CHAPTER 4 – EVALUATION OF ALTERNATIVES

Table of Contents

List of Tables

List of Figures

CHAPTER 4 – EVALUATION OF ALTERNATIVES

A. Description of Discharge Alternatives

The discharge alternatives considered in the City of Airway Heights Comprehensive Sewer Plan (Century West Engineering Corporation, April 2003) included: (1) Continued discharge to the City of Spokane Advanced Wastewater Treatment Plant; (2) Discharge to the Medical Lake Wastewater Treatment and Reuse Facility (WWT&RF); and (3) A separate treatment and discharge system owned by City of Airway Heights (City). Discharge to the City of Cheney Wastewater Treatment and Reclamation Plant was also briefly evaluated and determined to be more expensive than discharge to the City of Medical Lake, and therefore eliminated.

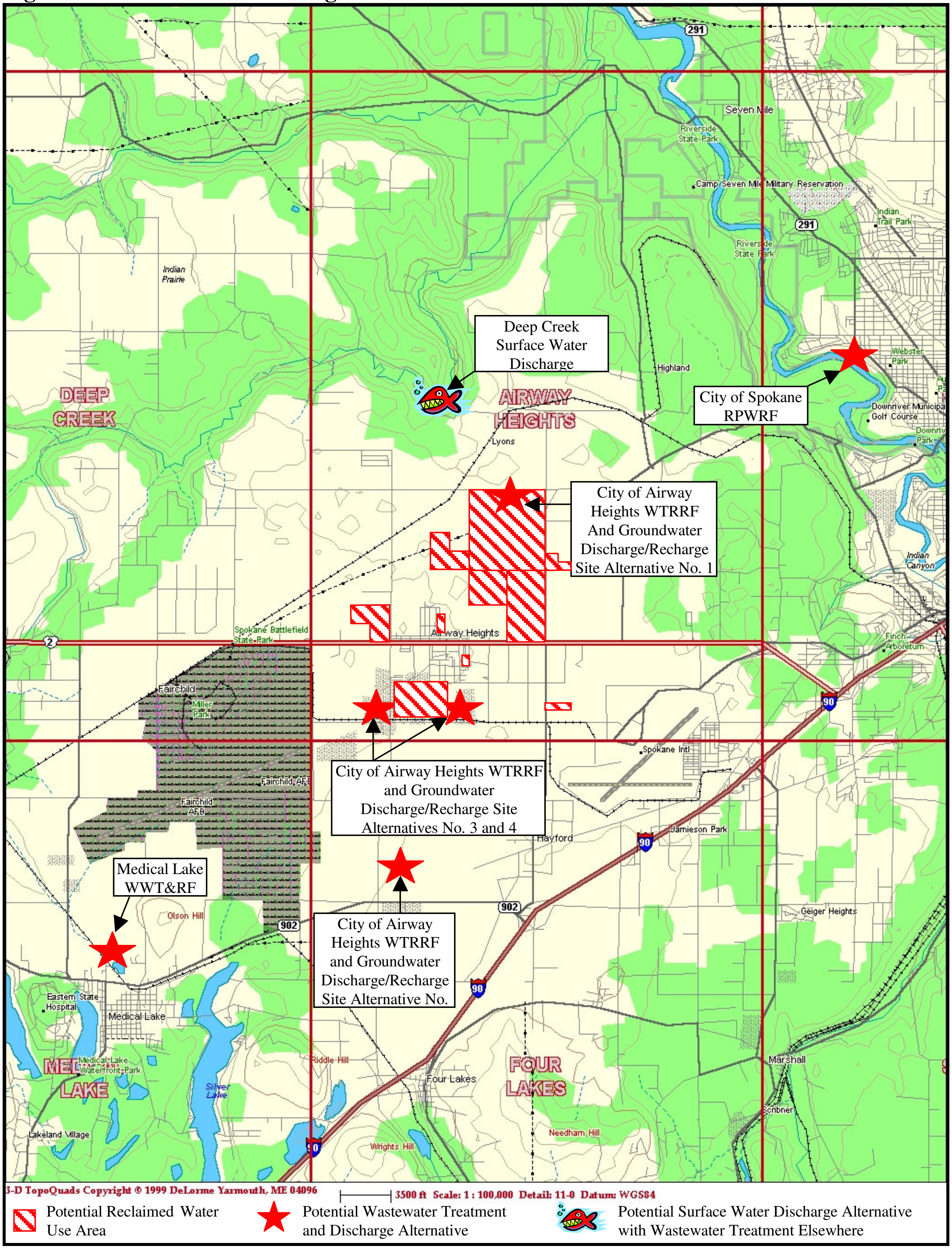
Figure 4-1, Location of Discharge Alternatives, shows the relative locations of the following discharge alternatives described in this Section: (1) Discharge to the City of Spokane Riverside Park Water Reclamation Facility (RPWRF) (formerly called the Spokane Advanced Wastewater Treatment Plant (SAWTP), (2) Discharge to the Medical Lake WWT&RF, (3) New wastewater treatment facility with discharge to Deep Creek, (4) New wastewater treatment facility with discharge to groundwater (via rapid infiltration basins or wetlands); and (5) New wastewater treatment facility with discharge to a reclaimed water system (that includes groundwater recharge as one of the reclaimed water uses).

1. Discharge to the City of Spokane Riverside Park Water Reclamation Facility

Under this alternative, wastewater would continue to be discharged to the City of Spokane's interceptor sewer to the RPWRF. In 1993, the City of Airway Heights entered into an interlocal agreement with the City of Spokane for sewer service. The interlocal agreement was updated in 2001. The City of Airway Heights purchased 680,000 GPD of capacity in the sewer main that connects the City of Spokane's regional collection system to the City of Airway Heights collection system at State Route 2 and Hayford Road. The City of Airway Heights also purchased 680,000 GPD of capacity in the City of Spokane treatment system and regional pump stations.

The City of Airway Heights Comprehensive Sewer Plan and Table 3-2, Wastewater Flow Projections, project that the City of Airway Heights will exceed its allocated capacity before 2007. Thus, to continue with this discharge alternative, the City of Airway Heights would need to negotiate with the City of Spokane to pay a connection charge for additional capacity in the treatment and regional collection systems. It is uncertain at this time if the City of Spokane will have future additional capacity in its treatment system to sell to the City of Airway Heights.

Figure 4-1. Location of Discharge Alternatives



The City of Spokane treatment system is currently undergoing a six-year Capital Improvement Program (CIP) to meet more restrictive effluent quality standards in its existing National Pollutant Discharge Elimination System (NPDES) permit for discharge to the Spokane River, to rehabilitate its existing facilities, and to add capacity for future growth through year 2045. These improvements are estimated to cost a minimum of $250 million, based on the 2001 updated cost estimate of the City of Spokane Wastewater Facilities Plan (Section 7 – Build-out). The City of Airway Heights is charged a portion of the City of Spokane's yearly treatment system CIP expenditures based on the interlocal agreement. The portion of the CIP charged to the City of Airway Heights is based on the ratio of the City of Airway Heights annual average wastewater flow each year to the City of Spokane's treatment system annual average flow in 2001 (~38 MGD), per the updated interlocal agreement. The City of Airway Heights is also charged a portion of the City of Spokane's annual operation and maintenance costs based on the same ratio.

The Washington State Department of Ecology (WA DOE) is currently performing a Total Maximum Daily Load (TMDL) study for dissolved oxygen reducing substances discharged to the Spokane River. The study, which is due to be completed at the end of 2004, is expected to recommend more stringent effluent standards for the City of Spokane treatment system NPDES permit. Based on the 1999 City of Spokane Wastewater Facilities Plan (Section 6 - Long Term Off-Site Treatment and Discharge Alternatives), these new standards may require an additional Capital Improvement Program in the range of $600 million to $1.1 billion to either construct treatment facilities capable of meeting the TMDL-based effluent standards or remove the City of Spokane treatment system discharge from the Spokane River for all or part of each year. The ramifications of the TMDL study are highly uncertain at this time. However, it is expected that if the City of Spokane is required to implement an additional CIP due to meeting the additional TMDL-based requirements, the City of Airway Heights will be charged a portion of the additional CIP costs.

2. Discharge to the Medical Lake Wastewater Treatment and Reuse Facility

This alternative is estimated to require the installation of approximately 10.3 miles of sewer forcemain and four lift stations for transmission of the City of Airway Heights wastewater to the Medical Lake WWT&RF. In addition, the Medical Lake facility would need to be expanded to accommodate the projected City of Airway Heights wastewater flow through the planning period. The Medical Lake WWT&RF is currently permitted for an annual average design flow of 1.03 MGD to serve the City of Medical Lake and the Department of Social and Health Services (DSHS) Eastern State Hospital campus. The Medical Lake facility expansion would be designed to treat the additional wastewater to Class A Reclaimed Water Standards for discharge to West Medical Lake and to the effluent standards required for discharge to the intermittent tributary to Deep Creek (the two permitted discharge points from the facility). Discharge of the City of Airway Heights wastewater to the Medical Lake facility would also require a modification of the facility's NPDES permit to allow additional flows to be discharged to the permitted receiving waters. It is uncertain if additional flows to the intermittent tributary to Deep Creek would be permitted due to the current moratorium on all new discharges to the Spokane River, including tributaries. In addition, flow of reclaimed water to West Medical Lake may be limited to the quantity to maintain lake water levels in the optimum range and to prevent the lake from overflowing.

In addition, an interlocal agreement between the City of Airway Heights and the City of Medical Lake would likely be required for the City of Medical Lake to the accept wastewater from the City of Airway Heights. This interlocal agreement would spell out the connection, capital, and operating charges required for discharge to the Medical Lake facility. Through the interlocal agreement, the City of Airway Heights could secure water rights to a portion of the reclaimed water produced at the Medical Lake facility. This reclaimed water could be pumped back to the City of Airway Heights and sold to potential reclaimed water customers. The revenues from the sale of the reclaimed water could potentially offset a portion of the capital and operating costs associated with returning the reclaimed water.

3. New Wastewater Treatment Facility with Discharge to Deep Creek

A potential outfall location for discharge of the City of Airway Heights wastewater to Deep Creek is located approximately 2 miles north of the City of Airway Heights northerly City limits through mostly Spokane County and private right-of-way land. At the potential discharge location, surface water flow through Deep Creek is intermittent because the discharge from the drainage basin flows underground during the dry seasons of each year. Flow from Deep Creek combined with the Coulee Creek drainage is discharged to the Spokane River at approximately River Mile 60.

The WA DOE has developed discharge criteria for discharges to intermittent streams. The WA DOE may use these criteria to develop NPDES permit requirements for discharge of the City of Airway Heights wastewater to Deep Creek. However, the criteria were initially developed for discharges of 0.5 MGD or less. Generally, the criteria limit effluent concentrations of 5-day Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), and ammonia nitrogen. However, due to the sensitivity of the Spokane River and Long Lake (on the river) to phosphorus, it is expected that phosphorus control will also be required. WA DOE may also require that effluent discharged to Deep Creek meet groundwater discharge requirements during the months when surface water flow in the creek ceases.

Until the TMDL study is completed, the WA DOE is prohibiting all new and increased discharges to the Spokane River, including tributaries. Therefore, it is expected that a discharge to Deep Creek would not be permitted until the TMDL limits are finalized. However, after the TMDL limits are finalized, discharging to Deep Creek may still be a viable discharge alternative, particularly for future peak wet weather discharges when other discharge options are unavailable.

4. New Wastewater Treatment Facility with Discharge to Groundwater

Discharge to the groundwater could be through rapid infiltration basins, or infiltration wetlands. Rapid infiltration basins would consist of several constructed basins where treated wastewater would be applied intermittently and allowed to infiltrate directly into the soil. An infiltration wetland would consist of constructed wetlands to receive the wastewater, provide additional pollutant removal, and then allow infiltration through the bottom of the wetland.

Groundwater hydrology in the West Plains area is complex. Much of the area is underlain by basalt at shallow depths. However, a study by Deobald and Buchanan[1] showed the presence of "paleochannels" in the basalt, filled with sediment. These features presumably carry ground water, recharged from precipitation, northerly toward Deep Creek and northeasterly toward the Spokane River. Effluent discharged to groundwater over the prominent paleochannel described by Deobald and Buchanan, as "extending from the Riddle Hill area northwards under Airway Heights to Deep Creek" would be expected to migrate to Deep Creek. Thus, an important consideration in the selection of a site for rapid infiltration basins or infiltration wetlands would be the relative location of the basins or wetlands to the paleochannel that runs through the City. A detailed hydrogeologic study would be required to determine the infiltration rate and groundwater flow rate from the site to ensure that effluent discharged to infiltration basins or wetlands would indeed migrate from the site at the desired rate.

As with surface water, discharges to groundwater are regulated by state statute through the WA DOE. In general, the criteria for discharge to groundwater prohibit the degradation of existing and future beneficial uses and quality of the groundwater. A treatment system that is permitted to discharge to groundwater would be expected to provide a very high level of treatment to ensure that the recharged groundwater quality is of equal or better quality than background water quality prior to discharge.

If the City chooses to claim a water right for the treated effluent discharged to groundwater, the City would be required to comply with the WA DOE and Department of Health (DOH) Water Reclamation and Reuse Standards and the Revised Code of Washington (RCW) 90.46 (Reclaimed Water Use). The regulations require the effluent to meet Class A reclaimed water standards, remove nitrogen, and initiate an industrial wastewater pre-treatment program either on its own or through the WA DOE. RCW 90.46.120 provides the owner of a permitted reclamation facility the exclusive right to any wastewater generated by the facility, including treated effluent discharged to groundwater. However, the owner of the reclamation facility will only retain the exclusive right to the portion of reclaimed water it can demonstrate that it can directly control and recover from the recharge aquifer. The amount of reclaimed water recovered from the recharge aquifer will depend on the groundwater flow rate out of the recharge area and the rate of groundwater withdrawal (by wells) from the recharge area, among other factors.

1 Deobald and Buchanan, Hydrogeology of the West Plains Area of Spokane County, Washington, May 1995.

In addition, under RCW 90.46.130, the City of Airway Heights would be required to demonstrate that it will not impair any existing water rights downstream from any existing freshwater discharge points, unless compensation or mitigation is agreed to by the holder(s) by the affected water right(s). In other words, the City of Airway Heights must submit an "impairment analysis" to the WA DOE to show that it is not impairing downstream water rights in the Spokane River by moving its discharge from the City of Spokane treatment facility (which discharges to the Spokane River) to a groundwater recharge aquifer (or to a reclaimed water distribution system). Typically, the impairment analysis is completed and approved as part of the Facilities Plan and associated SEPA process. A discussion of the impairment analysis is included in Chapter 5.

5. New Wastewater Treatment Facility with Discharge to Reclaimed Water System

Discharge of the City of Airway Heights' treated wastewater to a reclaimed water system would allow reuse of the treated effluent at various sites throughout the City during portions of the year. The reuse of treated effluent would reduce demand on the City's potable water system resources in addition to reducing the quantity of treated effluent discharged to waters of the State. Discharge to a reclaimed water system would require that the reclaimed water meet the WA DOE and DOH Water Reclamation and Reuse Standards. As with discharge of reclaimed water to groundwater, the City of Airway Heights would also be required to submit an impairment analysis to the WA DOE to show that it is not impairing downstream water rights.

There are several potential municipal, commercial, industrial, and institutional uses for treated effluent in the Airway Heights area. Most of the direct-contact uses require treatment to meet Class A reclaimed water standards although a few non-direct-contact uses require treatment to Class C standards. Definitions of the various classes of reclaimed water are provided in Subsection C.1.d, Reclaimed Water Regulations, of this Chapter. Potential reclaimed water users that are currently on the City's potable water supply system are listed in Table 4-1, Potential Reclaimed Water Customers. These potential customers are considered to be ideal candidates for reclaimed water use because such use would reduce or delay future costs associated with expanding the City's potable water supply system. City of Airway Heights water usage records for July 2001 through December 2003 were used to estimate the quantities of reclaimed water demand listed in Table 4-1. The total estimated average reclaimed water demand between May through October for all the potential reclaimed water customers is 0.513 MGD, or approximately 94 MG (365/2 x 0.513 MGD) per year. This is the estimated amount of direct-use reclaimed water that could potentially be sold to existing customers each year. Additional reclaimed water could be sold to future customers; however, those new customers would need to be developed.

Figure 4-2, City of Airway Heights Average Monthly Wastewater Flow Versus Potential Reclaimed Water Customer Water Use, illustrates the seasonal variation of reclaimed water supply and demand. Figure 4-2 shows that the average wastewater flow from Airway Heights (which includes the City of Airway Heights and Airway Heights Corrections Center) remains relatively constant throughout each year (at approximately 0.41 MGD for the previous five years, 1999-2003), whereas the estimated reclaimed water demand from the potential reclaimed water users (listed in Table 4-1) varies significantly throughout each year, dropping to below 0.07 MGD (~50 GPM) from January through March and rising to above 0.5 MGD from June through September.

Currently, not all of the potential reclaimed water customers could be served by a reclaimed water system (without a storage reservoir), because the potential reclaimed water demand would exceed the existing wastewater supply during May through October. The seasonal difference between demand and supply during May through October is approximately 20 MG. This means that a reclaimed water reservoir would be required to store an estimated 20 MG by the end of April of each year to satisfy all of the potential existing reclaimed water demand.

As wastewater flows increase due to growth in sewer connections, the City of Airway Heights dry weather wastewater flow will eventually exceed the seasonal reclaimed water demand. As illustrated in Figure 4-2, as early as 2005, it is estimated that the projected City of Airway Heights average monthly wastewater flow will exceed the existing maximum average monthly reclaimed water demand (which is approximately 0.6 MGD) in the highest demand month (July). Although seasonal storage of reclaimed water is not expected to be required to serve the existing potential reclaimed water customers in year 2005, a smaller volume of storage would likely still be required to compensate for weekly and diurnal demand variations.

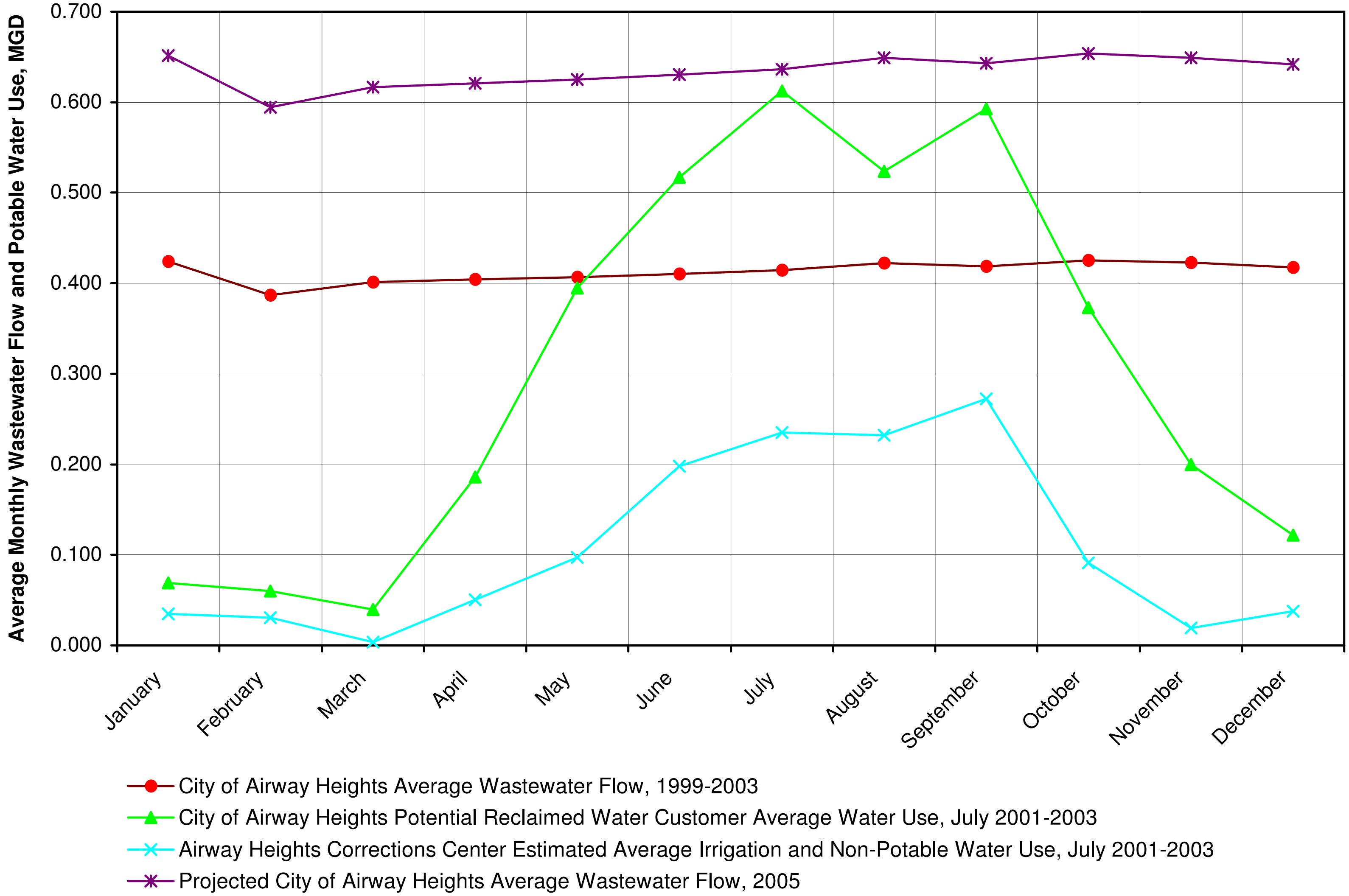
The current yearly difference between supply and demand is approximately 50 Million Gallons (MG) (i.e. 50 MG would need to be discharged to one of the other discharge alternatives). By design year 2030, the future yearly difference between supply and existing demand is estimated to be approximately 468 MG. This assumes no growth in reclaimed water customers. If all of the wastewater could be reused in the future for seasonal uses at design year 2030, then approximately 274 MG of storage would be required to store the volume of wastewater generated during the half of the year that the users could not use the reclaimed water directly. In theory, this volume of storage could prevent discharge to waters of the State. However, the capital costs and land requirements of a storage reservoir this large minimizes the cost effectiveness of this option when compared to treatment and seasonal discharge to one of the other discharge alternatives. In addition, developing the reclaimed water customers that would use all the stored reclaimed water each year may be a difficult task. Thus, if discharge to a reclaimed water system is selected, it is expected that one of the other discharge alternatives, such as groundwater recharge or discharge to surface water, would be required during portions of the year when demand for the reclaimed water is not available.

Table 4-1. Potential Reclaimed Water Customers								
Owner	**Location**	**Figures 4-3 to 4-6 Location Number**	**Type of Use**	**Minimum Reclaimed Water Class**	**Average Reclaimed Water Demand[1] (May–October) (MGD)**	**Maximum Month Reclaimed Water Demand[1] (MGD)**	**Peak Hourly Reclaimed Water Demand (MGD)**	**Footnote**
Washington State Department of Corrections (DOC) Contact: Ron May Phone: 509-244-6783	Airway Heights Corrections Center	1	Landscape Irrigation	Class A	0.194	0.323	0.646	2
Spokane Rock Products Contact: John Hjaltalin Phone: 509-533-1615	Spokane Rock Products 2691 South Craig Road Medical Lake, WA 99022	9	Aggregate Washing, Concrete Mixing, Dust Control	Class C	0.128	0.299	0.717	3
Shamrock Paving Company Contact: John Lundstrom Phone: 509-244-2800	Shamrock Paving Company 110 North Hayford Road Spokane, WA 99224	8	Gravel Washing, Dust Control	Class C	0.105	0.227	0.714	4
Owner: Spokane County Operator: Spokane Motorsports Complex, Inc. Contact: Vicki Coffman Phone: 509-220-4117	Spokane County Outdoor Recreational Vehicle (ORV) Park South 20 Russell Street Airway Heights, WA 99001	6	Landscape Irrigation	Class A	0.037	0.105	0.209	5
Kalispel Tribe of Indian Administration Contact: Wally Hubbard Phone: 509-445-1147	Northern Quest Casino 100 North Hayford Road Airway Heights, WA 99001	3A	Landscape Irrigation	Class A	0.018	0.038	0.075	2
	Kalispel Tribe Administrative Office 934 South Garfield Road Airway Heights, WA 99001	Not Shown	Landscape Irrigation	Class A	0.004	0.009	0.018	6
City of Airway Heights Contact: John Hyatt, Public Works Director Phone: 509-244-5429	Shorty Combs Park	2B	Landscape Irrigation	Class A	0.011	0.018	0.036	6
	Sunset Park	2A	Landscape Irrigation	Class A	0.003	0.005	0.011	6
Cheney School District No. 360 Contact: ? Phone: 509-559-4600	Sunset Elementary School 12824 West 12th Avenue Airway Heights, WA 99001	5	Landscape Irrigation	Class A	0.011	0.028	0.057	6

Table 4-1. Potential Reclaimed Water Customers								
Owner	**Location**	**Figures 4-3 to 4-6 Location Number**	**Type of Use**	**Minimum Reclaimed Water Class**	**Average Reclaimed Water Demand[1] (May–October) (MGD)**	**Maximum Month Reclaimed Water Demand[1] (MGD)**	**Peak Hourly Reclaimed Water Demand (MGD)**	**Footnote**
Metals Fabrication Company Contact: Dan Weaver Phone: 509-244-2909	Metals Fabrication 2524 South Hayford Road Airway Heights, WA 99001	10	Industrial Process	Class C (No exposure of workers)	0.002	0.005	0.011	3
Total Estimated Demand for Potential Reclaimed Water Customers					0.513	1.057	2.494	
Total Estimated Demand for Potential Reclaimed Water Customers (6 AM to 6 PM)							1.442	
Total Estimated Demand for Potential Reclaimed Water Customers (6 PM to 6 AM)							1.052	

1. The average reclaimed water demand and the maximum month reclaimed water demand were estimated from the City of Airway Heights water usage and billing records from July 2001 through October 2003. Prior to July 2001, Spokane Rock Products, the second largest potential reclaimed water customer, did not have its 6” potable water supply line in service. Therefore, the total estimated reclaimed water demand determined from water usage data prior to July 2001is not expected to be representative of the future potential demand.
2. The reclaimed water demand is calculated by subtracting the minimum wet weather flow from the maximum dry weather flow to estimate the maximum irrigation flow. The peak hourly demand assumes 12 hours per day (6 PM to 6 AM) of irrigation.
3. The peak hourly reclaimed water demand is calculated assuming 10 hours per day of use (6 AM to 4 PM).
4. The peak hourly reclaimed water demand is calculated assuming 4 hours per day (6 AM to 12 PM) of water truck filling for dust control purposes (account no. 197) and 10 hours per day of gravel washing operations (account no. 198) (6 AM to 4 PM). The billing usage numbers were multiplied by 7.48 to convert from cubic feet to gallons.
5. The reclaimed water demand is calculated assuming 15% of the water use is for domestic purposes and the remaining 85% of water use is for irrigation. Peak demand is calculated assuming 12 hours per day (6 PM - 6 AM) of irrigation.
6. Peak demand is calculated assuming 12 hours per day (6 PM - 6 AM) of irrigation.

Figure 4-2. City of Airway Heights Average Monthly Wastewater Flow Versus Potential Reclaimed Water Customer Water Use



Other future potential reclaimed water customers are listed in Table 4-2, Additional Potential Reclaimed Water Customers. These customers are not currently on the City's potable water supply system, and therefore the City does not have their water usage information readily available. Some of the potential customers listed in Table 4-2, namely Fairchild Air Force Base (FAFB), Spokane International Airport, and Fairways Golf Course, are outside the City's water service area; and therefore, it is unclear if the City could provide reclaimed water service to these customers. In addition, FAFB and Spokane Motor Sports, Inc., currently have their own groundwater supply wells.

Of the potential customers in Table 4-2, only FAFB and Kalispel Tribe of Indians Administration have been formally contacted regarding becoming a reclaimed water customer. The Deputy Base Civil Engineer at FAFB was contacted in November of 2003 regarding supplementing its water supply with reclaimed water. Since the Base has adequate water supply from its own existing groundwater supply wells, the Deputy Base Civil Engineer was doubtful that the cost of pumping water from its existing wells would be greater than the expense of installing the necessary reclaimed water distribution piping to and within the Base. Therefore, it seems unlikely that FAFB will participate as a reclaimed water customer in the near future.

Representatives from the Kalispel Tribe of Indian Administration have expressed a high level of interest in using reclaimed water for irrigation purposes for their future tribal casino and entertainment complex. This project is still in the planning stages, and the potential reclaimed water demand from this facility is still uncertain.

Although not specifically identified in Table 4-1 or 4-2, storage impoundments for landscape irrigation or recreational purposes where public contact is possible (i.e. non-restricted access) are required to meet Class A reclaimed water criteria. For example, if the City chooses to create a fish pond or demonstration wetland in a public park, or store reclaimed water in an impoundment for landscape irrigation in public spaces, the reclaimed water must meet Class A reclaimed water criteria.

.

No specific locations for agricultural crop irrigation with reclaimed water are specifically listed in Tables 4-1 or 4-2; however, there are numerous relatively rural parcels in the vicinity of Airway Heights that could potentially use reclaimed water for crop irrigation. Class A reclaimed water would be required for spray irrigation of food crops. If there is not contact between the reclaimed water and the edible portion of the crop, Class B reclaimed water would be required. For crops that undergo physical or chemical processing sufficient to destroy all pathogenic agents prior to distribution, sale or consumption, Class D reclaimed water is required. Class D reclaimed water is also required for irrigation of animal feed or fiber crops.

The locations of the potential reclaimed water customers listed in Tables 4-1 and 4-2 are shown on Figures 4-3 through 4-6, Reclaimed Water and Sewer Forcemain Routing for Site Alternative No. 1, 2, 3, and 4, respectively.

Table 4-2. Additional Potential Reclaimed Water Customers				
Owner	**Location**	**Figures 4-3 to 4-6 Location Number**	**Type of Use**	**Minimum Reclaimed Water Class**
Fairchild Air Force Base Contact: Ron Daniels Phone: 509-247-2291	Fairchild Air Force Base	Not Shown	Aircraft, Runway, Taxiway, and Roadway Washing; Landscape Irrigation	Class A (due to possible public contact)
Spokane International Airport Contact: David Crowner Phone: 509-455-6418	Spokane International Airport	Not Shown	Aircraft, Runway, Taxiway, and Roadway Washing; Landscape Irrigation	Class A (due to possible public contact)
Spokane Motors Sports, Inc. Contact: Orville Moe Phone: 509-244-3663	Spokane Raceway Park 101 North Hayford Road Spokane, WA 99224	7	Landscape Irrigation	Class A
Inland Asphalt Company	Inland Asphalt Company 802 North Francher Spokane, WA 99220	11	Aggregate Washing	Class C
Barrier Industries Contact: John Barrier 509-244-6235	Barrier Industries 13026 West McFarlane Road Airway Heights, WA 99001	12	Landscape Irrigation	Class A
Fairways Golf Course	Fairways Golf Course 9810 West Melville Road Cheney, WA 99004	Not Shown	Landscape Irrigation	Class A
Kalispel Tribe of Indians Administration Contact: Wally Hubbard Phone: 509-445-1147	Future Tribal Casino and Entertainment Complex	3B	Landscape Irrigation	Class A
Spokane Indian Tribe David Ernst – Planning Dir. Phone: 509-258-4581	Mixed Use Cultural/Entertainment Complex	4	Landscape Irrigation	Class A

B. Evaluation of Site Alternatives for New Treatment Facility

1. Description of Site Alternatives

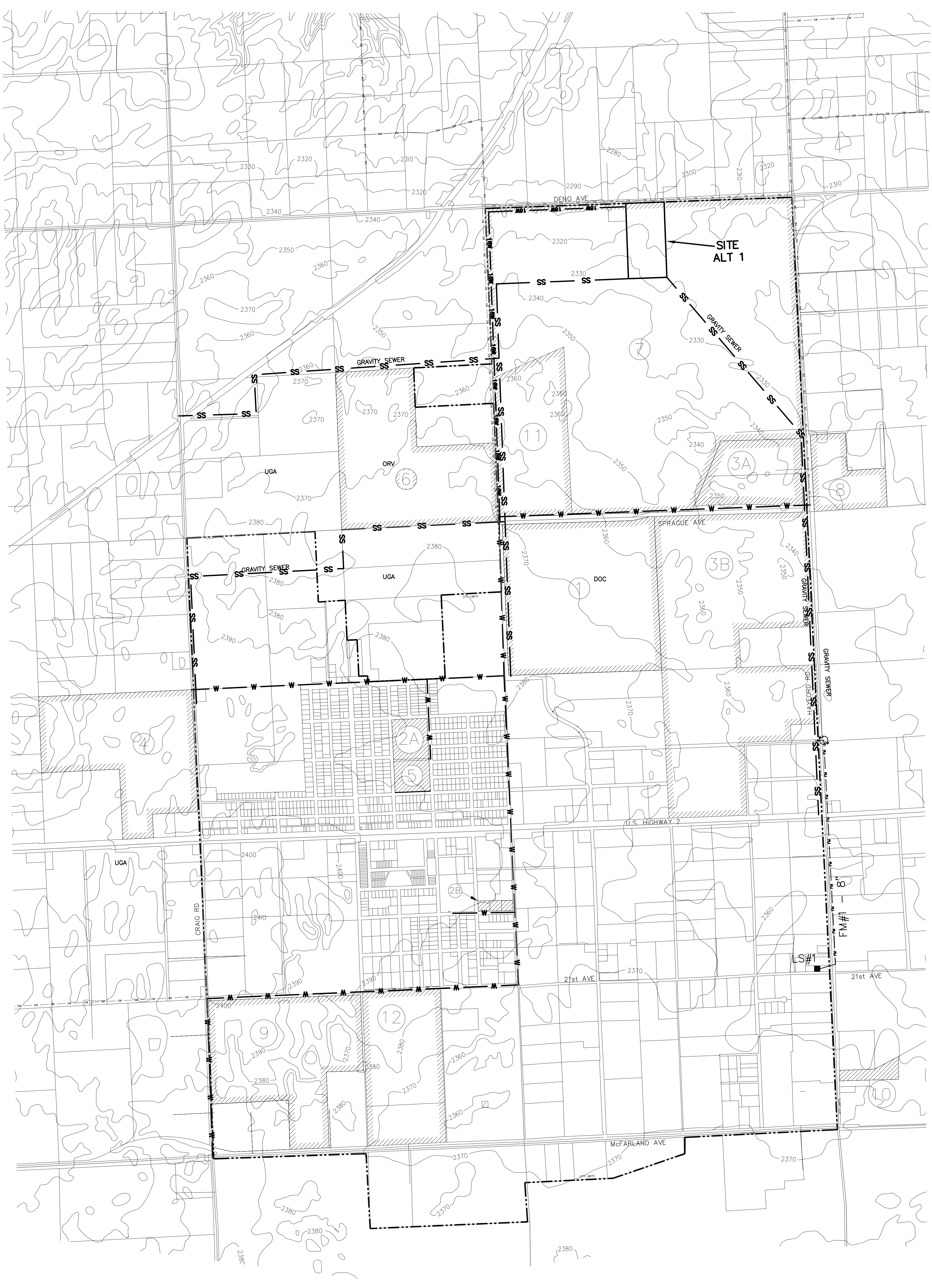
Four site alternatives have been evaluated for locating a future wastewater treatment facility that would discharge to one or more of the following discharge alternatives: (1) Deep Creek, (2) groundwater (via rapid infiltration basins or wetlands); and (3) a reclaimed water system. Refer to Figures 4-3 through 4-6 for the location of each site alternative and the proposed layout of the sewage collection and reclaimed water distribution system improvements required for each site alternative. The sewage collection system improvements shown in these figures are for full development of the City's sewer service area. Not all of these improvements will be required for initial connection to a new City of Airway Heights treatment facility. At start-up of the new treatment facility, the collection system improvements that would be required are lift stations and sewer line required for transmission of wastewater from the City's gravity collection system tie-in location (at State Route 2 and Hayford Road) to each site. The reclaimed water distribution system for each site shown in these figures is based on providing reclaimed water service to all the potential reclaimed water customers listed in Table 4-1. The sites are briefly described below and are evaluated in detail in Tables 4-4 through 4-8.

Site Alternative No. 1: Site Alternative No. 1 is located along Deno Road, West of Hayford Road, and East of Russell Street. The site is zoned Light Industrial which would allow its use for a wastewater treatment facility. This is a relatively low area located just within the northern City limits of Airway Heights. The site appears to be directly over the paleochannel described by Deobald and Buchanan that drains to Deep Creek. Discharge to groundwater could be by either rapid infiltration basins or infiltration wetlands, because of the large quantity of available land surrounding the site. There are currently no municipal groundwater supply wells within the vicinity of the site, so new wells would need to be installed in order to recover reclaimed water discharged to groundwater at the site. Seasonal discharge to Deep Creek could also potentially be a future discharge for this alternative due to its relative proximity to Deep Creek. The site is located approximately 1.4 miles from Deep Creek and is the closest of all the site alternatives to Deep Creek. Because of the relatively low elevation of the site compared to the rest of the City's collection system, this alternative would require fewer sewage lift stations and less forcemain for transmission of the City's wastewater to the proposed site. In addition, this site is closest to four out of five of the largest potential reclaimed water customers listed in Table 4-1.

Site Alternative No. 2: Site Alternative No. 2 is located outside the City limits of Airway Heights at the City's ParkWest Well Site, north of State Route 902, west of Craig Road, and east of McFerron Road. The site is zoned Light Industrial. The City currently owns 40 acres at the site. The City's ParkWest groundwater supply well is located at the site and could likely be used to recover reclaimed water discharged to groundwater at the site. The site appears to be over the paleochannel described by Deobald and Buchanan; however, the paleochannel is much shallower in this area, and therefore, the rate of drainage from the site may be inhibited. Thus, the site may be more appropriate for infiltration wetlands than infiltration basins. A small seasonal wetland located northwest of the site may be a sign of the slow drainage capacity of the area. Also, the site is located within the Spokane International Airport flight path lateral clear zones, and the waterfowl attracted to standing surface water in the wetlands may be undesirable. The site is farther away from the City's sewer collection system and potential reclaimed water users than the other site alternatives.

Site Alternative No. 3: Site Alternative No. 3 is located outside the City limits of Airway Heights, west of Craig Road, south of McFarlane Road, and is directly south of the Craig Road Landfill. The Craig Road Landfill has contributed to soil and groundwater contamination in the vicinity of the site. Applying large quantities of groundwater at the site may influence the spread of the contamination. The site is zoned as Light Industrial and Mining, which would allow its use for a wastewater treatment facility. The site does not appear to be over a paleochannel, and drainage from the site may be slower than required for rapid infiltration basins. The site may be more appropriate for infiltration wetlands. The site has a small permanent wetland located in the northeast corner of the site, and this may be a sign of the slow drainage capacity of the area. The site is located within the FAFB flight path lateral clear zones, and the waterfowl attracted to standing surface water in the wetlands may be undesirable. The site is farther away from the City's sewer collection system and potential reclaimed water users than Site Alternatives 1 and 4.

Site Alternative No. 4: Site Alternative No. 4 is located within the City limits, North of McFarlane Road, East of Lawson and West of Russell Street. The site surrounds the ¼ acre parcel where the City's No. 1 and 4 groundwater supply wells are located. A single owner owns 75 acres at the site and has approached the City of Airway Heights regarding purchasing the property. The City has already placed $10,000 in earnest money towards the purchase of the site, and is expected to make a decision regarding purchasing the site in November 2004, pending the results of the Facilities Planning process. The site is zoned Heavy Industrial, which would allow its use for a wastewater treatment facility. A portion of the site appears to be directly over a paleochannel. Rapid infiltration basins, not infiltration wetlands, are preferred for discharge to groundwater at this site, due to the limited quantity of available land surrounding the site. The City's groundwater supply wells could likely be used to recover reclaimed water discharged to groundwater at the site. The existing groundwater quality at the site may have elevated levels of certain contaminants due to the proximity of the site to Craig Road Landfill. This may impact the required effluent treatment requirements of the proposed wastewater treatment facility. The site elevation is higher than the proposed collection system tie-in location requiring more sewage lift stations and a longer sewage forcemain than site alternative no. 1. However, the site is closer to the proposed collection system gravity tie-in location and potential reclaimed water users than Site Alternatives No. 2 and 3. The site may also be a good location for a future regional wastewater treatment facility serving both the City of Airway Heights and FAFB; however, discharge of additional wastewater beyond the City's flow may have to be located elsewhere due to possible limitations related to site drainage and land availability.



LEGEND

- COMMON SEWER COLLECTION
- COMMON RECLAIMED WATER
- CONNECTION TO COMMON RECLAIMED WATER SYSTEM
- FORCE MAIN
- (2A) POTENTIAL RECLAIMED WATER CUSTOMER REFER TO TABLE 4–1

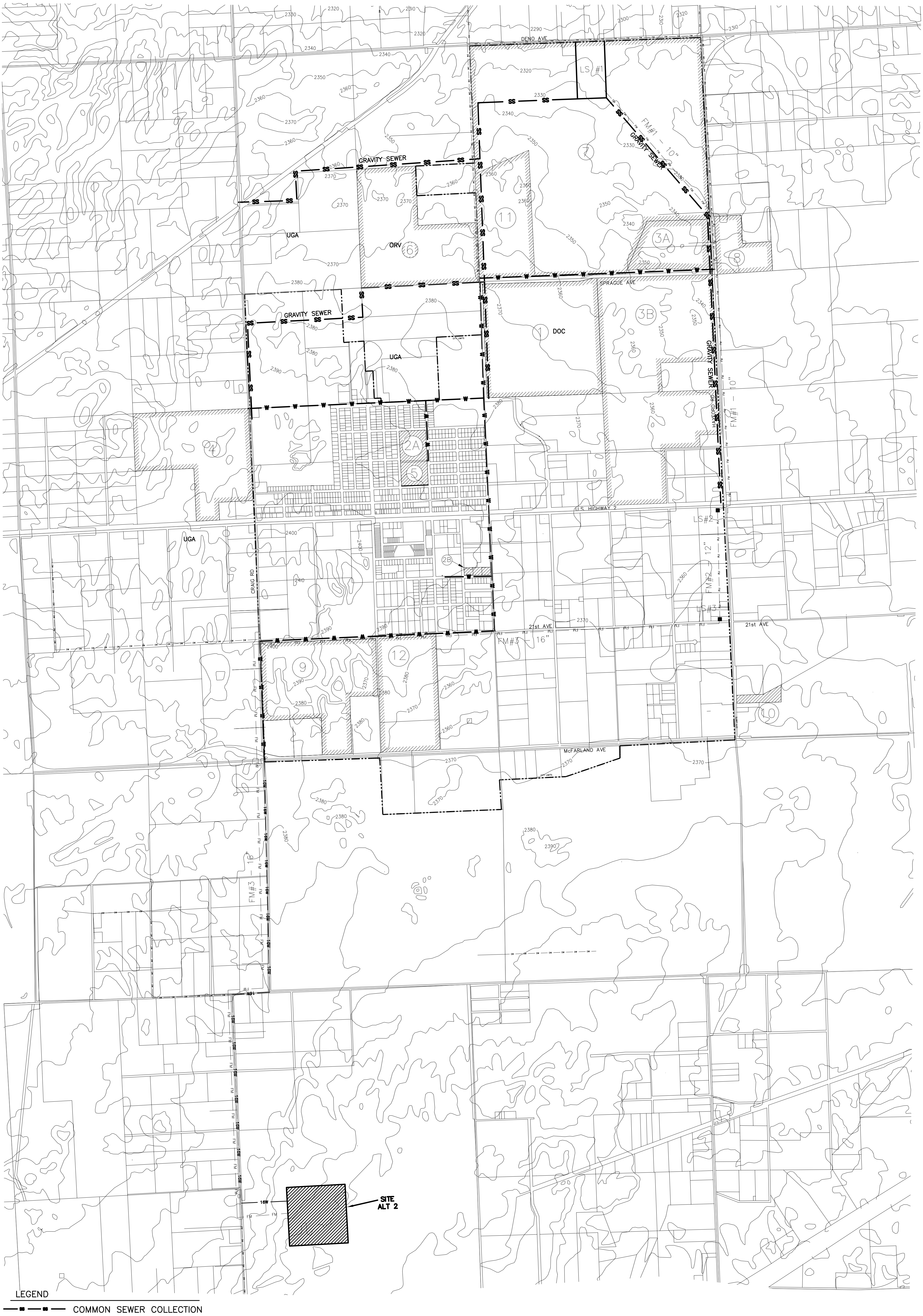
DESIGNED BY: EP			
DRAWN BY: WLH	SCALE:		
CHECKED BY: EP	NTS		
PROJECT NO: 30423.021.01			

CITY OF AIRWAY HEIGHTS
PROPOSED TREATMENT SITE #1
RECLAIMED WATER DISTRIBUTION
FUTURE SEWER COLLECTION
AND FORCE MAIN

CENTURY WEST
ENGINEERING CORPORATION
1825 N. Hutchinson Rd. 2nd Floor
Spokane, WA 99212
509-838-3810 phone • 509-624-0355 fax

DATE: 6/25/04

FIGURE 4–3



LEGEND

- COMMON SEWER COLLECTION
- COMMON RECLAIMED WATER
- CONNECTION TO COMMON RECLAIMED WATER SYSTEM
- FORCE MAIN
- POTENTIAL RECLAIMED WATER CUSTOMER REFER TO TABLE 4-1

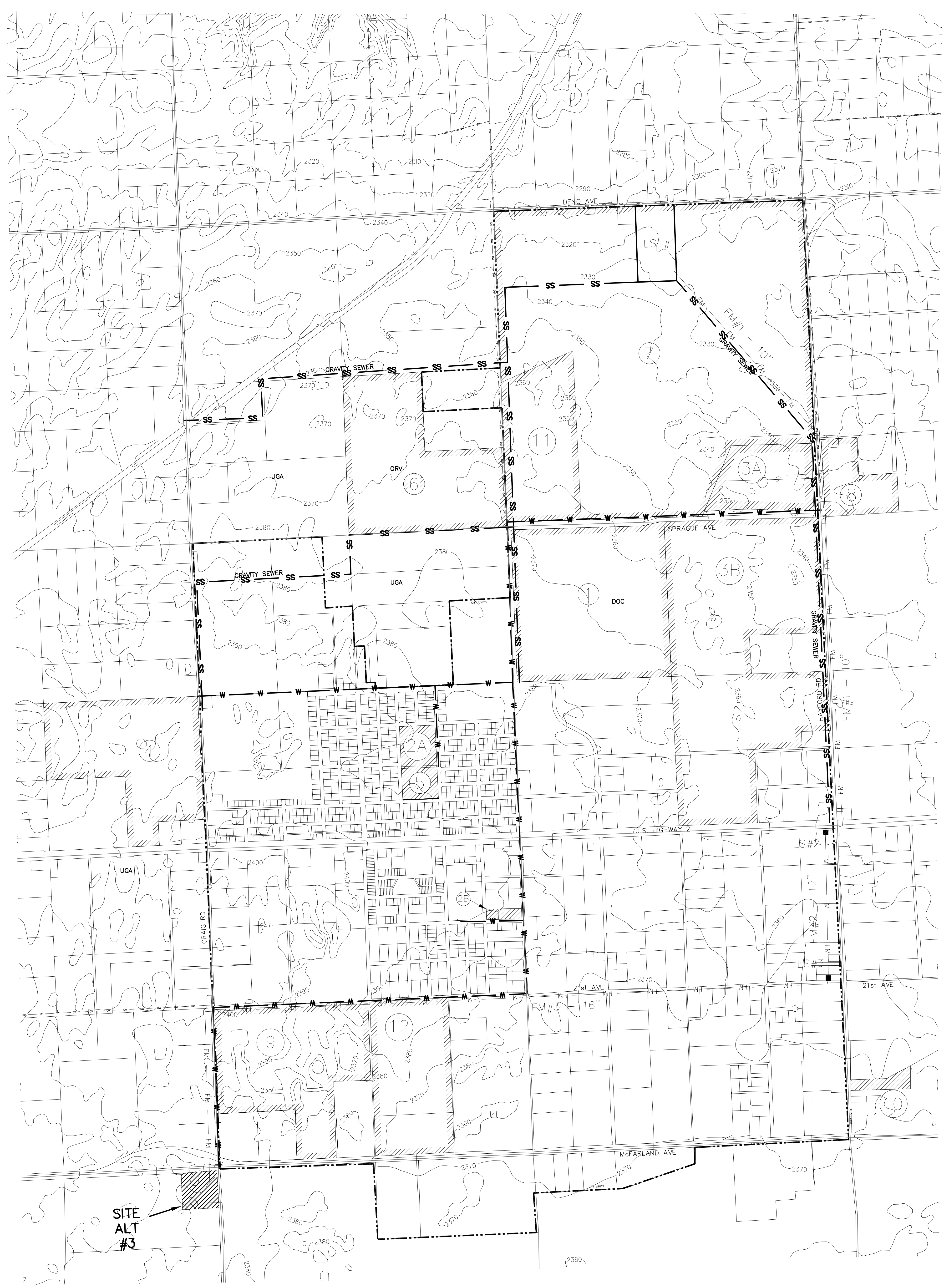
DESIGNED BY: EP		
DRAWN BY: WLH	SCALE:	
CHECKED BY: EP	NTS	
PROJECT NO:	30423.021.01	

CITY OF AIRWAY HEIGHTS
PROPOSED TREATMENT SITE #2
RECLAIMED WATER DISTRIBUTION
FUTURE SEWER COLLECTION
AND FORCE MAIN

CENTURY WEST
ENGINEERING CORPORATION
1825 N. Hutchinson Rd. 2nd Floor
Spokane, WA 99212
509-838-3810 phone • 509-624-0355 fax

DATE: 6/25/04

FIGURE 4-4



LEGEND

SS	COMMON SEWER COLLECTION
W	COMMON RECLAIMED WATER
16W	CONNECTION TO COMMON RECLAIMED WATER SYSTEM
FM	FORCE MAIN
2A	POTENTIAL RECLAIMED WATER CUSTOMER REFER TO TABLE 4–1

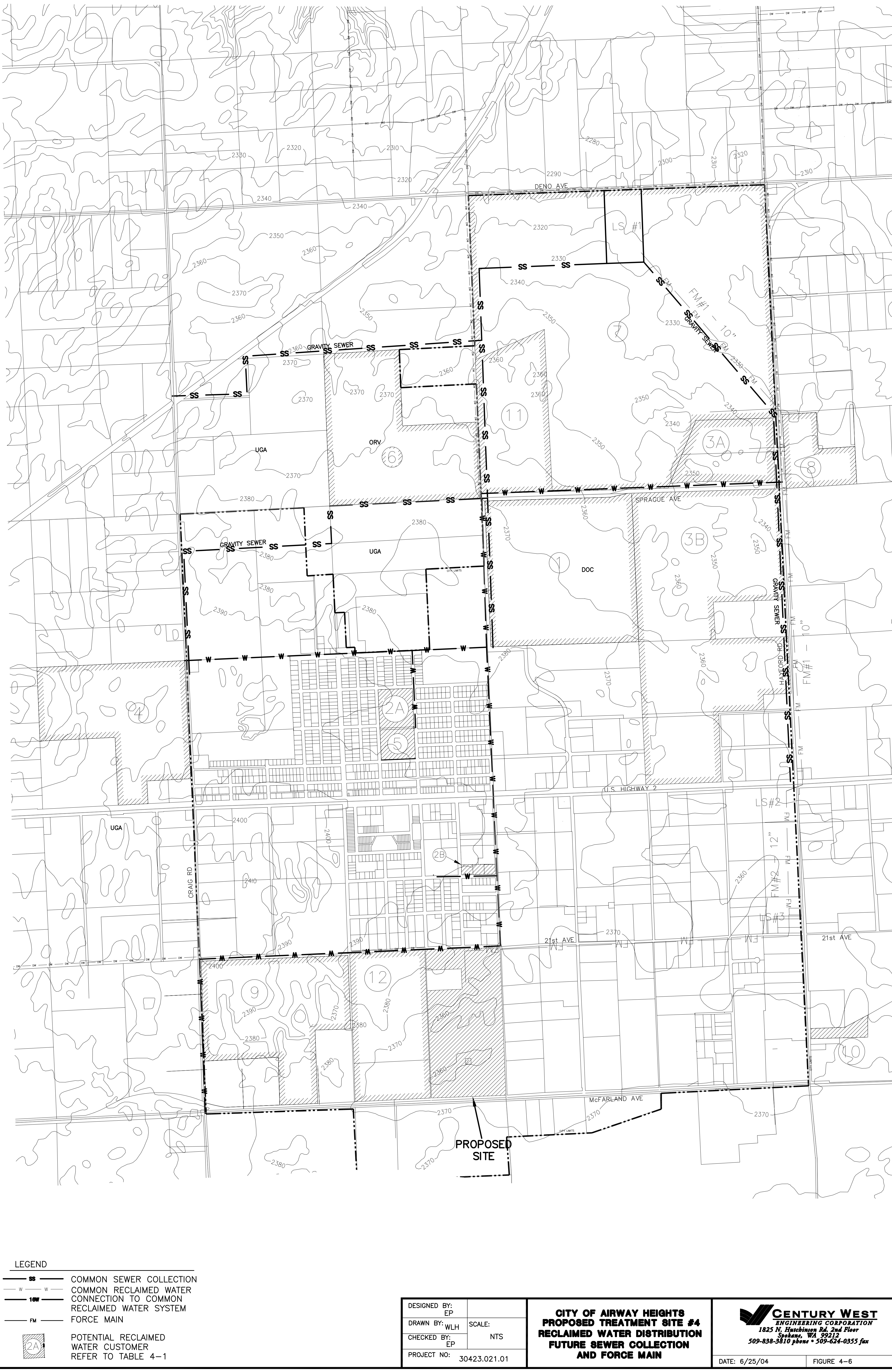
DESIGNED BY: EP	
DRAWN BY: WLH	SCALE: NTS
CHECKED BY: EP	
PROJECT NO: 30423.021.01	

CITY OF AIRWAY HEIGHTS
PROPOSED TREATMENT SITE #3
RECLAIMED WATER DISTRIBUTION
FUTURE SEWER COLLECTION
AND FORCE MAIN

CENTURY WEST
ENGINEERING CORPORATION
1825 N. Hutchinson Rd. 2nd Floor
Spokane, WA 99212
509-838-3810 phone • 509-624-0355 fax

DATE: 6/25/04

FIGURE 4–5



LEGEND

- SS — COMMON SEWER COLLECTION
- W — COMMON RECLAIMED WATER
- 16W — CONNECTION TO COMMON RECLAIMED WATER SYSTEM
- FM — FORCE MAIN
- 2A — POTENTIAL RECLAIMED WATER CUSTOMER REFER TO TABLE 4-1

DESIGNED BY: EP	
DRAWN BY: WLH	SCALE: NTS
CHECKED BY: EP	
PROJECT NO: 30423.021.01	

CITY OF AIRWAY HEIGHTS
PROPOSED TREATMENT SITE #4
RECLAIMED WATER DISTRIBUTION
FUTURE SEWER COLLECTION
AND FORCE MAIN

CENTURY WEST
ENGINEERING CORPORATION
1825 N. Hutchinson Rd. 2nd Floor
Spokane, WA 99212
509-838-3810 phone • 509-624-0355 fax

DATE: 6/25/04

FIGURE 4-6

2. Comparison of Project Costs for Site Alternatives

Table 4-3 compares the project costs for the four site alternatives. It is assumed that the cost of treatment will be the same for all the site alternatives; and therefore, the project costs for treatment are not included in the table.

The capital costs for the various site alternatives are separated into the following categories: collection system construction cost, reclaimed water distribution system construction cost, potential mitigation costs, engineering and administrative costs, land acquisition costs, and contingency. The construction, and operation and maintenance costs for the sewage collection system are for full development (build-out) of the City's sewer service area. Not all of these costs will be incurred for initial connection to a new City of Airway Heights treatment facility. At start-up of the new treatment facility, the collection system construction costs that will likely be incurred will be those related to construction of the lift stations and sewer transmission line between the City's gravity collection system tie-in location and the treatment facility site.

The construction cost of the reclaimed water distribution system for each site is based on providing reclaimed water service to all the potential reclaimed water customers listed in Table 4-1. The potential mitigation costs are those costs associated with providing odor control at the headworks of the wastewater treatment facility (due to long sewer forcemain lengths) and extending potable water service to customers whose wells may be affected by the discharge of treated effluent in the vicinity of their wells.

The operation and maintenance costs are based on: (1) Power costs associated with pumping the wastewater to each site and reclaimed water to the potential reclaimed water customers; and (2) Maintaining the forcemains, gravity sewer lines, lift stations, and air release valve assemblies in the collection and reclaimed water distribution systems.

The reclaimed water system revenues are based on income from two sources: (1) The seasonal distribution of 94 MG of reclaimed water to the potential reclaimed water customers listed in Table 4-1 at the existing City commercial water rate of $1.73 per 1000 gallons; and (2) The recovery of 196 MG of reclaimed water discharged to the groundwater in year 2020 (the midpoint of the treatment facility design period) and resold at the existing City commercial water rate of $1.73 per 1000 gallons of water.

In general, the information in Table 4-3 illustrates the following: (1) Site alternatives no. 1 and 4 are less expensive in capital and operation and maintenance costs than site alternatives no. 2 and no. 3; (2) The capital costs of site alternatives no. 1 and 4 are relatively equivalent within the accuracy of the cost estimate, although the annual operation and maintenance costs for site alternative no. 1 are less than for site alternative no. 4; (3) If a portion of the reclaimed water discharged to groundwater at site alternative no. 4 could be recovered and resold, then potentially the difference in operation and maintenance costs between the two alternatives could be offset by the potential reclaimed water revenues generated at site alternative 4.

Table 4-3. Comparison of Project Costs for Site Alternatives						
		Alternatives →	Alternative No. 1	Alternative No. 2	Alternative No. 3	Alternative No. 4
		Description→	Deno Road Site (North)	Park West Well Site (South)	Craig Road Site (East)	Site of City Wells 1 & 4 (South-Central)
No.	Item[1]	Unit Cost	Estimated Cost ($)	Estimated Cost ($)	Estimated Cost ($)	Estimated Cost ($)
	Capital Costs[2]					
1	**Collection System**					
1A	Russell Street Trunk and Collector Lines		1,463,000	1,463,000	1,463,000	1,463,000
1B	Hayford Collector		939,000	797,000	797,000	797,000
1C	Forcemains and Lift Stations		288,000	3,291,000	2,548,000	2,263,000
1D	Collection System Sales Tax	8.4%	226,000	466,000	404,000	380,000
1	**Collection System Subtotal**		2,916,000	6,017,000	5,212,000	4,903,000
2	**Reclaimed Water Distribution System**		2,408,000	2,580,000	1,913,000	1,837,000
3	**Potential Costs of Mitigation**		1,407,000	1,131,000	657,000	401,000
4	**Engineering and Administrative Costs**	18%	1,885,000	2,724,000	2,178,000	1,999,000
5	**Land Acquisition[3]**	Varies	750,000	750,000	310,000	310,000
6	**Contingency**	20%	1,874,000	2,641,000	2,054,000	1,890,000
	Estimated Project Capital Cost (2004 Dollars)		**11,240,000**	**15,843,000**	**12,324,000**	**11,340,000**
	Operation and Maintenance Costs[2]					
	Operation and Maintenance Costs		41,700	107,500	92,400	87,700
	PW of Project O&M Costs (2004 Dollars)	5% @ 20 yr	**520,000**	**1,340,000**	**1,152,000**	**1,093,000**
	Potential Project Revenues					
	Seasonal Distribution of Reclaimed Water[4]	$1.73/kgal	163,000	163,000	163,000	163,000
	Water Recovered From Supply Wells[5] (in 2020)	$1.73/kgal	0	340,000	0	340,000
	Subtotal of Potential Project Revenues		163,000	503,000	163,000	503,000
	PW of Project Revenues (2004 Dollars)	5% @ 20 yr	**2,023,000**	**6,269,000**	**2,032,000**	**6,269,000**
	Project Cost Minus Revenues (2004 Dollars)		**9,728,000**	**10,914,000**	**11,444,000**	**6,164,000**

1. The cost for treatment is assumed to be the same for all site alternatives.
2. The capital and operation and maintenance costs are based on full development (build-out) of the entire City of Airway Heights service area.
3. The land acquisition costs are assumed to be $10,000 for 75 acres for site alternatives 1 and 2, and ~$4,133 per acre for 75 acres for site alternatives no. 3 and 4. The higher unit price for site alternatives 1 and 2 are based on higher actual land purchase prices for the ParkWest Well site (at site alternative no. 2) and for the Airway Heights Corrections Center access road land and the Inland Power and Light substation land (both near site alternative no. 1). The cost per acre for site alternatives no. 3 and 4 (which are near each other) are based on the estimated purchase price for the 75-acre parcel for site alternative no. 4.
4. Revenues assume 94 MG of reclaimed water sold each year at the existing City commercial water rate of $1.73 per 1000 gallons.
5. Revenues assume 196 MG of the reclaimed water discharged to groundwater in year 2020 is recovered and resold at the City commercial water rate of $1.73 per 1000 gallons for site alternatives no. 2 and 4. Site alternatives no. 1 and 3 do not currently have groundwater supply wells serving the city water system and therefore the cost estimates for these site alternatives do not include revenues for reclaimed water recovery.

3. Evaluation of Site Alternatives

Site alternatives no. 1 through 4 are evaluated in detail in Tables 4-4 through 4-8, respectively. Each table lists the "site evaluation criteria" used to determine the overall adequacy of each site for locating a City of Airway Heights wastewater treatment, reclamation, and (groundwater) recharge facility (WTRRF). Each table also provides a description of the consultant's opinion of the ability of each site to meet each of the site evaluation criteria. Each site evaluation criterion is given a "weight" value, which is the number attributed to the importance of each criterion in relation to the other criteria in determining the overall adequacy of the site, and a "score" value, which is the number attributed to how well a specific site meets each site evaluation criterion as compared to the other alternative sites. The "total score" is equal to the "weight" number multiplied by the "score" number for each criterion. The total scores are then added together for each site alternative to determine a value that roughly represents the overall adequacy of a particular site, as compare to the other sites, for locating the proposed facility.

City staff and representatives from the project Sewer Advisory Committee provided the weight and score values for each criteria and alternative. Based on the results of the evaluation, the Sewer Advisory Committee is recommending that site alternative no. 4, be selected as the location of a proposed WTRRF. A summary of the site evaluation scores is provided in Table 4-8.

Table 4-4. Evaluation of City of Airway Heights WTRRF Site Alternative No. 1
North 1/2 Section 13, Township 25N, Range 41E
(Along Deno Road, West of Hayford Road, and East of Russell Street)

Site Evaluation Criteria	Ability of Proposed Site to Meet Criteria	Weight[1] 5 = Most Important 1 = Least Important	Score[2] 10 = Most Suitable 1 = Least Suitable	Total Score[3]
Land Ownership and Availability	One single property owner owns a majority of Section 13. The north-central portion of Section 13 is not currently being utilized and may be available for purchase.	5	6	30
Land Availability for Future Expansion and Buffering Requirements	Additional land surrounding the site is undeveloped and may be available to purchase for future expansion and buffering requirements.	5	9	45
Potential Impacts on Receiving Water Quality	The primary discharge of the facility is proposed to be to groundwater via rapid infiltration basins with seasonal discharge to the reclaimed water system. There are approximately 33 owners of wells within 1 mile of the site that may be impacted by the quality of effluent discharged at the site. None of the wells are municipal potable water supply wells.	5	7	35
Technical & Economic Impacts of Receiving Water Requirements	The site appears to be located on a layer of overburden soil (sand, gravel, boulders, fractured basalt) that may reach the groundwater depth (at approximately 240 to 280 feet below grade), indicating the presence of a paleochannel below the site. An additional geotechnical study would be required to determine the extent of the overburden, delineate the paleochannel, and recommend the final location any proposed rapid infiltration basins. Infiltration wetlands may also be located at this site; however, a minimum of 160 acres is estimated to be required for the infiltration wetlands versus 40 acres for rapid infiltration basins. Seasonal discharge to Deep Creek could also potentially be a future discharge due to its relative proximity to Deep Creek. The site is located approximately 1.4 miles from Deep Creek.	4	7	28
Feasibility of Connecting to City's Existing Collection System	The site elevation is lower than the proposed collection system tie-in locations requiring less energy for wastewater transmission and fewer pump stations than the other alternatives. The required length and size of the sewage forcemain would be less than the other proposed alternatives. Refer to Figure 4-3 for the proposed layout of the required sewage forcemain and lift stations.	4	7	28
Proximity to Potential Reclaimed Water Uses	The site is closer to most of the larger potential reclaimed water users compared to the other alternatives. Refer to Figure 4-3 for the location of the site in relation to the potential reclaimed water users.	4	9	36
Accessibility to Existing Roads and Utility Services	The site is located adjacent to an Inland Power and Light Company substation for electrical service. The site is also located adjacent to (paved) Deno Road and could be accessed from that road.	2	4	8
Ability to Obtain Required Approvals for Siting Facility	The City of Airway Heights would be the lead agency in the SEPA process. The siting of the facility would follow the City of Airway Heights Essential Public Facilities Siting Process.	5	8	40
Location Within Desired Floodplain Designation	The site is located within Federal Emergency Management Agency (FEMA) Flood Zone C, defined as areas of minimal flood hazards.	1	5	5

Table 4-4. Evaluation of City of Airway Heights WTRRF Site Alternative No. 1 North 1/2 Section 13, Township 25N, Range 41E (Along Deno Road, West of Hayford Road, and East of Russell Street)				
Site Evaluation Criteria	**Ability of Proposed Site to Meet Criteria**	**Weight[1]** 5 = Most Important 1 = Least Important	**Score[2]** 10 = Most Suitable 1 = Least Suitable	**Total Score[3]**
Compatible Site and Surrounding Land Use Designations	The site is zoned Light Industrial (I-1). North of the site, across Deno Road, the area is zoned Rural Traditional. There are approximately ten (10) residential parcels located within ¼ mile of the site.	3	5	15
Proximity from Areas of Natural and Aesthetic Significance	There is priority habitat for the Western Bluebird in the vicinity of the site. A Habitat Management Plan may be required for this alternative. The site does not appear to have any seasonal or permanent wetlands.	2	4	8
Proximity from Areas of Historical and Cultural Significance	The site does not appear to be in an area of natural or historical significance. However, due to the possibility of ancient tribal use of the site, the Washington State Office of Archaeology and Historic Preservation recommends a professional archaeological survey and consultation with nearby tribes' regarding the area's cultural significance, if any.	2	4	8
Minimal Previous Site Uses and Extent of Possible Soil and Groundwater Contamination	The site is located within the same Section as Spokane Raceway Park, and adjacent to an Inland Power and Light Company substation. The site has not previously been used for any industrial or commercial purposes. However, earthen-lined sewage ponds serving the Spokane Raceway Park are located within ½ mile from the site.	3	4	12
Feasibility of Mitigation Measures	Mitigation measures may include: (1) Providing buffer areas to reduce aesthetic and odor impacts of the facility; (2) Providing water service to parcels with water wells within the vicinity of the proposed rapid infiltration basins; (3) Habitat preservation and/or relocation for the Western Bluebird; and (4) Providing sewer service to Spokane Raceway Park and possible assistance with closure of sewage ponds. All of these measures are assumed to be technically and economically feasible.	3	5	15
Potential to Encourage Partnerships for Project Financing	The site is close to parcels owned by the Kalispel Tribe. The Kalispel Tribe may be developing 160 acres in the northeast quarter of Section 24. The site is also nearby the Airway Heights Corrections Center, which will be the largest single sewer and reclaimed water user in the proposed system. These agencies may potentially assist in financing the project in return for reclaimed water, reserved sewer capacity, or discounted or fixed sewer and reclaimed water rates.	2	5	10
Public Acceptability	The site is nearby rural residential parcels and has the potential to impact wells. However, the City can mitigate potential impacts to wells by providing water service.	4	6	24
Potential For Multiple Site Uses	The site is located nearby future proposed residential development northwest of the City and may be suitable and accessible for additional uses such as sports fields, a City park, a walking path, or a reclaimed water storage reservoir or pond. Multiple potential uses of the site may enhance public acceptability.	3	3	9

Table 4-4. Evaluation of City of Airway Heights WTRRF Site Alternative No. 1 North 1/2 Section 13, Township 25N, Range 41E (Along Deno Road, West of Hayford Road, and East of Russell Street)				
Site Evaluation Criteria	**Ability of Proposed Site to Meet Criteria**	**Weight[1]** 5 = Most Important 1 = Least Important	**Score[2]** 10 = Most Suitable 1 = Least Suitable	**Total Score[3]**
Least Cost	Site alternative no. 1 is estimated to be less expensive in capital and operation and maintenance (O&M) costs than site alternatives no. 2 and no. 3; its estimated capital cost is relatively equivalent with site alternative no. 1; and its estimated annual O&M costs are less than the other site alternatives. If a portion of the reclaimed water discharged to groundwater at site alternative no. 4 could be recovered and resold, then potentially the overall project cost of site alternative no. 1 could be more than for site alternative no. 4.	5	6	30
Sum of Total Scores For Each Site Evaluation Criteria				386

1. The "Weight" is the number attributed to the importance of each Site Evaluation Criterion in relation to the other Site Evaluation Criteria in determining the overall adequacy of the site for the proposed project.
2. The "Score" is the number attributed to how well the site meets the specific Site Evaluation Criteria as compared to the other site alternatives.
3. The "Total Score" is equal to the "Weight" number multiplied by the "Score" number for each specific criterion.

Table 4-5. Evaluation of City of Airway Heights WTRRF Site Alternative No. 2
South ½ Section 2, Township 24N, Range 41E
(ParkWest Well Site, North of State Route 902, West of Craig Road, East of McFerron Road)

Site Evaluation Criteria	Ability of Proposed Site to Meet Criteria	Weight[1] 5 = Most Important 1 = Least Important	Score[2] 10 = Most Suitable 1 = Least Suitable	Total Score[3]
Land Ownership and Availability	The City of Airway Heights currently owns 40 acres at the ParkWest Well site.	5	7	35
Land Availability for Future Expansion and Buffering Requirements	The land surrounding the City's ParkWest Well site resides within a single, undeveloped parcel and may be available to purchase for future expansion and buffering requirements.	5	8	40
Potential Impacts on Receiving Water Quality	The primary discharge of the facility is proposed to be to groundwater via rapid infiltration basins with seasonal discharge to the reclaimed water system. There are 48 owners of wells within 1 mile of the site that could potentially be impacted by the quality of effluent discharged at the site. One of these wells is the City's ParkWest Well, which is the largest producing well in the City's potable water supply system.	5	5	25
Technical & Economic Impacts of Receiving Water Requirements	The site appears to be located on a 60 to 70-foot thick layer of overburden soil (sand, gravel, boulders, fractured basalt) on top of the approximately 160 to 180-foot thick Wanapum Basalt layer. The relatively shallow basalt layer may inhibit adequate drainage of treated effluent discharged to groundwater at the site and render the site unsuitable for rapid infiltration basins, and possibly also infiltration wetlands. The site is located within the Spokane International Airport flight path lateral clear zones. Standing surface water in wetlands may attract waterfowl and possibly create an aviation hazard. The site may be a possible location for a future aquifer recharge project.	4	5	20
Feasibility of Connecting to City's Existing Collection System	The site elevation is higher than the proposed collection system tie-in locations requiring more energy for wastewater transmission and a longer forcemain than the other alternatives. The diameter of the forcemain and number of pump stations would be greater than for Alternative No.1 and equivalent to Alternative No. 3 and 4. Refer to Figure 4-4 for the proposed layout of the required sewage forcemain and lift stations.	4	5	20
Proximity to Potential Reclaimed Water Uses	The site is the farthest away from potential reclaimed water users, as compared to the other alternatives. Refer to Figure 4-4 for the location of the site in relation to the potential reclaimed water users.	4	2	8
Accessibility to Existing Roads and Utility Services	The site has an existing service road and electrical service for the City's ParkWest Well.	2	4	8
Ability to Obtain Required Approvals for Siting Facility	Spokane County, not the City of Airway Heights, would be the lead agency in the SEPA process. The siting of the facility would follow the Spokane County Essential Public Facilities Siting Process.	5	5	25

Table 4-5. Evaluation of City of Airway Heights WTRRF Site Alternative No. 2 South ½ Section 2, Township 24N, Range 41E (ParkWest Well Site, North of State Route 902, West of Craig Road, East of McFerron Road)				
Site Evaluation Criteria	**Ability of Proposed Site to Meet Criteria**	**Weight[1]** 5 = Most Important 1 = Least Important	**Score[2]** 10 = Most Suitable 1 = Least Suitable	**Total Score[3]**
Location Within Desired Floodplain Designation	The site is located within Federal Emergency Management Agency (FEMA) Flood Zone C, defined as areas of minimal flood hazards.	1	5	5
Compatible Site and Surrounding Land Use Designations	The site is zoned Light Industrial (I-1). East of the site, across Craig Road, the area is zoned Rural Traditional. South of the site, across State Route 902, the area is zoned as Mineral Land. There are approximately nine (9) residential parcels within ¼ mile of the site.	3	6	18
Proximity from Areas of Natural and Aesthetic Significance	The site is located near shrub steppe habitat designated as a priority habitat. A Habitat Management Plan may be required for this alternative. The site does not appear to have any seasonal or permanent wetlands, although a small seasonal wetland is located northwest of the site.	2	5	10
Proximity from Areas of Historical and Cultural Significance	The site does not appear to be in an area of natural or historical significance. However, due to the possibility of ancient tribal use of the site, the Washington State Office of Archaeology and Historic Preservation recommends a professional archaeological survey and consultation with nearby tribes' regarding the area's cultural significance, if any.	2	4	8
Minimal Previous Site Uses and Extent of Possible Soil and Groundwater Contamination	The site has not previously been used for any industrial or commercial purposes, and there are no reasons to suspect that the site would have possible soil or groundwater contamination.	3	7	21
Feasibility of Mitigation Measures	Mitigation measures may include: (1) Providing buffer areas to reduce aesthetic and odor impacts of the facility; (2) Providing water service to parcels with water wells within the vicinity of the proposed infiltration wetlands; (3) Habitat preservation and/or relocation of shrub steppe habitat; and (4) Measures to control waterfowl populations in infiltration wetlands. All of these measures are assumed to be technically and economically feasible, except for item No. 4 which would be technically difficult.	3	5	15
Potential to Encourage Partnerships for Project Financing	The site is far from parcels owned by organizations or agencies that may potentially assist in financing the project in return for reclaimed water, reserved sewer capacity, or discounted or fixed sewer and reclaimed water rates.	2	5	10
Public Acceptability	The site is nearby rural residential parcels and has the potential to impact wells surrounding the site, including the City's ParkWest Well, which is the largest producing well in the City's potable water supply system.	4	5	20
Potential For Multiple Site Uses	The site is located outside the City limits, away from dense residential development, and therefore, may not be particularly accessible for recreational uses such as a sports field, a City park, or a walking path. However, the site may be suitable for a reclaimed water	3	2	6

Table 4-5. Evaluation of City of Airway Heights WTRRF Site Alternative No. 2 South ½ Section 2, Township 24N, Range 41E (ParkWest Well Site, North of State Route 902, West of Craig Road, East of McFerron Road)				
Site Evaluation Criteria	**Ability of Proposed Site to Meet Criteria**	**Weight[1]** 5 = Most Important 1 = Least Important	**Score[2]** 10 = Most Suitable 1 = Least Suitable	**Total Score[3]**
	storage reservoir or pond.			
Least Cost	Site alternative no. 2 is estimated to be more expensive in capital, operation and maintenance (O&M), and overall project costs than the other site alternatives.	5	5	25
Sum of Total Scores For Each Site Evaluation Criteria				319

1. The "Weight" is the number attributed to the importance of each Site Evaluation Criterion in relation to the other Site Evaluation Criteria in determining the overall adequacy of the site for the proposed project.
2. The "Score" is the number attributed to how well the site meets the specific Site Evaluation Criteria as compared to the other site alternatives.
3. The "Total Score" is equal to the "Weight" number multiplied by the "Score" number for each specific criterion.

Table 4-6. Evaluation of City of Airway Heights WTRRF Site Alternative No. 3
Northeast 1/8 Section 34, Township 25N, Range 41E
(West of Craig Road and South of McFarlane Road)

Site Evaluation Criteria	Ability of Proposed Site to Meet Criteria	Weight[1] 5 = Most Important 1 = Least Important	Score[2] 10 = Most Suitable 1 = Least Suitable	Total Score[3]
Land Ownership and Availability	Two property owners own parcels at the proposed site. One parcel is approximately 9 acres, and is located at the northeast corner of the site, on the corner of Craig Road and McFarlane Road. The other parcel is approximately 66 acres, and is located to the south and east of the smaller parcel, along McFarlane Road.	5	6	30
Land Availability for Future Expansion and Buffering Requirements	The site may possibly be expanded to the west or to the south. There is one (1) ~80-acre parcel to the south, and one (1) ~160-acre parcel, to the west of the proposed site. The southern half of Section 34 is comprised of numerous, mostly rural, 5 to 20-acre, residential parcels, with one (1) ~80-acre parcel in the southwest corner of the Section. It is expected expansion to the southern half of the Section would be difficult. The parcel north of the site is owned by the U.S Military and is the location of the Craig Road Landfill.	5	6	30
Potential Impacts on Receiving Water Quality	The primary discharge of the facility is proposed to be to groundwater via rapid infiltration basins with seasonal discharge to the reclaimed water system. There are approximately 25 owners of wells within 1 mile of the site that could potentially be impacted by the quality of effluent discharged at the site. Two of these wells are City of Airway Heights potable water supply wells no. 1 and 4. The existing groundwater quality at the site may have elevated levels of certain contaminants due to the proximity of the site to Craig Road Landfill.	5	5	25
Technical & Economic Impacts of Receiving Water Requirements	The site appears to be located on a 30 to 50-foot thick layer of overburden soil (sand, gravel, boulders, fractured basalt) on top of the approximately 90 to 120-foot thick Wanapum Basalt layer. The relatively shallow basalt layer may inhibit adequate drainage of treated effluent discharged to groundwater at the site and render the site unsuitable for rapid infiltration basins, and possibly also infiltration wetlands. A minimum of 160 acres is estimated to be required for the infiltration wetlands (versus 40 acres for rapid infiltration basins) and therefore the site may not be large enough for infiltration wetlands. In addition, the site is located within the FAFB flight path lateral clear zones. Standing surface water in wetlands may attract waterfowl and create an aviation hazard.	4	5	20

Table 4-6. Evaluation of City of Airway Heights WTRRF Site Alternative No. 3 Northeast 1/8 Section 34, Township 25N, Range 41E (West of Craig Road and South of McFarlane Road)				
Site Evaluation Criteria	**Ability of Proposed Site to Meet Criteria**	**Weight**[1] 5 = Most Important 1 = Least Important	**Score**[2] 10 = Most Suitable 1 = Least Suitable	**Total Score**[3]
Feasibility of Connecting to City's Existing Collection System	The site elevation is higher than the proposed collection system tie-in locations requiring: (1) More energy for wastewater transmission, additional pump stations, and a larger forcemain size and length than for Alternative No.1; (2) Less energy for wastewater transmission, an equivalent forcemain size and number of pump stations, and a shorter forcemain length than for Alternative No. 2; and (3) More energy for wastewater transmission, an equivalent forcemain size and number of pump stations, and a longer forcemain than for Alternatives No. 4. Refer to Figure 4-5 for the proposed layout of the required sewage forcemain and lift stations. Because of its proximity to FAFB, the site may be a good location for a regional wastewater treatment and reclamation facility serving both FAFB and the City of Airway Heights.	4	5	20
Proximity to Potential Reclaimed Water Uses	The site is farther away from a majority of the potential reclaimed water users than Alternative No. 1 and 4, and closer than Alternative No. 2. Refer to Figure 4-5 for the location of the site in relation to the potential reclaimed water users.	4	5	20
Accessibility to Existing Roads and Utility Services	The site is currently accessed from (paved) McFarland Road and is nearby a high voltage electrical line, shared by Avista and Inland Power and Light Company, that runs along McFarlane Road.	2	5	10
Ability to Obtain Required Approvals for Siting Facility	Spokane County, not the City of Airway Heights, would be the lead agency in the SEPA process. The siting of the facility would follow the Spokane County Essential Public Facilities Siting Process.	5	5	25
Location Within Desired Floodplain Designation	The site is located within Federal Emergency Management Agency (FEMA) Flood Zone C, defined as areas of minimal flood hazards.	1	5	5
Compatible Site and Surrounding Land Use Designations	The smaller ~9-acre parcel is zoned for Mining. The larger ~66-acre parcel is zoned as Light Industrial. The land east of the site, across Craig Road, and south of the site is zoned as Light Industrial. North of the site, across McFarlane Road, the parcels are zoned as General Agricultural and Light Industrial. The land west of the site is zoned for Mining.	3	7	21
Proximity from Areas of Natural and Aesthetic Significance	The site is located near shrub steppe habitat designated as a priority habitat. A Habitat Management Plan may be required for this alternative. The site has a small permanent wetland in the northeast corner of the site. A Wetland Delineation Report, an Army Corps of Engineers Section 404 Permit, and a Biological Assessment may be required for construction at this site.	2	5	10
Proximity from Areas of Historical and Cultural Signific	The site does not appear to be in an area of natural or historical significance. However, due to the possibility of ancient tribal use of the site, the Washington State Office of Archaeology and Historic Preservation recommends a professional archaeological survey	2	4	8

Table 4-6. Evaluation of City of Airway Heights WTRRF Site Alternative No. 3 Northeast 1/8 Section 34, Township 25N, Range 41E (West of Craig Road and South of McFarlane Road)				
Site Evaluation Criteria	**Ability of Proposed Site to Meet Criteria**	**Weight**[1] 5 = Most Important 1 = Least Important	**Score**[2] 10 = Most Suitable 1 = Least Suitable	**Total Score**[3]
Significance	and consultation with nearby tribes' regarding the area's cultural significance, if any.			
Minimal Previous Site Uses and Extent of Possible Soil and Groundwater Contamination	The site is located immediately south of Craig Road Landfill and the previous FAFB WWTP. Craig Road Landfill has contributed to soil and groundwater contamination in the vicinity of the site. Applying large quantities of groundwater to the area may influence the spread of the contamination and the quantity of groundwater requiring treatment.	3	4	12
Feasibility of Mitigation Measures	Mitigation measures may include: (1) Providing buffer areas to reduce aesthetic and odor impacts of the facility; (2) Providing water service to parcels with water wells within the vicinity of any proposed infiltration basins; (3) Preservation and/or relocation of shrub steppe habitat and possible wetlands in the vicinity of the site; (4) Measures to control waterfowl populations in any infiltration wetlands; and (5) Measures to control the Craig Road Landfill contamination migration. Measures 1 through 3 are assumed to be technically and economically feasible. Measures 4 and 5 are expected to be technically and/or economically difficult.	3	4	12
Potential to Encourage Partnerships for Project Financing	The site is nearby FAFB, but is otherwise far from parcels owned by organizations or agencies that may potentially assist in financing the project in return for reclaimed water, reserved sewer capacity, or discounted or fixed sewer and reclaimed water rates.	2	4	8
Public Acceptability	The site is located away from residential zoning. The site has the potential to impact wells surrounding the site and influence the spread of contamination from Craig Road Landfill.	4	6	24
Potential For Multiple Site Uses	The site is located outside the City limits, away from dense residential development, and therefore, may not be particularly accessible for recreational uses such as a sports field, a City park, or a walking path. However, the site may be suitable for a reclaimed water storage reservoir or pond.	3	4	12
Least Cost	Site alternative no. 3 is estimated to be more expensive in capital, operation and maintenance (O&M), and overall project costs than site alternatives no. 1 and 4, and less expensive that site alternative no. 2.	5	4	20
Sum of Total Scores For Each Site Evaluation Criteria				312

1. The "Weight" is the number attributed to the importance of each Site Evaluation Criterion in relation to the other Site Evaluation Criteria in determining the overall adequacy of the site for the proposed project.
2. The "Score" is the number attributed to how well the site meets the specific Site Evaluation Criteria as compared to the other site alternatives.
3. The "Total Score" is equal to the "Weight" number multiplied by the "Score" number for each specific criterion.

Table 4-7. Evaluation of City of Airway Heights WTRRF Site Alternative No. 4 Southeast 1/8 Section 26, Township 25N, Range 41E (North of McFarlane Road, East of Lawson and West of Russell Street)				
Site Evaluation Criteria	**Ability of Proposed Site to Meet Criteria**	**Weight**[1] 5 = Most Important 1 = Least Important	**Score**[2] 10 = Most Suitable 1 = Least Suitable	**Total Score**[3]
Land Ownership and Availability	One single owner owns 75 acres and is willing to sell the property to the City. The City already owns approximately one-fourth of an acre in the center of the parcel where its potable water supply wells No. 1 and 4 are located.	5	8	40
Land Availability for Future Expansion and Buffering Requirements	The site may possibly be expanded to the south. There is a 58-acre parcel in the northeast corner of Section 35, located across McFarland Road from the proposed site, that may be suitable for expansion in the future. The possible expansion area is zoned as Heavy Industrial and is currently used for storage of construction materials. Two parcels are located immediately west of the site and are relatively developed industrial areas. There are twenty (20) commercial parcels located in the block immediately north of the proposed site (north of 21st Avenue) and ten (10) industrial parcels located in the block immediately east of the site (east of Russell Street). It is expected that expansion to the west, north, and east would be difficult.	5	7	35
Potential Impacts on Receiving Water Quality	The primary discharge of the facility is proposed to be to groundwater via rapid infiltration basins with seasonal discharge to the reclaimed water system. There are approximately 34 owners of wells within 1 mile of the site that could potentially be impacted by the quality of effluent discharged at the site. Two of these wells are City's potable water supply wells no. 1 and 4. The existing groundwater quality at the site may have elevated levels of certain contaminants due to the proximity of the site to Craig Road Landfill.	5	7	35
Technical & Economic Impacts of Receiving Water Requirements	The site appears to be located on a 100' to 200'+ thick layer of overburden soil (sand, gravel, boulders, fractured basalt) on top of the approximately 0 – 80 foot thick Wanapum Basalt layer (in some places the overburden may reach down to the Grande Ronde Basalt layer). A hydrogeologic study would be required to determine the extent of the overburden throughout the site, delineate the paleochannel, and recommend the final location of any proposed rapid infiltration basins. Based on previous studies (SAIC, 1992, and Deobald and Buchanan, 1995), it is estimated that less than 50% of the site is located directly above a paleochannel. Thus, only a portion of the site may be suitable for rapid infiltration basins. A minimum of 160 acres is estimated to be required for the infiltration wetlands (versus 40 acres for rapid infiltration basins), and, therefore, the site may not be large enough for infiltration wetlands. In addition, the site is located within the FAFB flight path lateral clear zones. Standing surface water in wetlands may attract waterfowl and create an aviation hazard. Two of the City's potable water supply wells are located approximately 1/8 of a mile north of McFarland Avenue in the lateral center of the parcel. The depths of Wells No. 1 and 4 are 175' and 200' below grade, respectively, and are located within overburden	4	7	28

Table 4-7. Evaluation of City of Airway Heights WTRRF Site Alternative No. 4 Southeast 1/8 Section 26, Township 25N, Range 41E (North of McFarlane Road, East of Lawson and West of Russell Street)				
Site Evaluation Criteria	**Ability of Proposed Site to Meet Criteria**	**Weight[1]** 5 = Most Important 1 = Least Important	**Score[2]** 10 = Most Suitable 1 = Least Suitable	**Total Score[3]**
	soil that is believed to be part of a paleochannel. Water applied to the surface of this area may eventually trickle down to the groundwater and recharge the groundwater supply for the City's two potable water supply wells. It is expected that the City would have to (at minimum) treat the effluent to Class A reclaimed water standards, drinking water standards, and provide AKART (All Known, Available, Reasonable Methods of Prevention, Control, & Treatment).			
Feasibility of Connecting to City's Existing Collection System	The site elevation is higher than the proposed collection system tie-in location requiring: (1) More energy for wastewater transmission, additional pump stations, and a larger forcemain size and length than for Alternative No.1; and (2) Less energy for wastewater transmission, an equivalent forcemain size and number of pump stations, and a shorter forcemain length than for Alternatives No. 2 and No. 3. Refer to Figure 4-6 for the proposed layout of the required sewage forcemain and lift stations. Because of its proximity to FAFB, the site may be a good location for a regional wastewater treatment and reclamation facility serving both FAFB and the City of Airway Heights; however, discharge of additional wastewater beyond the City's design flow may be required to be located elsewhere due to hydrogeologic limitations.	4	7	28
Proximity to Potential Reclaimed Water Uses	The site is farther away from a majority of the potential reclaimed water users than Alternative No. 1, closer than Alternative No. 2, and about the same distance as Alternative No. 3. Refer to Figure 4-6 for the location of the site in relation to the potential reclaimed water users.	4	6	24
Accessibility to Existing Roads and Utility Services	The site is currently accessed from Lawson Road and has electrical service for the City's existing Wells No. 1 and 4.	2	9	18
Ability to Obtain Required Approvals for Siting Facility	The City of Airway Heights would be the lead agency in the SEPA process. The siting of the facility would follow the City of Airway Heights Essential Public Facilities Siting Process.	5	8	40
Location Within Desired Floodplain Designation	The site is located within Federal Emergency Management Agency (FEMA) Flood Zone C, defined as areas of minimal flood hazards.	1	5	5

Table 4-7. Evaluation of City of Airway Heights WTRRF Site Alternative No. 4
Southeast 1/8 Section 26, Township 25N, Range 41E
(North of McFarlane Road, East of Lawson and West of Russell Street)

Site Evaluation Criteria	Ability of Proposed Site to Meet Criteria	Weight[1] 5 = Most Important 1 = Least Important	Score[2] 10 = Most Suitable 1 = Least Suitable	Total Score[3]
Compatible Site and Surrounding Land Use Designations	The site is zoned as Heavy Industrial, which is compatible with a proposed WTRRF. The areas immediately east, west, and south of the site, are also zoned as Heavy Industrial. The area north of the site is zoned as Commercial. The site is compatible with surrounding land uses and would not likely required rezoning or a Conditional Use Permit.	3	8	24
Proximity from Areas of Natural and Aesthetic Significance	The site is not located near any designated priority habitat and does not appear to have any seasonal or permanent wetlands.	2	6	12
Proximity from Areas of Historical and Cultural Significance	The site does not appear to be in an area of natural or historical significance. However, due to the possibility of ancient tribal use of the site, the Washington State Office of Archaeology and Historic Preservation recommends a professional archaeological survey and consultation with nearby tribes' regarding the area's cultural significance, if any.	2	4	8
Minimal Previous Site Uses and Extent of Possible Soil and Groundwater Contamination	The site has not previously been used for any industrial or commercial purposes. However, approximately 13 septic tanks and associated drain fields have been identified within 3,000 feet east and west of Wells 1 and 4 (Geoengineers, 2003). These tanks may be contributing to elevated nitrate levels in these wells, measured as high as 5.5 mg/L in February 2003 (Geoengineers, 2003). In addition, Craig Road Landfill is located about 4,600 feet west of the wells. Craig Road landfill has been identified as the source of elevated concentrations of TCE in Wells 1 and 4 (DOH, 1997). TCE has been detected in these wells since December 1999 (Geoengineers, 2003). Craig Road landfill may also be the source of the elevated concentrations of nitrates. Applying large quantities of treated wastewater effluent to the area may increase or dilute pollutant concentrations, depending on the quality of effluent discharged and the extent of the contamination.	3	6	18
Feasibility of Mitigation Measures	Mitigation measures may include: (1) Providing buffer areas to reduce aesthetic and odor impacts of the facility; (2) Preservation and/or relocation of shrub steppe habitat; (3) Providing buffer zones around the City's wells to mitigate the impacts of surface percolation of treated effluent at the site; and (4) Providing additional treatment (i.e., advanced oxidation, or membrane filtration) beyond what might be required for other site discharge alternatives due to the proximity of any proposed infiltration basins to the City's potable water supply wells. Measures 1, 2, and 3 are assumed to be technically and economically feasible. Measure 4 is technically feasible, but may be economically burdensome.	3	5	15

Table 4-7. Evaluation of City of Airway Heights WTRRF Site Alternative No. 4 Southeast 1/8 Section 26, Township 25N, Range 41E (North of McFarlane Road, East of Lawson and West of Russell Street)				
Site Evaluation Criteria	**Ability of Proposed Site to Meet Criteria**	**Weight**[1] 5 = Most Important 1 = Least Important	**Score**[2] 10 = Most Suitable 1 = Least Suitable	**Total Score**[3]
Potential to Encourage Partnerships for Project Financing	The site is nearby FAFB, but is otherwise far from parcels owned by organizations or agencies that may potentially assist in financing the project in return for reclaimed water, reserved sewer capacity, or discounted or fixed sewer and reclaimed water rates.	2	5	10
Public Acceptability	The site is located away from residential zoning. The site has the potential to impact nearby wells, including City Wells No. 1 and 4. Multiple potential uses of the site may enhance public acceptability.	4	6	24
Potential For Multiple Site Uses	The site is located within the City limits, within 2 ½ miles of dense residential development, and therefore, may be suitable for recreational uses such as a sports field, City park, or reclaimed water storage reservoir or pond.	3	6	18
Least Cost	Site alternative no. 4 is estimated to be less expensive in capital, operation and maintenance (O&M), and overall project costs than site alternatives no. 2 and no. 3; its estimated capital cost is relatively equivalent with site alternative no. 1; and its estimated annual O&M costs are more than site alternative no. 1. If a portion of the reclaimed water discharged to groundwater at site alternative no. 4 could be recovered and resold, then potentially the overall project cost of site alternative no. 4 could be less than for site alternative no. 1.	5	8	40
Sum of Total Scores For Each Site Evaluation Criteria				422

1. The "Weight" is the number attributed to the importance of each Site Evaluation Criterion in relation to the other Site Evaluation Criteria in determining the overall adequacy of the site for the proposed project.
2. The "Score" is the number attributed to how well the site meets the specific Site Evaluation Criteria as compared to the other site alternatives.
3. The "Total Score" is equal to the "Weight" number multiplied by the "Score" number for each specific criterion.

Table 4-8. Scoring of City of Airway Heights WTRRF Site Alternatives									
		Site Alternative No. 1		Site Alternative No. 2		Site Alternative No. 3		Site Alternative No. 4	
Site Evaluation Criteria	**Weight[1] (Importance)** 5 = Most 1 = Least	**Score[2] (Suitability)** 10=Most 1=Least	**Total Score[3]**	**Score[2] (Suitability)** 10=Most 1=Least	**Total Score[3]**	**Score[2] (Suitability)** 10=Most 1=Least	**Total Score[3]**	**Score[2] (Suitability)** 10=Most 1=Least	**Total Score[3]**
Land Ownership and Availability	5	6	30	7	35	6	30	8	40
Land Availability for Future Expansion and Buffering Requirements	5	9	45	8	40	6	30	7	35
Potential Impacts on Receiving Water Quality	5	7	35	5	25	5	25	7	35
Technical & Economic Impacts of Receiving Water Requirements	4	7	28	5	20	5	20	7	28
Feasibility of Connecting to City's Existing Collection System	4	7	28	5	20	5	20	7	28
Proximity to Potential Reclaimed Water Uses	4	9	36	2	8	5	20	6	24
Accessibility to Existing Roads and Utility Services	2	4	8	4	8	5	10	9	18
Ability to Obtain Required Approvals for Siting Facility	5	8	40	5	25	5	25	8	40
Location Within Desired Floodplain Designation	1	5	5	5	5	5	5	5	5
Compatible Site and Surrounding Land Use Designations	3	5	15	6	18	7	21	8	24
Proximity from Areas of Natural and Aesthetic Significance	2	4	8	5	10	5	10	6	12
Proximity from Areas of Historical and Cultural Significance	2	4	8	4	8	4	8	4	8
Minimal Previous Site Uses and Extent of Possible Soil and Groundwater Contamination	3	4	12	7	21	4	12	6	18
Feasibility of Mitigation Measures	3	5	15	5	15	4	12	5	15
Potential to Encourage Partnerships for Project Financing	2	5	10	5	10	4	8	5	10
Public Acceptability	4	6	24	5	20	6	24	6	24
Potential For Multiple Site Uses	3	3	9	2	6	4	12	6	18
Cost	5	6	30	5	25	4	20	8	40
Sum of Total Scores For Each Site Evaluation Criteria			**386**		**319**		**312**		**422**

1. The "Weight" is the number attributed to the importance of each Site Evaluation Criterion in relation to the other Site Evaluation Criteria in determining the overall adequacy of the site for the proposed project.
2. The "Score" is the number attributed to how well the site meets the specific Site Evaluation Criteria as compared to the other site alternatives.
3. The "Total Score" is equal to the "Weight" number multiplied by the "Score" number for each specific criterion.

C. Effluent Design Criteria for New Treatment Facility

1. Applicable Regulations and Standards

The discharge criteria for a new wastewater treatment facility to serve the City of Airway Heights will depend on the location of the discharge or use of the effluent, and the associated applicable regulations. A description of the applicable regulations for the proposed facility is provided below.

a. Secondary Treatment Regulations

Chapter 173–221 Washington Administrative Code (WAC), Discharge Standards And Effluent Limitations For Domestic Wastewater Facilities

In order to meet effluent quality requirements for any of the discharge alternatives, to surface water, to ground water, or for water reuse, the wastewater must receive biological treatment and disinfection to achieve "secondary" treatment criteria.

Chapter 173–221 WAC, requires that:

"Waters of the state shall be of the highest possible quality. Regardless of the quality of the waters of the state, all wastes and other materials and substances proposed for discharge into said waters shall be provided with all known, available, and reasonable methods of treatment (AKART) prior to discharge."

In addition, Chapter 173–221 WAC requires that:

1. "Domestic wastewater facilities which discharge to surface waters shall not exceed a thirty-day average of 30 milligrams per liter (mg/L) BOD, 30 mg/L TSS. Seven-day averages shall not exceed 45 mg/L BOD, 45 mg/L TSS. Additionally, the thirty-day average percent removals of BOD and TSS shall not be less than eight-five percent of influent concentrations.
2. Fecal coliform limits shall not exceed a monthly geometric mean of 200 organisms/100 milliliters (mL), and a weekly geometric mean of 400 organisms per 100 mL.
3. The effluent pH value shall be between 6.0 and 9.0 standard units…"

These are minimum standards. These standards may become more stringent or additional standards may be required depending on the additional applicable regulatory criteria associated with the specific discharge and/or reuse alternative.

b. Surface Water Regulations and Standards

Intermittent Stream Standards

Since Deep Creek is considered to be an intermittent stream at the potential discharge location, the Washington State Department of Ecology, Intermittent Stream Standards (Permit Writer's Manual, 92-109, Washington State Department of Ecology) would require:

"1. A treatment/disposal system that meets all the numeric criteria and characteristic uses for Class A streams. This may require removal of the discharge from the stream either seasonally or completely.
2. A treatment/disposal system that protects the characteristic uses in the intermittent stretch and both the numeric criteria and characteristic uses in the perennial stretch. This option requires the evaluation of treatment technology commonly available which exceeds secondary treatment and which produces the following effluent quality (as monthly averages):

   BOD and TSS – 15 mg/L
   Total Ammonia – 1 mg/L

   If costs for achieving 1 mg/L are disproportionate to costs for achieving BOD and TSS, Ecology may allow total ammonia average of 2 mg/L."

<u>Chapter 173-201A WAC, Water Quality Standards For Surface Waters of the State of Washington</u>

Chapter 173-201A WAC, Water Quality Standards For Surface Waters of the State of Washington, establishes minimum surface water quality criteria for Class A surface waters. These criteria include standards for fecal coliform, dissolved oxygen, temperature, pH, turbidity, toxic substances, ammonia, radioactive substances, and deleterious materials. The regulation also establishes a seasonal limit on phosphorus in the Spokane River from Long Lake Dam to Nine Mile Bridge. Since Deep Creek is a tributary to the Spokane River, phosphorus removal would also be required for discharge to Deep Creek. In instances where a mixing zone is difficult to establish (as for intermittent streams), the regulation allows discharge of specific contaminants in levels above the criteria the only when:

1. "It is clear, after satisfactory public participation and intergovernmental coordination, that overriding considerations of the public interest will be served;
2. "All wastes and other materials and substances discharged into said waters shall be provided with all known, available, and reasonable methods of prevention, control, and treatment (AKART) by new and existing point sources before discharge"; and
3. "…the lower water quality shall still be of high enough quality to fully support all existing beneficial uses."

<u>Spokane River Total Maximum Daily Load (TMDL) Allocation</u>

Future water quality criteria for Long Lake in the Spokane River may become more stringent based on the TMDL study currently being performed by the WA DOE. Therefore, the proposed effluent design criteria and associated treatment requirements for discharge to Deep Creek presented in this Plan may become more rigorous in the future.

c. Groundwater Regulations

<u>Chapter 173–200 WAC, Water Quality Standards For Ground Waters of the State of Washington</u>

All discharges to groundwater (whether or not it is reclaimed water) must comply with Chapter 173–200 WAC, Water Quality Standards For Ground Waters of the State of Washington. Chapter 173-200 sets groundwater quality criteria for nitrate (total nitrogen is also regulated to achieve this criteria), total coliform bacteria, total dissolved solids, pH, color, odor, foaming agents, chloride, fluoride, sulfate, metals, radionuclides, and carcinogens.

In addition, the regulation prohibits the degradation of the existing and future beneficial uses and quality of the groundwater. Thus, the groundwater quality criteria must also be equal to or of better quality than background (existing) water quality to comply with the antidegradation policy, except:

"…in those instances where it can be demonstrated to the department's (WA DOE) satisfaction that:

> (i) An overriding consideration of the public interest will be served; and
> (ii) All contaminants proposed for entry into said ground waters shall be provided with all known, available, and reasonable methods of prevention, control, and treatment (AKART) prior to entry."

Enforcement limits may exceed criterion only in rare circumstances (for a period not to exceed five years without reconsideration) if all of the following conditions are met:

"1. The permit holder or responsible person demonstrates to the department's satisfaction that an enforcement limit that exceeds a criterion is necessary to provide greater benefit to the environment as a whole and to protect other media such as air, surface water, soil, or sediments;
2. The activity has been demonstrated to be in the overriding public interest of human health and the environment;
3. The department selects, from a variety of control technologies available for reducing and eliminating contamination from each potentially affected media, the technologies that minimize impacts to all affected media; and
4. The action has been approved by the director of the department (WA DOE) or his/her designee."

d. Reclaimed Water Regulations

Water Reclamation and Reuse Standards

Wastewater discharge to the reclaimed water system will be require to meet the Water Reclamation and Reuse Standards, September 1997, Publication 97-23, Washington State Department of Ecology and Department of Health. Potential uses, such as landscape irrigation or storage of reclaimed water in an impoundment or pond, that allow public contact with the reclaimed water are, at minimum, required to meet Class A reclaimed water standards. Other potential uses, specifically dust control, paved surface and aggregate washing, or concrete manufacturing, where public and worker exposure to the reclaimed water can be limited, may meet Class C reclaimed water standards. Some of the definitions provided in the Standards are provided below.

"Class A Reclaimed Water" is required to be "at all times an oxidized, coagulated, filtered, disinfected wastewater. The wastewater shall be considered adequately disinfected if the median number of total coliform organisms in the wastewater after disinfection does not exceed 2.2 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed, and the number of total coliform organisms does not exceed 23 per 100 milliliters in any sample."

"Class C Reclaimed Water" is required to be "at all times an oxidized, disinfected wastewater. The wastewater shall be considered adequately disinfected if the median number of total coliform organisms in the wastewater after disinfection does not exceed 23 per 100 milliliters, as determined from the bacteriological results of the last 7 days for which analyses have been completed, and the number of total coliform organisms does not exceed 240 per 100 milliliters in any sample."

"Oxidized Wastewater" is defined as "wastewater in which organic matter has been stabilized such that the biochemical oxygen demand (BOD) does not exceed 30 mg/L and the total suspended solids (TSS) do not exceed 30 mg/L, is nonputrescible, and contains dissolved oxygen."

"Coagulated Wastewater" is defined as "an oxidized wastewater in which colloidal and finely divided suspended matter have been destabilized and agglomerated prior to filtration by the addition of chemicals or by an equally effective method."

"Filtered Wastewater" is defined as "an oxidized, coagulated wastewater which has been passed through natural undisturbed soils or filter media, such as sand or anthracite, so that the turbidity as determined by an approved laboratory method does not exceed an average operating turbidity of 2 nephelometric turbidity units (NTU), determined monthly, and does not exceed 5 NTU at any time."

"Disinfected Wastewater" is defined as "wastewater in which pathogenic organisms have been destroyed by chemical, physical or biological means."

Groundwater Recharge of Reclaimed Water by Surface Percolation

In addition to meeting Class A reclaimed water requirements, the Water Reclamation and Reuse Standards require the following for groundwater recharge (discharge to groundwater) for surface percolation (i.e. through rapid infiltration basins):

"1. An additional step in the secondary treatment process to reduce nitrogen prior to the final discharge to ground water.
2. An Ecology delegated industrial wastewater pre-treatment program (or all industries discharging into the generators wastewater collection system must have current waste discharge permits issued by Ecology).

The Washington Departments of Health and Ecology evaluate these types of projects on a case-by-case basis and may require additional treatment, reliability, buffering or other provisions to ensure that the system fully protects public health and the water quality and beneficial uses of the groundwater.
The project evaluation will, at minimum, include consideration of the following: "treatment and treatment reliability provided; reclaimed water quality and quantity; use or potential use of the groundwater; operation and management of the recharge facilities; soil characteristics; hydrogeology; residence time of the reclaimed water in the underground prior to withdrawal; and distance from the recharge area to nearest point of withdrawal."

Direct Aquifer Recharge of Reclaimed Water

Though not specifically proposed for this project because of the high cost, groundwater can also be recharged through "direct recharge" of reclaimed water.

The Standards define "Direct Recharge" as "the controlled subsurface addition of water directly to the groundwater basin that results in the replenishment of groundwater. Direct recharge of reclaimed water is typically accomplished via injection wells but may be accomplished by other methods that directly recharge into the groundwater saturated zone by a subsurface means."

For direct recharge to groundwater:

1. "AKART shall be applied to all wastewater prior to direct recharge."
2. "Reclaimed water used for direct recharge to potable ground water aquifers shall be reclaimed water that, as a minimum, is at all times an oxidized, coagulated, filtered, reverse osmosis-treated, disinfected wastewater."
3. The reclaimed water used for direct recharge to potable ground water aquifers shall meet the water quality criteria for primary contaminants (except nitrate), secondary contaminants, radionuclides, and carcinogens listed in Table 1 in chapter 173-200 WAC and any other maximum contaminant levels pursuant to chapter 246-290 WAC, Public Water Supplies (except total coliform organisms shall not exceed 5/100 mL in any sample).
4. The reclaimed water turbidity shall be less than or equal to 0.1 NTU (average) and 0.5 NTU (maximum);

5. The reclaimed water total nitrogen concentration shall be less than or equal to 10 mg/L as N;
6. The reclaimed water Total Organic Carbon (TOC) shall be less than or equal to 1.0 mg/L.

The Standards define "Reverse Osmosis" as "a treatment process, which relies upon a semipermeable membrane to separate water from its impurities. An external force is used to reverse the normal osmotic flow, resulting in movement of water from a solution of higher solute concentration to one of lower concentration."

As with groundwater recharge of reclaimed water by surface percolation, the WA DOE and DOH evaluate these types of projects on a case-by-case basis and may require additional treatment, reliability, buffering and/or other provisions to ensure that the system fully protects public health and the water quality and beneficial uses of the groundwater.

Preliminarily, it is assumed that discharge of reclaimed water through a subsurface drain field that lies within several feet of the ground surface <u>and does not discharge directly to the saturated zone of a recharge aquifer</u> is required to meet criteria similar to the groundwater recharge for surface percolation and <u>not</u> the criteria required for direct aquifer recharge.

A summary of the applicable regulatory criteria discussed in this Subsection is provided in Table 4-9, Applicable Regulatory Criteria for Various Discharge and Reuse Alternatives. The applicable regulatory criteria for direct injection to potable groundwater is provided in Table 4-9 for reference only. Direct recharge to the City's potable water supply aquifer is not proposed for this project due to the excessive cost of a reverse osmosis treatment system and the associated disposal of the concentrated waste stream.

Table 4-9. Applicable Regulatory Criteria for Various Discharge and Reuse Alternatives							
Constituent	**Frequency**	**Surface Water Discharge**	**Ground Water Discharge**	**Class A Water Reuse**			**Class C Water Reuse**
Potential Discharges/Uses For Evaluation →		Discharge to Deep Creek (Intermittent Stream)	By Surface Percolation	Groundwater Recharge by Surface Percolation	Landscape Irrigation, Impoundments	Direct Recharge (Injection) of Groundwater	Non-Contact Uses (Dust Control, Paved Surface & Aggregate Washing, Concrete Manufacturing)
Regulations/Standards →		-WAC 173-201A -Intermittent Stream Standards	-WAC 173-200[D] -WAC 173-221	-Reclaimed Water Standards -WAC 173-200[D]	-Reclaimed Water Standards	-Reclaimed Water Standards -WAC 173-200[D] -WAC 246-290	-Reclaimed Water Standards
5-Day Biochemical Oxygen Demand, BOD, mg/L	Monthly Average	15	30	30	30	N/A	30
	Weekly Average	23	45	N/A	N/A	5	N/A
5-Day BOD, % Removal	Monthly Average	85%	85%	N/A	N/A	N/A	N/A
Total Suspended Solids, TSS, mg/L	Monthly Average	15	30	30	30	N/A	30
	Weekly Average	23	45	N/A	N/A	5	N/A
TSS, % Removal	Monthly Average	85%	85%	N/A	N/A	N/A	N/A
Ammonia, NH_3-N, mg/L	Monthly Average	2[A]	N/A	N/A	N/A	N/A	N/A
	Weekly Average	3[A]	N/A	N/A	N/A	N/A	N/A
Total Phosphorus, TP-P, mg/L	Monthly Average	1[A]	N/A	N/A	N/A	N/A	N/A
	Weekly Average	2[A]	N/A	N/A	N/A	N/A	N/A
Total Nitrogen, mg/L as N	Monthly Average	N/A	10	10	N/A	10	N/A
Nitrate, NO_3-N, mg/L	Monthly Average	N/A	10	10	N/A	10	N/A
Nitrite, NO_2-N, mg/L	Not to Exceed	N/A	N/A	N/A	N/A	1.0	N/A
Turbidity, NTU	Average[C]	N/A	N/A	2	2	0.1	N/A
	Not to Exceed	N/A	N/A	5	5	0.5	N/A
Dissolved Oxygen, DO, mg/L	Not Less Than	8.0	N/A	Shall Be Present	Shall Be Present	Shall Be Present	Shall Be Present
Fecal Coliform Bacteria, CFU/100 ml	Monthly Log Mean	100	50[A]	N/A	N/A	N/A	N/A
	Weekly Log Mean[B]	200	100[A]	N/A	N/A	N/A	N/A
Total Coliform Bacteria, CFU/100 ml	Weekly Median	N/A	N/A	2.2	2.2	2.2	23
	Not to Exceed	N/A	1[E]	23	23	5	240
Total Residual Chlorine, mg/L	Monthly Average	0.011	N/A	N/A	N/A	N/A	N/A
	Not to Exceed	0.019	N/A	N/A	N/A	N/A	N/A
	Minimum	N/A	N/A	N/A	0.5	0.5	0.5
Total Dissolved Solids, TDS, mg/L	Not to Exceed	N/A	500	500	N/A	500	N/A

Table 4-9. Applicable Regulatory Criteria for Various Discharge and Reuse Alternatives							
Constituent	**Frequency**	**Surface Water Discharge**	**Ground Water Discharge**	**Class A Water Reuse**			**Class C Water Reuse**
Potential Discharges/Uses For Evaluation →		Discharge to Deep Creek (Intermittent Stream)	By Surface Percolation	Groundwater Recharge by Surface Percolation	Landscape Irrigation, Impoundments	Direct Recharge (Injection) of Groundwater	Non-Contact Uses (Dust Control, Paved Surface & Aggregate Washing, Concrete Manufacturing)
Regulations/Standards →		-WAC 173-201A -Intermittent Stream Standards	-WAC 173-200[D] -WAC 173-221	-Reclaimed Water Standards -WAC 173-200[D]	-Reclaimed Water Standards	-Reclaimed Water Standards -WAC 173-200[D] -WAC 246-290	-Reclaimed Water Standards
Specific Conductivity, umhos/cm	Not to Exceed	N/A	N/A	N/A	N/A	700	N/A
pH, S.U.	Within Range	6.5 to 8.5	6.5 to 8.5	6.5 to 8.5	N/A	6.5 to 8.5	N/A
Color, S.U.	Not to Exceed	N/A	15	15	N/A	15	N/A
Odor, S.U.	Not to Exceed	N/A	3	3	N/A	3	N/A
Foaming Agents, mg/L	Not to Exceed	N/A	0.5	0.5	N/A	0.5	N/A
Total Organic Carbon, TOC, mg/L	Not to Exceed	N/A	N/A	N/A	N/A	1.0	N/A
Asbestos, 10^6 fibers/liter <10 um	Not To Exceed	N/A	N/A	N/A	N/A	7	N/A
Chloride, mg/L	4-Day Average	230	N/A	N/A	N/A	N/A	N/A
	Not To Exceed	860	250	250	N/A	250	N/A
Cyanide, ug/L	4-Day Average	5.2	N/A	N/A	N/A	N/A	N/A
	Not To Exceed	22	N/A	N/A	N/A	200	N/A
Fluoride, mg/L	Not To Exceed	N/A	4	4	N/A	4	N/A
Sodium, mg/L	Not To Exceed	N/A	N/A	N/A	N/A	N/A	N/A
Sulfate, mg/L	Not To Exceed	N/A	250	250	N/A	250	N/A
Metals	Not To Exceed	Various	Various	Various	N/A	Various	N/A
Radionuclides	Not To Exceed	Various	Various	Various	N/A	Various	N/A
Priority Pollutants/Carcinogens	Not To Exceed	Various	Various	Various	N/A	Various	N/A
Total Trihalomethanes, THMs	Not To Exceed	N/A	N/A	N/A	N/A	0.1	N/A
Disinfection By-products, DBPs	Not To Exceed	N/A	N/A	N/A	N/A	Various	N/A
Volatile Organic Chemicals, VOCs	Not To Exceed	N/A	N/A	N/A	N/A	Various	N/A
Synthetic Organic Chemicals, SOCs	Not To Exceed	N/A	N/A	N/A	N/A	Various	N/A

A. AKART-based criteria.
B. Not more than 10 percent of all samples obtained for calculating the geometric mean value shall exceed this value.
C. Monitored continuously (sampled a minimum of once every four hours).

D. Some applicable groundwater criteria may be less than the criteria shown in order to meet background water quality and comply with the antidegradation policy in WAC 173-200 unless the Department grants an exception per WAC 173-200-050.
E. Typically monitored in the receiving water via ground water monitoring wells (at the "point of compliance") and not in the effluent at the point of discharge.
NTU Nephelometric Turbidity Unit
CFU Colony Forming Units
S.U. Standard Units
N/A Not Applicable or No Applicable Standard

2. Expected Effluent Design Criteria

The expected effluent design criteria for the various discharge and reuse alternatives from a City of Airway Heights wastewater treatment system are summarized in Table 4-10. These are the design criteria that the proposed facility is expected to meet at the facilities discharge point, and that typically determine the type and size of unit processes required for treatment, reclamation, and/or recharge of the wastewater. The effluent design criteria for direct injection to groundwater is provided in Table 4-10 for reference only. Direct recharge to the City's potable water supply aquifer is not proposed for this project due to the excessive cost of a reverse osmosis treatment system and the associated disposal of the concentrated waste stream.

Table 4-10. Expected Effluent Design Criteria for Discharge and Reuse Alternatives							
Constituent	**Frequency**	**Surface Water Discharge**	**Ground Water Discharge**	**Class A Water Reuse**			**Class C Water Reuse**
Potential Discharges/Uses For Evaluation →		Discharge to Deep Creek (Intermittent Stream)	By Surface Percolation	Groundwater Recharge by Surface Percolation	Landscape Irrigation, Impoundments	Direct Recharge (Injection) of Groundwater	Non-Contact Uses (Dust Control, Paved Surface & Aggregate Washing, Concrete Manufacturing)
5-Day Biochemical Oxygen Demand, BOD, mg/L	Monthly Average	15	15	15	15	5	15
	Weekly Average	23	23	23	23	5	23
5-Day BOD, % Removal	Monthly Average	85%	85%	N/A	N/A	N/A	N/A
Total Suspended Solids, TSS, mg/L	Monthly Average	15	15	15	15	5	15
	Weekly Average	23	23	23	23	5	23
TSS, % Removal	Monthly Average	85%	85%	N/A	N/A	N/A	N/A
Ammonia, NH_3-N, mg/L	Monthly Average	2[A]	2	2	N/A	2	N/A
	Weekly Average	3[A]	3	3	N/A	3	N/A
Total Phosphorus, TP-P, mg/L	Monthly Average	1[A]	N/A	N/A	N/A	N/A	N/A
	Weekly Average	2[A]	N/A	N/A	N/A	N/A	N/A
Total Nitrogen, mg/L as N	Monthly Average	N/A	10	10	N/A	10	N/A
Nitrate, NO_3-N, mg/L	Monthly Average	N/A	6	6	N/A	6	N/A
Nitrite, NO_2-N, mg/L	Not to Exceed	N/A	1.0	1.0	N/A	1.0	N/A
Turbidity, NTU	Average[C]	N/A	N/A	2	2	0.1	N/A
	Not to Exceed	N/A	N/A	5	5	0.5	N/A
Dissolved Oxygen, DO, mg/L	Not Less Than	6.0[F]	N/A	1.0	1.0	1.0	1.0
Fecal Coliform Bacteria, CFU/100 ml	Monthly Log Mean	100	50[A]	2.2	2.2	2.2	23
	Weekly Log Mean[B]	200	100[A]	23	23	5	240
Total Coliform Bacteria, CFU/100 ml	Weekly Median	N/A	N/A	2.2	2.2	2.2	23
	Not to Exceed	N/A	N/A[E]	23	23	5	240
Total Residual Chlorine, mg/L	Monthly Average	N/A[G]	N/A	N/A	N/A	N/A	N/A
	Not to Exceed	N/A[G]	N/A	N/A	N/A	N/A	N/A
	Minimum	N/A	N/A	N/A	0.5	0.5	0.5
pH, S.U.	Within Range	6.5 to 8.5	6.5 to 8.5	6.5 to 8.5	N/A	6.5 to 8.5	N/A
Total Organic Carbon, TOC, mg/L	Not to Exceed	N/A	N/A	N/A	N/A	1.0	N/A

A. AKART-based criteria.

B. Not more than 10 percent of all samples obtained for calculating the geometric mean value shall exceed this value.

C. Monitored continuously (sampled a minimum of once every four hours).
D. Criteria are determined based on protecting groundwater quality while considering the specific vegetation uptake rates and loading rates of various constituents.
E. A maximum total coliform bacteria value of 1.0 CFU/100 ml would be expected to be the limit as monitored in the ground water monitoring wells (at the "point of compliance") and not in the effluent at the point of discharge to the infiltration basins.
F. The effluent is expected to reach a saturation level of dissolved oxygen by the time it reaches Deep Creek.
G. An effluent design criterion for TRC is not expected to be required if UV disinfection is used for treatment. If chlorination/dechlorination is used for disinfection, the disinfection system would be designed to meet a monthly average concentration of TRC of 0.011 mg/L and a maximum concentration of TRC of 0.019 mg/L.
NTU Nephelometric Turbidity Unit
CFU Colony Forming Units
S.U. Standard Units
N/A Not Applicable or No Applicable Standard

D. Reliability Requirements for New Treatment Facility

1. US EPA Reliability Requirements for Wastewater Treatment Plants

The US Environmental Protection Agency (EPA) has developed definitions and criteria for wastewater treatment facility reliability in "Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability", Environmental Protection Agency Technical Bulletin EPA-430-99-74-001. The WA DOE has adopted the EPA criteria. The minimum standards of reliability are defined for three classes of wastewater treatment works. They are based on the consequences of degradation of the effluent quality on the receiving waters. Guidelines for establishment of the reliability criteria are as follows:

- Reliability Class I - Treatment works which discharge into navigable waters that could be permanently or unacceptably damaged by effluent which is degraded in quality for only a few hours.
- Reliability Class II - Treatment works which discharge into waters that would not be permanently or unacceptably damaged by short-term effluent quality degradations, but could be damaged by continued (on the order of days) effluent quality degradation.
- Reliability Class III - Treatment works not otherwise classified as Reliability Class I or Class II.

Component requirements for back-up or redundancy, and for reliability of service are based on the specific reliability class. A general summary of requirements for various treatment units is shown in Table 4-11. If the treated effluent is entirely or partially discharged to a reclaimed water system or to groundwater near a potable water supply source, it is expected that the treatment system will be required to meet the requirements of Reliability Class I.

Table 4-11. Wastewater Treatment System Reliability Requirements			
	Reliability Class		
General Requirements	**Class I**	**Class II**	**Class III**
Trash Removal	Yes	Yes	Yes
Grit Removal[1]	Yes	Yes	Yes
Provisions For Removal of Settled Solids[2]	Yes	Yes	Yes
Unit Operation Bypass[3]	Yes	Yes	Yes
Component Backup Features			
Backup Bar Screen for Mechanically Cleaned Bar Screen or Comminutor	Yes	Yes	Yes
Backup Pump[4]	Yes	Yes	Yes
Primary Sedimentation Basins[5]	Multiple Basins	Multiple Basins	Minimum, two
Trickling Filters	Multiple Filters[6]	Multiple Filters[5]	No Backup
Aeration Basin	Minimum of Two of Equal Volume	Minimum of Two of Equal Volume	Single Basin Permissible
Aeration Blowers or Mechanical Aerators[7]	Multiple Units	Multiple Units	Multiple Units
Air Diffusers[8]	Multiple Sections	Multiple Sections	Multiple Sections
Final Sedimentation Basins	Multiple Basins[6]	Multiple Basins[5]	Minimum, two[5]
Chemical Flash Mixer	Minimum of two or backup[9]	No backup	No backup
Chemical Sedimentation Basins	Multiple Basins[6]	No backup	No backup
Filters and Activated Carbon Columns	Multiple Units[6]	No backup	No backup
Flocculation Basins	Minimum, Two	No backup	No backup
Disinfectant Contact Basins	Multiple basins[6]	Multiple basins[5]	Multiple basins[5]

1 Not applicable to treatment works which do not pump or dewater sludge (e.g. stabilization ponds).
2 Applicable to channels, pump wells, and piping prior to degritting or primary sedimentation.
3 Not applicable where two or more units are provided and the operating unit can handle the peak flow; applicable to comminution regardless of number of units.
4 Sufficient capacity of remaining pumping units must be able to handle the peak flow with one pump out of service.
5 With largest unit out of service, the remaining units must have the capacity for at least 50 percent of the design flow.
6 With the largest unit out of service, the remaining units must have the capacity for at least 75 percent of the design flow.
7 With the largest unit out of service, the remaining units must be able to maintain the design oxygen transfer; the backup unit may be uninstalled.
8 With the largest section out of service, the oxygen transfer capability must not be measurably impaired.
9 If there is only one basin, the backup system must be provided with at least two mixing devices (one may be installed).

2. Water Reclamation and Reuse Standards Reliability Requirements

In addition, a treatment system that discharges reclaimed water to a reclaimed water distribution system or groundwater recharge aquifer will be required to meet the reliability requirements listed in the Water Reclamation and Reuse Standards. These reliability requirements include the following features.

Biological Treatment

All biological treatment unit processes shall be provided with one of the following reliability features:

(1) Alarm and multiple biological treatment units capable of producing oxidized wastewater with one unit not in operation;
(2) Alarm, short-term storage or disposal provisions, and standby replacement equipment;
(3) Alarm and long-term storage or disposal provisions; or
(4) Automatically actuated long-term storage or disposal provisions.

Secondary Sedimentation

All secondary sedimentation unit processes shall be provided with one of the following reliability features:

(1) Multiple sedimentation units capable of treating the entire flow with one unit not in operation;
(2) Standby sedimentation unit process; or
(3) Long-term storage or disposal provisions.

Coagulation

All coagulation unit processes shall be provided with the following features for uninterrupted chemical feed:

(1) Standby feeders;
(2) Adequate chemical storage and conveyance facilities;
(3) Adequate reserve chemical supply; and
(4) Automatic dosage control.

All coagulation unit processes shall be provided with one of the following reliability features:

(1) Alarm and multiple coagulation units capable of treating the entire flow with one unit not in operation;
(2) Alarm, short-term storage or disposal provisions, and standby replacement equipment;
(3) Alarm and long-term storage or disposal provisions;
(4) Automatically actuated long-term storage or disposal provisions; or
(5) Alarm and standby coagulation unit process.

Filtration

All filtration unit processes shall be provided with one of the following reliability features:

(1) Alarm and multiple filter units capable of treating the entire flow with one unit not in operation;
(2) Alarm, short-term storage or disposal provisions and standby replacement equipment;
(3) Alarm and long-term storage or disposal provisions;
(4) Automatically actuated long-term storage or disposal provisions; or
(5) Alarm and standby filtration unit process.

Disinfection

All disinfection unit processes where chlorine is used as the disinfectant shall be provided with the following features for uninterrupted chlorine feed:

(1) Standby chlorinator;
(2) Standby chlorine supply;
(3) Manifold systems to connect chlorine cylinders;
(4) Chlorine scales;
(5) Automatic switchover to full chlorine cylinders; and
(6) Continuous measuring and recording of chlorine residual.

All disinfection unit processes where chlorine is used as the disinfectant shall be provided with one of the following reliability features:

(1) Alarm and standby chlorinator;
(2) Alarm, short-term storage or disposal provisions, and standby replacement equipment;
(3) Alarm and long-term storage or disposal provisions;
(4) Automatically actuated long-term storage or disposal provisions; or
(5) Alarm and multiple point chlorination. Each point of chlorination shall have an independent power source, separate chlorinator, and separate chlorine supply.

All other disinfection unit processes shall be provided with one of the following reliability features:

(1) Alarm and standby disinfection unit capable of treating the design flow rate with the largest operating unit out of service;
(2) Alarm, short-term storage or disposal provisions, and standby replacement equipment;
(3) Alarm and long-term storage or disposal provisions; and
(4) Automatically actuated long-term storage or disposal provisions.

A wastewater treatment and reclamation facility for the City of Airway Heights would most likely meet the above reliability requirements as follows:

Biological Treatment: By alarm, short-term storage or disposal provisions (such as in a membrane-lined lagoon), and standby replacement equipment (such as an installed standby aerator);

Secondary Sedimentation: By multiple sedimentation units (such as multiple clarifiers) capable of treating the entire flow with one unit not in operation;

Coagulation: By providing uninterrupted chemical feed capability and alarm and multiple coagulation units (such as multiple coagulant feed pumps) capable of treating the entire flow with one unit not in operation;

Filtration: Alarm and multiple filter units capable of treating the entire flow with one unit not in operation; and

Disinfection: By alarm and standby disinfection unit (such as an extra UV module in each channel) capable of treating the design flow rate with the largest operating unit out of service.

E. Evaluation of Liquid Treatment Processes for New Treatment Facility

In order to meet effluent quality requirements for any of the discharge alternatives from a new wastewater treatment facility, the wastewater must be provided with secondary treatment, disinfection, and all known, available, and reasonable methods of treatment (AKART) prior to discharge. Thus, a new wastewater treatment facility will need the following minimum liquid treatment components, or "unit processes" to meet the expected effluent design criteria listed in Table 4-10.

1. Minimum Liquid Treatment Processes for a New Wastewater Treatment Facility

a. Screening and Grinding

The primary purpose of screening equipment is to remove oversized solids (i.e., plastics, trash, leaves, rags, etc.) from the influent wastewater of the facility thereby protecting downstream operations and equipment from damage. Modern screening equipment will also dewater the solids, and then transport them into containers for disposal as solid waste. There are different types of screens, including bar racks, coarse screens, and fine screens. Bar racks typically have ¾" to 2" sized openings; coarse screens typically have ¼" to 1.5"; and fine screens typically have openings of 1.5 mm (0.06") to 6 mm (1/4"). Typically, the most cost effective screening solution for a City the size of Airway Heights is to have one or more self-cleaning, in-line fine screens with an overflow channel and manually-cleaned bar rack in parallel to the fine screen(s) in case of "blinding" or build-up of solids on the fine screen due to failure of the cleaning mechanism. Fine screens with openings in the range of 2 to 3 mm are preferable because they are better at removing debris that can end up in the dewatered sludge, making the sludge more difficult to dispose of. In addition, some processes, such as membranes, require that fine screens with openings no larger than 2 mm be placed on the upstream side of these processes.

There are several types of in-line, self-cleaning, fine screens that are considered to be cost effective screening alternatives for the proposed facility. These screens can be evaluated in detail as part of the pre-design process and include: rotating-drum fine screens; in-channel fine screens; step screens; and side-hill screens. For preliminary planning purposes, an in-channel type fine screen is used in the facility cost estimates for comparison of discharge alternatives. The screen is sized for the proposed peak-hourly design flow.

Because the Airway Heights Corrections Center discharges a significant amount of its wastewater to the City's collection system, it is also recommended that a grinder be installed upstream of any of the City's collection system lift stations. Experience at other facilities has shown that large quantities of rags and other debris typically discharged from prisons and can upset lift station operations by clogging valves and binding on pump impellers. Grinders can be installed in channels or in-line and can shear solids into a consistent particle size of ¼". These solids are then small enough to pass through the sewage pumps and can then be removed at the treatment facility by the fine screens.

b. Grit Removal

Grit removal is required to remove relatively inert, dense particles such as sand or gravel, from the influent wastewater to reduce abrasion on downstream mechanical equipment and to prevent the formation of heavy deposits of grit in pipelines, channels, and tanks. Typically, the grit removal facilities are placed downstream of the screenings facilities to reduce maintenance by preventing screenings from building up in or on the grit removal equipment. Similar to the screening equipment, the grit removal equipment will also dewater the grit and transport it into containers for disposal as solid waste. There are several types of grit removal facilities including: horizontal flow channels, aerated grit chambers, and vortex grit chambers. Horizontal grit chambers typically have higher capital, space, and operational costs than the vortex grit chambers; and therefore, a vortex-type grit chamber is recommended for this application and is used in the facility cost estimates for comparison of discharge alternatives.

c. Extended Aeration Activated Sludge Treatment

A suspended growth, low loading-rate, aerated, activated sludge system with an extended solids retention time (SRT) is recommended as the biological treatment configuration to meet the 5-Day BOD, TSS, and ammonia nitrogen removal required for the proposed discharge alternatives. Other biological treatment configurations are available, such as attached growth processes (e.g., trickling filters and rotating biological contactors), lagoon systems (e.g., aerated or facultative lagoons), and higher loading-rate (and shorter SRT) systems (e.g. conventional plug-flow systems, conventional complete-mix systems, and high-rate aeration systems), but these systems have not been proven to consistently and reliably meet the stringent BOD, TSS, and ammonia effluent criteria required for discharge to an intermittent stream, a reclaimed water system, or a groundwater recharge aquifer. Extended aeration activated sludge systems are recommended for meeting the desired effluent criteria for several reasons: (1) they can consistently achieve nitrification; (2) they can handle large variations in flow and loading; (3) they are relatively flexible to operate; (4) they can be easily combined with other advanced biological treatment processes for removal of phosphorus and total nitrogen; and (5) they have been shown to have the best success at treating difficult to degrade organic compounds, some of which are emerging compounds of concern, namely pharmaceutically active compounds, household and industrial waste chemicals, hormones, and other endocrine disruptors. A summary table of treatment processes eliminated from further consideration and the reasons for not evaluating further is provided in Table 4-12A.

While these systems have much smaller land requirements than lagoon-type systems, they typically require more space than systems that have higher-loading rates and lower SRTs. Because of this, they are typically preferred for communities the size of Airway Heights where land area is more readily available. Of the extended aeration activated sludge variations, the oxidation ditch, the sequencing batch reactor (SBR), and extended aeration plug-flow or complete-mix systems, are common configurations that are typically selected for cities the size of Airway Heights. For these sized cities, extended aeration plug-flow and complete-mix facilities typically are used in the expansion of existing conventional activated sludge systems, whereas oxidation ditches and SBRs are often installed in new facilities.

Currently, in Washington State, there are approximately ten (10) operational reclaimed water facilities that are of similar size as the City of Airway Heights (i.e., greater than 0.5 MGD annual average design (AAF) flow). Of these facilities, six (6) are oxidation ditches, three (3) are SBRs, and two (2) are conventional activated sludge systems. Oxidation ditches are being used at the City of Medical Lake (1.0 MGD AAF), the City of Sequim (0.67 MGD AAF), the City of Ephrata (1.12 MGD AAF), the City of Snoqualmie (1.24 MGD AAF), and the City of Walla Walla (6.2 MGD AAF) for wastewater treatment and reclamation. The City of Cheney (1.5 MGD AAF) wastewater treatment and reclamation facility also uses oxidation ditches for wastewater treatment and discharge to constructed wetlands, and is in the final planning stages for adding tertiary treatment for the production of Class A reclaimed water by 2008. SBRs are being used at the City of Yelm (1.0 MGD AAF), the City of College Place (1.65 MGD MMF), and the City of Quincy (1.54 MGD AAF) for wastewater treatment and reclamation. Conventional activated sludge systems are used at King County's South Plant (up to 1.0 MGD of reclaimed water is produced from its 115 MGD AAF treatment plant) and the West Point Plant (up to 0.7 MGD of reclaimed water is produced from its 133 MGD AAF treatment plant). Of the ten facilities mentioned, the cities of Ephrata, Quincy, and Yelm all discharge to surface percolation facilities for groundwater recharge. (Note: The cities of Walla Walla and College Place, while tertiary treatment facilities, are not officially permitted as Class A reclaimed water facilities due to their inability to meet all the required redundancy requirements. The City of Walla Walla's facility is expected to meet these requirements and be permitted for Class A reclamation in 2008.)

Membrane bioreactors (MBRs) are a relatively new biological treatment technology that are being implemented in some wastewater reclamation installations around the United States. Membrane bioreactors are similar to other types of activated sludge systems, except that they use membranes in lieu of secondary clarifiers and tertiary filters to achieve suspended solids removal. They also operate at higher suspended solids concentrations, than extended aeration plants, and sometimes require equalization of peak influent flows to prevent overloading of the membranes. There are three main MBR competitors in the marketplace (Zenon Environmental Systems Inc. (Zenon), USFilter, and Kubota Corporation/Enviroquip Incorporated (Enviroquip)).

The Tulalip Tribes have installed an Enviroquip MBR plant at their casino and business park in Tulalip, Washington. The facility became operational in July 2003, and will eventually be utilized to produce reclaimed water for landscape irrigation, possible groundwater recharge, and stream flow augmentation. The facility is designed to handle an average flow of 1.25 MGD, up to a peak of 2.5 MGD, and is currently the largest operating MBR in Washington State.

King County has preliminarily selected MBR technology for its proposed 36 MGD Brightwater Treatment Plant in Snohomish County. This facility is planned to begin operation in 2010. Since the MBR is a relatively new technology, the County is reserving space on site to convert the MBR system to a more traditional system using secondary clarifiers in the future, if necessary. King County has also selected MBR technology for the (0.45 MGD) facility it is building for the City of Carnation. Spokane County has also preliminarily selected MBRs for its proposed 10 MGD wastewater treatment plant. The City of Duvall, Washington, is planning to retrofit its existing oxidation ditch activated sludge process with an (~1.65 MGD) MBR system. None of these facilities are in operation, and their ability to be permitted and meet reuse requirements remains to be demonstrated.

Because MBRs show promise as a cost effective biological treatment technology capable of meeting the required discharge criteria, it is recommended that City staff visit several MBR installations, at least one for each of the three major MBR manufacturers, prior to selection of the final biological treatment alternative. A detailed evaluation comparing MBRs, the oxidation ditch, and the SBR could then be completed as part of the pre-design process.

For preliminary planning purposes, the oxidation ditch is used as the selected biological treatment configuration in the facility cost estimates for comparison of discharge alternatives. A minimum of three oxidation ditches are estimated to be required for treatment of the maximum month loading to the facility in year 2030. To comply with reliability requirements, the cost of the biological treatment system includes the cost of two (2) aerators per oxidation ditch, one primary and one standby aerator, and the cost of a membrane-lined lagoon for short-term storage.

d. Secondary Clarification

The primary purpose of secondary clarification is to separate suspended solids from the activated sludge. Secondary clarification can be achieved in secondary clarifiers downstream from the activated sludge basins, as for oxidation ditches and MBRs, or within the activated sludge basins, as for SBRs and MBRs. Secondary clarifiers exterior to the activated sludge process are commonly circular basins, where solids settle to the bottom, and clarified effluent flows over a weir at the top of the clarifier to downstream processes. A portion of the solids (the return activated sludge (RAS)) is recycled by pumps from the clarifiers back to the beginning of the activated sludge system. For SBRs, clarification is performed inside the SBR aeration basins, as part of a non-aerated, quiescent settling phase. Solids settle to the bottom of the basins during this phase, and the clarified effluent is decanted to downstream treatment processes. For MBRs, the solids separation is achieved by flat-sheet (Kubota/Enviroquip) or hollow-fiber (US Filter and Zenon) membranes submerged in the aeration basins or in a downstream membrane tank. Water flows through the membranes, while solids are retained in the aeration basins or membrane tank. As with circular clarifiers, RAS is recycled back to the beginning of the activated sludge system. For all the options, waste activated sludge (WAS) is periodically pumped from the system to the dewatering facilities to maintain the desired SRT.

For preliminary planning purposes, circular clarifiers, downstream of oxidation ditches, are included in the facility cost estimates for comparison of discharge alternatives. To comply with reliability requirements, a minimum of three (3) clarifiers (two primary and one redundant) are included in the cost estimates. The third clarifier could be operated in series or parallel for operational flexibility and improved performance.

e. Disinfection

Disinfection is required for all discharge alternatives to remove pathogens, specifically fecal and total coliform bacteria. Common methods of disinfection for communities the size of Airway Heights include ultraviolet light (UV) disinfection and chlorination/dechlorination. UV disinfection has been shown to be the more cost effective disinfection alternative, particularly when dechlorination of the effluent is required prior to discharge to surface water, such as to Deep Creek, to a fishpond, or to constructed wetlands.

UV disinfection also has the following advantages over chlorination/dechlorination systems: (1) UV disinfection systems do not have the chemical storage and handling requirements associated with chlorination/dechlorination facilities; (2) Unlike chlorination systems, UV disinfection has the ability to deactivate cryptosporidium and giardia cysts at "normal" doses required for current reuse criteria targeting total coliforms; (3) Unlike chlorination, UV disinfection has the ability to kill viruses near "normal" doses required for current reuse criteria targeting total coliforms; (4) Unlike chlorination systems, UV disinfection does not generate disinfection byproducts, which have the potential to contribute to the formation of tri-halomethanes (THMs) (known carcinogens); and (5) Unlike chlorination systems, UV disinfection systems do not produce total dissolved solids (TDS) in the effluent, which is a concern for discharge to groundwater. UV is also a good choice for disinfection downstream of the proposed extended aeration activated sludge systems, secondary clarification systems, and tertiary treatment systems, because of the expected high transmissivity of the effluent entering the disinfection system. For these reasons, UV disinfection is the recommended treatment process for disinfection.

There are several types of UV disinfection systems, including: (1) low-pressure, low-intensity, open channel systems; (2) medium-pressure, high-intensity, open-channel systems; (3) low-pressure, high-intensity, open-channel systems; and (4) enclosed vessel systems. For preliminary planning purposes, a UV disinfection system with low-pressure, high intensity lamp banks is used in the facility cost estimates for comparison of discharge alternatives. The system would be sized for treatment of the peak hourly flow in year 2030. To comply with reliability requirements, a minimum of two (2) channels would be required, with one redundant bank in each channel. Alternate UV disinfection system can be evaluated as part of the pre-design process.

2. Additional Liquid Treatment Processes for Discharge to Deep Creek

a. Biological and Chemical Phosphorus Removal

In addition to the above minimum liquid treatment processes, discharge to Deep Creek will require biological and/or chemical phosphorus removal. Phosphorus is a nutrient that promotes algae growth in receiving waters, and thereby contributes to the suppression of dissolved oxygen. Phosphorus removal may only be required on a seasonal basis for discharge to Deep Creek. However, until the Spokane River TMDL study is completed, phosphorus effluent limits for discharge to Deep Creek, even on a seasonal basis, will be unknown.

Biological phosphorus removal is achieved by the "anaerobic conditioning" of wastewater and return activated sludge to promote enhanced biological uptake of phosphorus into cells of microorganisms. The phosphorus is removed from the system by periodically wasting the microorganisms (i.e. pumping waste activated sludge) from the secondary clarification system. The anaerobic conditioning of the wastewater is typically performed upstream of the rest of the activated sludge system in "anaerobic basins", as for an oxidation ditch or a MBR system, or as part of a non-aerated mixing phase, in the case of an SBR.

Chemical phosphorus removal is achieved by adding a metal salt, such as ferric chloride or aluminum sulfate, prior to secondary clarification or tertiary filtration. Once introduced, the metal salt reacts with the alkalinity and phosphate ions in the wastewater to form insoluble precipitates that are removed either in the secondary clarification or tertiary filtration system, depending on the injection location. Biological and chemical phosphorus removal are used in combination in some systems to reduce chemical costs where low phosphorus effluent limits are required.

Biological phosphorus removal can typically achieve low levels of phosphorus in a secondary effluent. The City of Medical Lake primarily uses biological phosphorus removal to achieve 85% removal of its influent phosphorus for its discharge to an intermittent tributary to Deep Creek, and uses a combination of biological and chemical phosphorus removal to achieve an average total phosphorus concentration of 0.5 mg/L or less for its discharge to West Medical Lake.

For preliminary planning purposes, both biological and chemical phosphorus removal systems are included in the facility cost estimate for discharge to Deep Creek. A minimum of three (3) anaerobic basins and a metal salt chemical feed system are included in the estimate. This level of treatment may not be adequate to meet year-round phosphorus effluent limits required as part of the future TMDL study. Therefore, the cost of the phosphorus removal systems included in the cost estimate is estimated to be a minimum cost associated with meeting existing standards only.

b. Biological Nitrogen Removal

Discharge to Deep Creek will also likely require biological nitrogen removal, in addition to the above minimum liquid treatment processes. Since surface water flow through Deep Creek is intermittent at the potential discharge location, the WA DOE may also require that effluent discharged to Deep Creek meet groundwater discharge requirements during the months when surface water flow in the creek ceases. Total nitrogen is one of the regulated contaminants in ground water. The City of Medical Lake is required to achieve an average effluent total nitrogen concentration of 10 mg/L or less for its facility's discharge to an intermittent tributary to Deep Creek.

Biological nitrogen removal is achieved by providing "anoxic" (i.e. without dissolved oxygen) conditions for the growth of microorganisms that convert nitrite-nitrogen and nitrate-nitrogen to nitrogen gas. The nitrogen gas is subsequently removed to the atmosphere. This process is also called "denitrification". A common configuration for biological nitrogen removal is to place "anoxic basins" between the upstream anaerobic basins and the downstream aeration basins. A portion of the activated sludge is recycled internally from the aeration basin to the anoxic basins to continually provide oxidized nitrogen to the anoxic basins for reduction to nitrogen gas. In the case of an SBR, denitrification is achieved through the cycling of mixed aerated and non-aerated phases inside the SBR basins. For preliminary planning purposes, three (3) anoxic basins are included in the facility cost estimate for discharge to Deep Creek.

c. Re-aeration

Re-aeration of the effluent may also be required prior to discharge to Deep Creek. The wastewater may have adequate dissolved oxygen prior to discharge depending on the final treatment system and effluent conveyance system layout. Thus, no additional cost has been included in the cost estimate for re-aeration facilities for this discharge alternative.

3. Additional Liquid Treatment Processes for Discharge to Groundwater

a. Biological Nitrogen Removal

As with discharge to Deep Creek, discharge to ground water will require biological nitrogen removal to meet groundwater discharge standards, and to prevent excessive total nitrogen and nitrate concentrations in groundwater sources for domestic water supplies. Thus, for preliminary planning purposes, three (3) anoxic basins are included in the facility cost estimate for discharge to groundwater. Biological phosphorus removal is not expected to be required for discharge to groundwater.

4. Additional Liquid Treatment Processes for Discharge to Reclaimed Water System

For the City of Airway Heights, a new reclaimed water system is expected to allow the following uses of Class A reclaimed water: landscape irrigation, storage impoundments for landscape irrigation, washing of vehicles or paved surfaces, water features (i.e. a fish pond, meandering stream, fountain, or demonstration wetland), and groundwater recharge by surface percolation. The following expected uses of minimum Class C reclaimed water (if public exposure is limited) or Class A (if there is a potential for public contact) reclaimed water are: aggregate washing, concrete mixing, dust control, and industrial processes.

a. Biological and Chemical Phosphorus Removal

In addition to the minimum liquid treatment processes for secondary treatment, biological phosphorus removal is recommended for discharge of reclaimed water to storage impoundments or water features where algae growth is aesthetically or otherwise undesirable. Phosphorus is a nutrient that promotes algae growth in receiving waters, and algae growth, in turn, suppresses dissolved oxygen, making conditions unfavorable for the growth of other forms of aquatic life. Thus, although biological phosphorus is not a regulatory requirement for discharge to a reclaimed water system, it is highly recommended to ensure the success of some downstream uses where adequate dissolved oxygen concentrations must be maintained, such as a fishpond. It is also recommended in storage facilities where algae growth may increase turbidity levels in the reclaimed water, potentially causing exceedance of acceptable turbidity criteria and re-treatment of the reclaimed water.

Although biological phosphorus removal is expected to be able to achieve the necessary phosphorus reduction, chemical phosphorus removal can be easily implemented in a reclaimed water facility because of the need for coagulation and filtration for Class A reuse. Thus, both biological and chemical phosphorus removal systems, specifically three (3) anaerobic basins and a metal salt chemical feed system, are included in the cost estimate for this discharge alternative.

b. Biological Nitrogen Removal

The largest use of reclaimed water is expected to be groundwater recharge by surface percolation. As with seasonal discharge to Deep Creek and discharge to groundwater, groundwater recharge will require biological nitrogen removal to meet groundwater discharge criteria, and to ensure that the public water system standards for total nitrogen and nitrate concentrations are not exceeded in the groundwater recharge aquifer. Thus, for preliminary planning purposes, three (3) anoxic basins are included in the facility cost estimate for discharge to a reclaimed water system.

c. Coagulation and Filtration

For Class A reclaimed water use, coagulation and filtration will be required beyond secondary treatment for the reduction of turbidity. Coagulation is achieved through the addition of "coagulant", such as a polymer, a metal salt, a polymer with attached metal ions, or a combination thereof, upstream of the filtration system. Typically, an automatic chemical make-up system is required to prepare the coagulant at the proper concentration for dosage, and a mixing apparatus is used to properly mix the coagulant with the secondary effluent.

There are many types of filtration systems that are capable of treating secondary effluent to Class A reclaimed water standards. These systems include: traveling bridge granular-media filters, continuous backwash granular-media filters, deep-bed granular-media filters, cloth-media filters, synthetic-media filters, and membrane filters. Of the approximately ten (10) operational reclaimed water facilities in Washington that are of similar size as the City of Airway Heights (i.e., greater than 0.5 MGD AAF), there are five (5) continuous-backwash (upflow) granular media filters, three (3) traveling bridge granular-media filters, one (1) deep-bed granular-media filter, and one (1) cloth-media filter. For preliminary planning purposes, a traveling bridge granular-media filter is used in the facility cost estimate for discharge to a reclaimed water system. Alternate filtration systems can be evaluated as part of the pre-design process. To comply with reliability requirements, a minimum of three (3) filters are included in the cost estimate, sized so that two of the filters are capable of treating the peak-hourly design flow in year 2030 with one unit not in service.

d. Hypochlorite Feed System

In addition to the minimum liquid treatment processes for secondary treatment and disinfection previously described, Class C reclaimed water use requires a minimum chlorine residual in the reclaimed water distribution system and at the point of use. Thus, a relatively small sodium or calcium hypochlorite feed system is typically used for this purpose. This type of system is also typically used to provide a chlorine residual in the treatment plant internal recycle water to prevent biological growth; however, this "use" is not specifically defined as reclaimed water use.

e. Voluntary Add-on Treatment Processes for Groundwater Recharge

All precautions must be taken to avoid potential health risks related to groundwater recharge operations, particularly when the possibility exists to augment significant portions of potable groundwater supplies. Even when wastewater is treated to Class A reclaimed water criteria, trace quantities of unregulated contaminants may still remain in the effluent. Examples of these unregulated, emerging compounds of concern are: antibiotics, pharmaceuticals, household and industrial waste chemicals, hormones, and other endocrine disruptors. Some of these compounds have been found in receiving waters using new, ultra-low detection methods. Testing protocols for many emerging compounds are still being developed.

Beyond biological treatment and decomposition with extended aeration activated sludge systems, advanced oxidation processes (AOPs) are currently the most effective at destroying difficult to degrade organic compounds, some of which are emerging compounds of concern. AOPs involve the creation of the hydroxyl free radical, through the breakdown of an oxidizer such as ozone or hydrogen peroxide, and the use of the radical as a very strong oxidant to react with reduced organic compounds. AOPs differ from many other advanced treatment processed (i.e., carbon adsorption, stripping, ion exchange, or reverse osmosis) because wastewater compounds are decomposed rather than concentrated or transferred to a different phase, avoiding the need to dispose of or regenerate materials. AOPs cannot be used for disinfection alone, at least not under the current regulatory framework or the current state of the industry. This is because the half-life of the free radicals is extremely short, so achieving the high concentrations required to meet the required combination of contact time and dose is prohibitive.

There are four AOP processes currently being used on a commercial scale. These are the production of the hydroxyl free radical with: (1) Ultraviolet (UV) light and ozone; (2) UV light and hydrogen peroxide; (3) Ozone and hydrogen peroxide; and (4) UV light, hydrogen peroxide, and ozone. Orange County Water District, Water Factory 21, has tested a 5 MGD pilot AOP system that uses UV light and hydrogen peroxide to treat its reverse osmosis effluent for indirect groundwater recharge. The test results have shown that AOP is effective in decomposing low molecular weight organic compounds in the reclaimed water effluent.

AOP is a <u>voluntary</u> add-on process for additional treatment of the reclaimed water beyond what is required by the Washington State Water Reclamation and Reuse Standards. Thus, the cost of a full-scale AOP system is <u>not</u> included in the cost estimate for this discharge alternative. This may be a treatment technology that the City may want to evaluate as a future add-on treatment process for groundwater recharge. As this is a relatively new technology for reclaimed water treatment, a detailed evaluation involving the review of manufacturer testing data and the operational data from existing installations would be required to effectively implement this option. A pilot study may also be required to evaluation the effectiveness of the system on specific contaminants in City's wastewater.

5. Summary of Liquid Treatment Processes for Discharge Alternatives

A summary of the required and recommended liquid treatment components for discharge (and reuse) alternatives from a new wastewater treatment facility is summarized in Table 4-12.

Table 4-12. Summary of Liquid Treatment Processes for Discharge and Reuse Alternatives						
Liquid Treatment Component	**Target Constituent Removed/Added[1]**	**Surface Water Discharge**	**Ground Water Discharge**	**Class A Water Reuse**		**Class C Water Reuse**
Potential Discharges/Uses For Evaluation →		Discharge to Deep Creek (Intermittent Stream)	By Surface Percolation	Groundwater Recharge by Surface Percolation	Landscape Irrigation, Impoundments	Non-Contact Uses
Screening and Grinding	Floatables Total Suspended Solids	X	X	X	X	X
Grit Removal	Grit	X	X	X	X	X
Extended Aeration Activated Sludge	5-Day BOD Ammonia Total Organic Carbon Odor Foaming Agents	X	X	X	X	X
Secondary Clarification	Total Suspended Solids Metals	X	X	X	X	X
Biological or Chemical Phosphorus Removal	Total Phosphorus	X			X	
Biological Nitrogen Removal	Total Nitrogen Nitrate Nitrite	X	X	X		
Coagulation and Filtration[2]	Total Suspended Solids Turbidity Color			X	X	
Disinfection	Fecal Coliform Bacteria Total Coliform Bacteria	X	X	X	X	X
Hypochlorite Feed System	Total Residual Chlorine				X	X
Re-aeration	Dissolved Oxygen	X				
Pretreatment Program	Total Dissolved Solids Radionuclides Priority Pollutants/ Carcinogens Volatile Organic Compounds Synthetic Organic Compounds Metals	X	X	X	X	X

1. Some contaminants may be removed in small quantities in various processes. Only dissolved oxygen and total residual chlorine are expected to be added.

2 = Coagulation and filtration for further reduction in phosphorus levels may be required for future year-round discharge to Deep Creek to meet new phosphorus discharge criteria required as part of the future TMDL study.

X = Required or Recommended

BOD = Biochemical Oxygen Demand

Table 4-12A. Summary of Biological Treatment Processes and Reasons for Elimination from or Selection for Further Consideration		
Biological Process	**Reasons for Elimination from or Selection for Further Consideration**	**Ability to Meet Effluent Criteria Ranking (1=Least Capable) (5=Most Capable)**
Facultative Lagoons	Reasons for Elimination from Selection: 1. They cannot consistently achieve nitrification, 5-Day BOD to less than 40 mg/L, and TSS to less than 100 mg/L. 2. They cannot be easily combined with other advanced biological treatment processes for removal of total phosphorus and nitrogen. 3. They can have high odor emissions that cannot be logistically captured and treated. 4. Algae growth may be detrimental to downstream tertiary filtration performance. 5. Settling is typically inadequate to meet required TSS effluent requirements. 6. The large area required for treatment is not available at the proposed site.	1
Aerated Lagoons W/out Solids Recycle	Reasons for Elimination from Selection: 1. They cannot consistently achieve nitrification, 5-Day BOD to less than 40 mg/L, and TSS to less than 60 mg/L. 2. They cannot be easily combined with other advanced biological treatment processes for removal of total phosphorus and nitrogen. 3. Algae growth may be detrimental to downstream tertiary filtration performance. 4. Settling is typically inadequate to meet required TSS effluent requirements. 5. Basin configuration often allows for incomplete mixing and inadequate treatment performance. 6. The large area required for treatment is not available at the proposed site.	1
High-Purity Oxygen Activated Sludge Systems	Reasons for Elimination from Selection: 1. They cannot achieve nitrification due to CO_2 accumulation in enclosed headspace and associated pH suppression. 2. They cannot consistently achieve 5-Day BOD and TSS to less than 30 mg/L. 3. They are less capable of maintaining treatment efficiency through large variations in flow and loading than extended aeration systems. 4. They cannot be easily combined with other advanced biological treatment processes for removal of total nitrogen due to nitrification limitations. 5. They are not as effective at treating difficult to degrade organic compounds due to lower solids residence times as extended aeration systems. 6. Process requires on-site generation of oxygen, which can be expensive and complex to operate.	2

Table 4-12A. Summary of Biological Treatment Processes and Reasons for Elimination from or Selection for Further Consideration		
Biological Process	**Reasons for Elimination from or Selection for Further Consideration**	**Ability to Meet Effluent Criteria Ranking (1=Least Capable) (5=Most Capable)**
High-Rate Aeration Activated Sludge Systems	Reasons for Elimination from Selection: 1. They cannot consistently achieve nitrification, and produces effluent of lesser quality in terms of 5-Day BOD and TSS than other activated sludge systems. 2. They are less capable of maintaining treatment efficiency through large variations in flow and loading than other activated sludge systems. 3. They cannot be easily combined with other advanced biological treatment processes for removal of total nitrogen due to nitrification limitations. 4. They are not as effective at treating difficult to degrade organic compounds due to lower solids residence times as extended aeration systems.	2
Aerated Lagoons W/Solids Recycle and Clarifiers	Reasons for Elimination from Selection: 1. They cannot consistently achieve nitrification at low temperatures, and 5-Day BOD and TSS to less than 30 mg/L. 2. Algae growth may be detrimental to downstream tertiary filtration performance. 3. Basin configuration often allows for incomplete mixing and inadequate treatment performance. 4. The large area required for treatment is not available at the proposed site.	3
Trickling Filters w/Clarifiers	Reasons for Elimination from Selection: 1. They cannot consistently achieve nitrification at low temperatures, and 5-Day BOD and TSS to less than 30 mg/L. 2. They cannot consistently achieve effluent requirements if treating large variations of flow and loading. 3. They are more complex to operate properly than suspended activated sludge alternatives. 4. They can be combined with other advanced biological treatment processes for removal of total phosphorus and nitrogen, although this is typically more expensive than other alternatives. 5. They can have high odor emissions that may require treatment and additional cost. 6. Sloughing of the biological growth may be detrimental to downstream tertiary filtration performance. 7. The process attracts vectors, such as filter flies and snails, that require additional maintenance. 8. The process should be protected from cold temperatures to maintain adequate treatment efficiency, increasing cost.	3
Rotating Biological Contactors w/Clarifiers	Reasons for Elimination from Selection: 1. They cannot consistently achieve nitrification at low temperatures, and 5-Day BOD and TSS to less than 30 mg/L. 2. They cannot consistently achieve effluent requirements if treating large variations of flow and loading. 3. They can be combined with other advanced biological treatment processes for removal of total phosphorus and nitrogen, although this is typically more expensive than other alternatives. 4. They can have high odor emissions that may require treatment and additional cost. 5. Sloughing of the biological growth may be detrimental to downstream tertiary filtration performance. 6. The process should be protected from cold temperatures to maintain adequate treatment efficiency, increasing cost. 7. Excessive loading and biofilm growth may cause mechanical stresses and failure of the plastic disks and shafts.	3

Table 4-12A. Summary of Biological Treatment Processes and Reasons for Elimination from or Selection for Further Consideration		
Biological Process	**Reasons for Elimination from or Selection for Further Consideration**	**Ability to Meet Effluent Criteria Ranking (1=Least Capable) (5=Most Capable)**
Conventional Activated Sludge Systems[1]	Reasons for Elimination from Selection: 1. They cannot consistently achieve nitrification at low temperatures, and 5-Day BOD and TSS to less than 25 mg/L. 2. They are less capable of maintaining treatment efficiency through large variations in flow and loading than extended aeration systems. 3. They can be easily combined with other advanced biological treatment processes for removal of total phosphorus and total nitrogen though total nitrogen removal is typically not as efficient due to nitrification limitations. 4. They are not as effective at treating difficult to degrade organic compounds due to lower solids residence times as extended aeration systems.	4
Extended Aeration Activated Sludge Systems[2]	Reasons for Selection 1. They can consistently achieve ammonia nitrogen to less than 3 mg/L, and 5-Day BOD and TSS to less than 15 mg/L. 2. They can maintain treatment efficiency through large variations in flow and loading. 3. They are relatively flexible to operate and easy to maintain as compared to some of the attached growth processes. 4. They can be easily combined with other advanced biological treatment processes for removal of total phosphorus to less than 1.0 mg/L and total nitrogen to less than 10 mg/L. 5. They have been shown to have the best success at treating difficult to degrade organic compounds, some of which are emerging compounds of concern, namely pharmaceutically active compounds, household and industrial waste chemicals, hormones, and other endocrine disruptors.	5

1. Includes complete-mix, plug-flow, step-feed, and contact stabilization.
2. Includes extended aeration complete-mix and plug-flow, oxidation ditches, and sequencing batch reactors.

6. Comparison of Treatment Costs for Discharge Alternatives

The specific equipment and processes included in the cost estimates for cost comparison of the discharge alternatives from a new wastewater treatment facility are listed in Table 4-13. Refer to Table 4-12 to see which treatment components are required and recommended for each discharge alternative.

Table 4-14 provides the estimated capital cost of a new wastewater treatment facility that includes the required liquid treatment components and associated equipment listed in Tables 4-12 and 4-13 for the discharge alternatives. Only one capital cost estimate is provided for discharge to a water reclamation system, because this alternative assumes direct use of Class A reclaimed water on a seasonal basis and groundwater recharge with Class A reclaimed water on a year-round basis. Groundwater recharge requires minimum Class A reclaimed water; therefore a Class C reclaimed water treatment system would not be feasible.

The costs for the influent pump station, headwork building (screening and grit removal), secondary clarifiers, sludge pump station, biosolids processing, and operations and laboratory facilities, are the same regardless of the discharge location. Yard piping, electrical, instrumentation and control, and site work (preparation, grading, roads, sidewalks, fencing, landscaping) are required at any site chosen and are estimated as a percentage of the various treatment item construction costs.

For the Deep Creek discharge alternative, the distribution system contract amount includes the cost of the discharge and outfall pipe and associated easements from Site Alternative No. 4 to Deep Creek. For the reclaimed water system discharge alternative, the distribution system contract includes the cost of the reclaimed water distribution system shown in Figure 4-6, Reclaimed Water and Sewer Forcemain Routing for Site Alternative No. 4.

The capital cost for discharge to Deep Creek is based on current regulatory discharge criteria that do not require filtration or coagulation. However, coagulation and filtration may be required for this discharge alternative in the future based on the outcome of the TMDL study on the Spokane River and its tributaries. If coagulation and filtration are required for future discharges to Deep Creek, the estimated capital cost for this alternative would increase by approximately $4 million.

The capital cost for discharge to groundwater is based on meeting background groundwater quality criteria through additional treatment on the surface of infiltration basins and within the soil underneath, without first providing tertiary treatment (unlike groundwater recharge). The amount of land necessary to provide the required "in-soil" treatment levels and adequate buffering from existing domestic supply wells may be significantly greater than what is included in the cost estimate. In addition, this discharge alternative is not expected to be possible at Site Alternative No. 4 due to the proximity of the City's existing groundwater supply wells to the proposed infiltration basins.

Table 4-13. Treatment Equipment Used in Cost Estimates for Discharge Alternatives			
Treatment Component	**Equipment or Process Used in Cost Estimates**	**No. of Units**	**Description**
Influent Pump Station	Self-Priming Pumps	3	• Three (3) self-priming, non-clog type pumps each at 1,350 GPM • Sized for peak hourly flow with one pump out of service
Screening	In-Channel Fine Screen	1	• 60" diameter drum • 2 mm opening size • Sized for peak hourly flow
Grit Removal	Vortex-Type Grit Chamber	1	• Includes grit pump, washer, conveyor • 10' diameter • Sized for peak hourly flow
Biological Phosphorus Removal	Anaerobic Basins	3	• Three basins each at 0.165 MG • Each with a 10-HP mixer • Influent distribution box
Biological Nitrogen Removal	Anoxic Basins	3	• Each at 0.23 MG • Each with a 15-HP mixer • Influent distribution box
Extended Aeration Activated Sludge	Oxidation Ditches	3	• Three basins each at 0.75 MG • Each with two (2) 75-HP vertical turbine aerators • Two (2) internal recirculation pumps each at 4,200 GPM • 1.54 MG short-term membrane-lined storage basin • Influent distribution box
Secondary Clarification	Circular Clarifiers	3	• Two in parallel at 60 feet in diameter • One in series at 75 feet in diameter • Three (3) WAS pumps each at 300 GPM • Four (4) RAS pumps each at 1,200 GPM • One (1) scum pump at 50 GPM • Influent distribution box
Coagulation	Liquid and/or Dry Polymer and Alum Feed Systems	1	• Automatic coagulant make-up system with storage and make-up tanks and a minimum of two (2) chemical feed pumps • Automatic liquid alum or polyaluminum chloride feed system with storage tanks and minimum of (2) chemical feed pumps
Filtration	Traveling Bridge Filters	3	• Three (3) filters each with a filtration area of 350 sq.ft. • Sized to treat the peak hourly flow with one unit out of service • Three (3) submersible filter feed pumps each at 1,350 GPM
Disinfection	Ultraviolet Disinfection System	1	• Low pressure, high intensity lamp banks (number varies with discharge alternative) • Two (2) channels each with one standby bank in each channel
Hypochlorite Feed System	Hypochlorite Feed System	1	• Automatic sodium or calcium hypochlorite feed system with a minimum of two (2) chemical feed pumps
Discharge Facilities	Infiltration Basins & Reclaimed Water Distribution	6	• Six (6) infiltration basins each at 100,000 sq.ft. • Five (5) groundwater monitoring wells • Two (2) reclaimed water pumps each at 900 GPM • 1.54 MG membrane-lined and covered RW equalization basin
Sludge Processing[2]	Dewatering, Hauling Off-Site by Private Contractor	1	• One (1) 37,000 gallon WAS storage tank and aeration system • One (1) 2-meter belt filter press (BFP) • One (1) polymer feed system • Two (2) BFP feed pumps each at 300 GPM • One (1) 40-foot long sludge conveyor

2 Refer to Subsection F, Evaluation of Biosolids Management Alternatives.

Table 4-14. Estimated Treatment Facility Capital Cost for Discharge Alternatives				
	Discharge Alternative →	Discharge to Deep Creek	Discharge to Groundwater	Discharge to Reclaimed Water System
Item		Estimated Cost ($)	Estimated Cost ($)	Estimated Cost ($)
1	Influent Pump Station	249,000	249,000	249,000
2	Headworks Building	500,000	500,000	500,000
3	Biological Treatment System	3,900,000	3,332,000[6]	3,900,000
4	Secondary Clarifiers	1,308,000	1,308,000	1,308,000
5	Sludge Pump Station	566,000	566,000	566,000
6	Coagulation and Filtration	0[7]	0	1,609,000
7	Disinfection[8]	312,000	456,000	576,000
8	Sludge Processing	1,122,000	1,122,000	1,122,000
9	Discharge Facilities	96,000[9]	380,000[10]	602,000[11]
10	Yard Piping (20%)[1]	1,625,000	1,583,000	2,086,000
11	Electrical (12%)[1]	975,000	950,000	1,252,000
12	Instrumentation and Control (8%)[1]	650,000	633,000	835,000
13	Operations and Laboratory	660,000	660,000	660,000
14	Site Rehabilitation (5%)[2]	602,000	587,000	763,000
15	Contractor Overhead & Profit (8%)[3]	1,011,000	986,000	1,282,000
16A	Treatment Contract Amount	13,646,000	13,312,000	17,310,000
16B	Distribution Contract Amount	1,728,000[12]	0	1,695,000[13]
17	State Sales Tax (8.4 %)	1,291,000	1,118,000	1,596,000
18	Total Construction Contract Cost	16,665,000	14,430,000	20,601,000
19	Engineering – Design (10%)[4]	1,667,000	1,443,000	2,060,000
20	Engineering – Construction (12%)[4]	2,000,000	1,732,000	2,472,000
21	Administrative (3%)[4]	500,000	433,000	618,000
22	Land Acquisition	310,000	310,000[14]	310,000
23	Contingency (20%)[5]	4,228,000	3,670,000	5,212,000
Estimated Project Capital Cost		**25,370,000**	**22,018,000**	**31,273,000**

1. As a percentage of the construction cost of the treatment facilities.
2. As a percentage of the construction cost of all the facilities at the treatment facility.
3. As a percentage of the total construction cost.
4. As a percentage of the total construction contract cost.
5. As a percentage of the total project costs (above).
6. Assumes no biological phosphorus removal.
7. Coagulation and filtration may be required for this discharge option in the future based on the outcome of the Spokane River TMDL study.
8. Cost and level of disinfection depend on discharge alternative.
9. Includes cost of reclaimed water pump station. Excludes cost of effluent infiltration, monitoring, and equalization facilities.
10. Includes cost of effluent infiltration and monitoring facilities. Excludes cost of reclaimed water pump station and equalization facilities.
11. Includes the cost of effluent infiltration, monitoring, equalization, and pumping facilities.
12. For the Deep Creek discharge transmission line and outfall from Site Alternative No. 4.
13. Includes the cost of the entire reclaimed water distribution system shown in Figure 4-6, Reclaimed Water and Sewer Forcemain Routing for Site Alternative No. 4.
14. Land requirements may be significantly greater to provide additional "in-soil" treatment and greater buffering from existing domestic supply wells due to lower level of treatment than Class A reclamation. This option is not likely possible at the proposed treatment facility site (Site Alternative No. 4) due to these constraints.

Table 4-15 includes the comparison of total treatment and distribution costs for the discharge alternatives from a new treatment facility, including treatment system operation and maintenance costs, distribution power and maintenance costs, and potential revenues from the (direct use) seasonal distribution of reclaimed water and the (indirect use) recovery and distribution of the reclaimed water from the City's groundwater supply wells. The total costs are calculated based on flows and loading for the projected first-year of operation (year 2010), the tenth-year of operation (year 2020), and the twentieth-year of operation (year 2030).

In general, the information in Table 4-15 illustrates the following: (1) The total treatment and distribution system costs for discharge to a reclaimed water system (with groundwater recharge) are estimated to be higher than for discharge to Deep Creek or groundwater; (2) When potential reclaimed water revenues are subtracted from the total treatment and distribution costs, the total costs for the reclaimed water system discharge alternative is estimated to be less than the total costs for discharge to Deep Creek before the projected tenth-year of operation (year 2020); and (3) Discharge to groundwater is estimated to be the least costly alternative within the projected twenty-year planning period (years 2010 to 2030) even when projected reclaimed water revenues are considered. However, the cost for this discharge alternative does not include potential costs associated with: (1) Providing additional land for "in-soil" treatment and buffering; and (2) Developing water resources to satisfy the City's future water system demand. These costs could make discharge to groundwater more costly than discharge to a reclaimed water system within the projected twenty-year planning period.

Discharge to a water reclamation system with direct use of reclaimed water on a seasonal basis and groundwater recharge on a year-round basis is proposed for a new City of Airway Heights wastewater treatment facility because this alternative: (1) Provides for the City's future water system demand; (2) Conserves the City's existing potable water supply; (3) Provides potential for the development of public parks and recreational uses dependent on water availability; (4) Provides potential for public education in areas related to water conservation and reclamation; and (5) Encourages economic development by providing utility services necessary for future growth.

The discharge to groundwater or to Deep Creek without reclamation is not proposed for this project because of the City's limited water supply resources. The City intends to reclaim as much of the water rights for the treated effluent recharged to groundwater as possible.

Table 4-15. Estimated Total Costs for Discharge Alternatives from New Treatment Facility			
Discharge Alternative →	**Discharge to Deep Creek**	**Discharge to Groundwater**	**Discharge to Reclaimed Water System**
Item	**Estimated Cost ($)**	**Estimated Cost ($)**	**Estimated Cost ($)**
First-Year (Year 2010) Costs			
Estimated Total First-Year Treatment and Distribution Costs			
Estimated Operation & Maintenance Costs	595,000	580,000	612,000
Present Worth of Operation and Maintenance Costs (20 Years @ 5%)	7,416,000	7,229,000	7,627,000
Estimated Treatment and Distribution Capital Cost	25,370,000	22,018,000	31,273,000
Total First-Year Treatment and Distribution Cost (2004 Dollars)	**32,786,000**	**29,247,000**	**38,900,000**
Potential First-Year Revenues			
Seasonal Distribution of Reclaimed Water	0	0	163,000
Water Recovered From Supply Wells	0	0	201,000
Subtotal of Potential First-Year Revenues	0	0	364,000
Present Worth of First-Year Revenues (20 Years @ 5%) (2004 Dollars)	**0**	**0**	**4,536,000**
First-Year Costs Minus Potential Revenues (2004 Dollars)	**32,786,000**	**29,247,000**	**34,364,000**
Tenth-Year (Year 2020) Costs			
Estimated Total Tenth-Year Treatment and Distribution Costs			
Estimated Operation & Maintenance Costs	690,000	674,000	706,000
Present Worth of Operation and Maintenance Costs (20 Years @ 5%)	8,599,000	8,400,000	8,798,000
Estimated Treatment and Distribution Capital Cost	25,370,000	22,018,000	31,273,000
Total Tenth-Year Treatment and Distribution Costs (2004 Dollars)	**33,969,000**	**30,418,000**	**40,071,000**
Potential Tenth-Year Revenues			
Seasonal Distribution of Reclaimed Water	0	0	163,000
Water Recovered From Supply Wells	0	0	340,000
Subtotal of Potential Tenth-Year Revenues	0	0	503,000
Present Worth of Tenth-Year Revenues (20 Years @ 5%) (2004 Dollars)	**0**	**0**	**6,268,000**
Tenth-Year Costs Minus Potential Revenues (2004 Dollars)	**33,969,000**	**30,418,000**	**33,803,000**
Twenty-Year (Year 2030) Costs			
Estimated Total Twenty-Year Treatment and Distribution Costs			
Estimated Operation & Maintenance Costs	734,000	715,000	747,000
Present Worth of Operation and Maintenance Costs (20 Years @ 5%)	9,147,000	8,910,000	9,309,000
Estimated Treatment and Distribution Capital Cost	25,370,000	22,018,000	31,273,000
Total Twenty-Year Treatment and Distribution Costs (2004 Dollars)	**34,517,000**	**30,928,000**	**40,582,000**
Potential Twenty-Year Revenues			
Seasonal Distribution of Reclaimed Water	0	0	163,000
Water Recovered From Supply Wells	0	0	405,000
Subtotal of Potential Twenty-Year Revenues	0	0	568,000
Present Worth of Twenty-Year Revenues (20 Years @ 5%) (2004 Dollars)	**0**	**0**	**7,079,000**
Twenty-Year Costs Minus Potential Revenues (2004 Dollars)	**34,517,000**	**30,928,000**	**33,503,000**

F. Evaluation of Biosolids Management Alternatives for New Treatment Facility

The solids produced and removed from the biological treatment system and treated for beneficial use are referred to as "biosolids". Sludge treatment to produce biosolids must meet specific regulations depending on the disposal method. The level of treatment determines the class of biosolids. Disposal methods for "Class A" biosolids may include placement on landscaping and crops intended for human consumption. Class A biosolids must employ specific treatments to meet the quality requirements for this use. The composting system at the City of Cheney produces Class A biosolids, whereas the City of Medical Lake contracts for off-site composting to meet Class A biosolids standards. These Class A biosolids are marketed as a soil amendment for crops and landscaping. "Class B" biosolids are treated to a lesser degree than Class A biosolids. Class B biosolids are suitable for use on crops that are processed prior to consumption. The Spokane Riverside Park Water Reclamation Facility produces Class B biosolids for application on farmlands that produce grain crops.

1. Biosolids Management Criteria

The City of Airway Heights will be required to obtain a "Biosolids Permit," which will be regulated by the WA DOE under WAC 173-308, Biosolids Management. WAC 173-308 was signed into law on March 31, 1998. The biosolids must also meet the criteria of the 40 CFR Part 503, Standards for the Use or Disposal of Sewage Sludge. WAC 173-308 is based on the 40 CFR Part 503 Regulations. The biosolids regulations require that the biosolids be treated to meet requirements in three areas. These are pathogen reduction, vector attraction reduction and pollutant limits.

a. Pathogen Reduction

Pathogens are disease-causing organisms, such as certain bacteria, viruses and parasites. The 40 CFR Part 503 Regulations and WAC 173-308-170 have outlined two levels of pathogen reduction that determine the restrictions on use of the final product. These two levels are defined as Class A and Class B.

<u>Class A Pathogen Reduction Standards</u>

Biosolids that have been treated to Class A pathogen reduction standards can be distributed to the general public with some restrictions. Materials meeting this class of treatment are regularly marketed and sold. Class A biosolids must meet one of the following criteria at the time of use, disposal, or sale:

(1) A fecal coliform density of less than 1,000 most probable number (MPN) per gram of total dry biosolids; and
(2) A Salmonella sp. bacteria density of less than 3 MPN per four grams of total dry biosolids.

The regulations have outlined six alternatives that can be used to treat the solids to Class A pathogen reduction standards that include meeting specific treatment requirements related to:

(1) Time and temperature;
(2) pH and temperature;
(3) Process monitoring as a substitute for monitoring of enteric viruses and viable helminth ova (pathogenic organisms) if the process, under strictly held parameters, is proven to reduce pathogens to non-detectable levels;
(4) Monitoring for enteric viruses and viable helminth ova after to treatment;
(5) Procedures to Further Reduce Pathogens (PFRPs) as listed in the regulations;
(6) PFRPs as approved by the WA DOE;

The seven processes that are listed in the regulations as PFRPs including the following:

(1) Composting;
(2) Heat drying;
(3) Heat treatment;
(4) Thermophilic aerobic digestion;
(5) Beta ray irradiation;
(6) Gamma ray irradiation; and
(7) Pasteurization.

A more detailed summary of the pathogen reduction requirements for Class A Biosolids is included in Table 4-16, Summary of Class A Pathogen Reduction Requirements.

Class B Pathogen Reduction Standards

Biosolids can be treated to a lesser degree of pathogen reduction and meet the Class B standard. Biosolids of this quality are restricted in how they can be land applied. Typically, this class of biosolids is applied to agricultural lands with restricted access to the public and use of the crops. The regulations provide three alternatives for meeting the Class B requirement. The first alternative specifies a minimum level of pathogen removal based on sampling for fecal coliform levels. The second alternative specifies five defined treatment processes to significantly reduce pathogens (PSRP) that have been approved for meeting the minimum level of pathogen removal specified for the first alternative. The defined treatment processes include:

(1) Aerobic digestion;
(2) Air drying;
(3) Anaerobic digestion;
(4) Composting; and
(5) Lime stabilization;

The third alternative requires that the biosolids be treated in a process that provides an equivalent level of pathogen reduction as the above five PSRPs as approved by WA DOE. A summary of the pathogen reduction requirements for Class B Biosolids is included in Table 4-17.

Table 4-16. Summary of Class A Pathogen Reduction Requirements		
Pathogen Reduction Alternatives		**Description**
1.	Thermal Treatment	This alternative requires biosolids to be heated under specific time and temperature conditions depending on the dewatered solids content and consistency. This alternative has high initial and ongoing costs.
2.	High pH - High Temperature	• Elevate the pH to more than 12 for more than 72 hours. • Maintain the Temperature above 52°C (126°F) for at least 12 hours during the period that the pH is greater than 12. • Air dry to over 50% solids after the 72-hour period of elevated pH. The elevation of pH requires working with and handling potentially dangerous chemicals such as lime or caustic.
3.	Other Processes, Requiring Demonstration of Pathogen Reduction	This alternative allows process monitoring as a substitute for monitoring of enteric viruses and viable helminth ova (pathogens) if the process, under strictly held parameters, is proven to reduce pathogens to non-detectable levels.
4.	Monitoring of Pathogens	This alternative requires monitoring of enteric viruses and viable helminth ova after treatment. Helminth ova monitoring takes four weeks for results, causing operations and storage difficulties.
5.	Process to Further Reduce Pathogens (PFRP)	There are seven ***Processes to Further Reduce Pathogens*** (PFRP's). These are listed below.
		<u>Composting.</u> Using within-vessel or static aerated pile composting, the temperature of the biosolids must be maintained at a minimum of 55°C for a minimum of three days. Using the windrow composting method, the temperature of the biosolids must be maintained at 55°C or higher for fifteen days or longer. During the period when the compost is maintained at 55°C or higher, there must be a minimum of five turnings of the windrow. Aerated static pile composting has been successful in the region at the City of Cheney, WA and the City of Coeur d'Alene, ID, but it can be expensive. <u>Heat Drying</u>. Biosolids are dried by direct or indirect contact with hot gases to reduce the moisture content to 10% or less. Either the temperature of the biosolids particles or the wet bulb temperature of the gas in contact with the biosolids must exceed 80°C. This alternative has high energy and equipment costs and potential for odors. <u>Heat Treatment</u>. Liquid biosolids must be heated to 180°C or higher for 30 minutes. This alternative has high energy and equipment costs and potential for odors. <u>Thermophillic Aerobic Digestion</u>. Liquid biosolids are agitated with air or oxygen to maintain aerobic conditions for a minimum mean cell residence time of 10 days at 55°C to 60°C. Supplemental heat is required, and initial costs are high for this alternative. This alternative has potential for odors. <u>Beta Ray Irradiation</u>. Biosolids are irradiated with beta rays at doses of at least 1.0 megarad at room temperature (20°C). The costs of this alternative are unknown, and there are no known installations in the Northwest. <u>Gamma Ray Irradiation</u>. Biosolids are irradiated with gamma at room temperature (20°C). . The costs of this alternative are unknown, and it is not recommended due to the impracticality of implementation and operation. <u>Pasteurization</u>. The temperature of the biosolids is maintained at 70°C or higher for 30 minutes or longer. The resulting product cannot be stored readily. End product is at most 35% solids.
6.	Process Equivalent To A PFRP	The permitting authority has responsibility for determining if a process is to be considered as equivalent to a PFRP

Table 4-17. Summary of Class B Pathogen Reduction Requirements		
Pathogen Reduction Alternatives		Description
1.	Monitoring of indicator organisms.	Fecal coliforms geometric mean density of samples must be less than 2 million colony-forming units (CFU) or most probable number (MPN) per gram of biosolids (dry-weight basis). A risk if the samples do not meet the limits, then the sludge cannot be applied, and storage is a problem
2.	Process to Significantly Reduce Pathogens (PSRP).	There are five ***Processes to Significantly Reduce Pathogens*** (PSRP's). These are listed below.
		<u>Aerobic digestion</u>. Biosolids are activated with air or oxygen to maintain aerobic conditions for a specified mean cell residence time at a specific temperature. Values for the mean cell residence time and temperature must be between forty days at 20°C and sixty days at 15°C. Experience in this area has shown that the specified temperature cannot be reliably maintained for much of the year. Volume for aerobic digestion must include 5 to 6 months of storage volume. There is a high potential for odors, especially during seasonal transition periods. <u>Air Drying</u>. Air drying is accomplished with drying beds, paved or unpaved, with a minimum drying time of 3 months. During two of the three months, the ambient average daily temperature must be above 0°C, which may not happen in the winter. The beds must be covered, and drying bed area must accommodate up to five full months of biosolids production. Loading thickened biosolids on the drying beds to no more than six inches deep has prevented odors from becoming a problem at some facilities in Eastern Washington, but occasional odor episodes may still a risk. <u>Anaerobic digestion</u>. This process treats biosolids in the absence of air for a specific mean cell residence time at a specific temperature. Values for the mean cell residence time and temperature must be between fifteen days at 35 to 55°C and sixty days at 20°C. <u>Composting</u>. Using the within-vessel, static aerated pile, or windrow composting methods, the temperature of the biosolids must be raised to 40°C or higher and remain at 40°C or higher for five days. For four hours during the five days, the temperature in the compost pile must exceed 55°C. This alternative is similar to the composting option for achieving Class A pathogen reduction requirements However, the time and temperature requirements are not as high, so that Class B biosolids composting requires slightly less space and energy than Class A biosolids composting. <u>Lime Stabilization.</u> Sufficient lime is added to the biosolids to raise the pH of the biosolids to 12 after 2 hours of contact. Lime-stabilization facilities typically have a very difficult time achieving the pH requirement without the addition of unwieldy amounts of lime. Final biosolids containing lime is not a particularly marketable product.
3.	Biosolids treated in a process equivalent to a PSRP	This alternative requires that the biosolids be treated in a process that is equivalent to a PSRP, as determined by the permitting authority. Demonstration of equivalency rests with the biosolids generator.

b. Vector Attraction Reduction

The pathogens in biosolids pose a disease risk when they are brought into contact with humans or other susceptible hosts, plants, or animals. Vectors, including flies, mosquitoes, fleas, rodents, and birds, can transmit pathogens to humans and other hosts physically through contact or biologically by playing a specific role in the life cycle of the pathogen. Reducing the attractiveness of biosolids to vectors reduces the potential for transmitting diseases from pathogens in biosolids.

WAC 173-308-180 contains six vector attraction reduction alternative criteria that the biosolids must meet for the application of biosolids to land, with additional requirements based on the type of application site or intended use of the biosolids. These additional requirements will vary depending on if the biosolids are:

(1) Applied in bulk to agricultural land;
(2) Applied in bulk to forestland;
(3) Applied in bulk to a public contact site;
(4) Applied in bulk to land reclamation (i.e., strip mines and construction) sites;
(5) Applied in bulk to a lawn or home garden;
(6) Sold or given away; or
(7) Applied as intermediate or final cover for a landfill.

The requirements are designed to either reduce the appeal of the biosolids to vectors or prevent vectors from coming in contact with the biosolids. The vector attraction reduction requirements are summarized in Table 4-18 below.

Table 4-18. Vector Attraction Reduction Requirements	
Vector Attraction Reduction Requirements For Biosolids Applied to Land.	
1.	Volatile Solids Reduction for Aerobic or Anaerobic Digestion. The mass of volatile solids in the biosolids must be reduced by a minimum of thirty-eight percent. Many of the pathogen reduction alternatives may reduce volatile solids content to some extent, but reaching 38 percent reduction is not guaranteed. It is especially difficult with extended aeration processes because the biosolids may already be partially stabilized.
1A.	Volatile Solids Reduction for Anaerobic Digestion. If the volatile solids reduction in alternative no. 1 above cannot be achieved, vector attraction reduction can be demonstrated by further digesting a portion of the anaerobically digested biosolids for specified time and temperature and achieving a further volatile solids reduction of 17 percent. This alternative is for class B biosolids produced from anaerobic digestion.
1B.	Volatile Solids Reduction for Aerobic Digestion. If the volatile solids reduction in alternative no. 1 above cannot be achieved, vector attraction reduction can be demonstrated by further digesting a portion of the aerobically digested biosolids with a solids content of 2% or less for specified time and temperature and achieving a further volatile solids reduction of 15 percent. This alternative is for class B biosolids produced from aerobic digestion.
2.	Specific Oxygen Uptake Rate Aerobic Digestion. The specific oxygen uptake rate for biosolids treated in an aerobic process must be less than or equal to 1.5 milligrams of oxygen per hour per gram of total solids (dry weight basis) at a temperature of 20°C. The oxygen uptake rate option applies principally to aerobically digested sludge that cannot meet the 38% volatile solids reduction (option 1 above), with extended aeration plants, for example.
3.	Aerobic Processes. For aerobic processes such as composting, the temperature must be greater than 40°C for 14 days or longer. The temperature and time requirements can be met with aerated composting, in-vessel composting and windrow composting. This option is considered to be the first choice for meeting vector attraction reduction requirements in composting operations, because pathogen reduction and vector attraction reduction requirements can be met in a single process.
4.	Alkaline Stabilization. The pH of the biosolids must be raised to twelve or higher by alkali addition and, without the addition of more alkali, must remain at twelve or higher for two hours and then at 11.5 or higher for an additional twenty-two hours. This alternative is appropriate for a facility using the High pH-High Temperature (Alternative No. 2) for Class A pathogen reduction, or for a facility using the Lime Stabilization alternative for class B pathogen reduction.
5.	Dry Stabilized Solids to 75% Solids. This alternative applies when the biosolids do not contain primary sludge, as will be the case for the proposed City of Airway Heights facility. Drying beds are the most cost efficient way to accomplish this level of drying, but other drying methods are available if drying beds are not an option. Rotary dryers are a type of mechanical dryer used for facilities of similar size as the one proposed for the City of Airway Heights, for example. However, mechanical drying requires large amount of energy and is typically expensive to operate.
6.	Dry Stabilized Solids to 90% Solids. Drying to 90% solids applies to biosolids that may contain primary sludge. This will not be the case for the City of Airway Heights.
Additional Vector Attraction Reduction Requirements For Bulk Biosolids Applied to Agricultural Lands	
7.	Injection. Class B biosolids must be injected beneath the soil surface so that no significant amount of biosolids may be present on the land surface within one hour after injection. When the biosolids are Class A for pathogens, the biosolids must be injected below the land surface within eight hours after being discharged from the pathogen treatment process.
8.	Incorporation. Class B biosolids must be incorporated into the soil within 6 hours of application to land. When biosolids that are incorporated into the soil are Class A with respect to pathogens, the biosolids must be applied to the land within eight hours after being discharged from the pathogen treatment process. These last two options reduce vector attraction by preventing vectors from coming into contact with the biosolids. These options are difficult to implement in the wintertime, and cannot be used for "bagged" quantities of biosolids that are distributed to the general public.

c. Pollutant Limits

The regulations establish limits on ceiling concentrations, cumulative pollutant loading rates, alternate (exceptional quality) pollutant concentrations, and annual loading rates of nine (9) heavy metals for biosolids applied to land. These limits are required to protect are summarized in Table 4-19, Pollutant Limits for Land Application of Biosolids.

The "ceiling concentration limits" are the maximum allowable concentrations of the various metals in biosolids applied to land. Biosolids with metals concentrations higher than the allowable ceiling concentration limits are considered to be solid waste, and may not be applied to land.

The "cumulative loading rates" are the maximum allowable quantity of the various metals that can be applied to a specific area of land. These rates are used to determine application site life, which is the number of years that biosolids with a uniform metal content can be applied to a specific site before the cumulative pollutant loading rates would be exceeded.

The "alternate concentration limits" are lower concentration limits that, when achieved, exempts the application of the biosolids from the cumulative and annual loading rate limits, as wells as, from certain record-keeping, reporting, and labeling requirements.

The "annual loading rates" are the maximum allowable annual quantities of the various metals that can be applied to a specific area of land when the biosolids exceed the alternate concentration limits and are sold or given away for land application.

Table 4-19. Pollutant Limits for Land Application of Biosolids

Parameter	Ceiling Concentration Limits[B] (mg/kg)	Cumulative Loading Rates[C] (kg/ha)	Alternate Concentration Limits[D] (mg/kg)	Annual Loading Rates[C] (kg/ha/yr)
Arsenic	75	41	41	2.0
Cadmium	85	39	39	1.9
Copper	4,300	1,500	1,500	75
Lead	840	300	300	15
Mercury	57	17	17	0.85
Molybdenum[A]	75	-	-	-
Nickel	420	420	420	21
Selenium	100	100	100	5.0
Zinc	7,500	2,800	2,800	140

A From 40CFR Part 530 Regulations.
B Cannot land apply biosolids if metal concentrations exceed these limits.
C Applicable if metals concentration is between "ceiling" and "alternate concentration limits.
D Cumulative and annual loadings are not applicable if metals concentrations are less than listed values.

Table 4-20, Monitoring Requirements for Land Application of Biosolids, lists the parameters that are required to be monitored for land application of biosolids. The nitrogen, phosphorus and potassium content of the biosolids are monitored to ensure that the biosolids are applied at agronomic rates, and do not degrade groundwater quality. There is no cumulative limit for these constituents, but WAC 173-308-190 states that the annual ability of the land to use the nutrients in the solids should not be exceeded unless approved by WA DOE in a site-specific application plan. The frequency of sampling is determined by the annual quantity of biosolids produced based on dry weight.

Table 4-20. Monitoring Requirements for Land Application of Biosolids

Parameter	Unit
Arsenic	mg/kg dry weight
Cadmium	mg/kg dry weight
Copper	mg/kg dry weight
Lead	mg/kg dry weight
Mercury	mg/kg dry weight
Molybdenum	mg/kg dry weight
Nickel	mg/kg dry weight
Selenium	mg/kg dry weight
Zinc	mg/kg dry weight
Total nitrogen	Percent dry weight
Nitrate nitrogen	Percent dry weight
Ammonia nitrogen	Percent dry weight
Phosphorus	Percent dry weight
Potassium	Percent dry weight
pH	Standard units
Total solids	Percent
Volatile solids	Percent
PCBs[A]	µg/kg

[A] PCBs include PCB-1016, -1221, -1232, -1242, -1248, -1254, and -1260.

2. Biosolids Production Projections

In the activated sludge process for treatment of wastewater, microorganisms consume waste as an energy source and reproduce, causing an increase in the biomass. The microorganisms are thus able to maintain a healthy population within the reactor basin. Excess activated sludge is produced, which must be wasted to maintain an optimum concentration of microorganisms. Wasting excess microorganisms results in “Waste Activated Sludge” or WAS. This becomes the sludge, or “biosolids” (after treatment) that must be disposed of properly.

Sludge production projections have been made to determine sludge handling and treatment facilities sizing needs at design production levels. These projections were used for preliminary screening of alternatives. Though there are numerous biosolids treatment, processing, and disposal alternatives, only three (3) alternatives were identified in the scope of work for this Facilities Plan. These alternatives are:

(1) Production of a Class A biosolids with composting;
(2) Production of a Class B biosolids with agricultural land disposal; and
(3) Off-site treatment and disposal of biosolids.

These alternatives were chosen for a preliminary analysis to estimate sludge processing costs because these alternatives are utilized at other wastewater treatment facilities in Spokane and neighboring counties and have been found to be the least expensive options for sludge treatment and disposal.

The sludge production projections are summarized in Table 4-21, based on flow and loading projections presented in Table 3-4, Wastewater Flow and Loading Projections for the City of Airway Heights.

Table 4-21. Sludge Production Projections for the City of Airway Heights

	Year			
	2010	**2030**	**2010**	**2030**
Waste Activated Sludge[1]	Dry Solids		Wet Solids	
Annual Average Production, PPD	782	2,055	4,890	12,850
Annual Average Production, TPY	143	375	900	2,350
Maximum Month Production, PPD	2,104	4,007	13,150	25,050
Maximum Month Production, TPM	32	60	200	380

1. Sludge production estimates are for waste activated sludge from an extended aeration activated sludge process. It is assumed that dewatered screenings and grit are disposed off-site separately from the biosolids. These preliminary estimates do not include additional solids due to coagulant addition prior to filtration or polymer addition prior to dewatering.
PPD = Pounds Per Day
TPY = Tons Per Year
TPM = Tons Per Month

3. Production of Class A Biosolids with Composting

Aerated static pile composting is the most common type of composting method implemented in the United States. It has been estimated that approximately one-half of all composting facilities use aerated static pile, with the remainder split between windrow and in-vessel facilities (*WEF Manual of Practice*, 1998). Since the City of Airway Heights is comprised of relatively developed urban and residential areas where odors and particulate emissions may be of concern, an aerated static pile type facility is preferred over windrow-type composting. The aerated static pile facility has a relatively smaller footprint that can be placed inside a building allowing better control of air emissions. The windrow-type composting facility requires larger sized areas and therefore is typically located outdoors. The windrows also require periodic turning which tends to generate significant amounts of dust and odors. In-vessel type composting facilities tend to have higher capital costs and maintenance costs than the other composting alternatives for facilities of similar size to the one proposed for the City of Airway Heights, and therefore are not considered further.

The City of Cheney uses the aerated static pile method to produce Class A biosolids that are sold in bulk to the public or private landscaping contractors. The City of Cheney currently charges approximately $12.50 per cubic yard sold. Income from selling the compost does not pay for the cost of processing the biosolids but helps offset a small portion of the operating costs.

Aerated static pile composting consists of an aeration grid of piping, cattle slats, or perforated polyethylene blocks, which are placed beneath a compost pile. Blowing air through the bottom of the pile provides oxygen for microbial decomposition of the biosolids, reduces the moisture content of the biosolids, and removes heat generated by microbial activity. The pile is not turned (as with windrow type composting), but is left alone until the time and temperature regulatory requirements are met for adequate pathogen and vector attraction reduction. For aerated static pile composting, the temperature of the biosolids must be maintained for a minimum of 55 degrees Celsius for a minimum of three days to meet the pathogen reduction requirements for Class A biosolids. In addition, the temperature of the biosolids must remain above 40 degrees Celsius with an average temperature of the biosolids higher than 45 degrees Celsius for an additional two weeks to meet vector attraction reduction requirements. A typical residence time for the biosolids in the aerated static piles is three weeks.

To ensure that adequate biological decomposition and stabilization of the biosolids occurs, the porosity, carbon-to-nitrogen ratio, moisture content, temperature, airflow, pH, and detention time of each static pile is monitored. A bulking agent, such as hog fuel or wood chips, is added to the compost to maintain air spaces in the static pile so that adequate oxygen can reach the pile microorganisms. An amendment, such as shredded yard waste, is often added to increase the carbon-to-nitrogen ratio of the compost to reduce the emissions of ammonia. The bulking agent and amendment are screened prior to mixing with the biosolids to ensure a specific porosity in the static pile. The compost is screened after the composting process to recycle a portion of the bulking agent back into the process.

This alternative would require the following for processing the biosolids:

(1) An 87,000-gallon, aerated, waste activated sludge (WAS) storage tank;
(2) A 2-meter belt filter press and associated feed pumps and polymer feed system;
(3) A conveyor for conveying the dewatered sludge from the belt filter press to the composting area;
(4) A 28,000-square foot composting building with space for aerated static piles;
(5) A batch-type compost mixer for mixing the dewatered sludge, bulking agent, and amendment;
(6) A front-end loader for loading the bulking agent and amendment into the compost mixer and building the static piles;
(7) An aeration system for the static piles; and
(8) A live bottom feed hopper, conveyor, and rotary trommel screen for screening the compost and separating the bulking agent from the finished compost.

4. Production of Class B Biosolids with Agricultural Land Application

Application of Class B biosolids to agricultural land application is the predominant method of sludge disposal in the United States, and is currently practiced by the City of Sandpoint, Idaho; the Hayden Area Regional Sewer Board; the City of Pullman, Washington; and the City of Spokane, Washington. To be applied to agricultural land, Class B biosolids must meet requirements for pathogen reduction (for Class B biosolids), vector attraction reduction, pollutant (heavy metals) limits, and site restrictions (for Class B biosolids). The biosolids must also be applied at agronomic rates.

A land application site for Class B biosolids is subject to more site restrictions than for Class A biosolids, due to the greater potential for pathogens in the biosolids. Specifically, the required period between biosolids application and crop harvest is greater, and public access is restricted. A summary of the site restrictions for Class B biosolids from WAC 173-308-210 is presented in Table 4-22, Summary of Land Application Restrictions For Class B Biosolids.

The City of Airway Heights may have difficulty finding available agricultural land that can meet all the applicable site restriction requirements listed in Table 4-22. However, the City of Spokane currently applies its anaerobic digested sludge on various agricultural sites throughout Spokane County, Stevens County, and Lincoln County. The City of Spokane also has procedures in place for the record-keeping, permitting, and management of its various application sites. Thus, the City of Spokane may be willing to allow Class B biosolids from the City of Airway Heights to be land applied at one of its land application sites under the City of Spokane's general biosolids permit on a contract basis. The City of Spokane has previously charged other cities approximately $15 per cubic yard of Class B biosolids for this service.

For preliminary estimating purposes, the City of Airway Heights would need access to approximately 70 acres per year initially and 180 acres per year in 2030 for land application of its biosolids at one or multiple application sites. This estimate is based on a minimum nitrogen uptake of 200 lb/acre/year for a typical forage crop such as alfalfa. The City does not need to own this land, but each site will be required to be monitored under its own or the City's biosolids permit, and record keeping and proper documentation would be needed to show that the site access restrictions are being followed.

There are many options for producing Class B biosolids as seen from Table 4-17, Summary of Class B Pathogen Reduction Requirements. Based on studies performed for similar sized projects in the Inland Northwest region (*Biosolids Alternatives Analysis for the City of Colville*, Esvelt Environmental Engineering (EEE), 1999; *City of Post Fall Sludge Management Plan*, EEE, 1998, and *Facilities Plan for the Liberty Lake Wastewater Treatment Facility*, Century West Engineering Company and EEE, 1999), the following alternatives are selected for evaluation for producing Class B biosolids for the City of Airway Heights:

(a) Thickening, Storage, and Dewatering Prior to Land Incorporation;
(b) Thickening Prior to Land Application via Subsurface Injection;
(c) Thickening and Air Drying on Drying Beds Prior to Land Incorporation; and
(d) Dewatering and Air Drying on Drying Beds Prior to Land Incorporation.

Table 4-22. Summary of Land Application Restrictions for Class B Biosolids.
Food crops with Harvested Parts That Touch the Biosolids / Soil Mixture If the harvested parts of these foods are totally above the land surface, they shall not be harvested for 14 months after the biosolids application.
Food crops with Harvested Parts Below the Land Surface These crops shall not be harvested for 20 months after application of biosolids when the biosolids remain on the land surface for 4 months or longer prior to incorporation into the soil. When biosolids are incorporated into the soil in less than 4 months, the crops must not be harvested for 38 months after biosolids application.
Food Parts with Harvested Parts That Do Not Touch the Biosolids/Soil Mixture, Feed Crops, and Fiber Crops (forests and grain fall into this category) These crops shall not be harvested for 30 days after application of biosolids.
Animal Grazing Animals shall not be grazed on the land for 30 days after biosolids application.
Turf Growing Turf grown on land where class B biosolids are applied shall not be harvested for 1 year after application of biosolids when the turf is placed on either land with a high potential for public exposure or lawn, unless otherwise specified by the permitting authority.
Public Access Public access to land with a high potential for public exposure shall be restricted for 1 year after application of the biosolids. Public access to land that has a low potential for public exposure shall be restricted for 30 days after application of biosolids.
Signage During the time when access is restricted, signs must be posted around the application site at all significant points of access, and otherwise around the perimeter so that they can be noticed by a reasonably observant person.
Setbacks Biosolids may not be applied within 100 feet of a well unless otherwise approved in a permit. Biosolids may not be applied to land that is ten meters or less from surface waters of the state, unless otherwise approved by the Department of Ecology. Biosolids may not be applied to the land if they enter a wetland, waters of the state, or likely to adversely affect a threatened or endangered species or its critical habitat.

These alternatives are selected because of lower capital, operation, maintenance, and replacement costs; long-term viability and reliability of the production processes; ability to consistently achieve product quality; and feasibility of implementation and operation.

a. Thickening, Storage, and Dewatering Prior to Land Incorporation

This alternative would require the following for processing the biosolids:

(1) An 87,000-gallon, aerated, WAS storage tank for storage of the solids at ~1% solids prior to thickening approximately twice per week at start-up and up to four times per week at design capacity.
(2) A 2- meter belt filter press with an attachment that allows the machine to also be used as a gravity belt thickener and associated feed pumps and polymer feed system. The sludge is thickened to 4%-5% for long-term (seasonal) storage to reduce tank volume requirements.
(3) A 900,000-gallon aerated thickened sludge storage tank for storage of the biosolids (for up to six months) through the winter when land incorporation is not possible. The belt filter press, with the gravity belt attachment removed, would be used to dewater the thickened sludge before it is trucked away to be land applied. Dewatering with a belt filter press to 15% to 16% dry solids serves to further reduce sludge volume and make it easier to handle.
(4) A conveyor for conveying the dewatered biosolids from the belt filter press to the sludge hauling truck.
(5) A 15-cubic yard truck for hauling and spreading the dewatered biosolids at the application site three-times per week (in the summer) at start-up and daily (in the summer) at design.

This alternative is not considered a process to significantly reduce pathogens (PSRP). The aerated thickened sludge storage tank is not specifically designed to meet the aerobic digester time and temperature requirements outlined in the regulations, because the temperatures cannot be reliably maintained throughout the year in cold climates. However, the class B pathogen criteria can be met year-round in cold climates, if the sludge is thickened to 4%-5%, and aerobic conditions are maintained throughout a solids retention time of upwards of 50 days. Class B pathogen reduction criteria can then be demonstrated by monitoring of indicator organisms (fecal coliform, salmonella, enteric viruses, and viable helminth ova). To meet vector attraction reduction requirements, the owner or manager of the land application site is typically responsible for incorporating the biosolids in the soil (typically with a tractor) within six hours of spreading.

b. Thickening Prior to Land Application via Subsurface Injection

This alternative would require the following for processing the biosolids:

(1) An 87,000-gallon, aerated, WAS storage tank;
(2) A 2-meter gravity belt thickener and associated feed pumps and polymer feed system;
(3) A 900,000-gallon aerated thickened sludge storage tank; and
(4) A 4,000-gallon sludge injector truck for daily hauling to the application site.

This alternative is similar to alternative 'a', except that instead of a belt filter press with an attachment that allows it to thicken, a traditional gravity belt thickener would be used to bring the sludge to a solids content of 4-5%. As above, a new aerated thickened sludge storage tank would be required, with a volume of about 900,000 gallons for winter storage of the biosolids. Disposal would be by land application, but with sludge injection equipment instead of spreading equipment. This type of equipment consists of a tanker truck with an injector attachment. The attachment consists of several nozzles that are dragged behind the truck, submerged in the soil. The sludge is liquid enough that it can be injected into the soil through the mechanism. Pathogen reduction and vector attraction requirements are met as in alternative 'a'.

c. Thickening and Air Drying on Drying Beds Prior to Land Incorporation

This alternative would require the following for processing the biosolids:

(1) An 87,000-gallon, aerated, WAS storage tank;
(2) A 2-meter gravity belt thickener and associated feed pumps and polymer feed system;
(3) A 600,000-gallon aerated thickened sludge storage tank;
(4) 300,000-square feet of concrete drying beds and associated sludge distribution system;
(5) A front-end loader for loading the hauling and spreading truck; and
(6) A 12-cubic yard truck for hauling and spreading the dried biosolids once per week at start-up and twice per week at design (in warm weather months).

This alternative is similar to alternative 'a', except that the thickened sludge is placed on drying beds to meet pathogen reduction and vector attraction reduction requirements. The thickened sludge is stored for approximately four months during the winter and placed on the drying beds for the remaining eight months of the year. Class B pathogen reduction requirements are met with a minimum drying bed retention time of three months. Two of the three months must have an ambient average daily temperature above 0°C. This also allows the vector attraction reduction requirements to be met by resulting in sludge that is greater than 75% dry solids. The preliminary sizing of the drying beds is based on a sludge depth of approximately 6 inches. This sludge depth has been shown to reduce the production of objectionable odors.

d. Dewatering and Air Drying on Drying Beds Prior to Land Incorporation

This alternative would require the following for processing the biosolids:

(1) An 87,000-gallon, aerated, WAS storage tank;
(2) A 2-meter belt filter press and associated feed pumps and polymer feed system;
(3) A conveyor for conveying the dewatered sludge from the belt filter press to an area where the sludge can be picked up with a front-end loader;
(4) 150,000-square feet of concrete drying beds;
(5) A front-end loader for spreading the dewatered sludge on the drying beds and loading the hauling truck; and
(6) A 10-cubic yard truck for hauling and spreading the dried biosolids once per week at start-up and twice per week at design (in warm weather months).

This alternative is similar to alternative ‘c’, except that a belt filter press, in lieu of a gravity belt thickener, would be used to dewater the sludge to 15% to 16% total solids. The drying bed area is therefore smaller than alternative ‘c’ because of the lower water content of the sludge. Dewatered sludge is applied year-round to the drying beds, so that an aerated thickened sludge storage tank is not required. Drying times would be the same as in alternative ‘c’ to meet pathogen reduction and vector reduction requirements.

5. Off-Site Treatment and Disposal of Biosolids

Several cities in this region are contracting with private a company to take wastewater treatment plant sludge and compost it off-site. The cities of Post Falls, Lewiston, and Moscow in Idaho, and the cities of Clarkston and Medical Lake in Washington are all disposing of sludge in this manner. The viability of this alternative can change over time because of the reliance on the private company to continue to operate. EKO systems in Lewiston, Idaho, and Missoula, Montana is the company that is currently serving these municipalities. These cities have negotiated 1 to 5 year contracts with EKO Systems with clauses for renewal and termination of the agreement. There is a risk to these cities that EKO Systems could stop participating, but the cost savings for them have offset this risk.

The City of Medical Lake currently pays approximately $68 per wet ton of biosolids removed from its facility. Because the City of Airway Heights is within 9 miles of the City of Medical Lake, this unit price is assumed for the cost comparison of this alternative with the other biosolids management alternatives.

Presently, the cities are providing sludge that is wasted directly from the secondary clarifiers and then dewatered on a belt filter press. No additional on-site treatment of the sludge occurs beyond dewatering. This alternative would require the following for processing the sludge:

(1) An 87,000-gallon, aerated, WAS storage tank;
(2) A 2-meter belt filter press and associated feed pumps and polymer feed system; and
(3) A conveyor for conveying the dewatered sludge from the belt filter press to the sludge hauling truck.

The sludge hauling truck is typically provided by EKO Systems, and therefore is not included in the list of required equipment.

Another alternative for off-site treatment and disposal may be to haul dewatered sludge to the City of Cheney WWTRF to be composted via aerated static pile composting with the City of Cheney’s sludge. This option would require expanding the City of Cheney’s existing composting building capacity and providing an unloading/loading area for the City of Airway Heights sludge. The additional capital, operation, and maintenance costs would most likely be incorporated into the cost per ton of biosolids processing fee that the City of Cheney would charge to the City of Airway Heights. Additional savings may result from an economy of scale by having one larger composting facility instead of separate facilities, particularly if the City of Medical Lake also participates by hauling its sludge to the City of Cheney’s facility. Additional negotiations between all interested parties would be required in order to develop costs for this alternative.

Hauling the City of Airway Heights sludge to Cheney's composting facility for off-site treatment and reuse is a feasible alternative that is worth considering in earnest because:

(1) It would provide a reliable and long-term solution for biosolids processing for several cities in the region;
(2) The City of Cheney's facility is located in a relatively undeveloped area and therefore issues related to odor and particulate emissions are minimized;
(3) The City of Cheney's facility has ample space for significant expansion of its composting facility;
(4) The City of Cheney's facility reliably produces a Class A biosolids product that can be given away, sold, and even used by the municipalities for their own landscaping purposes; and
(5) It would keep funds used for biosolids treatment in Spokane County.

In addition, issues related to having access to adequate biosolids application land in the future do not apply to this alternative, unlike for a Class B biosolids product.

6. Comparison of Costs for Biosolids Management Alternatives

A comparison of the capital and operating costs for the various biosolids management alternatives are summarized in Table 4-23. The annual cost per dry ton of biosolids for each alternative is also presented. The capital cost is amortized based on a 20-year project design life and a discount rate of 5%. The operation and maintenance costs are based the projected quantity of biosolids generated for start-up year 2010. Alternative No. 1, dewatering and hauling off-site for treatment, is estimated to be the least cost alternative based on capital cost as well as total cost per dry ton, and is the proposed biosolids management alternative for a new City of Airway Heights wastewater treatment facility.

Table 4-23. Comparison of Costs for Biosolids Management Alternatives

No.	Item	Description	Alternative No. 1	Alternative No. 2A	Alternative No. 2B	Alternative No. 2C	Alternative No. 2D	Alternative No. 3
		Pathogen Reduction Class→	No Pathogen Reduction	Production of Class B Biosolids with Agricultural Land Application				Class A Biosolids
		Description→	Dewatering, Off-Site Disposal	Thickening, Storage, Dewatering, Spreading	Thickening, Storage, Injection	Thickening, Storage, Drying, Spreading	Dewatering, Drying, Spreading	Dewatering and Composting
			Estimated Cost ($)	Estimated Cost ($)	Estimated Cost ($)	Estimated Cost ($)	Estimated Cost ($)	Estimated Cost ($)
Construction Cost								
1A	WAS Storage	WAS Storage Tank	70,000	70,000	70,000	70,000	70,000	70,000
		Aeration System	30,000	30,000	30,000	30,000	30,000	30,000
1B	Thickening	BFP Thickener Attachment	N/A	40,000	N/A	N/A	N/A	N/A
		Gravity Belt Thickener	N/A	N/A	150,000	150,000	N/A	N/A
		Thickened Sludge Pumps	N/A	40,000	40,000	40,000	N/A	N/A
		Polymer Feed System	N/A	N/A	50,000	50,000	N/A	N/A
1C	Thickened Sludge Storage	Thickened Sludge Tank	N/A	720,000	720,000	480,000	N/A	N/A
		Aeration System	N/A	180,000	180,000	120,000	N/A	N/A
		Blower Building - 20' x 20'	N/A	40,000	40,000	40,000	N/A	N/A
1D	Dewatering	Building - 100' x 40'	400,000	400,000	N/A	N/A	400,000	400,000
		Belt Filter Press	240,000	240,000	N/A	N/A	240,000	240,000
		Sludge Conveyor	70,000	70,000	N/A	N/A	70,000	280,000
		Sludge Feed Pumps, VFD	50,000	50,000	N/A	N/A	50,000	50,000
		Polymer Feed System	50,000	50,000	N/A	N/A	50,000	50,000
1E	Drying	Drying Beds	N/A	N/A	N/A	2,400,000	1,200,000	N/A
		Front-End Loader	N/A	N/A	N/A	120,000	120,000	120,000
1F	Land Application	Hauling/Spreading Truck	N/A	200,000	N/A	200,000	200,000	N/A
		Tank/Injection Truck	N/A	N/A	210,000	N/A	N/A	N/A
1G	Composting	Composting Building	N/A	N/A	N/A	N/A	N/A	1,400,000
		Compost Mixer	N/A	N/A	N/A	N/A	N/A	100,000
		Aeration System	N/A	N/A	N/A	N/A	N/A	40,000
		Hopper	N/A	N/A	N/A	N/A	N/A	100,000
		Trommel Screen	N/A	N/A	N/A	N/A	N/A	170,000
		Installation, Accessories	88,000	140,000	90,000	78,000	88,000	212,000
	Subtotal		998,000	2,270,000	1,580,000	3,778,000	2,518,000	3,262,000

Table 4-23. Comparison of Costs for Biosolids Management Alternatives								
		Alternatives →	**Alternative No. 1**	**Alternative No. 2A**	**Alternative No. 2B**	**Alternative No. 2C**	**Alternative No. 2D**	**Alternative No. 3**
2	Support Systems							
	Yard Piping	20% of Facilities Cost	200,000	454,000	316,000	756,000	504,000	652,000
	Electrical	12% of Facilities Cost	120,000	272,000	190,000	453,000	302,000	391,000
	Instrumentation & Control	6% of Facilities Cost	60,000	136,000	95,000	227,000	151,000	196,000
	Site Rehabilitation	5% of Facilities Cost	50,000	114,000	79,000	189,000	126,000	163,000
	Subtotal		430,000	976,000	680,000	1,625,000	1,083,000	1,402,000
3	Overhead & Profit	8% of Construction Cost	80,000	182,000	126,000	302,000	201,000	261,000
4	Estimated Contract Amount		1,508,000	3,428,000	2,386,000	5,705,000	3,802,000	4,925,000
5	State Sales Tax	8.4%	122,000	278,000	193,000	462,000	308,000	399,000
	Total Estimated Construction Contract Cost		1,630,000	3,706,000	2,579,000	6,167,000	4,110,000	5,324,000
Engineering and Administrative Costs								
	Engineering	Design	163,000	371,000	258,000	617,000	411,000	532,000
	Engineering	Construction	179,000	408,000	284,000	678,000	452,000	586,000
	Administrative	Project	49,000	111,000	77,000	185,000	123,000	160,000
	Estimated Engineering and Administrative Costs		342,000	779,000	542,000	1,295,000	863,000	1,118,000
Land Acquisition Costs								
	Land Acquisition	Building and Pavement	4,000	8,000	8,000	32,000	20,000	12,000
Estimated Capital Cost For Alternatives			**1,976,000**	**4,493,000**	**3,129,000**	**7,494,000**	**4,993,000**	**6,454,000**
Amortized Capital Cost (20 years at 5%)			**159,000**	**361,000**	**252,000**	**602,000**	**401,000**	**518,000**
Operation and Maintenance Costs								
1	Labor	Lead Operator III	5,000	7,500	6,000	7,500	7,500	10,000
		Operator II	4,500	6,800	5,400	6,750	5,400	9,000
		Lab Technician	4,000	4,000	4,000	4,000	4,000	5,000
		Truck Driver	N/A	14,000	28,000	7,000	7,000	N/A
2	Power	KWH	2,500	5,000	4,500	3,750	2,500	3,750
3	Chemicals	Polymer	5,800	7,200	3,000	3,000	5,800	5,800
4	Bulking Agent	Hog Fuel	N/A	N/A	N/A	N/A	N/A	6,400
5	Maintenance	2% of Equipment	8,800	14,000	9,000	7,800	8,800	21,200
6	Sludge Disposal	Tons WS Per Year	61,200	N/A	N/A	N/A	N/A	N/A
7	Laboratory Supplies	Budget	500	500	500	500	500	500
8	Vehicles	Fuel, Maint., Replacement	N/A	5,000	10,000	2,500	2,500	N/A
9	Taxes & Insurance	Budget	2,000	4,000	3,000	8,000	5,000	7,000
10	Professional & Admin.	Budget	1,500	4,500	4,500	4,500	4,500	2,250
Estimated Operation & Maintenance Cost For Alternatives			**95,800**	**72,500**	**77,900**	**55,300**	**53,500**	**70,900**
Estimated Total Cost Per Year (2010)			**254,800**	**433,500**	**329,900**	**657,300**	**454,500**	**588,900**
Estimated Total Cost Per Ton Dry Solids (2010)			**1,790**	**3,040**	**2,310**	**4,600**	**3,180**	**4,120**

G. Evaluation of Final Discharge Alternatives

The discharge alternatives recommended for further evaluation and ranking are: (1) Continued Discharge to the City of Spokane Riverside Park Water Reclamation Facility (RPWRF); (2) Discharge to the City of Medical Lake WWT&RF; and (3) Construction of a City of Airway Heights Wastewater Treatment, Reclamation, and Recharge Facility (WTRRF).

1. Comparison of Project Costs for Discharge Alternatives

a. Discharge to the Spokane RPWRF Versus Discharge to New Treatment Facility

The projected annual costs of continued discharge to the City of Spokane RPWRF are compared with the estimated annual costs associated with the City of Airway Heights constructing and operating its own WTRRF in Figures 4-7 and 4-8. Figure 4-7 shows the projected City of Airway Heights treatment and additional collection system costs associated with a new WTRRF excluding potential reclaimed water revenues from the direct distribution of reclaimed water or the recharge and recovery of groundwater from the new facility. The cost projections in Figure 4-7 also do not include the capital costs associated with the reclaimed water distribution system. Figure 4-8 shows the projected City of Airway Heights treatment, additional collection, and reclaimed water distribution system costs associated with a new WTRRF, including potential revenues associated with the direct distribution of reclaimed water and the recharge and recovery of groundwater water from new facility.

The City of Airway Heights is currently charged for sewer service by the City of Spokane based on the ratio of the City of Airway Heights annual average flow to the overall City of Spokane treatment and collection system flows in year 2001, the year the interlocal agreement between the two entities was updated. This ratio is multiplied by actual, eligible costs for operation and maintenance, and capital improvement expenditures in the treatment and collection systems each year to determine the next year's assessment. The City of Airway Heights is also charged for each new connection added to the system.

The operating costs for continued discharge to Spokane are calculated based on the 2004 Airway Heights Monthly Service Charge Calculation provided by the City of Spokane. The City of Airway Heights annual portion of treatment and collection system operating costs are projected by multiplying the 2004 Spokane Wastewater Budget with the ratio of the City of Airway Heights projected annual flow each year to the City of Spokane treatment system flow in year 2001(~38 MGD), and adjusting the annual cost by a general cost inflation factor of 3%. The regional collection lift station operating costs are allocated based on the ratio of the City of Airway Heights annual average flow to the total lift station flow. The regional collection system maintenance costs are allocated based on the ratio of City of Airway Heights flows to the rest of the flows through the regional collection system. In 2004, the City of Airway Heights paid $294,750 for the treatment and collection of approximately 0.45 MGD. This equates to a cost per volume factor of approximately $1,750 per MG. This factor is multiplied with the projected City of Airway Heights wastewater flows each year from Table 3-2 and adjusted by a general cost inflation factor of 3%.

The collection system and storm water project capital costs for continued discharge to Spokane are also calculated based on the 2004 Airway Heights Monthly Service Charge Calculation. The City of Airway Heights annual portion of these capital costs are projected by multiplying the budgeted 6-year collection system and storm water CIP eligible costs (divided by 6 years) with the ratio of the City of Airway Heights projected annual flow each year to the City of Spokane treatment system flow in year 2001(~38 MGD), and adjusting the annual cost by a general cost inflation factor of 3%. In 2004, the City of Airway Heights paid $113,804 for collection system and storm water CIP eligible costs for its wastewater flow of 0.45 MGD. This equates to a cost per volume factor of approximately $693 per MG. This factor is multiplied with the projected City of Airway Heights wastewater flows for six years from 2005 to 2010, and adjusted by a general cost inflation factor of 3%.

As previously discussed, the City of Spokane is currently in the process of implementing an estimated $250 million dollar (in 2001 dollars) treatment system capital improvement program (CIP) at its RPWRF to meet the discharge requirements in its existing NPDES permit and repair and maintain its existing facilities. Although the original CIP program outlined in the City of Spokane 1999 Facilities Plan was intended to occur over six years from 2003 through 2008, the program is expected to require additional improvements (i.e., digester repair) and take longer to complete that originally proposed. Therefore, for comparison purposes, the 2001 updated estimated cost for the treatment system CIP is converted to 2004 dollars, assuming a general cost inflation rate of 3%, and then amortized over 20 years at an interest rate of 3%, assuming all the funds are secured by 2004 and paid back over the next 20 years. This equates to an annual debt service payment for the City of Spokane of approximately $18,362,000, and a cost per volume factor of approximately $1,325 per MG. This factor is multiplied with the projected City of Airway Heights wastewater flows for twenty years from 2005 (the initial debt service payment) to 2024, to project the costs associated with implementing the existing CIP.

Although the ramifications of the WA DOE TMDL study on the Spokane River are highly uncertain, it is expected that the study will recommend more stringent effluent standards for the City of Spokane treatment system, and that the City of Airway Heights will be charged a portion of the additional costs associated with meeting these additional requirements. For order-of-magnitude comparison purposes, $800 million (2004 dollars) is used as an approximation of the cost to either construct treatment facilities capable of meeting the TMDL-based effluent standards or remove the City of Spokane treatment system discharge from the Spokane River for all or part of each year. The 1999 City of Spokane Wastewater Facilities Plan estimated that this would require a capital improvement program in the range of $600 million to $1.1 billion.

To project the costs associated with implementing a future TMDL-based CIP, the cost of the $800 million CIP is amortized over 20 years at an interest rate of 3%, assuming all the funds are secured by 2008 (for initial implementation) and paid back over the next 20 years. This equates to an annual debt service payment for the City of Spokane of approximately $60,521,000, and a cost per volume factor of approximately $4,368 per MG. This factor is multiplied with the projected City of Airway Heights wastewater flows for twenty years from 2005 (the initial debt service payment) to 2024 to determine the annual cost to the City of Airway Heights. The total annual costs associated with implementing the existing and TMDL-based CIPs are projected by adding together the cost of both programs for each year.

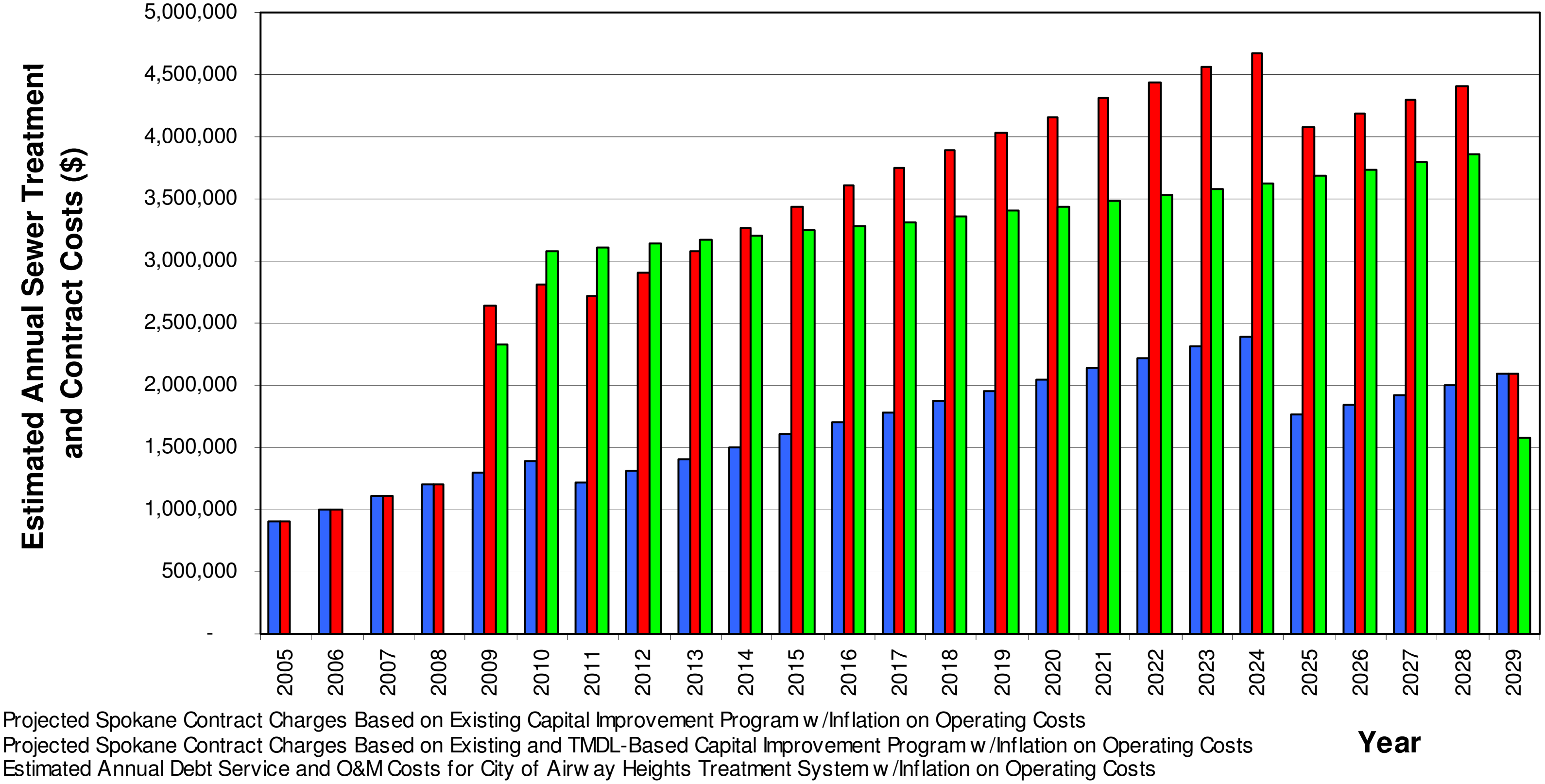
The operation and maintenance costs for a new City of Airway Heights WTRRF in year 2010 are estimated to be approximately $600,000 for treatment and $27,000 for additional collection system costs, in 2004 dollars. To project the yearly operation and maintenance costs shown in Figure 4-7, these costs are converted to 2010 dollars based on a general cost inflation rate of 3% and then projected over the next 20 years based on a yearly 1% supplies and utility services growth rate and 3% general cost inflation rate.

The capital cost for a new City of Airway Heights WTRRF is estimated to be approximately $28,518,000 for treatment and $2,301,000 for additional collection system improvements required at start-up. To project the annual cost of capital debt service shown in Figure 4-7, these costs are converted to 2008 dollars, the expected project implementation year, and then amortized over the next 20 years (2009 to 2028), based on an annual interest rate of 3%.

The yearly operation and maintenance costs for the reclaimed water distribution system are estimated to be approximately $12,000, in 2004 dollars. The yearly potential revenues from direct distribution of reclaimed water are estimated to be $163,000, in 2004 dollars. These costs assume no growth in the direct use of reclaimed water during the planning period. The potential revenues from water recovered from supply wells (due to the recharge of reclaimed water) are estimated to increase in proportion to the projected annual City of Airway Heights wastewater flow minus the quantity sold for direct reuse. In year 2010, this amount is estimated to be approximately $201,000 (in 2004 dollars). To project the yearly operation and maintenance costs in Figure 4-8, these costs are converted to 2010 dollars, projected over the next 20 years based on a 3% general cost inflation rate (and yearly wastewater flow increases for recharged and recovered groundwater), and then subtracted from the treatment and additional collection system operation and maintenance costs for each year.

The capital cost for a reclaimed water distribution system is estimated to be approximately $2,823,000. To project the annual cost of capital debt service shown in Figure 4-8, this cost is converted to 2008 dollars, amortized over the next 20 years (2009 to 2028), based on an annual interest rate of 3%, and then added to the yearly capital debt service costs for the treatment and additional collection system improvements.

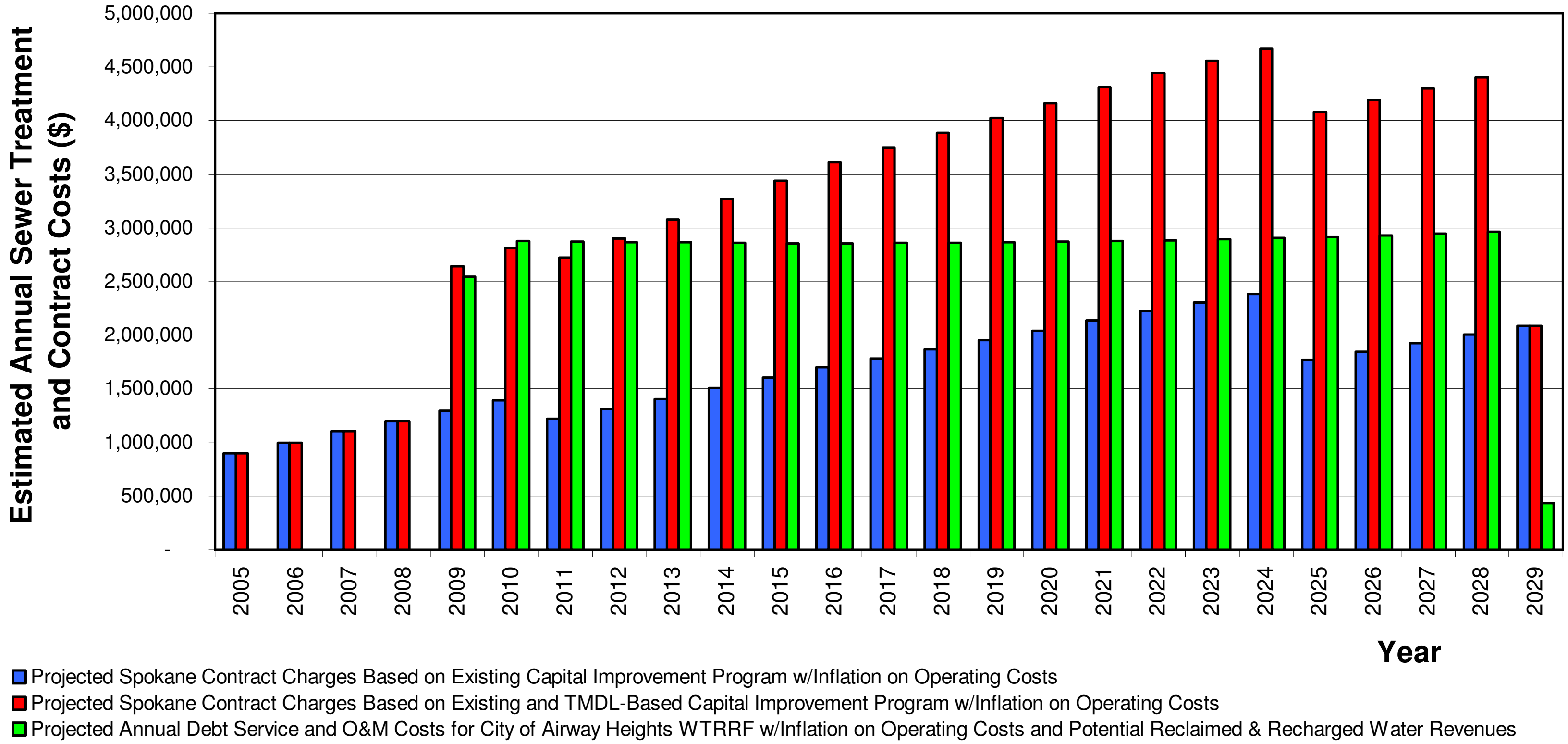
Figure 4-7. Projected Annual Costs for City of Spokane Sewer Contract and New City of Airway Heights Treatment Facility Without Potential Reclaimed Water Revenues



Footnotes:

1. All debt service interest rates are assumed at 3% for 20 years.
2. Projected City of Spokane contract charges are based on an estimated existing $250 million treatment system CIP and new $800 million treatment system CIP required for meeting new TMDL requirements for discharge to the Spokane River. The amount charged to the City of Airway Heights is allocated based on City of Airway Heights annual average flow for each year.
3. A 3% inflation rate is applied to the projected City of Spokane annual operating budget contract charges.
4. A 3% inflation rate is applied to the $250 million CIP program costs from 2001 (the date of the updated Spokane Facilities Plan estimate) to 2004 (the estimated loan initiation year).
5. A 3% inflation rate is applied to the $800 million CIP program costs from 2004 to 2008 (the estimated loan initiation year).
6. A 3% inflation rate is applied to the City of Airway Heights treatment annual operation and maintenance costs and to the capital cost from 2004 to 2008 (the estimated loan initiation year).

Figure 4-8. Projected Annual Costs for City of Spokane Sewer Contract and New City of Airway Heights Treatment Facility Including Potential Reclaimed Water Revenues



Footnotes:

1. All debt service interest rates are assumed at 3% for 20 years.
2. Estimated City of Spokane contract charges are based on an estimated existing $250 million treatment system CIP and new $800 million treatment system CIP required for meeting new TMDL requirements for discharge to the Spokane River. The amount charged to the City of Airway Heights is allocated based on City of Airway Heights annual average flow for each year.
3. A 3% inflation rate is applied to the estimated City of Spokane annual operating budget contract charges.
4. A 3% inflation rate is applied to the $250 million CIP program costs from 2001 (the date of the updated Spokane Facilities Plan estimate) to 2004 (the estimated loan initiation year).
5. A 3% inflation rate is applied to the $800 million CIP program costs from 2004 to 2008 (the estimated loan initiation year).
6. A 3% inflation rate is applied to the City of Airway Heights treatment annual operation and maintenance costs and to the capital cost from 2004 to 2008 (the estimated loan initiation year).
7. Revenues for direct use of reclaimed water assume 94 MG sold (based on existing commercial users) at the 2004 commercial water rate of $1.73 per 1,000 gallons with prices increased at an inflation rate of 3%.
8. Revenues for recharged and recovered reclaimed water assume the reclaimed water is recovered for sale at the 2004 commercial water rate of $1.73 per 1,000 gallons with prices increased at an inflation rate of 3%.

Table 4-24 provides the present worth of the estimated annual sewer costs shown in Figures 4-7 and 4-8.

Table 4-24. Present Worth of Projected Costs for City of Spokane Sewer Contract and New City of Airway Heights Treatment Facility

Discharge Alternative	Present Worth of Total Costs For Years 2009-2029 (2004 Dollars)[5]
City of Spokane RPWRF with $250 Million Existing Capital Improvement Program (CIP)[1]	$23,947,000
City of Spokane RPWRF with Existing $250 Million CIP and $800 Million TMDL-based CIP[1,2]	$49,385,000
City of Airway Heights WTRRF Without Potential Reclaimed Water Revenues[3]	$44,617,000
City of Airway Heights WTRRF With Potential Reclaimed Water Revenues[3,4]	$38,015,000

1. Debt service interest rates for the City of Spokane CIPs are assumed at 3% for 20 years. A 3% inflation rate is applied to the City of Airway Heights' portion of the City of Spokane annual operating budget contract charges. A 3% inflation rate is applied to the existing $250 million CIP program costs from 2001 (the date of the updated Spokane Facilities Plan cost estimate) to 2004 (the estimated loan initiation year).
2. A 3% inflation rate is applied to the $800 million CIP program costs from 2004 to 2008 (the estimated loan initiation year).
3. Debt service interest rates for the City of Airway Heights WTRRF capital cost are assumed at 3% for 20 years. A 3% inflation rate is applied to the City of Airway Heights treatment annual operation and maintenance costs and to the capital cost from 2004 to 2008 (the estimated loan initiation year).
4. A 3% inflation rate is applied to potential revenues for reclaimed water.
5. A 3% discount interest rate is applied to the annual costs shown in Figures 4-7 and 4-8 to arrive at the present worth values for year 2004.

b. Discharge to Medical Lake WWTRF Versus Discharge to New Treatment Facility

Discharge to the Medical Lake WWTRF is estimated to require the installation of approximately 10.3 miles of sewer forcemain and four lift stations for transmission of the City of Airway Heights wastewater to the Medical Lake WWT&RF. In addition, the Medical Lake facility would need to be expanded beyond its existing 1.04 MGD AAF capacity to accommodate the additional projected 1.54 MGD City of Airway Heights wastewater flow. The Medical Lake facility expansion would be designed to treat the additional wastewater to Class A Reclaimed Water Standards for seasonal discharge to West Medical Lake or to the City of Airway Heights reclaimed water distribution system, and to the effluent standards required for discharge to the intermittent tributary to Deep Creek. Discharge facilities for the transmission of reclaimed water to the City of Airway Heights or to West Medical Lake would also likely be required for this alternative.

Upgrade in the treatment capacity of the Medical Lake facility would require most of the treatment components of a new City of Airway Heights treatment facility, except that some of the treatment units would likely not need to be duplicated, such as the headworks and sludge processing facilities. Other existing facilities, such as the laboratory and operations building, would also not need to be duplicated. In addition, some of the redundancy requirements that would be required for a new City of Airway Heights treatment facility, due to its proposed 100% reclaimed water discharge (e.g., short-term membrane-lined storage and redundant filtration facilities), would also not likely be required for a Medical Lake facility expansion, because of its alternate non-reclaimed water discharge.
Table 4-25 compares the City of Airway Heights WTRRF capital costs with the capital costs associated with discharge to the Medical Lake WWT&RF. The table compares the costs associated with two discharge alternatives from the Medical Lake Facility: (1) Return and reuse of the Class A reclaimed water within the City of Airway Heights during periods of demand (typically May through October) with discharge to the Deep Creek intermittent tributary during the remainder of each year; and (2) Discharge to West Medical Lake during a majority of the year with discharge to the Deep Creek intermittent tributary when high lake levels in West Medical Lake prevent discharge (typically less than three months per year). The treatment system capital costs for expanding the Medical Lake facility do not include potential reimbursement to Medical Lake for use of existing facilities. The cost of this reimbursement would add additional capital cost to this alternative, and would likely be charged to the City of Airway Heights at the time of connection, as part of the connection fee.

Discharge of the City of Airway Heights wastewater to the Medical Lake facility would require a modification of the facility's existing NPDES permit to allow additional flows to be discharged to the permitted receiving waters or new reclaimed water use areas. Due to the TMDL study on the Spokane River and its tributaries, it is not known if the DOE would allow additional discharges to the Deep Creek tributary, and if additional treatment would be required beyond existing standards. The estimated costs for discharging to the Deep Creek tributary assume that the additional treated effluent would be permitted to be discharged to the Deep Creek tributary when the other discharge options are not available, and that no additional treatment would be required beyond the existing permit standards.

Table 4-26 includes a comparison of project costs for a new City of Airway Heights treatment facility versus discharge to the Medical Lake WWT&RF. The cost comparison includes treatment system capital, operating and maintenance costs, additional collection system power and maintenance costs, distribution system power and maintenance costs, and potential revenues from the (direct use) seasonal distribution of reclaimed water and the (indirect use) recovery and distribution of the reclaimed water from the City's groundwater supply wells (not applicable to the Medical Lake discharge alternatives). The operation and maintenance costs assume that some of the operation and maintenance costs for a separate City of Airway Heights treatment facility could be shared in a combined Medical Lake facility. The potential reclaimed water revenues assume that an interlocal agreement between the City of Airway Heights and the City of Medical Lake would provide water rights to the City of Airway Heights for its portion of wastewater treated at the facility. The total costs are calculated based on flows and loading for the projected first-year of operation (year 2010), the tenth-year of operation (year 2020), and the twentieth-year of operation (year 2030).

The collection system costs in Tables 4-25 and 4-26 include costs associated with transporting the City of Airway Heights wastewater from the location of proposed site alternative no. 4 at Lawson Road to the Medical Lake treatment facility. These costs do not include the additional collection system costs associated with transporting the City's wastewater from the existing gravity collection system tie-in location, at State Route 2 and Hayford Road, to the proposed Lawson Road site. These costs would be the same for both discharge to a new Airway Heights facility or to the Medical Lake facility, and therefore are not included in the cost comparison.

In general, the information in Table 4-26 illustrates the following: (1) The costs of the treatment, collection, and distribution systems for discharge to a new City of Airway Heights treatment facility are estimated to be higher than for discharge to the Medical Lake treatment facility; and (2) When potential reclaimed water revenues are subtracted from the total treatment, collection, and distribution costs, the total cost for discharging to a new City of Airway Heights treatment facility is estimated to be less than the total cost for discharge to the City of Medical Lake facility before the projected tenth-year of operation (year 2020).

Table 4-25. Comparison of Capital Costs for New Airway Heights Treatment Facility Versus Discharge to the Medical Lake WWT&RF				
	Potential Reuse/Discharge Alternative →	**Airway Heights WTRRF**	**Medical Lake WWT&RF Upgrade/Return & Reuse**	**Medical Lake WWT&RF Upgrade/ Discharge**
	Item[1]	**Estimated Cost ($)**	**Estimated Cost ($)**	**Estimated Cost ($)**
1	Influent Pump Station[2]	249,000	299,000	299,000
2	Headworks Building[3]	500,000	174,000	174,000
3	Biological Treatment System[4]	3,900,000	3,776,000	3,776,000
4	Secondary Clarifiers[1]	1,308,000	1,308,000	1,308,000
5	Sludge Pump Station[1]	566,000	566,000	566,000
6	Coagulation and Filtration[5]	1,609,000	1,061,000	1,061,000
7	Disinfection[6]	576,000	384,000	384,000
8	Sludge Processing[7]	1,122,000	0	0
9	Discharge Facilities[8]	602,000	246,000	72,000
10	Yard Piping (20 %)[9]	2,086,000	1,563,000	1,528,000
11	Electrical (12 %)[9]	1,252,000	938,000	917,000
12	Instrumentation and Control (8 %)[9]	835,000	625,000	611,000
13	Operations and Laboratory[7]	660,000	0	0
14	Site Rehabilitation (5%)[10]	763,000	547,000	535,000
15	Contractor Overhead & Profit (8 %)[11]	1,282,000	919,000	898,000
16A	Contract Cost for Treatment	17,310,000	12,406,000	12,129,000
16B	Contract Cost for Collection[12]	0	2,920,000	2,920,000
16C	Contract Cost for Transmission[13]	0	2,314,000	879,000
16D	Contract Cost for Distribution (Within Airway Heights)[14]	1,695,000	1,695,000	0
17	State Sales Tax (8.4%)	1,596,000	1,624,000	1,338,000
18	Total Construction Contract Cost	20,601,000	20,959,000	17,266,000
19	Engineering - Design (10%)[15]	2,060,000	2,096,000	1,727,000
20	Engineering - Construction (12%)[15]	2,472,000	2,515,000	2,072,000
21	Administration (3%)[15]	618,000	629,000	518,000
22	Land Acquisition[16]	310,000	40,000	40,000
23	Contingency (20 %)[17]	5,212,000	5,248,000	4,325,000
	Estimated Total Project Cost (2004 Dollars)	**31,273,000**	**31,487,000**	**25,948,000**

1. Refer to Table 4-13 for a listing of the equipment used in the cost estimates for the treatment system components. If there is no cost difference between the alternatives, the proposed facilities are the same.
2. The new Influent Pump Station at the Medical Lake facility would also require odor control facilities due to the collection system length.
3. The existing Headworks could be used for expanding the Medical Lake facility, but an additional finescreen, flow meter, and sampler would be required.
4. No membrane-lined short-term storage would be required to meet redundancy requirements for expanding the Medical Lake facility.
5. Only two (2) filters sized to treat the entire flow would be required to meet redundancy requirements for expanding the Medical Lake facility.
6. Fewer modules would be required to meet redundancy requirements for expanding the Medical Lake facility.
7. The existing facilities are adequate for expanding the Medical Lake facility.
8. A 1.54 MG reclaimed water (RW) reservoir and water pump station would be required for returning the RW to Airway Heights. A new RW pump station would be required for returning the RW to West Medical Lake. No infiltration basins or monitoring wells are included with these options.
9. As a percentage of the construction cost of the new treatment facilities.
10. As a percentage of the construction cost of all new facilities at the treatment facility.
11. As a percentage of the total construction cost of all new facilities at the treatment facility.
12. ~40,000 feet of transmission line between Airway Heights and the Medical Lake facility would be required for the Medical Lake discharge alternatives.
13. Approx. 35,000 feet of transmission line between the Medical Lake facility and the Airway Heights RW distribution system would be required for reuse and approx.12,500 feet of transmission line between the Medical Lake facility and West Medical Lake and a new outfall would be required for discharge.
14. Includes the cost of the reclaimed water distribution system for Site Alternative No. 4 shown in Figure 4-6.
15. As a percentage of the total construction contract costs.
16. Ten (10) acres, at $4,000 per acre, is estimated to be required for expanding the Medical Lake facility.
17. As a percentage of the total project costs.

Table 4-26. Comparison of Total Costs for New Airway Heights Treatment Facility Versus Discharge to the Medical Lake WWT&RF			
Potential Reuse/Discharge Alternative →	**Airway Heights WTRRF**	**Medical Lake WWT&RF Upgrade/Return & Reuse**	**Medical Lake WWT&RF Upgrade/ Discharge**
Item	**Estimated Cost ($)**	**Estimated Cost ($)**	**Estimated Cost ($)**
First-Year (Year 2010) Costs			
Estimated Total First-Year Treatment, Collection, and Distribution Costs			
Estimated Operation & Maintenance Costs	612,000	539,000	535,000
Present Worth of Operation and Maintenance Costs (20 Years @ 5%)	7,627,000	6,718,000	6,668,000
Estimated Treatment, Collection, and Distribution Capital Cost	31,273,000	31,487,000	25,948,000
Estimated Total First-Year Cost (2004 Dollars)	**38,900,000**	**38,205,000**	**32,616,000**
Potential First-Year Revenues			
Seasonal Distribution of Reclaimed Water	163,000	163,000	0
Water Recovered From Supply Wells	201,000	0	0
Subtotal of Potential First-Year Revenues	364,000	163,000	0
Present Worth of First-Year Revenues (20 Years @ 5%) (2004 Dollars)	**4,536,000**	**2,031,000**	**0**
First-Year Total Cost Minus Potential Revenues (2004 Dollars)	**34,364,000**	**36,174,000**	**32,616,000**
Tenth-Year (Year 2020) Costs			
Estimated Total Tenth-Year Treatment, Collection, and Distribution Costs			
Estimated Operation & Maintenance Costs	706,000	638,000	640,000
Present Worth of Operation and Maintenance Costs (20 Years @ 5%)	8,798,000	7,951,000	7,976,000
Estimated Treatment, Collection, and Distribution Capital Cost	31,273,000	31,487,000	25,948,000
Estimated Total Tenth-Year Cost (2004 Dollars)	**40,071,000**	**39,438,000**	**33,924,000**
Potential Tenth-Year Revenues			
Seasonal Distribution of Reclaimed Water	163,000	163,000	0
Water Recovered From Supply Wells	340,000	0	0
Subtotal of Potential Tenth-Year Revenues	503,000	163,000	0
Present Worth of Tenth-Year Revenues (20 Years @ 5%) (2004 Dollars)	**6,268,000**	**2,031,000**	**0**
Tenth-Year Total Cost Minus Potential Revenues (2004 Dollars)	**33,803,000**	**37,407,000**	**33,924,000**
Twenty-Year (Year 2030) Costs			
Estimated Total Twenty-Year Treatment, Collection, and Distribution Costs			
Estimated Operation & Maintenance Costs	747,000	682,000	688,000
Present Worth of Operation and Maintenance Costs (20 Years @ 5%)	9,309,000	8,499,000	8,574,000
Estimated Treatment, Collection, and Distribution Capital Cost	31,273,000	31,487,000	25,948,000
Estimated Total Twenty-Year Cost (2004 Dollars)	**40,582,000**	**39,986,000**	**34,522,000**
Potential Twenty-Year Revenues			
Seasonal Distribution of Reclaimed Water	163,000	163,000	0
Water Recovered From Supply Wells	405,000	0	0
Subtotal of Potential Twenty-Year Revenues	568,000	163,000	0
Present Worth of Twenty-Year Revenues (20 Years @ 5%) (2004 Dollars)	**7,079,000**	**2,031,000**	**0**
Twenty-Year Total Cost Minus Potential Revenues (2004 Dollars)	**33,503,000**	**37,955,000**	**34,522,000**

2. Scoring of Final Discharge Alternatives

A summary of the scoring of the final discharge alternatives is provided in Table 4-27. The table lists the "discharge evaluation criteria" used by the Sewer Advisory Committee to determine the recommended discharge alternative. Each evaluation criterion is given a "weight" value, which is the number attributed to the importance of each criterion, in relation to the other criteria, in determining the adequacy of the alternatives in meeting the priorities of the City of Airway Heights, and a "score" value, which is the number attributed to how likely a specific discharge alternative can meet each evaluation criterion, as compared to the other alternatives. The "total score" is equal to the "weight" number multiplied by the "score" number for each criterion. The total scores are then added together for each site alternative to determine a value that roughly represents the overall adequacy of a particular discharge alternative, as compared to the other discharge alternatives, in meeting the priorities of the City of Airway Heights.

City staff and representatives from the project Sewer Advisory Committee provided the weight values for each evaluation criteria and the score values for each discharge alternative. Discharge to a new City of Airway Heights WTRRF was given the highest score for 17 of the 22 evaluation criteria, and was given the highest overall total score for being able to meet the priorities of the City of Airway Heights.

Table 4-27. Scoring of Final Discharge Alternatives							
		Spokane RPWRF		Medical Lake WWT&RF		Airway Heights WTRRF	
Discharge Alternative Evaluation Criteria	Weight[1] (Importance) 5 = Most 1 = Least	Score[2] (Suitability) 10=Most 1=Least	Total Score[3]	Score[2] (Suitability) 10=Most 1=Least	Total Score[3]	Score[2] (Suitability) 10=Most 1=Least	Total Score[3]
Environmental Criteria							
Minimizes Negative Impacts on Surface Water Quality	3.83	4.67	23.33	7.00	35.00	8.00	40.00
Minimizes Negative Impacts on Ground Water/Drinking Water Quality	5.00	6.33	31.67	7.20	36.00	7.67	38.33
Minimizes Negative Impacts to Areas of Natural, Aesthetic, or Recreational Significance	3.00	4.83	24.17	7.00	35.00	7.67	38.33
Growth Management Criteria							
Provides for Future Sewer System Demand	4.50	3.00	15.00	4.60	23.00	8.50	42.50
Provides for Future Water System Demand	4.50	2.33	11.67	4.60	23.00	7.83	39.17
Conserves City's Existing Potable Water Supply	4.33	3.83	19.17	4.60	23.00	8.50	42.50
Feasibility Criteria							
Does Not Require New Regulatory Approvals/Permits	3.67	7.00	35.00	5.60	28.00	3.50	17.50
Does Not Require Creation of New Interagency Agreements	2.50	4.00	20.00	3.60	18.00	6.50	32.50
Does Not Require Renegotiations of Existing Interagency Agreements	2.50	3.80	19.00	4.40	22.00	7.33	36.67
Does Not Require Capital Financing	3.50	5.80	29.00	3.80	19.00	4.00	20.00
Is Easy to Implement	2.83	6.33	31.67	4.20	21.00	3.83	19.17
Is Simple to Maintain	2.83	6.83	34.17	4.60	23.00	5.00	25.00
Economic Criteria							
Minimizes Sewer System Capital Costs	4.17	5.50	27.50	6.20	31.00	4.67	23.33
Minimizes Sewer System Operating Costs	4.33	5.50	27.50	5.40	27.00	5.00	25.00
Encourages Economic Development	4.00	2.83	14.17	3.40	17.00	8.50	42.50
Supports Stabilizing Sewer Rates	4.17	3.33	16.67	3.20	16.00	8.50	42.50
Social Criteria							
Provides Potential for Additional Recreational Facilities	3.00	1.50	7.50	2.60	13.00	7.67	38.33
Provides Potential for Public Education	2.67	3.50	17.50	3.80	19.00	6.50	32.50
Minimizes Negative Impacts to Areas of Historical, Cultural, and Social Significance	3.00	4.33	21.67	4.40	22.00	4.67	23.33
Minimizes Public Concerns Related to Drinking Water Quality	4.33	4.50	22.50	4.80	24.00	5.67	28.33
Minimizes Public Concerns Related to Increasing Sewer Rates	4.17	3.17	15.83	4.60	23.00	6.83	34.17
Minimizes Public Concerns Related to Increasing Water Rates	4.17	3.83	19.17	5.00	25.00	7.00	35.00
Sum of Total Scores For Evaluation Criteria			461		488		677

1. The "Weight" is the number attributed to the importance of each Evaluation Criteria in relation to the other Evaluation Criteria in determining the overall adequacy of the alternative in meeting the priorities of the City of Airway Heights.
2. The "Score" is the number attributed to how likely the alternative can meet the specific Evaluation Criteria as compared to the other alternatives.
3. The "Total Score" is equal to the "Weight" number multiplied by the "Score" number for each specific criterion.

3. Recommended Discharge Alternative

Based on the weight values provided by the Sewer Advisory Committee in Table 4-27, the following criteria are considered to be the highest six priorities for the City of Airway in determining its choice of wastewater discharge alternative:

1. Minimizing negative impacts on groundwater and drinking water quality;
2. Providing for future sewer system demand;
3. Providing for future water system demand;
4. Conserving the city's existing potable water supply;
5. Minimizing sewer system operating costs; and
6. Minimizing public concerns related to drinking water quality.

Discharge to a new City of Airway Heights WTRRF was given the highest score in five of these six categories with the exception of minimizing sewer system operating costs. Clearly, protecting the public's groundwater and drinking water quality and providing for future growth are considered to be high priorities for the City of Airway Heights. Constructing and operating a new City of Airway Heights WTRRF is considered to be the best way to achieve these priorities. Continued discharge to the City of Spokane's wastewater system does not provide a water resource for future growth, and the limitation on the City of Airway Heights wastewater discharge capacity to the City of Spokane's wastewater system may adversely affect growth within the Airway Heights service area. Discharging to the City of Medical Lake's facility may not be a cost effective alternative if additional flows to the intermittent tributary to Deep Creek are prohibited. For these reasons and others, discharging to a new City of Airway Heights WTRRF is the recommended discharge alternative.