funding through the Title XVI program administered by the Bureau of Reclamation would have the greatest impact on the total project cost by funding up to 25% of the project. The potential impact of grant funding on the cost of reclaimed water is shown in Table 1-4.

Table 1-4: Projected reclaimed water unit cost.

Year	Annual Demand (MG)	Projected Unit Cost – Local Funding ($/AF)	Projected Unit Cost – 25% Grant Funding ($/AF)
2015	115.63	267.53	213.89
2020	218.88	1,059.59	832.92
2025	322.47	1,108.29	692.72
2030	379.20	926.42	582.95
2035	431.88	767.45	480.11

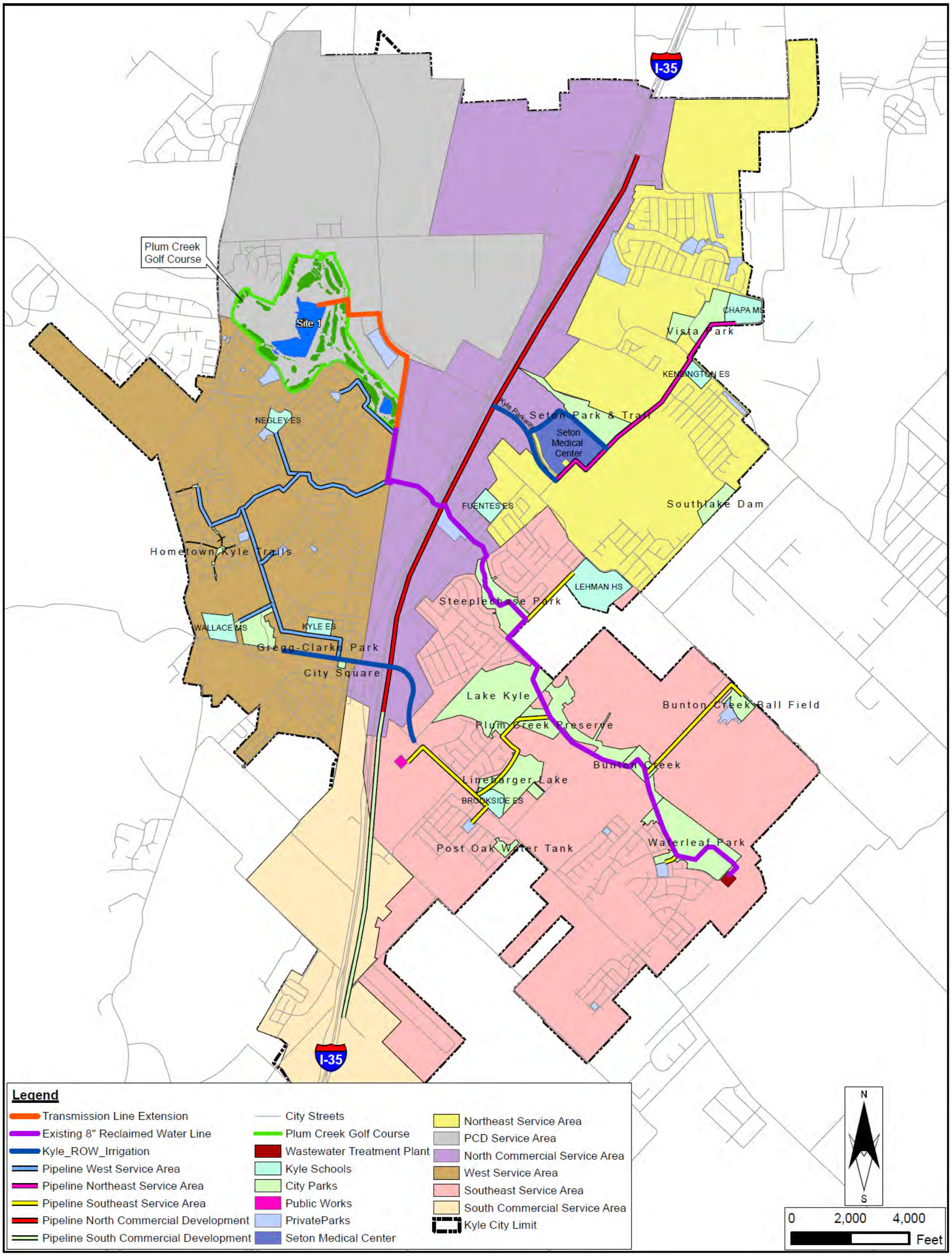

Figure 1-1: Recommended reclaimed water system.

2 Introduction

The City of Kyle has partnered with the Barton Springs/Edwards Aquifer Conservation District (BSEACD), the Plum Creek Watershed Partnership, Guadalupe-Blanco River Authority (GBRA), and the Texas State Soil and Water Conservation Board (TSSWCB) to complete the City of Kyle Direct Water Reuse Feasibility Study (Study). The Study was made possible through funding by the Texas Water Development Board (TWDB) and the U.S. Department of Interior Bureau of Reclamation (Reclamation).

2.1 Background

The City of Kyle has experienced tremendous growth in population during the past twenty years. Growing from a town of just over 2,225 people in 1990 to a city of 28,016 in the 2010 Census, the city has aggressively pursued water supply strategies to meet current and future needs for water at the same time it develops the infrastructure to serve the community's businesses and residents, and to meet the recreational needs of its citizens. Development of these new water supplies involves transporting water from increasingly distant and more expensive sources.

The city is also keenly aware of the importance of improving and maintaining water quality in the region. While the increased volume of treated wastewater that results from growth is but one of the sources of nutrients in the Plum Creek watershed, the city is a key participant and supporter of the watershed protection planning effort carried out through the Plum Creek Watershed Partnership. The city has undertaken this feasibility study to determine if developing a reclaimed water utility system can provide a cost-effective strategy for meeting a part of the current and future needs of the city and whether water reuse has the potential of minimizing the discharge of nutrients to the Plum Creek watershed.

As it has grown, the city has actively developed water supply alternatives. Before 1999, Kyle's water supply consisted of wells in the Edwards Aquifer. But with growth, the city added wells in the Barton Springs portion of the Edwards Aquifer, regional surface water through a contract with the Guadalupe-Blanco River Authority (GBRA) and, more recently, has joined in the Hays – Caldwell Public Utility Agency (HCPUA) to access groundwater in the Carrizo-Wilcox formation in Gonzales County.

Direct reuse of wastewater effluent in Kyle began in the city with development of the Plum Creek Golf Course in 1998. The reclaimed water system was designed and built by the developer of the golf course and operation of the system remained the property and responsibility of the golf course operator even as ownership of the course changed. Recognizing reclaimed water as a resource and that future water sources will be increasingly more costly, the City of Kyle has initiated this study of the feasibility of expanding the system to meet a broader range of needs throughout the community.

2.2 Project Scope

The purpose of this planning study is to evaluate the feasibility of developing reclaimed water for various public and private sector uses within the city and its utility service area during a twenty year period (2015-2035). The project scope included tasks intended to provide a review of available data, identify potential reclaimed water users, develop conceptual treatment and transmission plans, evaluate costs, benefits, and environmental considerations, and to identify necessary steps for implementation:

- Collect existing data and develop geospatial data for Geographical Information Systems (GIS) mapping, population projections, and the locations and acreages of potential reclaimed water delivery points were gathered as part of the study. Descriptions of the data sources are summarized in Appendix C.
- Develop the potential reclaimed water demand.
- Evaluate the impact of reclaimed water demands on watershed water quality.
- Develop a conceptual plan for supplementary treatment, storage, and transmission.
- Characterize potential environmental considerations for the use of reclaimed water.
- Perform cost and benefit analysis for the conceptual plan.
- Develop an implementation strategy for expansion of the reclaimed water system that includes recommended steps and phases.

The objectives of the project were achieved by meeting with city staff, representatives of Momark Development, Seton Medical Center Hays, and Hays Consolidated Independent School District; evaluating existing and future reclaimed water needs; and assessing the costs and benefits of various alternatives for reclaimed water storage and delivery.

2.2.1 Public Involvement

Three public meetings were conducted to solicit public input regarding the study with notices of the meetings posted on the city's web site. The first meeting was a conducted as a part of a joint meeting of the city's standing Parks and Recreation Committee and the Planning and Zoning Commission on October 21, 2011. The second public meeting was conducted as part of the March 18, 2012 meeting of the city's Public Works and Service Committee. The final public meeting was conducted as part of the regular agenda for the City Council on August 7, 2012. Documentation of the public meetings is contained in Appendix N.

The draft final report was made available for public review and comment between July 7 and August 7, 2012 with a notice posted in the local newspaper. Review comments received and responses to those comments are presented in Appendix O.

2.3 Study Area

The study area, shown in Figure 2-1, includes the area incorporated as the City of Kyle in Hays County, Texas. As a home rule city, areas outside the City of Kyle, but within its extraterritorial jurisdiction (ETJ), could be annexed into the city in the future and will likely receive Kyle water and sewer utility service. In addition to the city's home rule authority under the Texas Constitution, there are overlapping jurisdictions of entities involved in the regulation of groundwater and surface water within the study area. These agencies and their general regulatory authority for water resources include:

- *Barton Springs Edward Aquifer Conservation District* – (BSEACD) is a groundwater conservation district charged by the Texas Legislature to preserve, conserve, and protect the aquifers and groundwater resources within its jurisdiction, which includes parts of four Central Texas counties. It is governed by a Board of five elected directors.
- *Edwards Aquifer* Authority – (EAA) is a regulatory agency charged with managing, conserving, preserving, protecting, and increasing the recharge of the Edwards Aquifer in an eight-county region. The Authority has a board of directors with 15 elected members from the eight-county region and two non-voting appointed members.
- *Plum Creek Conservation District* – (PCCD) is a special law district created by the Texas Legislature with authority to monitor, maintain and improve a system of 28 flood control structures and underground water resources in parts of Hays and Caldwell Counties. PCCD is governed by six directors appointed by the county commissioners' courts.

The study area includes the private homeowner association (HOA) parks as well as the city's public park system, the Plum Creek Golf Course, Plum Creek Planned Unit Development (PUD), Seton Medical Center Hays and irrigated public rights-of-way.

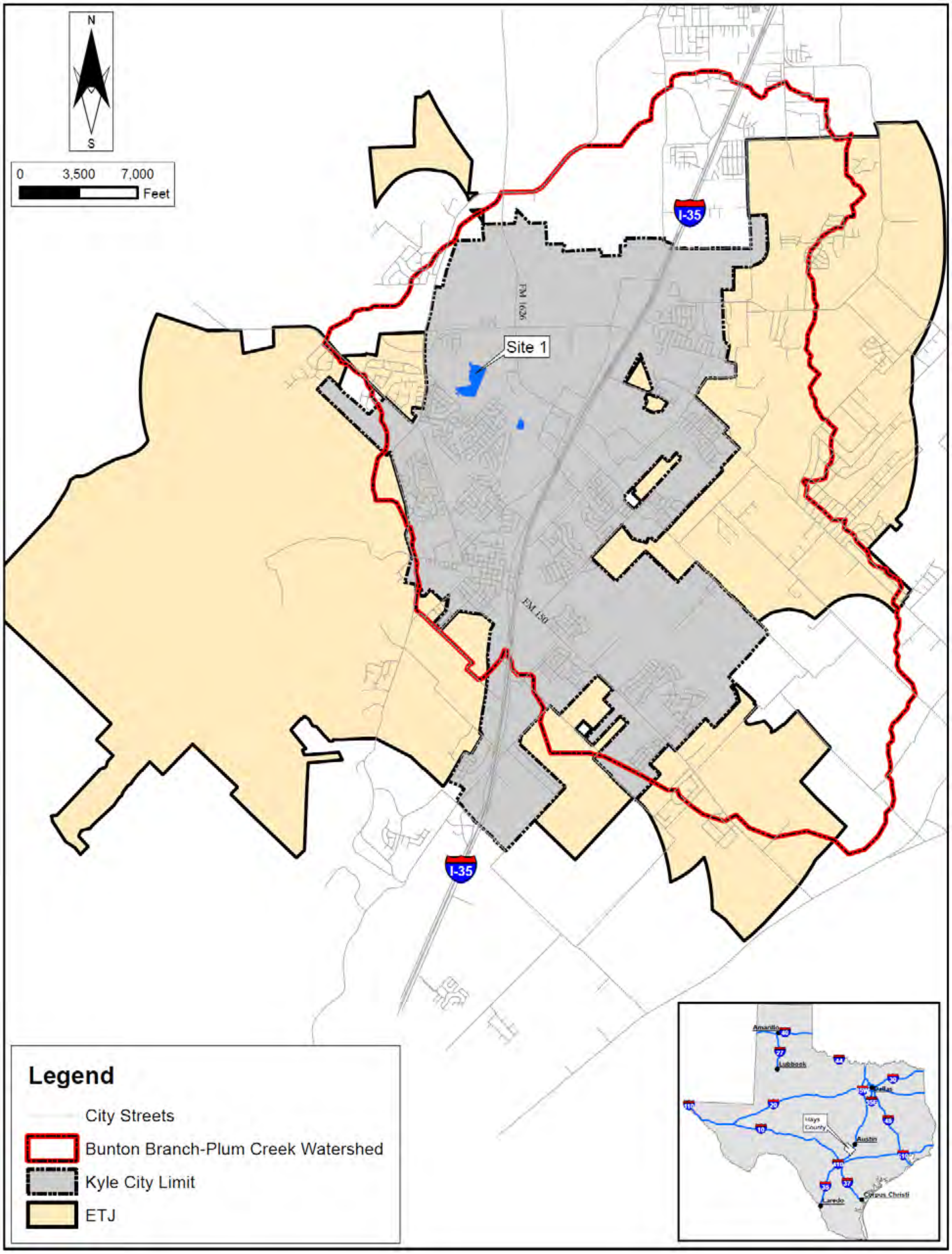

Figure 2-1: Project study area.

3 Population

The City of Kyle has experienced significant growth during the past twenty years. Between the 1990 and 2000 Census, the city more than doubled its population from 2,225 to 5,314. Growth in the next decade was even more dramatic with an increase of over 420% to a 2010 Census population of 28,016. To project the population of the city through the year 2030, three sources of population data were considered.

3.1 City of Kyle Comprehensive Plan

The City of Kyle completed an updated Comprehensive Plan in June 2010, prior to the results of the 2010 Census. Projected populations were developed using a composite analogy method to produce three growth rates through the year 2040 (Figure 3-1). The lowest projected rate of growth was that developed using the state demographer's rate of growth for Hays County and applied to the estimated population of the city. In the medium growth rate scenario, growth rates for the counties along IH-35 between South Austin and South San Antonio were averaged and a weighted premium applied to the Hays County growth rate to account for the influence of IH-35 on Kyle's prospective growth. The fastest rate of growth anticipated aggressive development plans for Kyle and for Hays County.

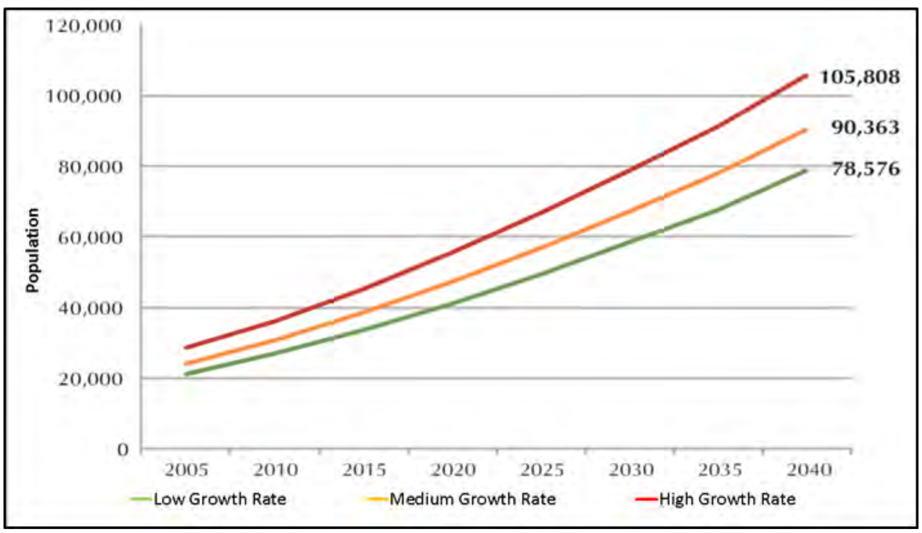

Figure 3-1: Comprehensive plan population projections (from Kyle Comprehensive Plan, 2010).

3.2 Kyle Economic Development

The city's economic development department contracts with a firm that provides demographic and development data to commercial developers. In a demographic report prepared June 2010, SitesUSA provided forecasts for the 2015 and 2020 population for the City of Kyle using proportional block groups. This report projected a 2015 population of 42,594 and 2020 population of 60,225.

3.3 South Central Texas Regional Water Plan – Region L

The final source for population projections was the data prepared for the Region L Water Plan. Under Texas Senate Bill 1, the TWDB is responsible for developing a state water plan. The state water plan is a compilation of plans developed by the sixteen regional planning groups. The City of Kyle is located in the South Central Texas Regional Planning group (Region L). Under the guidance of the TWDB, the Region L Planning Group developed population projections using Census Bureau data, including birth, death and migration rates, and input from the various cities in Region L.

The 2011 Region L Water Plan was completed in September 2010, prior to publication of the results of the 2010 Census. The projected 2010 population for the City of Kyle presented in the 2011 Region L Water Plan was 21,457. This number was more than 6,500 persons lower than the 2010 Census population of 28,016. Figure 2 provides an illustration of how applying 2010 Census value to the rates of growth used in the 2011 Region L Water Plan might affect those population projections.

The Region L projected rates of growth drop off sharply in 2020. Following the dramatic 420% growth rate experienced by the City of Kyle between the 2000 and 2010 Census, the Region L projections anticipated a growth rate of just over 45% between 2010 and 2020. Subsequent rates of growth dropped off sharply after 2020.

Recognizing that the city has added approximately 200 single-family units during the recent recession, an alternative projection of population growth was developed that anticipates the rates of growth for the decades following 2020 will decrease, but not to the extent expected in the Region L projections. A comparison of the three projections is shown in Figure 3-2.

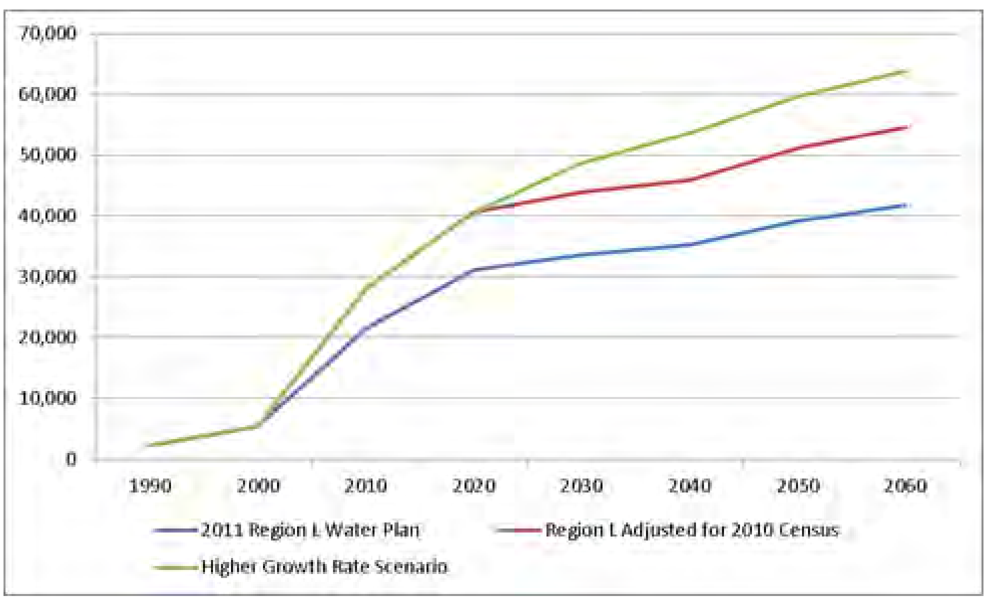

Figure 3-2: City of Kyle population projections.

3.4 Study Area Population

The projected population of the service area is of particular relevance to this study since the rate of population growth directly influences the increase in drought period reclaimed water availability. The feasibility of a reclaimed water supply system depends on the volume of treated effluent keeping pace with increases in demand. Table 3-1 presents a comparison of the three population projections. Considering a planning period of twenty years beginning in 2015, using the higher growth rates projections for the year 2035 based on the Comp Plan or the economic development department could result in an accelerated program for development of a reclaimed water system. A more moderate rate of growth will extend the projected period in which facilities could be developed.

A conservative approach of projecting wastewater flow rates using the TWDB population projections adjusted for the 2010 Census is used in this study.

Table 3-1: Comparison of population projections.

Year	TWDB	TWDB (adjusted)	Comp Plan	Eco. Dev.	TWDB Higher Growth Rate Scenario
2015	26,292	34,329	--	42,594	34,328
2020	31,126	40,641	48,500	60,225	40,641
2025	32,370	42,265	--	--	44,705
2030	33,613	43,888	68,000	--	48,769
2035	34,408	44,926	--	--	51,207

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4 Water Supply, Water Demand, and Treated Wastewater Availability

4.1 Regional Current and Projected Water Supplies

The 2011 Region L Water Plan describes the region's water supply as having limited surface water resources as a result of the presences of five major and three minor aquifers that have formed the primary water supplies. Of the primary aquifers in the region, the City of Kyle is located nearest the Edwards, Trinity, and Carrizo-Wilcox Aquifers. Surface water supply for the Kyle area is the U.S. Army Corps of Engineers owned Canyon Lake reservoir located on the Guadalupe River in Comal County.

With projections of water demand for the South Central Texas region to exceed all water sources during drought conditions (Figure 4-1), the Region L Planning Group identified a group of water

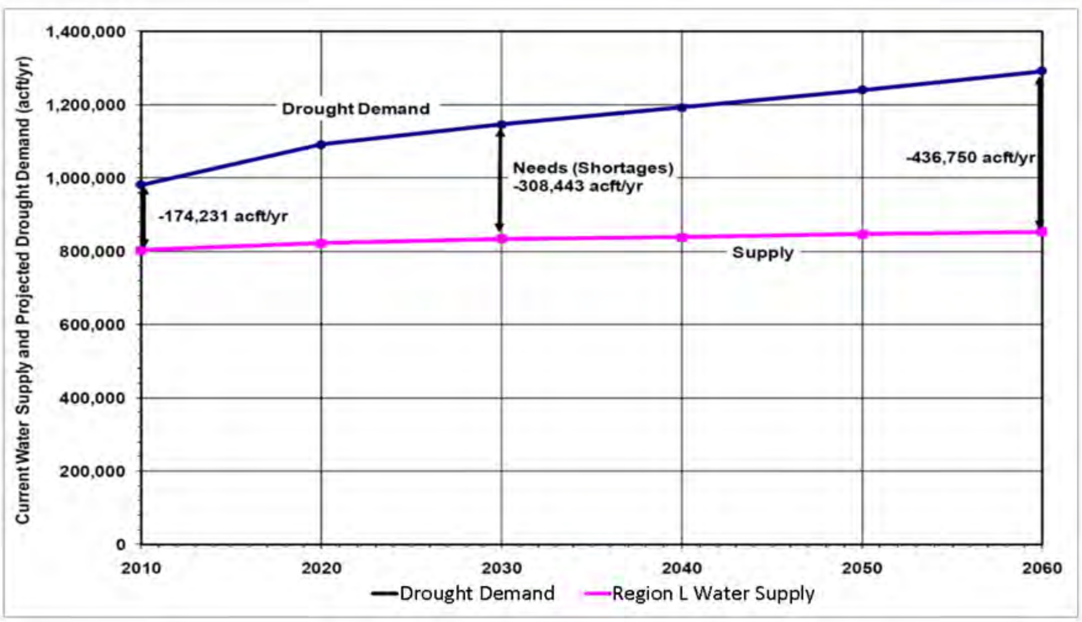

Figure 4-1: Region L projected water supplies and demand 2010 – 2060 (from 2011 Region L Water Plan).

management strategies for closing the increasing gap between water supplies and demand. New supplies to meet the projected 2060 water demands of the region include water reuse to provide as much as 6% of the supply (Figure 4-2).

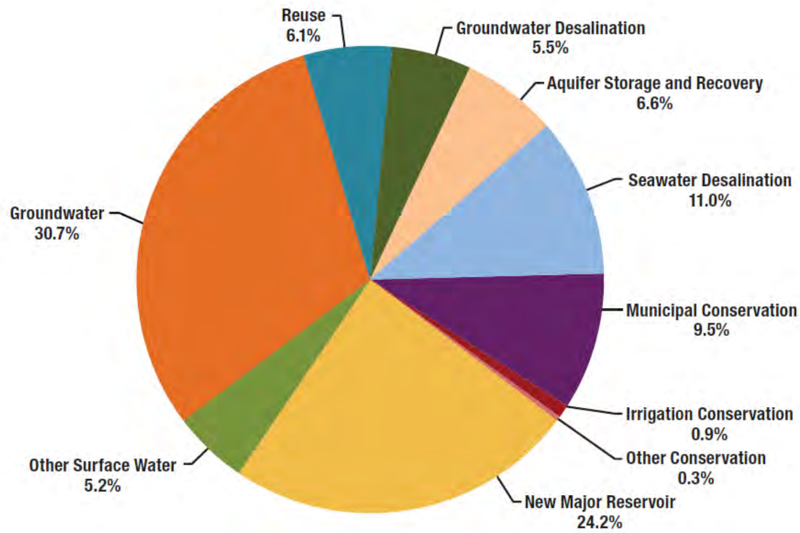

Figure 4-2: Region L 2060 water management strategies (from Fig. L.4, Water for Texas: Summary of the 2011 Regional Water Plans).

Water reuse is characterized by the Region L Water Plan as a water management strategy that will capture more attention by water users as other water supplies experience increasing pressures of demand and development costs. The Region L Water Plan review of water reuse is, for the most part, focused on existing large scale water reuse projects. But implementation of water reuse as an alternative water supply beyond the existing projects enhances the region's ability to meet future water demand.

4.2 Local Current and Projected Water Supplies

The City of Kyle is a rapidly growing community in a region historically supplied by the Edwards Aquifer. The Edwards Aquifer underlies parts of nine counties in South Central Texas, including much of Hays County located west of Kyle. In 2000, the Edwards Aquifer supplied approximately 44 percent of the total water used in the South Central Texas Region (2011, Region L Water Plan). Increasing water supply demands on the Edwards Aquifer and the recurring drought cycles has been a primary driver for communities, including Kyle, to develop alternative water sources. As with most cities in the South Central Texas region, water supplies in the region are typically high quality, but limited supply. A system of safeguards is in place to monitor and preserve the water quality in both the Edwards Aquifer and the Barton Springs portion of the Edwards Aquifer.

In an effort to reduce reliance on the Edwards Aquifer and to diversify the city's water supplies, Kyle initiated a series of contracts with GBRA beginning in 1999 to purchase treated surface water. Water from the Guadalupe River is pumped to the San Marcos Surface Water Treatment Plant for treatment and then pumped north to Kyle and other water purveyors by GBRA. Kyle is also a participant in the Hays Caldwell Public Utility Agency, a utility consortium formed to purchase and pump up to 10 mgd of water from the Carrizo-Wilcox Aquifer by 2018, and increasing the supply to 30 mgd by 2032.

The current and projected water supplies for Kyle are detailed in Table 4-1. This accounting includes the current use of reclaimed water by the Plum Creek Golf Course and an emergency supply contract with the City of San Marcos. Water supplied by BSEACD is presented as the historical use volume (506 AF) to which the city is contracted to receive annually, and 568 AF of conditional use water. The conditional use supply is an interruptible supply that can be curtailed or halted during drought periods.

Table 4-1: Current and projected water supplies.

Water Source	Maximum Capacity	
	AF	gallons
Edwards Aquifer	432	140,767,200
BSEACD (Historical Limit)	506	164,880,100
BSEACD (Conditional Use)	568	185,082,800
GBRA	5,533	1,802,928,050
Reuse	336	109,388,816
City of San Marcos[1]	560	182,476,000
HCPUA 2018[2]	4,481	1,459,995,519
HCPUA 2032[2]	5,601	1,824,994,399

[1] *Emergency Interconnect*
[2] *projected, Region L 2011*

4.3 Current and Projected Water Demands

As shown in Table 4-2 below, the 2011 Region L Water Plan projected that water demand in Kyle would increase to the point of exceeding demand between the years 2010 and 2020. However, as previously discussed, the results of the 2010 Census differ from the population

Table 4-2: Projected water supplies and demand (from Region L Water Plan, 2011).

	2000	2010	2020	2030	2040	2050	2060
Population							
Region L 2011 Water Plan	5,314	21,457	31,126	33,613	35,203	39,197	41,850
Water Supply (AF)							
Edwards	243	243	243	243	243	243	243
Edwards (Barton Springs)	304	304	304	304	304	304	304
Canyon Lake (GBRA)	589	2,957	2,957	2,957	2,957	2,957	2,957
TOTAL	1,136	3,504	3,504	3,504	3,504	3,504	3,504
Water Demand (AF)	702	2,740	3,940	4,217	4,377	4,874	5,203
Surplus/(Shortage)	434	764	(436)	(713)	(873)	(1,370)	(1,699)

projected in the 2011 Region L Water Plan. Applying the actual 2010 Census population and adjusted projections for the years 2020 through 2060 produce a higher projected water demand. This higher demand, along with the projected supply from the HCPUA indicates that Kyle could experience greater water supply shortages during drought conditions earlier than that shown in the water plan. Table 4-3 presents the predicted impact of higher demand of including the HCPUA supplies in the projections developed for the water plan.

Table 4-3: Adjusted water demand projection.

	2000	2010	2020	2030	2040	2050	2060
Population							
Adjusted for 2010 Census	5,314	28,016	40,641	48,769	53,646	59,735	63,779
Water Supply (AF)							
Edwards	243	243	243	243	243	243	243
Edwards (Barton Springs)	304	304	304	304	304	304	304
Canyon Lake (GBRA)	589	2,957	2,957	2,957	2,957	2,957	2,957
HCPUA	0	0	4,481	4,481	10,082	10,082	10,082
TOTAL	1,136	3,504	7,985	7,985	13,586	13,586	13,586
Water Demand (AF)	702	3,578	5,144	6,118	6,670	7,428	7,929
Surplus/(Shortage)	434	(74)	2,841	1,867	6,916	6,158	5,657

Kyle's water demand is directly influenced by significant population growth and climate. Between 2007 and 2011 when the city experienced an 8% annual increase in water demand, rainfall ranged from above average in 2007 to approximately 50% of average in 2008 and again in 2011 (Figure 4-3).

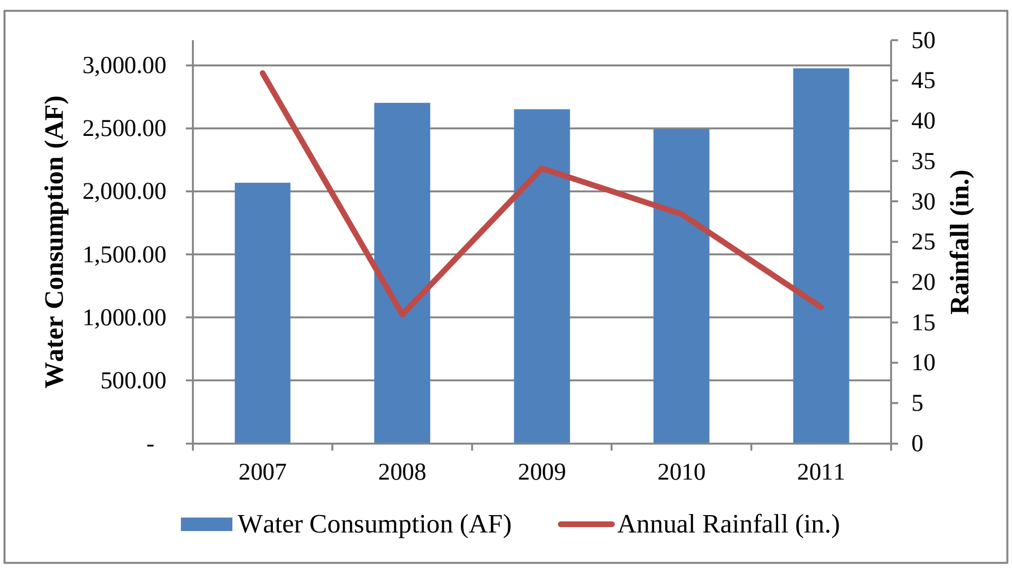

Figure 4-3: Kyle annual water demand.

A comparison of the city's projected water demand with its water sources is presented in Table 4-4. Projected demands through the year 2015 will require approximately 80% of the available supplies under normal conditions, but could exceed 86% in drought conditions when conditional use water from BSEACD is not available. The effect of the HCPUA supply availability in 2018 is shown in the year 2020 in Table 4-4 when the percentage decreases to approximately 61% of sources.

Table 4-4: Projected water demand as a percentage of current water sources.

Year	Population	Water Demand (mgd)	Water Sources (mgd)	Water Demand (% of Sources)	Water Demand During Drought Conditions (% of Sources)
2015	34,328	5.28	6.58	80.2%	86.8%
2020	40,641	6.19	10.58	58.5%	61.5%
2025	44,705	6.78	10.58	64.1%	67.3%
2030	48,769	7.37	10.58	69.6%	73.2%
2035	51,207	7.72	15.58	49.6%	51.2%

4.4 Costs of Water

Each new source of water comes at a price that is the result of the costs of developing new and more distant sources of water. The data in Table 4-5 illustrates how the costs of development, treatment, and transportation drive the unit cost of water in Kyle. Water from the Edwards Aquifer, being both nearby and requiring only disinfection and pumping, is the lowest cost supply. The price of the city's BSEACD supply reflects both the short distance and low treatment costs of the Edwards Aquifer supply, but also includes marginal costs associated with limited supply in an area of increasing demand and environmental concerns. The costs presented in Table 4-5 are the city's costs for water and not the retail price.

The cost of surface water supplied by GBRA includes the cost of acquiring the water supply, treatment, and pumping over a distance of almost 25 miles before reaching the City of Kyle system. The projected cost of acquiring, developing, and pumping water from the Carrizo-Wilcox Aquifer through participation in the HCPUA triples the city's cost of the GBRA supply. But recognizing that the other sources are closed to further increases in volume, the city, through HCPUA, is developing a potable water source that will allow the city to continue to grow beyond the 20 year planning horizon of this study.

Table 4-5: Water source costs (2011).

Water Source	$/AF
Edwards Aquifer	116.00
BSEACD (Historical Limit)	156.40
BSEACD (Conditional Use)	231.35
GBRA	418.58
City of San Marcos	958.00
HCPUA[1]	1,245.00

[1] *Projected cost*

By using the lower cost supplies first, the city is able to minimize the average cost of water (Table 4-6). During drought conditions when the conditional use water through BSEACD is unavailable, the average cost increases by as much as 5% in the year 2015, but more significantly when the more costly HCPUA supply is available after 2018 (Table 4-7).

Table 4-6: Average water supply cost.

Year	Water Demand (AF)	Edwards Aquifer (AF)	BSEACD (Historical Limit) (AF)	BSEACD (Conditional Use) (AF)	GBRA (AF)	HCPUA (AF)	Total Cost	Average Cost ($/AF)
2015	5,911.30	432	506	568	4,405.30	0.00	$ 2,104,629	$ 356.03
2020	6,936.67	432	506	568	5,430.67	0.00	$ 2,533,827	$ 365.28
2025	7,596.75	432	506	568	5,533.00	557.75	$ 3,271,059	$ 430.59
2030	8,256.86	432	506	568	5,533.00	1,217.86	$ 4,092,899	$ 495.70
2035	8,652.81	432	506	568	5,533.00	1,613.81	$ 4,585,858	$ 529.98

Table 4-7: Average water supply cost during drought conditions.

Year	Water Demand (AF)	Edwards Aquifer (AF)	BSEACD (Historical Limit) (AF)	BSEACD (Conditional Use) (AF)	GBRA (AF)	HCPUA (AF)	Total Cost	Average Cost ($/AF)
2015	5,911.30	432	506	0	4,973.30	0.00	$ 2,210,976	$ 374.03
2020	6,936.67	432	506	0	5,533.00	465.67	$ 3,025,012	$ 436.09
2025	7,596.75	432	506	0	5,533.00	1,125.75	$ 3,846,812	$ 506.38
2030	8,256.86	432	506	0	5,533.00	1,785.86	$ 4,668,653	$ 565.43
2035	8,652.81	432	506	0	5,533.00	2,181.81	$ 5,161,611	$ 596.52

4.5 Assessment of Needs for Water Reuse

Reclaimed water has the potential for replacing up to 64 AF of potable water used for the irrigation of Kyle Parkway, Seton Medical Center Hays irrigation, and cooling water makeup at Seton Medical Center Hays. However, the greatest need for reclaimed water in Kyle is for the enhancement of the quality of life for a growing population by increasing the capacity of local parks. Without irrigation, Kyle's parks are susceptible to damage from use and over-use and from recurring drought. During the drought conditions of 2011, for example, athletic fields were closed due to large cracks caused by excessive shrinkage and drying of the clay soils common in much of the city. As a reliable, drought-proof source of water, reclaimed water has the potential of providing a cost effective enhancement of recreational opportunities to Kyle's citizens without increasing the city's need for more costly water supplies.

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5 Potential Reclaimed Water Users and Demands

Presently, the only reclaimed water user in Kyle is the Plum Creek Golf Course through a system that is owned and operated by the Plum Creek PUD developer. An expanded availability of reclaimed water in Kyle could provide water for irrigation of landscaping that is presently not irrigated and could also replace the use of potable water for irrigation and for cooling. Existing and potential customer sites that appear suitable for reclaimed water use were identified and are shown in Figure 5-1. The potential reclaimed water demands are summarized in the following sections.

5.1 Park Irrigation

Since public and private parks are presently not irrigated, the primary benefit of extending reclaimed water service to these facilities would be to improve playing surfaces and increase the capacity for park activities resulting from population growth. An evaluation of the potential irrigation demand began with an inventory of public and private parks acreage. The area of each park that could reasonably be expected to be irrigated was developed through discussions with city staff and measurement of existing athletic field and playground areas using GIS. The inventory of existing public and private park acreage is presented in Table 5-1.

Table 5-1: Park inventory.

Potential Reclaimed Water Use Location	User Category	Total Area (ac.)	Irrigated Area (ac.)
City Square	Public Park	1.44	1.21
Gregg-Clarke Park	Public Park	29.30	7.32
Waterleaf Park	Public Park	92.03	22.08
Lake Kyle	Public Park	118.28	13.54
Hometown Kyle Trails	Public Park	4.59	0.69
Steeplechase Park	Public Park	43.91	2.82
Bunton Creek Ball Field	Public Park	13.03	3.16
Decker Park	Private Park	1.83	1.83
HOA Park South	Private Park	1.19	1.19
McNaughton Park	Private Park	0.65	0.65
Hometown Kyle Trails Park	Private Park	2.41	2.41
Silverado	Private Park	0.70	0.70
Waterleaf HOA Park	Private Park	1.00	1.00
TOTAL		**310.35**	**58.60**

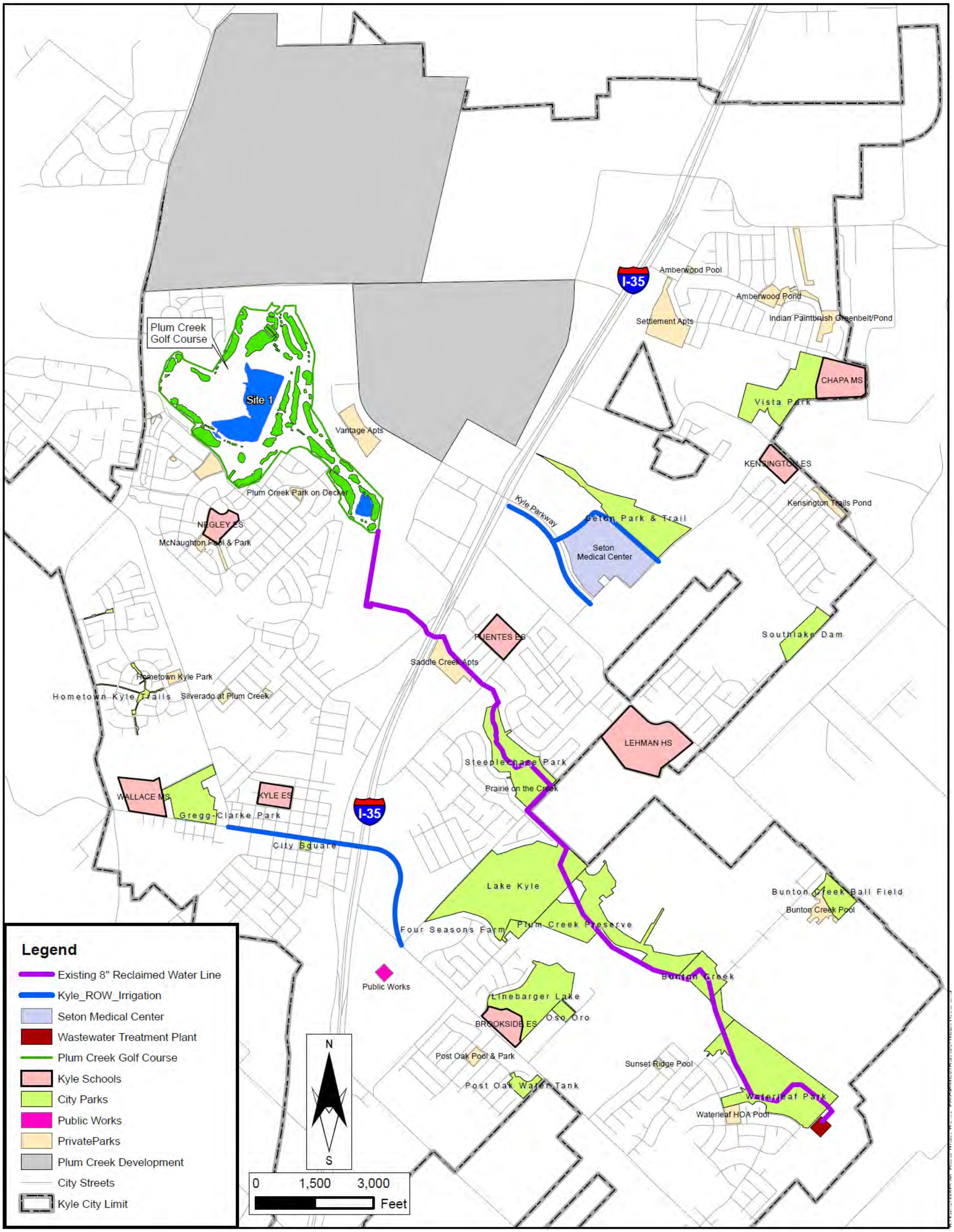

Figure 5-1: Potential reclaimed water users.

5.1.1 Future Parklands

The development of both public and private park acreage is estimated according to population growth. Using the city's July 2006 Master Parks Plan, the rate of park growth was projected to increase at a rate of 5.25 acres per 1,000 population. Park acreage includes both public and private or HOA parks (Table 5-2). A total of 140.6 acres of public and private parks are projected for 2035 with a total irrigated area of 42.2 acres.

Table 5-2: Future park acreage.

Year	Total Park Acreage	Increase (ac.)
2012	438.6	--
2015	482.8	51.9
2020	515.9	33.1
2025	537.3	21.3
2030	558.6	21.3
2035	571.4	12.8

5.2 Hays Consolidated Independent School District

The Hays Consolidated Independent School District (HCISD) operates eight schools within the city limits of Kyle. The area of each school was evaluated for playground, practice field, and athletic field areas. Since most HCISD schools are not presently irrigated, reclaimed water irrigation would require, not only extension of the water supply to each campus, but also construction of irrigation systems by the district. The inventory of HCISD schools shows that approximately 24 acres of the district's 159 acres could be irrigated using reclaimed water (Table 5-3).

Table 5-3: School property irrigation.

Potential Reclaimed Water Use Location	User Category	Total Area (ac.)	Irrigated Area (ac.)
Lehman HS	School	53.57	11.28
Chapa MS	School	24.73	3.74
Wallace MS	School	20.11	2.37
Fuentes ES	School	15.00	3.05
Brookside ES	School	13.95	0.66
Kyle ES	School	10.80	0.65
Negley ES	School	10.74	0.84
Kensington ES	School	10.47	1.09
TOTAL		**159.37**	**23.69**

5.3 Plum Creek Planned Unit Development (PUD)

The Plum Creek PUD contains over 1,198 acres of undeveloped land. Development plans for the PUD include single-family, commercial (including multi-family), greenbelts, parks, and street rights-of-way. The total area of each type of land use and projected areas of impervious cover were estimated by the engineer for the PUD (Rhames, 2011). In addition to the undeveloped acreage, the Plum Creek PUD also includes the Plum Creek Golf Course. The total acreage of undeveloped property is presented in Table 5-4, along with the Plum Creek Golf Course.

Table 5-4: Plum Creek PUD.

Potential Reclaimed Water Use Location	User Category	Total Area (ac.)	Irrigated Area (ac.)
Plum Creek Golf Course	Golf Course	308.84	197.01
Plum Creek Dev. ROW	Right-of-Way	36.20	36.20
Plum Creek Dev. Parks	Private Park	36.90	35.10
Plum Creek Comm. Dev.	Commercial	756.00	154.10
Plum Creek SF Dev.	Single-Family	253.50	76.08
Plum Creek Greenbelts	Private Park	83.60	79.42
TOTAL		**1,475.04**	**577.91**

5.4 Right-of-Way (ROW) Irrigation

Landscaping along Kyle Parkway and Seton Parkway is presently irrigated by the city using potable water. Additional ROW along an extension of Center Street and within the Plum Creek PUD is expected to be developed to a community entry-way standard that will include irrigation of medians and parkway areas. The total area of ROW that is included for potential reclaimed water irrigation includes the existing area irrigated along Kyle Parkway and Seton Parkway and the proposed area associated with the extension and redevelopment of Center Street east of IH 35.

Table 5-5: ROW irrigation.

Potential Reclaimed Water Use Location	User Category	Total Area (ac.)	Irrigated Area (ac.)
Kyle Pkwy ROW	Right-of-Way	6.05	5.75
Center St. Streetscape	Right-of-Way	5.62	5.62
TOTAL		**11.67**	**11.37**

5.5 Commercial Development

Undeveloped areas within the city's commercial zoning districts were measured using GIS. An impervious area percentage of 85% was applied to the commercial zoning along IH 35 to calculate a total area of landscaping that can be irrigated using reclaimed water (Table 5-6). A total of 112.4 acres of the irrigated area are included in the projected 2035 irrigation demand.

Table 5-6: Future commercial acreage.

Potential Reclaimed Water Use Location	Total Area (ac.)	Irrigated Area (ac.)
Future Comm. IH 35 N	1044	62.64
Future Comm. IH 35 S	830	49.80

The inventory revealed a total of 4,032 acres of existing and future areas that could be reclaimed water users for irrigation in Kyle. Adjustments for factors such as impervious cover and non-irrigated landscaping produce an estimated 834 acres that would contribute to the reclaimed water demand (Table 5-7).

Table 5-7: Potential reclaimed water irrigation use locations.

Potential Reclaimed Water Use Location	User Category	Total Area (ac.)	Irrigated Area (ac.)
City Square	Public Park	1.44	1.21
Gregg-Clarke Park	Public Park	29.30	7.32
Waterleaf Park	Public Park	92.03	22.08
Lake Kyle	Public Park	118.28	13.54
Hometown Kyle Trails	Public Park	4.59	0.69
Steeplechase Park	Public Park	43.91	2.82
Bunton Creek Ball Field	Public Park	13.03	3.16
Kyle Pkwy ROW	Right-of-Way	6.05	5.75
Seton Medical Center	Commercial	59.45	5.50
Seton Medical Center (cooling)	Commercial	--	--
Plum Creek Golf Course	Golf Course	308.84	197.01
Plum Creek Dev. ROW	Right-of-Way	36.20	36.20
Plum Creek Dev. Parks	Private Park	36.90	35.10
Plum Creek Comm. Dev.	Commercial	756.00	154.10
Plum Creek SF Dev.	Single-Family	253.50	76.08
Plum Creek Greenbelts	Private Park	83.60	79.42
Lehman HS	School	53.57	11.28
Chapa MS	School	24.73	3.74
Wallace MS	School	20.11	2.37
Fuentes ES	School	15.00	3.05
Brookside ES	School	13.95	0.66
Kyle ES	School	10.80	0.65
Negley ES	School	10.74	0.84
Kensington ES	School	10.47	1.09
Decker Park	Private Park	1.83	1.83
HOA Park South	Private Park	1.19	1.19
McNaughton Park	Private Park	0.65	0.65
Vantage Apts.	Commercial	1.85	1.85
Hometown Kyle Trails Park	Private Park	2.41	2.41
Silverado	Private Park	0.70	gated
Waterleaf HOA Park	Private Park	1.00	1.00
Center St. Streetscape	Right-of-Way	5.62	5.62
Future Comm. IH 35 N	Commercial	1044	62.64
Future Comm. IH 35 S	Commercial	830	49.80
Future Parkland	Parks (all)	140.6	42.18
TOTAL		**4,032.30**	**833.53**

This inventory is summarized in Table 5-8.

Table 5-8: Irrigation summary.

Potential Reclaimed Water Use Location	Total Area (ac.)	Irrigated Area (ac.)
Public Park Acreage	302.58	50.82
ROW Acreage	47.87	47.57
Private/HOA Park Acreage	128.27	122.29
Golf Course	308.84	197.01
Commercial Property	2,691.30	273.89
Single-Family Property	253.50	76.08
Schools	159.37	23.69
Future Parkland	140.56	42.18
TOTAL Acreage	**4,032.30**	**833.53**

5.6 Potential Reclaimed Water Demand

The market for reclaimed water in Kyle is primarily providing water for irrigation and cooling. The market for irrigation is comprised of existing potable water uses that can be offset with reclaimed water, residential and commercial properties that will be developed to rely on potable water if reclaimed water is not available, and public parks that may continue without irrigation or could come to rely on potable water in the future. The market for reclaimed water as an offset for potable water used for cooling is currently limited to the Seton Medical Center Hays.

Reclaimed water demands were developed using the GIS data for each potential location and rainfall and evaporation rates for the region. These rates were compared with consumption of reclaimed water by the Plum Creek Golf Course and with potable water meter records for Kyle Parkway and Seton Medical Center Hays.

5.6.1 Potable Water Replacement

In addition to the continued use of reclaimed water for irrigation of the Plum Creek Golf Course, there are two categories of potential reclaimed water uses – potable water replacement and new landscape irrigation. Three existing high volume uses of potable water for which reclaimed water could be substituted located near the golf course supply pipeline are irrigation of Kyle Parkway ROW, Seton Medical Center Hays landscape irrigation, and Seton Medical Center Hays cooling tower makeup water. Seton Medical Center Hays and Kyle Parkway were completed in 2009. Water consumption for 2011 represents the first full year of operation after vegetation is fully established and operations of the medical center are normalized. Seton also operates a cooling tower for environmental cooling of the medical center. This system uses potable water to provide makeup water for the facility’s cooling tower. Potable water used for makeup water for the Medical Center cooling system totaled 11.3 MG in 2011.

The 2011 consumption of these three potential reclaimed water users (Table 5-9) reveals that an annual volume of approximately 21 million gallons could be replaced with reclaimed water. However, without replacing the existing 8-in. diameter reclaimed water transmission main, only a portion of the irrigation demand for Kyle Parkway and Seton Medical Center can be replaced with reclaimed water without affecting service to the Plum Creek Golf Course.

Table 5-9: 2011 Potable water use.

Location	Consumption (MG)
Kyle Parkway ROW	6.2
Seton Medical Center Irrigation	3.7
Seton Medical Center Cooling	11.3
TOTAL	21.2

5.6.2 Reclaimed Water Demand

Monthly irrigation water demands were developed for each potential location using an average evapotranspiration rate and assuming that vegetation would be maintained to exhibit a higher quality even during periods of low rainfall. The reclaimed water demands presented in Appendix D are summarized in Table 5-10.

Table 5-10: Reclaimed water demand (2035).

Potential Reclaimed Water Use Location	Total Area (ac.)	Irrigated Area (ac.)	Peak Reclaimed Water Demand (gpd)	Annual Reclaimed Water Demand (MG)	Annual Reclaimed Water Demand (AF)
Cooling Makeup Water	--	--	51,061	11.33	34.78
Public Park Acreage	302.58	50.82	194,332	28.25	86.71
ROW Acreage	47.87	47.57	154,014	22.39	68.72
Private/HOA Park Acreage	128.27	122.29	379,496	55.17	169.32
Golf Course	308.84	197.01	752,397	109.39	335.70
Comm. Property	2,691.30	273.89	1,287,158	134.97	414.20
SF Property	253.50	76.08	232,506	33.80	103.74
Schools	159.37	23.69	90,455	13.15	40.36
Future Parkland	140.56	42.18	161,089	23.42	71.87
TOTAL	**4,032.30**	**833.53**	**3,302,507**	**431.88**	**1,325.40**

5.7 Consultation with Potential Reclaimed Water Customers

Representatives of potential reclaimed water customers were contacted to assess the market potential for reclaimed water. The drought-proof nature of reclaimed water is an important consideration for potential customers, as are the customer's capital costs for replacing potable water.

Plum Creek PUD, MoMark Development

Terry Mitchell, President

The developer of Plum Creek PUD's interest in a supply of reclaimed water is to enhance amenities within the remaining acreage of the PUD. These include irrigation of public rights-of-way, commercial property irrigation, and a potential dual water system for single family property irrigation. The developer is also interested in ensuring that the Plum Creek Golf Course has access to a drought-proof and economical supply of water for irrigation.

Hays Consolidated Independent School District

Carter Scherff, Assistant Superintendent & Rod Walls, Facilities Director.

Few schools in Kyle have irrigation systems for playgrounds and athletic fields. One or more bond issues would be required for Hays CISD to obtain the financing for construction of irrigation systems.

Seton Medical Center Hays

Rudy Qunitinilla, Chief Engineer

Seton Medical Center uses potable water for both landscape irrigation and for cooling system makeup water. Reclaimed water pricing would be an important factor in a decision to convert both systems to reclaimed water, particularly for the cooling system. Chemical analyses of the reclaimed water to verify compatibility with the cooling system should be conducted prior to the conversion.

5.8 Water and Wastewater Agency Jurisdiction

The City of Kyle provides water and wastewater service under Certificates of Convenience and Necessity (CCN) issued by the Texas Commission on Environmental Quality (TCEQ) (Figure 5-2). As a home rule city and under the city's CCN, the City of Kyle maintains jurisdictional authority for water and sewer services within the CCN subject only to the regulation of public water and sewer systems by the TCEQ.

There are also areas within the city in which water service is provided under a CCN issued to Monarch Utilities, an investor-owned utility. The city's water CCN (No. 11024) and sewer CCN (No. 20410) are shown in Figure 5-2. None of the potential reclaimed water customers are located outside the city's water or sewer certificated area. There are presently no state regulations affecting the city's authority to extend reclaimed water service to customers regardless of location.

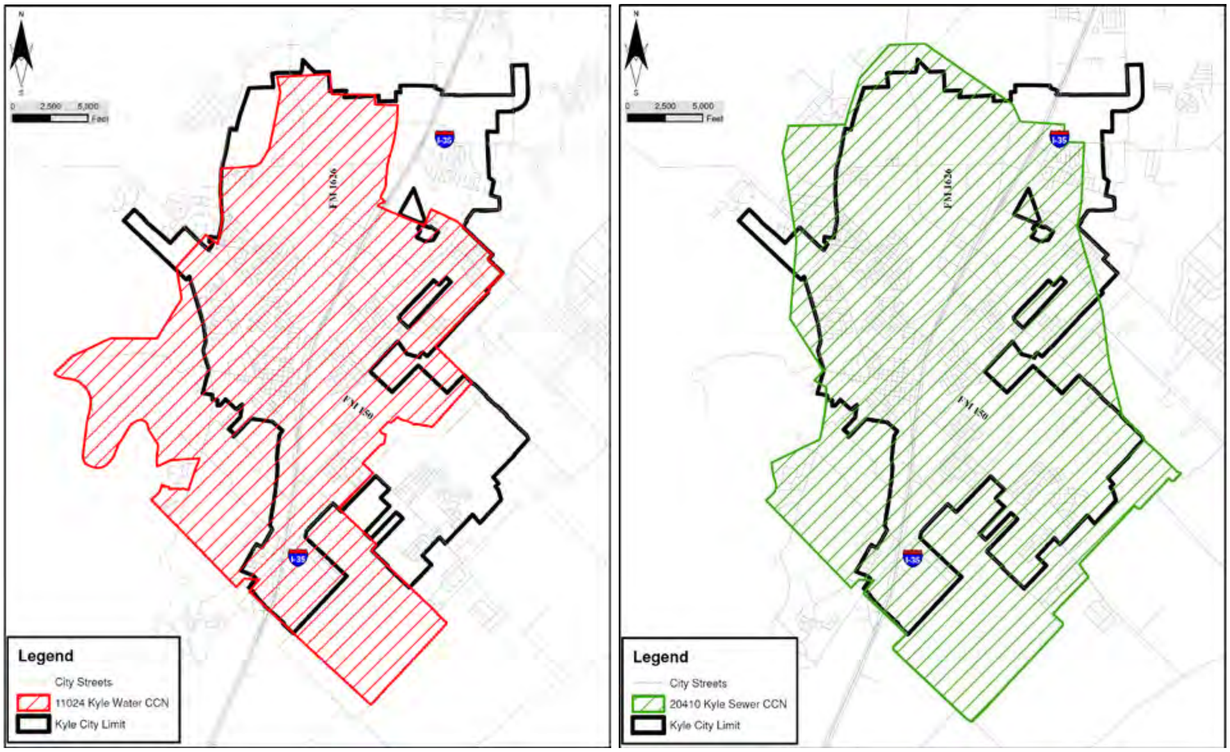

Figure 5-2: Kyle water and sewer CCNs.

5.9 Wastewater Treatment Plant

The Kyle WWTP is a 3 mgd plant arranged in two parallel concentric circular package units that use fine bubble diffusers, dissolved oxygen control systems, clarifiers, two digesters, a mechanical bar screen, and chlorination with dechlorination facilities. The plant is permitted to discharge effluent with 10 mg/L BOD, 15 mg/L TSS, and 3 mg/L ammonia nitrogen. Daily flows for the Kyle WWTP average approximately 1.8 mgd, but have peaked as high as 8.0 mgd in January 2007. The existing reclaimed water pump station is located at the southeastern corner of the WWTP as shown in Figure 5-3. The next phase of development for the Kyle WWTP is to add an additional 1.5 mgd unit when wastewater flows reach 90% of the current plant capacity. There are no current plans to change the treatment process or to alter the existing discharge permit parameters.

5.9.1 Existing Reclaimed Water System

The existing reclaimed water system was built in 1998 by the developer of what is now the Plum Creek Golf Course (PCGC). The system included approximately 11,000 LF of 8-in. diameter pipeline and pump station located at the WWTP. The city's WWTP at that time was located at FM 150 near Lehman Road near what is now the public works building. In 2001, approximately 5,300 LF of the original pipeline was abandoned and a new reclaimed water pump station and about 13,650 LF of new 8-in. pipeline was built when the FM 150 WWTP was abandoned and the new WWTP was built at the New Bridge Street location. The current system configuration includes approximately 23,600 LF of 8-in. pipeline, a duplex pump station with dual 40 HP pumps (Figure 5-4).

Figure 5-3: Kyle wastewater treatment plant.

The entire reclaimed water system continues under the ownership and operation by the owner of the Plum Creek Golf Course. Recurring accumulation of solids in the wet well (Figure 5-5), combined with limited accessibility for maintenance, prompted the current owner of the system to initiate rehabilitation of the pump station during the fourth quarter of 2011. The proposed rehabilitation included the addition of coarse and fine screens to eliminate pump clogging and improved accessibility for routine cleaning and maintenance of the pumps and wet well.

This system is designed to meet the peak irrigation demand of the golf course of 756,000 gpd with one pump in operation. The costs of operation include pumping costs, but more important are the costs of removing the existing pumps for cleaning and debris removal. An evaluation of the system indicates that the pressure rating of the PVC pipe would be exceeded if both pumps are operated simultaneously. Even with this limitation, a small amount of additional capacity exists in the system.

Reclaimed water supplied by the existing system meets the state regulatory criteria for Type II reclaimed water. The regulations and characteristics of Type I and Type II reclaimed water are summarized in Sections 9.1.2 and 9.1.3 of this report.

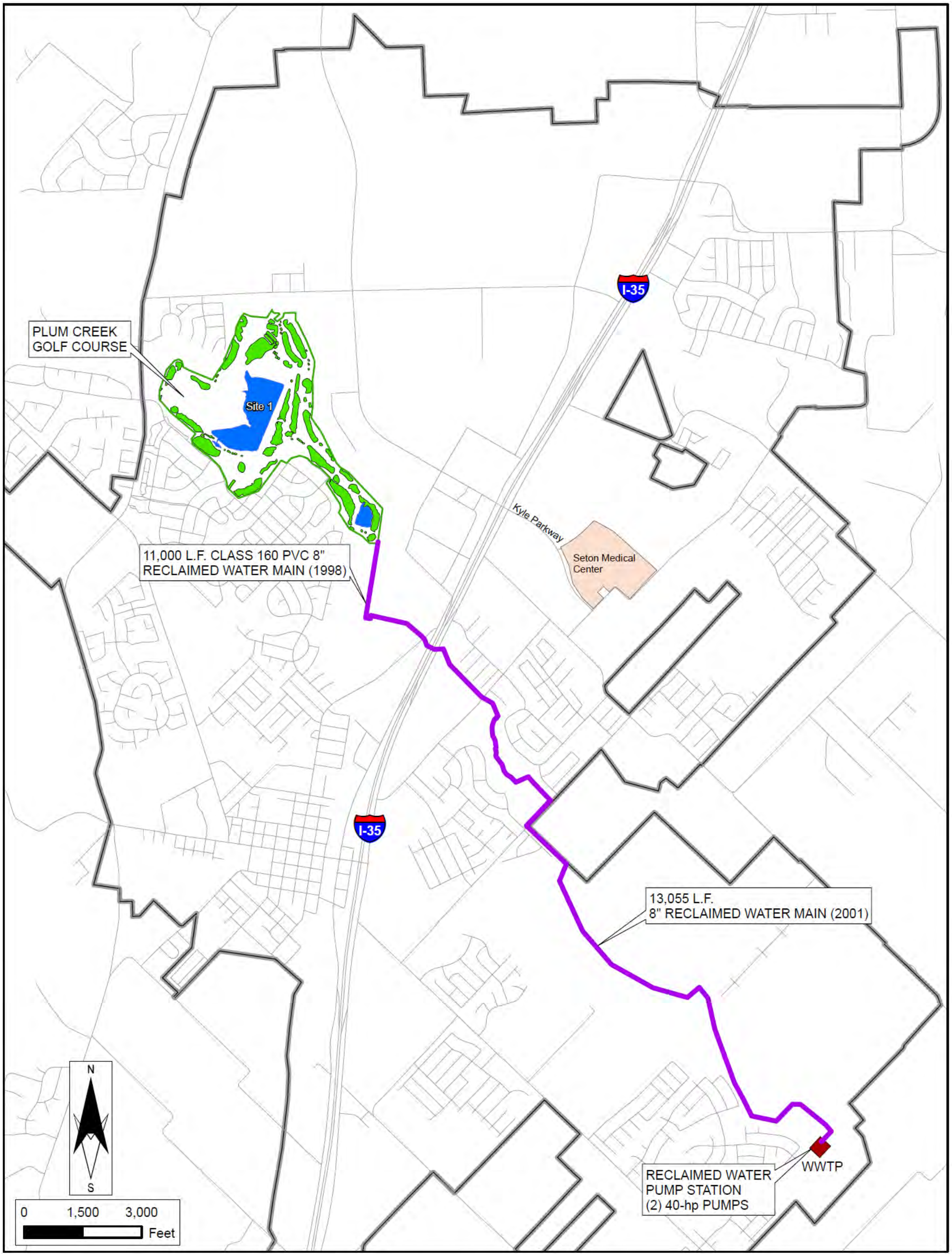

Figure 5-4: Existing reclaimed water system.

Figure 5-5: Existing reclaimed water wet well (photo by Terry Mitchell, 2011).

5.9.2 Effluent Volume

Wastewater flow volume can vary significantly in response to local rainfall and the condition of the collection system. Six years of flow data for the Kyle wastewater system were reviewed to determine an approximate per capita wastewater flow for both average and dry weather conditions (Table 5-11).

Dry weather flows were particularly evident in the Kyle flow data for 2008 and 2011 when the area experienced approximately fifty percent of normal rainfall. Average and above average rainfall amounts occurred in the rest of the six year period between 2006 and 2011.

Table 5-11: Treated effluent flow volume (mgd).

MONTH	2007	2008	2009	2010	2011
January	3.143	1.808	1.690	2.857	1.635
February	1.990	1.683	1.777	3.227	1.611
March	2.575	1.888	1.725	2.268	1.524
April	2.353	1.779	1.708	2.277	1.566
May	2.051	1.717	1.714	2.159	1.603
June	2.118	1.572	1.732	2.286	1.541
July	2.109	1.576	1.509	2.093	1.537
August	2.173	1.701	1.645	2.025	1.567
September	2.192	1.663	1.809	2.485	1.556
October	2.190	1.617	3.195	1.962	1.525
November	2.218	1.645	2.537	1.957	1.589
December	1.849	1.718	2.002	1.633	1.965
Avg. (dry weather)		1.7	1.7	1.9	1.6
Avg.	2.2	1.7	1.9	2.3	1.6

Both conditions were considered relevant in the evaluation of effluent availability. Dry weather flows provided a basis for estimating the lower limit of reclaimed water availability during drought conditions while average wastewater flows provide the basis for projecting reclaimed water supply during normal conditions. Both daily dry-weather and average daily wastewater flows were used to calculate per capita flows. These per capita flow values applied to the projected populations for the planning period provided the daily dry weather (DW) and Average flows shown in Table 5-12.

Table 5-12: Projected dry weather (DW) and average wastewater flow.

Year	Population	DW flow (mgd)	Avg. Flow (mgd)
2015	34,328	1.96	2.78
2020	40,641	2.32	3.29
2025	44,705	2.56	3.62
2030	48,769	2.79	3.95
2035	51,207	2.93	4.15

As a source of water supply, reclaimed water produced by the Kyle wastewater treatment plant will increase in volume at the rate of population growth. Figure 5-6 presents the increase in wastewater effluent for both dry weather and average flow conditions through 2060.

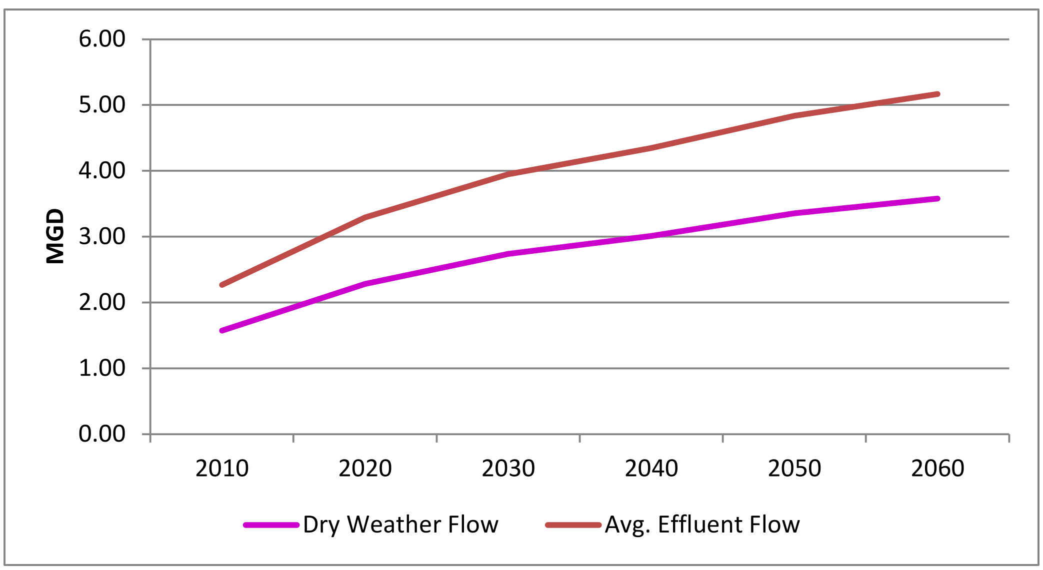

Figure 5-6: Projected wastewater flows.

5.9.3 Effluent Quality

Mean monthly effluent quality for the years 2006 through 2011 are presented in Figure 5-7 through Figure 5-9. The monthly mean biochemical oxygen demand (BOD) concentration illustrates how effluent from the Kyle WWTP is consistently within the permit limit of 10 mg/l.

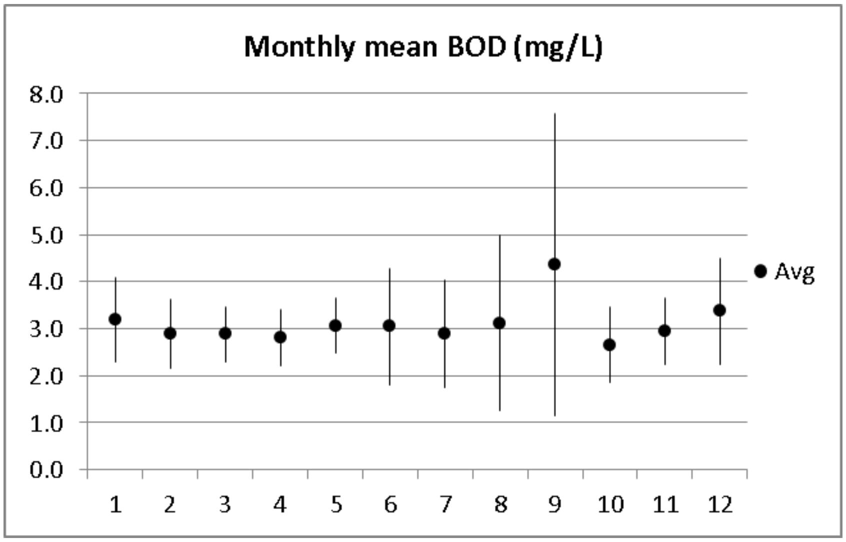

Figure 5-7: Effluent mean monthly BOD concentration.

The data revealed that the Kyle WWTP has had some variation in meeting the effluent total suspended solids (TSS) limit of 15 mg/l during 2006. However, since that year, the plant has consistently met the permit limit.

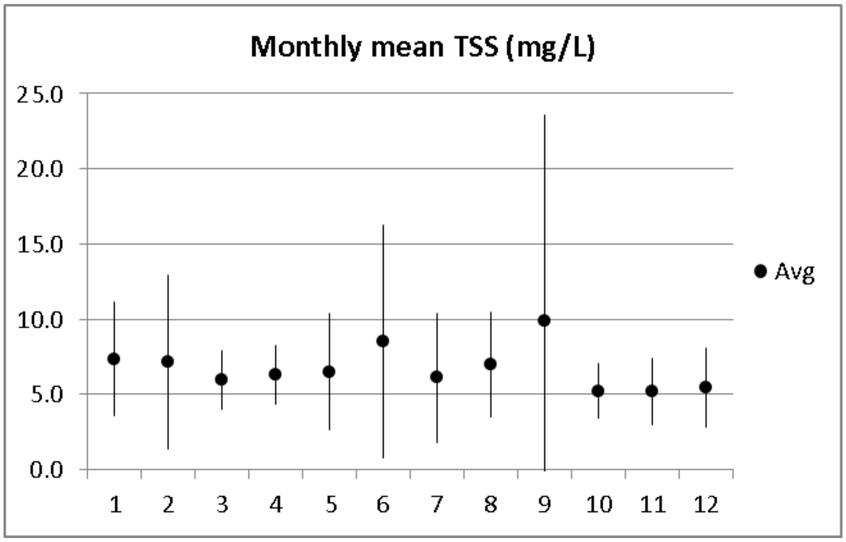

Figure 5-8: Effluent mean monthly TSS concentration.

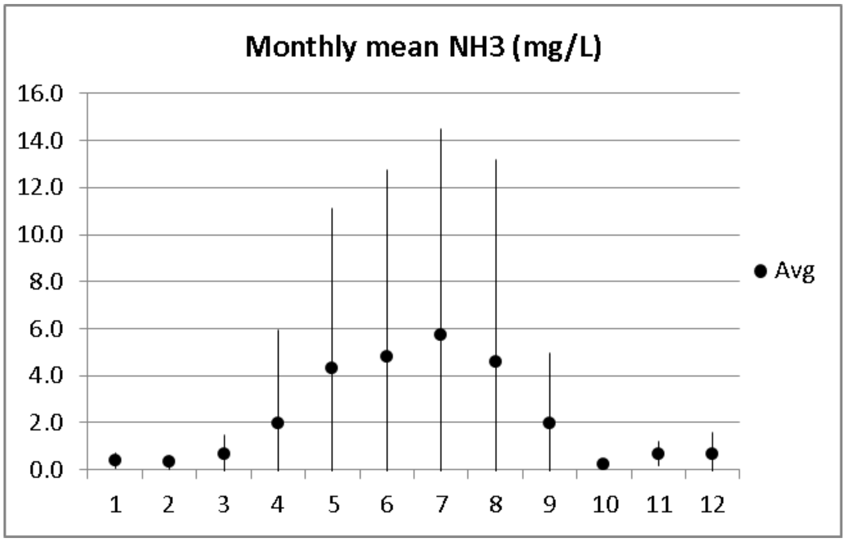

Figure 5-9: Effluent mean monthly NH3 concentration.

These data indicate that the existing wastewater treatment process is capable of consistently producing effluent that meets the parameters for Type II reclaimed water.

While the quality parameters of BOD, turbidity, and bacteria are prescribed by state regulation to ensure suitability for human contact with reclaimed water, the suitability of the water to be used for irrigation as it relates to potential effects on the irrigated plants is also considered. Most important of these quality criteria is salinity. Salinity is determined by measuring the total dissolved solids (TDS) in mg/l or the electrical conductivity of the water. Conductivity data would be obtained by effluent testing as part of the implementation of a reclaimed water system.

5.10 Projected Wastewater Treatment Facilities

With the accumulation of solids in the existing reclaimed water wet well and the potential use of reclaimed water in areas of possible public exposure, additional treatment facilities that would enable that portion of the effluent intended for reuse to meet Type I quality parameters are warranted.

Further reduction of suspended solids and turbidity with additional filtration of the effluent is central to achieving virus removal and inactivation and preparing the reclaimed water for effective disinfection prior to distribution. Tertiary treatment of the entire volume of WWTP effluent is not a practical alternative as only a portion of the effluent is needed for supplying a reclaimed water system. The additional capital and O&M costs associated with tertiary treatment of all effluent would further increase the cost of the reclaimed water.

Two treatment technologies were considered to provide additional BOD and turbidity removal. Membrane bioreactor (MBR) and rotating disk filtration systems were considered for the supplemental treatment of wastewater effluent. Supplemental treatment or effluent polishing units draw effluent from the chlorine contact chamber for supplemental treatment.

MBR and rotating disk filtration treatment systems are capable of producing high quality reclaimed water. An MBR treatment unit is characterized by a relatively simple and efficient operation. In the MBR treatment process, wastewater effluent would be pumped from the chlorine contact chamber to the MBR unit for filtration. MBR treatment relies on a low pressure microporous membrane that is used to separate solids and liquid in wastewater. Construction includes addition of a reactor tank in which the MBR unit is submerged and pumps to move effluent to the MBR and from the MBR to the bulk storage tank. Additional disinfection is provided as reclaimed water is pumped from the MBR to a bulk storage tank.

Capital costs for MBR construction are higher than conventional treatment processes and higher than the costs of rotating disk filtration. MBR units are not without operational considerations in that membranes can be clogged with grease or solids. However, placing the MBR unit at the end of the treatment process minimizes most of the operational considerations, leaving higher capital costs as the primary determining factor for effluent polishing.

Like MBR units, rotating disk filters can be easily integrated into the existing wastewater treatment plants without changing the current treatment processes for discharge permit compliance or requiring extensive construction on the WWTP site. The system considered for this application is a surface filtration system that consists of continuously rotating disk filters made of woven stainless steel mesh. Solids are removed during a backwash cycle and discharged from the filter back to the WWTP headworks. The addition of rotating disk filters was included in this analysis as providing the required quality of reclaimed water at the lowest capital and operating costs.

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6 Description of Alternatives

Alternatives were considered that could establish a system that can be expanded to serve various sectors of the city and to serve existing and future reclaimed water users. A secondary objective for the alternatives is to ensure an adequate supply of reclaimed water with a minimal impact on existing and future land uses. The reclaimed water system alternatives considered do not involve major modifications to the city's existing wastewater treatment plant, but rather afford flexibility in the design of future expansions of the plant to provide Type I reclaimed water quality as a result of the treatment process or by additional treatment of only the volume of effluent required for supplying the reclaimed water system.

Alternatives for the production and delivery of reclaimed water are guided by three project elements: source of supply, storage, and transmission (piping and pumping). The reclaimed water sources are limited to either construction of reclaimed water production facilities (RWPF) or effluent from the existing WWTP. Storage alternatives considered included use of the Natural Resources Conservation Service (NRCS) structure referred to as Plum Creek Site 1 and construction of a ground storage reservoir.

The alternatives considered include:

- Alternative 1- Existing System (Private Ownership): Continued private ownership and operation of the reclaimed water system with no action by the City of Kyle.
- Alternative 1A – Existing System (Wastewater Utility): Transfer of the existing system to the City of Kyle and operation by the city's wastewater utility.
- Alternative 2 – Reclaimed Water Production Facilities (RWPF): Construction of Reclaimed Water Production Facilities (RWPF) to draw raw wastewater from the collection system for onsite treatment.
- Alternative 3 – Potable Water Use: The consumption of potable water for the each of the potential uses identified in Section 5.
- Alternative 4 – WWTP Effluent: Phased construction of a reclaimed water system that includes additional treatment of effluent from the Kyle WWTP and transmission of reclaimed water to multiple service areas within the city.

6.1 Alternative 1 – Existing System (Private Ownership)

Under this alternative, the existing reclaimed water system would remain under private ownership and operation with service dedicated for irrigation of the Plum Creek Golf Course. Type II reclaimed water is presently provided to the Plum Creek Golf Course through a system that was designed and built by the golf course developer using reclaimed water drawn directly from the WWTP outfall. Operation of the golf course reclaimed water system has highlighted certain limitations of the existing reclaimed water system that would need to be addressed with development of a reclaimed water utility. Continuing with a privately owned and operated system limits the use of reclaimed water to a single user.

While this alternative incurs no costs to the city, it is not without certain risks to the City of Kyle. Much of the city's growth in the near term is projected to occur within the Plum Creek PUD. With the marketability of commercial and residential property in the Plum Creek PUD linked to the long-term viability of the Plum Creek Golf Course, it is reasonable to conclude that the City of Kyle's capacity for maintaining the infrastructure built to serve the PUD likewise benefits to some degree from a community amenity such as the golf course. Continuation of private ownership and operation of the existing reclaimed water system hinges almost entirely on the capacity of the golf course owner to maintain and replace the pumping system and transmission piping.

6.2 Alternative 1A – Existing System (Wastewater Utility)

Under this alternative, the ownership and operation of the existing reclaimed water system would be transferred from the Plum Creek Golf Course (PCGC) to the City of Kyle. With establishment of a utility rate structure, the city would assume responsibility for maintenance and operation of the system. However, the limited amount of capacity in the system would not be available for other uses, *e.g.* Kyle Parkway irrigation or Seton Medical Center Hays cooling makeup water, without adding treatment to achieve Type I reclaimed water quality and reconfiguring the pump station to eliminate issues with pump clogging. As a Type II reclaimed water utility, the system would serve only the Plum Creek Golf Course. The additional treatment, pumping, and pipeline and related costs required to make use of the available system capacity and provide Type I reclaimed water for Kyle Parkway irrigation or to Seton Medical Center Hays is discussed in detail in Section 6.5.1 as Phase 1 under Alternative 4.

Assigning terms for any transfer of ownership of the existing system would be highly speculative at this time, given the fact that the current owner could obtain benefits such as increased system reliability and expanded opportunities for reclaimed water service within the Plum Creek PUD and the latitude for negotiation that exists between the owner and the city at this time. Therefore, acquisition costs are not assigned to this alternative.

6.3 Alternative 2 – Reclaimed Water Production Facilities (RWPF)

RWPF technology offers certain advantages in locating treatment facilities near the point of use in order to eliminate the need for construction of large scale reclaimed water pumping and transmission facilities. Location and space requirements are but two necessary considerations for RWPF technology. Requirements for buffers from buildings and the space required for the RWPF units are significant aspects of the technology, but so is the need for access to an adequate supply of wastewater. Additionally, and perhaps more importantly, is the consideration of RWPF technology is its potential impact of the technology on the city's wastewater collection and treatment systems.

6.3.1 RWPF Technology

A representative list of system capacity and treatment technologies were evaluated for cost and suitability for location in parks. Three processes were considered as viable RWPF alternatives. These were:

- Sequencing Batch Reactor (SBR)
- Membrane Biological Reactors (MBR)
- Continuous Backwash Upflow Media (CBUM)

Sequencing Batch Reactor

Sequencing batch reactors (SBR) consist of two tanks with a common inlet. Wastewater is drawn into one tank for aeration while the other tank is decanting. A variation of the SBR technology allows influent flow to continue into a basin during the settle and decant phases or at any time during the operating cycle. This design variation allows the inflow to be continuously aerated, settled, and decanted for a controlled time period, enhancing the flow capacity of the treatment system and reducing the system footprint.

Membrane Biological Reactor

MBR technology includes both self-contained flat sheet membrane panels that are submerged in a tank and hollow fiber membranes. Advantages of hollow fiber membranes over the flat sheet membranes are higher packing density and better clean-in-place chemical circulation resulting in reduced footprint and maintenance downtime.

Some manufacturers provide an anoxic basin and aeration basin prior to the membrane basin or aeration and membrane basins combined into a single basin. Membranes require periodic maintenance including clean-in-place and external cleaning.

Continuous Backwash Upflow Media

CBUM technology is a modular approach to treating wastewater that relies on polymer conditioned sand media filtration along a suspended media process. Solids are separated from the liquid stream in the preliminary separator and compacted using a screw conveyor. The liquid stream then passes through the first stage filtration tank, which contains a polymer conditioned sand media removing finer solids. The effluent first stage filtration tank flows under gravity to the bio tank. Dissolved organic matter is treated in the bio tank and another filtration follows the biological treatment. In this second stage filtration tank, excess and dead microorganisms and remaining fine solids are trapped in the polymer conditioned sand media. The effluent of second stage filtration tank is either stored in a tank for disinfection or additional treatment as required.

RWPF Technology Considerations

While RWPF technology offers certain advantages to a centralized reclaimed water system, distinct aspects of RWPF technology would require additional analysis before such systems could be considered for as a truly viable alternative for producing reclaimed water. Specific local factors that would require additional analysis include:

- Wastewater interceptor flow rates: The potential viability of RWPF technology is specific to each potential reclaimed water user. An initial question of whether the interceptor nearest each user would provide sufficient water to meet the peak day demand, solids deposition in the sewer is an operational concern that would require diurnal flow monitoring during summer months to verify minimum flow velocities for resuspension of solids.

- On-site storage of reclaimed water: Using RWPF technology, the ability to meet peak day demands would require construction of multiple reclaimed water storage facilities near points of use or installation of multiple pumping stations to transport reclaimed water to storage at Site 1. The loss of usable acreage within local parks and decentralization of pumping and storage could represent substantial added costs over a centralized system.
- Space requirement and aesthetic considerations: In an area such as an established park, adding a RWPF and related storage can affect the space available for other uses. Adding these facilities may also require landscape architectural design to integrate the facilities with the surroundings.
- Concentration of solids: The return of solids to the wastewater interceptor has the potential of increasing the influent strength at the POTW. While this alternative would not necessarily create a need for expansion of the existing WWTP, the treatment process would need to be analyzed in light of a higher influent BOD and TSS loads.
- RWPF Costs: The construction of a decentralized reclaimed water system substitutes the capital cost of centralized pumping, storage and transmission with multiple treatment units.

RWPFs would be sized for the peak day capacity. The RWPF are typically highly compact facilities designed to treat base loads with minimal peaking factors and little or no redundant equipment, which can help minimize capital costs.

RWPF units are compact wastewater treatment facilities that provide onsite production of reclaimed water. In addition to the challenge of identifying locations along the wastewater collection system where wastewater flows are sufficient to meet the peak demands for reclaimed water, the collection system flows must have sufficient velocity to accommodate return flows of concentrated solids. This concentration of solids also has the potential of affecting the wastewater treatment process since the process is designed for a specific influent concentration of BOD and TSS. Since comprehensive flow monitoring and modeling of the Kyle wastewater collection system that could provide data needed for the identification of potential RWPF sites has not been undertaken at this time, insufficient information exists for consideration of the RWPF alternative.

6.4 Alternative 3 – Potable Water Use

As discussed in Section 4, the City of Kyle has developed multiple water supply sources for potable water. Without the development of reclaimed water, the city's potable water supplies would provide the single alternative for the demands identified in Section 5. Addition of the various demands to the potable water distribution system will require additions to transmission, storage, pumping, and distribution to be included in future modeling and planning. The development of the projected demands would coincide with the city's development of the HCPUA water supply.

6.5 Alternative 4 – WWTP Effluent

Based on the wastewater treatment data presented in Section 5.9, effluent from the Kyle WWTP appears to provide a reliable source for reclaimed water in quantities that will meet the projected demands for all of the potential uses identified in Section 5. Under this alternative, the existing private reclaimed water system would be transferred to the city to allow for staged expansion of both the system and customer base. Initial development of a single-pipe system for transmission of reclaimed water to storage and for distribution to users minimizes construction costs and allows for expansion of the system as demand increases. The primary treatment, transmission, storage facilities would be developed in two phases with uses along the primary route between the Kyle WWTP and the golf course served first. In addition to the two phase development of the initial reclaimed water system, six service areas are defined for extension of service as warranted by demand.

6.5.1 System Development Phases and Service Areas

A phased approach of developing a conceptual reclaimed water treatment and transmission system and the identification of potential service areas is presented in this section. Reclaimed water for the conceptual system is obtained from the effluent stream of the Kyle WWTP. The existing WWTP would not be expanded, nor would the treatment process be modified as part of this alternative. Additional treatment to obtain Type I reclaimed water quality would be obtained by the addition of rotating disk filters and additional disinfection for only the volume of effluent diverted for the supply of reclaimed water.

Phased Development

Recognizing that the existing system has limited capacity for meeting the projected demands for reclaimed water, development of increased system capacity is accomplished in two phases. Components of the reclaimed water system can be phased over time to minimize capital and operating costs and to allow prospective users to develop site specific infrastructure. These phases are defined for key components of the reclaimed water system beginning with the existing golf course system.

Phase 1

The existing 525 gpm pumps are designed to meet the golf course peak demand. However, the existing 8-in. pipeline can accommodate flows up to 770 gpm without exceeding the Class 160 PVC pressure rating. In order to take advantage of the remaining pipeline capacity of 245 gpm, at least one existing pump would be replaced. The delivery of reclaimed water from the additional capacity of the existing pipeline could not take advantage of the storage now used for irrigation of the PCGC, but instead require that the additional delivery point(s) be irrigated in a relatively short period of time. Assuming a 3-hour period of irrigation, the 245 gpm of remaining pipeline capacity would serve an irrigated area of approximately 11 acres in addition to the PCGC.

The construction of facilities under Phase 1 is intended to take advantage of the unused capacity of the existing system to meet the irrigation demand for Kyle Parkway ROW irrigation and Seton Medical Center irrigation (Figure 6-1). By adding an 8-in. diameter pipeline extension to Kyle

Parkway and Seton Medical Center, potable water consumption can be decreased by approximately 10 MG per year. While most of the irrigation demand for Kyle Parkway and Seton can be met, the peak month demands of both Kyle Parkway and Seton cannot be met without exceeding the capacity of the existing system. By recognizing that the peak month irrigation of Kyle Parkway and Seton irrigation would be limited to 95% of projected demand, the extension of reclaimed water and implementation of conservation measures during that peak month would allow both areas to be maintained without potable water.

Equipment for the supplemental treatment needed to achieve Type I quality for reclaimed wagter would also be added as part of Phase 1 to ensure that reclaimed water that meets the Type I water quality parameters is delivered for irrigation of public spaces. The proposed reclaimed water project would include the addition of tertiary treatment in the form of rotating disk filters and disinfection. However, as proposed, the reclaimed water project would not reduce, postpone, or eliminate future expansion or replacement of the existing WWTP|. Detailed preliminary opinions of probable project costs for Phase 1 are presented in Appendix F.

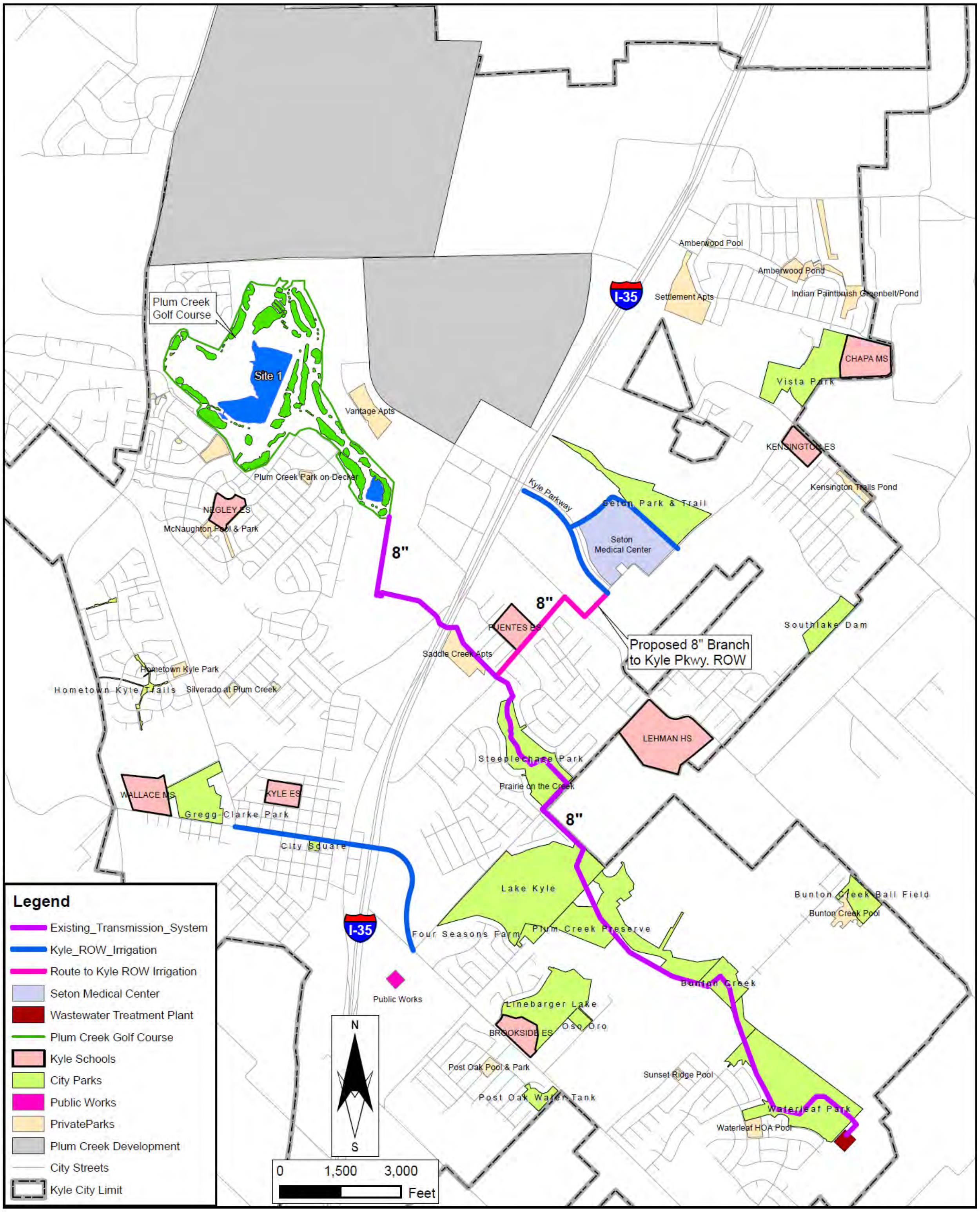

Figure 6-1: Phase 1 reclaimed water system.

Phase 2

Beyond the addition of Kyle Parkway and Seton landscape irrigation discussed as Phase 1, the addition of any new demand or delivery point for the reclaimed water system will require an increase in the capacity of the transmission system, pumping, and storage. For the purposes of this study, replacement of the existing 8-in. transmission pipeline is recommended rather than construction of a parallel pipeline since a parallel pipeline increases overall maintenance costs and requires valuable easement space.

New delivery points and reclaimed water users can come in the form of private users (e.g. irrigation of commercial or single family property in the Plum Creek PUD and HOA parks, or cooling system makeup water for Seton Medical Center) or public users (city parks and schools). Extensions beyond the Phase 2 system are considered for new service areas, allowing the demand in those areas to drive construction of reclaimed water distribution mains.

The alternatives for storage include use of the NRCS impoundment at Plum Creek Site 1 and construction of a ground storage tank in an area near Kohlers Crossing, north of the PCGC and Plum Creek Site 1. The addition of ground storage would add approximately $2.6 million to the estimated project costs.

Computer modeling of the reclaimed water system using an elevated storage option was developed, but with the cost of elevated storage tank construction triple the cost of ground storage construction, elevated storage is not included as part of this study.

The addition of system capacity and storage included in Phase 2 are shown in Figure 6-2. A 14-in. diameter transmission pipeline is extended to the PCGC along a route parallel to the existing 8-in. pipeline, with 18-in. and 24-in. pipe extended to storage at Site 1. Distribution pumps for withdrawing water from storage are added along with additional pumping capacity at the Kyle WWTP. With the completion of Phase 2, the basic infrastructure to meet the projected water demands is in place. Detailed preliminary opinions of probable project costs for Phase 2 are presented in Appendix F.

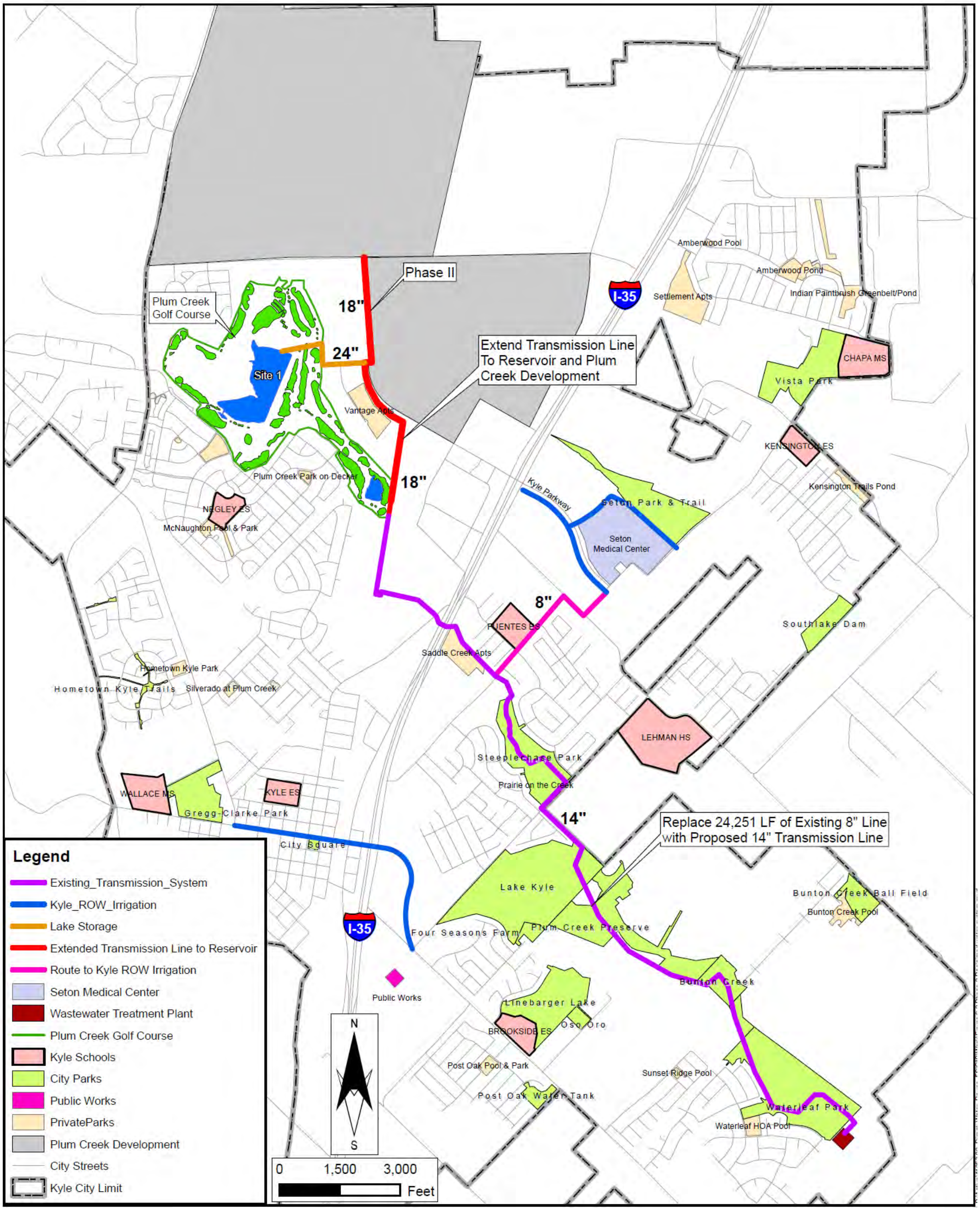

Figure 6-2: Phase 2 reclaimed water system.

Recommended Reclaimed Water Service Areas

Following the construction of the Phase 2 infrastructure, the reclaimed water utility system can be expanded to meet demands in various areas of the city. The six service areas delineated in Figure 6-3 illustrate a sequence for expansion of the reclaimed water utility. The projected reclaimed water demands for each service area are shown in Table 6-1. Detailed preliminary opinions of probable project costs for each service area are presented in Appendix G.

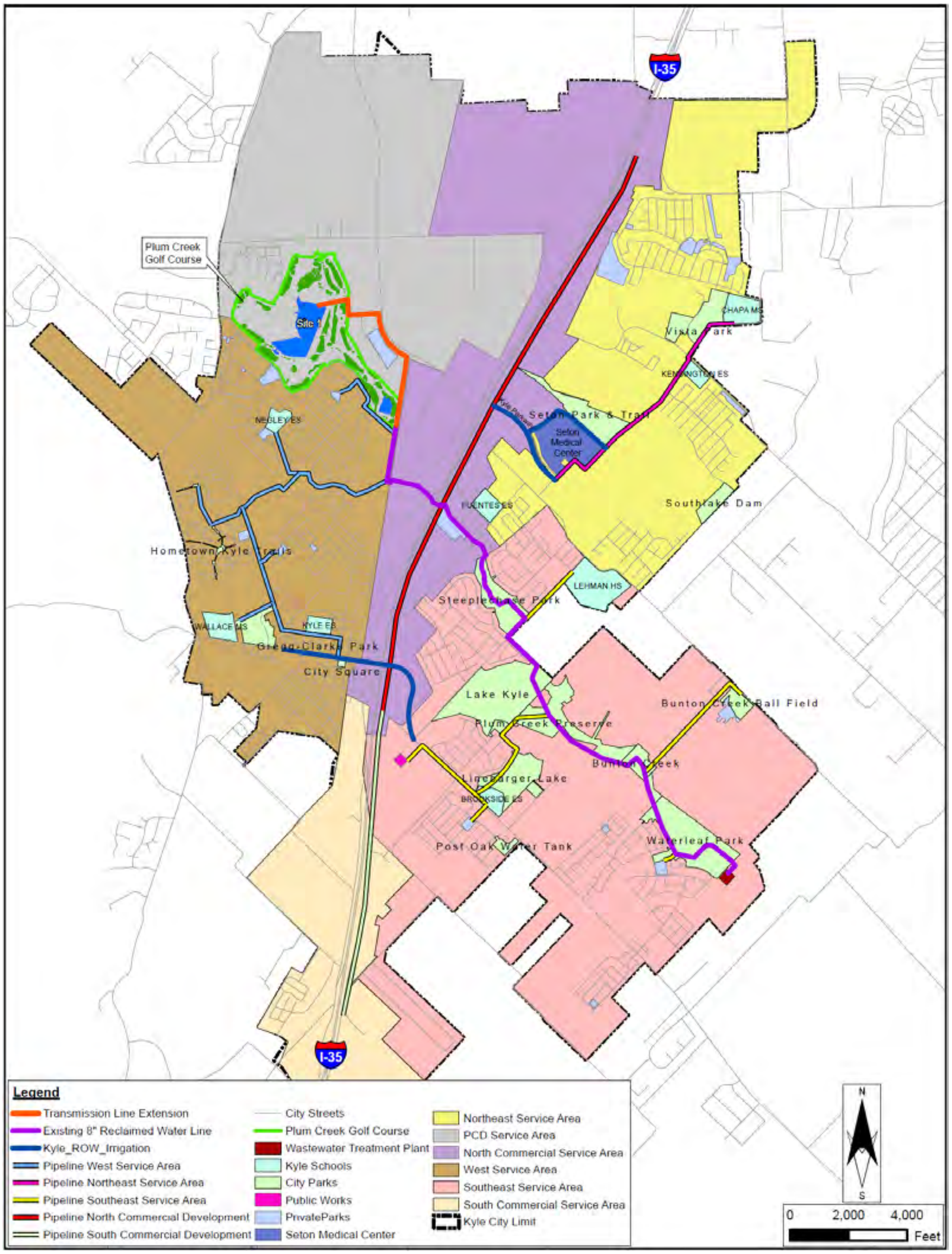

Figure 6-3: Reclaimed water service areas.

Table 6-1: Service area reclaimed water demands (2035).

Service Area	Annual Demand (MG)
Plum Creek	278.58
Southeast	41.69
Northeast	29.58
West	34.78
N Comm	19.60
S Comm	27.65
TOTAL	**431.89**

Plum Creek Service Area

The projected reclaimed water demands for the Plum Creek PUD include commercial landscape irrigation, irrigation of medians and rights of way, parks, and a dual water system for irrigation of single family development landscaping. Development of the PUD is projected to take place at an annual rate of approximately four percent per year between 2015 and 2035.

Southeast Service Area

Public and private parks are the potential reclaimed water users in the Southeast Service Area. Most potential uses are located along the reclaimed water transmission main, minimizing the capital costs for main extensions. The Southeast Service Area includes:

- Waterleaf Park
- Waterleaf HOA Park
- Lake Kyle
- Steeplechase Park
- Bunton Creek Ball Field
- Brookside ES
- Lehman HS
- Post Oak HOA Park

Northeast Service Area

The reclaimed water demand for the Northeast Service Area has the greatest potential for substituting reclaimed water for potable water. The service area includes:

- Seton Medical Center
- Kyle Parkway
- Chapa Middle School

- Fuentes Elementary School
- Kensington Elementary School

Presently, landscape irrigation for Kyle Parkway and Seton Medical Center are supplied by the potable water system. The reclaimed water demand for the Northeast Service Area also anticipates that Seton Medical Center's cooling system makeup water could be switched from potable to reclaimed water, along with the facility's landscape irrigation.

West Service Area

The West Service Area is comprised of potential reclaimed water uses that are considerably smaller than the other areas.

- City Square
- Gregg-Clarke Park
- Hometown Kyle Trails
- Hometown Kyle Trails
- Decker Park
- McNaughton Park
- Vantage Apts.
- Hometown Kyle Trails Park
- Silverado
- Center St. Streetscape
- Wallace MS
- Kyle ES
- Negley ES

Future Commercial Service Areas

The commercially zoned property along IH 35 was divided into two reclaimed water service areas – the North Commercial Service Area and the South Commercial Service Area. The rate at which reclaimed water demand could develop for commercial landscape irrigation in these areas is assumed to be at a rate of about two percent per year for the twenty year planning period.

6.6 Reclaimed Water Storage

Storage of reclaimed water allows for the balancing of the supply of treated effluent with the reclaimed water demand and also allows transmission pipeline diameters to be minimized. During periods of peak demand in summer, reclaimed water can be produced continuously during a 24-hour period and pumped to storage. Storage for the existing system is a small pond located on the golf course property.

But as reclaimed water demands increase and the transmission system is expanded to more delivery points, storage requirements will increase to match the peak day demand volume. For the built-out reclaimed water utility system, storage would allow irrigation of the Plum Creek Golf Course and the other delivery points to take place during a six hour period at night without risking over-drafting the wastewater effluent when plant flows are at their lowest.

6.6.1 Storage Volume

The current system operates with only a storage pond located at the Plum Creek Golf Course. But as additional demands are added to the system, direct pumping and the golf course pond will not be sufficient to meet increased demand. The conceptual system configuration used in this study includes 200,000 gallons of off-peak effluent storage at the Kyle WWTP and storage near the point of highest projected demand. Storage at the Kyle WWTP allows off-peak flows during the nighttime irrigation period to be collected and pumped to the system storage.

Two alternatives for reclaimed water storage were considered. The tank storage option included a 2.6 MG welded steel tank located north of Kohlers Crossing and north of the Plum Creek Golf Course. The second alternative is use of the NRCS impoundment at Plum Creek Site 1.

6.6.2 Storage Alternatives

The two general types of reclaimed water storage are storage structures and ponds. Structured storage is typically steel or concrete tanks that provide flexibility in the location of storage, maintain water quality and essentially eliminate evaporative losses. Structured storage also requires a minimal land area compared to storage ponds. Structured storage includes both ground storage tanks and elevated storage tanks.

Ground storage tanks can be built using welded or bolted steel plates or reinforced concrete. Steel tanks typically have the lowest capital cost, but have continuing maintenance costs of recoating to prevent deterioration of the steel plates and members. Reinforced concrete tanks can provide a viable alternative to steel when long term maintenance is considered. Unlike steel tanks, concrete tanks can be designed to be placed above ground or underground. As an underground storage reservoir for reclaimed water, a concrete tank can provide efficient storage, minimal maintenance and discreet placement in parks or high traffic areas, but at a higher construction cost. Concrete tanks can be completely buried with up to two feet of soil covering the top to allow planting of grass and shrubs, or the top of the tank can be incorporated into the landscaping. The exposed roofs of buried concrete tanks have been used as basketball courts and have been designed with additional reinforcement to allow parking.

Elevated storage tanks are designed to supply pressurized reclaimed water even when supply pumps are not in operation. Elevated storage tanks rely on hydrostatic pressure produced by maintaining a volume of water above the highest delivery point. These tanks serve the same purpose of ground storage tank in that the stored volume of water provides a reserve during times of peak usage. Elevated storage tanks can reduce the costs of pumping, but have significantly higher capital costs than ground storage tanks.

Ponds provide the lowest unit cost of construction of reclaimed water storage but may include potential negative factors, such as evaporative losses and degradation of water quality over time. While studies have demonstrated that the quality of effluent stored in open ponds will diminish over time due to bacterial regrowth and contamination by local wildlife (Higgins, 2009), the potential savings in capital costs and creation of aquatic habitat were considered as strong positive factors in evaluating an existing lake located at the Plum Creek Golf Course.

Plum Creek Site 1

Plum Creek Site 1 is one of approximately 18 dams constructed in the Plum Creek watershed by NRCS and local sponsors. NRCS watershed dams are developed for the purposes of reducing flood damages to bridges, agricultural lands, and erosion control. Most watershed projects were planned and the dams built when the surrounding properties were rural in nature. As in many other areas of the state, the conversion of property in Kyle from agricultural to urban land use in has marked a significant change in the area. As a result of downstream urbanization, many dams originally constructed as low hazard are now, or will be, classified as high hazard dams. High hazard category dams are usually those in or near urban areas where failure would be expected to cause loss of human life, extensive damage to agricultural, industrial or commercial facilities, important public utilities (including the design purpose of the facility), main highways or railroads. As a result of downstream urbanization, this dam is classified as a high hazard structure.

The annual operation and maintenance of dams is the responsibility of the project sponsors. In the Plum Creek watershed, dams are sponsored by the Plum Creek Conservation District (PCCD). NRCS recently evaluated the as-built and current condition data for Plum Creek Site 1 (Appendix I). Analysis of this memorandum indicates that the structure may be suitable for reclaimed water storage without compromising its principal function of flood protection.

Storage Capacity

In evaluating the use of Plum Creek Site 1 for storage of reclaimed water, only the principal spillway storage volume was considered. The principal spillway storage is the volume below the principal spillway that remains in the reservoir and is primarily subject to evaporation. The elevations for the Site 1 dam are shown in Figure 6-4.

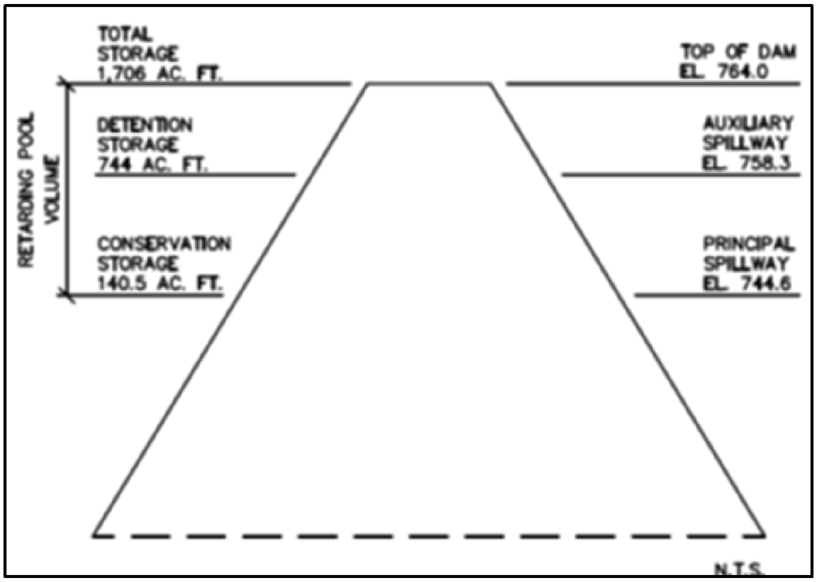

Figure 6-4: Plum Creek Site 1 dam elevations.

According to the NRCS information, Plum Creek Site 1 was built in 1965 to manage a drainage area of 1,300 acres. The current condition data presented by the NRCS reveals the actual drainage area served by the dam to be 1,185 acres. The data also show the principal spillway storage of Site 1 to be 140.5 ac. ft. (45.8 MG), or approximately 50% greater than the capacity of the original design. Principal spillway storage can also be considered as conservation storage, which is water that is impounded for consumptive uses such as municipal, industrial and irrigation and nonconsumptive uses such as recreation and fish and wildlife. The flood control function of the dam is in the retarding pool – that portion of the reservoir allotted to the temporary impoundment of floodwater with its upper limit being the elevation of the crest of the auxiliary spillway.

Assuming the peak water demand reaches 2.9 mgd (2035), Site 1 storage will provide approximately 16 days of storage. As shown in Table 6-2, the storage volume in Site 1 would begin to be drawn down during the peak month in drought conditions as the peak demand reaches 65 MG (2.12 mgd). Should demand begin to exceed the volume of reclaimed water produced by the Kyle WWTP, then additional storage in the form of off-peak storage at the WWTP could be added to the system to capture the effluent produced during the hours of midnight through 6 AM. It is during this six hour period that the system functions as a distribution system and effluent could be stored to be pumped to Site 1 during the next day.

Water stored in the reservoir is designated for recreational use without authorization for withdrawal (Appendix I). Withdrawal of water stored in the reservoir will require a water rights permit for municipal uses, such as irrigation. In addition to permitting of water rights to withdraw water from the reservoir, the discharge of reclaimed water to Site 1 would be regulated by TCEQ as an outfall of the city's WWTP and will require an amendment of the city's TPDES permit for a second outfall.

Table 6-2: Net storage change (peak month).

Year	WWTP Effluent (mgd)	Lake Storage (days)	Off-Peak Vol. (MG)	Lake Evaporation (MG)	Reclaimed Water Demand (MG)	Storage Vol. Change (MG)	Lake Vol. End of Peak Month (MG)
2015	61.07	54	9.39	7.13	24.66	19.89	45.78
2020	72.23	45	11.16	7.13	42.11	11.83	45.78
2025	79.36	22	12.31	7.13	65.67	-5.75	40.04
2030	86.8	18	13.33	7.13	79.63	-13.29	32.49
2035	91.14	16	14.26	7.13	91.25	-21.50	24.28

For the purposes of this study, it is assumed that the storage of reclaimed water in the Site 1 reservoir would be maintained at or below the level of principal spillway storage to avoid affecting the detention storage capacity of the structure and as well as avoiding any routine release of water from the reservoir. In this analysis, an operation strategy would provide that pumping of reclaimed water to Site 1 would cease when the water level reaches a specified elevation at or below the principal spillway crest and the discharge of effluent returns to the city's primary outfall at the WWTP.

6.6.3 WWTP Off-Peak Storage

The rate of flow through a wastewater treatment plant varies, not only with each day, but during the day. In the conceptual system for the Kyle reclaimed water system, costs are minimized by using the transmission system for both transporting reclaimed water to storage and for distributing water to users during a 6-hour irrigation period. Comparing the projected WWTP flow volume with the future reclaimed water demands, lake storage volume, and evaporative losses from lake storage, it was determined that the volume of storage in Site 1 would provide an adequate volume in most years. However, as demand increases, storage volume during the peak month will be drawn down significantly.

Off-peak volume is WWTP effluent that is discharged during the 6-hour period when the system is operating as a distribution system and is not adding reclaimed water to the storage at Site 1. In the future, an off-peak storage facility could be located at the Kyle WWTP to allow the WWTP flow during the nighttime irrigation period to be temporarily stored and pumped to lake storage during the next 18 hours to minimize the lake drawdown.

7 Economic Analysis

7.1 Project Cost Summary

Preliminary opinions of probable project costs were developed using cost data provided by equipment suppliers for rotating disk filters and pumps, and recent project bid tabulations for utility construction. Current 2012 year costs are used for all phases of construction. Sizes of pumps and transmission and distribution piping were developed through a computer model of the proposed system using H_2OMap Water® software.

7.1.1 Alternative 1

Due to the private ownership and operation of the existing reclaimed water system, the costs for Alternative 1 are not available.

7.1.2 Alternative 1A

As previously discussed, there are two options for the development of Alternative 1A – operation by the city's wastewater utility. The first option would be to operate the system to continue serving a single customer (Plum Creek Golf Course) while the second option would be to invest in upgrading the pumping system, increasing water quality to Type I reclaimed water, and extending service to Kyle Parkway or Seton Medical Center Hays. The first option would not incur capital costs. The second option of expanding the existing system and level of reclaimed water treatment is considered as Alternative 1A for the purposes of this analysis. This alternative has the advantage of being the least cost alternative that provides a reclaimed water substitution for approximately 5 MG/yr. of potable water. The costs for Alternative 1A are those developed as Phase 1 (Table 7-1) to increase the use of reclaimed water using capital elements common to both Alternative 1A and Alternative 4.

7.1.3 Alternative 2

As previously discussed, flow data for the wastewater collection system is required in order to identify potential RWPF locations. Since that data is not available, costs for Alternative 2 cannot be developed at this time.

7.1.4 Alternative 3

Only two alternatives will meet the full 2035 demand. Without development of an expanded reclaimed water system, only potable water would be available to meet the 2035 demand using the city's potable water utility and the potable water supplies discussed in Section 4. Costs associated with the increased storage, pumping, transmission, and distribution capacity for the projected demands were developed and are presented in Table 7-1. The water supply for Alternative 3 includes the city's existing supplies (Edwards Aquifer and surface water from GBRA) and the future Carrizo-Wilcox supply from HCPUA. Water supply costs are the average of all existing supplies through the year 2020 and HCPUA costs from 2020 through 2035.

Table 7-1: Potable Water Alternative Costs

Year	Annual Demand (MG)	Capital Costs	Debt Service	Power Costs	O&M Costs	Treatment Costs	Water Supply Costs	$/AF	$/kgal
2015	115.63	$1,217,013	$ 96,380	$12,064	$ 12,170	$ 5,435	$ 126,346	$ 711	$ 2.18
2020	215.22	8,629,074	779,760	26,327	98,461	10,115	822,288	2,630	8.07
2025	318.81	6,113,913	1,263,950	43,729	159,600	14,984	1,218,086	2,760	8.47
2030	377.37	0	1,263,950	52,389	159,600	17,736	1,441,838	2,535	7.78
2035	431.88	0	1,167,570	61,220	159,600	20,298	1,650,112	2,308	7.08

Notes:

- O&M costs are projected using 1% of the capital costs.
- Treatment costs include disinfection.
- Debt service is calculated using 5% interest over 20 yrs.

7.1.5 Alternative 4

The capital cost of a reclaimed water system varies according to the peak irrigation demand and the geographic distribution of the supply system. With a projected 2035 reclaimed water demand of 431.88 MG per year, the Kyle reclaimed water system would serve areas located along the central transmission pipeline and in areas that are relatively distant from the core of the system. The relatively high costs of serving low demand areas, such as the West Service Area, is balanced with the low capital cost and high demand of areas such as Plum Creek PUD and the Southeast Service Area. Probable costs for the complete system are detailed in Appendix E, with the costs for Phases 1 and 2 in Appendix F and each service area detailed in Appendix G. The summary of probable costs for the reclaimed water system is presented in the following tables. Table 7-2 includes the annual costs of developing the initial system in Phase 1 and Phase 2. In Table 7-3, the probable costs are presented by service area for projected year 2035 demands. These data demonstrate the differences in capital cost and demand between the service areas previously discussed. A projection of annual costs presented in Table 7-4 demonstrates how the unit cost of reclaimed water decreases with increasing demand.

Table 7-2: Summary of annual costs (2015 - 2020).

Phase	Annual Demand (MG)	Capital Costs	Debt Service	Power Costs	O&M Costs	Treatment Costs	$/AF	$/kgal
Phase 1	115.63	$ 843,750	$ 67,705	$ 12,064	$ 8,438	$ 6,731	$ 267.53	$ 0.77
Phase 2	205.05	4,506,250	356,870	57,455	45,063	$ 11,723	762.26	2.34

Notes:

- O&M costs are projected using 1% of the capital costs.
- Treatment costs include tertiary treatment and disinfection.
- Debt service is calculated using 5% interest over 20 yrs.

Table 7-3: Service area cost summary (2035).

Service Area	Annual Demand (MG)	Capital Costs	Debt Service	Power Costs	O&M Costs	Treatment Costs	$/AF	$/kgal
Plum Creek	278.58	$ 375,000	$ 29,700	$ 41,840	3,750	$ 16,217	$ 107.03	$ 0.33
Southeast	41.69	683,750	54,150	4,163	6,838	2,427	711.56	2.18
Northeast	29.58	417,500	33,060	3,061	4,175	1,722	623.64	1.91
West	19.60	1,385,000	109,680	2,384	13,850	1,141	2,845.63	8.73
N Comm	34.78	1,821,250	144,230	4,885	18,213	2,025	1,586.61	4.87
S Comm	27.65	1,032,500	81,770	3,590	10,325	1,610	1,146.54	3.52
TOTAL	**431.88**	**$11,065,000**	**$ 876,280**	**$ 59,924**	**$ 110,650**	**$ 25,141**	**$ 808.80**	**$ 2.48**

Notes:

- O&M costs are projected using 1% of the capital costs.
- Treatment costs include tertiary treatment and disinfection.
- Debt service is calculated using 5% interest over 20 yrs.

Table 7-4: Summary of annual costs.

Year	Annual Demand (MG)	Capital Costs	Debt Service	Power Costs	O&M Costs	Treatment Costs	$/AF	$/kgal
2015	115.63	$ 843,750	$ 67,705	$ 12,064	$ 8,438	$ 6,731	$267.53	$ 0.77
2020	215.22	5,982,500	547,756	26,327	68,263	12,528	1,059.59	3.25
2025	318.81	4,238,750	887,884	43,729	110,650	18,558	1,108.29	3.40
2030	377.37	0	887,884	52,389	110,650	21,967	926.42	2.84
2035	431.88	0	820,180	61,220	110,650	25,141	767.45	2.36

Notes:

- O&M costs are projected using 1% of the capital costs.
- Treatment costs include tertiary treatment and disinfection.
- Debt service is calculated using 5% interest over 20 yrs.

7.2 Cost Comparison of Alternatives

Alternative 4 represents the recommended alternative that will provide a drought-proof water source for the potential uses and for potable water offset for meeting the 2035 demand using reclaimed water. Alternative 4 also has the flexibility to extend service as demand develops in the various service areas defined in this study. Capital costs for Alternative 4 are detailed in Appendix E, with Alternative 4 System Expansion Costs presented in Appendix F and Service Area Estimated Costs presented in Appendix G.

The projected costs for water supplies to meet the 2035 demand are summarized in Table 7-5.

Table 7-5: Alternative costs summary (2035).

Item	Alternative 1	Alternative 1A	Alternative 2	Alternative 3	Alternative 4
Capital Cost[1]	0	$843,750	--	$15,960,000	$11,065,000
Annual Volume (MG)	109.4	115.6	--	431.88	431.88
Potable Water Offset (MG/Y)	0	5.0	--	0	21.2
Unit Cost ($/kgal)	Undefined[2]	$0.76	--	$7.08	$2.36

[1] Cost to City of Kyle for system fully developed to meet 2035 demand.

[2] Costs of private ownership and operation are not available.

7.3 General Economic Conditions and Strategic Concerns

The City of Kyle's taxable assessed value has increased by 50% to a total of $1.39 billion in the four year period of 2007 through 2011. According to a bond rating by Standard & Poor's (2011), the City of Kyle's A+ bond rating is influenced by the city's access to the deep economic and employment base of the Austin area; its ability to maintain a strong financial position; and strong income levels. At the time of that rating, the city was planning to spend a portion of the city's general fund balance in 2011 in part, to fund an increase in the operating costs for parks.

The 2010 Comprehensive Plan notes the position of Kyle relative to the I-35 corridor between Austin and San Marcos, and the expected population growth along this corridor and within Hays County. The population and economic analysis chapter in this plan also cautions about "below average economic diversity" and perhaps most critically, the beginnings of a "bifurcation in employment in lower paying retail and manufacturing or distributional jobs generated by I-35 versus the higher skill and paid jobs generated by the anchor cities in health care, business services, and information." (Kyle Comprehensive Plan, 2010, p. 18).

Thus, the attraction of higher skill and paid jobs is a strategic imperative for Kyle. Referencing the same ESRI source information as the Comprehensive Plan (Tapestry Segmentation, ESRI, http://www.esri.com/library/brochures/pdfs/tapestry-segmentation.pdf), then a broad target group for planning purposes is described as the LifeMode group L2: Upscale Avenues. This group is likely to prefer outdoor recreation opportunities (ESRI, p.14), and therefore is more likely to place value in communities which offer stable and improved recreational facilities.

7.4 Overview of Economic Benefits

There are a number of benefits related to the use of reclaimed water which may accrue to different entities and stakeholders in the community that can be either difficult to quantify or may only be described qualitatively. These benefits accrue directly and indirectly to the City of Kyle, the environment, and to the region. In many cases, since these benefits extend across political boundaries they are also difficult to quantify in financial terms (Raucher, 2006).

7.4.1 Social Benefits

Improved community aesthetics and quality of life

Both the public and private parks in Kyle incorporate a variety of plants and grasses to provide shade, visual enjoyment and playing surfaces. Much of the area of larger, community and regional parks are maintained in close to natural conditions with little or no irrigation. However, supplemental irrigation of areas within those parks, such as picnic areas, playgrounds, and athletic fields, can provide an improved capacity for accommodating the increased and heavier uses associated with more visitors and activities.

Supports community values associated with recreation

Summer recreational programs provide opportunities for a healthy lifestyle. The drought-proof nature of reclaimed water provides a source of water for ensuring plant maintenance and for providing increased recreational opportunities that enhance the local quality of life, particularly during the summer months when activities peak and potable water conservation measures are in effect.

Local control

The development of water sources in Central Texas typically requires participation in a regional effort. This is evidenced by the development of surface water as a source by GBRA and the current development of the Carrizo-Wilcox Aquifer supply through the HCPUA. But developing a reclaimed water utility can be seen as development of a local water supply that is not subject to allocation by multiple jurisdictions. Both the development and use of reclaimed water would, subject to current state regulations, be at the direction of the Kyle City Council in response to the will of the local community.

7.4.2 Environmental Benefits

Reduction in nutrient load in the Plum Creek Watershed

While the proposed project will not affect the concentration of nutrients in the wastewater treatment plant effluent, direct water reuse will, as discussed in Section 8.3, reduce the nutrient load to the Plum Creek watershed. As shown in Table 7-2, water reuse could remove almost 2 tons of nitrogen during the initial years of the project and up to 6 tons of nitrogen as the project reaches its maximum reclaimed water demand. Nutrients remaining in reclaimed water following treatment may also decrease the amount of fertilizer needed for plant maintenance.

Storm water quality improvement

Maintenance of turf grasses, shrubs and trees in public and private parks provide a vegetative buffer along the along creeks and tributaries that filters storm water runoff to improve water quality. Maintaining vegetation in areas adjacent to the watercourse reduces both the sediment load and contaminants in urban runoff.

7.4.3 Financial Benefits

Deferral of additional potable system capacity

As the city's population grows and the utility system ages, the design of water main replacements will consider historical demand and records of low pressure and system repair. Shifting park irrigation to reclaimed water will remove significant historical and future demands in the area of the parks irrigated with reclaimed water and preserve potable water system capacity for future population growth.

A similar benefit is gained in the capacity and maintenance of potable water storage. While capacity in existing storage tanks is gained for population growth by shifting park irrigation to reclaimed water, storage tanks are added for reclaimed water. However, maintenance costs for these structures is lower than for potable water tanks as the coating systems and maintenance are not required to meet drinking water standards.

Reduced potable water demand

A key benefit from developing a reclaimed water system for park irrigation is to eliminate a current and future potable demand. Replacing potable water for park irrigation with reclaimed water results in a savings of potable water for the demands associated with population growth. Replacing this demand will also reduce demand on the Edwards Aquifer during the summer months, providing an incremental reduction in the cost of developing additional water supplies.

Long-term sustainability of parklands

Developing parks is a significant investment by the current generation to ensure that the city's parks meet the needs of the present without compromising the ability of future generations to meet their own needs. Preserving vegetation in the parks provides both an inviting developed environment for people and a means of preventing damage due to erosion of surfaces worn by increasing use.

Increased tax base through increased property value

A survey conducted as part of a study of the economic impact of parks and recreation programs on local communities suggests that buyers are willing to pay a premium for property located near a public park (Perryman, 2006). A reasonable extension of that conclusion could be that the level of maintenance of parks during summer months could have a similar positive effect on adjacent properties by providing an area of sustained vegetation during recurring drought periods.

Evaluation of the economic feasibility of the project was limited to those direct benefits that are directly quantifiable. As discussed in greater detail in the following sections and noted appendices, this economic analysis considers reduced potable water demand, the avoided costs of HCPUA water, and the reduced nutrient load into Plum Creek as key components.

7.5 Benefits Not Considered

The remaining direct benefits and all of the indirect benefits generally accrue to the community in a manner that would require a more detailed economic analysis of the entire community beyond the addition of water reuse. For example, in an overview of how to conduct economic impact analyses of park and recreation services, Crompton (2010) focused on the multiplier effect special events and tournaments have on the local economy as a result of local investment in park and recreation services. In another study (Perryman Group, 2006), it was suggested that local park and recreation programs are an enrichment of the quality of life for existing residents as well as an enhancement in economic development focused on knowledge-based industries and on attracting retirees. While Perryman references a survey in which half of respondents would be willing to pay 10% more for a home located near a park, there are no studies that consider the potential effects of the overall quality of parks has on property values or desirability. Additional work, beyond the scope of this study, would be required to quantify such impacts.

7.6 Methodology

A present value analysis was conducted to determine the relative expense of developing reclaimed water for irrigation compared to the baseline alternative of continued potable water irrigation and cooling use. The decision to irrigate and provide cooling water has been selected as the baseline alternative versus a “no irrigation/no cooling” alternative because the latter is not consistent with the adopted Comprehensive Plan and does not contribute to the stability and continued protection of public park and open space improvements.

An alternative is preferable in a present value analysis when its present value is lower in absolute terms relative to other alternatives. The analysis forecasts the costs of each alternative over a 20-year horizon, and assumes a discount rate of 4.000%. The analysis horizon of 20 years has been selected because it corresponds to the maximum period of debt service that the community might assume. The discount rate of 4.000% was utilized in this analysis, following the guidance of the U.S. Water Resources Council:

(http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/cntsc/?&cid=nrcs143_009685).

7.7 Calculating the Annual Costs of the Baseline Alternative

The baseline alternative is defined as the cost of meeting the demands described in Section 5.6 with water from the potable water sources identified in Section 4.2 in each year of the analysis horizon to maintain the health and integrity of the respective areas being served and meet state-mandated effluent permit limits for receiving waters. The baseline scenario includes a supply cost component, projected costs of expanding the potable water system and an equivalent nutrient removal cost.

7.7.1 Annual Supply Costs

The costs to supply reclaimed water is a function of the average water supply cost projections presented in Table 4-6 and discussed in Section 4.4 of this report. Utilizing the average cost is assumed to be conservative relative to utilizing drought condition supply costs, which are projected to be higher (ref. Table 4-7).

The figures in Table 4-6 are shown in five-year increments based on known or projected pricing changes unique to the specific water resource. For the purposes of the present value analysis, these costs are assumed to be uniform for each of the years within the five year period, and were not interpolated for those interim years.

7.7.2 Equivalent Nutrient Removal Benefit and Cost

Section 8.3 of this report describes in detail the significant benefit of effluent reuse in achieving nutrient reduction. Therefore, in order to compare the baseline scenario on equal footing with the primary alternative – the reuse scenario – the costs to achieve an equivalent nutrient reduction must be incorporated into the present value analysis. Capital investment and additional operations and maintenance costs, associated with the development of Biological Nutrient Removal (BNR) processes, are assumed in this scenario in order to provide the same quantity (pounds removed) of nutrient reduction as the effluent reuse scenario. These assumptions are described in the following tables:

Table 7-6: Average cost of nutrient removal, BNR system, baseline alternative.

	BNR						
Year	**ADF (mgd)**	**BNR Capacity (mgd)**	**Capital Cost**	**Annual O&M Costs**	**Debt Service**	**NH3 Removal (lb./yr.)**	**$/lb NH3 Removed**
2015	2.78	2.78	$4,865,000	$194,600	$385,280	7,752	$74.80
2020	3.29	3.78	1,750,000	230,300	523,870	9,174	82.20
2025	3.62		0	253,400	523,870	10,095	77.00
2030	3.95	4.78	1,750,000	276,500	662,460	11,015	85.24
2035	4.15		0	290,500	662,460	11,573	82.35

Notes:
- BNR used only during summer months.
- NH3 removal to meet current permit limit.
- Costs of BNR do not anticipate changes in surface water quality stds. or permit limits.
- Capital increments of 1 mgd @ $1.75M/mgd

Table 7-7: Estimated nutrient removal, effluent reuse alternative.

Year	Reuse					
	ADF (mgd)	Capital Cost	Annual O&M Costs	Debt Service	NH3 Removal (lb./yr.)	$/lb NH3 Removed
2015	2.78	$843,750	$27,233	$67,705	3,826	$24.82
2020	3.29	5,982,500	107,118	547,756	6,525	100.36
2025	3.62	4,238,750	172,937	887,884	9,043	117.30
2030	3.95	0	185,006	887,884	11,157	96.16
2035	4.15	0	197,011	820,180	12,458	81.65

Thus, in years 2015-2019, to provide an equivalent level of nutrient removal compared to the reuse alternative, the baseline (continued potable supply) alternative must add BNR capacity, capable of removing 3,826 pounds per year, at a cost of $74.80 per pound. The calculation is performed for each year of the analysis, through 2035, and entered into the present value calculation (Section 7.8 below).

7.8 Calculating the Cost of the Reuse Alternative

The reuse alternative and its associated costs are described fully in Sections 6.3 through 6.5. There are five components to this alternative's cost calculation: the cost of other sources, debt service costs, power, operations and maintenance, and treatment.

7.8.1 Cost of other Sources

As the reuse alternative is intended to be used in conjunction with existing water sources, the existing water sources are considered as part of the cost structure, though the quantity required to meet required demand is reduced as a result of the availability of this alternative. These existing water sources include the Edwards Aquifer, BSEACD Historical Limit and Conditional Use, additional contracted supply through GBRA, and the HCPUA, as discussed in Sections 4.2, 4.3, and 4.4 of this report. The figures in Table 4-6 are shown in five-year increments based on known or projected pricing changes unique to the specific water resource. For the purposes of the present value analysis, these costs are assumed to be uniform for each of the years within the five year period, and were not interpolated for those interim years.

7.8.2 Debt Service Costs

The reuse alternative assumes the issuance of debt to fund capital components of the alternative. Consultations with the City of Kyle's financial advisor and bond counsel yielded the safest assumptions for factoring in the cost of debt service and the resulting schedule is incorporated into the present value analysis. The detail of the debt service provided as Appendix K illustrates financing of the reclaimed water system detailed in Table 7-4 through three bond issues in Series 2015, Series 2020, and Series 2025.

7.8.3 Recurring Annual Costs

The cost of power, operations and maintenance, and treatment are described in detail in Appendix H – Projected System O&M Costs.

7.9 Calculating the Present Value of the Baseline Scenario

In order to compare the costs of the baseline scenario to the alternative scenario, each scenario being comprised of differing series of costs accruing over the life of the project, a present value approach is employed. This approach applies the principle of discounting to the stream of flows, converting them to a single present value. The present value "accounts for the absolute size and the timing of a proposed action" (Mikesell, 1995 p.231). The basic equation for computing net present value is as follows in Equation 1:

Equation 1

$PV = \sum_{t}^{T} \frac{C_t}{(1+r)^t}$; where T= the life of the project and r = the discount rate.

Substituting the assumptions for this analysis:

Equation 2

$$PV_{Baseline} = \sum_{t}^{20} \frac{C_{TotalExistingSupplies} + C_{EquivNutrient\,\mathrm{Re}moval}}{(1+.0500)^t}$$

This equation yields a present value of $61,416,672 in absolute terms. The detail of the annual costs is provided in Appendix L.

7.10 Calculating the Present Value of the Reuse Alternative

The reuse alternative's present value can be calculated using the following equation, derived from Equation 3:

Equation 3

$$PV_{\mathrm{Re}use} = \sum_{t}^{20} \frac{C_{TotalOtherSources} + C_{DebtService} + C_{Power} + C_{O\&M} + C_{Treatment}}{(1+.0500)^t}$$

This equation yields a present value of $49,570,406 in absolute terms. The detail of the annual costs is provided in Appendix L.

7.11 Comparison of Baseline Scenario and Reuse Alternative

Comparing the results of the present value analysis for each scenario, the reuse alternative is the more cost-effective alternative:

$$PV_{\mathrm{Re}use} = \$49{,}570{,}406 < PV_{Baseline} = \$61{,}416{,}672$$

In summary, if the projected annual costs of each alternative, over twenty years, were compared and "brought back to the current year" through discounting, the reuse alternative for irrigation and cooling would be preferable to continued and expanded use of potable water supply.

7.12 Recommended Alternative

The use of reclaimed water from the Kyle WWTP (Alternative 4) is the recommended project for providing a water supply for the potential uses defined in Section 5. Based on the analysis described in the preceding sections, implementation of Alternative 4 will address the following:

i. While the proposed reclaimed water project will not postpone or eliminate the need for development of the HCPUA as a water supply, it will reduce the demand on future water supplies by creating a substitute for potable water for Kyle Parkway irrigation, Seton Medical Center Hays irrigation and cooling makeup water. This substitution for potable water will shift the existing demand of approximately 21 MG/yr. (Table 5-9) from potable water supplies to reclaimed water. The proposed reclaimed water project will also allow the various irrigation uses, such as city parks, to introduce irrigation without increasing demand on potable water supplies. A projected 42.2 MG/yr. of future irrigation demands for single-family irrigation could likewise be moved from the HCPUA demand to reclaimed water.

ii. Since the city's existing rights to the Edwards Aquifer are limited, existing withdrawals from the Edwards Aquifer will not increase or decrease as a result of the proposed project.

iii. Under the city's contract with GBRA for supply and treatment of water stored in the U.S. Corps of Engineers project at Canyon Lake, water remains in the reservoir until demands increase requiring withdrawal and treatment. By substituting reclaimed water for potable water and avoiding an increase in potable demand for the potential uses of reclaimed water, the proposed project has the potential to delay withdrawals from Canyon Lake.

iv. By providing disk filters and disinfection for only the volume of reclaimed water that is required, the proposed project does not require changes in the treatment process or capacity of the city's WWTP.

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8 Environmental Considerations

A review of available environmental information was performed to assess potential significant impacts on endangered or threatened species, public health and safety, natural resources, and regulated waters of the U.S. The review does not include a detailed survey or detailed investigation of environmental features or of cultural resources. A more detailed investigation would be conducted at the time actual facility locations are determined.

8.1 Environmental Features of the Study Area

The primary environmental features within the study area include the floodplains of Plum Creek and its tributaries. All of the potential reclaimed water use locations are located outside of the Edwards Aquifer Recharge Zone boundary (Figure 8-1).

8.1.1 Floodplain

The location and extent of floodplains were considered for the purposes of locating potential reclaimed water pumping and storage facilities. Using the base flood elevations (BFE) and flood insurance rate maps (FIRM) provided by Federal Emergency Management Agency (FEMA) under the National Flood Insurance Program, potential locations for pumps or storage were identified as being outside the regulatory floodplain.

8.1.2 Endangered or Threatened Species

The Texas Parks and Wildlife Department (TPWD) Rare, Threatened, and Endangered Species database contains county level information about the habitat of species of special concern in the State of Texas. A review of the TPWD database for Hays County reveals that the habitats for federally listed threatened and endangered species of fish and amphibians in Hays County are primarily large perennial rivers and streams and not in intermittent creeks. During the project design phase, a survey of areas affected by the proposed project will be conducted to determine if habitats for any listed species exist within the project area and, if any are identified, for the project to be designed to avoid impacting those areas. Once completed and in service, the use of reclaimed water for irrigation of developed property and for cooling will not create a potential for significantly impacting endangered or threatened species or the habitat of those species.

Since the proposed reclaimed water irrigation is restricted to the transition zone of the Edwards Aquifer, the use of reclaimed water for in Kyle will not affect endangered or threatened species of the aquifer. Aquatic species habitat that may exist downstream of Kyle in the Plum Creek watershed will not be affected by reclaimed water irrigation that could be introduced into watershed by rainfall induced runoff since runoff will be diluted and moved downstream with the increased flow resulting from stormwater. An onsite assessment of potential habitat for listed species would be conducted as part of the design process.

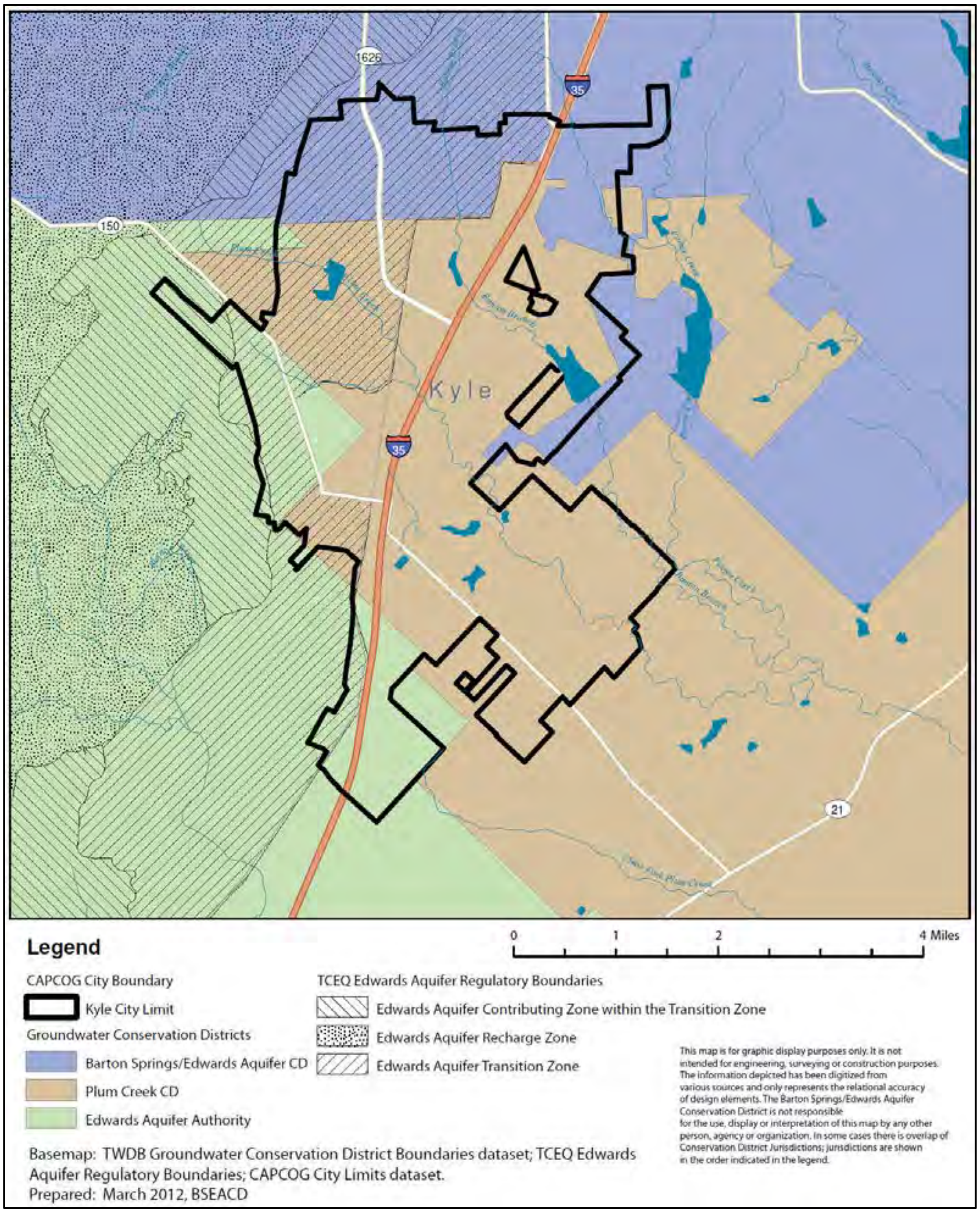


Figure 8-1: Groundwater regulatory boundaries.

8.1.3 Archeological and Cultural Resources

Construction of the project must adhere to various state and federal regulations intended to ensure that historic and prehistoric resources are identified along the project route or will be identified through a reconnaissance. Since construction of the proposed project would take place in existing and future public rights-of-way and on developed property, it is unlikely that the project will have a significant impact on a site, structure, or object that is listed in or eligible for listing in the National Registry of Historic Places, affects a historic or cultural resource or traditional and sacred sites, or the loss or destruction of a significant scientific, cultural, or historic resources. While the proposed project should not impact historic properties or prehistoric sites, the city will, during the design phase, coordinate the project design with the State Historic Preservation Officer or secure the services of a qualified archeologist to ensure that the requirements of the Archeological and Historic Preservation Act of 1974; National Historic Preservation Act of 1966; and the Texas Antiquities Code are addressed prior to construction. Once completed and in service, the use of reclaimed water for irrigation of developed property and for cooling will not create a potential for significantly impacting cultural resources.

8.1.4 Edwards Aquifer Transition Zone

The transition zone of the Edwards Aquifer is described as a thin strip of land south and southeast of the recharge zone from San Antonio to Austin where limestone that overlies the Edwards formation are faulted and fractured and has caves and sinkholes. The boundary between the recharge and transition zones transects the northwestern portion of Kyle just outside of the study area. The transition zone was established to regulate petroleum storage tanks. Since the proposed project will be located entirely outside of the Edwards Aquifer recharge zone and will be designed and operated to meet all regulations that apply to the transition zone, the proposed project will not create a potential for significantly impacting Edwards Aquifer.

8.1.5 Wetlands and Waters of the U.S.

Wetlands are defined for regulatory purposes under the Clean Water Act as [EPA Regulations listed at 40 CFR 230.3(t)]:

"…those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas."

A preliminary review of the USFWS National Wetlands Inventory (NWI) revealed that scanned wetlands mapping exists for approximately half of the City of Kyle and the study area. No data is presently included in the NWI for the southern half of the project area. Possible wetland areas are shown in the NWI along creeks and near the NRCS impoundments in the city. A detailed delineation of wetland areas in the project area will be conducted during the final design of a reclaimed water system. Utility crossings must comply with the terms of Nationwide Permit 12 (NWP-12) relating to activities required for the construction, maintenance, and repair of utility lines and associated facilities in waters of the United States. The design of the project will ensure that waters of the U.S. and wetland areas are avoided both during construction and operation of the proposed project.

8.1.6 Public Health and Safety

Existing regulations regarding the use of reclaimed water and, during the construction phase, construction safety requirements of the State of Texas and City of Kyle will ensure that safeguards are in place to ensure that the health and safety of the public is protected. Project construction would increase vehicular and truck traffic in the project area. Short-term air emissions and increase in noise levels would occur in and around the construction corridors. Construction activities would involve use of hazardous materials during construction; however implementation of best management practices (BMPs) related to fueling, vehicle washing and handling, use, and storage of chemicals would minimize any risk to either workers or the public. Project implementation would incrementally increase the use of chemicals used for disinfection of wastewater. All treatment chemicals would be handled and stored in compliance with federal, state and local requirements.

8.1.7 Natural Resources

Natural resources are materials or substances such as minerals, forests, water, and fertile land that occur in nature and can be used for economic gain. The construction and operation of a reclaimed water utility for irrigation of public and private properties and for cooling will not significantly impact the natural resources of the project area.

8.2 Potential Impact of Direct Reuse at Kyle WWTP on Watershed Water Quality

8.2.1 Overview

The Plum Creek Watershed Protection Plan (WPP) noted the presence of nutrient concerns (namely, nitrate-nitrogen) along the entire main stem of Plum Creek (Figure 8-2). Although creek sections with phosphorus concerns were present, they were located further below the immediate downstream area of the Kyle Wastewater Treatment Plant (Kyle WWTP) outfall. Thus the phosphorus levels may be related to effluent from multiple dischargers in the watershed. Presently, the Kyle WWTP does not have phosphorus limits in its discharge permit. Current permitted levels at the Kyle WWTP (based on the most recent discharge monitoring records (DMRs)) are as follows: annual average flow < 3 mgd, BOD < 10 mg/L, TSS < 15 mg/L and NH3 < 3 mg/L which correspond to current permitted loads of BOD < 250 lb/d , TSS < 375 lb/d, and NH3 < 75 lb/d. As part of its operations, the Kyle WWTP reports measurements of discharge, ammonia (NH3), total suspended solids (TSS) and biochemical oxygen demand (BOD) on a monthly basis.

In its recommended management measures, the WPP proposed that all wastewater treatment facilities in the Plum Creek watershed work towards the voluntary treatment levels of BOD < 5 mg/L, TSS < 5 mg/L, NH3 < 2 mg/L and TP < 1 mg/L. In particular, for the Kyle WWTP, the WPP proposed a permitted flow of 4.5 mgd which translates to proposed permitted loads of BOD < 187 lb/d, TSS < 187 lb/d, NH3 < 75 lb/d and TP < 37 lb/d. These loads are calculated by multiplying the proposed permitted flow with proposed permitted concentrations. Implementing the WPP proposed limits would result in reduction of 25% in permitted BOD loads, 50% reduction in permitted TSS loads, and no net reduction in permitted NH3 loads (due to increase permitted discharge) over current permit levels.

The direct, non-potable reuse of the Kyle WWTP effluent is a potential method for reducing nutrient loads discharged into Plum Creek. It involves diverting part of the wastewater effluent to satisfy irrigation demands in the upper Plum Creek watershed. This study seeks to quantify the impact brought about by direct reuse on the watershed water quality for the projected period of 2015 to 2035.

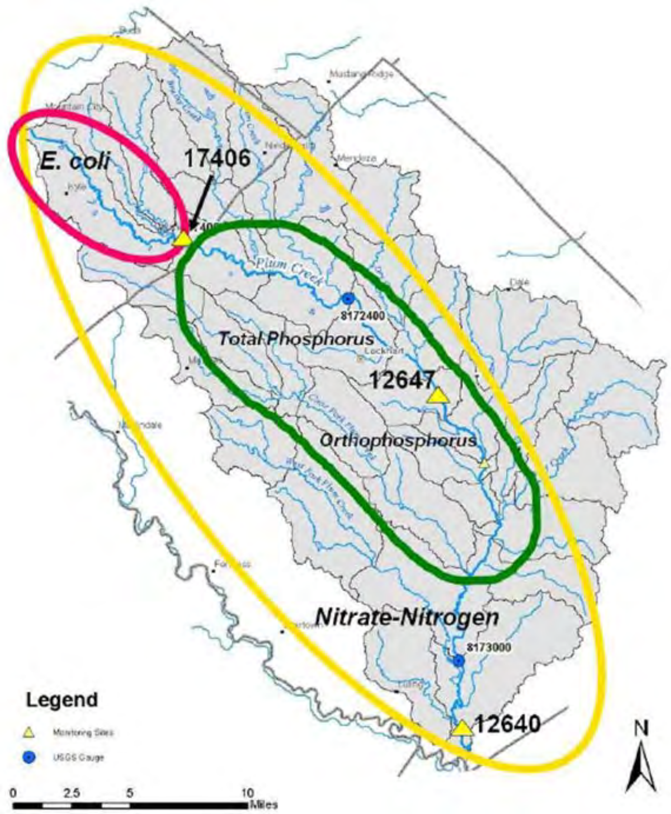


Figure 8-2 : Nutrient and bacteria concerns in the Plum Creek Watershed (From Figure 2.12 of the Plum Creek Watershed Protection Plan).

The Soil and Water Assessment Tool (SWAT) is a basin-scale model that simulates daily flows and events in the watershed. This tool allows prediction of management impacts on water volume and loads of nutrients, bacteria, and other pollutants over long periods of time. Because the application of the SWAT model originally used to develop the WPP is beyond the scope of this study, the capability to mechanistically predict the impact of reducing effluent on nutrient concentrations downstream has been limited in this study. Nonetheless, this study focused on comparing the proposed permitted loads in the WPP – which are based on the WPP's SWAT modeling – with the projected effluent loads from Kyle WWTP under direct reuse and no reuse conditions. To do this, the Kyle WWTP effluent loads at 5-yr intervals from 2015 to 2035 were calculated based on projected changes in population size, wastewater inflow, irrigated areas and irrigation demands for the Kyle area. Calculated loads were then compared against proposed permitted loads to evaluate the effectiveness of direct reuse in meeting future water quality goals in the watershed.

A key limitation of this study is that although it addresses load reductions for the sake of meeting the WPP proposed goals, the evaluation is based on nutrient loads instead of concentrations. The main reason is because direct reuse is primarily a mechanism for reducing loads. Subsequent reduction in downstream concentrations can only occur if a significant background flow is available to dilute the discharge. Unfortunately, according to the WPP, the northern, upstream section of Plum Creek is intermittent throughout most of its history with little background flow (whether from baseflow or upstream runoff) to dilute the Kyle WWTP effluent. Presently, summer flows in the section are known to be dominated by treatment plant discharge. Because of this, even though the proposed load requirements may be met by direct water reuse, implementing direct reuse may not be as effective in reducing downstream concentrations. A more thorough investigation, however, using surface runoff simulation results from the SWAT model, is recommended to confirm this.

8.2.2 Approach

Sources of data

The following sources of data were utilized to project the effluent nutrient loads at the Kyle WWTP 5-yr intervals from 2015 to 2035,

1. DMRs (Discharge Monitoring Reports) from Jan 2006 to Dec 2011. The reports obtained from the Kyle WWTP operated by Aqua Texas and contained the following information:
    a. Average monthly discharge rates. These were used to calculate typical average monthly flows for each calendar month as a percentage of the total annual flow. When performing nutrient load projections, the percentages were utilized to distribute the projected annual flows among the 12 calendar months.
    b. Concentration measurements for BOD, TSS and NH3 monitored on a monthly basis. These were used to compute average concentrations and standard deviations for each calendar month to calculate projected nutrient loads.
2. Projections in wastewater inflow: The wastewater inflow projections were computed using population projections for Kyle (Chapter 3), and per capita usage of water which were derived from historical data (Chapter 4). The projections were computed for each 5-year interval beginning in 2015 and ending in 2035. Inflows were provided on an annual average basis.
3. Projections in irrigation demands: The irrigation demand projections were generated by using future projections of the irrigated area that will be supplied by treatment effluent. The projections were computed for each 5-year interval beginning in 2015 and ending in 2035. Inflows were provided on monthly basis (Chapter 5).

Summary of data

The monitoring data obtained from the discharge monitoring records of the Kyle WWTP are provided in Table 8-1 (2006 to 2008) and Table 8-2 (2009 to 2011). The average daily flow, TSS, NH3 and carbonaceous biochemical oxygen demand (CBOD) concentrations as well as the percentage of total annual flow for each month are displayed in the tables.

Table 8-1: List of data from Discharge Monitoring Records for 2006 to 2008.

Month	Year	ADF (mgd)	TSS (mg/l)	NH3 (mg/l)	CBOD (mg/l)	% of total annual flow
1	2006	1.065	12.87	0.39	3.87	7%
2	2006	1.064	18.37	0.33	4.00	7%
3	2006	1.165	8.20	2.26	3.30	7%
4	2006	1.233	6.00	10.10	2.25	8%
5	2006	1.084	8.20	16.32	4.20	7%
6	2006	1.210	23.25	20.58	5.50	8%
7	2006	1.222	13.38	22.93	4.75	8%
8	2006	1.310	12.40	22.01	6.80	8%
9	2006	1.667	37.50	7.93	9.87	10%
10	2006	1.750	7.63	0.31	2.38	11%
11	2006	1.445	9.00	1.28	4.00	9%
12	2006	1.716	9.25	2.43	3.88	11%
1	2007	3.143	10.30	0.31	2.60	12%
2	2007	1.991	5.25	0.14	2.38	7%
3	2007	2.575	3.75	0.30	2.75	10%
4	2007	2.354	9.00	0.70	3.87	9%
5	2007	2.052			3.13	8%
6	2007	2.118	6.50	0.39	2.25	8%
7	2007	3.193	6.75	0.18	2.00	12%
8	2007	2.072	6.00	0.47	2.50	8%
9	2007	1.892	7.63	0.55	4.25	7%
10	2007	1.732	3.70	0.19	4.00	6%
11	2007	1.785	3.55	1.23	3.11	7%
12	2007	1.849	3.38	0.38	4.25	7%
1	2008	1.808	6.13	1.00	4.50	9%
2	2008	1.684	3.44	0.85	2.44	8%
3	2008	1.888	5.57	0.77	2.43	9%
4	2008	1.779	4.00	0.40	2.75	9%
5	2008	1.717	2.00	1.75	2.63	8%
6	2008	1.573	2.57	2.07	2.60	8%
7	2008	1.576	2.00	2.07	2.33	8%
8	2008	1.702	2.38	0.61	2.13	8%
9	2008	1.663	1.56	1.37	2.00	8%
10	2008	1.617	7.00	0.46	2.30	8%
11	2008	1.645	4.28	0.82		8%
12	2008	1.718	3.00	0.82	2.11	8%

Table 8-2: List of data from Discharge Monitoring Records for 2009 to 2011.

Month	Year	ADF (mgd)	TSS (mg/l)	NH3 (mg/l)	CBOD (mg/l)	% of total annual flow
1	2009	1.720	3.00	0.42	3.42	7%
2	2009	1.777	3.75	0.31	2.27	7%
3	2009	1.726	4.25	0.23	2.33	7%
4	2009	2.057	4.33	0.14	3.00	9%
5	2009	1.799	3.09	2.96	2.89	7%
6	2009	1.732	2.66	5.27	2.61	7%
7	2009	1.509	3.10	6.67	2.27	6%
8	2009	1.645	4.50	2.78	2.30	7%
9	2009	1.809	2.60	1.79		8%
10	2009	3.195	3.13	0.11	1.90	13%
11	2009	2.537	2.80	0.49	2.20	11%
12	2009	2.513	3.27	0.13	2.93	10%
1	2010	2.8567	3.9	0.193	2.222	11%
2	2010	3.2276	3.75	0.0662	2.58	12%
3	2010	2.2676	5.7	0.14	2.6	8%
4	2010	2.1682	6.75	0.25	2.75	8%
5	2010	2.1587	11.3	0.137	2.875	8%
6	2010	2.2855	5.7	0.15	2.2	8%
7	2010	2.0939	3.285	0.128	2.142	8%
8	2010	2.0254	8.33	1.45	1.777	7%
9	2010	2.431	4.111	0.1	3.444	9%
10	2010	1.9624	4.5	0.1	3.25	7%
11	2010	1.9565	5.77	0.133	2.44	7%
12	2010	1.6331	6.888	0.177	2.222	6%
1	2011	1.6353	8	0.1	2.5	9%
2	2011	1.6112	8.25	0.162	3.625	8%
3	2011	1.524	8.5	0.36	3.875	8%
4	2011	1.5661	7.875	0.287	2.25	8%
5	2011	1.603	8	0.488	2.666	8%
6	2011	1.541	10.444	0.222	3.111	8%
7	2011	1.537	8.125	2.464	3.875	8%
8	2011	1.567	8.4	0.2	3.2	8%
9	2011	1.556	5.75	0.1	2.25	8%
10	2011	1.521	5.5	0.125	2.125	8%
11	2011	1.5891	6	0.14	3	8%
12	2011	1.9651	7	0.112	4.875	10%

Inflows

Using the data from Table 8-1 and Table 8-2, the average inflows for each calendar month (calculated as percentage of the total annual inflow) were computed and shown in Figure 8-3 below. Average flow percentages are denoted by black dots while the +/-1 standard deviation interval around the mean is denoted by the bars.

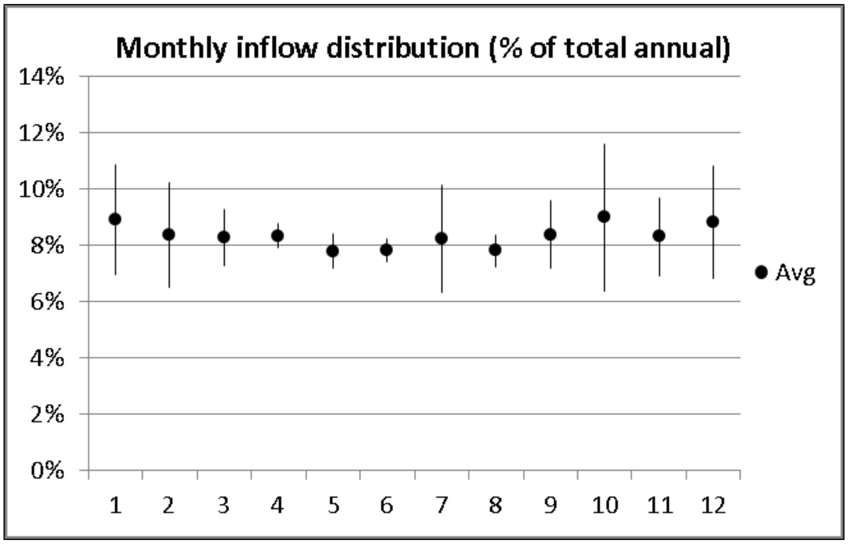


Figure 8-3: Monthly inflow distribution to Kyle WWTP as % of total annual flow.

The graph shows that the wetter months, October to April, tend to have a higher share of the annual inflow than May to September (drier months). The computed average flow percentages will be used in subsequent analyses as "distribution factors" to allocate the projected total annual WWTP inflows to each calendar month for each 5-year scenario.

Nutrients

Using the data from Table 8-1 and Table 8-2, the average TSS, NH3 and BOD concentrations for each calendar month as well the associated standard deviations were calculated and shown in Figure 8-4, Figure 8-5, and Figure 8-6 below. Average flows are denoted by black dots while the +/-1 standard deviation interval are denoted by the bars.

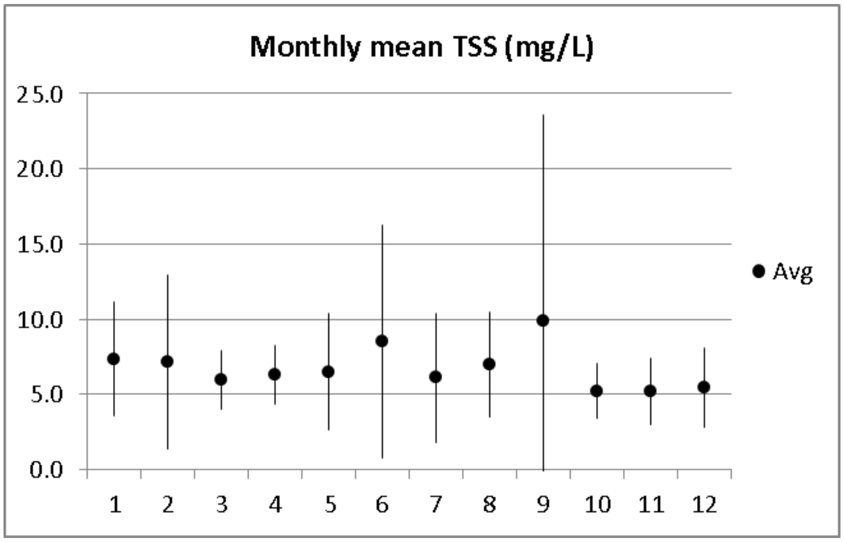


Figure 8-4: Monthly mean TSS concentration (mg/L) in Kyle WWTP effluent.

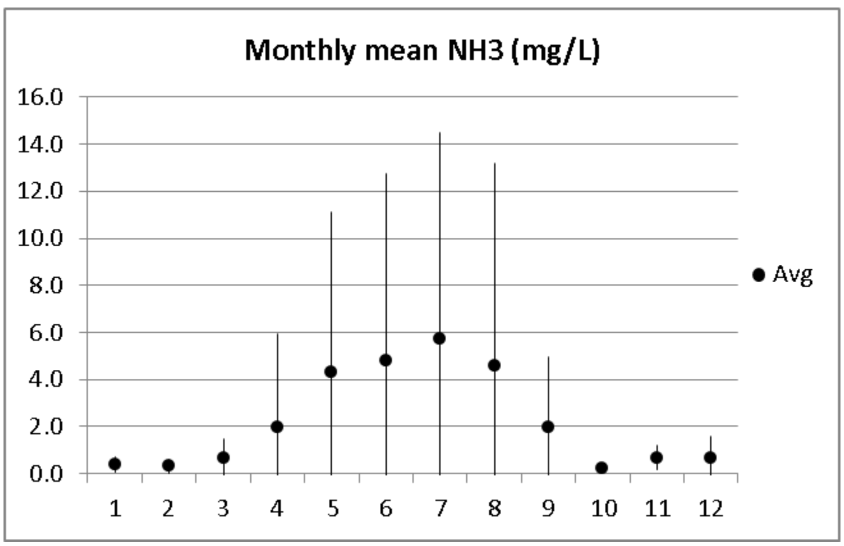


Figure 8-5: Monthly mean NH_3 concentration (mg/L) in Kyle WWTP effluent.

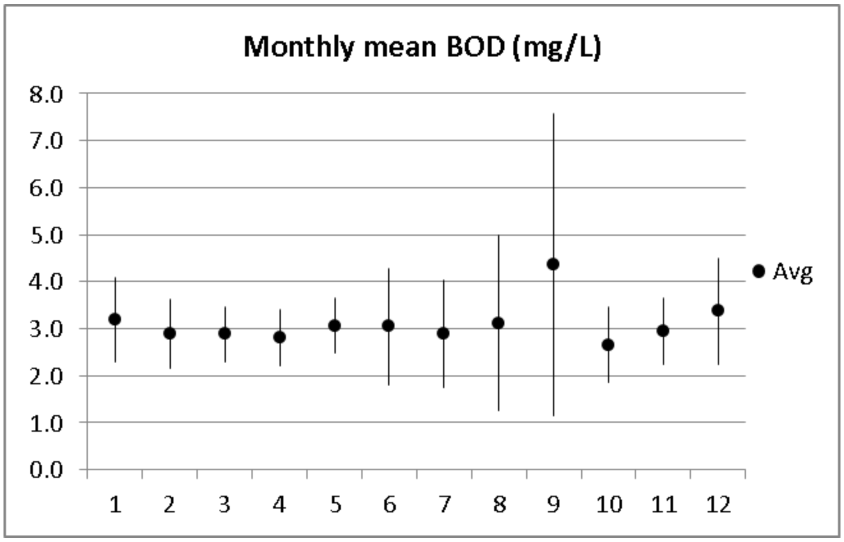


Figure 8-6: Monthly mean BOD concentration (mg/L) in Kyle WWTP effluent.

Projected annual average WWTP inflow and irrigation demand

The projected annual treatment plant inflow and irrigation demands computed by the study team are shown in Figure 8-7 for 2015 to 2035. Each of the 5-year intervals between 2015 and 2035 is considered a scenario for calculating projected nutrient loads. Both the projected WWTP inflows and irrigation demands exhibit steady increases with time.

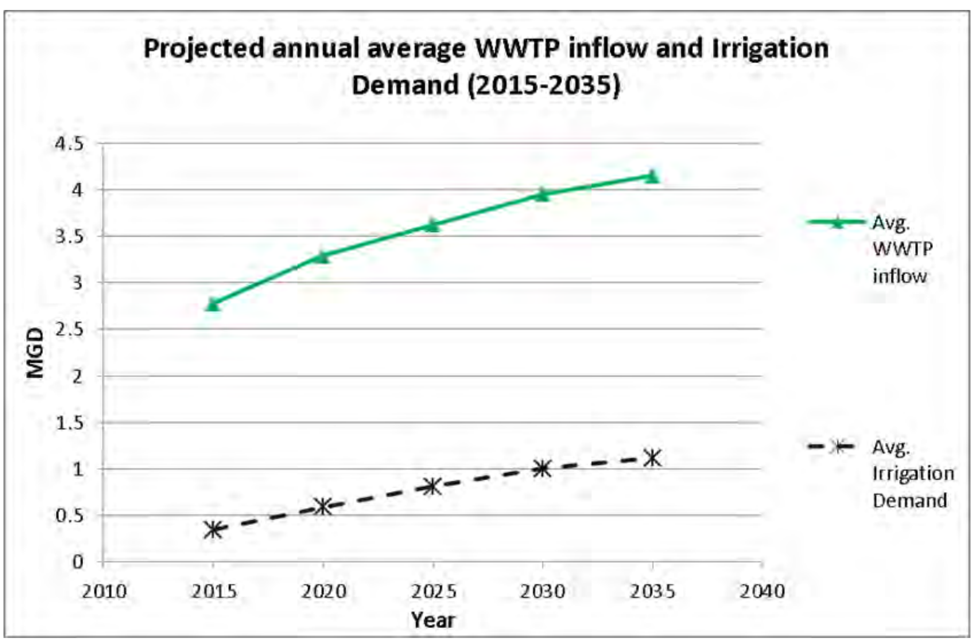


Figure 8-7: Projected annual average WWTP inflow and irrigation demands for 2015 to 2035.

Projected monthly irrigation demand

The projected irrigation demands were computed by the study team on a monthly basis for each 5-year interval scenario for the period 2015 to 2035. Figure 8-8 shows typical monthly irrigation demands expressed as a percentage of the total annual irrigation demand for a given scenario.

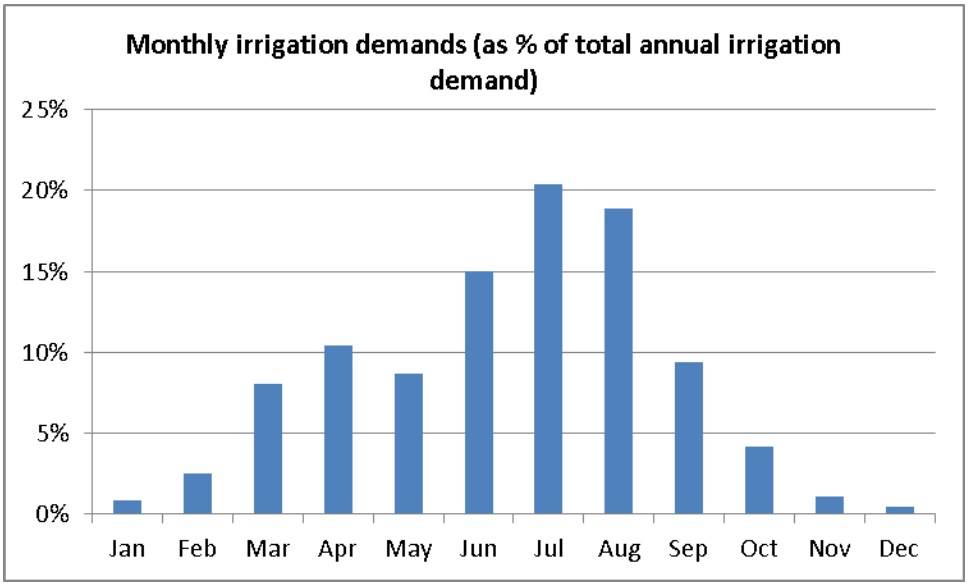


Figure 8-8: Projected monthly irrigation demand expressed as percentage of total annual irrigation demand for 2015 to 2035.

Calculation of projected monthly WWTP discharges and nutrient loads

Within each 5-year scenario, the mean inflows, WWTP discharge and nutrient loads were computed for each calendar month under two conditions:

1. no effluent reuse; and,

2. with effluent reuse.

Resulting loads were than plotted against permitted flows and loads to evaluate the effectiveness of direct reuse in meeting the WPP proposed limits.

Monthly WWTP discharges

For no effluent reuse, the projected WWTP discharge for a given month is calculated as follows:

$Q_{\text{month, scenario, no reuse}} = Q_{\text{WWTP inflow. scenario}} \text{ x } DF_{\text{month}} \text{ x } 12$

Where:

$\boldsymbol{Q}_{\textit{month, scenario, no reuse}}$ = Projected WWTP discharge for given month and scenario (no reuse) (mgd)

$\boldsymbol{Q_{WWTP\ inflow.\ scenario}}$ = Projected annual average WWTP inflow for scenario (mgd) (see Figure 8-7).

$\boldsymbol{DF_{month}}$ = distribution factor for given month (as % of total annual flow) calculated in Figure 8-3.

With effluent reuse, the projected WWTP discharge for a given month is calculated by subtracting the irrigation demand for the given month and scenario from the projected monthly WWTP discharge (under no reuse conditions):

$Q_{month,\ scenario,\ with\ reuse} = Q_{month,\ scenario,\ no\ reuse} - Q_{Irrigation\ demand,\ month,\ scenario}$

Where:

$\boldsymbol{Q_{month,\ scenario,\ with\ reuse}}$ = Projected monthly WWTP discharge for given month and scenario (with reuse)(mgd)

$\boldsymbol{Q_{month,\ scenario,\ no\ reuse}}$ = Projected monthly WWTP discharge for given month and scenario (no reuse) (mgd)

$\boldsymbol{Q_{irrigation\ demand,\ month,\ scenario}}$ = Projected monthly irrigation demand for given month and scenario (mgd) calculated by study team.

Monthly WWTP nutrient loads

The projected effluent loads for a given month, nutrient (e.g. NH3), scenario and condition are calculated by multiplying the WWTP discharge by the average concentration for a given month:

$L_{month,\ nutrient,\ scenario} = Q_{month,\ scenario,\ condition} * C_{nutrient,\ month} * 8.34$

where

$\boldsymbol{L_{month,\ nutrient,\ scenario}}$ = Projected mean effluent load for a given month, nutrient and scenario (lb/d)

$\boldsymbol{Q_{month,\ scenario}}$ = Projected WWTP discharge for given month, scenario (mgd)

$\boldsymbol{C_{nutrient,\ month}}$ = Average concentration for a given month (mg/L).

8.34 = Conversion factor to lb/d

The standard deviation of the load is calculated from the standard deviations of flow and concentration as follows:

$$\sigma_{L_{month,nutrient}} = \left(\sqrt{\left(\frac{\sigma_{Q_{month,,scenario}}}{Q_{month,scenario}}\right)^2 + \left(\frac{\sigma_{C_{nutrient,month}}}{C_{nutrient,month}}\right)^2}\right) L_{month,nutrient}$$

Where:

$\sigma_{L_{month,nutrient}}$ = Standard deviation of projected effluent load for a given month, nutrient and scenario (lb/d)

$L_{month,\ nutrient,scenario}$ = Projected mean effluent load for a given month, nutrient and scenario (lb/d)

$\sigma_{Q_{month,,scenario}}$ = Standard deviation projected WWTP discharge for given month, scenario (mgd)

$Q_{month,scenario}$ = Projected WWTP discharge for given month, scenario (mgd)

$\sigma_{C_{nutrient,month}}$ = Standard deviation of concentration for a given month and nutrient (mg/L)

$C_{nutrient,\ month}$ = average concentration for a given month and nutrient (mg/L).

8.2.3 Results

Projected nutrient loads for 2015 to 2019 (i.e. “2015 scenario”), 2020 to 2024 (i.e. “2020 scenario”), 2025 to 2029 (i.e. “2025 scenario”), 2030 to 2034 (i.e. “2030 scenario”), and 2035 and beyond (i.e. “2035 scenario”) were computed and shown in the following figures in this section. In each figure, the left column contains a series of figures that show the mean monthly effluent loads if no direct reuse is applied (“no reuse”). The right column contains a series of figures that show the monthly effluent loads if direct reuse is applied (“with reuse”). Current permitted loads are shown as a black solid line while WPP proposed permitted loads are shown as a black dashed line for comparison.

At the end of each figure is a table that summarizes the average, minimum and maximum mean monthly effluent loads under “no reuse” and “with reuse” condition. It also counts the number of months out of the year where the WPP proposed limits are not met under each condition.

2015 scenario

Figure 8-9 shows the projected mean monthly flow and nutrient loads for 2015 to 2019 under direct reuse (“with reuse”) and no reuse (“no reuse”) conditions. Table 8-3 provides a summary of the mean monthly flows and loads and compares with the WPP proposed nutrient load limits.

Figure 8-9: Projected mean monthly flow and nutrient loads for 2015 to 2019 under direct reuse and no reuse conditions.

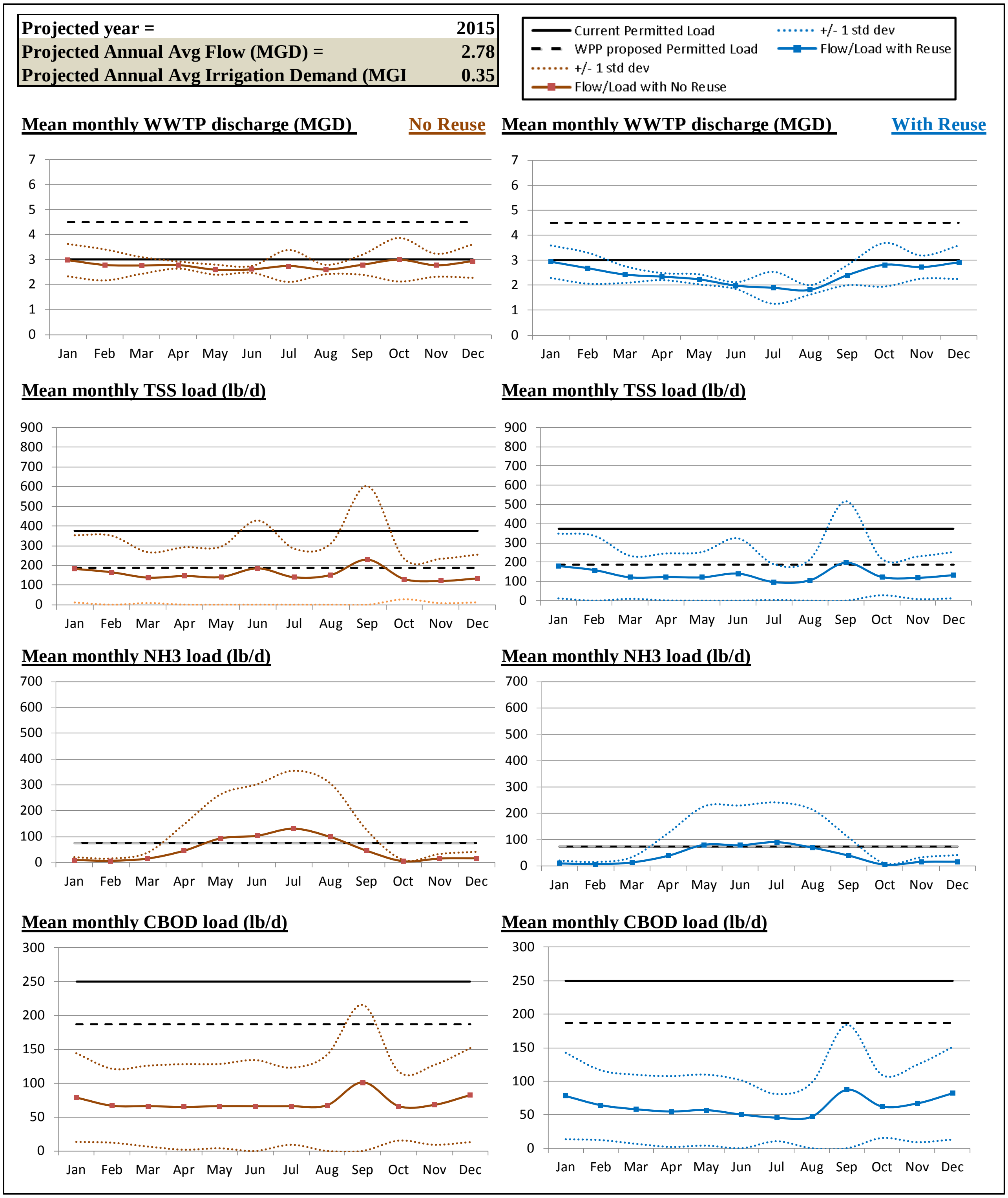


Table 8-3: Summary of project mean monthly flows and nutrient loads for 2015 to 2019 under no reuse and reuse conditions.

	No Reuse				With Reuse			
	Flow (mgd)	**TSS load (lb/d)**	**NH3 load (lb/d)**	**CBOD load (lb/d)**	**Flow (mgd)**	**TSS load (lb/d)**	**NH3 load (lb/d)**	**CBOD load (lb/d)**
AVERAGE Monthly Mean	2.78	155	49	72	2.43	135	39	63
MAX Monthly Mean	3.00	229	131	101	2.94	197	91	87
MIN Monthly Mean	2.60	121	5	65	1.82	96	5	46
WPP proposed permitted load	4.50	187	75	187	4.50	187	75	187
# Months/yr exceeding WPP proposed load	0 mo./yr	1 mo./yr	4 mo./yr	0 mo./yr	0 mo./yr	1 mo./yr	3 mo./yr	0 mo./yr

Observations from 2015 scenario

The projected annual average mean flow is 2.78 mgd and the annual average irrigation demand is 0.35 mgd for 2015 conditions. Without reuse, TSS loads are likely to exceed the WPP proposed loads for about one month out of each year while NH3 loads are likely to exceed four months out of each year. With reuse, TSS loads is likely to exceed the WPP proposed loads one month out of a year while NH3 loads are likely to exceed three months out of a year. Exceedences in NH3 loads under "with reuse" conditions are expected in the summer (May to August) where high average concentrations of ammonia are expected. Neither CBOD loads nor discharge rates are expected to exceed WPP proposed limits for either "with reuse" and "no reuse" conditions for 2015. Because of the relatively low direct reuse rates in this scenario, the resulting load reductions have not yet made significant impact in helping the Kyle WWTP meet the WPP proposed loads.

2020 scenario

Figure 8-10 shows the projected mean monthly flow and nutrient loads for 2020 to 2024 under direct reuse and no reuse conditions. Table 8-4 provides a summary of the mean monthly flows and loads and compares with the WPP proposed nutrient load limits.

Figure 8-10: Projected mean monthly flow and nutrient loads for 2020 to 2024 under direct reuse and no reuse conditions.

Projected year =	**2020**
Projected Annual Avg Flow (MGD) =	**3.29**
Projected Annual Avg Irrigation Demand (MGI	**0.59**

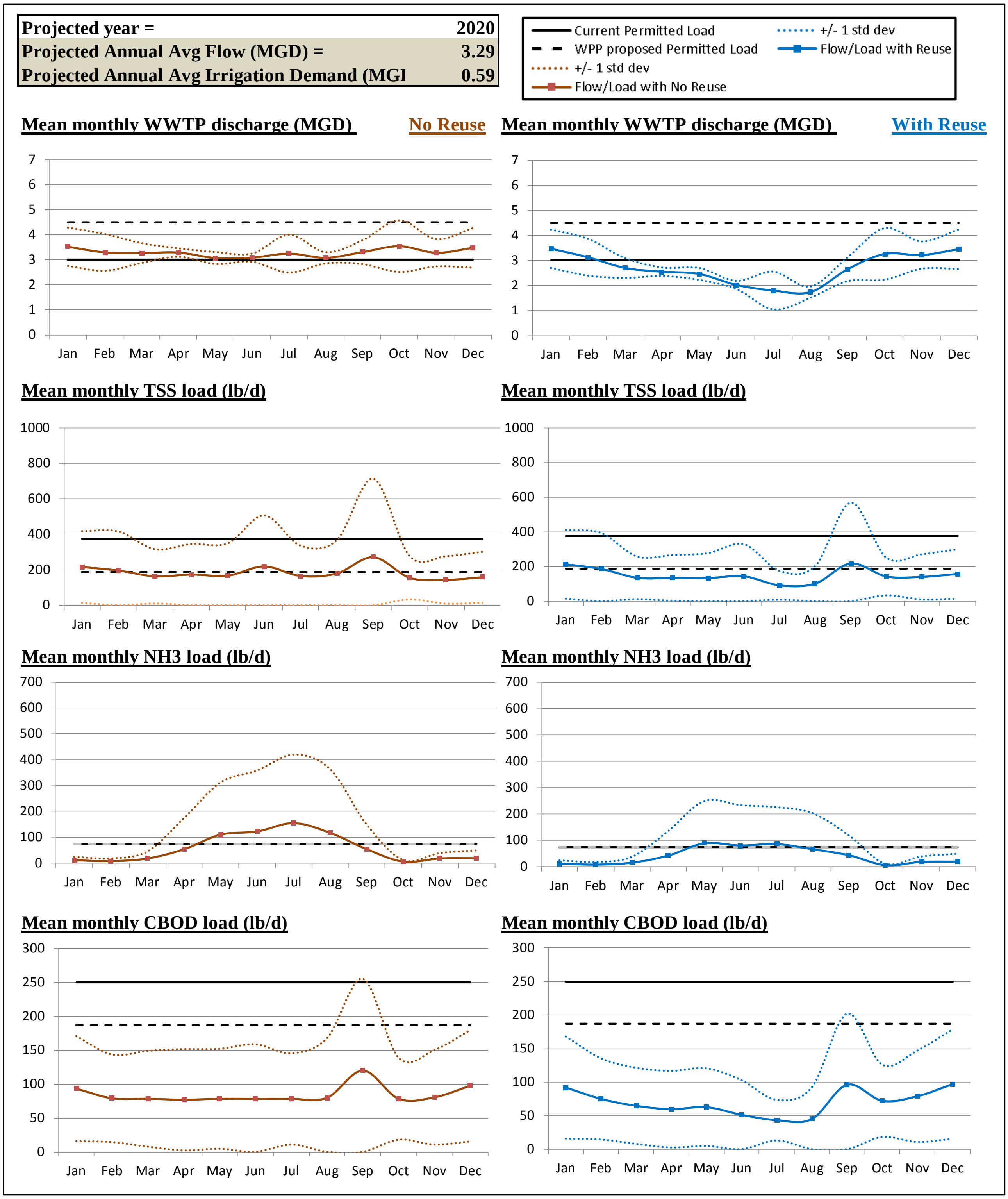


Table 8-4: Summary of project mean monthly flows and nutrient loads for 2020 to 2024 under no reuse and reuse conditions.

	No Reuse				With Reuse			
	Flow (mgd)	**TSS load (lb/d)**	**NH3 load (lb/d)**	**CBOD load (lb/d)**	**Flow (mgd)**	**TSS load (lb/d)**	**NH3 load (lb/d)**	**CBOD load (lb/d)**
AVERAGE Monthly Mean	3.29	184	58	85	2.70	149	40	70
MAX Monthly Mean	3.54	271	155	120	3.47	217	89	97
MIN Monthly Mean	3.07	143	6	77	1.74	91	6	43
WPP proposed permitted load	4.50	187	75	187	4.50	187	75	187
# Months/yr exceeding WPP proposed load	0 mo/yr	4 mo/yr	4 mo/yr	0 mo/yr	0 mo/yr	2 mo/yr	3 mo/yr	0 mo/yr

Observations from 2020 scenario

The projected annual average mean flow is 3.29 mgd and the annual average irrigation demand is 0.59 mgd for 2020 conditions. Without reuse, TSS loads are expected to exceed the WPP proposed loads four months out of a year while NH3 loads are expected to exceed four months out of a year. With reuse, TSS loads are likely to exceed the WPP proposed loads two months out of a year while NH3 loads are likely to exceed three months out of a year. Exceedences in NH3 loads under "with reuse" conditions are more probable in the summer (May to August) where high average concentrations of ammonia are known to occur. Although the number of exceedences for NH3 is the same for both "with reuse" and "no reuse" conditions, the difference in magnitude of the NH3 loads is now significant. The average monthly mean NH3 load for "no reuse" is 58 lbs/d while that for "with reuse" is 40 lb/d - which represents a load reduction of 30%.

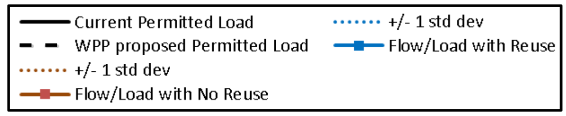
Even with direct reuse, exceedences in TSS loads can occur in January when inflows are high but irrigation demands or low, or in September when high average TSS concentrations are known to occur. Neither CBOD loads nor discharge rates are likely to exceed WPP proposed limits for both "with reuse" and "no reuse" conditions for 2020.

2025 scenario

Figure 8-11 shows the projected mean monthly flow and nutrient loads for 2025 to 2029 under direct reuse and no reuse conditions. Table 8-5 provides a summary of the mean monthly flows and loads and compares with the WPP proposed nutrient load limits.

Figure 8-11: Projected mean monthly flow and nutrient loads for 2025 to 2029 under direct reuse and no reuse conditions.

Projected year =	**2025**
Projected Annual Avg Flow (MGD) =	**3.62**
Projected Annual Avg Irrigation Demand (MGI	**0.81**



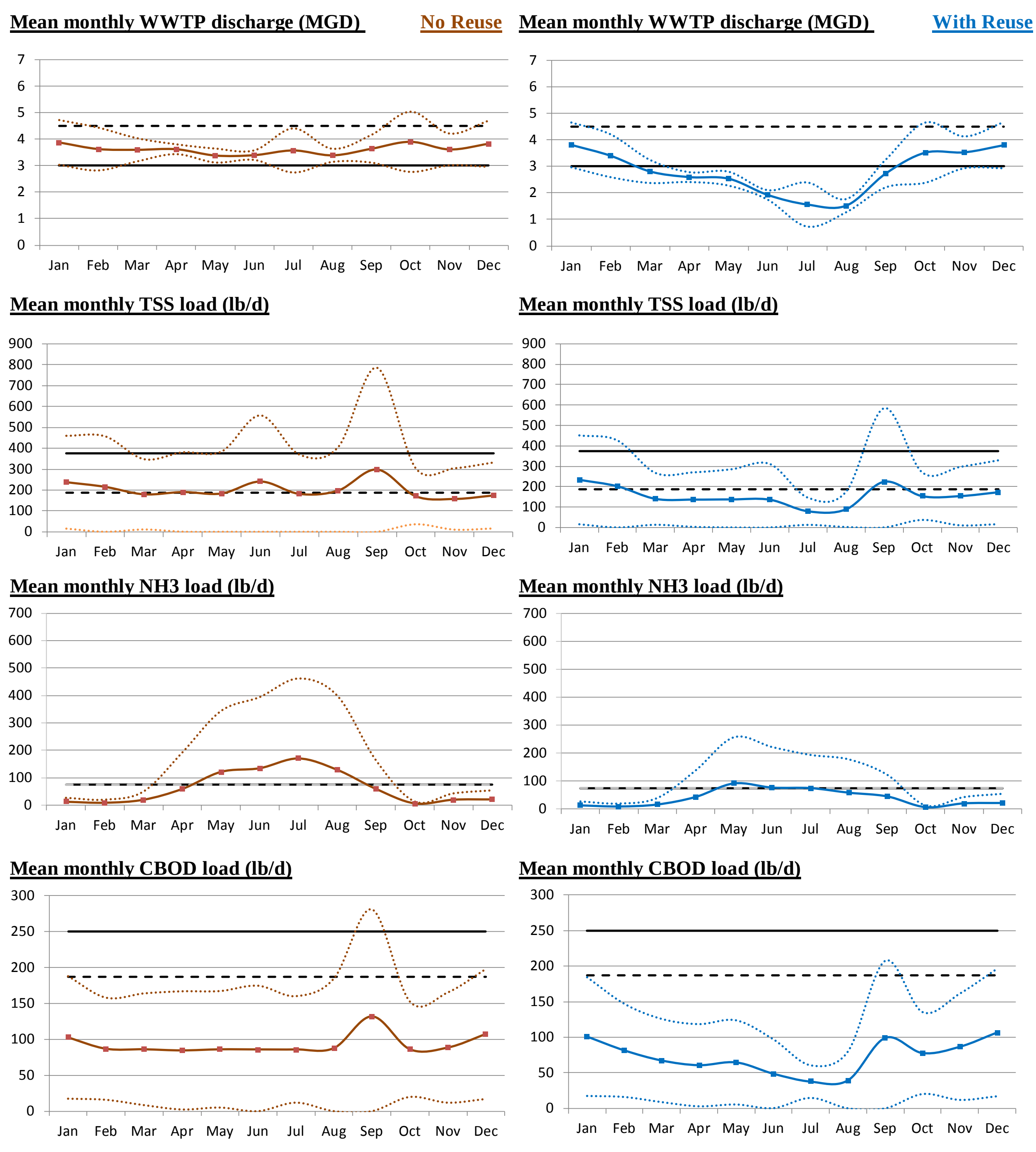


Table 8-5: Summary of project mean monthly flows and nutrient loads for 2025 to 2029 under no reuse and reuse conditions.

	No Reuse				With Reuse			
	Flow (mgd)	**TSS load (lb/d)**	**NH3 load (lb/d)**	**CBOD load (lb/d)**	**Flow (mgd)**	**TSS load (lb/d)**	**NH3 load (lb/d)**	**CBOD load (lb/d)**
AVERAGE Monthly Mean	3.62	202	64	93	2.81	155	39	73
MAX Monthly Mean	3.90	298	171	132	3.81	233	91	107
MIN Monthly Mean	3.38	157	7	85	1.52	79	6	38
WPP proposed permitted load	4.50	187	75	187	4.50	187	75	187
# Months/yr exceeding WPP proposed load	0 mo/yr	6 mo/yr	4 mo/yr	0 mo/yr	0 mo/yr	3 mo/yr	2 mo/yr	0 mo/yr

Observations from 2025 scenario

The projected annual average mean flow is 3.62 mgd and the annual average irrigation demand is 0.81 mgd for 2025 conditions. Without reuse, TSS loads are likely to exceed the WPP proposed loads six months out of a year while NH3 loads are likelihood to exceed four months out of a year. On the other hand, with reuse, TSS loads are expected to exceed the WPP proposed loads three months out of a year while NH3 loads are expected to exceed two months out of a year. Even with direct reuse, exceedences in NH3 loads can still happen in the early summer (May and June) where high average concentrations of ammonia are known to occur. Exceedences in TSS loads under "with reuse" conditions can happen in January and February when inflows are high but irrigation demands or low, or in September when high average TSS concentrations are expected. Neither CBOD loads nor discharge rates are likely to exceed WPP proposed limits for either "with reuse" and "no reuse" conditions for 2025.

2030 scenario

Figure 8-12shows the projected mean monthly flow and nutrient loads for 2030 to 2034 under direct reuse and no reuse conditions. Table 8-6 provides a summary of the mean monthly flows and loads and compares with the WPP proposed nutrient load limits.

Figure 8-12: Projected mean monthly flow and nutrient loads for 2030 to 2034 under direct reuse and no reuse conditions.

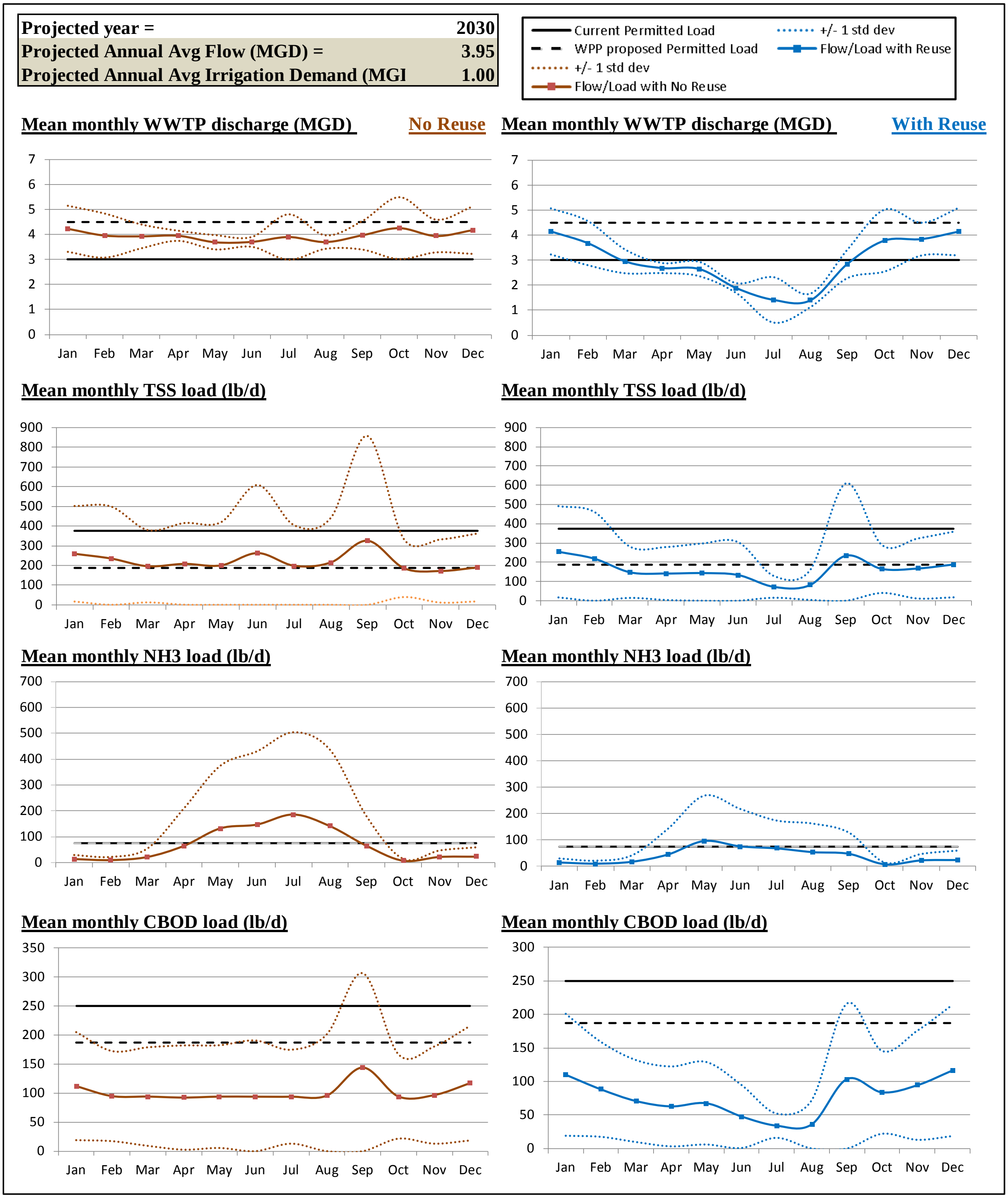


Table 8-6: Summary of project mean monthly flows and nutrient loads for 2030 to 2034 under no reuse and reuse conditions.

	No Reuse				With Reuse			
	Flow (mgd)	TSS load (lb/d)	NH3 load (lb/d)	CBOD load (lb/d)	Flow (mgd)	TSS load (lb/d)	NH3 load (lb/d)	CBOD load (lb/d)
AVERAGE Monthly Mean	3.95	220	70	102	2.95	162	39	76
MAX Monthly Mean	4.26	325	186	144	4.15	254	95	116
MIN Monthly Mean	3.69	172	8	92	1.39	72	7	34
WPP proposed permitted load	4.50	187	75	187	4.50	187	75	187
# Months/yr exceeding WPP proposed load	0 mo/yr	10 mo/yr	4 mo/yr	0 mo/yr	0 mo/yr	4 mo/yr	2 mo/yr	0 mo/yr

<u>Observations from 2030 conditions</u>

The projected annual average mean flow is 3.95 mgd and the annual average irrigation demand is 1.00 mgd for 2030 conditions. Without reuse, TSS loads are likely to exceed the WPP proposed loads nine months out of a year while NH3 loads are likely to exceed five months out of a year. On the other hand, with reuse, TSS loads are likely to exceed the WPP proposed loads four months out of a year while NH3 loads are likely to exceed three months out of a year. Exceedences in NH3 loads under “with reuse” conditions are more probable in the early summer (May and June) where high average concentrations of ammonia are known to occur. Exceedences in TSS loads under “with reuse” conditions can occur in December, January and February when inflows are high but irrigation demands are low, or in September when high average TSS concentrations are known to occur. Neither CBOD loads nor discharge rates are likely to exceed WPP proposed limits for both “with reuse” and “no reuse” conditions for 2030.

2035 scenario

Figure 8-13shows the projected mean monthly flow and nutrient loads for 2035 and after under direct reuse and no reuse conditions. Table 8-7 provides a summary of the mean monthly flows and loads and a comparison with the WPP proposed nutrient load limits.

Figure 8-13: Projected mean monthly flow and nutrient loads for 2035 and after under direct reuse and no reuse conditions.

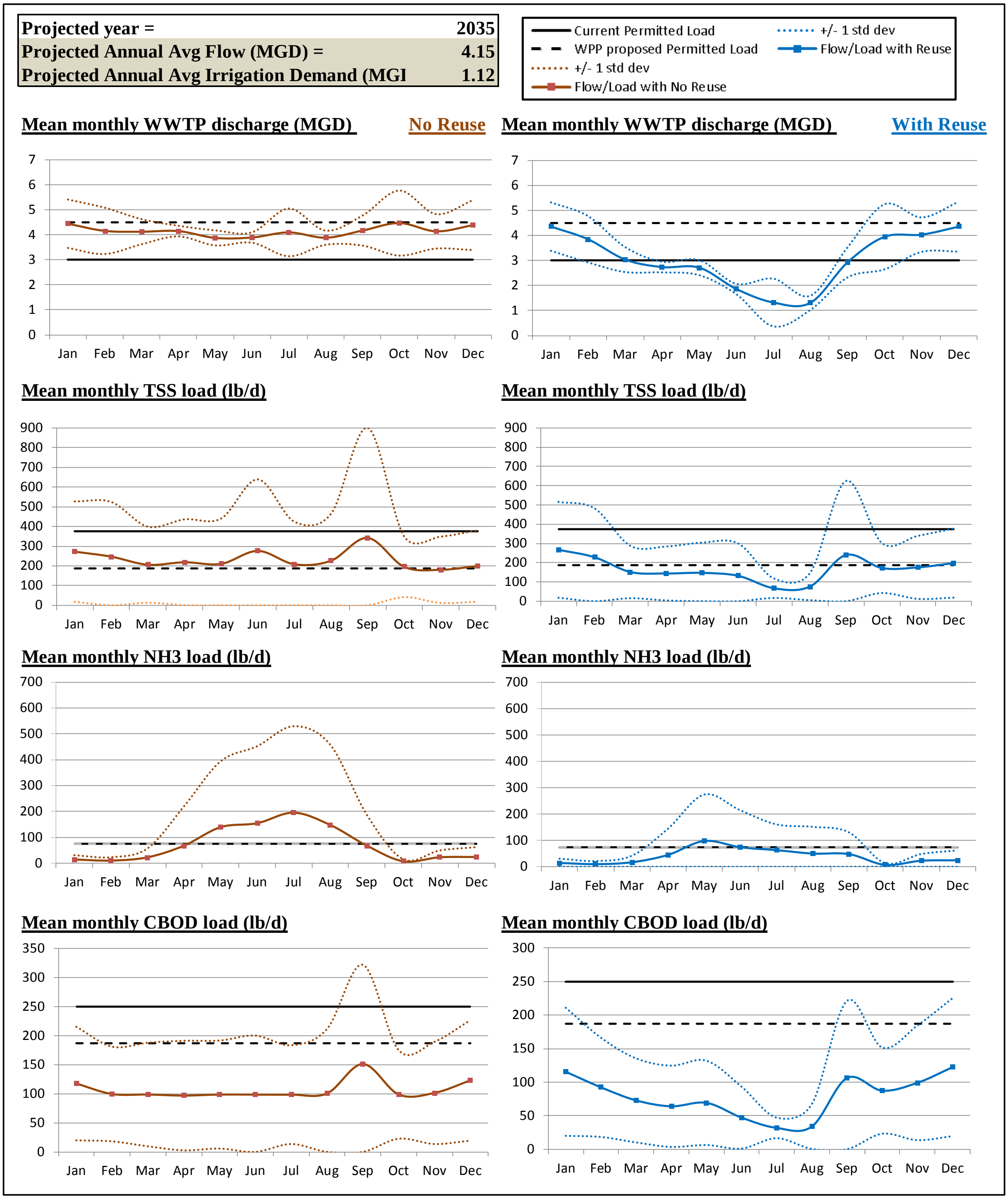


Table 8-7: Summary of project mean monthly flows and nutrient loads for 2035 and after under no reuse and reuse conditions.

	No Reuse				With Reuse			
	Flow (mgd)	TSS load (lb/d)	NH3 load (lb/d)	CBOD load (lb/d)	Flow (mgd)	TSS load (lb/d)	NH3 load (lb/d)	CBOD load (lb/d)
AVERAGE Monthly Mean	4.15	232	73	107	3.04	167	39	78
MAX Monthly Mean	4.47	342	196	151	4.36	267	98	122
MIN Monthly Mean	3.88	180	8	97	1.31	67	7	32
WPP proposed permitted load	4.50	187	75	187	4.50	187	75	187
# Months/yr exceeding WPP proposed load	0 mth/yr	11 mth/yr	4 mth/yr	0 mth/yr	0 mth/yr	4 mth/yr	1 mth/yr	0 mth/yr

<u>Observations from 2035 conditions</u>

The projected annual average mean flow is 4.15 mgd and the annual average irrigation demand is 1.12 mgd for 2035 conditions. Without reuse, TSS loads are expected to exceed eleven months out of a year, and NH3 loads are expected to exceed four months out of a year. On the other hand, with reuse, TSS loads are expected to exceed the WPP proposed loads four months out of a year while NH3 loads are expected to exceed one month out of a year. The decline in exceedences in NH3 loads under “with reuse” conditions from 2030 to 2035 is due to the increased reuse rates. Exceedences in TSS loads under “with reuse” conditions can occur in December, January and February when inflows are high but irrigation demands or low, or in September when high average TSS concentrations are known to occur. CBOD loads are not likely to exceed WPP proposed limits for either “with reuse” and “no reuse” conditions for 2035.

8.2.4 Discussion

Observed trends in the nutrient load projections

Based on comparison of the projected nutrient loads with the WPP’s proposed load limits, NH3 and TSS effluent loads are more likely to cause concerns than CBOD and discharge from an exceedence stand point. High NH3 effluent loads are expected during the summer months because of the high average concentration of effluent NH3 that have been observed historically. There were two episodes between 2006 and 2011 where NH3 levels in the Kyle WWTP effluent were unusually high. The first episode was from April to Sept, 2006 when NH3 concentrations averaged 18 mg/L. The second episode was from May to August, 2009 when concentrations averaged at 4.4 mg/L. These observations have the effect of raising the estimated NH3 concentrations during the summer months. Fortunately, because irrigation demands are higher during the summer than other months, direct reuse is effective in reducing the high summer NH3 loads. It is observed that as irrigation demands increase with each successive 5-year scenario, the number of months per year that are likely to exceed the WPP proposed NH3 load limits decreases. To illustrate: in 2015, the expected number of months with NH3 load exceedences is 3 months/year with direct reuse. In 2035, this number declines to 1 month/year.

Among the new effluent standards proposed by the WPP, TSS may be the most stringent. This is because the average TSS concentrations are presently around 6.7 mg/L in the Kyle WWTP effluent – which is already above the proposed TSS concentration limit of 5 mg/L. The current permitted TSS concentration limit is 15 mg/L. Satisfying the new WPP limits will be challenging in the wet winter months (Dec to Feb) when irrigation demands are low and direct reuse will be less effective.

Current CBOD effluent concentrations from the Kyle WWTP are very low (averaging about 3.1 mg/L) and are unlikely to cause exceedences when permitted limits are changed from current levels of 15 mg/L to the WPP proposed level of 5 mg/L.

The impact of reuse of Kyle WWTP effluent on watershed water quality was evaluated by calculating future nutrient loads discharged into Plum Creek under two conditions: 1) with direct reuse and 2) no reuse. Future loads were computed based on historical nutrient measurements, projected changes in wastewater inflow, and projected changes in irrigation demands around the Kyle for each 5-year interval from 2015 to 2035. The resultant loads under the two conditions were then compared against WPP proposed permitted loads (which are based on the WPP SWAT watershed modeling) to evaluate the effectiveness of direct reuse in meeting future watershed water quality goals.

Based on the projections, NH3 and TSS effluent loads are most likely to cause concerns under the WPP's proposed nutrient load limits from an exceedence standpoint. High NH3 effluent loads are expected during the summer months due to the high historical concentrations of observed effluent NH3 concentrations. Fortunately, because irrigation demands are higher during the summer, direct reuse can be effective in reducing the magnitude of NH3 loads, and as such can be effective in limiting potential exceedences of WPP proposed limits.

The WPP's proposed TSS limit may be the most stringent among the various proposed limits. This is because even though the current average TSS concentration in the effluent (6.7 mg/L) is much lower than the current permit limit of 15 mg/l, it is higher than the proposed limit (5 mg/L). It was observed that direct reuse can help reduce TSS loads in the summer but may not be effective during the wet winter months (Dec to Feb) when irrigation demands are low.

As mentioned earlier in this report, the key limitation of this study is that it primarily addresses how load reductions proposed by the WPP may be achieved with direct reuse. But load reductions will affect concentrations in the streams in the watershed only if a significant background flow is available to dilute the WWTP discharge. However, since according to the WPP, the northern, upstream section of Plum Creek is intermittent with little background flow (whether from baseflow or upstream runoff), direct reuse alone may not affect downstream concentrations. Additional investigation using surface runoff simulation results from the Plum Creek WPP SWAT model is recommended for confirmation.

8.2.5 Potential Environmental Effects of the Project

The previous sections describe how potential environmental risks to the aquatic environment of the Site 1 impoundment will be analyzed as part of the process of obtaining an amendment to the city's TPDES discharge permit and how the reduction of WWTP effluent resulting from developing a water reuse system will reduce the nutrient load in the Plum Creek watershed.

The planning level of analysis conducted in this study did not reveal potentially significant environmental effects or risks associated with the project. The potentially significant environmental features of the area, including wetlands and habitat for protected species, will be identified through field surveys during the project design phase in order for the project to be designed to avoid adversely impacting those features.

Potentially significant impacts on public health and safety related to construction will be addressed during the project design with the inclusion of traffic control and worker and public safety plans as part of the construction plans. The project design will also include development of a construction site storm water pollution prevention plan (SWPPP) to minimize the impacts of construction phase erosion on local waterways.

Other potential environmental effects of the project are discussed in the following sections:

In-stream Flow Reduction

The rapid population growth in Kyle has significantly increased the sustained flow of the upper reaches of Plum Creek. Plum Creek is an intermittent stream in which the base flow has been artificially augmented by the increase in the city's wastewater effluent. The city's discharge of treated effluent should not be confused with the condition in many effluent-dominated streams in Texas where treated effluent is a return flow of water diverted within the watershed of the receiving stream.

Instead, the city's effluent creates an artificial base flow in Plum Creek from a potable water supply of groundwater pumping and the importation of surface water from Canyon Lake. In addition to reducing the volume of nutrients discharged to the watershed, diversion of effluent to supply a reclaimed water system could reduce the volume of effluent discharged to Plum Creek. Considering the 2010 Kyle WWTP discharge to Plum Creek as a basis for comparison, a comparison of the projected wastewater discharge and reclaimed water demands indicate that the reclaimed water project would not reduce the instream flow of Plum Creek.

Table 8-8: Kyle WWTP Discharge to Plum Creek

Year	WW Effluent (AF)	Reclaimed Water (AF)	Net Discharge to Plum Creek (AF)	% of 2010 Discharge
2010	2,542.7		2,542.7	100.0%
2015	3,114.0	354.9	2,759.1	108.5%
2020	3,685.3	660.5	3,024.8	119.0%
2025	4,054.9	978.4	3,076.5	121.0%
2030	4,424.6	1,158.1	3,266.5	128.5%
2035	4,648.6	1,325.4	3,323.2	130.7%

Environmental Compliance Measures

Specific environmental regulation compliance measures will be completed during the design and construction phases of the recommended project. These include an environmental information document for state loans, an archeological assessment of the project route, identification of potential habitats for threatened, rare, or endangered species along the project route and a delineation of wetlands and waters of the U.S. However, no studies or detailed assessments have been initiated prior to, or as a result of this feasibility study.

Effects on Regional Water Supply and Water Quality

As discussed in Section 8.2.4, the proposed project has the potential of reducing the total volume of nutrients discharged to Plum Creek. Any effect of the proposed reclaimed water project on water quality in the Guadalupe River watershed would be part of a cumulative effort to reduce nutrient loads. In terms of hydrology, water quality, and hazardous materials impacts, implementation of best management practices (BMPs) would minimize any potential impacts to receiving waters and groundwater. Typical BMPs include scheduling or limiting activities to certain times of the year based on hydrologic considerations, installing sediment barriers such as silt fence and fiber rolls, and maintaining equipment and vehicles used for construction in good condition.

The proposed project would provide a reclaimed water supply to municipal, residential, and commercial uses in the study area. The reclaimed water would increase the reliability of supplies for landscape irrigation and industrial cooling. As a reliable alternative water supply, reclaimed water would reduce some of the concerns that surround the potential of future drought conditions. During times of drought, or as area population increases, use of reclaimed water for landscape irrigation would help reduce demand on existing potable water supplies and save that potable water for municipal users.

9 Legal and Institutional Considerations

9.1 Regulatory Considerations

The use of reclaimed water is regulated by the TCEQ under Title 30 of the Texas Administrative Code, 30 TAC §210 (Chapter 210). The regulations provide for the quality criteria, design, and operational requirements for the beneficial use of reclaimed water. The use of reclaimed water requires notification and approval of the TCEQ under Chapter 210, with specific responsibilities assigned to the reclaimed water producer, the reclaimed water provider, and the reclaimed water user. The specific responsibilities of each party as designated by the Chapter 210 regulations are summarized in the following points.

The responsibilities of the reclaimed water producer include ensuring that the quality of the reclaimed water that leaves the treatment process meets the minimum quality prescribed by state regulations, and for sampling, analyzing, and reporting the quality of reclaimed water produced.

The reclaimed water provider is responsible for the delivery of reclaimed water to the user that meets the minimum quality prescribed by state regulations and for maintaining records of the volume and quality of reclaimed water delivered to the user. The reclaimed water provider must notify the TCEQ of proposed direct reuse and obtain written approval to provide reclaimed water. Minimum notification requirements include a detailed description of the intended use, a clear indication of the means for regulatory compliance, evidence of the provider's authority to terminate noncompliant reclaimed water use by contract or other binding agreement, an operation and maintenance plan, and a description of the reclaimed water quality.

The reclaimed water user is responsible for the proper use of reclaimed water.

9.1.1 Record Keeping

The reclaimed water provider is responsible for maintaining records associated with the delivery, use, and quality of reclaimed water. The reclaimed water provider must maintain records of notifications to TCEQ of reclaimed water projects, copies of contracts with each user, volumes of reclaimed water delivered, and analyses of reclaimed water quality. The reclaimed water provider must submit monthly reports to TCEQ the volume of reclaimed water delivered to a user or provider and the quality of water delivered.

With the existing reclaimed water system owned and operated by Plum Creek Golf Course (PCGC), the City of Kyle is the reclaimed water producer and PCGC is both the provider and user.

9.1.2 Type I Reclaimed Water Use

The Chapter 210 rules regulate the quality, place and manner of use of effluent from wastewater treatment facilities to protect public health by minimizing risks of infection and disease transmission. Depending on the potential for human contact, Texas regulations provide for two types of reclaimed water. Type I reclaimed water can be used where human contact with the reclaimed water is likely. The potential uses for Type I reclaimed water include (30 TAC §210.32):

- Residential irrigation, including landscape irrigation at individual homes.
- Urban uses, including irrigation of public parks, golf courses with unrestricted public access, school yards, or athletic fields.
- Use of reclaimed water for fire protection, either in internal sprinkler systems or external fire hydrants.
- Irrigation of food crops where the applied reclaimed water may have direct contact with the edible part of the crop, unless the food crop undergoes a pasteurization process.
- Irrigation of pastures for milking animals.
- Maintenance of impoundments or natural water bodies where recreational activities, such as wading or fishing, are anticipated even though the water body was not specifically designed for such a use.
- Toilet or urinal flush water.
- Other similar activities where there is the potential for unintentional human exposure.

9.1.3 Type II Reclaimed Water Use

Type II reclaimed water can be used where human contact with the reclaimed water is unlikely. The potential uses for Type II reclaimed water include (30 TAC §210.32):

- Irrigation of sod farms, silviculture, limited access highway rights of way, and other areas where human access is restricted or unlikely to occur. The restriction of access to areas under irrigation with reclaimed water could include the following:
- The irrigation site is considered to be remote.
- The irrigation site is bordered by walls or fences and access to the site is controlled by the owner/operator of the irrigation site.
- The irrigation site is not used by the public during the times when irrigation operations are in progress. Such sites may include golf courses, cemeteries, and landscaped areas surrounding commercial or industrial complexes. The "syringing" or "wetting" of greens and tees on golf courses shall be allowable under Type II so long as the "syringing" is done with hand-held hoses as opposed to automatic irrigation equipment. The public need not be excluded from areas where irrigation is not taking place. For example, irrigation of golf course fairways at night would not prohibit the use of clubhouse or other facilities located a sufficient distance from the irrigation.
- The irrigation site is restricted from public access by local ordinance or law with specific standards to achieve such a purpose.

- Irrigation of food crops where the reclaimed water is not likely to have direct contact with the edible part of the crop, or where the food crop undergoes pasteurization prior to distribution for consumption.
- Irrigation of animal feed crops other than pasture for milking animals.
- Maintenance of impoundments or natural water bodies where direct human contact is not likely.
- Soil compaction or dust control in construction areas where application procedures minimize aerosol drift to public areas.
- Cooling tower makeup water. Use for cooling towers which produce significant aerosols adjacent to public access areas may have special requirements.
- Irrigation or other non-potable uses of reclaimed water at a wastewater treatment facility.
- Type I reclaimed water may be utilized for any of the Type II uses identified above.

9.1.4 Reclaimed Water Quality Standards

The following summarizes the quality parameters contained in 30 TAC §210.33.

	Type I (30-day average)	**Type II (30-day average)**
BOD5 or CBOD5	5 mg/l	20 mg/l
Turbidity	3 NTU	15 mg/l
Fecal Coliform	20 CFU/100 ml*	200 CFU/100 ml*
Fecal Coliform (not to exceed)	100 CFU/100 ml**	800 CFU/100 ml**
	* geometric mean	** single grab sample

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9.2 Reclaimed Water System Operations

The design and operation of a reclaimed water system is regulated through Design Criteria for Wastewater System (30 TAC§217) and Use of Reclaimed Water (30 TAC §210). The design, construction and operation of a reclaimed water conveyance system is addressed through 30 TAC§217.51. Design criteria for reclaimed water systems (§217.69) requires signs and color coding of pipes and appurtenances to indicate the presence of non-potable water and requires a minimum separation distance of 4.0 feet from potable water pipes. Pipe for non-potable systems are required to have a minimum pressure rating of 150 psi.

Purple pipe is required for all reclaimed water piping as an element of the city's cross-connection control program. Chapter 210 regulations require that hose bibs, faucets, and exposed piping (interior and outside) used for reclaimed water must be painted purple and labeled as non-potable. However, it is typically not necessary to replace buried piping that will be converted from potable to non-potable water provided all visible features, such as irrigation heads, and valve boxes, are changed to purple (Centeno, 2012).

Runoff of reclaimed water to waters of the state is to be prevented by the reclaimed water user (30 TAC §210.24), primarily by avoiding excessive irrigation and avoiding storage in ponds directly influenced by storm water runoff. Applying reclaimed water at the proper rate for the existing soil and atmospheric conditions is the principal means of avoiding runoff from irrigated sites. Maintenance of the irrigation system to correct sprinkler head and controller malfunctions is also an essential part of avoiding runoff from irrigated sites.

9.2.1 Non-Potable Water

The proposed storage of reclaimed water in the Plum Creek Site 1 impoundment is feasible under current regulations, but would require applications to amend certain permitted conditions and uses. Under current regulations (30 TAC§210.22e), ponds for storage of reclaimed water must be located to prevent discharges to waters of the state by diverting runoff away from the pond. Otherwise, the discharge must be permitted through an amendment of the TPDES permit. Amendment of the city's TPDES permit may be considered a major amendment and could require biomonitoring as part of the application process to identify potential changes in receiving water quality.

For any water to be withdrawn from Plum Creek Site 1 and used for irrigation, the use must be changed from recreational use to municipal use through application to the TCEQ. Under current regulations, storing reclaimed water in Plum Creek Site 1 will change the designation of the water from reclaimed water to raw water.

9.3 Water Rights Considerations

As the population of the state and nation grows, wastewater effluent makes up an increasing percentage of the water in streams and rivers. Some estimates suggest that as much as sixty percent of the water that is distributed through a municipal water system for use as potable water is returned to Texas' streams and rivers as wastewater effluent (TWCA, 2004). These return flows can become part of the water to be appropriated from the watercourse or otherwise considered to be an important part of maintaining the aquatic environment. To appreciate the relationship between water reuse and water rights requires a review of some certain aspects of water law in Texas. It is important to note that once water is returned to a watercourse, it is considered waters of the state and subject to appropriation by the state.

The regulatory definition of reuse is (30 TAC §297.1) is *the authorized use for one or more beneficial purposes of use of water that remains unconsumed after the water is used for the original purpose of use and before that water is either disposed of or discharged or otherwise allowed to flow into a watercourse, lake, or other body of state-owned water*. Reuse projects are defined in terms of either indirect or direct reuse. Direct reuse is known as "flange-to-flange" reuse in that treated effluent is drawn from the plant before it is discharged to a watercourse. Indirect reuse is when treated effluent is captured downstream from the point at which it was discharged to a watercourse. The diversion and indirect reuse of return flows utilizing from surface water sources is considered to be a new appropriation of state water. The indirect reuse of return flows that are the product of groundwater has not been considered to be a new appropriation.

The fundamental difference between direct and indirect water reuse in Texas is that direct reuse does not involve retrieving effluent from a stream or waterway, and thus avoids a new state surface water permitting process. Indirect reuse, on the other hand, does involve a permitting process that may consider the potential negative impacts on downstream water rights holders whose water rights may be based on an assumed reliability or continuation of return flows. Direct reuse, however, involves diversion of effluent for beneficial reuse without being released to a stream or waterway. The Texas Water Code provides the basis for utilities to reuse water without additional water rights permitting until that water is discharged from the wastewater treatment plants:

> *Except as specifically provided otherwise in the water right, water appropriated under a permit, certified filing, or certificate of adjudication may, prior to its release into a watercourse or stream, be beneficially used and reused by the holder of a permit, certified filing, or certificate of adjudication for the purposes and locations of use provided in the permit, certified filing, or certificate of adjudication. Once water has been diverted under a permit, certified filing, or certificate of adjudication and then returned to a watercourse or stream, however, it is considered surplus water and therefore subject to reservation for instream uses or beneficial inflows or to appropriation by others unless expressly provided otherwise in the permit, certified filing, or certificate of adjudication.* [Texas Water Code 30 §11.046(c)]

But if the underlying water right contains limitations on the return of unused water, the reuse of water, either by direct or indirect reuse, can be limited (30 TAC§297.45(a)).

9.3.1 Return Flows and Environmental Flows

Return flows are the portion of diverted waters of the state that are not consumed and are returned to a watercourse. Historically, the regulation of return flows has been limited to water quality standards established by the state. But since the passage of Senate Bill 1, the role of return flows in the aquatic environment of a watershed has become a consideration in the indirect reuse permitting process. Presently, since no surface water permitting process is required for direct reuse projects, environmental flows are not a regulatory consideration in defining direct reuse projects. However, the passage of Senate Bill 3 has established processes for each river basin in Texas to develop environmental flow standards specifying flow requirements to maintain a sound ecological environment at various locations within the river basins, as well as estuarine flow requirements for Texas' coastal estuarine systems. Such standards have been developed and adopted for the Sabine, Neches, Trinity, San Jacinto, Colorado, Lavaca, Guadalupe, and San Antonio river basins, and are in the process of being developed elsewhere.

The development of such environmental flow standards has largely been based on statistical analyses of historic hydrologic data in the component watersheds comprising these river basins. Depending upon the watershed and the process employed by the stakeholders and their scientific experts, the historic period of streamflow analyzed may be from conditions in the early 1900's through recent hydrologic streamflow conditions. It is important to recognize that these historic flows include varying levels of historic return flows. As such, the specified environmental flow criteria within the standard may include an implicit assumption of some level of return flows. Thus, the adopted environmental flow criteria may potentially impact the availability and reliability of indirect reuse water in a particular watershed.

9.4 Interagency Cooperation

A summary of the groundwater regulations in the Kyle area was prepared by the BSEACD staff (Appendix M). This technical memorandum provides an overview of and discussion of requirements and their potential to affect the implementation of the project.

Through the enabling legislation (SB 289, 55th Texas Legislature), the Plum Creek Conservation District (PCCD) was created by the Texas Legislature in 1957 for managing flood control in Hays and Caldwell Counties. PCCD is responsible for the operation, maintenance, and management of the NRCS dam for Plum Creek Site 1. Flood control dams built within the boundaries of the district with funding from the NRCS are maintained by PCCD using a $0.02 tax levy on property within the district. The purpose and status of this feasibility study was presented to the PCCD board of directors on May 15, 2012. While the PCCD is not granted jurisdiction over water impounded at Site 1, its cooperation is needed by the city for development of a management plan that will allow for adjustment of the storage level to accommodate maintenance of the dam.

The water rights to the impoundment were acquired by the Plum Creek HOA, Inc. in December 2004 under Water Right No. 5839 (Appendix I). Storage of reclaimed water at the Site 1 impoundment begins with addressing any of the PCCD and NRCS regarding operation and maintenance of the dam. Any discharge of reclaimed water to the impoundment under an amendment to the city's TPDES discharge permit will provide a constant level for the impoundment at or below the elevation for conservation storage. Access to water stored in the impoundment for irrigation or any other municipal use will require that the water right to the impoundment be obtained by the city and amended to allow the stored water to be used for municipal uses.

10 Reclaimed Water Utility Implementation Plan

The objective of this study is to evaluate the feasibility of implementing a reclaimed water utility for public and private uses. Development of an expanded reclaimed water system will involve the development of viable alternatives for capital funding, implementation of appropriate policies and procedures and adoption or modification of existing ordinances. The development of a reclaimed water utility will build on the experience of the Plum Creek Golf Course system, but will necessarily develop an organization and process needed to establish the management, operation, maintenance, and capacity for expanding the system to become a reclaimed water utility.

A formal commitment by the City of Kyle to pay for the construction and operation of a reclaimed water system cannot be made without adoption of a plan for financing and construction is incorporated into the city's capital improvements plan. A firm plan for funding the construction costs has not yet been developed by the city, but a complete, detailed financial capability analysis will be provided to Reclamation and TWDB prior in advance of securing federal or state participation in the proposed project.

This section presents a summary of potential funding opportunities for developing a reclaimed water utility, and a discussion of the administrative issues to be addressed as part of reclaimed water implementation. Implementation of the reclaimed water utility can occur in phases to take advantage of the full capacity of the existing system and to allow time for the ownership and operation of the system to transition from a single user to a multiple user system. The actual scope and timing of each phase will depend on development of irrigation facilities to use the reclaimed water and the availability of funding for construction of the necessary infrastructure.

10.1 Summary of Funding Opportunities

The terms "financial" and "economic" analysis are often used interchangeably when discussing project implementation. However, the terms describe very different aspects of project implementation in that a project can be economically viable, but due to lack of funds, financially infeasible. Economic analysis refers to the evaluation on a societal level of costs and benefits of a project. When benefits equal or exceed costs for a project, the project is deemed economically viable. To be financially viable, a project must have the funds necessary for implementation including construction, operation and maintenance (O&M), and recurring costs.

This summary of funding opportunities is intended to address the financial viability of a reclaimed water system by identifying and describing funding sources that can assist in funding the implementation of the project. It should be noted that timing is a significant factor when seeking multiple funding sources. Funding sources may not have available funds or the application dates may occur before a project has the necessary information available to submit an application.

This section summarizes the major funding sources with potential for application in implementing recycled water projects. The local, state, and federal government funding mechanisms for reclaimed water projects are summarized below.

Project funding mechanisms for capital projects typically involve:

- Cash (collected as user fees or general revenue)
- Bonds and Certificates of Obligation
- State Revolving Fund (Loans)
- Grants

These types of funding mechanisms are also applicable to reclaimed water projects. A brief description of these types of funding mechanisms is provided below.

Cash: Cash includes revenues from operations and ad valorem taxes plus interest income minus operating expenses and debt service charges. The sources of revenues could include utility service charges and property taxes.

Bonds and Certificates of Obligation: There are two types of bonds available to support reclaimed water projects. Revenue bonds are those funded by the service fees and charges paid by the Kyle utility customers. General obligation bonds that are guaranteed by the property taxing authority of the city are another common debt instrument. Under Chapter 271 of the Local Government Code, cities are authorized to issue certificates of obligation (CO) that are guaranteed by the taxing authority of the city.

Loans: Loans are available from a variety of sources including the state Clean Water Revolving Fund (CWSRF) and the Water Infrastructure Fund (WIF). SRF loans are administered by the Texas Water Development Board and are intended to fund a variety of projects. SRF programs can offer low interest loans, as well as refinancing of existing debt under certain conditions.

Grants: Grants are typically money from governmental agencies for specific projects and require no repayment.

10.1.1 Potential State Funding Mechanisms

The following sections describe specific state programs that may be available for implementing a reclaimed water system.

Texas Water Development Board (TWDB)

<u>Clean Water State Revolving Fund</u>

The Clean Water State Revolving Fund provides loans at below-market interest rates and principal forgiveness for planning, designing, and constructing wastewater infrastructure.

Eligible applicants are wastewater treatment management agencies, including cities, commissions, counties, and river authorities that have authority to dispose of sewage.

The Clean Water State Revolving Fund presently offers fixed rate loans at subsidized interest rates. The maximum repayment period for a loan is 30 years from the completion of project construction. A cost-recovery loan origination fee of 1.85 percent is imposed to cover administrative costs of operating the Clean Water State Revolving Fund. Applicants have the option to finance the origination fee in their loan. Individual entities will be limited to funding in an amount not to exceed 15 percent of the total funds available.
Prospective loan applicants submit project information to TWDB that describes their existing wastewater facilities, facility needs, the nature of the project being considered, and project cost estimates. This information is used to rate each proposed project and place prospective projects in priority order on the project priority list in the Intended Use Plan. A fundable projects list is established, and available funds are distributed in accordance with the funding order specified in the Intended Use Plan. All applicants on the fundable projects list will be notified and invited to submit complete applications within three months of the date of the invitation letter. All applicants are encouraged to schedule a preapplication conference that will guide them through the Clean Water State Revolving Fund application process. The fundable projects list is revised as projects decline or funding becomes available. Invitations are then sent to the next eligible applicant on the list.

Water Infrastructure Fund (WIF)

Projects must be specifically recommended water management strategies in the most recent TWDB approved regional water plan or approved State Water Plan. A semi-annual priority rating process applies. Loans for planning, design, and construction can be funded through the WIF. All loans through the WIF are offered at a subsidized interest rate that was most recently 100 basis points below the TWDB's cost of funds. Repayment periods are a maximum of 20 years.

State Loan Program Texas Water Development Fund II (DFund)

The DFund can be used for planning, acquisition and construction of water related infrastructure, including water supply, wastewater treatment, stormwater and nonpoint source pollution control, flood control, reservoir construction, storage acquisition, and agricultural water conservation projects, and municipal solid waste facilities. This is essentially a pure state loan program that does not receive Federal subsidies, and is the more streamlined of the agency programs. The interest rate on a Texas Water Development Fund loan varies depending on market conditions. Currently, the lending rate scales are set 0.35 percent above the TWDB's borrowing cost.

Edwards Aquifer Authority (EAA)

Conservation Grants

The Authority's Groundwater Conservation Grant Program, introduced in 2009, is an annual program to improve water use efficiency across the region. Through this program, municipal Edwards Aquifer permit holders can apply to the Authority for grant funding to cover up to half the projected costs of qualified conservation programs and Best Management Practices (BMPs) that result in savings of Edwards groundwater. Funding has been limited to about $300,000 per year.

U.S. Bureau of Reclamation (Reclamation)

Reclamation Wastewater and Groundwater Study and Facilities (Title XVI)

Reclamation provides funding for both the planning and construction of water recycling projects. Planning funds may be made available for either appraisal or feasibility level study efforts. Currently, Reclamation funds for water recycling and reuse are appropriated under the authority of the Reclamation Wastewater and Groundwater Study and Facilities Act of 1992 (Title XVI of Public Law 102-575 as amended). Reclamation funding for Title XVI is subject to the availability of congressionally appropriated funds. Generally, Title XVI authorizes the Federal government to fund up to 25 percent of the capital cost of authorized water recycling projects, up to a maximum of $20 million per project.

Federal construction funds are provided only for projects specifically authorized by Congress pursuant to the various sections of Title XVI. Reclamation makes funding recommendations on construction of authorized projects in the President's annual budget request to Congress. Projects not yet authorized for construction require specific congressional authorization before Congress can appropriate funds through the Title XVI program.

Before Congress will authorize a project that meets the definition in Title XVI, the following prerequisites must be met:

- A feasibility report that complies with the provision of Title XVI must be completed by Reclamation or the non-Federal project sponsor.
- The Secretary of Interior has determined that the non-Federal project sponsor is financially capable of funding its share of the project costs.
- Project compliance with the National Environmental Policy Act and other environmental laws.
- The Secretary of Interior has approved a cost-sharing agreement with the non- Federal project sponsor that commits the non-Federal project sponsor to funding its proportionate share of the project construction costs on an annual basis.

Reclamation does not make recommendations to Congress on Title XVI project authorizations. Project sponsors must work with their local Congressional delegation to receive project authorization. When and if a project is authorized, project sponsors will be eligible to receive competitive grants under the WaterSMART program, contingent upon appropriations. Project sponsors should coordinate with their local Reclamation office to find out about the status of program funding.

Depending on the number of funding requests, a delay of several years may be expected due to the Congressional pace and schedule. Continuation of funding from one fiscal year to the next may also be an issue as it is at the discretion of Congress. Also, due to limited budgets, not all projects may receive a full 25 percent federal participation. In accordance with Title XVI and other federal laws, priority will be given by Reclamation to projects that:

- reduce, postpone, or eliminate development of new or expanded water supplies;
- reduce or eliminate the use of existing diversions from natural watercourses;
- reduce the demand on existing federal water supply facilities;
- improve surface or groundwater quality, or the quality of effluent discharges, except where the purpose is to meet surface discharge requirements;
- help fulfill Reclamation's legal and contractual water supply obligations;
- serve the federal environmental interests in restoring and enhancing habitats and providing water for federally threatened and endangered species;
- promote and apply a regional or watershed perspective;
- serve a small, rural, or economically disadvantaged community; and
- provide significant economic benefits.

10.2 Project Implementation Considerations

This section discusses the actions necessary to develop and implement a reclaimed water utility. The successful implementation of a reclaimed water utility in Kyle can be measured in terms of:

- Expansion of the reclaimed water customer base
- Public support
- Political support
- Enhancement of public and private parks
- Reduced growth in demand for surface water or water from the HCPUA
- Positive return on investment

The interdependence of these criteria is such that the failure of a reclaimed water project in any one area could negatively impact the successful implementation of a project. In characterizing the successful implementation of a reclaimed water project, it could be said that a reclaimed water project should have:

1. A growing demand for reclaimed water service within the limits of the transmission and distribution system.

2. Public and political acceptance and support of the importance of irrigation for public and private recreational facilities and public rights-of-way, the planned reclaimed water facilities, water quality parameters, and irrigation procedures.
3. Public acceptance of the capability of the City of Kyle to successfully build and operate the project.
4. A well-defined project purpose of enhancing the city's parklands during cycles of normal weather patterns and drought cycles, minimizing potable water use, and reducing the nutrient load into the Plum Creek watershed.
5. Success in obtaining capital funding for construction.
6. Long-term project performance that meets or exceeds expectations.

10.2.1 Reclaimed Water System Ownership, Management, and Operation

The following sections describe recommended administrative actions that are necessary for the implementation of the proposed reclaimed water project.

System Ownership

Since the golf course is a significant user of reclaimed water, it will be a key customer of a publicly owned system. A change in ownership of the reclaimed water system would establish the underlying value of the public benefit afforded customers of both the city and the Plum Creek Golf Course as a benefit to taxpayers by providing improved recreational facilities and as a water resource management strategy. Using a typical municipal utility arrangement, extensions of the reclaimed water system would be accomplished through capital improvements and developer installed infrastructure that is dedicated to the city for maintenance.

Wastewater Treatment Plant Monitoring Program

With the current design and loading conditions, effluent from the Kyle WWTP can be used only as Type II reclaimed water in areas where public contact is unlikely. A continuing problem with the buildup of solids and trash in the reclaimed water wet well should be addressed, possibly through improved influent screening and wet well recirculation. Additional water quality monitoring of the Kyle WWTP effluent and Plum Creek Site 1 impoundment water quality will provide the background data for an application to TCEQ to amend the city's TPDES discharge permit to allow discharge of effluent to the impoundment.

Chapter 210 Reclaimed Water Use Notification

The city is presently authorized under Chapter 210 to deliver Type II reclaimed water to the Plum Creek Golf Course at the city's wastewater treatment plant. State regulations (30 TAC §210) require notification and approval by the TCEQ for the use of reclaimed water. The Chapter 210 regulations assign specific responsibilities to the reclaimed water producer, the reclaimed water provider, and the reclaimed water user. The specific responsibilities of each party as designated by the Chapter 210 regulations are summarized in the following points.

- The responsibilities of the reclaimed water producer include ensuring that the quality of the reclaimed water that leaves the treatment processes meets the minimum quality prescribed by state regulations, and for sampling, analyzing, and reporting the quality of reclaimed water produced.
- The reclaimed water provider is responsible for the delivery of reclaimed water to the user that meets the minimum quality prescribed by state regulations and for maintaining records of the volume and quality of reclaimed water delivered to the user.
- The reclaimed water user is responsible for the proper use of reclaimed water.

Use of Plum Creek Site 1 for storage involves changes in regulatory requirements between the Kyle WWTP and the end user. Chapter 210 regulations apply to the movement of reclaimed water from the WWTP to the point that it is discharged to the reservoir. With a discharge to waters of the state at the reservoir that would be permitted through an amendment to the city's TPDES discharge permit, the water would no longer be regulated under Chapter 210. Barring changes to state regulations between this study and actual implementation, water withdrawn from the reservoir is then simply be non-potable water instead of reclaimed water.

10.2.2 Water Rights Permitting - Plum Creek Site 1

The storage of non-potable water in the Plum Creek Site 1 impoundment depends on successfully converting the impoundment from domestic and livestock use to municipal use. All water below the conservation pool level would become available for municipal uses, including irrigation. Water rights to the impoundment (Water Right No. 5839) were acquired by Plum Creek HOA, Inc. in December 2004. Amendment of the existing water right would begin with the submittal of an *Application to Amend Water Right* (TCEQ Form 10201). The application would include a description of the source, a water budget that includes water added and withdrawn from the impoundment and evaporative losses.

Securing a permit to use water stored at Plum Creek Site 1 would require that the existing water right owned by Plum Creek HOA (WR No. 5839) be amended for the volume of reclaimed water to be stored as well as a change from recreational and livestock to municipal use. Reclaimed water would be stored at Site 1 and used for irrigation. Runoff from the watershed would be allowed to pass through the Site 1 reservoir and be discharged through the principal spillway. While this concept demonstrates that downstream water rights holders would not be adversely affected by the granting of water rights for irrigation using Site 1, the water rights permitting process will afford an opportunity for all downstream water rights holders to participate in the permitting process and to potentially object to TCEQ granting irrigation water rights in the use of Site 1.

10.2.3 TPDES Discharge Permit

In addition to amending the water rights to the Plum Creek Site 1 impoundment, the city's wastewater discharge permit must be amended to allow an effluent discharge at a location other than the existing outfall location on Plum Creek. The amended permit will specify both the effluent quality and maximum quantity that can be discharged to Plum Creek Site 1.

The city's existing discharge permit (TPDES No. TX 0119466) authorizes the city to discharge wastewater from the WWTP at a single specific location defined in the permit. Storage of reclaimed water at Site 1 would require permitting of an alternate outfall location. The process for obtaining a major permit amendment is outlined in the following list:

1. Contact TCEQ staff well in advance of submitting an application for a major amendment to an existing permit.

   This is not a requirement, but is highly recommended for major changes to existing permitted facilities. Staff will assist in defining the specific type of permit needed as well as the specific information needed for the permit application package.

2. Determine if the water body receiving the discharge is on the Texas Clean Water Act Section 303(d) List.

   The Texas Water Quality Inventory and 303(d) List describe the status of the state's waters on historical surface and groundwater quality data and identify water bodies that are not meeting standards set for their use (the List).

3. Complete and submit a permit application package (one original and three copies) at least 330 days before the proposed discharge begins or as soon as possible for new or amended discharges.

The following forms and reports are needed to complete the permit application package:

   a. Domestic Administrative Report

      The report should include the applicable sections, checklist, and the appropriate signatures. The appropriate permit application fees are also required.

   b. Domestic Technical Report

      The technical report should include applicable sections and worksheets.

   c. Core Data Form

      This form presents basic information about the owner, the operator and the site.

Upon receipt of the application, TCEQ will conduct an administrative and technical review.

1. Administrative Review

   TCEQ staff will verify that the application is complete and the administrative portion of the application includes the appropriate information. If not, a Notice of Deficiency letter will be issued describing the information is needed by a certain date. If deficiencies are not addressed within the specified time, the application may be returned.

   The Notice of Receipt of Application and Intent to Obtain Permit or NORI is the first notice to be published by the applicant. It is published only after the application is declared administratively complete.

2. Technical Review

The technical aspects of the application will be reviewed and evaluated. If the application is declared technically complete, TCEQ staff will proceed with preparing a draft permit, technical summary or fact sheet for the application and public notice. The Notice of Application and Preliminary Decision or NAPD is the second notice to be published by the applicant, but only after technical review of the application is complete and TCEQ staff has made a preliminary decision to issue the draft permit.

3. Comments from the Applicant

   As the applicant, the city will be given an opportunity to review and provide comments on the draft permit. Certain permits are sent to EPA for their review and approval after comments from the applicant are resolved. The draft permit is then filed with the TCEQ Office of the Chief Clerk and instructions on the second public notice are mailed to the applicant.

   The applicant must publish notice in a local and widely distributed newspaper and make a copy of the application and draft permit available in a public place. The public notice informs the public that the TCEQ has prepared a draft wastewater permit and provides instructions for commenting on the application. The public may provide comments or request a public meeting or request a public hearing on the application.

4. Public Comments

   Comments on the application and draft permit are considered by the TCEQ and may, upon request, conduct a public meeting. The TCEQ staff will prepare a Response to Comments that addresses all of the public comments received during the comment period on the application and draft permit. The application may also be referred by the Commission for a public hearing if requested by affected parties.

5. Final Action on the Application

   The commission or TCEQ may issue the draft permit or revise the draft permit based on public comments or recommendations from the public hearing.

10.3 Administrative Framework

Implementing the proposed project will involve the development of certain policies or amendment of ordinances in order to provide the administrative framework for a project. It will also require a clear definition of, not only the ownership of the system, but also the responsibilities for management of the system development, construction and operation.

10.3.1 Policies and Procedures

Developing a reclaimed water or non-potable water utility requires a number of policies and procedures be implemented by the city to ensure the integrity of the system and to protect the city’s potable water system. These policies and procedures should provide guidance for the installation, operation and maintenance of both city-owned facilities and customer facilities. The following list provides several of the policies and procedures that may be developed as part of the project implementation.

- Reclaimed water system design specifications.
- Cross-connection control requirements.
- Site inspection authority
- Enforcement policies
- Cost recovery policies and pricing structure.
- Reclaimed water system standard operating procedures.
- System record keeping and reporting procedures.
- Non-potable Water User Manual
- Emergency procedures plan.
- Park irrigation standard operating procedures.

Certain aspects of a reclaimed water utility may necessitate modification of existing ordinances or adoption of new ordinances. These may include:

- Establish a rate and fee ordinance for reclaimed or non-potable water.
- Adoption of non-potable water requirements as part of the city's plumbing code, including requirements for dual water distribution systems within a defined reclaimed water service area.
- Adoption of non-potable irrigation requirements as part of the city's water conservation ordinance.
- Requirements for the use of non-potable water for irrigation within specific zoning codes within a defined reclaimed water service area.

10.4 Project Funding Strategy

A major public infrastructure project such as this will impact both water and wastewater rates for all customers. As discussed in Section 10.1, there are several loans and grants available to supplement the city's commitment of capital for construction of a reclaimed water utility system, but receipt of financial assistance is by no means assured.

The city's funding for the design and construction of the reclaimed water project would be in the form of debt service for revenue bonds issued for the city's water and wastewater utility. The recovery of debt service and operating expenses should through a combination of reclaimed water rates and fees and, in recognition of the benefits to all utility customers, funding through the water and wastewater utilities.

10.4.1 *Reclaimed Water Pricing*

A "cost of service" methodology is the typical standard for setting utility rates. Cost of service rates are those charged to customers that includes the full system operation and maintenance costs, as well as recovery of the capital cost and debt service. Rates are charged to different customer classes on the basis of how their use of the service drives system costs.

However, there are certain aspects of developing reclaimed water rates that makes the process considerably different from that of typical utility rate designs. Most utilities that provide reclaimed water utility service do so as part of a broader public purpose of minimizing demands on limited or higher cost potable supplies and enhancing the aesthetic appeal of the community. The benefits to water and wastewater customers realized through the development of the reclaimed water system are described in Section 7.4. A standard cost of service rate making approach will produce reclaimed water rates that are much higher than those for potable water due in large part to the small number of customers who can make use of reclaimed water.

The rate-making process for reclaimed water is also different from potable water in that potable water is a readily available substitute for reclaimed water. With a choice of equal commodities, the logical consumer response is for a consumer to use that which has the lowest price (Casey, 2006). While rate-making for potable water is generally a process for determining the full cost associated with providing service and allocating those costs to the various customer classes, most utilities providing reclaimed water service have established rates that are designed to encourage reclaimed water use (AWWA, 2008).

In their 2008 survey of reclaimed water rates, the American Water Works Association (AWWA) reported that most utilities were recovering less than 25 percent of the annual operating costs for reclaimed water utilities through rates. The primary reason that utilities employ reclaimed water rates that allocate significant costs associated with developing reclaimed water back to the water and wastewater utility rates is to maintain an economic incentive for using reclaimed water. If reclaimed water is priced at its full cost, the fact that the cost will likely be higher than that for potable water would all but eliminate the incentive to develop reclaimed water as a water source for uses that do not need potable water quality.

The fact that potable water for specific uses can be restricted during times of high water demand or drought is generally insufficient justification to price reclaimed water at or above the price of potable water. The impacts of such restrictions are viewed as temporary and the impacts are absorbed by the users. While water users can absorb short-term impacts of water restrictions, utilities must consider reclaimed water as just one element of water source planning.

In determining what revenue sources besides reclaimed water rates can be employed to fund the development of reclaimed water, it is important to define the benefits and policy issues to be considered in developing reclaimed water pricing (AWWA, 2008).

As a supplement to potable water, reclaimed water can provide a drought-resistant water source that can benefit future water utility customers by reducing water demand attributable to irrigation. This has the effect of extending the city's supplies from GBRA and, eventually, from the HCPUA and, to some extent, preserving the utility's surface water capacity. Future customers could be expected to share in the cost of developing a reclaimed water system as part of the overall cost of securing water sources for the future potable water demand.

10.4.2 Reclaimed Water Rate Design

The key considerations in developing rates for reclaimed water are:

1. What are the overall goals and objectives of developing a reclaimed water system?
2. What is the desired level of cost recovery?

Like the definition of the goals and objectives for a reclaimed water utility, the appropriate level of cost recovery for reclaimed water is a policy decision that would be addressed by the city council. Utilities have established reclaimed water rates that are, on average, between 50 percent and 100 percent of the potable water rate (AWWA, 2008). The current potable water rates are presented in Table 10-1.

Table 10-1: Existing water utility volumetric rates.

Customer Class	$ per kgal
Commercial	5.51
Irrigation	6.44
Multifamily	5.51
Single-Family Residential	
0 to 4,000	3.06
4,001 to 8,000	3.82
8,001 to 12,000	4.59
12,001 to 16,000	5.34
16,001 to 20,000	6.11
20,001 to 30,000	6.88
30,001 to 50,000	7.64
50,001 +	9.17

Table 10-2 presents projected cost recovery using a percentage of the current potable water rate for commercial customers assuming that the rate for reclaimed water would be established as a percentage of the current commercial rate.

Table 10-2: Reclaimed water cost recovery.

Year	Projected Volume (MG)	Annual Reclaimed Water System Costs (Debt Service + O&M)	Revenue based on % of current irrigation rate	
			30%	50%
2015	115.63	$94,053	$ 372,344	$ 558,515
2020	218.88	646,634	704,794	1,057,191
2025	322.47	1,048,128	1,038,358	1,557,537
2030	379.20	1,060,091	1,221,028	1,831,542
2035	442.84	1,072,627	1,425,957	2,138,936

10.4.3 Proposed Project Funding Plan

As part of the city's fiscal year FY 2011-2012 budget, the city implemented a 3-year rate plan for the water and wastewater utilities. Under this rate plan, water rates were increased by 30% in FY 2011-2012 and will be increased 20% in each of the following fiscal years. Wastewater rates were increased 25% in the first year and will see a 20% increase in the second year and 10% in the third. These increases were necessary to restore the city's utility fund to a positive net operating income following a period of operating expenses exceeding water and sewer utility revenues. The city's current capital improvements program (CIP) includes a total of $7.6 million in capital projects to be funded from both long term debt and development fees and grants. Recognizing that the net debt burden for Kyle citizens is relatively high (Standard & Poor's, 2011), it is important to consider that the impact of adding an $11.06 million reclaimed water project to the CIP can be eased through securing federal funding through Title XVI and, potentially, securing TWDB loans if the cost of money is cheaper than that available by city debt issues.

Funding for the design and construction of the reclaimed water project can be phased over a period of years using city issued debt in the form of certificates of obligation or revenue bonds, or can be financed as a single project using a combination of federal grants, state loans, and city issued debt. A plan proposed for the Kyle reclaimed water project assumes that the city would be successful in securing Title XVI grant funding in an amount of 25% of the project cost and that the remaining 75% of the project cost could be funded through the Water Infrastructure Fund (WIF) administered by the TWDB, provided that the 2011 Region L Regional Water Plan and State Water Plan are amended to include water reuse as a recommended water management strategy for the City of Kyle and the TWDB online Infrastructure Finance Report Survey is completed for the project.

Designed, funded and constructed as a single project, the total project cost of $11,065,000 would be distributed as shown in Table 10-3. Comparison of the unit costs for reclaimed water (Table 7-4) illustrates the potential benefit of Title XVI grant funding to the overall cost of reclaimed water.

Table 10-3: Proposed funding plan annual costs.

Year	Annual Demand (MG)	Title XVI Grant	TWDB WIF Financing	Debt Service	Power Costs	O&M Costs	Treatment Costs	$/AF	$/kgal
2015	115.63	$ 210,938	$ 632,813	$ 50,115	$12,064	$ 8,438	$ 6,731	$217.96	$ 0.61
2020	218.88	1,495,625	4,486,875	405,450	26,327	68,263	12,741	814.85	2.50
2025	322.47	1,059,688	3,179,063	657,210	43,723	110,650	18,772	857.43	2.63
2030	379.20			657,210	52,383	110,650	22,074	723.81	2.22
2035	442.84			657,210	61,214	110,650	25,779	629.01	1.93
Max.	601.73			$614,415	$81,638	$110,650	$ 35,028	$376.93	$ 1.40

10.5 Non-Potable Water Customer Contract

Reclaimed water utility service may be provided under the terms of a standard contract for service that addresses, at a minimum, the following provisions:

- Definition of the customer's and city's responsibilities.
- Description of the uses and areas of application of non-potable water.
- Prohibited uses of non-potable water.
- Quantities of non-potable water, unit of measurement, and method of billing.
- Pressure requirements.
- Fees for establishing service.
- Fees for use of non-potable water.
- Compliance with city rules, regulations, policies, and procedures related to the use of non-potable water.
- City's right to inspect plumbing and irrigation systems.
- City's right to limit hours of non-potable water use.
- Enforcement provisions.
- Suspension and termination of service.
- Obligations of the city.
- Procedures for contract modification.
- Remedies upon default.
- Backflow device inspection.
- Non-potable water quality.

10.6 Implementation Steps

Implementation of a reclaimed water system should proceed in a logical, step-by-step approach, beginning with a public and political consensus on the need for the project and the framework in which the project would be developed. The initial steps toward implementation should include:

1. Initiate meetings through youth sports leagues, HOAs, and civic associations to disseminate information regarding the purpose of the reclaimed water utility and the project costs.
2. Define how the ownership and operations of a reclaimed water system will be structured.
3. Negotiate commitments for reclaimed water from potential users.
4. Initiate amendment of the city's TPDES discharge permit and acquisition of municipal water rights to store water at Site 1.

5. Prepare draft revisions to the municipal code of ordinances to define the purpose and regulations regarding the use of reclaimed water in Kyle. Actual amendment of the city code, if required, could be concurrent with the completion of construction of the project.
6. Once the framework for development of the project is established, the actual project development could begin with incorporating the project into the city's CIP.
7. Public outreach should continue throughout the implementation process with the following key elements:

   a. Involve the public throughout the project implementation with opportunities for comment. Managing expectations becomes more than answering whether the project is on budget and on schedule, it is also important to provide a clear reminder that the primary purpose of the project is to irrigate parklands for the benefit of the community and not to market reclaimed water to consumers or industry. As the HCPUA supply is added to the city's water sources, the implementation of a reclaimed water utility becomes a visible part of the city's overall strategy for water management and community development.

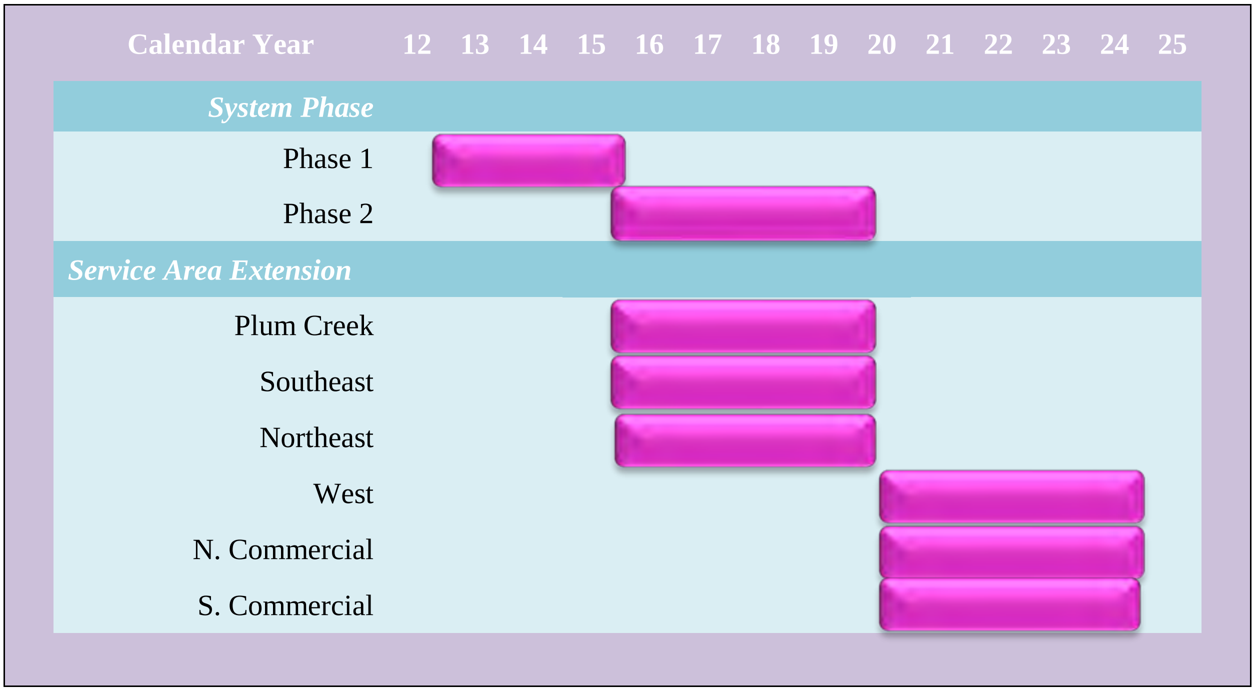
   b. Public concerns that arise should be addressed with complete candor using all available scientific and regulatory information.

   c. Public outreach information should address the fundamental relationships between developing and maintaining parks and public amenities and water conservation.

10.6.1 Reclaimed Water System Implementation

As previously described, implementation of the reclaimed water system can be phased and scaled for demand in the various service areas in the city. The proposed schedule presented in Figure 10-1 includes development of the system for the Plum Creek, Southeast, and Northeast service areas as part of Phase 2 since each of these service areas are located adjacent to the primary transmission system.

Figure 10-1: Project implementation schedule.



The following summarizes the schedule for implementing the reclaimed water project:

2012 - 2013

1. Conduct a review of the Feasibility Study with the City Council.
2. Disseminate public information and conduct public meetings on the findings of the feasibility study.
3. City staff to develop a draft framework for implementing a reclaimed water utility.
4. Outline revisions to the municipal code of ordinances.
5. Negotiate commitments for reclaimed water use with public and private sector users.
6. Negotiate terms for acquisition the existing water rights permit and begin the process to amend the water rights permit for Site 1 to change the use from recreational/livestock to municipal and to change the volume of water associated with the proposed storage or reclaimed water.
7. Perform testing of wastewater effluent (conductivity, nitrogen, and phosphorus) to provide data for development of park irrigation standard operating procedures.
8. Initiate water quality modeling required for amending the city's TPDES permit.
9. Begin development of a project funding plan, including debt issuance schedule and application for state or federal grants and/or loans.
10. Incorporate the reclaimed water system project and park irrigation systems into the city's CIP.

2013 - 2014

1. Disseminate public information regarding project schedule.
2. Develop amendments to city ordinance and SOPs for reclaimed water.
3. Initiate a request to amend the Region L Regional Water Plan and State Water Plan to include water reuse as a recommended water management strategy for the City of Kyle.
4. Complete project funding plan. Establish schedule for debt issuance and applications for state or federal grants and/or loans.
5. Complete negotiations for reclaimed water user commitments in the Plum Creek, Southeast, and Northeast service areas.
6. Complete Phase 1 design for Kyle Parkway irrigation and reclaimed water treatment.
7. Finalize acquisition or amendment of Water Rights Permit.
8. Obtain amendment to TPDES discharge permit.
9. Obtain TxDOT and railroad permits for pipeline crossings.
10. Obtain authorizations required under 30 TAC §210.

2014 - 2015

1. Install rotating disk filtration and disinfection at WWTP.
2. Install 8-in. distribution main to Kyle Parkway.
3. Install park irrigation systems.

2015 - 2016

1. Begin preliminary design of reclaimed water system Phase 2 (14-in. transmission main).
2. Begin negotiations for reclaimed water user commitments in the West, N. Commercial, and S. Commercial service areas.

2016 -2020

1. Complete design of reclaimed water system Phase 2.
2. Construct Phase 2 – storage and distribution pumping.

2021

1. Begin preliminary design of service area extensions.

10.7 Research Needs

The proposed project is developed to rely on conventional technologies for the treatment, pumping, and transmission of reclaimed water. By using proven technologies, the city can avoid the added time and expense of basic research. There are no basic research needs for the project.

10.8 Recommendations

This study has defined a reclaimed water project that can be implemented to provide non-potable water for public and private sector uses in the City of Kyle. The feasibility study has defined a sequence for the phased development of a reclaimed water utility that would provide an alternative water source for irrigation and for commercial cooling. The recommendations below summarize the recommended capital improvements and policies and procedures for a reclaimed water utility.

10.8.1 Recommended Capital Improvements

The capital improvements described as Alternative 4 beginning in Section 6.5 include:

- A rotating disk filter unit to provide supplemental treatment to achieve Type I reclaimed water quality;
- A new reclaimed water pumping station at the Kyle WWTP;
- Transmission mains to storage at the Site 1 impoundment;
- A nonpotable water pumping station at Site 1; and
- Transmission mains to each of six service areas.

The major elements of the proposed project are summarized in Table 10-4 and shown in Figure 10-2. Phasing of the system development is recommended as a way to optimize system expansion based on actual reclaimed water demand.

Table 10-4: Summary of reclaimed water infrastructure costs.

Project	Annual Demand (MG)	Capital Costs
Phase 1	115.63	$ 843,750
Phase 2	205.05	4,506,250
Plum Creek	278.58	375,000
Southeast	46.74	683,750
Northeast	33.16	417,500
N Commercial	34.78	1,821,250
West	21.92	1,385,000
S Commercial	27.65	1,032,500
TOTAL	**442.84**	**$11,065,000**

In addition to the construction of infrastructure to treat, store, and transmit reclaimed water, implementation of a reclaimed water project will require certain regulatory authorizations and the development of city policies and procedures.

10.8.2 Recommended Administrative Actions

- Obtain commitments from potential reclaimed water users.
- Amend the city's TPDES discharge permit to allow storage of reclaimed water at Site 1.
- Negotiate terms for acquisition the existing water rights permit and begin the process to amend the water rights permit for Site 1 to change the use from recreational/livestock to municipal and to change the volume of water associated with the proposed storage or reclaimed water.
- Amend the city's Chapter 210 notification to include additional users and uses.
- Develop reclaimed water and non-potable water system design specifications.
- Develop a comprehensive backflow prevention program.
- Amend city ordinances and policies (as needed), including cross-connection control, cost recovery, and system standard operating procedures.
- Develop a Non-potable Water Customer contract.

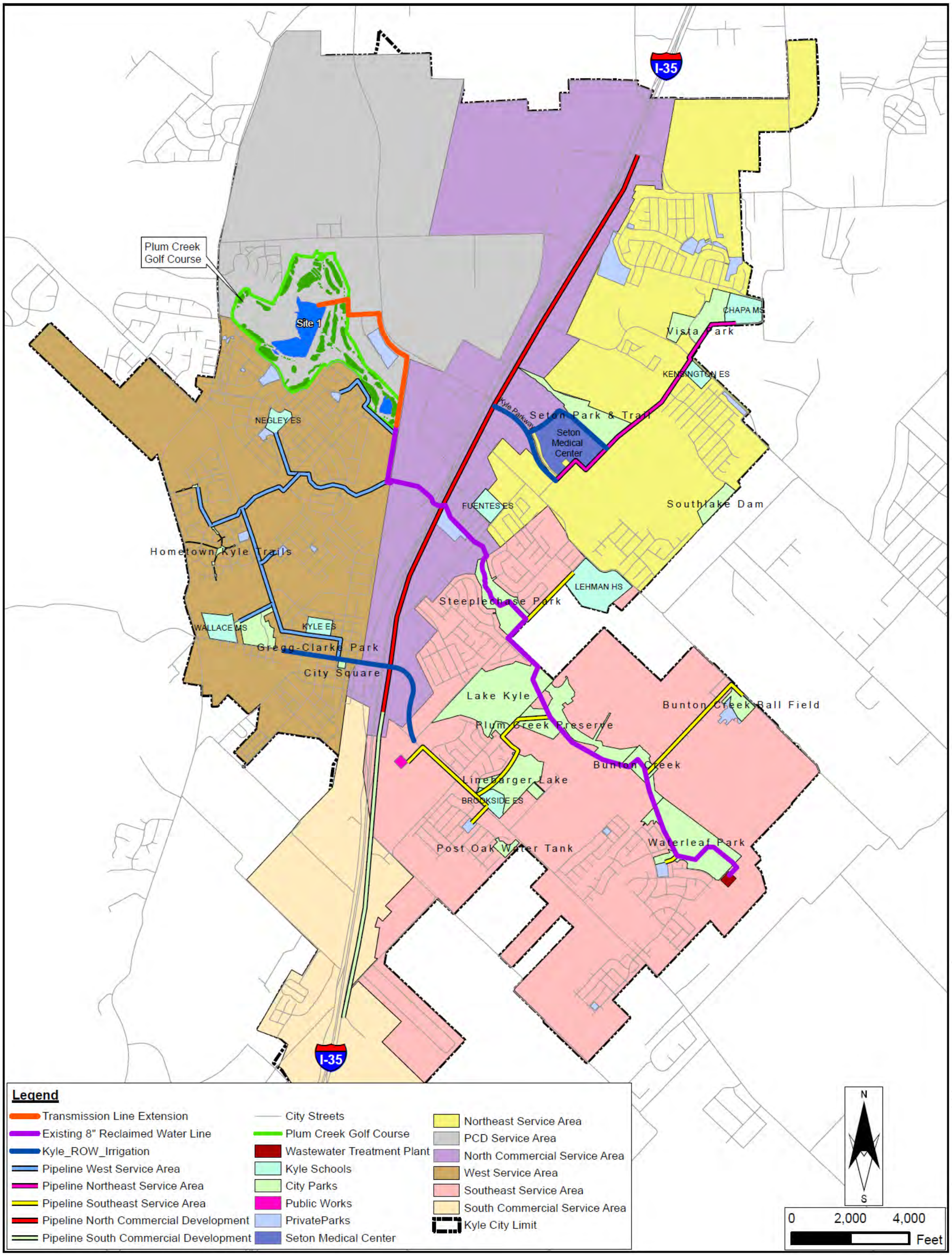


Figure 10-2: Recommended reclaimed water infrastructure.

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12 Appendices

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Appendix A: Acknowledgements

Collins K. Balcombe
Supervisory Program Coordinator
U.S. Bureau of Reclamation
5316 Highway 290 West, Suite 510
Austin, TX 78735-8931

Darel Ball
Division Manager, GBRA
933 East Court Street
Seguin, TX 78155

Jason Beimer
Utility Coordinator
City of Kyle
P.O. Box 40
Kyle, TX 78640

Steve Clamons
GIS Analyst
City of Kyle
P.O. Box 40
Kyle, TX 78640

Nikki Dictson
Extension Program Specialist
Texas Agrilife Extension Service
355A Heep Center, 2474 TAMU
College Station, TX 77843-2474

James R. Earp, C.P.M.
Assistant City Manager
City of Kyle
P.O. Box 40
Kyle, TX 78640

Raquel Garcia
Grants Administrator
City of Kyle
P.O. Box 40
Kyle, TX 78640

Robin Gary
Public Information and Education Coordinator
BSEACD
1124 Regal Row
Austin, TX 78748

Johnie Halliburton
Executive Manager
Plum Creek Conservation District
1403 Blackjack St., Suite-C
Lockhart, Texas 78644

Byron Hardin, CPM
Hardin and Associates Consulting
5005 W. Royal Lane, Suite 170
Irving, TX 75063

Kirk Holland, P.G.
General Manager
BSEACD
1124 Regal Row
Austin, TX 78748

Brian Koch
Watershed Coordinator
Texas State Soil and Water Conservation Board
4311 South 31st Street, Suite 125
Temple TX 76502

Debbie Magin
Director of Water Quality Services
GBRA
933 East Court Street
Seguin, TX 78155

Terry Mitchell
President, Momark Development
P.O. Box 5654
Austin, TX 78763

Chris Stewart, AICP
Stewart Planning Consulting, LLC
100 E. Anderson Lane, Suite 285
Austin, TX 78752

Connie Townsend
Project Manager
Texas Water Development Board
1700 North Congress Avenue
Austin, TX 78711-3231

Kerry Urbanowicz
Parks Director
City of Kyle
P.O. Box 40
Kyle, TX 78640

Harper Wilder
Public Works Director
City of Kyle
P.O. Box 40
Kyle, TX 78640

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Appendix B: Abbreviations, Acronyms and Conversions

AF, ac-ft ……………Acre-Feet (1 acre-foot = 325,851 gallons)
AWWA……………..American Water Works Association
BFE…………………Base Flood Elevation
BOD_5………………. Biochemical Oxygen Demand
BSEACD……………Barton Springs/Edwards Aquifer Conservation District
$CBOD_5$……….…….Carbonaceous Biochemical Oxygen Demand
CFU…………………Colony Forming Units
CIP ……………...…Capital Improvements Plan
City …………………City of Kyle
COD …………..……Chemical Oxygen Demand
EAA………….…….Edwards Aquifer Authority
EARZ……………… Edwards Aquifer Recharge Zone
ET………………….. Evapotranspiration
FEMA………….……Federal Emergency Management Agency
GBRA……….………Guadalupe-Blanco River Authority
gpm………….………Gallons per Minute
HCPUA……….…… Hays – Caldwell Public Utility Agency
HP ………………..….Horsepower
IH……………….……. Interstate Highway
in …………………….. Inches
kgal ………..……… Thousand Gallons
kwh………….…….. Kilowatt Hours
LF………………….. Linear Feet
mgd…………….…. Million Gallons per Day
mg/l ………….…….. Milligrams per Liter
ml ………………..…..Milliliter
NPDES…………….. National Pollutant Discharge Elimination System
NRCS……………… Natural Resources Conservation Service
NTU………….…….. Nephelometric Turbidity Units
NWI…………….…… National Wetlands Inventory
O&M……………….. Operations and Maintenance
PCCD…………….….Plum Creek Conservation District
POTW……….…….. Publicly Owned Treatment Works
PUD……………….. Planned Unit Development
Region L…..…………South Central Texas Regional Water Planning Group
RWPF…………….…Reclaimed Water Production Facility
SCTRWPG………….South Central Texas Regional Water Planning Group
TAC ………….……..Texas Administrative Code
TCEQ…………….… Texas Commission on Environmental Quality
TPDES ………..……. Texas Pollutant Discharge Elimination System
TPWD…………..….. Texas Parks & Wildlife Department
TWCA…………….. Texas Water Conservation Association
TWDB…………….. Texas Water Development Board
TSS ………….…….. Total Suspended Solids
TxDOT…………….. Texas Department of Transportation

USACE…………….. U.S. Army Corps of Engineers
USFWS………..…… U.S. Fish and Wildlife Service
WWTP……….…….. Wastewater Treatment Plant

Appendix C: Data Inventory

City of Kyle
The City of Kyle Planning Department provided GIS layers for mapping including: street centerlines; street rights-of-way; contours; water and wastewater utility mains; city limits; city ETJ boundary; parcels; floodplain; park locations and areas; park trails; impervious cover in parks; private park locations and areas.

The City of Kyle Public Works Department provided records of the city's water demand; and Discharge Monitoring Reports (DMR) for the Kyle WWTP for the years 2006 through 2011.

Plum Creek Conservation District (PCCD)
PCCD provided GIS layers for the district boundaries; record drawings and data for the Plum Creek Site 1 dam.

Momark Development
Momark Development provided GIS layers for the Plum Creek Development and the Plum Creek Golf Course; record drawings of the existing reclaimed water transmission main; and engineering calculations of projected reclaimed water demand for the Plum Creek Development.

Austin Community College (ACC)
ACC provided a copy of the preliminary campus master plan for the Hays campus of ACC.

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Appendix D: Reclaimed Water Demand

Reclaimed Water Delivery Point	Total Area (ac.)	Added Area (ac.) 2015	2020	2025	2030	2035	Irrigation Demand (gallons per month) Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Demand (gal)
Plum Creek Service Area																			
Plum Creek Golf Course	308.84	197.01					599,160	2,225,451	9,072,993	11,426,836	9,672,153	16,476,899	23,324,441	21,612,555	9,971,733	4,194,120	684,754	128,391	109,389,487
Plum Creek Dev. ROW	36.20		7.24	7.24	7.24	7.24	88,075	327,136	1,333,708	1,679,718	1,421,783	2,422,065	3,428,637	3,176,994	1,465,821	616,526	100,657	18,873	16,079,994
Plum Creek Dev. Parks	36.90		7.02	7.02	7.02	7.02	85,399	317,195	1,293,181	1,628,677	1,378,580	2,348,466	3,324,452	3,080,456	1,421,279	597,791	97,599	18,300	15,591,375
Plum Creek Comm. Dev.	756.00		30.82	30.82	30.82	30.82	374,927	1,392,587	5,677,471	7,150,400	6,052,399	10,310,502	14,595,386	13,524,165	6,239,862	2,624,491	428,488	80,342	68,451,023
Plum Creek SF Dev.	253.50		15.22	15.22	15.22	15.22	185,104	687,528	2,802,998	3,530,191	2,988,102	5,090,350	7,205,821	6,676,953	3,080,654	1,295,726	211,547	39,665	33,794,639
Plum Creek Greenbelts	83.60		15.88	15.88	15.88	15.88	193,230	717,711	2,926,053	3,685,171	3,119,283	5,313,823	7,522,165	6,970,079	3,215,898	1,352,609	220,834	41,406	35,278,262
Service Area Total		*197.01*	*76.18*	*76.18*	*76.18*	*76.18*	*1,525,895*	*5,667,609*	*23,106,406*	*29,100,992*	*24,632,301*	*41,962,105*	*59,400,902*	*55,041,203*	*25,395,248*	*10,681,263*	*1,743,880*	*326,977*	*278,584,780*
Northeast Service Area																			
Kyle Pkwy ROW	6.05	5.75					17,480	64,925	264,692	333,362	282,172	480,691	680,459	630,517	290,912	122,358	19,977	3,746	3,191,290
Seton Medical Center Hays		5.50					16,727	62,129	253,294	319,007	270,021	459,992	651,157	603,366	278,385	117,089	19,117	3,584	3,053,866
Seton MC - Cooling Tower	--						458,375	535,485	794,659	940,311	991,718	1,313,009	1,582,893	1,492,932	1,143,796	946,737	646,866	486,220	11,333,000
Chapa MS	24.73			3.74			11,387	42,295	172,432	217,166	183,819	313,142	443,279	410,745	189,512	79,709	13,014	2,440	2,078,939
Fuentes ES	15.00			3.05			9,274	34,446	140,435	176,868	149,709	255,035	361,023	334,526	154,346	64,918	10,599	1,987	1,693,165
Kensington ES	10.47			1.09			3,309	12,291	50,110	63,111	53,419	91,002	128,821	119,366	55,074	23,164	3,782	709	604,159
Service Area Total		*11.25*	*0.00*	*7.88*	*0.00*	*0.00*	*516,552*	*751,570*	*1,675,622*	*2,049,826*	*1,930,857*	*2,912,870*	*3,847,632*	*3,591,452*	*2,112,024*	*1,353,975*	*713,353*	*498,687*	*21,954,420*
Southeast Service Area																			
Waterleaf Park	92.03		22.08				67,163	249,462	1,017,037	1,280,891	1,084,200	1,846,978	2,614,553	2,422,660	1,117,782	470,140	76,758	14,392	12,262,015
Waterleaf HOA Park	1.00		1.00				3,036	11,277	45,976	57,904	49,012	83,495	118,194	109,519	50,531	21,253	3,470	651	554,318
Lake Kyle	118.28		13.54				41,182	152,960	623,606	785,391	664,788	1,132,492	1,603,138	1,485,477	685,378	288,271	47,065	8,825	7,518,572
Steeplechase Park	43.91		2.82				8,577	31,856	129,874	163,568	138,451	235,856	333,875	309,370	142,739	60,036	9,802	1,838	1,565,841
Bunton Creek Ball Field	13.03		3.16				9,612	35,702	145,555	183,317	155,168	264,334	374,187	346,724	159,974	67,285	10,985	2,060	1,754,903
Brookside ES	13.95			0.66			1,993	7,403	30,183	38,013	32,176	54,813	77,592	71,898	33,173	13,952	2,278	427	363,901
Lehman HS	53.57			11.28			34,319	127,469	519,681	654,504	554,000	943,760	1,335,972	1,237,919	571,159	240,230	39,221	7,354	6,265,588
Post Oak HOA Park	1.19		1.19				3,620	13,447	54,823	69,046	58,444	99,561	140,937	130,593	60,254	25,343	4,138	776	660,983
Service Area Total		*0.00*	*20.71*	*11.94*	*0.00*	*0.00*	*169,501*	*629,577*	*2,566,736*	*3,232,635*	*2,736,238*	*4,661,290*	*6,598,449*	*6,114,159*	*2,820,988*	*1,186,510*	*193,716*	*36,322*	*30,946,122*
West Service Area																			
City Square	1.44			1.21			3,667	13,621	55,532	69,939	59,199	100,848	142,759	132,281	61,033	25,670	4,191	786	669,525
Gregg-Clarke Park	29.30			7.32			22,265	82,698	337,154	424,624	359,419	612,285	866,741	803,127	370,552	155,854	25,446	4,771	4,064,935
Hometown Kyle Trails	3.82			0.69			2,098	7,794	31,777	40,021	33,875	57,708	81,691	75,695	34,925	14,689	2,398	450	383,121
Hometown Kyle Trails	0.77			0.06			190	704	2,870	3,615	3,060	5,213	7,379	6,838	3,155	1,327	217	41	34,608
Decker Park	1.83			1.83			5,566	20,672	84,278	106,142	89,843	153,052	216,658	200,756	92,626	38,959	6,361	1,193	1,016,105
McNaughton Park	0.65			0.65			1,977	7,343	29,938	37,705	31,915	54,368	76,963	71,314	32,903	13,839	2,259	424	360,950
Vantage Apts.	1.85			1.85			5,638	20,939	85,368	107,515	91,006	155,032	219,460	203,353	93,824	39,463	6,443	1,208	1,029,249
Hometown Kyle Trails Park	2.41			2.41			7,330	27,227	111,002	139,800	118,332	201,584	285,359	264,415	121,997	51,312	8,378	1,571	1,338,307
Silverado	0.70			0.70			2,116	7,858	32,038	40,349	34,153	58,182	82,361	76,316	35,211	14,810	2,418	453	386,265
Center St. Streetscape	5.62			5.62			17,092	63,484	258,820	325,967	275,912	470,028	665,364	616,530	284,458	119,643	19,534	3,663	3,120,496
Wallace MS	20.11			2.37			7,205	26,761	109,102	137,407	116,307	198,134	280,475	259,890	119,910	50,434	8,234	1,544	1,315,402
Kyle ES	10.80			0.65			1,987	7,380	30,087	37,892	32,074	54,639	77,346	71,669	33,067	13,908	2,271	426	362,745
Negley ES	10.74			0.84			2,559	9,505	38,751	48,805	41,310	70,374	99,620	92,308	42,590	17,913	2,925	548	467,209
Service Area Total		*0.00*	*0.00*	*3.86*	*0.00*	*0.00*	*79,689*	*295,987*	*1,206,718*	*1,519,781*	*1,286,407*	*2,191,445*	*3,102,175*	*2,874,492*	*1,326,251*	*557,822*	*91,073*	*17,076*	*14,548,916*
subtotal		***208.26***	***96.89***	***99.87***	***76.18***	***76.18***	**2,291,637**	**7,344,743**	**28,555,482**	**35,903,234**	**30,585,802**	**51,727,710**	**72,949,159**	**67,621,306**	**31,654,511**	**13,779,570**	**2,742,022**	**879,062**	**346,034,238**
Future Comm. Along I35 N	1044			31.32	15.66	15.66	190,505	707,590	2,884,789	3,633,201	3,075,294	5,238,886	7,416,085	6,871,785	3,170,547	1,333,535	217,720	40,822	34,780,760
Future Comm. Along I35 S	830			24.90	12.45	12.45	151,455	562,547	2,293,463	2,888,465	2,444,918	4,165,015	5,895,930	5,463,201	2,520,645	1,060,186	173,092	32,455	27,651,370
Future Park Development	140.6		14.06	14.06	7.03	7.03	128,281	476,471	1,942,535	2,446,495	2,070,816	3,527,717	4,993,782	4,627,266	2,134,956	897,964	146,606	27,489	23,420,378
TOTAL		***208.26***	***110.95***	***170.15***	***111.32***	***111.32***	**2,761,877**	**9,091,351**	**35,676,269**	**44,871,395**	**38,176,830**	**64,659,328**	**91,254,955**	**84,583,558**	**39,480,659**	**17,071,255**	**3,279,440**	**979,828**	**431,886,745**

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Appendix E: Estimated Project Costs

Preliminary Opinion of Probable Project Cost					
	Complete System				
Item No.	**Description**	**Est. Quantity**	**Unit**	**Unit Price**	**Total Cost**
1	Treatment (Rotating Disk Filter)	1	LS	300,000	$ 300,000
2	Concrete Pad for Filter Equipment	10	SY	40	400
3	Valves and Piping (From Chambers to Filter, From Filter to Wet Well)	1	LS	10,000	10,000
4	Electrical and Controls	1	LS	20,000	20,000
5	Chlorinator Equipment	1	LS	10,000	10,000
6	Chlorinator Equipment Shelter	1	LS	3,000	3,000
7	Pumps (8hp, 800gpm;30 TDH - Horiz. End Suction, Pump from Filter to Storage)	3	EA	10,500	31,500
8	Pumps (125hp - Horiz. End Suction, @ WWTP)	3	EA	54,350	163,050
9	Pumps (200hp - Horiz. End Suction, @ Lake)	4	EA	65,000	260,000
10	Enclosed Pump Structures (@ WWTP & Lake)	1,800	SF	73	131,400
11	Above Ground Welded Steel Tank (@ WWTP)	100,000	GAL	1.13	112,500
12	PIPE, 2" DIA. (PVC C-900)	1,389	LF	10	13,890
13	PIPE, 4" DIA. (PVC C-900)	8,713	LF	20	174,260
14	PIPE, 6" DIA. (PVC C-900)	26,638	LF	30	799,140
15	PIPE, 8" DIA. (PVC C-900)	7,443	LF	40	297,720
16	PIPE, 10" DIA. (PVC C-900)	11,052	LF	50	552,617
17	PIPE, 12" DIA. (PVC C-900)	18,786	LF	60	1,127,164
18	PIPE, 14" DIA. (PVC C-905)	35,330	LF	70	2,473,073
19	PIPE, 18" DIA. (PVC C-905)	6,751	LF	90	607,590
20	PIPE, 24" DIA. (PVC C-905)	2,583	LF	120	309,960
21	Highway Bore with Steel Casing	600	LF	65	39,000
22	Railroad Bore with Steel Casing	600	LF	65	39,000
23	Concrete thrust blocks	6.75	CY	60	405
24	Trench Safety	118,685	LF	1.00	118,685
25	Erosion & Sediment control	118,685	LF	1.00	118,685
26	Traffic control plan	1	LS	24,000	24,000
27	Gate/Blocking valves	42	EA	1,500	63,000
28	Comb. Air/Vac Valves & Vault	1	EA	6,000	6,000
29	Comb. Rate of Flow & Pressure Reducing Valve	4	EA	10,000	40,000
30	Master Meter	2	EA	2,000	4,000
31	Fittings	10.78	TN	4,000	43,120
32	Pump Intake Screening (@ Lake)	1	LS	23,000	23,000
33	Mobilization/bonds/insurance	1	LS	791,616	791,616
				Subtotal	**$8,708,000**
				Engineering & Survey @ 10%	$870,800
				Permitting	$180,000
				Contingency @ 15%	$1,306,200
				TOTAL	**$11,065,000**

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Appendix F: System Expansion Estimated Costs

Phase 1					
Item No.	**Description**	**Est. Quantity**	**Unit**	**Unit Price**	**Total Cost**
1	Treatment (Rotating Disk Filter)	1	LS	300,000	$ 300,000
2	Concrete Pad for Filter Equipment	10	SY	40	400
3	Valves and Piping (From Chambers to Filter, From Filter to Wet Well)	1	LS	10,000	10,000
4	Electrical and Controls	1	LS	20,000	20,000
5	Chlorinator Equipment	1	LS	10,000	10,000
6	Cover for Chlorinator Equipment	1	LS	3,000	3,000
7	PIPE, 8" DIA. (PVC C-900)	4,115	LF	40.00	164,600
8	Concrete thrust blocks	0.2	CY	60.00	12
9	Trench Safety	4,115	LF	1.00	4,115
10	Erosion & Sediment control	4,115	LF	1.00	4,115
11	Traffic control plan	1	LS	2,000.00	2,000
12	Gate/Throttling valves	3	EA	1,500.00	4,500
13	Master Meter	1	EA	2,000.00	2,000
14	Fittings	0.3	TN	4,000.00	1,280
15	Mobilization/bonds/insurance	1	LS	52,602	52,602
				Subtotal	**$579,000**
				Engineering & Survey @ 10%	$57,900
				Permitting	$120,000
				Contingency @ 15%	$86,850
				TOTAL	**$843,750**

Phase 2					
Item No.	**Description**	**Est. Quantity**	**Unit**	**Unit Price**	**Total Cost**
1	PIPE, 14" DIA. (PVC C-905)	24,351	LF	70	1,704,570
2	PIPE, 18" DIA. (PVC C-905)	3,981	LF	90	358,290
3	PIPE, 24" DIA. (PVC C-905)	2,583	LF	120	309,960
4	Pumps (8hp, 800gpm;30 TDH - Horiz. End Suction, Pump from Filter to Storage)	3	EA	10,500	31,500
5	Pumps (125hp - Horiz. End Suction, @ WWTP)	3	EA	54,350	163,050
6	Pumps (200hp - Horiz. End Suction, @ Lake)	4	EA	65,000	260,000
7	Enclosed Pump Structures (@ WWTP & Lake)	1,800	SF	73	131,400
8	Above Ground Welded Steel Tank (@ WWTP)	100,000	GAL	1.13	112,500
9	Highway Bore with Steel Casing	300	LF	65	19,500
10	Railroad Bore with Steel Casing	300	LF	65	19,500
11	Concrete thrust blocks	2	CY	60	120
12	Trench Safety	30,915	LF	1.00	30,915
13	Erosion & Sediment control	30,915	LF	1.00	30,915
14	Traffic control plan	1	LS	5,000	5,000
15	Gate/Blocking valves	2	EA	1,500	3,000
16	Comb. Air/Vac Valves & Vault	1	EA	6,000	6,000
17	Comb. Rate of Flow & Pressure Reducing Valve	1	EA	10,000	10,000
18	Master Meter	1	EA	2,000	2,000
19	Fittings	3.2	TN	4,000	12,800
20	Pump Intake Screening (@ Lake)	1	LS	23,000	23,000
21	Mobilization/bonds/insurance	1	LS	323,402	323,402
				Subtotal	**$3,557,000**
				Engineering & Survey @ 10%	$355,700
				Permitting	$60,000
				Contingency @ 15%	$533,550
				TOTAL	**$4,506,250**

Appendix G: Service Area Estimated Costs

Plum Creek Service Area					
Item No.	**Description**	**Est. Quantity**	**Unit**	**Unit Price**	**Total Cost**
1	PIPE, 18" DIA. (PVC C-905)	2,770	LF	90	$ 249,300
2	Concrete thrust blocks	0.5	CY	60	30
3	Trench Safety	2,770	LF	1.00	2,770
4	Erosion & Sediment control	2,770	LF	1.00	2,770
5	Traffic control plan	1	LS	2,000	2,000
6	Gate/Blocking valves	2	EA	1,500	3,000
7	Comb. Rate of Flow & Pressure Reducing Valve	1	EA	10,000	10,000
8	Fittings	0.8	TN	4,000	3,200
9	Mobilization/bonds/insurance	1	LS	27,307	27,307
				Subtotal	**$300,000**
				Engineering & Survey @ 10%	$30,000
				Contingency @ 15%	$45,000
				TOTAL	**$375,000**

Southeast Service Area					
Item No.	**Description**	**Est. Quantity**	**Unit**	**Unit Price**	**Total Cost**
1	PIPE, 4" DIA. (PVC C-900)	4,580	LF	20	91,600
2	PIPE, 6" DIA. (PVC C-900)	11,990	LF	30	359,700
3	Concrete thrust blocks	0.5	CY	60	30
4	Trench Safety	16,570	LF	1.00	16,570
5	Erosion & Sediment control	16,570	LF	1.00	16,570
6	Traffic control plan	1	LS	2,000	2,000
7	Gate/Blocking valves	5	EA	1,500	7,500
8	Fittings	0.8	TN	4,000	3,200
9	Mobilization/bonds/insurance	1	LS	49,717	49,717
				Subtotal	**$547,000**
				Engineering & Survey @ 10%	$54,700
				Contingency @ 15%	$82,050
				TOTAL	**$683,750**

Northeast Service Area					
Item No.	**Description**	**Est. Quantity**	**Unit**	**Unit Price**	**Total Cost**
1	PIPE, 6" DIA. (PVC C-900)	8,931	LF	30	267,930
2	Concrete thrust blocks	0.5	CY	60	30
3	Trench Safety	8,931	LF	1.00	8,931
4	Erosion & Sediment control	8,931	LF	1.00	8,931
5	Traffic control plan	1	LS	2,000	2,000
6	Gate/Blocking valves	2	EA	1,500	3,000
7	Comb. Rate of Flow & Pressure Reducing Valve	1	EA	10,000	10,000
8	Fittings	0.8	TN	4,000	3,200
9	Mobilization/bonds/insurance	1	LS	30,402	30,402
				Subtotal	**$334,000**
				Engineering & Survey @ 10%	$33,400
				Contingency @ 15%	$50,100
				TOTAL	**$417,500**

North Commercial Development Area					
Item No.	**Description**	**Est. Quantity**	**Unit**	**Unit Price**	**Total Cost**
1	PIPE, 10" DIA. (PVC C-900)	7,646	LF	50	382,317
2	PIPE, 12" DIA. (PVC C-900)	5,988	LF	60	359,267
3	PIPE, 14" DIA. (PVC C-905)	7,354	LF	70	514,774
4	Concrete thrust blocks	1	CY	60	60
5	Trench Safety	20,988	LF	1.00	20,988
6	Erosion & Sediment control	20,988	LF	1.00	20,988
7	Traffic control plan	1	LS	5,000	5,000
8	Gate/Blocking valves	10	EA	1,500	15,000
9	Fittings	1.6	TN	4,000	6,400
10	Mobilization/bonds/insurance	1	LS	132,479	132,479
				Subtotal	**$1,457,000**
				Engineering & Survey @ 10%	$145,700
				Contingency @ 15%	$218,550
				TOTAL	**$1,821,250**

West Service Area					
Item No.	**Description**	**Est. Quantity**	**Unit**	**Unit Price**	**Total Cost**
1	PIPE, 2" DIA. (PVC C-900)	1,389	LF	10	13,890
2	PIPE, 4" DIA. (PVC C-900)	4,133	LF	20	82,660
3	PIPE, 6" DIA. (PVC C-900)	5,717	LF	30	171,510
4	PIPE, 8" DIA. (PVC C-900)	3,328	LF	40	133,120
5	PIPE, 10" DIA. (PVC C-900)	3,406	LF	50	170,300
6	PIPE, 12" DIA. (PVC C-900)	5,959	LF	60	357,540
7	Concrete thrust blocks	1.05	CY	60	63
8	Trench Safety	23,932	LF	1.00	23,932
9	Erosion & Sediment control	23,932	LF	1.00	23,932
10	Traffic control plan	1	LS	2,000	2,000
11	Gate/Blocking valves	8	EA	1,500	12,000
12	Comb. Rate of Flow & Pressure Reducing Valve	1	EA	10,000	10,000
13	Fittings	1.68	TN	4,000	6,720
14	Mobilization/bonds/insurance	1	LS	100,767	100,767
				Subtotal	**$1,108,000**
				Engineering & Survey @ 10%	$110,800
				Contingency @ 15%	$166,200
				TOTAL	**$1,385,000**

South Commercial Development Area					
Item No.	**Description**	**Est. Quantity**	**Unit**	**Unit Price**	**Total Cost**
1	PIPE, 12" DIA. (PVC C-900)	6,839	LF	60	410,356
2	PIPE, 14" DIA. (PVC C-905)	3,625	LF	70	253,730
3	Concrete thrust blocks	1	CY	60	60
4	Trench Safety	10,464	LF	1.00	10,464
5	Erosion & Sediment control	10,464	LF	1.00	10,464
6	Traffic control plan	1	LS	5,000	5,000
	Highway Bore with Steel Casing	300	LF	65	19,500
	Railroad Bore with Steel Casing	300	LF	65	19,500
7	Gate/Blocking valves	10	EA	1,500	15,000
8	Fittings	1.6	TN	4,000	6,400
9	Mobilization/bonds/insurance	1	LS	75,047	75,047
				Subtotal	**$826,000**
				Engineering & Survey @ 10%	$82,600
				Contingency @ 15%	$123,900
				TOTAL	**$1,032,500**

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Appendix H: Projected System O&M Costs

Appendix H1: Phase 1 Expansion

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Phase 1 (2015) - Existing 40 HP (525 gpm)												
Monthly Demand	633,363	2,352,490	9,590,921	12,079,132	10,224,284	17,417,474	23,436,000	22,846,298	10,540,965	4,433,539	723,843	135,721
Daily Demand	20,431	84,018	309,385	402,638	329,816	580,582	756,000	736,977	351,366	143,017	24,128	4,378
Time of Pumping (hrs)	0.65	2.67	9.82	12.78	10.47	18.43	24.00	23.40	11.15	4.54	0.77	0.14
kwh	19	79	291	378	310	546	710	693	330	134	23	4
Cost/Day (10¢/kwh)	$1.92	$7.89	$29.07	$37.84	$30.99	$54.56	$71.04	$69.25	$33.02	$13.44	$2.27	$0.41
Cost/Month	$59.52	$236.85	$901.24	$1,135.05	$960.76	$1,636.69	$2,202.24	$2,146.83	$990.52	$416.61	$68.02	$12.75

Appendix H2: Phase 2 Expansion

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Phase 2 (2020) - Lake Pump Station - 3X200hp (2900gpm)												
Irrigation Demand (gpd)	49,014	159,879	543,946	705,883	584,531	1,016,417	1,383,514	1,282,817	606,551	270,137	61,984	23,019
Total Pumping Rate (gpm)	8700	8700	8700	8700	8700	8700	8700	8700	8700	8700	8700	8700
Time of Pumping (hrs)	0.09	0.31	1.04	1.35	1.12	1.95	2.65	2.46	1.16	0.52	0.12	0.04
kwh	42	136	463	600	497	865	1177	1091	516	230	53	20
Cost/Day (10¢/kwh)	$4.17	$13.60	$46.27	$60.04	$49.72	$86.45	$117.68	$109.11	$51.59	$22.98	$5.27	$1.96
Cost/Month	$129.24	$421.57	$1,434.27	$1,801.22	$1,541.28	$2,593.62	$3,648.02	$3,382.51	$1,547.75	$712.29	$158.17	$60.70
Phase 2 (2020) - WWTP Pump Station - 2X125hp (1190gpm)												
Irrigation Demand (gpd)	49,014	159,879	543,946	705,883	584,531	1,016,417	1,383,514	1,282,817	606,551	270,137	61,984	23,019
Total Pumping Rate (gpm)	2380	2380	2380	2380	2380	2380	2380	2380	2380	2380	2380	2380
Time of Pumping (hrs)	0.34	1.12	3.81	4.94	4.09	7.12	9.69	8.98	4.25	1.89	0.43	0.16
kwh	63	207	705	914	757	1317	1792	1662	786	350	80	30
Cost/Day (10¢/kwh)	$6.35	$20.71	$70.47	$91.45	$75.73	$131.68	$179.24	$166.19	$78.58	$35.00	$8.03	$2.98
Cost/Month	$196.85	$642.09	$2,184.55	$2,743.45	$2,347.54	$3,950.36	$5,556.34	$5,151.93	$2,357.39	$1,084.90	$240.90	$92.45

Appendix H3: Plum Creek Service Area

	Distance (ft)	Diameter (in)	"C" Factor	Static Head (ft)
Pipe Segment	2,770	18	120	35

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Irrigation Demand (gpd)	49,222	202,415	745,368	970,033	794,590	1,398,737	1,916,158	1,775,523	846,508	344,557	58,129	10,548
Lake Pump Station												
Total Pumping Rate (gpm)	137	562	2070	2695	2207	3885	5323	4932	2351	957	161	100
Time of Pumping (hrs)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	1.76
Head Loss (ft/100)	0.001	0.014	0.159	0.259	0.179	0.509	0.911	0.791	0.201	0.038	0.001	0.001
Friction (ft)	0.0	0.4	4.4	7.2	5.0	14.1	25.2	21.9	5.6	1.1	0.0	0.0
Total Dynamic Head	35.0	35.4	39.4	42.2	40.0	49.1	60.2	56.9	40.6	36.1	35.0	35.0
horse power required	1.61	6.70	27.47	38.25	29.69	64.23	107.95	94.51	32.12	11.62	1.90	1.18
kwh	7	30	122	170	132	285	479	420	143	52	8	2
Cost/Day (10¢/kwh)	$0.72	$2.98	$12.19	$16.98	$13.18	$28.52	$47.93	$41.96	$14.26	$5.16	$0.85	$0.15
Cost/Month	$22.20	$92.23	$378.04	$509.51	$408.66	$855.51	$1,485.77	$1,300.86	$427.80	$159.93	$25.37	$4.75
WWTP Pump Station - 2X125hp (1190gpm)												
Total Pumping Rate (gpm)	2380	2380	2380	2380	2380	2380	2380	2380	2380	2380	2380	2380
Time of Pumping (hrs)	0.34	1.42	5.22	6.79	5.56	9.80	13.42	12.43	5.93	2.41	0.41	0.07
kwh	64	262	966	1257	1029	1812	2482	2300	1097	446	75	14
Cost/Day (10¢/kwh)	$6.38	$26.22	$96.56	$125.67	$102.94	$181.21	$248.24	$230.02	$109.67	$44.64	$7.53	$1.37
Cost/Month	$197.68	$812.92	$2,993.48	$3,770.09	$3,191.16	$5,436.27	$7,695.49	$7,130.69	$3,290.00	$1,383.78	$225.92	$42.36

Appendix H4: Southeast Service Area

Irrigation Demand (gallons per day)												
Delivery Point	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Waterleaf Park	2,167	8,909	32,808	42,696	34,974	61,566	84,340	78,150	37,259	15,166	2,559	464
Waterleaf HOA Park	98	403	1,483	1,930	1,581	2,783	3,813	3,533	1,684	686	116	21
Lake Kyle	1,328	5,463	20,116	26,180	21,445	37,750	51,714	47,919	22,846	9,299	1,569	285
Steeplechase Park	277	1,138	4,189	5,452	4,466	7,862	10,770	9,980	4,758	1,937	327	59
Bunton Cr. Ball Field	310	1,275	4,695	6,111	5,005	8,811	12,071	11,185	5,332	2,170	366	66
Brookside ES	64	264	974	1,267	1,038	1,827	2,503	2,319	1,106	450	76	14
Lehman HS	1,107	4,552	16,764	21,817	17,871	31,459	43,096	39,933	19,039	7,749	1,307	237
Post Oak HOA Park	117	480	1,768	2,302	1,885	3,319	4,546	4,213	2,008	818	138	25
Total	**5,468**	**22,485**	**82,798**	**107,754**	**88,266**	**155,376**	**212,853**	**197,231**	**94,033**	**38,275**	**6,457**	**1,172**

Delivery Point	**Selected Peak Day Demand (gpm)**	**Pipe Segment**	**Distance (ft)**	**Diameter (in)**	**"C" Factor**	**Static Head (ft)**
Brookside ES	42	7	530	6	120	5
Post Oak Park	76	8	774	4	120	0
Bunton Cr. Ball Field	101	3	4768	6	120	-15
Lehman HS	120	10	2310	6	120	10
WaterLeaf HOA Park	64	34	405	4	120	15
Waterleaf Park	234	2	4203	14	120	15
Lake Kyle	144					
Steeplechase Park	179					

Lake Pump Station												
Segment 5 (Brookside + Post Oak Park)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	181	745	2,742	3,569	2,923	5,146	7,049	6,532	3,114	1,268	214	39
Total Pumping Rate (gpm)	118	118	118	118	118	118	118	118	118	118	118	118
Time of Pumping (hrs)	0.03	0.11	0.39	0.50	0.41	0.73	1.00	0.92	0.44	0.18	0.03	0.01
Head Loss (ft/100)	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167
Friction (ft)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Total Dynamic Head	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0	53.0
horse power required	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10
kwh	0	0	1	1	1	1	2	1	1	0	0	0
Cost/Day (10¢/kwh)	$0.00	$0.02	$0.06	$0.08	$0.06	$0.11	$0.16	$0.14	$0.07	$0.03	$0.00	$0.00
Cost/Month	$0.12	$0.51	$1.87	$2.35	$1.99	$3.39	$4.81	$4.45	$2.05	$0.86	$0.14	$0.03

Lake Pump Station												
Segment 7 (Brookside + Post Oak Park)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	181	745	2,742	3,569	2,923	5,146	7,049	6,532	3,114	1,268	214	39
Total Pumping Rate (gpm)	118	118	118	118	118	118	118	118	118	118	118	118
Time of Pumping (hrs)	0.03	0.11	0.39	0.50	0.41	0.73	1.00	0.92	0.44	0.18	0.03	0.01
Head Loss (ft/100)	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167	0.167
Friction (ft)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Total Dynamic Head	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
horse power required	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
kwh	0	0	0	0	0	0	0	0	0	0	0	0
Cost/Day (10¢/kwh)	$0.00	$0.00	$0.01	$0.01	$0.01	$0.01	$0.02	$0.02	$0.01	$0.00	$0.00	$0.00
Cost/Month	$0.01	$0.06	$0.21	$0.26	$0.22	$0.38	$0.53	$0.49	$0.23	$0.10	$0.02	$0.00

Lake Pump Station												
Segment 8 (Post Oak Park)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	117	480	1,768	2,302	1,885	3,319	4,546	4,213	2,008	818	138	25
Total Pumping Rate (gpm)	76	76	76	76	76	76	76	76	76	76	76	76
Time of Pumping (hrs)	0.03	0.11	0.39	0.50	0.41	0.73	1.00	0.92	0.44	0.18	0.03	0.01
Head Loss (ft/100)	0.533	0.533	0.533	0.533	0.533	0.533	0.533	0.533	0.533	0.533	0.533	0.533
Friction (ft)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Total Dynamic Head	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
horse power required	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
kwh	0	0	0	0	0	0	0	0	0	0	0	0
Cost/Day (10¢/kwh)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.01	$0.01	$0.01	$0.00	$0.00	$0.00	$0.00
Cost/Month	$0.01	$0.03	$0.09	$0.12	$0.10	$0.17	$0.24	$0.22	$0.10	$0.04	$0.01	$0.00

Lake Pump Station												
Segment 10 (Lehman HS)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	1,107	4,552	16,764	21,817	17,871	31,459	43,096	39,933	19,039	7,749	1,307	237
Total Pumping Rate (gpm)	120	120	120	120	120	120	120	120	120	120	120	120
Time of Pumping (hrs)	0.15	0.63	2.33	3.03	2.48	4.37	5.99	5.55	2.64	1.08	0.18	0.03
Head Loss (ft/100)	0.172	0.172	0.172	0.172	0.172	0.172	0.172	0.172	0.172	0.172	0.172	0.172
Friction (ft)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Total Dynamic Head	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
horse power required	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
kwh	0	0	1	1	1	2	3	2	1	0	0	0
Cost/Day (10¢/kwh)	$0.01	$0.03	$0.10	$0.13	$0.10	$0.18	$0.25	$0.23	$0.11	$0.04	$0.01	$0.00
Cost/Month	$0.20	$0.82	$3.02	$3.80	$3.22	$5.48	$7.76	$7.19	$3.32	$1.39	$0.23	$0.04

Lake Pump Station												
Segment 3 (Bunton Creek Ball Field)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	310	1,275	4,695	6,111	5,005	8,811	12,071	11,185	5,332	2,170	366	66
Total Pumping Rate (gpm)	101	101	101	101	101	101	101	101	101	101	101	101
Time of Pumping (hrs)	0.05	0.21	0.77	1.01	0.83	1.45	1.99	1.85	0.88	0.36	0.06	0.01
Head Loss (ft/100)	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
Friction (ft)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Total Dynamic Head	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0	-9.0
horse power required	-0.31	-0.31	-0.31	-0.31	-0.31	-0.31	-0.31	-0.31	-0.31	-0.31	-0.31	-0.31
kwh	0	0	0	0	0	0	0	0	0	0	0	0
Cost/Day (10¢/kwh)	$0.00	$0.00	-$0.02	-$0.02	-$0.02	-$0.03	-$0.05	-$0.04	-$0.02	-$0.01	$0.00	$0.00
Cost/Month	-$0.04	-$0.15	-$0.55	-$0.69	-$0.58	-$0.99	-$1.40	-$1.30	-$0.60	-$0.25	-$0.04	-$0.01

Lake Pump Station												
Segment 2 (Waterleaf Park)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	2,167	8,909	32,808	42,696	34,974	61,566	84,340	78,150	37,259	15,166	2,559	464
Total Pumping Rate (gpm)	234	234	234	234	234	234	234	234	234	234	234	234
Time of Pumping (hrs)	0.15	0.63	2.34	3.04	2.49	4.39	6.01	5.57	2.65	1.08	0.18	0.03
Head Loss (ft/100)	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Friction (ft)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Total Dynamic Head	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4	15.4
horse power required	1.21	1.21		1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21
kwh	0	1	2	3	2	4	5	5	2	1	0	0
Cost/Day (10¢/kwh)	$0.01	$0.06	$0.21	$0.27	$0.22	$0.39	$0.54	$0.50	$0.24	$0.10	$0.02	$0.00
Cost/Month	$0.43	$1.77	$6.50	$8.19	$6.93	$11.81	$16.72	$15.50	$7.15	$3.01	$0.49	$0.09

Lake Pump Station												
Segment 34 (Waterleaf HOA Park)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	98	403	1,483	1,930	1,581	2,783	3,813	3,533	1,684	686	116	21
Total Pumping Rate (gpm)	64	64	64	64	64	64	64	64	64	64	64	64
Time of Pumping (hrs)	0.03	0.11	0.39	0.51	0.41	0.73	1.00	0.93	0.44	0.18	0.03	0.01
Head Loss (ft/100)	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383	0.383
Friction (ft)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Total Dynamic Head	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5
horse power required	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
kwh	0	0	0	0	0	0	0	0	0	0	0	0
Cost/Day (10¢/kwh)	$0.00	$0.00	$0.01	$0.01	$0.01	$0.02	$0.03	$0.02	$0.01	$0.00	$0.00	$0.00
Cost/Month	$0.02	$0.09	$0.32	$0.40	$0.34	$0.57	$0.81	$0.75	$0.35	$0.15	$0.02	$0.00

Northeast Service Area - WWTP Pump Station - 2X125hp (1190gpm)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	5,468	22,485	82,798	107,754	88,266	155,376	212,853	197,231	94,033	38,275	6,457	1,172
Total Pumping Rate (gpm)	2380	2380	2380	2380	2380	2380	2380	2380	2380	2380	2380	2380
Time of Pumping (hrs)	0.04	0.16	0.58	0.75	0.62	1.09	1.49	1.38	0.66	0.27	0.05	0.01
kwh	7	29	107	140	114	201	276	256	122	50	8	2
Cost/Day (10¢/kwh)	$0.71	$2.91	$10.73	$13.96	$11.43	$20.13	$27.58	$25.55	$12.18	$4.96	$0.84	$0.15
Cost/Month	$21.96	$90.30	$332.53	$418.79	$354.48	$603.88	$854.84	$792.10	$365.46	$153.71	$25.10	$4.71

Appendix H5: Northeast Service Area

Irrigation Demand (gallons per month)												
Delivery Point	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Kyle Pkwy ROW	17,480	64,925	264,692	333,362	282,172	480,691	680,459	630,517	290,912	122,358	19,977	3,746
Seton Medical Ctr	16,727	62,129	253,294	319,007	270,021	459,992	651,157	603,366	278,385	117,089	19,117	3,584
Seton MC - Cooling	458,375	535,485	794,659	940,311	991,718	1,313,009	1,582,893	1,492,932	1,143,796	946,737	646,866	486,220
Chapa MS	11,387	42,295	172,432	217,166	183,819	313,142	443,279	410,745	189,512	79,709	13,014	2,440
Fuentes ES	9,274	34,446	140,435	176,868	149,709	255,035	361,023	334,526	154,346	64,918	10,599	1,987
Kensington ES	3,309	12,291	50,110	63,111	53,419	91,002	128,821	119,366	55,074	23,164	3,782	709
Total	516,552	751,570	1,675,622	2,049,826	1,930,857	2,912,870	3,847,632	3,591,452	2,112,024	1,353,975	713,353	498,687
						Irrigation Demand (gpd)						
Delivery Point	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Kyle Pkwy ROW	564	2,319	8,538	11,112	9,102	16,023	21,950	20,339	9,697	3,947	666	121
Seton Medical Ctr	540	2,219	8,171	10,634	8,710	15,333	21,005	19,463	9,279	3,777	637	116
Seton MC - Cooling	14,786	19,124	25,634	31,344	31,991	43,767	51,061	48,159	38,127	30,540	21,562	15,685
Chapa MS	367	1,511	5,562	7,239	5,930	10,438	14,299	13,250	6,317	2,571	434	79
Fuentes ES	299	1,230	4,530	5,896	4,829	8,501	11,646	10,791	5,145	2,094	353	64
Kensington ES	107	439	1,616	2,104	1,723	3,033	4,156	3,851	1,836	747	126	23
Total	**16,663**	**26,842**	**54,052**	**68,328**	**62,286**	**97,096**	**124,117**	**115,853**	**70,401**	**43,677**	**23,778**	**16,087**
Delivery Point	**Selected Peak Day Demand (gpm)**	**Pipe Segment**	**Distance (ft)**	**Diameter (in)**	**"C" Factor**	**Static Head (ft)**						
Kyle Pkwy ROW	122	14	2890	8	120	30						
Seton Medical Ctr	100	14	2890	8	120	30						
Seton MC - Cooling	50											
Chapa MS	119	16	2410	6	120	-25						
Fuentes ES	194	13	1225	8	120	25						
Kensington ES	69	15	6250	6	120	-5						

Lake Pump Station												
Segment 16 (Chapa MS)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	367	1,511	5,562	7,239	5,930	10,438	14,299	13,250	6,317	2,571	434	79
Total Pumping Rate (gpm)	119	119	119	119	119	119	119	119	119	119	119	119
Time of Pumping (hrs)	0.05	0.21	0.78	1.01	0.83	1.46	2.00	1.86	0.88	0.36	0.06	0.01
Head Loss (ft/100)	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170
Friction (ft)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Total Dynamic Head	-20.9	-20.9	-20.9	-20.9	-20.9	-20.9	-20.9	-20.9	-20.9	-20.9	-20.9	-20.9
horse power required	-0.84	-0.84	-0.84	-0.84	-0.84	-0.84	-0.84	-0.84	-0.84	-0.84	-0.84	-0.84
kwh	0	0	0	-1	-1	-1	-1	-1	-1	0	0	0
Cost/Day (10¢/kwh)	$0.00	-$0.01	-$0.05	-$0.06	-$0.05	-$0.09	-$0.12	-$0.12	-$0.05	-$0.02	$0.00	$0.00
Cost/Month	-$0.10	-$0.41	-$1.50	-$1.89	-$1.60	-$2.72	-$3.85	-$3.57	-$1.65	-$0.69	-$0.11	-$0.02
Lake Pump Station												
Segment 13 (Fuentes+Hosp. Irr. + Kens. ES. + Chapa MS)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	1,313	5,399	19,880	25,872	21,193	37,306	51,106	47,355	22,577	9,190	1,550	281
Total Pumping Rate (gpm)	482	482	482	482	482	482	482	482	482	482	482	482
Time of Pumping (hrs)	0.05	0.19	0.69	0.89	0.73	1.29	1.77	1.64	0.78	0.32	0.05	0.01
Head Loss (ft/100)	0.556	0.556	0.556	0.556	0.556	0.556	0.556	0.556	0.556	0.556	0.556	0.556
Friction (ft)	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
Total Dynamic Head	31.8	31.8	31.8	31.8	31.8	31.8	31.8	31.8	31.8	31.8	31.8	31.8
horse power required	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16	5.16
kwh	0	1	3	3	3	5	7	6	3	1	0	0
Cost/Day (10¢/kwh)	$0.02	$0.07	$0.26	$0.34	$0.28	$0.49	$0.68	$0.63	$0.30	$0.12	$0.02	$0.00
Cost/Month	$0.54	$2.21	$8.14	$10.25	$8.68	$14.78	$20.93	$19.39	$8.95	$3.76	$0.61	$0.12

Lake Pump Station												
Segment 14 (Hosp. Irr. + Kens. ES. + Chapa MS)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	1,014	4,168	15,350	19,976	16,363	28,805	39,460	36,564	17,432	7,096	1,197	217
Total Pumping Rate (gpm)	288	288	288	288	288	288	288	288	288	288	288	288
Time of Pumping (hrs)	0.06	0.24	0.89	1.16	0.95	1.67	2.28	2.12	1.01	0.41	0.07	0.01
Head Loss (ft/100)	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214
Friction (ft)	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2
Total Dynamic Head	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2
horse power required	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51
kwh	0	1	2	3	2	4	6	5	3	1	0	0
Cost/Day (10¢/kwh)	$0.02	$0.06	$0.23	$0.30	$0.25	$0.43	$0.59	$0.55	$0.26	$0.11	$0.02	$0.00
Cost/Month	$0.47	$1.94	$7.15	$9.01	$7.62	$12.99	$18.39	$17.04	$7.86	$3.31	$0.54	$0.10

Lake Pump Station												
Segment 15 (Kens. ES. + Chapa MS)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	474	1,949	7,179	9,343	7,653	13,471	18,455	17,100	8,153	3,318	560	102
Total Pumping Rate (gpm)	188	188	188	188	188	188	188	188	188	188	188	188
Time of Pumping (hrs)	0.04	0.17	0.64	0.83	0.68	1.19	1.64	1.52	0.72	0.29	0.05	0.01
Head Loss (ft/100)	0.395	0.395	0.395	0.395	0.395	0.395	0.395	0.395	0.395	0.395	0.395	0.395
Friction (ft)	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.7
Total Dynamic Head	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7
horse power required	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
kwh	0	0	1	1	1	1	2	1	1	0	0	0
Cost/Day (10¢/kwh)	$0.00	$0.02	$0.06	$0.08	$0.06	$0.11	$0.15	$0.14	$0.07	$0.03	$0.00	$0.00
Cost/Month	$0.12	$0.49	$1.82	$2.29	$1.94	$3.31	$4.68	$4.34	$2.00	$0.84	$0.14	$0.03

WWTP Pump Station - 2X125hp (1190gpm)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	16,663	26,842	54,052	68,328	62,286	97,096	124,117	115,853	70,401	43,677	23,778	16,087
Total Pumping Rate (gpm)	2380	2380	2380	2380	2380	2380	2380	2380	2380	2380	2380	2380
Time of Pumping (hrs)	0.12	0.19	0.38	0.48	0.44	0.68	0.87	0.81	0.49	0.31	0.17	0.11
kwh	22	35	70	89	81	126	161	150	91	57	31	21
Cost/Day (10¢/kwh)	$2.16	$3.48	$7.00	$8.85	$8.07	$12.58	$16.08	$15.01	$9.12	$5.66	$3.08	$2.08
Cost/Month	$66.92	$107.80	$217.08	$265.56	$250.15	$377.37	$498.47	$465.28	$273.62	$175.41	$92.42	$64.61

Appendix H6: North Commercial Service Area

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
gallons per month	190,505	707,590	2,884,789	3,633,201	3,075,294	5,238,886	7,416,085	6,871,785	3,170,547	1,333,535	217,720	40,822
gpd	6,145	25,271	93,058	121,107	99,203	174,630	239,229	221,670	105,685	43,017	7,257	1,317
Daily Demand at All 6 Delivery Points (gpd)	1,024	4,212	15,510	20,184	16,534	29,105	39,871	36,945	17,614	7,170	1,210	219
Peak Demand Rate for 6 Hours Irrigation (gpm)							111					
Pipe Segment		**Demand Rate (gpm)**	**Distance (ft)**	**Diameter (in)**	**"C" Factor**	**Static Head (ft)**						
North of Main Branch 1		111	2,642	12	120	14						
North of Main Branch 2		111	3,346	12	120	14						
North of Main Branch 3		111	4,054	10	120	14						
North of Main Branch 4		111	3,593	10	120	14						
South of Main Branch 1		111	2,396	14	120	0						
South of Main Branch		111	4,958	14	120	0						

Lake Pump Station												
Segment 1 North of Main Branch	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	4,097	16,847	62,038	80,738	66,135	116,420	159,486	147,780	70,457	28,678	4,838	878
Total Pumping Rate (gpm)	444	444	444	444	444	444	444	444	444	444	444	444
Time of Pumping (hrs)	0.15	0.63	2.33	3.03	2.48	4.37	5.99	5.55	2.64	1.08	0.18	0.03
Head Loss (ft/100)	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066	0.066
Friction (ft)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Total Dynamic Head	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5
horse power required	2.32	2.32	2.32	2.32	2.32	2.32	2.32	2.32	2.32	2.32	2.32	2.32
kwh	0	1	4	5	4	7	10	10	5	2	0	0
Cost/Day (10¢/kwh)	$0.03	$0.11	$0.40	$0.52	$0.43	$0.75	$1.03	$0.95	$0.45	$0.18	$0.03	$0.01
Cost/Month	$0.82	$3.36	$12.38	$15.59	$13.20	$22.48	$31.82	$29.49	$13.61	$5.72	$0.93	$0.18
Lake Pump Station												
Segment 2 North of Main Branch	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	3,073	12,636	46,529	60,553	49,602	87,315	119,614	110,835	52,842	21,509	3,629	658
Total Pumping Rate (gpm)	333	333	333	333	333	333	333	333	333	333	333	333
Time of Pumping (hrs)	0.15	0.63	2.33	3.03	2.48	4.37	5.99	5.55	2.64	1.08	0.18	0.03
Head Loss (ft/100)	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039	0.039
Friction (ft)	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Total Dynamic Head	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1
horse power required	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69
kwh	0	1	3	4	3	5	7	7	3	1	0	0
Cost/Day (10¢/kwh)	$0.02	$0.08	$0.29	$0.38	$0.31	$0.55	$0.75	$0.69	$0.33	$0.13	$0.02	$0.00
Cost/Month	$0.60	$2.45	$9.02	$11.36	$9.61	$16.37	$23.18	$21.48	$9.91	$4.17	$0.68	$0.13
Lake Pump Station												
Segment 3 North of Main Branch	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	2,048	8,424	31,019	40,369	33,068	58,210	79,743	73,890	35,228	14,339	2,419	439
Total Pumping Rate (gpm)	222	222	222	222	222	222	222	222	222	222	222	222
Time of Pumping (hrs)	0.15	0.63	2.33	3.03	2.48	4.37	5.99	5.55	2.64	1.08	0.18	0.03
Head Loss (ft/100)	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045	0.045

Friction (ft)	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Total Dynamic Head	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6
horse power required	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16
kwh	0	1	2	3	2	4	5	5	2	1	0	0
Cost/Day (10¢/kwh)	$0.01	$0.05	$0.20	$0.26	$0.21	$0.38	$0.52	$0.48	$0.23	$0.09	$0.02	$0.00
Cost/Month	$0.41	$1.69	$6.21	$7.83	$6.62	$11.28	$15.97	$14.80	$6.83	$2.87	$0.47	$0.09

Lake Pump Station												
Segment 4 North of Main Branch	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	1,024	4,212	15,510	20,184	16,534	29,105	39,871	36,945	17,614	7,170	1,210	219
Total Pumping Rate (gpm)	111	111	111	111	111	111	111	111	111	111	111	111
Time of Pumping (hrs)	0.15	0.63	2.33	3.03	2.48	4.37	5.99	5.55	2.64	1.08	0.18	0.03
Head Loss (ft/100)	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
Friction (ft)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Total Dynamic Head	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2
horse power required	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53
kwh	0	0	1	1	1	2	2	2	1	0	0	0
Cost/Day (10¢/kwh)	$0.01	$0.02	$0.09	$0.12	$0.10	$0.17	$0.24	$0.22	$0.10	$0.04	$0.01	$0.00
Cost/Month	$0.19	$0.77	$2.83	$3.57	$3.02	$5.15	$7.29	$6.75	$3.11	$1.31	$0.21	$0.04
Lake Pump Station												
Segment 5 South of Main Branch	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	2,048	8,424	31,019	40,369	33,068	58,210	79,743	73,890	35,228	14,339	2,419	439
Total Pumping Rate (gpm)	222	222	222	222	222	222	222	222	222	222	222	222
Time of Pumping (hrs)	0.15	0.63	2.33	3.03	2.48	4.37	5.99	5.55	2.64	1.08	0.18	0.03
Head Loss (ft/100)	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009
Friction (ft)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total Dynamic Head	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
horse power required	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
kwh	0	0	0	0	0	0	0	0	0	0	0	0
Cost/Day (10¢/kwh)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.01	$0.01	$0.01	$0.00	$0.00	$0.00	$0.00
Cost/Month	$0.01	$0.02	$0.08	$0.10	$0.09	$0.15	$0.21	$0.20	$0.09	$0.04	$0.01	$0.00

Lake Pump Station												
Segment 6 South of Main Branch	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	1,024	4,212	15,510	20,184	16,534	29,105	39,871	36,945	17,614	7,170	1,210	219
Total Pumping Rate (gpm)	111	111	111	111	111	111	111	111	111	111	111	111
Time of Pumping (hrs)	0.15	0.63	2.33	3.03	2.48	4.37	5.99	5.55	2.64	1.08	0.18	0.03
Head Loss (ft/100)	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Friction (ft)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total Dynamic Head	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
horse power required	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
kwh	0	0	0	0	0	0	0	0	0	0	0	0
Cost/Day (10¢/kwh)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Cost/Month	$0.00	$0.01	$0.02	$0.03	$0.03	$0.04	$0.06	$0.06	$0.03	$0.01	$0.00	$0.00
Northeast Service Area - WWTP Pump Station - 2X125hp (1190gpm)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	6,145	25,271	93,058	121,107	99,203	174,630	239,229	221,670	105,685	43,017	7,257	1,317
Total Pumping Rate (gpm)	2380	2380	2380	2380	2380	2380	2380	2380	2380	2380	2380	2380
Time of Pumping (hrs)	0.04	0.18	0.65	0.85	0.69	1.22	1.68	1.55	0.74	0.30	0.05	0.01
kwh	8	33	121	157	129	226	310	287	137	56	9	2
Cost/Day (10¢/kwh)	$0.80	$3.27	$12.06	$15.69	$12.85	$22.62	$30.99	$28.72	$13.69	$5.57	$0.94	$0.17
Cost/Month	$24.68	$101.49	$373.73	$470.69	$398.41	$678.71	$960.77	$890.25	$410.75	$172.76	$28.21	$5.29

Appendix H7: West Service Area

West Service Area												
Irrigation Demand (gallons per month)												
Delivery Point	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
City Square	3,667	13,621	55,532	69,939	59,199	100,848	142,759	132,281	61,033	25,670	4,191	786
Gregg-Clarke Park	22,265	82,698	337,154	424,624	359,419	612,285	866,741	803,127	370,552	155,854	25,446	4,771
Hometown Kyle Trails	1,916	7,117	29,014	36,541	30,930	52,690	74,587	69,113	31,888	13,412	2,190	411
Hometown Kyle Trails	190	704	2,870	3,615	3,060	5,213	7,379	6,838	3,155	1,327	217	41
Decker Park	5,546	20,600	83,985	105,774	89,531	152,520	215,905	200,059	92,304	38,823	6,339	1,188
McNaughton Park	1,977	7,343	29,938	37,705	31,915	54,368	76,963	71,314	32,903	13,839	2,259	424
Vantage Apts.	5,638	20,939	85,368	107,515	91,006	155,032	219,460	203,353	93,824	39,463	6,443	1,208
Hometown Kyle Trails Park	7,330	27,227	111,002	139,800	118,332	201,584	285,359	264,415	121,997	51,312	8,378	1,571
Silverado	2,116	7,858	32,038	40,349	34,153	58,182	82,361	76,316	35,211	14,810	2,418	453
Center St. Streetscape	17,092	63,484	258,820	325,967	275,912	470,028	665,364	616,530	284,458	119,643	19,534	3,663
Wallace MS	7,205	26,761	109,102	137,407	116,307	198,134	280,475	259,890	119,910	50,434	8,234	1,544
Kyle ES	1,987	7,380	30,087	37,892	32,074	54,639	77,346	71,669	33,067	13,908	2,271	426
Negley ES	2,559	9,505	38,751	48,805	41,310	70,374	99,620	92,308	42,590	17,913	2,925	548
Total	**79,487**	**295,238**	**1,203,662**	**1,515,933**	**1,283,149**	**2,185,895**	**3,094,319**	**2,867,213**	**1,322,892**	**556,410**	**90,842**	**17,033**
Irrigation Demand (gallons per day)												
Delivery Point	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
City Square	118	486	1,791	2,331	1,910	3,362	4,605	4,267	2,034	828	140	25
Gregg-Clarke Park	718	2,954	10,876	14,154	11,594	20,409	27,959	25,907	12,352	5,028	848	154
Hometown Kyle Trails	62	254	936	1,218	998	1,756	2,406	2,229	1,063	433	73	13
Hometown Kyle Trails	6	25	93	121	99	174	238	221	105	43	7	1
Decker Park	179	736	2,709	3,526	2,888	5,084	6,965	6,454	3,077	1,252	211	38
McNaughton Park	64	262	966	1,257	1,030	1,812	2,483	2,300	1,097	446	75	14
Vantage Apts.	182	748	2,754	3,584	2,936	5,168	7,079	6,560	3,127	1,273	215	39
Hometown Kyle Trails Park	236	972	3,581	4,660	3,817	6,719	9,205	8,530	4,067	1,655	279	51
Silverado	68	281	1,033	1,345	1,102	1,939	2,657	2,462	1,174	478	81	15
Center St. Streetscape	551	2,267	8,349	10,866	8,900	15,668	21,463	19,888	9,482	3,859	651	118
Wallace MS	232	956	3,519	4,580	3,752	6,604	9,048	8,384	3,997	1,627	274	50

Kyle ES	64	264	971	1,263	1,035	1,821	2,495	2,312	1,102	449	76	14
Negley ES	83	339	1,250	1,627	1,333	2,346	3,214	2,978	1,420	578	97	18
Total	**2,564**	**10,544**	**38,828**	**50,531**	**41,392**	**72,863**	**99,817**	**92,491**	**44,096**	**17,949**	**3,028**	**549**

Delivery Point	**Selected Peak Day Demand (gpm)**	**Pipe Segment**	**Distance (ft)**	**Diameter (in)**	**"C" Factor**	**Static Head (ft)**			
Negley ES	54	19	2198	4	120	30			
Kyle ES	42	26	2039	8	120	-25			
Wallace MS	151	25	1102	6	120	25			
Hometown Kyle Trails 1	40	21	1262	4	120	25			
Hometown Kyle Trails 2	4	22	1390	2	120	5			
Hometown Kyle Trails Park	153	23	3406	10	120	15			
City Square	77	27	1678	6	120	-15			
Center St. Streetscape	119	27	1678	6	120	-15			
Decker Park	116	29	3179	6	120	30			
Gregg-Clarke Park	116	24	1063	8	120	-5			
Silverado Park	44	23	3406	10	120	15			
McNaughton Park	41	19	2198	4	120	30			
Vantage Apts.	118	31	3837	18		-40			

Lake Pump Station												
Segment 18 (All Delivery Points Except Decker & Vantage)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	2,203	9,061	33,365	43,421	35,568	62,611	85,773	79,477	37,892	15,423	2,602	472
Total Pumping Rate (gpm)	842	842	842	842	842	842	842	842	842	842	842	842
Time of Pumping (hrs)	0.04	0.18	0.66	0.86	0.70	1.24	1.70	1.57	0.75	0.31	0.05	0.01
Head Loss (ft/100)	0.217	0.217	0.217	0.217	0.217	0.217	0.217	0.217	0.217	0.217	0.217	0.217

Friction (ft)	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Total Dynamic Head	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
horse power required	10.62	10.62	10.62	10.62	10.62	10.62	10.62	10.62	10.62	10.62	10.62	10.62
kwh	0	1	5	7	6	10	13	12	6	2	0	0
Cost/Day (10¢/kwh)	$0.03	$0.14	$0.52	$0.68	$0.55	$0.97	$1.33	$1.24	$0.59	$0.24	$0.04	$0.01
Cost/Month	$1.06	$4.37	$16.10	$20.27	$17.16	$29.23	$41.38	$38.34	$17.69	$7.44	$1.21	$0.23
Lake Pump Station												
Segment 19 (McNaughton+Negley)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	146	602	2,216	2,884	2,362	4,158	5,696	5,278	2,516	1,024	173	31
Total Pumping Rate (gpm)	95	95	95	95	95	95	95	95	95	95	95	95
Time of Pumping (hrs)	0.03	0.11	0.39	0.50	0.41	0.73	1.00	0.92	0.44	0.18	0.03	0.01
Head Loss (ft/100)	0.811	0.811	0.811	0.811	0.811	0.811	0.811	0.811	0.811	0.811	0.811	0.811
Friction (ft)	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8
Total Dynamic Head	47.8	47.8	47.8	47.8	47.8	47.8	47.8	47.8	47.8	47.8	47.8	47.8
horse power required	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54	1.54
kwh	0	0	0	1	0	1	1	1	0	0	0	0
Cost/Day (10¢/kwh)	$0.00	$0.01	$0.04	$0.06	$0.05	$0.08	$0.11	$0.10	$0.05	$0.02	$0.00	$0.00
Cost/Month	$0.09	$0.37	$1.36	$1.72	$1.45	$2.48	$3.51	$3.25	$1.50	$0.63	$0.10	$0.02
Lake Pump Station												
Segment 29 (Decker Park)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	179	736	2,709	3,526	2,888	5,084	6,965	6,454	3,077	1,252	211	38
Total Pumping Rate (gpm)	116	116	116	116	116	116	116	116	116	116	116	116
Time of Pumping (hrs)	0.03	0.11	0.39	0.51	0.41	0.73	1.00	0.93	0.44	0.18	0.03	0.01
Head Loss (ft/100)	0.162	0.162	0.162	0.162	0.162	0.162	0.162	0.162	0.162	0.162	0.162	0.162
Friction (ft)	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1	5.1
Total Dynamic Head	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1
horse power required	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37
kwh	0	0	0	1	0	1	1	1	0	0	0	0
Cost/Day (10¢/kwh)	$0.00	$0.01	$0.04	$0.05	$0.04	$0.07	$0.10	$0.09	$0.04	$0.02	$0.00	$0.00

Cost/Month	$0.08	$0.33	$1.23	$1.54	$1.31	$2.23	$3.15	$2.92	$1.35	$0.57	$0.09	$0.02
Lake Pump Station												
Segment 20 (All Deliveries Except Decker, Vantage, Negley, McNaughton)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	2,057	8,459	31,149	40,538	33,206	58,453	80,076	74,199	35,376	14,399	2,429	441
Total Pumping Rate (gpm)	747	747	747	747	747	747	747	747	747	747	747	747
Time of Pumping (hrs)	0.05	0.19	0.70	0.90	0.74	1.30	1.79	1.66	0.79	0.32	0.05	0.01
Head Loss (ft/100)	0.173	0.173	0.173	0.173	0.173	0.173	0.173	0.173	0.173	0.173	0.173	0.173
Friction (ft)	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3
Total Dynamic Head	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3	24.3
horse power required	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11
kwh	0	1	3	4	3	6	8	7	4	1	0	0
Cost/Day (10¢/kwh)	$0.02	$0.09	$0.31	$0.41	$0.34	$0.59	$0.81	$0.75	$0.36	$0.15	$0.02	$0.00
Cost/Month	$0.64	$2.65	$9.74	$12.27	$10.39	$17.70	$25.05	$23.21	$10.71	$4.50	$0.74	$0.14
Lake Pump Station												
Segment 21 (Hometown Kyle Trails 1,2)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	68	279	1,029	1,339	1,096	1,930	2,644	2,450	1,168	475	80	15
Total Pumping Rate (gpm)	44	44	44	44	44	44	44	44	44	44	44	44
Time of Pumping (hrs)	0.03	0.11	0.39	0.51	0.42	0.73	1.00	0.93	0.44	0.18	0.03	0.01
Head Loss (ft/100)	0.194	0.194	0.194	0.194	0.194	0.194	0.194	0.194	0.194	0.194	0.194	0.194
Friction (ft)	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Total Dynamic Head	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4
horse power required	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41
kwh	0	0	0	0	0	0	0	0	0	0	0	0
Cost/Day (10¢/kwh)	$0.00	$0.00	$0.01	$0.02	$0.01	$0.02	$0.03	$0.03	$0.01	$0.01	$0.00	$0.00
Cost/Month	$0.02	$0.10	$0.36	$0.46	$0.39	$0.66	$0.93	$0.87	$0.40	$0.17	$0.03	$0.01
Lake Pump Station												

Segment 22 (Hometown Kyle Trails 2)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	6	25	93	121	99	174	238	221	105	43	7	1
Total Pumping Rate (gpm)	4	4	4	4	4	4	4	4	4	4	4	4
Time of Pumping (hrs)	0.03	0.10	0.39	0.50	0.41	0.72	0.99	0.92	0.44	0.18	0.03	0.01
Head Loss (ft/100)	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067	0.067
Friction (ft)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Total Dynamic Head	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
horse power required	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
kwh	0	0	0	0	0	0	0	0	0	0	0	0
Cost/Day (10¢/kwh)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Cost/Month	$0.00	$0.00	$0.01	$0.01	$0.01	$0.01	$0.02	$0.02	$0.01	$0.00	$0.00	$0.00
Lake Pump Station												
Segment 23 (Kyle Trails Park, Kyle ES, Wallace MS, City Square, Center St., Gregg-Clarke, Silverado)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	1,989	8,180	30,120	39,199	32,110	56,523	77,432	71,749	34,208	13,924	2,349	426
Total Pumping Rate (gpm)	703	703	703	703	703	703	703	703	703	703	703	703
Time of Pumping (hrs)	0.05	0.19	0.71	0.93	0.76	1.34	1.84	1.70	0.81	0.33	0.06	0.01
Head Loss (ft/100)	0.377	0.377	0.377	0.377	0.377	0.377	0.377	0.377	0.377	0.377	0.377	0.377
Friction (ft)	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8
Total Dynamic Head	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8
horse power required	6.58	6.58	6.58	6.58	6.58	6.58	6.58	6.58	6.58	6.58	6.58	6.58
kwh	0	1	3	5	4	7	9	8	4	2	0	0
Cost/Day (10¢/kwh)	$0.02	$0.09	$0.35	$0.45	$0.37	$0.65	$0.89	$0.83	$0.40	$0.16	$0.03	$0.00
Cost/Month	$0.71	$2.93	$10.79	$13.59	$11.50	$19.59	$27.74	$25.70	$11.86	$4.99	$0.81	$0.15
Lake Pump Station												

Segment 24 (Gregg-Clarke, Wallace MS)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Irrigation Demand (gpd)	951	3,909	14,395	18,734	15,346	27,014	37,007	34,291	16,349	6,654	1,123	204
Total Pumping Rate (gpm)	267	267	267	267	267	267	267	267	267	267	267	267
Time of Pumping (hrs)	0.06	0.24	0.90	1.17	0.96	1.69	2.31	2.14	1.02	0.42	0.07	0.01
Head Loss (ft/100)	0.186	0.186	0.186	0.186	0.186	0.186	0.186	0.186	0.186	0.186	0.186	0.186
Friction (ft)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Total Dynamic Head	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0
horse power required	-0.27	-0.27	-0.27	-0.27	-0.27	-0.27	-0.27	-0.27	-0.27	-0.27	-0.27	-0.27
kwh	0	0	0	0	0	0	0	0	0	0	0	0
Cost/Day (10¢/kwh)	$0.00	$0.00	-$0.02	-$0.02	-$0.02	-$0.03	-$0.05	-$0.04	-$0.02	-$0.01	$0.00	$0.00
Cost/Month	-$0.04	-$0.15	-$0.56	-$0.70	-$0.60	-$1.02	-$1.44	-$1.33	-$0.61	-$0.26	-$0.04	-$0.01
Lake Pump Station												
Segment 25 (Wallace MS)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	232	956	3,519	4,580	3,752	6,604	9,048	8,384	3,997	1,627	274	50
Total Pumping Rate (gpm)	151	151	151	151	151	151	151	151	151	151	151	151
Time of Pumping (hrs)	0.03	0.11	0.39	0.51	0.41	0.73	1.00	0.93	0.44	0.18	0.03	0.01
Head Loss (ft/100)	0.264	0.264	0.264	0.264	0.264	0.264	0.264	0.264	0.264	0.264	0.264	0.264
Friction (ft)	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
Total Dynamic Head	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9
horse power required	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42	1.42
kwh	0	0	0	1	0	1	1	1	0	0	0	0
Cost/Day (10¢/kwh)	$0.00	$0.01	$0.04	$0.05	$0.04	$0.08	$0.10	$0.10	$0.05	$0.02	$0.00	$0.00
Cost/Month	$0.08	$0.34	$1.26	$1.59	$1.35	$2.30	$3.25	$3.01	$1.39	$0.58	$0.10	$0.02
Lake Pump Station												
Segment 26 (Kyle ES, City Square, Center St.)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	734	3,017	11,111	14,460	11,845	20,850	28,563	26,467	12,619	5,136	867	157
Total Pumping Rate	238	238	238	238	238	238	238	238	238	238	238	238

(gpm)												
Time of Pumping (hrs)	0.05	0.21	0.78	1.01	0.83	1.46	2.00	1.85	0.88	0.36	0.06	0.01
Head Loss (ft/100)	0.151	0.151	0.151	0.151	0.151	0.151	0.151	0.151	0.151	0.151	0.151	0.151
Friction (ft)	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
Total Dynamic Head	-21.9	-21.9	-21.9	-21.9	-21.9	-21.9	-21.9	-21.9	-21.9	-21.9	-21.9	-21.9
horse power required	-1.76	-1.76	-1.76	-1.76	-1.76	-1.76	-1.76	-1.76	-1.76	-1.76	-1.76	-1.76
kwh	0	0	-1	-1	-1	-2	-3	-2	-1	0	0	0
Cost/Day (10¢/kwh)	-$0.01	-$0.03	-$0.10	-$0.13	-$0.11	-$0.19	-$0.26	-$0.24	-$0.11	-$0.05	-$0.01	$0.00
Cost/Month	-$0.21	-$0.85	-$3.14	-$3.95	-$3.34	-$5.70	-$8.06	-$7.47	-$3.45	-$1.45	-$0.24	-$0.04
Lake Pump Station												
Segment 27 (City Square, Center St.)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	670	2,754	10,140	13,197	10,810	19,029	26,068	24,155	11,516	4,688	791	143
Total Pumping Rate (gpm)	196	196	196	196	196	196	196	196	196	196	196	196
Time of Pumping (hrs)	0.06	0.23	0.86	1.12	0.92	1.62	2.22	2.05	0.98	0.40	0.07	0.01
Head Loss (ft/100)	0.427	0.427	0.427	0.427	0.427	0.427	0.427	0.427	0.427	0.427	0.427	0.427
Friction (ft)	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2
Total Dynamic Head	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8
horse power required	-0.52	-0.52	-0.52	-0.52	-0.52	-0.52	-0.52	-0.52	-0.52	-0.52	-0.52	-0.52
kwh	0	0	0	0	0	-1	-1	-1	0	0	0	0
Cost/Day (10¢/kwh)	$0.00	-$0.01	-$0.03	-$0.04	-$0.04	-$0.06	-$0.08	-$0.08	-$0.04	-$0.02	$0.00	$0.00
Cost/Month	-$0.07	-$0.28	-$1.02	-$1.29	-$1.09	-$1.86	-$2.63	-$2.44	-$1.12	-$0.47	-$0.08	-$0.01
WWTP Pump Station - 2X125hp (1190gpm)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	2,564	10,544	38,828	50,531	41,392	72,863	99,817	92,491	44,096	17,949	3,028	549
Total Pumping Rate (gpm)	2380	2380	2380	2380	2380	2380	2380	2380	2380	2380	2380	2380
Time of Pumping (hrs)	0.02	0.07	0.27	0.35	0.29	0.51	0.70	0.65	0.31	0.13	0.02	0.00
kwh	3	14	50	65	54	94	129	120	57	23	4	1
Cost/Day (10¢/kwh)	$0.33	$1.37	$5.03	$6.55	$5.36	$9.44	$12.93	$11.98	$5.71	$2.33	$0.39	$0.07
Cost/Month	$10.30	$42.35	$155.94	$196.39	$166.23	$283.19	$400.87	$371.45	$171.38	$72.08	$11.77	$2.21

Appendix H8: South Commercial Service Area

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Irrigation Demand (gallons per month)		151,455	562,547	2,293,463	2,888,465	2,444,918	4,165,015	5,895,930	5,463,201	2,520,645	1,060,186	173,092	32,455
gpd		4,886	20,091	73,983	96,282	78,868	138,834	190,191	176,232	84,022	34,200	5,770	1,047
Daily Demand at All 6 Delivery Points (gpd)		814	3,348	12,330	16,047	13,145	23,139	31,699	29,372	14,004	5,700	962	174
Peak Demand Rate for 6 Hours Irrigation (gpm)								88					

Pipe Segment	**Demand Rate (gpm)**	**Distance (ft)**	**Diameter (in)**	**"C" Factor**	**Static Head (ft)**						
South Branch 1	100	3,625	14	120	-1						
South Branch 2	100	2,599	12	120	-1						
South Branch 3	100	2,244	12	120	-1						
South Branch 4	100	1,996	12	120	-1						

Lake Pump Station												
Segment 1 - South Branch 1	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	4,886	20,091	73,983	96,282	78,868	138,834	190,191	176,232	84,022	34,200	5,770	1,047
Total Pumping Rate (gpm)	400	400	400	400	400	400	400	400	400	400	400	400
Time of Pumping (hrs)	0.20	0.84	3.08	4.01	3.29	5.78	7.92	7.34	3.50	1.42	0.24	0.04
Head Loss (ft/100)	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026	0.026
Friction (ft)	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Total Dynamic Head	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
horse power required	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
kwh	0	0	0	0	0	0	0	0	0	0	0	0
Cost/Day (10¢/kwh)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	-$0.01	$0.00	$0.00	$0.00	$0.00	$0.00
Cost/Month	$0.00	-$0.02	-$0.06	-$0.08	-$0.07	-$0.11	-$0.16	-$0.15	-$0.07	-$0.03	$0.00	$0.00
Lake Pump Station												
Segment 2 - South Branch 2	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	3,664	15,068	55,487	72,212	59,151	104,125	142,643	132,174	63,016	25,650	4,327	785
Total Pumping Rate (gpm)	300	300	300	300	300	300	300	300	300	300	300	300
Time of Pumping (hrs)	0.20	0.84	3.08	4.01	3.29	5.78	7.92	7.34	3.50	1.42	0.24	0.04
Head Loss (ft/100)	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032
Friction (ft)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Total Dynamic Head	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
horse power required	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
kwh	0	0	0	0	0	0	0	0	0	0	0	0
Cost/Day (10¢/kwh)	$0.00	$0.00	$0.00	$0.00	$0.00	-$0.01	-$0.01	-$0.01	$0.00	$0.00	$0.00	$0.00
Cost/Month	-$0.01	-$0.03	-$0.12	-$0.15	-$0.13	-$0.22	-$0.30	-$0.28	-$0.13	-$0.05	-$0.01	$0.00

Segment 3 - South Branch 3	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	2,443	10,045	36,991	48,141	39,434	69,417	95,096	88,116	42,011	17,100	2,885	523
Total Pumping Rate (gpm)	200	200	200	200	200	200	200	200	200	200	200	200
Time of Pumping (hrs)	0.20	0.84	3.08	4.01	3.29	5.78	7.92	7.34	3.50	1.42	0.24	0.04
Head Loss (ft/100)	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
Friction (ft)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Total Dynamic Head	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7
horse power required	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04
kwh	0	0	0	0	0	0	0	0	0	0	0	0
Cost/Day (10¢/kwh)	$0.00	$0.00	-$0.01	-$0.01	-$0.01	-$0.02	-$0.03	-$0.02	-$0.01	$0.00	$0.00	$0.00
Cost/Month	-$0.02	-$0.09	-$0.31	-$0.40	-$0.33	-$0.57	-$0.81	-$0.75	-$0.35	-$0.15	-$0.02	$0.00
Lake Pump Station												
Segment 4 - South Branch 4	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	1,221	5,023	18,496	24,071	19,717	34,708	47,548	44,058	21,005	8,550	1,442	262
Total Pumping Rate (gpm)	100	100	100	100	100	100	100	100	100	100	100	100
Time of Pumping (hrs)	0.20	0.84	3.08	4.01	3.29	5.78	7.92	7.34	3.50	1.42	0.24	0.04
Head Loss (ft/100)	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
Friction (ft)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total Dynamic Head	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9
horse power required	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03
kwh	0	0	0	0	0	0	0	0	0	0	0	0
Cost/Day (10¢/kwh)	$0.00	$0.00	-$0.01	-$0.01	-$0.01	-$0.01	-$0.02	-$0.02	-$0.01	$0.00	$0.00	$0.00
Cost/Month	-$0.01	-$0.06	-$0.22	-$0.27	-$0.23	-$0.40	-$0.56	-$0.52	-$0.24	-$0.10	-$0.02	$0.00
Northeast Service Area - WWTP Pump Station - 2X125hp (1190gpm)												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Irrigation Demand (gpd)	4,886	20,091	73,983	96,282	78,868	138,834	190,191	176,232	84,022	34,200	5,770	1,047
Total Pumping Rate (gpm)	2380	2380	2380	2380	2380	2380	2380	2380	2380	2380	2380	2380
Time of Pumping (hrs)	0.03	0.14	0.52	0.67	0.55	0.97	1.33	1.23	0.59	0.24	0.04	0.01
kwh	6	26	96	125	102	180	246	228	109	44	7	1
Cost/Day (10¢/kwh)	$0.63	$2.60	$9.58	$12.47	$10.22	$17.99	$24.64	$22.83	$10.89	$4.43	$0.75	$0.14
Cost/Month	$19.62	$80.69	$297.12	$374.21	$316.74	$539.59	$763.83	$707.77	$326.55	$137.35	$22.42	$4.20

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Appendix I – Plum Creek Site 1 Conditions

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United States Department of Agriculture

NRCS

Natural Resources Conservation Service
101 South Main Street
Temple, Texas 76501

Subject: PDM - Plum Creek Site 1 Hazard Classification   Date: September 14, 2010

To: John Mueller, State Conservation Engineer   File Code: 390-15

During the rehabilitation planning of Plum Creek Site 1, it was determined that the structure meets federal and state "high" hazard criteria.

The table below lists the conditions shown in as-built plans compared to the current conditions. Current condition SITES routings were made with the orifice plate removed.

Plum Creek Site 1	**As-built plans**	**Current condition**
CN AMC II	81	74
Drainage Area (acres)	1,300	1,185
Hazard Classification	Significant	High
Principal Spillway Crest (elevation, feet)	744.6	744.6
Principal Spillway Pipe (diameter, inches)	24	24
Principal Spillway Storage (ac ft)	94	140.5
Auxiliary Spillway Frequency (% chance of occurrence)	1.27	< 0.2
Auxiliary Spillway Crest (elevation, feet)	758.3	758.3
Routed 100 year AS Crest (elevation, feet)		755.2
Detention Storage (ac ft)	876	744
Top of Dam (elevation, feet)	764.2	764.0
Total Storage TOD (ac ft)	1,706	1,706

Updated current watershed hydrologic conditions were used to develop alternatives presented in this report. It is recommended that the remaining orifice plate be removed (current condition shown above) after the Samson Road improvement construction is completed downstream of the dam. The Water Resources Staff has terminated planning on this structure, and recommends that TCEQ be informed of the findings.

Steve Bednarz
ASTC Water Resources

cc: Brian Wenberg, Assistant State Conservation Engineer, NRCS, Temple
Isidro Morales, DC, NRCS, Lockhart
Johnie Halliburton, General Manager, Plum Creek Conservation District

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Appendix J – Water Use Permit No. 5839

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TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

WATER USE PERMIT

APPLICATION NO. 5839 PERMIT NO. 5839 TYPE §11.121

Permittee:	Plum Creek Homeowner's Association, Inc.	Address:	12335 Hymeadow Drive Suite 300 Austin, TX 78750
Filed:	May 12, 2004	Granted:	DEC 29 2004
Purpose:	Recreation	County:	Hays
Watercourse:	Plum Creek, tributary of the San Marcos River, tributary of the Guadalupe River	Watershed:	Guadalupe River Basin

WHEREAS, Plum Creek Homeowners Association, Applicant, seeks authorization to maintain an existing Soil Conservation Service (SCS) dam and reservoir for in-place recreational purposes on Plum Creek, tributary of the San Marcos River, tributary of the Guadalupe River, Guadalupe River Basin; and

WHEREAS, the reservoir has a capacity of 180 acre-feet of water and a surface area of 39.34 acres and is located approximately 10.1 miles north from San Marcos and 2.2 miles north from Kyle, Texas, Hays County; and

WHEREAS, the dam is located in the Henry Loller Survey 19, Abstract 290, with station 22+40 on the centerline of the dam being N 23.5217°W, 1,713.30 feet from the northeast corner of the Loller Survey, also being at Latitude 30.0194°N, Longitude 97.8790°W; and

WHEREAS, Plum Creek Conservation District is the local sponsor for the SCS dam and has provided a letter of consent of this application dated May 4, 2004; and

WHEREAS, Plum Creek Development Partners, Ltd., Mountain City Golf Co., L.L.C., and Plum Creek Homeowner's Association, Inc. own the land innundated by the reservoir and ownership is evidenced by an Amended and Ratified Easement Agreement dated August 17, 2004; and

WHEREAS, the Texas Commission on Environmental Quality finds that jurisdiction over the application is established; and

WHEREAS, the Executive Director recommends that special conditions be included in the permit for the protection of instream uses; and

WHEREAS, no person protested the granting of this application; and

WHEREAS, this permit, if issued, will be subject to the administrative requirements of the South Texas Watermaster office; and

WHEREAS, the Commission has complied with the requirements of the Texas Commission on Environmental Quality in issuing this permit;

NOW, THEREFORE, Water Use Permit No. 5839 is issued to the Plum Creek Homeowners Association, Inc. subject to the following terms and conditions:

1. IMPOUNDMENT

   Permittee is authorized to utilize an existing Soil Conservation Service (SCS) dam and reservoir for in-place recreational purposes on Plum Creek, tributary of the San Marcos River, tributary of the Guadalupe River, Guadalupe River Basin. The reservoir has a capacity of 180 acre-feet of water and a surface area of 39.34 acres and is located approximately 10.1 miles north from San Marcos and 2.2 miles north from Kyle, in Hays County. The dam is located in the Henry Loller Survey 19, Abstract 290 with station 22+40 on the centerline of the dam being N 23.5217°W, 1,713.30 feet from the northeast corner of the Loller Survey, also being at Latitude 30.0194°N, Longitude 97.8790°W.

2. USE

   Permittee is authorized to use the reservoir for in-place recreational purposes with no right of diversion.

3. TIME PRIORITY

   The time priority of this right is May 12, 2004.

4. SPECIAL CONDITIONS

   A. Permittee shall submit to the Executive Director of the TCEQ verification that areas along the upstream margin of the reservoir are to be preserved and managed to promote fish and wildlife habitat in perpetuity.

   B. Permittee shall maintain suitable outlets in good working condition in the aforesaid dam to allow the passage of flows in Plum Creek when the reservoir elevation is higher than 744.6 feet above mean sea level.

This permit is issued subject to all superior and senior water rights in the Guadalupe River Basin.

Permittee agrees to be bound by the terms, conditions, and provisions contained herein and such agreement is a condition precedent to the granting of this permit.

All other matters requested in the application which are not specifically granted by this permit are denied.

This permit is issued subject to the Rules of the Texas Commission on Environmental Quality and to the right of continuing supervision of State water resources exercised by the Commission.

TEXAS COMMISSION ON
ENVIRONMENTAL QUALITY

For the Commission

Date issued: DEC 29 2004

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Appendix K – Debt Service Detail

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Year	Series 2015 Payment	Series 2020 Payment	Series 2025 Payment	TOTAL
2015	$67,704.68			$67,704.68
2016	$67,704.68			$67,704.68
2017	$67,704.68			$67,704.68
2018	$67,704.68			$67,704.68
2019	$67,704.68			$67,704.68
2020	$67,704.68	$480,051.28		$547,755.96
2021	$67,704.68	$480,051.28		$547,755.96
2022	$67,704.68	$480,051.28		$547,755.96
2023	$67,704.68	$480,051.28		$547,755.96
2024	$67,704.68	$480,051.28		$547,755.96
2025	$67,704.68	$480,051.28	$340,128.27	$887,884.23
2026	$67,704.68	$480,051.28	$340,128.27	$887,884.23
2027	$67,704.68	$480,051.28	$340,128.27	$887,884.23
2028	$67,704.68	$480,051.28	$340,128.27	$887,884.23
2029	$67,704.68	$480,051.28	$340,128.27	$887,884.23
2030	$67,704.68	$480,051.28	$340,128.27	$887,884.23
2031	$67,704.68	$480,051.28	$340,128.27	$887,884.23
2032	$67,704.68	$480,051.28	$340,128.27	$887,884.23
2033	$67,704.68	$480,051.28	$340,128.27	$887,884.23
2034	$67,704.68	$480,051.28	$340,128.27	$887,884.23
2035		$480,051.28	$340,128.27	$820,179.54
2036		$480,051.28	$340,128.27	$820,179.54
2037		$480,051.28	$340,128.27	$820,179.54
2038		$480,051.28	$340,128.27	$820,179.54
2039		$480,051.28	$340,128.27	$820,179.54
2040			$340,128.27	$340,128.27
2041			$340,128.27	$340,128.27
2042			$340,128.27	$340,128.27
2043			$340,128.27	$340,128.27
2044			$340,128.27	$340,128.27
2045				$0.00

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Appendix L – Present Value Analysis

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City of Kyle
Direct Water Reuse Feasibility Study

Reuse Alternative

Year	Total Other Sources	Reuse Debt Service	Reuse Power	Reuse O&M	Reuse Treatment	Total Annual Reuse Costs	Total Water Supply Cost
2015	$ (2,104,628)	($50,779)	($12,064)	($7,238)	($6,731)	($76,812)	($2,181,439)
2016	$ (2,104,628)	($50,779)	($12,064)	($7,238)	($6,731)	($76,812)	($2,181,439)
2017	$ (2,104,628)	($50,779)	($12,064)	($7,238)	($6,731)	($76,812)	($2,181,439)
2018	$ (2,104,628)	($50,779)	($12,064)	($7,238)	($6,731)	($76,812)	($2,181,439)
2019	$ (2,104,628)	($50,779)	($12,064)	($7,238)	($6,731)	($76,812)	($2,181,439)
2020	$ (2,533,827)	($410,817)	($26,327)	($67,063)	($12,741)	($516,948)	($3,050,775)
2021	$ (2,533,827)	($410,817)	($26,327)	($67,063)	($12,741)	($516,948)	($3,050,775)
2022	$ (2,533,827)	($410,817)	($26,327)	($67,063)	($12,741)	($516,948)	($3,050,775)
2023	$ (2,533,827)	($410,817)	($26,327)	($67,063)	($12,741)	($516,948)	($3,050,775)
2024	$ (2,533,827)	($410,817)	($26,327)	($67,063)	($12,741)	($516,948)	($3,050,775)
2025	$ (3,271,059)	($495,849)	($43,723)	($109,450)	($18,772)	($667,794)	($3,938,853)
2026	$ (3,271,059)	($495,849)	($43,723)	($109,450)	($18,772)	($667,794)	($3,938,853)
2027	$ (3,271,059)	($495,849)	($43,723)	($109,450)	($18,772)	($667,794)	($3,938,853)
2028	$ (3,271,059)	($495,849)	($43,723)	($109,450)	($18,772)	($667,794)	($3,938,853)
2029	$ (3,271,059)	($495,849)	($43,723)	($109,450)	($18,772)	($667,794)	($3,938,853)
2030	$ (4,092,896)	($495,849)	($52,383)	($109,450)	($22,074)	($679,756)	($4,772,652)
2031	$ (4,092,896)	($495,849)	($52,383)	($109,450)	($22,074)	($679,756)	($4,772,652)
2032	$ (4,092,896)	($495,849)	($52,383)	($109,450)	($22,074)	($679,756)	($4,772,652)
2033	$ (4,092,896)	($495,849)	($52,383)	($109,450)	($22,074)	($679,756)	($4,772,652)
2034	$ (4,092,896)	($495,849)	($52,383)	($109,450)	($22,074)	($679,756)	($4,772,652)
2035	$ (4,585,854)	($495,849)	($61,214)	($109,450)	($25,779)	($692,292)	($5,278,146)
							($46,834,390)

Baseline (Potable) Alternative

Year	Total Other Supplies	Potable Water Debt Service	Potable Water Power	Potable Water O&M	Potable Water Treatment	Total Annual Potable Costs	Equivalent Nutrient Removal Benefit	Total Water Supply Cost
2015	($2,104,628)	$ (96,380)	$ (12,064)	$ (12,170)	$ (5,435)	($2,230,676)	$ (286,155)	($2,516,831)
2016	($2,104,628)	$ (96,380)	$ (12,064)	$ (12,170)	$ (5,435)	($2,230,676)	$ (286,155)	($2,516,831)
2017	($2,104,628)	$ (96,380)	$ (12,064)	$ (12,170)	$ (5,435)	($2,230,676)	$ (286,155)	($2,516,831)
2018	($2,104,628)	$ (96,380)	$ (12,064)	$ (12,170)	$ (5,435)	($2,230,676)	$ (286,155)	($2,516,831)
2019	($2,104,628)	$ (96,380)	$ (12,064)	$ (12,170)	$ (5,435)	($2,230,676)	$ (286,155)	($2,516,831)
2020	($2,533,827)	$ (779,760)	$ (26,327)	$ (98,461)	$ (10,115)	($3,448,490)	$ (536,385)	($3,984,875)
2021	($2,533,827)	$ (779,760)	$ (26,327)	$ (98,461)	$ (10,115)	($3,448,490)	$ (536,385)	($3,984,875)
2022	($2,533,827)	$ (779,760)	$ (26,327)	$ (98,461)	$ (10,115)	($3,448,490)	$ (536,385)	($3,984,875)
2023	($2,533,827)	$ (779,760)	$ (26,327)	$ (98,461)	$ (10,115)	($3,448,490)	$ (536,385)	($3,984,875)
2024	($2,533,827)	$ (779,760)	$ (26,327)	$ (98,461)	$ (10,115)	($3,448,490)	$ (536,385)	($3,984,875)
2025	($3,271,059)	$ (1,263,950)	$ (43,729)	$ (159,600)	$ (14,984)	($4,753,322)	$ (696,319)	($5,449,641)
2026	($3,271,059)	$ (1,263,950)	$ (43,729)	$ (159,600)	$ (14,984)	($4,753,322)	$ (696,319)	($5,449,641)
2027	($3,271,059)	$ (1,263,950)	$ (43,729)	$ (159,600)	$ (14,984)	($4,753,322)	$ (696,319)	($5,449,641)
2028	($3,271,059)	$ (1,263,950)	$ (43,729)	$ (159,600)	$ (14,984)	($4,753,322)	$ (696,319)	($5,449,641)
2029	($3,271,059)	$ (1,263,950)	$ (43,729)	$ (159,600)	$ (14,984)	($4,753,322)	$ (696,319)	($5,449,641)
2030	($4,092,896)	$ (1,263,950)	$ (52,389)	$ (159,600)	$ (17,736)	($5,586,572)	$ (951,092)	($6,537,663)
2031	($4,092,896)	$ (1,263,950)	$ (52,389)	$ (159,600)	$ (17,736)	($5,586,572)	$ (951,092)	($6,537,663)
2032	($4,092,896)	$ (1,263,950)	$ (52,389)	$ (159,600)	$ (17,736)	($5,586,572)	$ (951,092)	($6,537,663)
2033	($4,092,896)	$ (1,263,950)	$ (52,389)	$ (159,600)	$ (17,736)	($5,586,572)	$ (951,092)	($6,537,663)
2034	($4,092,896)	$ (1,263,950)	$ (52,389)	$ (159,600)	$ (17,736)	($5,586,572)	$ (951,092)	($6,537,663)
2035	($4,585,854)	$ (1,167,570)	$ (61,220)	$ (159,600)	$ (20,298)	($5,994,542)	$ (1,025,849)	($7,020,392)
								($61,416,672)

Discount Rate 0.0400
(FY 2012 Plan Formulation Rate For Federal Water Projects, updated 10/2011)
http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/cntsc/?&cid=nrcs143_009685

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Appendix M – BSEACD Technical Memorandum

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Technical Memorandum

A Review of the Regulatory Framework and Hydrogeotechnical Constraints Affecting Kyle Water Re-use Feasibility Related to Groundwater Resources

Prepared for:

The City of Kyle
and
RPS Espey Consultants, Inc.

Prepared by:

Barton Springs/Edwards Aquifer Conservation District

June 22, 2012

Technical Memorandum

A Review of the Regulatory Framework and Hydrogeotechnical Constraints Affecting Kyle Water Re-use Feasibility Related to Groundwater Resources

1.0 Background, Purpose, and Approach

The Barton Springs/Edwards Aquifer Conservation District (BSEACD) serves portions of southeastern Travis, northeastern Hays, and northwestern Caldwell Counties, including a portion of the City of Kyle (City.) The City uses groundwater from the Barton Springs segment of the Edwards Aquifer under permits from the BSEACD for part of its water supply. Firm yield supplies of this aquifer are fully developed, and in fact currently authorized withdrawals from the aquifer during extreme drought would exceed the ability of the aquifer to achieve its desired future condition. Accordingly, provision of alternative sources of water for current uses of the water during extreme drought is highly desirable.

The BSEACD enthusiastically supported the City's application for facility planning grant funding to assess the feasibility of re-using treated effluent for irrigation of City public lands and thereby potentially conserving high-quality Edwards Aquifer water for higher-value and less discretionary uses, such as drinking water. One measure of this support was offering to provide in-kind technical services to assess constraints imposed by groundwater quantity and quality on the feasibility of the conceptual plans for the reclaimed water project. Working along with the City's staff and its engineering consulting team, led by RPS Espey Consultants, Inc. (Espey), the BSEACD staff assessed the prospective project elements from the standpoint of a groundwater regulatory authority, specifically examining hydrogeotechnical and groundwater-related regulatory and institutional constraints imposed on and by the conceptual project plans. This technical memorandum contains the results, findings, and conclusions of this assessment by the BSEACD in fulfillment of its pledge of in-kind technical services in support of the facility planning grant project.

This report reflects the BSEACD staff's over-arching perspective on all such projects. In particular, as a regulatory agency itself and one that interfaces routinely with other regulatory agencies, the BSEACD does not equate "permit-ability" *necessarily* with "acceptability"; regulations and agency decision-making are a public balancing of politics, precedents, science and engineering, public good, and environmental impact. At best, the lack of regulatory authorities applicable to a project or a project's compliance with applicable regulations may be just a first-order approximation of its environmental goodness and acceptability. Further, a project that is currently able to be permitted might still be subject to low-probability but high-consequence events that could have deleterious impacts. It is important for any feasibility study to assess the likelihood and significance of such extraordinary circumstances and how they might be mitigated or avoided, while also maintaining a sense of proportion about those matters.

This report is subdivided into two major sections, corresponding to the two assessment tasks that the BSEACD and Espey agreed would form the scope of the BSEACD's evaluation. In each section, the project design as currently conceived is first examined for elements affecting feasibility, and then additional constraints or concerns that would or could arise from possible future extension of the project into other, more sensitive areas are briefly characterized; it should be emphasized that this latter assessment is for some speculative, possible future configuration for the project that is not currently proposed or contemplated, but which could be facilitated by the existence of the project as currently planned. A final section provides an overall summary of the BSEACD's findings and conclusions regarding the feasibility of the water re-use project, primarily from a groundwater perspective, along with some recommendations for consideration by the City.

2.0 Legal, Regulatory and Institutional Issues Affecting Feasibility of Using Reclaimed Water

The objective of this assessment area is to identify any legal or institutional requirements or barriers to implementing the proposed project that are presented by the groundwater institutional framework. The first subsection summarizes the Edwards Aquifer Authority (EAA) regulations and land-use authorities that apply and don't apply to the conceptual plan for effluent re-use, and assesses any regulatory constraints or issues that may be presented and how they may be mitigated. A second subsection addresses any groundwater rights or regulatory issues potentially resulting from the implementation of the proposed project.

2.1 Constraints Imposed By EAA Regulations and Land Use Authorities

The proposed project involves storage, transmission, and application of highly treated effluent to irrigation areas within the jurisdictional area of the EAA. The project area as currently proposed is immediately adjacent to but does not extend into the BSEACD's jurisdictional area; so EAA's rules and regulations, not BSEACD's are applicable to the project. The EAA's primary purpose is to manage, enhance, and protect the San Antonio pool of the Edwards Aquifer System in central and southwest Texas. To this end, the Authority has been directed by the Texas Legislature through the Edwards Aquifer Authority Act (Act) to achieve certain management goals. The pertinent directives of the Act related to water quality protection include:[1]

- protect the water quality of the Aquifer;
- protect the water quality of the surface streams to which the Aquifer provides streamflow;
- recognize the extent of the hydrogeologic connection and interaction between surface water and groundwater;
- protect aquatic and wildlife habitat; and
- protect species that are designated as threatened or endangered under state or federal law;

The means to achieve these directives include certain authorities to regulate land use that may affect water quality that are unique to the EAA and generally unavailable to other more conventional Chapter 36 Groundwater Conservation Districts (GCDs).[2] These additional land use authorities also apply in a water quality buffer zone which extends an additional five miles up gradient of the EAA's jurisdictional boundaries (Figure 1).

[1] EAA Groundwater Management Plan, approved January 5, 2011
[2] Texas Water Code Chapter 36 – Groundwater Conservation BSEACDs

2.1.1 Existing EAA Land Use Authorities

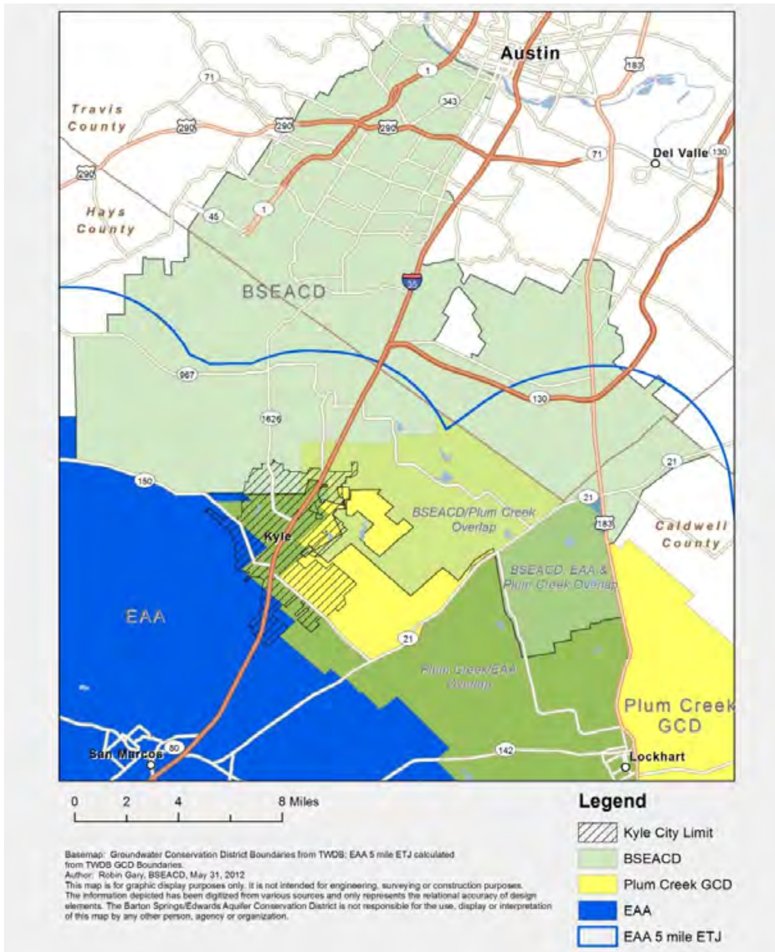

Figure 1. Map of GCD jurisdictional boundaries in project area. EAA boundaries include the 5-mile extended water quality buffer.

The following is a summary of the land use authorities currently available to the EAA that affect or potentially affect the re-use project.

<u>EAA Rule 713, Subchapter E:</u>

Under this rule, the EAA regulates certain activities having the potential to pollute the Edwards Aquifer and hydrologically connected surface streams. The activities addressed are those related to the response to unauthorized discharges in violation of a permit issued by the Texas Commission on Environmental Quality (TCEQ, or Commission) under Texas Water Code § 26.121 (code prohibiting unauthorized discharges of waste), and discharges or spills of oil, petroleum products, used oil, hazardous substances, industrial solid waste or other substances on the recharge zone and contributing zone of the Aquifer. Activities include notification of spills of reportable quantities and required actions to abate or contain certain spills and discharges.

This rule should have no appreciable effect on the proposed project provided that reclaimed-water storage, transmission lines, irrigation areas, and other related facilities and infrastructure remain down gradient of the recharge zone and of the contributing area of the transition zone, as currently proposed. The BSEACD only notes herein and has not made an assessment of the efficacy of how good engineering practices in designing and constructing the facilities would preclude problems in normal operation; the location down gradient of the Edwards recharge zone likely mitigates any residual regulatory concern. Any facilities, particularly any areas irrigated with reclaimed water that may be planned in the future to be extended into or up gradient of the recharge zone may require compliance with this chapter in the event there is a line break or an unauthorized discharge in violation of a Texas Pollutant Discharge Elimination System (TPDES) permit, a Texas Land Application Permit (TLAP), or a Chapter 210 Re-use Authorization.

EAA Rule 713, Subchapter F:

Under this rule, the EAA regulates the storage of certain substances and hazardous materials on the recharge zone and the contributing zone of the EAA. Facilities in these environmentally sensitive areas are required to register with the Authority if they store an aggregate quantity exceeding 1,000 gallons or 10,000 pounds of regulated substances in containers 55-gallons or less in size.

In addition to the registration requirement, regulated facilities are required to have secondary containment for regulated substances and to prepare a Spill Prevention and Response Plan (SPRP).

This rule should have no appreciable effect on the proposed project provided that reclaimed water storage, transmission lines, irrigation areas, and other related facilities and infrastructure remain down gradient of the recharge zone as currently proposed. The converse also applies: if the project were to extend into the recharge or contributing zone, Rule 713 would be of regulatory emphasis. However, the conceptual plan for the proposed project does not identify use of any such substances that are regulated under this rule.

EAA Rule 713, Subchapter G:

Under this rule, the EAA regulates aboveground storage tanks (ASTs) and underground storage tanks (USTs) located in, above, or on the Edwards Aquifer recharge zone.

The rule states that, on or after October 18, 2002, no person may install or have installed an AST or UST system for the purpose of storing or otherwise containing regulated substances. Storage tanks in existence prior to October 18, 2002, must be registered with the EAA.

Since the proposed project does not identify the required use of any such facilities or substances that are regulated under this Rule, it should have no appreciable effect on the proposed project.

2.1.2 Use of Reclaimed Water on the Recharge Zone

EAA's rules have a general prohibition that states, "a person may not pollute or contribute to pollution of the Aquifer" (EAA Rule §711.232). Although this general provision could arguably be invoked to address illicit discharges or unauthorized wastewater permitted discharges, there is no explicit prohibition or formal policy directly addressing the use of reclaimed water over the recharge zone. That said, the EAA has taken a general position in opposition to the practice as indicated in their comments concerning new developments and facility planning efforts. For example, the EAA indicated their position in response to the proposed use of reclaimed water on a golf course associated with the Paso Robles Planned Community where they stated ""…staff believes the use of reclaimed water on the recharge zone is not in the best interest of aquifer water quality." Similarly, the EAA stated in a letter providing support the City of New Braunfels's Regional Water Facility Planning Grant Application their concerns about the potential effects of use of reclaimed water on city parklands near endangered and threatened aquatic species habitat. The EAA has also gone so far as to get approval of conceptual rules that would prohibit the use of reclaimed water of the recharge zone. These rules, however, were not included in the pending rule package to allow further discussion and vetting.

Given the potential for future regulations or prohibitions and the uncertainty associated with the potential risks involved, all project phases should avoid the end use of reclaimed water or construction of any reclaimed water facilities up-gradient or over the recharge zone until such time that these risks are better understood and can be prevented and/or mitigated with proper system design and operation.

2.2 Groundwater Rights and Regulatory Issues

Implementation of the reclaimed water project as conceptually planned will not likely have a direct effect on groundwater rights. However, importantly there may be opportunities for indirect benefits to the Edwards Aquifer, particularly where City demand that is currently provided by Edwards Aquifer pumping can be replaced or reduced by reclaimed water.

This project benefit could be more firmly realized when aquifer demand that is replaced by reclaimed water can be institutionalized through commitments to additional curtailments in pumpage during extreme drought conditions. The BSEACD is currently working with those of its permittees holding historical production permits, including the City, to foster arrangements to achieve additional extreme drought pumping curtailment in order to ensure preservation of the Desired Future Condition (DFC) established for the freshwater

Barton Springs segment of the Edwards Aquifer.[3] The City is encouraged to participate with the BSEACD in this endeavor to preserve this groundwater resource for as long as possible during drought.

2.2.1 Groundwater Planning and Coordination

The following subsections assess potential issues associated with the pertinent agencies, regional water planning groups, and other projects

South Central Texas Regional Water Planning Group (Region L)

A cursory review of the current Region L water plan indicates that the prospective reclaimed water project is not specified in the regional plan. The diverted discharges will have the effect of reducing demand currently supplied by other sources as well as reducing supplies identified by downstream demands dependent on continued discharges. Both the potential reductions in demand and supply should be accounted for in the Region L plans or at the very least, should be brought to their attention. Amending the Region L plan in the next planning cycle to include the project would be recommended, not only to be able to account for the diversions but also to eligible for additional funding from Texas Water Development Board if needed.

Groundwater Management Area 10

The receiving area of the reclaimed water project would be primarily located in the central subdivision of Groundwater Management Area (GMA) 10 (Figure 2). However, the reuse could affect demands that are currently being served in part by pumpage of the Edwards Aquifer in the northern subdivision of GMA 10 (the Barton Springs segment).

The City of Kyle, for example, is permitted by the BSEACD for 165,000,000 gallons/year of firm-yield historical pumpage. As mentioned, there may be an opportunity for this new, re-use water supply to allow for further reductions in extreme drought pumpage by the City. This will facilitate compliance with maintaining the DFC in the northern subdivision of GMA 10, and is an important potential benefit of the project.

The BSEACD has committed in its management plan to "diversify water supplies available to users in the BSEACD and thereby allow for appropriate pumpage curtailments, especially during extreme drought."[4] The development of reclaimed water for the appropriate non-potable use in an appropriate area is consistent with this goal, particularly if such new supplies have the potential to reduce demand on the Edwards Aquifer.

[3] The BSEACD, representing the northern subdivision of GMA 10, has established a Desired Future Condition (DFC) that preserves a minimum of 6.5 cfs of springflow at Barton Springs during a recurrence of the Drought of Record.
[4] BSEACD Management Plan (approved September 15, 2008). Objective 3-1, p. 41.

Plum Creek Conservation District (PCCD)

The proposed reuse project facilities and irrigation areas are primarily located within the PCCD's and EAA's jurisdiction including the extended water quality buffer area (Figure 1). Although the PCCD does not have the explicit land use authorities of the EAA and does not regulate the use of the Edwards Aquifer in its jurisdictional area, the project should be mindful of PCCD's Rule 2 related to waste and pollution. These rules generally relate to wastewater use but also address potential pollution pathways created by inadequately protected abandoned wells, namely through its abandoned wells regulation. The existence of abandoned wells in the vicinity of the irrigation areas is at least conceptually within the regulatory sphere of PCCD.

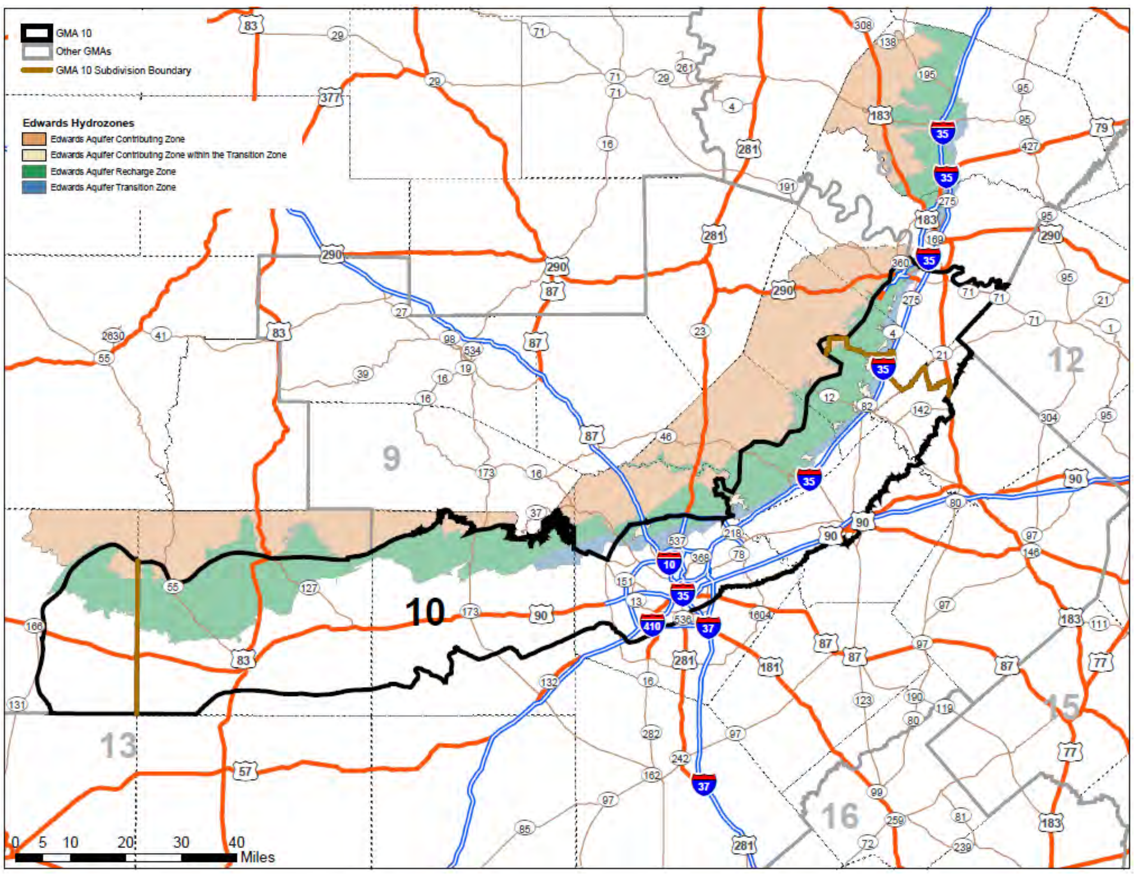

Figure 2. Map of GMA 10 and the three subdivisions. Note that the BSEACD and PCCD are the only GCDs located within the Northern Subdivision, and only BSEACD regulates the Edwards Aquifer therein.

The reclaimed water project should include a thorough inventory of all wells in the vicinity of the project, which may require a compilation of existing data, walking surveys, and analysis of areal imagery to include any potential abandoned wells. Using the inventory, abandoned wells should be plugged and facilities and equipment should be located at safe distances from existing wells within both the PCCD and EAA.

Plum Creek Watershed Partnership: The evaluation of the proposed project, which is based on re-use of treated effluent that is currently being directly discharged to Plum Creek, currently includes a review of the "potential impact of direct reuse on watershed water *quality,*" which is presumed to be positive. It also should include a review of potential water *quantity* effects, as the reduced flow during natural low flow conditions may have an adverse effect on the hydrologic flow regime that has been established with the wastewater discharges, affect alluvial groundwater systems dependent on recharge from losing streams, create impacts on the downstream water rights holders, and impact environmental flow needs. BSEACD focused its evaluations on the groundwater resources in the immediate project area and has not made such assessments of these largely downstream effects, but it trusts that the project team is working with the Plum Creek Watershed Partnership to evaluate these aspects as they relate to project feasibility and acceptance.

2.2.2 Multi-Jurisdictional or Interagency Agreements and Coordination

It is understood that the City and its project managers have involved other relevant political jurisdictions and agencies in identifying and exploring ways of accommodating potential regulatory issues. The BSEACD is one of those. The project team is well advised to keep those jurisdictions apprised of the project as it evolves through updates and informative meetings, and once the project design is firmed up to request a regulatory assessment to ensure that all anticipated issues are addressed.

The proposed project also has potential to provide benefits that might positively affect the management objectives of the BSEACD in the groundwater arena and the Plum Creek Watershed Partnership in the surface water arena. These benefits should be spotlighted by engaging both groups to identify these benefits as key objectives of the project. For example, these could include a greater-than-required curtailment in groundwater pumpage during extreme groundwater drought conditions, or meeting a stipulated reduction in nutrient loading to the surface streams. Further, interlocal agreements could be executed to institutionalize these shared goals and objectives.

3.0 Hydrogeotechnical Review of Reclaimed-Water Delivery and Irrigation System

This portion of the assessment was conducted to determine if any of the proposed irrigation areas receiving reclaimed water by the City of Kyle or any upset conditions in the reclaimed-water delivery systems would likely have any impact on the Edwards Aquifer or other aquifers in the area. TCEQ's Edwards rules prohibit certain activities within the Edwards recharge zone and require some limitations on activities that can take place in areas adjacent to the recharge zone that might contribute flow to the recharge zone. None of these prohibitions or limitations are germane to the project as proposed.

3.1 Methods

This portion of the assessment was primarily based on existing mapping in the area; no field work, e.g., to define the existence of any discrete recharge features, was warranted in this evaluation. Various maps were combined in GIS to determine the positions of the proposed effluent distribution lines and areas proposed for irrigation by reclaimed water relative to the TCEQ Edwards boundaries. The following maps were used:

- Map of proposed effluent distribution system prepared by Espey Consultants
- Map of TCEQ Chapter 213[5] boundaries
- USGS topographic quadrangles: Mountain City and San Marcos North
- Maps and databases of water well locations from TWDB, EAA, and BSEACD

This information was compiled into a single map, which is a major output of this assessment (Figure 3, and under separate cover). Detailed geologic maps of the area were reviewed for consistency, but geology is not included in the figure to preserve clarity.

3.2 Definitions of Hydrologic Zones in the Edwards Rules

The "Edwards Rules", as presented in 30 TAC Chapter 213 administered by TCEQ, describe four zones that relate to the Edwards Aquifer (shown at a regional scale in Figure 4.) The zones, depicted relative to the proposed project elements in Figure 3, are recharge, contributing, transition, and 'contributing within the transition' zones. The transition zone is the most relevant to the issue of irrigating areas with reclaimed water in the City; however, because of the proximity of the contributing within the transition zone to the proposed irrigation areas, this zone will also be discussed in this report. The italicized text following each heading below is taken directly from TCEQ Chapter 213, Subchapters A and B.

[5] Texas Commission on Environmental Quality, 30 TAC Chapter 213 Edwards Rules.

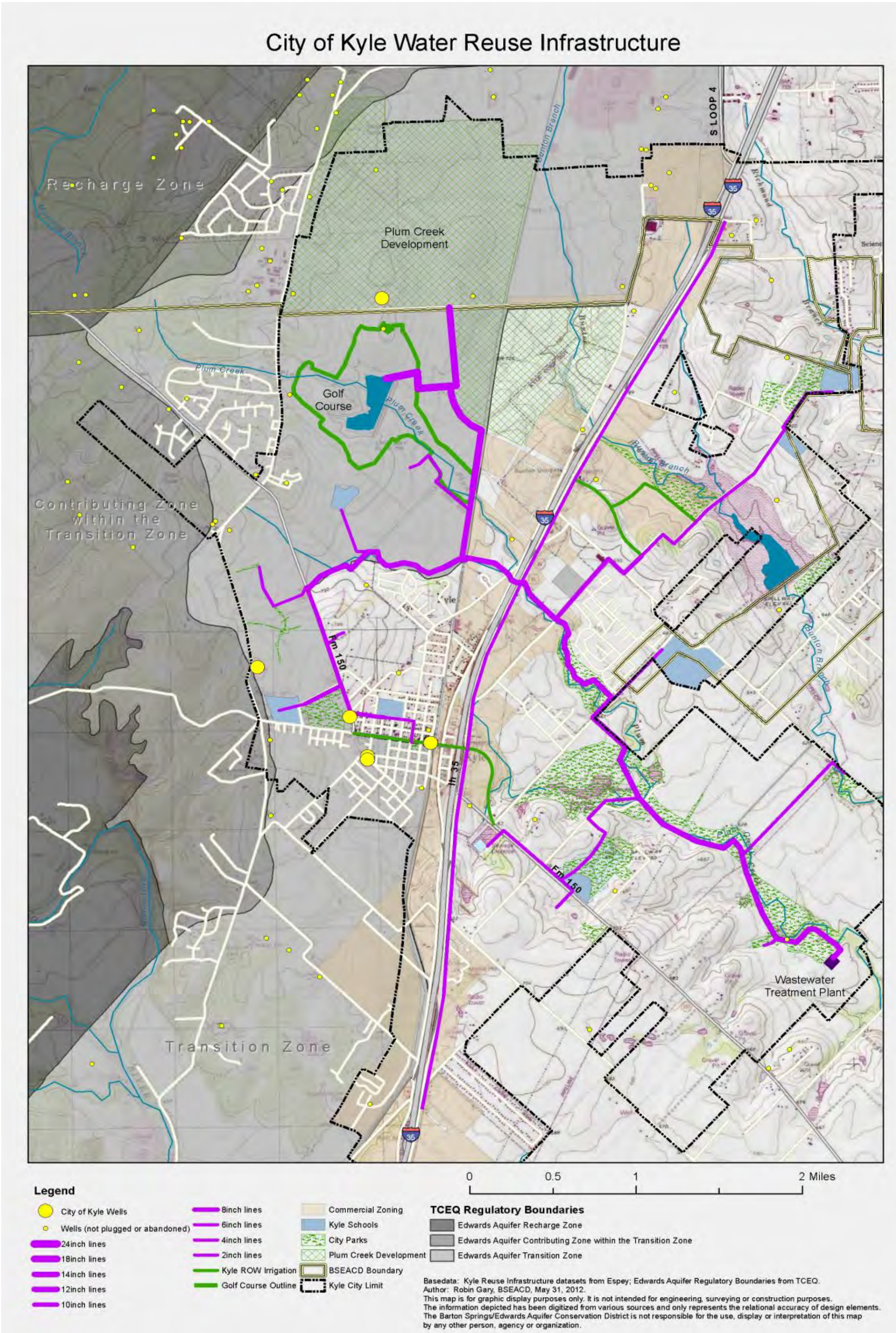

Figure 3. Project elements in relation to various features and jurisdictional boundaries.

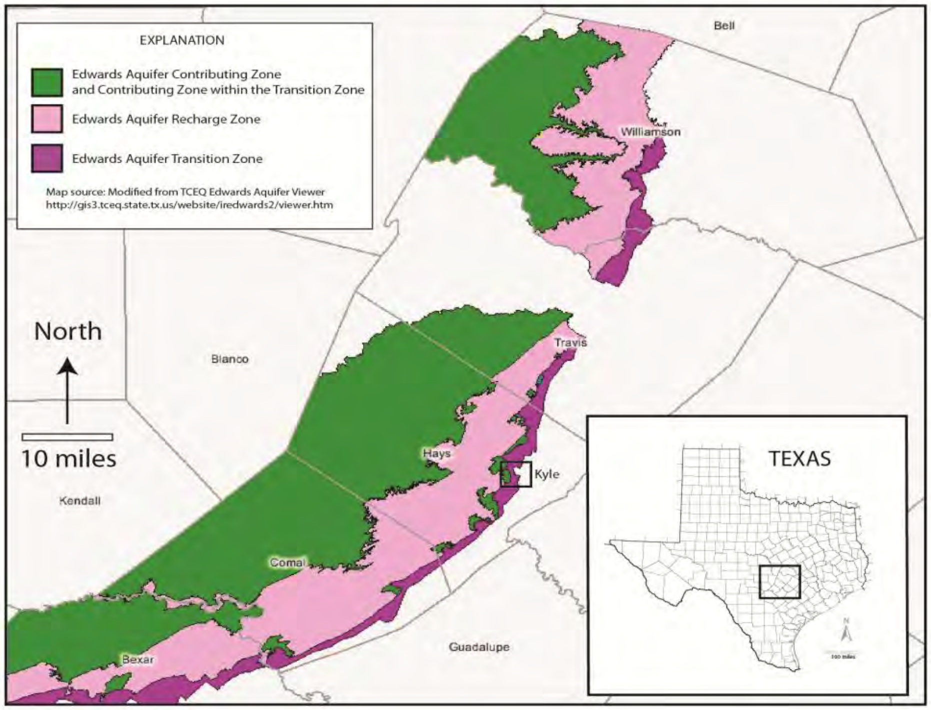

Figure 4. Boundaries of TCEQ's Edwards Aquifer Zones.

Recharge Zone (TCEQ § 213.3 (27)

Generally, that area where the stratigraphic units constituting the Edwards Aquifer crop out, including the outcrops of other geologic formations in proximity to the Edwards Aquifer, where caves, sinkholes, faults, fractures, or other permeable features would create a potential for recharge of surface waters into the Edwards Aquifer. The recharge zone is identified as that area designated as such on official maps located in the agency's central office and in the appropriate regional office.

Contributing Zone (TCEQ § 213.22 (2)

The area or watershed where runoff from precipitation flows down-gradient to the recharge zone of the Edwards Aquifer. The contributing zone is illustrated on Contributing Zone (Southern Part) for the Edwards Aquifer and Contributing Zone (Northern Part) for the Edwards Aquifer. The contributing *zone is located upstream (upgradient) and generally north and northwest of the recharge zone.*

Contributing Zone within the Transition Zone (TCEQ § 213.22 (3)

The area or watershed where runoff from precipitation flows down-gradient to the recharge zone of the Edwards Aquifer. The contributing zone within the transition zone is depicted in detail on the official recharge and transition zones maps of the agency as provided for in §213.3 of this title (relating to Definitions). The contributing zone within the transition zone is located generally south and east of the recharge zone and includes specifically those areas where stratigraphic units not included in the Edwards Aquifer crop out at topographically higher elevations and drain to stream courses where stratigraphic units of the Edwards Aquifer crop out and are mapped as recharge zone.

Transition Zone (TCEQ § 213.3 (36)

That area where geologic formations crop out in proximity to and south and southeast of the recharge zone and where faults, fractures, and other geologic features present a possible avenue for recharge of surface water to the Edwards Aquifer, including portions of the Del Rio Clay, Buda Limestone, Eagle Ford Group, Austin Chalk, Pecan Gap Chalk, and Anacacho Limestone. The transition zone is identified as that area designated as such on official maps located in the agency's central office and in the appropriate regional office.

3.3 Results

Compliance with Edwards Rules

A comparison between the locations of the proposed effluent distribution lines and proposed areas for irrigation indicates that all of these areas are within the Edwards transition zone (Figure 3), as described above. The westernmost areas of proposed irrigation areas are about 300 ft from the 'contributing within the transition zone.' There are no prohibitions in the Edwards rules (TCEQ Chapter 213) against such discharges in the Edwards transition zone. TAC §210.4(d) provides that reclaimed water can be used for irrigation on the recharge zone provided the plans are approved by TCEQ. However, such approval by TCEQ or compliance with its rules should not be interpreted as warranting environmentally soundness or protection of all water resources under any and all conditions. However, for purposes of this feasibility study, the salient aspect of the hydrogeologic setting is that the project area as currently designed is not on the recharge zone.

Potential for Recharge to Edwards Aquifer and Local Aquifers

Geologic units exposed at the surface in the vicinity of the Kyle project area are the Eagle Ford Group, Austin Chalk, and Taylor Group. The Eagle Ford and Taylor consist largely of shale and clay, are very impermeable, and are not likely sources of groundwater for even small supply wells. The Austin Chalk that is exposed at the surface over much of the area west of IH-35 is generally of low permeability, but it is capable of yielding small amounts of groundwater to wells. A review of available well location data for this area has not indicated the presence of any wells that obtain water from the Austin Chalk. However, well databases are typically incomplete and there is a potential for Austin Chalk wells, especially small domestic use wells, in the areas proposed for the reclaimed-water distribution lines and irrigation with reclaimed water. A field reconnaissance should be conducted prior to construction of the distribution system to look for any wells in the vicinity of the distribution lines and irrigation areas that might obtain water from the Austin Chalk. Any such wells should be inspected for any openings that could allow entry of reclaimed water into the well bore. A properly operating irrigation system is unlikely to contribute any significant amount of reclaimed water to the Austin Chalk, however, leaking pipes or malfunctioning sprinkler heads could discharge enough reclaimed water in a small area to provide recharge to the Austin Chalk.

The transition zone is considered in the Edwards rules because of the potential for transport of contaminants from the surface through the confining units to the Edwards Aquifer by way of faults. However, faults in the vicinity of Kyle are not known to be capable of transmitting any significant amount of surface water into the subsurface. The proper design and operation of the reclaimed-water irrigation systems should preclude that water from moving below the root zone of the soils. The main reclaimed-water storage pond in the Plum Creek Golf Course is lined, so the additional head provided by impounding that water is not likely to create substantial infiltration into the underlying strata, provided the integrity of the pond construction is maintained.

Improperly constructed and deteriorated wells can also present pathways for contaminants at the surface to reach an aquifer. The only wells identified by this assessment that are near any proposed distribution lines are the City's public water supply wells along FM 150 in downtown Kyle, regulated by EAA. The wells and the distribution lines are physically separated under normal operating conditions, but in the event of some upset condition that resulted in loss of reclaimed water to the local environment, the wells and their water supply could be adversely affected. These wells should be inspected prior to activation of the re-use system for any openings at the well heads that could allow for movement of contaminants into the wells; consideration should be given to providing a larger buffer around those wells as a mitigation measure. A well in the Edwards that provides water to the Plum Creek Golf Course is located close to areas that could be irrigated with reclaimed water. The exact locations and configurations of irrigated areas should be delineated to ensure that reclaimed water is not able to enter this well.

3.4 Potential Future Modifications to the Proposed System

As currently proposed the distribution lines and irrigated areas all fall within the Edwards transition zone. This is the major mitigation factor that eliminates concern about the adverse impact of the proposed project on the groundwater resources. If any changes are made that would extend the lines and irrigated areas to the west, it is possible that discharge of reclaimed water could occur in the contributing within the transition zone, or in the recharge zone if the lines were extended even farther to the west. For example, the currently proposed distribution line that extends to Wallace Middle School comes within about 300 ft of the boundary between the transition zone and the contributing within the transition zone. Even though the Edwards rules do not prohibit discharge of reclaimed water into the contributing within the transition zone, the BSEACD and EAA have concerns about reclaimed water recharging the Edwards Aquifer, and any reclaimed water flowing at the surface in the contributing within the transition zone has the potential to reach the recharge zone where it would be likely to enter the subsurface and recharge the Edwards Aquifer. If the discharge is such that it is only irrigating vegetated areas without any runoff, there is only a small chance that some amount of discharged water would reach the recharge zone. However, a malfunctioning system could contribute significant amounts of reclaimed water to the Edwards Aquifer.

At a minimum, if such a system modification were proposed in the future, field surveys to characterize any discrete recharge features at or near the down-gradient boundary of the recharge zone should be conducted, and coordination with EAA specific to such plans should also be undertaken. This suggestion is made without regard to whether irrigation with reclaimed water is allowable by TCEQ or not, or the conditions under which TCEQ might assert one or the other of those outcomes. In BSEACD's senior staff's view, an abundance of caution is warranted in such a circumstance, and BSEACD would recommend that any extensions of the effluent distribution and especially irrigation systems should avoid the more sensitive recharge zone and 'contributing within the transition' zone, to avoid both possibly real and likely perceived concerns. "Feasibility", especially by a political subdivision like the City of Kyle, should encompass more dimensions than just what is "allowed" or "accepted."

4.0 Findings and Conclusions

The assessment by the staff of the Barton Springs/Edwards Aquifer Conservation District indicates that, as currently conceived and proposed, the water re-use project by the City of Kyle should not encounter or be accompanied by adverse impacts on the local or regional groundwater resources. Conversely, there exist both the likely benefits of a desired overall reduction in the waste contaminant loadings to Plum Creek downstream of the project area, and the potential benefit of reducing the demand on the Barton Springs segment of the Edwards Aquifer during extreme drought conditions by substituting reclaimed water for some part of the demand for irrigation water. The assessment did not attempt to quantify those positive impacts. The conclusions drawn by BSEACD are largely based on the location of all the project elements on the much less sensitive transition zone and the absence of certain pathways to affect important regional and local aquifer systems.

BSEACD staff believes that the project would benefit from the following recommendations and suggestions:

1. Future modifications to the reclaimed-water distribution and irrigation systems should not extend into the contributing within the transition zone without a more complete assessment of risks, and must not extend into the recharge zone, regardless of its status regarding compliance with the Edwards Rules.

2. The City should work with the BSEACD to implement an arrangement to achieve additional extreme drought pumping curtailments of its Historical Use Production Permit in order to increase and assure the project's propounded potential benefit of reducing pumping on the Barton Springs aquifer and thereby preserving of the Desired Future Condition (DFC) established for the freshwater Barton Springs segment of the Edwards Aquifer, in exchange for some valuable policy consideration.

3. The City should ensure the project is included in the next revision of the Region L Water Plan to account for its benefits in regional and state water planning and to make the project eligible for additional attractive funding by the Texas Water Development Board.

4. Before the project is implemented, the City should make a thorough compilation of existing data, walking surveys, and analysis of areal imagery to identify any potential abandoned wells, and ensure that abandoned wells are properly plugged (and newly discovered existing wells are avoided.)

5. After the project details are finalized and before the project is approved, the City should continue to engage the various regulatory entities in identifying and assessing their potential regulatory issues with the project.

6. As part of the process in finalizing the project, the City should highlight the project's shared benefits between the City and both BSEACD and the Plum Creek Watershed Partnership, and identify those benefits as key objectives of the project;, the City should then consider entering into interlocal agreements or MOUs with one or both of those entities for the purpose of achieving those benefits with more certainty.

7. The City should conduct a field reconnaissance prior to construction of the reclaimed-water distribution system to assess wells in the vicinity of the distribution lines and irrigation areas that obtain water from the Austin Chalk, and to inspect and repair any such wells for openings that could allow entry of reclaimed water into the well bore.

8. The City should also inspect the EAA public water supply wells and the well that provides water to the Plum Creek Golf Course, which are relatively close to the project's major distribution lines, for any openings at the well heads that could allow for movement of contaminants into the wells, and/or also consider providing a larger buffer in the routing of the effluent lines around those wells.

Appendix N: Public Involvement

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CITY OF KYLE

PLANNING & ZONING COMMISSION JOINT WORK SESSION WITH THE PARKS AND RECREATION COMMITTEE

KYLE CITY HALL
100 W. Center Street

Notice is hereby given that the Planning and Zoning Commission and the Parks and Recreation Committee of the City of Kyle, Texas will meet at 6:30 PM on October 25, 2011, at Kyle City Hall 100 W Center St for the purpose of a work session.

Posted this the 21st day of October prior to 6:30 PM.

I. Call Meeting To Order

II. Joint Discussion between the Planning and Zoning Commission and the Parks and Recreation Committee regarding the Regional Water/Wastewater Facility Planning Grant City of Kyle Water Reuse Feasibility Study.

III. Citizen Comment Period With the Planning and Zoning Commission and the Parks and Recreation Committee.

*Per Texas Attorney General Opinion No. JC-0169; Open Meeting & Agenda Requirements, Dated January 24, 2000: The permissible responses to a general member communication at the meeting are limited by 551.042, as follows: "SEC.551.042. Inquiry Made at Meeting. (a) If, at a meeting of a government body, a member of the public or of the governmental body inquires about a subject for which notice has not been given as required by the subchapter, the notice provisions of this subchapter, do not apply to:(1) a statement of specific factual information given in response to the inquiry; or (2) a recitation of existing policy in response to the inquiry. (b) Any deliberation of or decision about the subject of the inquiry shall be limited to a proposal to place the subject on the agenda for a subsequent meeting.

Kyle issues, from kickball to water reuse

Posted By Free Press Contributor On October 19, 2011 @ 3:43 pm In Hays County,Kyle,Kyle Parks & Recreation,Neighbors | No Comments

Kyle Parks & Recreation
by KERRY URBANOWICZ

The very popular pastime of Adult Kickball in Kyle is back. The 2012 season starts with the challenging "Winter League." The winter league plays in extreme conditions and welcomes all the extreme players, however, the team registration deadline in this Friday, October 21. All team forms and fees must be turned in to the Kyle Parks and Recreation office before the deadline.

Kickball coaches and players have their organizational meeting on Wednesday, October 26 and games start on November 3. Women's games will be played on Thursday nights and co-ed games will be played on Friday nights. The season goes right through the winter with the end of season tournament in late February.

You are invited to attend a public meeting on Tuesday, October 25, at 6:30 p.m. at Kyle City Hall. The city of Kyle is serving as the local sponsor for a regional water and wastewater study to determine the feasibility of direct water reuse in the community. This study is focused on the viability of water reuse as a means of implementing regional water supply alternatives in the South Central Texas region. The study is funded by the city of Kyle and the Texas Water Development Board. In this first of three public meetings, an overview of the scope and methodology of the study will be presented. Interested parties are encouraged to attend to provide comment or input regarding issues important for consideration by the study group.

Do you have bicycle riders in the family? If so, mark your calendar for Saturday, November 5. The 4th annual Family Fun Ride will be held at City Square Park and all ages are invited. On-site registration and check-in begins at 8:30 a.m. in the Historic Kyle City Hall. The event starts at 9 a.m. and includes a safety clinic and bike rodeo. The Family Fun Ride will have two courses with one of them being 3.5 miles, great for the entire family and the other being a fun 10 miles. Take advantage of the early bird discount by registering before 5 p.m. on October 28!

For more details and information on Adult Kickball League or the Family Fun Ride, including registration forms, fees and general questions, please contact the Kyle Parks and Recreation office at 512-262-3939, email at parks@cityofkyle.com, visit the website at www.kylepard.com or stop by the Parks and Recreation office located in Kyle City Hall.

Other Upcoming Events:

November 30: Santa's Arrival, School Choirs and Tree Lighting, City Square Park

December 5: Pool Passes go on sale for 2012 Season (stocking stuffers)

January 1: Polar Bear Splash at Kyle Pool

Read more:

- Ready for some football? [1] 08/24/2011
- Kickin' it up in Kyle: Competition culminates in Gregg-Clarke Park Sunday [2] 02/3/2010
- Get to know your candidates [3] 02/3/2010
- Market days and more… [4] 02/3/2010
- New sports complex opens in Kyle [5] 06/22/2011

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URLs in this post:

[1] Ready for some football?: **http://haysfreepress.com/archives/22831**
[2] Kickin' it up in Kyle: Competition culminates in Gregg-Clarke Park Sunday: **http://haysfreepress.com/archives/2086**
[3] Get to know your candidates: **http://haysfreepress.com/archives/2213**
[4] Market days and more…: **http://haysfreepress.com/archives/2256**
[5] New sports complex opens in Kyle: **http://haysfreepress.com/archives/20634**

CITY OF KYLE

Notice of Public Works & Public Service Committee Meeting

Notice is hereby given that the Public Works & Public Service Committee, as placed into service to foster citizen input, by the governing body of the City of Kyle, Texas will meet at 7:00 p.m. on Wednesday, March 21, 2012, at the Kyle Public Works Building, 520 East RR 150, in Kyle, Texas, for the purpose of discussing the following agenda.

Posted this the 18th day of March 2012 prior to 7:00 p.m.

AGENDA

I. Roll Call

II. Public Comment: 3 minute limit each person

III. Committee changes in operation to include an election ~ *David Wilson*

IV. Discuss City Visioning Forum, March 24, 2012 at 9:00 am in the Ernest Kimbro Bldg at Kyle Elementary ~ *David Wilson*

V. Discussion of a potential water reuse policy ~ *Harper Wilder and Steve Widacki*

VI. Discussion and input for a water conservation grant to help homeowners use less water ~ *David Wilson and Harper Wilder*

VII. Major projects visioned for the next 5 years ~ *David Wilson, Harper Wilder, and Steve Widacki*

VIII. Committee member items to discuss

IX. ADJOURN

(Committee posts this Open Meetings Act notice although no policy making action can be taken by this citizen advisory committee.)

*Per Texas Attorney General Opinion No. JC-0169; Open Meeting & Agenda Requirements, Dated January 24, 2000: The permissible responses to a general member communication at the meeting are limited by 551.042, as follows: "SEC.551.042. Inquiry Made at Meeting. (a) If, at a meeting of a government body, a member of the public or of the governmental body inquires about a subject for which notice has not been given as required by the subchapter, the notice provisions of this subchapter, do not apply to:(1) a statement of specific factual information given in response to the inquiry; or (2) a recitation of existing policy in response to the inquiry. (b) Any deliberation of or decision about the subject of the inquiry shall be limited to a proposal to place the subject on the agenda for a subsequent meeting.

Sign in Sheet

City of Kyle

Water Reuse Feasibility Study

March 21, 2012

Name	Address	Email
Raquel Gai	RR150E Kyle, TX	rgarcia@cityofkyle.com
Steven Widacki		swidacki@cityofkyle.com
ALAN McPherson	1227 Fairway Kyle	amcpherson@earthlink.net
MARK SCHULTZ	402 WEST NORTH KYLE, TX	schultzfm@msn.com
Connie Townsend	TWDB 1700 N. Congress Austin, TX	Connie.townsend@twdb.texas.gov
Johnie Halliburton	1101 W. SAN ANTONIO ST. Lockhart, TX. 78644	johnie@pced.org
DAVID Wilson	P.O. Box 576 Kyle, TX 78640	davidw576@yahoo.c
TAD WALTERS	1000 SWEET GUM DR	MWALTERS@ESD4.ORG
Debbie Magin	GBRA 933 E. Court Seguin	dmagin@gbra.org
ROD WALLS	HAYS CISD 21003 IH 35 KYLE TX	WALLSR@HAYSCISD.NET
Paul Alvarez	P.O. Bx 1083 Kyle	

Sign-up Sheet

Meeting: PUBLIC WORKS COMMITTEE MEETING

Date: 03-21-12 @ 7PM / KYLE PUBLIC WORKS FACILITY

First Name	Last Name	Employer/Agency	Title	Work Phone	E-Mail
HARPER	WILDER	CITY OF KYLE	DIR. OF PW	512-262-3024	hwilder@cityofkyle.com
Raquel	Garcia	"	Grants Admin	512-262-3947	rgarcia@cityofkyle.com
MARK	SCHULTZ	KYLE FIRE	LT.	512-265-3131	schultzfm@msn.com
Johnie	Halliburton	Plum Creek Cons. Dist.	Exec. Mgr.	512-398-2383	johnie@pccd.org

Public Notices, continued from page 3D

A Cashier's Check, Certified Check or acceptable BIDDER's Bond, payable to Hays Shadow Creek Development, Inc. In an amount not less than five percent (5%) of the Bid must accompany each bid as a guarantee that, if awarded the Contract, the BIDDER will enter into a contract and execute bonds within ten (10) days of award of the Contract. Performance and Payment Bonds shall also be executed on the forms furnished by the OWNER and shall specifically provide for "Performance" and for "Labor and Materials Payment". Each bond shall be issued in an amount of one hundred percent (100%) of contract price by a solvent Surety company, authorized to do business in the State of Texas and acceptable to the OWNER.

The OWNER reserves the right to reject any and all bids to waive any and all technicalities and formalities in bidding. The OWNER reserves the right to determine which bids are most advantageous to the OWNER and the DISTRICT, and to award the Contract on this basis. No bid may be withdrawn for a period of forty-five (45) days after opening of the bids. If a submitted bid is withdrawn within said period, bid guaranty shall become the property of the OWNER, not as penalty, but as liquidated damages, or OWNER may pursue any other action allowed by law. A mandatory pre-bid conference will be held on Tuesday, July 17, 2012 at 2:00 p.m. at the offices of Texas Engineering Solutions at 5000 Bee Caves Rd, Suite 206, Austin, Texas 78746. Prospective bidders are encouraged to visit the site.

TEXAS EDUCATION AGENCY
DIVISIÓN DE EDUCACIÓN DE CARRERAS Y TECNOLOGÍA NOTIFICACIÓN PÚBLICA DE NO DISCRIMINACIÓN EN PROGRAMAS VOCACIONALES (PROGRAMAS EDUCATIVOS DE CARRERAS Y TECNOLOGÍA)

1. El distrito escolar de Hays ofrece programas vocacionales en agricultura, manejo de negocios, tecnología de automóviles, electrónicos, tecnología de ciencias de salud, educación de mercadotecnia, justicia criminal, y servicios familiares y comunitarios. La admisión a estos programas se basa en interés, aptitud, edad apropiada y espacio en el salón de clase.

2. Es norma del distrito escolar de Hays de no discriminar por motivos de raza, color, origen nacional, sexo o impedimento, en sus programas, servicios o actividades vocacionales, tal como lo requieren el Título VI de la Ley de Derechos Civiles de 1964, según enmienda, el Título IX de las Enmiendas en la Educación, de 1972, y la Sección 504 de la Ley de Rehabilitación de 1973, según enmienda.

3. Es norma del distrito escolar de Hays de no discriminar por motivos de raza, color, origen nacional, sexo, impedimento o edad, en sus procedimientos de empleo, tal como lo requieren el Título VI de la Ley de Derechos Civiles de 1964, según enmienda; el Título IX de las Enmiendas en la Educación, de 1972, la ley de Discriminación por Edad, de 1975, según enmienda, y la Sección 504 de la Ley de Rehabilitación de 1973, según enmienda.

4. El distrito escolar de Hays tomará las medidas necesarias para asegurar que la falta de habilidad en el uso del inglés no sea un obstáculo para la admisión y participación en todos los programas educativos y vocacionales.

5. Para información sobre sus derechos o procedimientos para quejas, comuníquese con la Coordinadora del Título IX, Carolyn Hitt, en 21003 IH 35 Kyle, Texas 78640, al número de teléfono, 512/ 268-2141 y/o la Coordinadora de la Sección 504, Sara Thurman, en 4820 Jack C Hays Trail, Buda, Texas 78610, al número de teléfono, 512/ 268-2141.

TEXAS EDUCATION AGENCY
DIVISION OF CAREER AND TECHNICAL EDUCATION PUBLIC NOTIFICATION OF NONDISCRIMINATION IN CAREER AND TECHNICAL EDUCATION PROGRAMS)

Hays CISD offers career and technical education programs in agriculture, business, auto technology, electronics, health science technology, marketing education, family and consumer science, criminal justice, and technology education. Admission to these programs is based on interest and aptitude, age appropriateness, and class space available.

It is the policy of Hays CISD not to discriminate on the basis of race, color, national origin, sex or handicap in its vocational programs, services or activities as required by Title VI of the Civil Rights Act of 1964, as amended; Title IX of the Education Amendments of 1972; and Section 504 of the Rehabilitation Act of 1973, as amended.

It is the policy of Hays CISD not to discriminate on the basis of race, color, national origin, sex, handicap, or age in its employment practices as required by Title VI of the Civil Rights Act of 1964, as amended; Title IX of the Education Amendments of 1972; the Age Discrimination Act of 1975, as amended; and Section 504 of the Rehabilitation Act of 1973, as amended.

Hays CISD will take steps to assure that lack of English language skills will not be a barrier to admission and participation in all educational and vocational programs.

For information about your rights or grievance procedures, contact the Title IX Coordinator, Carolyn Hitt, at 21003 IH 35, Kyle, Texas 78640, 512-268-2141and/or the Section 504 Coordinator, Sara Thurman, at 4820 Jack C. Hays Trail, Buda, Texas 78610, 512-268-2141.

PUBLIC NOTICE
HAYS COUNTY
INVITATION FOR BIDS

Hays County will be accepting sealed Bids for:

FM 1626, Bid No. 2012-B04

Sealed Bids will be received by Hays County, Purchasing Office, 712 South Stagecoach Trail, Suite 1071, San Marcos, TX 78666 until 2:00 p.m. local time on Tuesday, July 17, 2012 at which time and place the bids will be publicly opened and read.

A non-mandatory Pre-Bid Conference will be held on Friday, June 29, 2012 at 2:00 p.m. at the Hays County Purchasing Office, 712 South Stagecoach Trail, Suite 1071, San Marcos, TX 78666.

To submit Proposals for this Contract, prospective bidder shall, on Tuesday, July 17, 2012, meet the following requirements: (1) be qualified via "Full Participation" or "Bidder's Questionnaire" by the Texas Department of Transportation (TxDOT) for bidding on State projects or within the 90 day grace period for the preparation of a new qualification statement, or have submitted the Bidder's Questionnaire or the Confidential Questionnaire and have it on file with TxDOT at least 10 days before the date proposals are to be opened; (2) be registered with the State of Texas; and (3) provide suitable evidence of prior experience for similar work and be able to provide written documentation of successfully completed similar contracts.

Plans, Specifications, and Bidding documents for pre-qualified bidders and interested non-bidders may be secured from CivCast's website (www.civcastusa.com) beginning Monday, June 25, 2012. To receive the official Bid Form, contact Cindy Maiorka at 512-393-2273 or cindym@co.hays.tx.us.

Bid security in the amount not less than five percent (5%) of the total amount of the bid, issued by an acceptable surety company or in the form of a certified or cashier's check, must accompany each bid as a guarantee that the successful bidder will enter into a proper contract and execute bonds and guaranties within ten (10) days after the date contract documents are received by the awarded contractor. Performance and Payment Bonds will be required as stated in the bidding documents.

Hays County is an Affirmative Action/Equal Opportunity Employer.

Any bid may be withdrawn prior to the above scheduled time for the opening of the bids or authorized postponement thereof. Any bid received after the time and date specified shall not be accepted.

Issued by order of the Hays County Commissioners Court on Tuesday, May 22, 2012.

Bert Cobb, M.D., County Judge.

PUBLIC NOTICE

The City of Uhland will hold a public hearing at 6:00 p.m. on Thursday, July 12, 2012 at the Uhland City Hall located at 15 N. Old Spanish Trail, Uhland, Texas in regard to the submission of an application to the Department of Agriculture/Office of Rural Affairs for a Texas Community Development Block Grant Program (TxCDBG) grant. The purpose of this meeting is to allow citizens an opportunity to discuss the citizen participation plan, the development of local housing and community development needs, the amount of TxCDBG funding available, all eligible TxCDBG activities, and the use of past TxCDBG funds. The City encourages citizens to participate in the development of this TxCDBG application and to make their views known at this public hearing. Citizens unable to attend this meeting may submit their views and proposals to Russell Schultz, Mayor, at the Uhland City Hall. Persons with disabilities that wish to attend this meeting should contact City Hall to arrange for assistance. Individuals who require auxiliary aids or services for this meeting should contact City Hall at least two days before the meeting so that appropriate arrangements can be made.

For further information, contact Russell Schultz, Mayor, at 512-398-7399.

Russell Schultz
Mayor

Public Notice: Notice of Public Hearing

NOTICE IS HEREBY GIVEN TO ALL INTERESTED PERSONS, THAT:

The City of Kyle shall hold a public hearing on a request by First Baptist Church of Kyle to rezone approximately 0.23 acres from "R1" Single Family Residential 1 to "CBD-2" Central Business District 2 on property located at 110 N. Nance, in Hays County, Texas.

The Planning and Zoning Commission may recommend and the City Council may consider assigning any zoning district which is equivalent or more restrictive and is also consistent with the Comprehensive Plan.

A public hearing will be held by the Planning and Zoning Commission on Tuesday, July 24, 2012 at 6:30 p.m.

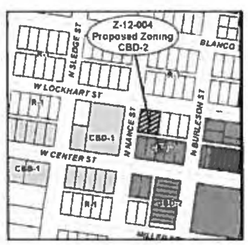
A public hearing will be held by the Kyle City Council on Tuesday, August 7, 2012, at 7:00 p.m.

Council action and second reading may be considered at the meeting to follow the public hearing (August 21, 2012).

Kyle City Hall Council Chambers
100 W Center St., Kyle, Texas

Owner: First Baptist Church of Kyle
Agent: Tim C. Pappas, R.P.L.S.
Phone: (512) 578-8629

Publication Date July 4, 2012
Z-12-004



Public Notice: Notice of Public Hearing

NOTICE IS HEREBY GIVEN TO ALL INTERESTED PERSONS, THAT:

The City of Kyle shall hold a public hearing on a request by PGI Investment, LLC to assign original zoning to approximately 37.37 acres from "AG" Agriculture to "RS" Retail Service District and to assign original zoning to approximately 10.37 acres from "AG" Agriculture to "RV" Recreational Vehicle Park District on property located at 24800 S. IH-35, in Hays County, Texas.

The Planning and Zoning Commission may recommend and the City Council may consider assigning any zoning district which is equivalent or more restrictive and is also consistent with the Comprehensive Plan.

A public hearing will be held by the Planning and Zoning Commission on Tuesday, July 24, 2012 at 6:30 p.m.

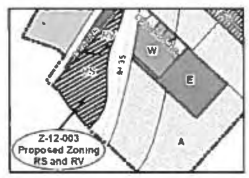
A public hearing will be held by the Kyle City Council on Tuesday, August 7, 2012, at 7:00 p.m.

Council action and second reading may be considered at the meeting to follow the public hearing (August 21, 2012)

Kyle City Hall Council Chambers
100 W Center St., Kyle, Texas

Owner: PGI Investments
Agent: Hugo Elizondo Jr., P.E.
Cuatro Consultants
Phone: (512) 312-5040

Publication Date July 4, 2012
Z-12-003



Public Notice: Notice of Public Hearing

NOTICE IS HEREBY GIVEN TO ALL INTERESTED PERSONS, THAT:

The City of Kyle shall hold a public meeting relating to the City of Kyle's Direct Water Reuse Feasibility Study. This will be the third required public meeting for the TWDB Facility Planning Grant Program for the City of Kyle's Regional Reuse Feasibility Study. The study was completed on June 30, 2012 and the purpose of this meeting is to obtain public comment on the Draft Final Report. This draft report is available for public viewing at the City of Kyle Public Library. The public comment period is from July 7, 2012 to August 7, 2012. Comments can be received orally/written at the public meeting, as well as be email to rgarcia@cityofkyle.com or by U.S. mail at P.O. Box 40, Kyle, Texas 78640 anytime during the public comment period.

The public meeting will be held by the Kyle City Council on Tuesday August 7, 2012 at 7:00 p.m.

Kyle City Hall, Council Chambers
100 W. Center St., Kyle, Texas

Public Notice: Notice of Public Hearing
City of Kyle City Code Amendment

NOTICE IS HEREBY GIVEN TO ALL INTERESTED PERSONS, THAT:

The City Council and Planning and Zoning Commission of the City of Kyle, Texas, will hold public hearings in the City Council Chambers at 100 W. Center Street, Kyle, Texas, for the purpose of receiving testimony, comments, and written evidence from the public on the following:

Amendment to Plum Creek PUD Article II Section I- Part D (f) Exception to height regulations to allow a maximum height of 80 feet for all civic structures.

The public hearing schedule is as follows:

July 24, 2012 Planning and Zoning Public Hearing at 6:30 p.m.

August 7th, 2012 City Council Public Hearing 7 p.m.

Council action and second reading may be considered at the meeting to follow the public hearing (August 21, 2012).

Public Notice: Notice of Public Hearing

NOTICE IS HEREBY GIVEN TO ALL INTERESTED PERSONS, THAT:

The City of Kyle shall hold a public hearing on a request by KCW Interest 3 LLC and FHC Consolidated to rezone approximately 3.846 acres from "R-3-1" Multi-Family Residential 1 to "R-1-T" Residential Townhome, on property located 110 Creekside Trail, in Hays County, Texas.

The Planning and Zoning Commission may recommend and the City Council may consider assigning any zoning district which is equivalent or more restrictive and is also consistent with the Comprehensive Plan.

A public hearing will be held by the Planning and Zoning Commission on Tuesday, July 24, 2012 at 6:30 p.m.

A public hearing will be held by the Kyle City Council on Tuesday, August 7, 2012, at 7:00 p.m.

Council action and second reading may be considered at the meeting to follow the public hearing (August 21, 2012).

Kyle City Hall Council Chambers
100 W Center St., Kyle, Texas

Owner: KCW Interest 3 LLC. And FHC Consolidated
Agent: Gary Whited
Phone: (512) 773-3208

Publication Date: July 4, 2012
Z-12-005

Public Notice: Notice of Public Hearing

NOTICE IS HEREBY GIVEN TO ALL INTERESTED PERSONS, THAT:

The City of Kyle shall hold a public hearing on a request by John and Sammie Tritico on behalf of Liquid Waste Solutions, LLC to rezone approximately 6.29 acres from "RS" Retail Services to "CM" Construction Manufacturing District on property located at 2270 and 2788 S. Loop 4, in Hays County, Texas.

The Planning and Zoning Commission may recommend and the City Council may consider assigning any zoning district which is equivalent or more restrictive and is also consistent with the Comprehensive Plan.

A public hearing will be held by the Planning and Zoning Commission on Tuesday, July 24, 2012 at 6:30 p.m.

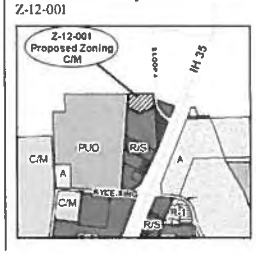
A public hearing will be held by the Kyle City Council on Tuesday, August 7, 2012, at 7:00 p.m.

Council action and second reading may be considered at the meeting to follow the public hearing (August 21, 2012).

Kyle City Hall Council Chambers
100 W Center St., Kyle, Texas

Owner: John and Sammie Tritico
Liquid Waste Solutions, LLC
Phone: (512) 529-8816

Publication Date: July 4, 2012
Z-12-001



Health Care

Continued from pg. 4D

fully implemented state-run exchange would trump those of a federal one.

"We have the ability to solve problems and craft solutions that take into consideration our uniqueness as a state," Coleman said. But he said he is glad the state will be required to opt into some kind of exchange "whether or not somebody like Rick Perry said no."

There has not been much public discussion about how the state would go about creating an exchange, Sanaie said. But, she said she "has confidence" state officials have begun examining potential strategies. State health officials have said they've been working behind the scenes to make sure Texas wasn't left in a lurch if federal health reform was upheld — and that instituting an exchange wouldn't be too taxing.

The Medicaid expansion, if implemented, is targeted at poor adults — those who can't afford to buy insurance through the exchange. In a press release, Texas Hospital Association President Dan Stultz said the Medicaid expansion is essential to financially support the Affordable Care Act. "Without the Medicaid expansion, many will remain uninsured, shifting costs to the insured and increasing uncompensated care to health care providers," he said.

In addition to their decisions about the Medicaid expansion and the health insurance exchange, Texas Republicans face another question — whether to file more litigation. Abbott said he will work with Congress to attempt to have the law repealed, and that the state will explore "all possible avenues" to further litigation against "Obamacare." But he said it is hard to tell what aspects of the law that litigation might target.

"We don't want to do ready, fire, aim," Abbott said. "Let us look at it — analyze it — before we start discussing what further legal action could be lodged."

CITY OF KYLE

Notice of Regular City Council Meeting

KYLE CITY HALL
100 W. Center Street

Notice is hereby given that the governing body of the City of Kyle, Texas will meet at 7:00 PM on 8/7/2012, at Kyle City Hall, 100 West Center Street, Kyle, Texas for the purpose of discussing the following agenda.

Posted this 2nd day of August, 2012 prior to 7:00 p.m.

I. Call Meeting To Order

II. Approval of Minutes

1. City Council Regular Meeting - July 17, 2012 ~ *Amelia Sanchez, City Secretary*

   Attachments

III. Citizen Comment Period With City Council

The City Council welcomes comments from Citizens early in the agenda of regular meetings. Those wishing to speak must sign in before the meeting begins at the Kyle City Hall. Speakers may be provided with an opportunity to speak during this time period, and they must observe the three-minute time limit.

IV. Presentation

2. Recognition of Employee of the Month for the Month of July ~ *Lanny Lambert, City Manager*

   - *Joshua Moreno and Nikki Ladet*

   Attachments

3. Recognition and Special Thanks to Gary Job Corps ~ *Jeff Barnett, Chief of Police*

   Attachments

4. Recognition of Accomplishments by the 2012 Kyle Kuda Swim Team ~ *Kerry Urbanowicz, Director of Parks and Recreation*

Attachments

5. Presentation of Draft Final Report of the City of Kyle Direct Water Reuse Feasibility Study ~ *Stephen Jenkins*, *Espey Consultants*

Attachments

6. Presentation of Water Conservation Plan and Rebates ~ *James Earp, Assistant City Manager*

Attachments

7. Report on Water Tank Inspections ~ *Jason Biemer, Utility Coordinator, Public Works*

Attachments

8. Presentation of Kyle Chamber of Commerce Quarterly Report for Reporting Period April 2012 through June 2012 ~ *Ray Hernandez, Executive Director of Kyle Area Chamber of Commerce & Visitor's Bureau*

Attachments

V. Appointments

9. Consideration of Nomination(s) for Appointment to the Kyle Depot Board ~ *Diane Hervol, Mayor Pro Tem*
   - *Ed Winn*

Attachments

10. Consideration of Nomination(s) for Appointment to the Library Board ~ *Lucy Johnson, Mayor*
    - *Charlotte Towles*

Attachments

VI. Consent Agenda

11. Hometown Kyle Phase 4A - Final Plat (FP-12-004)
    Owner: RH of Texas, LP
    8.948 acres; 40 Single Family Lots
    Located off of Chapparo Drive
    Agent: Steven Ihnen, P.E., GICE, Inc.
    ~ *Sofia Nelson, Director of Planning*

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Appendix O: Report Comments and Responses

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Initial Review – City of Kyle Direct Water Reuse Study Feasibility Report Submittal

The following items are major deficiencies that need to be addressed in order for Reclamation to begin its formal review process:

General Comments

1. Section 4.B.4.a of the Directives and Standards (D&S) requires a description of the non-Federal funding condition or the reasonably foreseeable future actions that the City would take if the Title XVI project is not implemented (i.e., non-Title XVI alternative). This report provides combinations of supply options that could be implemented under different scenarios, but it remains unclear as to which specific potable water supply(s) the proposed Title XVI project is meant to postpone or eliminate. The appropriate location for this discussion appears to be in Section 6.4, Alternative 3 – Potable Water Use, but no such discussion exists. On Page 61, the report mentions the incremental reduction in the cost of developing the Edwards Aquifer (3rd paragraph), but it also mentions avoided costs HCPUA (6th paragraph). The report should clarify whether one or both of these alternatives is meant to serve as the non-Federal funding condition.

2. For the non-Title XVI alternative(s) identified above, Section 4.B.4.c of the D&S requires a description of benefits to be gained, total project cost, life cycle cost, and corresponding cost of water produced, expressed in cost per million gallons or acre-foot. The purpose of this requirement is to allow a direct cost comparison to be made among alternatives, pursuant to Section 4.B.5.b. The costs must be developed for a non-Title XVI alternative that would satisfy the same demand as the proposed Title XVI project. This draft report provides costs in Section 4.4, but it is unclear how those costs were developed and on what level of service they were based. The draft report also shows a unit cost of $1.83 per 1,000 gallons in Section 7.2, but does not provide supporting documentation for what or how this cost is based. For the non-Title XVI alternative(s), please provide a description of the benefits to be gained, the total project cost, and life cycle cost. The costs must be likely and realistic, and they must be developed with the same standards with respect to interest rates and period of analysis as those developed for the Title XVI alternative. Note: according to 4.B.5.b of the D&S, the cost of the Title XVI alternative does <u>not</u> need to be the least expensive in order to justify its implementation.

3. Pursuant to Section 4.B.4.d of the D&S, please provide a <u>brief</u> description of references, design data, and assumptions to support cost estimates for both the Title XVI and non-Title XVI alternatives.

4. Section 4.B.6 of the D&S requires justification of why the proposed Title XVI project is the selected alternative in terms of meeting four criteria (i-iv). The draft report appears to address "i" and ii" through its discussion of offsetting either HCPUA or Edwards Aquifer supplies, respectively, but it remains unclear as to how the proposed Title XVI project would address criteria "iii" and "iv". Please explain.

5. The report provides projections based on two different planning windows, 2035 and 2040. This results in substantive inconsistencies with regards to population projections, recycled water demands, project scope/type of service provided, cost analyses, etc. Please define only one planning window and address all requirements of the D&S in terms thereof.

Page-Specific Comments

6. Crosswalk Table. The current structure of the crosswalk table is difficult to follow and makes cross referencing the D&S sections with report page numbers difficult. Please consider adding grid lines or make other revisions as necessary.

7. Crosswalk Table. The crosswalk table contains erroneous D&S/Report Section/Page number correlations. For example, Section 4.a is correlated to Section 10.4.3 and Page 115 of the report, and this information is contained in neither place. Rather, this section should be correlated to Page 44, which is supposed to describe the non-Title XVI alternative (i.e., Alternative 3). Furthermore, Section 4.d is correlated to Section 6 and Pages 41-56; instead, it should be correlated to Pages 58, 59, and Appendices. To facilitate the formal agency review, we recommend correcting any inaccuracies throughout the crosswalk table.

8. Crosswalk Table. It is not acceptable to indicate a D&S requirement such as Research Needs as "N/A." Please address all requirements of the D&S. If (for example) research needs are not needed, then briefly state such in the body of the report.

9. Section 5.6. Table 5-10 does not appear to include "Future Parks," as provided in Table 5-2. Please clarify which recycled demand calculation is correct.

10. Section 5.6. Please provide a description of the cooling makeup water use projection and how this calculation was made.

11. Section 6; General. The list and descriptions of alternatives provided in the section overview (i.e., Alternatives 1, 1A, 2, and 3) is not consistent with the list provided in each of the subsections (i.e., Alternative 1, 1A, 2, 3, and 4). Please correct.

12. Section 7; General. The cost per 1,000 gallons of the proposed Title XVI project is not consistent across Table 7-2 ($2.42), 7-3 ($2.43), and 7-4 ($1.74), partly due to inconsistent volumes of reclaimed water provided (i.e., 442.84 versus 601.73). Consistent with General Comment No. 2, please provide only one unit cost and be consistent in its use and application.

13. Section 7.2; General. Consistent with General Comment No. 2, please provide a cost comparison of the non Title XVI alternative(s) that would satisfy the same demand as the proposed Title XVI alternative. The alternatives used for comparison must be likely and realistic and developed with the same standards with respect to interest rates and period of analysis.

14. Section 8 excludes a description of potential environmental impacts to specific resources required in the D&S, namely public health or safety, historic properties, and natural resources. On the latter resource, a brief discussion should be included on the potential impacts to fish and wildlife habitat, including potential effects caused by a reduction in in-stream flows from Plum Creek.

15. Appendix O; Report Comments and Responses; Page 187. This appendix is blank and is not referenced in the body of the report. Please provide a discussion of the extent to which the public was involved in the feasibility study and a summary of comments received, if any.

Attachment I

City of Kyle

Direct Water Reuse Feasibility Study

TWDB Contract No. 1148311256

Draft Report Review Comments

1. Page 113, second paragraph: Please clarify that the current 2011 Region L Regional Water Plan (RWP) and the 2012 State Water Plan (SWP) do not have "reuse" as a recommended water management strategy for the City of Kyle and therefore an amendment to these plans would be required in order for this project to be eligible for funding from the Water Infrastructure Finance Program. Another requirement to be eligible for this funding is to complete the TWDB online Infrastructure Finance Report Survey. Please contact Ms. Wendy Barron at wendy.barron@twdb.texas.gov for information specific to your entity for this process.
2. Page 102, fourth paragraph *Loans*: The current terms of the SRF and state loans do not offer zero percent interest, guarantee of repayment, or bond insurance. Please revise as necessary.
3. Page 102, last paragraph: Please clarify that although the rules provide for fixed or variable rate loans, the TWDB only offers fixed rate loans under this program.
4. Page 5, first bullet: 'Obtain water rights ~~for the storage of reclaimed water~~ at Site 1'. Please clarify that what is actually needed is a water rights permit amendment regarding change of **use** from recreation/livestock to municipal and the associated water volume for this new use (as described in section 10.2.2); same clarification needed on pages 116 and 118.
5. Pages 25, 28, and 29: There appears to be a discrepancy (153.4 acres vs. 140.56 acres) between the future park area in Table 5-2 and the irrigation summary in Table 5-7 and 5-8. Please reconcile and revise report as appropriate.
6. Pages 29 and 30: There appears to be a discrepancy (1,030.29 acres vs. 960.01 acres) between the irrigated area summary in Table 5-8 and the total irrigated area in Table 5-10 (and executive summary Table 1-1). Please reconcile and revise report as appropriate.
7. Page 32, section 5.9: Please consider including a brief explanation of the characteristics and applications of Type I and Type II reclaimed water in this section or a reference to the detailed information included in Section 9.
8. Page 42, Section 6.2: Please clarify whether there are purchase costs for the existing system attributed to changing the ownership of the existing reclaimed system.
9. Page 42, Section 6.3: Please clarify whether or not the existing wastewater treatment plant would need to increase its capacity as a result of this alternative.
10. Page 58, Table 7-4: Alternative 1A is to transfer the existing system to the City of Kyle and will be operated and maintained by the city's wastewater utility. However, the capital cost shown in Table 7-4 is $843,750 which seems to be the project costs of Phase I. Please clarify and provide costs of changing the ownership of the existing system, if applicable, per comment 16 above.
11. Page 63, Section 7.8: Please revise first sentence - the considered alternatives are described by Sections 6.1 through 6.5, not only by Sections 6.3 and 6.4. Also, please note that the costs are not fully described for each alternative by Sections 6.1 through 6.5.

12. Page 64, Section 7.8.3: Please note that Appendix E is a table to show the opinion of probable project costs, instead of power, operation and maintenance, and treatment costs. Please also clarify which alternative Appendix E refers to.

13. Page 65, Section 7.10: Appendix K shows that the debt service is 30 years. Please clarify why 20 years was used in calculating Present Values.
14. Page 71, first full paragraph: Please define and/or describe the SWAT model referred to this paragraph.
15. Page 99, Section 9.3.1 content on "Return and Environmental Flows" is very confusing. Please consider re-writing this paragraph to provide more clarity.
16. It appears that many of the report appendix references need to be updated. Please reconcile and revise where appropriate. Examples include: page 53, paragraph 4 reference to Appendix H should be Appendix I; page 57 reference to Appendix F should be Appendix G for each service area, however, the 'complete system' probable costs appears to be missing from Appendix G; and, page 65 references to Appendix K should be Appendix L.
17. Please consider the following suggestions to enhance clarity/understanding for some of the report figures:
    a. Figure 1-1 (& 10-2): The following items are missing from the figure legend: independent transmission lines for Plum Creek, NE service area, SE service area, West service area, and location of Site 1 impoundment. Also appears to be a typographical error in legend for the proposed transmission line per 'Phases 2-3'; there is no Phase 3 currently identified in this study.
    b. Figures 3-1 and 4-1 are difficult to read and Fig.3-1 is missing a legend. Please provide all graphs in a format consistent with those presented in Section 5 (Figure 5-6).
18. Please consider adding text in the report to summarize the three public meetings that were held as part of Task 1 to discuss the study with the public and solicit their input, with a reference to Appendix N which contains copies of all of the notices, sign-in sheets, and meeting materials.
19. Please define all acronyms the first time they are used. For example, HCPUA is used first on page 3 and defined on page 7; AWWA on page 111; and, 'TWCA' and 'AWWA' are missing from Appendix B.
20. Please correct all spelling and typographical errors in the report. For example, top of p. 70 first sentence should refer to biochemical (instead of biological) oxygen demand.

Review Comments and Responses on the Draft Final Report

The following are the responses to comments received from Reclamation prior to initiation of its formal review process:

1. Section 4.B.4.a of the Directives and Standards (D&S) requires a description of the non-Federal funding condition or the reasonably foreseeable future actions that the City would take if the Title XVI project is not implemented (i.e., non-Title XVI alternative). This report provides combinations of supply options that could be implemented under different scenarios, but it remains unclear as to which specific potable water supply(s) the proposed Title XVI project is meant to postpone or eliminate. The appropriate location for this discussion appears to be in Section 6.4, Alternative 3 – Potable Water Use, but no such discussion exists. On Page 61, the report mentions the incremental reduction in the cost of developing the Edwards Aquifer (3rd paragraph), but it also mentions avoided costs HCPUA (6th paragraph). The report should clarify whether one or both of these alternatives is meant to serve as the non-Federal funding condition.
    A. *A clarification that Alternative 3 – Potable Water Use is the only non-federal alternative that can meet the full projected demands has been included in Section 7.1.4.*

2. For the non-Title XVI alternative(s) identified above, Section 4.B.4.c of the D&S requires a description of benefits to be gained, total project cost, life cycle cost, and corresponding cost of water produced, expressed in cost per million gallons or acre-foot. The purpose of this requirement is to allow a direct cost comparison to be made among alternatives, pursuant to Section 4.B.5.b. The costs must be developed for a non-Title XVI alternative that would satisfy the same demand as the proposed Title XVI project. This draft report provides costs in Section 4.4, but it is unclear how those costs were developed and on what level of service they were based. The draft report also shows a unit cost of $1.83 per 1,000 gallons in Section 7.2, but does not provide supporting documentation for what or how this cost is based. For the non-Title XVI alternative(s), please provide a description of the benefits to be gained, the total project cost, and life cycle cost. The costs must be likely and realistic, and they must be developed with the same standards with respect to interest rates and period of analysis as those developed for the Title XVI alternative. Note: according to 4.B.5.b of the D&S, the cost of the Title XVI alternative does <u>not</u> need to be the least expensive in order to justify its implementation.
    A. *The non-Title XVI alternative costs are now detailed in Section 7.1. Costs for Alternative 3 (the non-Title XVI alternative that capable of meeting the demands developed in Section 5) are presented in Section 7.1.4.*

3. Pursuant to Section 4.B.4.d of the D&S, please provide a brief description of references, design data, and assumptions to support cost estimates for both the Title XVI and non-Title XVI alternatives.
    A. *The references, design data, and assumptions are summarized in Section 7.1.*

4. Section 4.B.6 of the D&S requires justification of why the proposed Title XVI project is the selected alternative in terms of meeting four criteria (i-iv). The draft report appears to address "i" and ii" through its discussion of offsetting either HCPUA or Edwards

Aquifer supplies, respectively, but it remains unclear as to how the proposed Title XVI project would address criteria "iii" and "iv". Please explain.

A. *Section 7.12 has been added to present the required justification.*

5. The report provides projections based on two different planning windows, 2035 and 2040. This results in substantive inconsistencies with regards to population projections, recycled water demands, project scope/type of service provided, cost analyses, etc. Please define only one planning window and address all requirements of the D&S in terms thereof.

   A. *The report has been clarified to define the planning period as 2015-2035 with references to 2040 used to illustrate the extent to which project unit costs decrease at the end of debt payments.*

6. Crosswalk Table. The current structure of the crosswalk table is difficult to follow and makes cross referencing the D&S sections with report page numbers difficult. Please consider adding grid lines or make other revisions as necessary.

   A. *The crosswalk table has been updated to include report page numbers and grid lines.*

7. Crosswalk Table. The crosswalk table contains erroneous D&S/Report Section/Page number correlations. For example, Section 4.a is correlated to Section 10.4.3 and Page 115 of the report, and this information is contained in neither place. Rather, this section should be correlated to Page 44, which is supposed to describe the non-Title XVI alternative (i.e., Alternative 3). Furthermore, Section 4.d is correlated to Section 6 and Pages 41-56; instead, it should be correlated to Pages 58, 59, and Appendices. To facilitate the formal agency review, we recommend correcting any inaccuracies throughout the crosswalk table.

   A. *The crosswalk table has been updated.*

8. Crosswalk Table. It is not acceptable to indicate a D&S requirement such as Research Needs as "N/A." Please address all requirements of the D&S. If (for example) research needs are not needed, then briefly state such in the body of the report.

   A. *Section 10.7* Research Needs *has been added to the report.*

9. Section 5.6. Table 5-10 does not appear to include "Future Parks," as provided in Table 5-2. Please clarify which recycled demand calculation is correct.

   A. *Tables 1-1 and 5-10 have been revised to include future park acreage for both public and private parks in the year 2035.*

10. Section 5.6. Please provide a description of the cooling makeup water use projection and how this calculation was made.

    A. *A clarification has been added to Section 5.6 that describes that the medical center uses a cooling tower for environmental cooling and that the system presently uses potable water to make up for evaporative losses in the system. The volume presented was the potable water demand for 2011.*

11. Section 6; General. The list and descriptions of alternatives provided in the section overview (i.e., Alternatives 1, lA, 2, and 3) is not consistent with the list provided in each of the subsections (i.e., Alternative 1, lA, 2, 3, and 4). Please correct.
    A. *The list of four alternatives in Section 6 is addressed in Sections 6.1, 6.2, 6.3, and 6.4.*

12. Section 7; General. The cost per 1,000 gallons of the proposed Title XVI project is not consistent across Table 7-2 ($2.42), 7-3 ($2.43), and 7-4 ($1.74), partly due to inconsistent volumes of reclaimed water provided (i.e., 442.84 versus 601.73). Consistent with General Comment No. 2, please provide only one unit cost and be consistent in its use and application.
    A. *The reclaimed water demand volume and unit costs in the tables in Section 7 have been corrected.*

13. Section 7.2; General. Consistent with General Comment No. 2, please provide a cost comparison of the non-Title XVI altenative(s) that would satisfy the same demand as the proposed Title XVI alternative. The alternatives used for comparison must be likely and realistic and developed with the same standards with respect to interest rates and period of analysis.
    A. *The costs for the non-Title XVI alternatives are presented in Sections 7.1.1 through 7.1.4. Clarification of the cost comparison in Section 7.2 has been provided.*

14. Section 8 excludes a description of potential environmental impacts to specific resources required in the D&S, namely public health or safety, historic properties, and natural resources. On the latter resource, a brief discussion should be included on the potential impacts to fish and wildlife habitat, including potential effects caused by a reduction in in- stream flows from Plum Creek.
    A. *Potential environmental impacts have been included in Sections 8.1.2, 8.1.3, 8.1.5, 8.1.6, 8.1.7 and 8.2.5.*

15. Appendix O; Report Comments and Responses; Page 187. This appendix is blank and is not referenced in the body of the report. Please provide a discussion of the extent to which the public was involved in the feasibility study and a summary of comments received, if any.
    A. *This discussion is included in Section 2.2.1* Public Involvement *and has been added to the final report with a summary of comments in the referenced appendices.*

The following are the responses to comments from the TWDB on the June 2012 Draft Final Report.

1. Page 113, second paragraph: Please clarify that the current 2011 Region L Regional Water Plan (RWP) and the 2012 State Water Plan (SWP) do not have "reuse" as a recommended water management strategy for the City of Kyle and therefore an amendment to these plans would be required in order for this project to be eligible for funding from the Water Infrastructure Finance Program. Another requirement to be eligible for this funding is to complete the TWDB online Infrastructure Finance Report Survey.
   A. *The text on pg. 113 has been modified to clarify that funding from the WIF will require an amendment of the Region L and State Water Plans, as well as completing the Infrastructure Finance Report Survey.*

2. Page 102, fourth paragraph *Loans*: The current terms of the SRF and state loans do not offer zero percent interest, guarantee of repayment, or bond insurance. Please revise as necessary.
   A. *The paragraph has been modified as recommended.*

3. Page 102, last paragraph: Please clarify that although the rules provide for fixed or variable rate loans, the TWDB only offers fixed rate loans under this program.
   A. *The text has been modified to clarify that it is fixed rate loans that are available.*

4. Page 5, first bullet: 'Obtain water rights ~~for the storage of reclaimed water~~ at Site 1. Please clarify that what is actually needed is a water rights permit amendment regarding change of use from recreation/livestock to municipal and the associated water volume for this new use (as described in section 10.2.2); same clarification needed on pages 116 and 118.
   A. *The text has been modified to reflect the need to amend an existing water rights permit for a change of use and volume.*

5. Pages 25, 28, and 29: There appears to be a discrepancy (153.4 acres vs. 140.56 acres) between the future park area in Table 5-2 and the irrigation summary in Table 5-7 and 5-8. Please reconcile and revise report as appropriate.
   A. *As shown in Table 5-7 and 5-8, the total of public and private parkland in the year 2035 is 571.4 ac. Table 5-2 has been corrected to reconcile the future park acreage for both public and private parks in the year 2035 to be 571.4 ac.*

6. Pages 29 and 30: There appears to be a discrepancy (1,030.29 acres vs. 960.01 acres) between the irrigated area summary in Table 5-8 and the total irrigated area in Table 5-10 (and executive summary Table 1-1). Please reconcile and revise report as appropriate.
   A. *Tables 1-1 and 5-10 have been revised to include future park acreage for both public and private parks in the year 2035.*

7. Page 32, section 5.9: Please consider including a brief explanation of the characteristics and applications of Type l and Type II reclaimed water in this section or a reference to the detailed information included in Section 9.
    A. *The principal differences between Type I and Type II reclaimed water parameters are first summarized in Section 1.2, but a reference to Sections 9.1.2 and 9.1.3 has been added to the description of the existing reclaimed water system infrastructure in Section 5.9.1.*

8. Page 42, Section 6.2: Please clarify whether there are purchase costs for the existing system attributed to changing the ownership of the existing reclaimed system.
    A. *The text has been updated to clarify that the terms of a transfer are completely negotiable at this time and that a purchase price has not been assigned as part of this study.*

9. Page 42, Section 6.3: Please clarify whether or not the existing wastewater treatment plant would need to increase its capacity as a result of this alternative.
    A. *This section has been modified to clarify that the RWPFs would not necessarily create the need to expand the existing WWTP, but that the treatment process would need to be evaluated in light of the potential increase in influent concentrations of BOD and TSS.*

10. Page 58, Table 7-4: Alternative I A is to transfer the existing system to the City of Kyle and will be operated and maintained by the city's wastewater utility. However, the capital cost shown in Table 7-4 is $843,750 which seems to be the project costs of Phase I. Please clarify and provide costs of changing the ownership of the existing system, if applicable, per comment 16 above.
    A. *Thank you for the comment. Clarification that costs associated with Alternative 1A are those necessary to produce Type I reclaimed water quality and to make use of the available capacity in the existing system has been added to Section 6.2.*

11. Page 63, Section 7.8: Please revise first sentence - the considered alternatives are described by Sections 6.1 through 6.5, not only by Sections 6.3 and 6.4. Also, please note that the costs are not fully described for each alternative by Sections 6.1 through 6.5.
    A. *The clarification has been added to Section 7.8 along with clarification that there are no direct costs to the city for Alternative 1; that costs for Alternative 1A are incurred if the intent is to increase water quality to Type I and make use of the available system capacity; that no costs can be developed for Alternative 2 with the available data; and that the costs associated with Alternative 3 are the average cost of potable water supplies plus O&M and depreciation as represented in the city's retail water rate.*

12. Page 64, Sect ion 7.8.3: Please note that Appendix E is a table to show the opinion of probable project costs, instead of power, operation and maintenance, and treatment costs. Please also clarify which alternative Appendix E refers to.
    A. *Section 7.8.3 has been clarified to reference Appendix H. References to Appendices E, F, and G for Alternative 4 have been added to Section 7.2.*

13. Page 65, Section 7.1 0: Appendix K shows that the debt service is 30 years. Please clarify why 20 years was used in calculating Present Values.
    A. *The debt service detail presented in Appendix K illustrates potential project funding using three separate debt issuances in 2015, 2020, and 2025 – each with a 20 year term. A clarification of the three debt issues is presented in Section 7.8.2.*

14. Page 71, first full paragraph: Please define and/or describe the SWAT model referred to this paragraph.
    A. *The text has been modified to include a definition of the SWAT model used in the development of the WPP.*

15. Page 99, Section 9.3.1 content on "Return and Environmental Flows" is very confusing. Please consider re-writing this paragraph to provide more clarity.
    A. *Section 9.3.1 has been revised.*

16. It appears that many of the report appendix references need to be updated. Please reconcile and revise where appropriate. Examples include: page 53, paragraph 4 reference to Appendix H should be Appendix I; page 57 reference to Appendix F should be Appendix G for each service area, however, the 'complete system' probable costs appears to be missing from Appendix G; and, page 65 references to Appendix K should be Appendix L.
    A. *Appendix G has been updated to include the cost of the complete project. References to the appendices have been updated.*

17. Please consider the following suggestions to enhance clarity/understanding for some of the report figures:
    a. Figure 1-1 (& 10-2): The following items are missing from the figure legend: independent transmission lines for Plum Creek, NE service area, SE service area, West service area, and location of Site 1 impoundment. Also appears to be a typographical error in legend for the proposed transmission line per 'Phases 2-3'; there is no Phase 3 currently identified in this study.
        A. *Figures 1-1 and 10-2 have been revised.*

    b. Figures 3-1 and 4-1 are difficult to read and Fig.3-1 is missing a legend. Please provide all graphs in a format consistent with those presented in Section 5 (Figure 5-6).
        A. *Figures 3-1 and 4-1 have been enlarged to improve legibility and revised to include a legend.*

18. Please consider adding text in the report to summarize the three public meetings that were held as part of Task 1 to discuss the study with the public and solicit their input, with a reference to Appendix N which contains copies of all of the notices, sign-in sheets, and meeting materials.
    A. *Section 2.2.1 Public Involvement has been added to the final report.*

19. Please define all acronyms the first time they are used. For example, HCPUA is used first on page 3 and defined on page 7; AWWA on page Ill; and, 'TWCA' and 'AWWA' are missing from Appendix B
    A. *The final report has been edited to define acronyms and to add additional acronyms to Appendix B.*

20. Please correct all spelling and typographical errors in the report. For example, top of p. 70 first sentence should refer to biochemical (instead of biological) oxygen demand.
    A. *Corrections have been made.*

The following are the responses/revisions to TWDB comments on the December 2012 Final Report.

21. Table 5-2 indicates that the total "future parks" area decreased from the draft 140.6 acres to final 132.8 acres. However, Ch.5 text and subsequent tables 5-7, 5-8, & 5-10 are still utilizing the draft 140.6-ac number in calculations.
    A. *Table 4-4 on pg. 19 shows the 2015 population as 34,328. Using 5.25 acres/1,000 population, the 2015 acreage is an increase of 51.9 acres instead of 44.2. Table 5-2 is revised for the 2015 acreage of 51.9 for a total acreage of 140.6.*

22. Table 5-6 lists commercial irrigated acres for IH35 N & S are listed as 156.6ac & 1245ac, respectively; however, these values are different in Table 5-7 (62.64ac & 49.8ac) & in tables 5-8 & 5-10 Commercial total irrigated is 273.89ac rather than 442.55ac.
    A. *The text preceding Table 5-6 and the irrigated area column of Table 5-6 have been corrected to include the 2035 irrigated acreage. Table 5-8 provides the total acreage for ALL commercial property (see User Category column, Table 5-7). Table 5-8 and Table 5-10 are correct showing 273.89 acres of irrigated area for Commercial Property. The Peak and Annual Reclaimed Water Demand columns in Table 5-10 are correct.*

23. TWDB Comment #1 regarding the requirement to amend the 2011 Region L Water Plan & the 2012 State Water Plan was addressed on page 115 of the final plan. However, it was not added as a bulleted task item in the reclaimed water project's implementation schedule (suggest before bullet 3 of "2013-2014" on page 119). The City would need to be the entity to initiate the request to amend the Region L RWP & the SWP for inclusion of this project as a recommended WMS for Kyle
    A. *Revision has been made as suggested.*

Appendix P: Title XVI Feasibility Study Report Crosswalk

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Title XVI Feasibility Study
Report Review Crosswalk (WTR-11-01)

Title XVI Feasibility Study Report Contents			Location in Report	
			Section	**Page**
1		**Introductory information**		
	a	identification of non-federal project sponsors	1	1
	b	description of the study area & project area map	2.3	8-10
	c	definition of study area in terms of site-specific project area	5	23-29
		& any reclaimed water distribution systems	2.1 & 5.9.1	7 & 32-34
2		**Statement of problems & needs**		
	a	description of the problem & need for reuse	2.1	7
	b	description of current & projected water supplies & potential sources of additional water other than reuse	4.2	16-17
	c	description of current & projected water demands	4.3	17-19
	d	description of any water quality concerns for current and projected water supply	4.2	16
	e	description of current & projected wastewater options other than reuse	5.9	32
3		**Water Reclamation & Reuse Opportunities**		
	a	Description of all uses for reclaimed water or categories	5	23-30
	b	description of water market available to utilize reclaimed water including:	5.6	29
	i	identification of potential users, expected uses, peak use, on-site conversion costs, desire to use reclaimed water	5.6.2	30
	ii	description of any consultation with potential customers	5.7	31
	iii	description of the market assessment procedures	5.7	31
	c	discussion of considerations which may prevent implementing a reuse project. Identify methods or community incentives	10.4.1	114-115
	d	identification of all W & WW agencies that have jurisdiction in the potential service area or over sources of reclaimed water	5.8	31
	e	description of potential sources of water to be reclaimed	5.9	32
	f	description & location of the source water facilities, including capabilities, existing flows, treatment processes, design criteria, plans for future facilities	5.9, 5.10	32-39
	g	description of the current water reuse taking place	5.9.1	32-34
	h	summary of water reclamation technology currently used & opportunities for development of improved technologies	5.10	38-39
4		**Description of alternatives**		
	a	description of the non-federal funding condition. Reasonably forseeable future actions city would take if federal funding were not provided for the project.	7.1.4	57-58
	b	Statement of objectives all alternatives are designed to meet	6	41
	c	description of other water supply alternatives considered to accomplish objectives addressed by the project.	4.2, 6	16; 41-56
	d	description of the proposed project including detailed project costs; annual O&M	7.1; 7.1.5; Appendices E, F, G, & H	57, 58
	e	description of waste-stream discharge treatment & disposal water quality requirements for the project	5.10	38
	f	description of at least 2 alternative measures, or technologies available for water reclamation.	6	41-47

Title XVI Feasibility Study
Report Review Crosswalk (WTR-11-01)

Title XVI Feasibility Study Report Contents			Location in Report	
			Section	Page
5		**Economic Analysis**		
	a	description of conditions that exist in the area & provide projections of the future with, and without the project.	7.3	60
	b	cost comparison of alternatives that would satisfy the same demand as reuse	7.2	59
	c	costs of the alternative most likely to be implemented in the absence of reuse	7.1.4	57
	d	qualitative benefits	7.4	60-62
6		**Selection of the proposed Title XVI Project**		
	a	provide an analysis of whether the proposed project will address the following:		
	i	reduction, postponement, or elimination of development of new water supplies	7.12	67
	ii	reduction or elimination of the use of existing diversions	7.12	67
	iii	reduction of demand on existing federal water supplies	7.12	67
	iv	reduction, postponement, or elimination of new or expanded WW facilities	7.12	67
7		**Environmental consideration and potential effects**		
	a	Address the following:		
	i	discuss potential significant impacts on endangered species	8.1.2	69
		public health and safety	8.1.6	72
		natural resources	8.1.7	72
		cutural resources	8.1.3	70
		regulated waters of the U.S.	8.1.5	71
	ii	discuss potential environmental effects or risks	8.2.5	96
	iii	describe status of federal, state, local environmental compliance measures	8.2.5	96
	iv	any other information assessing measures needed for NEPA compliance	8.2.5	96
	v	discuss how the project will affect water supply and quality	8.2.5	97
	vi	discuss extent to which public was involved in the study & comments received.	2.2.1; Appendices N & O	8
	vii	describe potential effects project may have on historic properties	8.1.3	70
8		**Legal & Institutional Requirements**		
	a	analysis of potential water rights issues	9.3	102
	b	discuss legal & institutional requirements	9	99-102
	c	discuss need for multi-jurisdictional or interagency agreements	9.4	103
	d	discuss permitting procedures required for implementation	10.2.1 - 10.2.3	110-113
	e	discuss any unresolved issues	10.2.1 - 10.2.2	110-111
	f	identify current & projected WW permit requirements	10.2.3	111-113
	g	describe rights to WW discharges resulting from implementation	9.3	102-103
9		**Financial Capability of Sponsor**		
	a	proposed schedule for project implementation	10.6.1	119-121
	b	willingness of sponsor to pay for its share	10.4	114-118
	c	plan for funding project & O&M	10.4	114-118
	d	Description of sources of funding	10.4.3	116
10		**Research needs**		
	a	describe whether proposed project includes research needs	10.7	121

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