TECHNICAL MEMORANDUM No. 3

for the
Cities of Hayden, Post Falls and Rathdrum
with Kootenai County

Rathdrum Prairie
Wastewater Master Plan

Wastewater Treatment and Discharge Evaluation

Final Draft

November 2008

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Section 1 – Current Wastewater Treatment System Planning

1.1 Overview

Two entities currently manage all the wastewater treatment in the study area. The City of Hayden routes wastewater flow to the Hayden Area Regional Sewer Board (HARSB) wastewater treatment plant (WWTP). HARSB manages all the treatment for Hayden as well as for the Kootenai County Airport and for the Hayden Lake Recreational Water and Sewer District (HLRWSD). Wastewater flows generated by the City of Post Falls and the City of Rathdrum are routed to the City of Post Falls WWTP. The U.S. Environmental Protection Agency (EPA) authorizes both treatment plants to discharge to the Spokane River with independent National Pollutant Discharge Elimination System (NPDES) Permits. Both facilities have similar treatment processes. The following sections detail each treatment plant's unit processes, operations, and planned upgrades.

1.2 City of Hayden

Hayden's wastewater is routed to the HARSB WWTP under the October 1986 "Joint Powers Agreement of the Hayden Area Regional Sewer Board for the Hayden Area Regional Sewer Facilities" (Joint Powers Agreement). Hayden and the HLRWSD were signatories to the Joint Powers Agreement "under the authority of Idaho Code 67-2328 to provide for the acquisition, ownership, development, operation, and maintenance of the proposed Hayden Area Regional Sewer Facility." The facility consisted of an interim drainfield, regional collector, and mechanical treatment plant (Phase I and Phase II). Phase IIIA added the Spokane River outfall while Phase IIIB expanded the mechanical treatment plant. The following documents have been added to the initial 1986 agreement:

- Bylaws of Hayden Area Regional Sewer Board, June 1987
- First Amendment to the Joint Powers Agreement of the Hayden Area Regional Sewer Board for the Hayden Area Regional Sewer Facilities, June 1, 1990 - changed Kootenai County from a contract discharger to a full HARSB voting member
- Resolution 1996-1 Hayden Area Regional Sewer Board – provided for WWTP expansion (Phase IIIB) from 5,000 users to 7,500 users to accommodate growth within the City of Hayden as well as connections sold on a first-come/first-served basis for HARSB capital funding

The Joint Powers Agreement and additional documents appear in **Appendix A** of this Technical Memorandum.

1.2.1 HARSB Treatment Plant

The HARSB WWTP is located in the City of Hayden on the west side of Atlas Road, 0.75 mile north of Hayden Avenue, and immediately south of the Kootenai County Airport. Its current treatment capacity is 2.0 million gallons per day (mgd) of average annual flow with Phase IIIC upgrades substantially complete in September 2008. HARSB currently averages approximately 1.1 mgd treated flow. Approximately 1.65 mgd of its 2.0 mgd rated capacity has been sold, although not all the connections are currently active.

HARSB is a regional facility operating an oxidation ditch type of activated sludge biological wastewater treatment. Influent from two long and two shorter force mains first goes through screening to remove large debris and rags in the headworks building followed by grit accumulation. Screened wastewater then flows through Division Box No. 1 to each of three oval oxidation ditches. The raw wastewater mixes with returned solids from the gravity settling basins (secondary clarifiers), as required to maintain an optimum mixed liquor suspended solids (MLSS) and solids retention time (SRT). The typical MLSS concentration ranges from 3,000 to 5,000 milligrams per liter (mg/L), with the SRT ranging from 8 to 12 days. Two vertical turbine aerators in each oxidation ditch provide mixing energy and oxygen to the "activated" biological solution for an average hydraulic retention time (HRT) ranging from 12 to 18 hours. Division Box No. 2 then splits the fully oxidized wastewater evenly between the four existing secondary clarifiers.

The clarified effluent is disinfected with chlorine and pumped to the Spokane River from October through late spring. Once river flows drop below 2,000 cubic feet per second (cfs) or as crop irrigation is needed, the operators redirect the final effluent pumps to deliver water to the HARSB reuse site approximately 1.5 miles north of the treatment plant. They grow and contract for the harvest of alfalfa, timothy, and orchard grass hay, as well as hybrid poplar trees. During the growing season, HARSB operates a "zero discharge" facility by applying fertilizer and reuse water to match the agronomic and hydraulic uptake rate of the crops. **Figure 1.1** provides an overall flow schematic showing the treatment train with the 2008 Phase IIIC upgrades complete. All figures appear at the end of this memorandum.

HARSB has generally provided excellent treatment during their current permit period. From 2005 through 2007 it removed an average of over 97 percent of the influent total suspended solids (TSS) and 5-day biochemical oxygen demand (BOD_5) with standard deviations of 4 and 5 mg/L, respectively. During the same period, the plant also averaged over 61 percent and 88 percent removal of total phosphorus and ammonia, respectively, although neither constituent was explicitly targeted. The process has been stable and consistent.

1.2.2 HARSB Planned Upgrades

HARSB treatment capacity was analyzed in the October 2004 "Treatment Plant Upgrade Program to 1.65 MGD and Projected Facilities to 2.25 MGD and 4.0 MGD" (J-U-B ENGINEERS, Inc., 2004). The report reviewed the capacity of individual unit processes throughout the WWTP, reviewed flow and loading, identified plant capacity replacement issues, and provided upgrade recommendations. Those recommendations led to the 2005-06 Phase IV Upgrade design, which went to bid for construction in June 2006.

1.2.2.1 Phase IV BNR and Oxidation Ditch Design

The Phase IV design included a new headworks building with screening and grit removal capacity up to 4.5 mgd average daily flow. It also included biological nutrient removal (BNR) basins and equipment for two 1.5 mgd increments to be added as budgets would allow. BNR requires sequential anaerobic (no oxygen) and anoxic (no dissolved oxygen) "selector basins." Return activated sludge (RAS) settled out of the clarifiers enters the first anaerobic selector and mixes with the influent wastewater. The RAS quickly consumes any remaining oxygen and begins the biological phosphorus removal process, which is described in more detail as part of the Post Falls WWTP discussion. Returned MLSS from the oxidation ditch discharge enters the anoxic selector where it provides nitrate as an oxygen source for denitrifying bacteria. As the nitrate gives up its oxygen, nitrogen gas off-gases to the atmosphere and the activated sludge continues to oxidize the incoming wastewater as a food source. Denitrification allows the treatment process to beneficially recover 2.9 milligrams (mg) of oxygen and 3.6 mg of alkalinity (as calcium carbonate) per milligram of nitrate-nitrogen removed (Jeyanayagam, 2005). This represents a recovery of up to 63 percent of the oxygen and 50 percent of the alkalinity consumed by the ammonia oxidation process. A BNR treatment process can therefore reduce energy input for aeration as well as chemical input to maintain alkalinity and pH within acceptable discharge limits. The HARSB Phase IV BNR facilities were designed to reduce total nitrogen to below 10.0 mg/L and total phosphorus (TP) below 1.5 mg/L on a monthly average basis.

The project bid also included a 1.2 MG oxidation ditch, 80-foot-diameter clarifier, and a utility building to house the required pumping and electrical controls. In all, the Phase IV project would have increased the biological treatment capacity of the HARSB WWTP to 3.0 mgd with additive alternates for full BNR to the same capacity. All connections and structures were also designed to readily stage a similar construction project in the future to reach a 4.5 mgd capacity. Of course, solids processing, filtration, disinfection, pumping, outfall piping, and reuse expansion projects would have to augment Phase IV and other future capacity expansion projects. **Figure 1.2** shows the physical layout of the existing HARSB WWTP plus the “Option A” Phase IV improvements and conceptual layout for future expansion projects.

1.2.2.2 Alternative Oxidation Ditch and MBR Evaluations

When Phase IV bids were opened in July 2006, it became apparent that the available funding was significantly short of the base project requirement, even without the BNR additions. There would have been significant advantages to move forward with the Phase IV project and build the headworks, yard piping, and utility building out to their ultimate capacity. The remainder of the site would have also been master planned for BNR, filtration, and disinfection upgrades. With indications that growth pressures were easing and discharge restrictions were tightening, HARSB rejected all bids on the Phase IV project and requested an independent review of the post-bid alternative developed by J-U-B for HARSB in August 2006. CH2M Hill Consulting Engineers performed the evaluation based on:

- “Option B” would have added only the new headworks and larger clarifier to claim some process improvements to a rated capacity of up to 1.8 mgd. It was rejected by HARSB and eliminated from the evaluation.
- “Option C” would add a third 0.6 MG oxidation ditch and 60-foot clarifier plus modify the existing headworks for a new screen with minimal ancillary facilities to conserve available capital. Future expansion of the treatment capacity would utilize either 1) additional oxidation ditches and clarifiers or 2) membrane bioreactors (MBRs). **Figures 1.3** and **1.4** show potential conceptual layouts of “Option C.”
- “Option D” would add biological treatment capacity through the use of MBRs rather than expanding oxidation ditch and clarifier processes. The conceptual layout for Option D would be similar to Option C2, only there would be no oxidation ditch expansions.

An MBR wastewater treatment system is an activated sludge process that uses a physical barrier (membrane) to separate the solids from the liquid. The membranes are immersed in the activated sludges, typically in separable basins for maintenance purposes. MBRs eliminate the need for separate gravity settling and provide high quality filtered effluent suitable for reuse. The physical separation barrier also means that the activated sludge settling characteristics become inconsequential. Therefore, the mixed liquor concentrations usually vary from 8,000 to 12,000 mg/L, which is three to five times the concentration of conventional activated sludge systems. The increased MLSS means aeration basin volumes can become smaller. The smaller aeration basins, elimination of gravity clarifiers, and filtration incorporated into the end of the aerobic basin mean that MBRs dramatically decrease the land area required for a wastewater reclamation treatment plant. The BNR process can also be included in the overall MBR basin and process configuration. The primary disadvantage of an MBR is the cost for the purchase of the membrane equipment (initial and replacement).

The resulting analysis compared operating, maintenance, and capital costs as well as added unit processes to the oxidation ditch treatment to produce an equivalent level of treatment. The analysis concluded that the most cost-effective and practical expansion option for HARSB was "Option C" with future expansion utilizing oxidation ditches, clarifiers, BNR, and filtration steps (CH2M Hill, 2007). Consequently, HARSB authorized J-U-B to design the Phase IIIC expansion project in February 2007. The project entered into construction in August 2007, with substantial completion expected in September 2008.

1.2.2.3 Phase IIIC – Interim Improvements

The secondary capacity rating for the Phase IIIC headworks, Oxidation Ditch No. 3, and Clarifier No. 4 expansion is 2.0 mgd. HARSB will also need to expand the following components as the plant approaches 2.0 mgd of average annual flow:

- Sludge storage and dewatering
- Chlorine feed, contact, and de-chlorination facilities
- Land application/reuse – land and irrigation system
- Outfall and diffuser or intermediate booster pump station
- Aeration upgrades in Oxidation Ditches No. 1 and No. 2 may also be needed to meet the reliability criteria for new nitrification requirements for ammonia reduction
- Electrical upgrades for new facilities

It appears certain that the new NPDES Permit will require phosphorus removal regardless of the rate of plant expansion. Phosphorus removal is currently envisioned to start with chemical addition in the headworks and will require filtration and a new plant drain pump station within one or two permit cycles (5 to 10 years). The headworks, oxidation ditches, clarifiers, nutrient removal, and filtration, disinfection, effluent pumping, reuse, and solids handling systems would all have to be expanded beyond 2.4 mgd in the future. The previously designed Phase IV project will be reconsidered for implementation as part of the future phosphorus reduction and/or plant expansions being evaluated to meet anticipated river discharge and reuse requirements over the next 10 to 20 years as part of HARSB's facility planning process currently under way. The regulatory framework discussion appears later in this memo.

1.2.3 HARSB Flow Projections – Exclusive Tier

Current planning for HARSB treatment capacity includes flow from the City of Hayden built-out to its current Area of City Impact (ACI), or "exclusive tier" as discussed in Technical Memorandum No. 1. Plans also include growth for the Kootenai County Airport. However, HLRWSD has fully allocated their "equivalent residential" (ER) treatment capacity at HARSB. Each ER has been defined by HARSB at 200 gallons per day (gpd) per ER. Current flow planning allocations are summarized in **Table 1-1.**

Table 1-1 – Current Flow Planning for HARSB WWTP

Entity	Existing ER [1]	Future Exclusive Tier ER	Future Average Annual Flow (mgd)
City of Hayden	5,807	14,552 [2]	2.91
HLRWSD	2,439	2,439 [3]	0.49
Kootenai County Airport	114	400 [3]	0.08
TOTAL	8,360	17,391	3.48

[1] *Hayden Area Regional Sewer Board, December 2007 Board Meeting Packet; includes 891 paid but unconnected ERs (337 Hayden, 525 HLRWSD, 9 Airport, 20 miscellaneous)*

[2] *Welch Comer & Associates, "Hayden Sewer Master Plan Update," December 2006*

[3] *J-U-B ENGINEERS, Inc., "Treatment Plant Upgrade Program to 1.65 mgd and Projected Facilities to 4.0 mgd," October 2005, Table 5*

HARSB daily monitoring report (DMR) data through 2007 indicates that the flow per ER is declining. This is evident in Table 1-1 where the expected average flow would be 1.49 mgd for 7,469 active ERs at 200 gpd/ER. The actual flow averaged 1.14 mgd in December 2007, or 153 gpd/ER. The peak daily flow values decreased from 1.89 mgd in 2005 to 1.52 mgd in 2007 (from 290 to 204 gpd/ER). The decline in peak flows likely reflects increased attention to inflow and infiltration (I/I). The 2004 report documented 1.05 mgd for 5,841 connected ERs, or 180 gpd/ER on an annual basis, which is much more consistent with the accepted 200 gpd/ER planning standards. While water-conserving fixtures and appliances are now the national standard, it is not reasonable to assume an annual average 23 percent flow reduction to the WWTP. Neither does influent wastewater to HARSB provide clear evidence of water conservation through increased concentration trends. Those data are discussed more fully later in this Technical Memo. Therefore, this study will continue to utilize the 200 gpd/ER shown in Table 1-1.

1.3 City of Post Falls

The City of Post Falls pumps wastewater to their treatment plant through a system of approximately 30 lift stations and force mains. As previously mentioned, the treatment plant also receives wastewater from the City of Rathdrum's 8-mile force main, making Post Falls WWTP a significant regional facility. **Appendix B** contains the January 1996 "Intergovernmental Agreement between the City of Post Falls and the City of Rathdrum for the Treatment and Discharge of Wastewater" (Agreement). The Agreement superseded an earlier agreement and provides the framework for capacity allocation, operation, maintenance, legal obligations, capital budgets, and expansion. With a current plant rating of 3.1 mgd and a defined capacity allocation of 80 percent/20 percent (Post Falls/Rathdrum) for the first 75 percent of the plant's capacity, Post Falls is allocated 1.86 mgd and Rathdrum 0.465. Since Post Falls generated approximately 2.1 mgd and Rathdrum approximately 0.4 mgd on a peak month basis in 2007, the cities are negotiating an update to the Agreement to reallocate the remaining 0.6 mgd and provide for plant expansion. The Agreement defines an equivalent residence (ER) as 165 gpd of "normal domestic sewage" in order to quantify commercial and industrial users compared to a dwelling unit. Post Falls also refers to a "service unit" (SU) of 165 gpd in their Capital Planning documents for homes less than 1,000 square feet. All other homes are considered to consume 1.27 SU of treatment capacity.

1.3.1 Post Falls WWTP

The Post Falls WWTP is located on the south side of Seltice Way between McGuire Road and Chase Road. Its current capacity is 3.1 mgd after recent aeration and clarifier upgrades.

Post Falls operates an activated sludge biological wastewater treatment system that is similar to the HARSB system. The raw influent is metered, screened, and de-gritted in the headworks building. Following the anaerobic cells, Splitter Box No. 1 divides flow to the four oxidation ditches, with Splitter Box No. 2 sending oxidized wastewater evenly to up to five secondary clarifiers. The biological solids grown in the oxidation ditches settle out in the clarifiers and return to the process or are wasted, depending on process requirements. The clarified water flows into a channel for effluent flow metering and ultraviolet (UV) light disinfection and then flows by gravity to the Spokane River. Final effluent also provides internal plant reuse water. Chlorine added to the plant reuse water provides additional disinfection. Existing treatment also includes capabilities for biological phosphorus removal and nitrification, which improves overall plant performance and efficiency. **Figure 1.5** provides a process flow schematic showing the overall treatment train for the existing system.

1.3.1.1 Enhanced Biological Phosphorus Removal

Besides UV light disinfection and no current wastewater reclamation for reuse, the primary difference between the HARSB and Post Falls treatment systems is that Post Falls utilizes an enhanced biological phosphorus removal process (EBPR). For EBPR, screened and de-gritted raw influent flows to the anaerobic selector basin where it mixes with RAS from the underflow of the secondary clarifiers. The anaerobic selector is a 6-celled concrete structure divided evenly into 64,600-gallon cells for EBPR. Typically, the first two cells simply allow the RAS to mix with a portion of the raw influent in order to denitrify the RAS. Denitrification is the biological reduction of nitrate by bacteria utilizing the oxygen from the nitrate molecule, then releasing nitrogen gas to the atmosphere. It is important to deplete the nitrate oxygen source so the operators can manage the remaining anaerobic cells to maximize the phosphorus accumulating organisms (PAOs). PAOs are in the RAS flow from the clarifiers. PAOs first lose their accumulated phosphorus in the anaerobic cells so they can take in and store volatile fatty acids (VFAs) available in the anaerobic influent. In the subsequent aerobic zone (oxidation ditches), the PAOs utilize the stored VFAs as a carbon and energy source and take up all the phosphorus released in the anaerobic zone plus additional phosphorus from the influent wastewater. VFA metabolism releases 24 to 36 times more energy in the aerobic zone than PAOs require to store them. The readily available energy source increases PAO cell growth and is often called "luxury uptake" because of the associated phosphorus accumulation. The excess cell growth with its accumulated phosphorus then leaves the system with the waste activated sludge removed from the secondary clarifier underflow.

1.3.2 Post Falls WWTP Planned Upgrades

The plant's capacity was most recently analyzed for the City of Post Falls in the December 2006 "Draft Wastewater Treatment Master Plan" (J-U-B ENGINEERS, Inc., 2006). The Master Plan identified deficiencies in the existing wastewater treatment system and provided direction for meeting future NPDES Permit limits. The report identified a historical monthly average flow of 2.4 mgd. It suggested upgrading Oxidation Ditch No. 1 and Oxidation Ditch No. 3 aeration systems with two 60 hp vertical turbine aerators each along with secondary clarifier improvements to provide a capacity of 3.1 mgd. The report also outlined phased upgrades to 4.0 mgd and then 5.0 mgd.

The aeration system and clarifier work was completed in 2007. Evaluation for the phased expansion of screening, BNR, aerobic oxidation, clarification, disinfection, and solids dewatering began in mid-2006. The City and design team decided to first compare an expansion of current oxidation ditch secondary treatment processes with alternative conceptual layouts, process criteria, and operating history of the existing WWTP. The primary reasons to change processes for future expansion would be to:

- Conserve space
- Significantly improve process performance
- Reduce capital and operating costs

Changing to deeper basins and fine bubble air diffusers would increase the oxygen transfer efficiency and conserve space for the aerobic portion of the process. Utilizing an MBR process could further conserve space on the plant site. Both of these changes would provide an equivalent level of treatment through the BNR and aerobic secondary processes. MBR treatment utilizes a more concentrated biological mass, which can further reduce the aerobic footprint by two-fold or more. It also eliminates solids settleability concerns because it combines clarification and filtration by placing the membrane barrier between the aeration basin and the final effluent. Consequently, an MBR also produces reuse quality water in the smallest possible footprint.

Because the City is not overly constrained by land availability on its 25-acre site, conserving space was not their major motivation when reviewing potential alternative processes. Since that decision, the City also purchased a 7-acre parcel to the east for a street and fleet shop as well as potential WWTP build-out.

Process performance at the Post Falls WWTP has been very good during the current permit period. From 2005 through 2007, the plant has averaged almost 98 percent removal of total suspended solids (TSS) and 5-day biochemical oxygen demand (BOD_5) with standard deviations of 1.4 percent and 1.1 percent, respectively. TP removal through the EBPR process has also been excellent at over 92 percent. EBPR is somewhat more susceptible to process upsets than secondary treatment with an effluent TP average of 0.55 mg/L and standard deviation of 0.65 mg/L. Average ammonia reduction through the oxidation ditch process has also been very good with an effluent concentration of 0.18 mg/L (99 percent removal) and standard deviation of 0.54 mg/L. Of course, without denitrification, the ammonia is converted to nitrate and cellular mass with most of the nitrate discharged into the Spokane River.

The high quality, familiar unit processes and stable operating history led the City toward expanding their existing secondary treatment process. Operating a distinctly different and separate process in order to expand plant capacity appeared to create more operating complexities than would be offset by potential gains in process efficiencies or space conservation. In addition, feasibility level cost comparisons did not show significant, if any, long-term capital or operation cost advantage. Therefore, design plans for an oxidation ditch, clarifier, and EBPR expansion to treat influent wastewater up to 4.0 mgd is near completion for bidding in 2008. The design includes BNR to recover alkalinity and oxygen as well as additive alternates to increase capacity to 5.0 mgd. The base project will expand influent screening and grit removal as well as solids dewatering, pumping, yard piping, and electrical support facilities beyond the 5.0 mgd rating. UV disinfection will be expanded to 4.0 mgd until added capacity is specifically required. **Figure 1.6** shows the current expansion layout as well as a conceptual layout for future facilities at the Post Falls WWTP.

Like HARSB, the City anticipates increasingly stringent treatment requirements for discharging to the Spokane River. Because of the treatment requirements coupled with an increasing emphasis on water conservation and reuse, the City purchased 618 acres of farmland on the Rathdrum Prairie for the express intent of future reuse-driven agriculture and/or open space. Regulatory aspects will be detailed in later sections of this Technical Memorandum.

1.3.3 Post Falls WWTP Flow Projections – Exclusive Tier

Current build-out planning for Post Falls' wastewater treatment capacity includes flow from the City of Post Falls and Rathdrum. Until recently, all flow and load planning was based on the Post Falls 2000 Wastewater Master Plan (Kimball Engineering, 2000). Rathdrum's 2006 Collection System Master Plan added significant potential loading (Welch Comer, 2006). In addition, Post Falls' City Engineer has updated the City's anticipated future land use and resulting flows. They were incorporated into the 2000 Wastewater Master Plan flow model as part of this Master Plan. The resulting updated current flow planning allocations were described in detail in Technical Memorandum No. 2 and appear in summary below in **Table 1-2.**

Table 1-2 – Current Flow Planning for Post Falls' WWTP Flow Capacity

Entity	2000 ACI Flow Planning (mgd) [1]	2008 Exclusive Tier Flow Planning (mgd)
City of Post Falls	8.4	9.29 [2]
City of Rathdrum	2.1	3.87 [3]
TOTAL	10.5	13.16

[1] *Kimball Engineering, August 2000, City of Post Falls Wastewater Master Plan 2000, Final Summary Report, Figure 7*

[2] *Direct communication, City of Post Falls, Assistant Engineer, 2007 (south of Prairie Avenue)*

[3] *Welch Comer and Associates, June 2006, Provisional Sanitary Sewer Evaluation*

From January 2005 to January 2008, Post Falls' influent flow increased from 2.00 mgd to 2.12 mgd. In addition, Rathdrum's influent flow to the Post Falls WWTP increased from 0.33 mgd to 0.43 mgd. The calculated 606 ER equivalent flow increase for Rathdrum and 727 ER increase for Post Falls appear to be low compared to the rapid growth experienced in both jurisdictions during that time period. Post Falls reported 1,275 building permits issued for new construction (excluding remodels and additions) during the same period while Rathdrum reported 395 (Coeur d'Alene Press, January 22, 2008). Since those permits included duplexes, multi-family and commercial uses, the number of ERs would be higher than the number of permits. The influent BOD_5 has shown a general increase from 2005 through 2007, but BOD_5 and TSS did not show any significant trends over that period (262 to 268 and 252 to 242 mg/L, respectively). Therefore, one has to assume that there has been some flow reduction due to water-conserving plumbing fixtures and a delay in plant loading between the building permit phase and the building's occupation. This trend needs further consideration and review as more specific design projects proceed in the future.

By the end of 2007, Rathdrum's flow comprised 16 percent of the total flow compared with Post Falls' 84 percent. Rathdrum remains within their 1996 allocation of 0.465 mgd while Post Falls has exceeded their 1.86 mgd allocation. Although Rathdrum's flows may continue to increase as building permits turn into occupied structures, it seems likely that they will stay within their agreed allocation at the Post Falls plant until the Agreement is renegotiated. It also appears likely that both cities will stay within the plant's rated flow as long as the expansion project can be completed in the next three to five years. Any major upgrade project should also allow a year to optimize performance of the new BNR process, as well as the new mechanical and electrical equipment.

The 0.6 mgd of available treatment capacity represents at least 3,636 ERs under the Agreement. The highest historical rate of building permit activity was in 2005, with Post Falls issuing 652 permits and Rathdrum issuing 153 permits. The 3,636 ERs of plant capacity available at the end of 2007 would provide 909 ER/year through 2012 or 1,212 ER/year through 2011. Both values are greater than the highest number of building permits ever issued in Post Falls and Rathdrum combined in a single year. The existing WWTP provides a reasonable level of assurance for interim capacity.

1.4 City of Rathdrum

The City of Rathdrum collects its wastewater flow at a central lift station, then pumps it to the Post Falls WWTP via a dedicated force main owned and operated by Rathdrum. Discharge and treatment at the Post Falls WWTP are governed by the January 1996 Intergovernmental Agreement between the City of Post Falls and the City of Rathdrum, as previously described. The Agreement appears for reference in **Appendix B** of this Technical Memorandum.

Since Rathdrum does not have wastewater treatment capabilities, the current sewer master plan does not include specific treatment evaluation. Instead, it reviewed the Agreement with Post Falls' and Rathdrum's proportionate share of total treatment capacity. As discussed in the previous section, the Agreement is the subject of current negotiations between the cities. Rathdrum flow currently comprises approximately 0.43 mgd of the total January 2008 average plant flow of 2.55 mgd.

The City's June 2006 "Provisional Sanitary Sewer Evaluation" (Welch Comer & Associates, Inc.) included build-out projections to the extent of the current ACI (also known as the exclusive tier). Those projects were previously included in **Table 1-2** followed by a discussion of their implications at the Post Falls WWTP.

An additional large lift station will serve the westernmost extents of the City in future years, and the existing 8-inch force main will be paralleled with an additional 14-inch force main to the Post Falls WWTP. An analysis of the force main upgrade was performed by Welch Comer in their 2006 report for Rathdrum.

Rathdrum currently does not intend to add treatment for their wastewater flow under current planning scenarios. However, they purchased 320 acres of land for treatment plant siting and/or reclamation and reuse in the mid 1990s. This land is located on the northwest corner of Hayden Avenue and Greensferry Road bordered by their existing sewer force main. This Master Plan analysis assumes that Rathdrum's land is available for reuse as well as satellite treatment facilities to best benefit the overall collection, conveyance, and treatment approach. Formal agreements would have to be developed to accomplish this goal.

Section 2 – Regulatory Framework

There are numerous regulatory issues that can impact wastewater planning endeavors, and regulations are continually changing. This plan addresses current and emerging regulations as they relate to wastewater treatment, reclamation, reuse, and discharge. Staying abreast of emerging regulations will be a continual challenge as elements of the Master Plan go to implementation in the future.

2.1 Existing NPDES Permits

As discussed in previous sections, wastewater generated by the City of Rathdrum is routed to and treated by the Post Falls WWTP. The City of Hayden flows to HARSB WWTP. Both HARSB and Post Falls discharge to the Spokane River with independent authorization from the U.S. EPA under the following NPDES Permits:

- City of Post Falls NPDES Permit No. ID-002585-2
- HARSB NPDES Permit No. ID-002659-0

Post Falls discharges year-round into the Spokane River. HARSB discharges to the river from October through May. From June 1 through September 30 and when river flows fall below 2,000 cfs, HARSB *must* discharge to their land application reuse facility. Both permits became effective on November 2, 1999, and expired on November 2, 2004. Although both entities re-applied for discharge permits in a timely manner, the EPA directed them to operate under their 1999 permits until the new permits are issued. Future permit limitations are discussed in the following sections. They are driven primarily by water quality issues downstream in the Lake Spokane hydroelectric impoundment. Those same issues led to Post Falls' current requirement to remove at least 70 percent of their influent phosphorus from March 1 through October 31. Post Falls must also reduce total ammonia to less than 8.2 mg/L from July 1 through September 30 and remove at least 85 percent of their influent BOD_5 and TSS year round. HARSB's removal of their discharge from the river during low flows from June 1 through September 30 is considered equivalent to Post Falls' efforts. When EPA issues new permits, the limitations will be more severe and more extensive.

2.2 Spokane River Water Quality Issues

As mentioned previously, water quality issues in Lake Spokane have required wastewater treatment improvements upstream for a number of years. For example, the Spokane WWTP has been chemically removing phosphorus since the late 1970s. Idaho dischargers have been removing phosphorus on a seasonal basis since the 1990s to reduce algae growth and increase dissolved oxygen (DO).

2.2.1 Dam Re-Licensing

Lake Spokane, also known as Long Lake, is a hydroelectric reservoir on the Spokane River approximately 30 miles northwest of Spokane, Washington. Long Lake Dam is 64 river miles downstream from the Idaho/Washington border. It is owned and operated by Avista Utilities. Completed in 1915, the Long Lake Hydroelectric Development can produce 71 megawatts (MW) of electricity to meet the energy needs of approximately 35,000 households. The 23.5-mile-long reservoir has a maximum depth of approximately 200 feet. At an elevation of

1,533 feet, Lake Spokane impounds 105,000 acre-feet of water, with no minimum flow requirements.

Avista Utilities (formerly Washington Water Power) applied to the Federal Energy Regulatory Commission (FERC) for re-licensing of its entire “Spokane River Project” in July 2005. The Spokane River Project includes the Post Falls Dam in Idaho (separate application) plus the Upper Falls, Monroe Street, Nine Mile, and Long Lake Dams in Washington. Avista continues to operate their Spokane River Hydroelectric Project under their existing FERC license, which expired on July 31, 2007, on a year-to-year basis until a new license is issued.

In July 2006, Avista separately requested State Water Quality Certification for the project dams from the Washington Department of Ecology (WDOE) and the Idaho Department of Environmental Quality (IDEQ) under Section 401 of the Federal Clean Water Act to support their FERC applications. Avista also conducted public outreach and completed reports on potential project impacts on metals, water quality, sediment routing, and total dissolved gas to support their FERC applications. The Water Quality Certification requests were withdrawn and requested again in July 2007 in order to “restart the clock” and give IDEQ and WDOE additional time to complete their review of the large amount of information submitted for the application. IDEQ and WDOE issued draft Water Quality Certifications for comment on April 22 and April 7, 2008, respectively. The certifications are intended to regulate minimum stream flows and dissolved gas, among other conditions, to meet water quality requirements. The Water Quality Certifications were approved in a letter and Order No. 5492 issued by WDOE on June 10, 2008, and by IDEQ on June 5, 2008. They appear on the IDEQ and WDOE websites. WDOE’s certification includes compliance with DO levels in Lake Spokane through a required Dissolved Oxygen Water Quality Attainment Plan (DO WQAP) within two years. Avista is required to evaluate and implement reasonable and feasible measures to improve DO conditions in Lake Spokane in proportion to its level of responsibility. WDOE included a 10-year compliance schedule.

Avista and Inland Empire Paper appealed the Water Quality Certifications by WDOE for opposite reasons. Inland Empire Paper cited the need for Avista to be more explicitly required to participate in solutions for Lake Spokane Water Quality problems. Avista appealed because they believe WDOE overstepped their regulatory authority regarding flow and fish species propagation. The certifications are under review again pending inclusion of Avista in the TMDL process.

2.2.2 Total Maximum Daily Load

In a parallel process, WDOE has been developing a Total Maximum Daily Load (TMDL) for the Spokane River and Lake Spokane as mandated by Section 303(d) of the Federal Clean Water Act. Surface waters that do not meet the State-established water quality standards, which are intended to protect, restore, and preserve their designed uses, must first receive technology-based pollution controls (Merrill and Cusimano, 2004). If technology standards do not achieve the required water quality, the Clean Water Act requires the State to place the surface water on a list of “impaired” water bodies and prepare a TMDL for approval.

The goal of the TMDL is to attain the State’s water quality standards by determining the amount of specific pollutants that can be discharged to the water body and still meet the standards. The amount of the specific pollutants is called the loading capacity. The TMDL also allocates the loading capacity among the various sources, both point and non-point. The TMDL must also consider seasonal variations and include a margin of safety that takes into account any lack of knowledge about the cause of the water quality problem or its loading capacity.

WDOE prepared the 2004 draft "Total Maximum Daily Load to Restore and Maintain Dissolved Oxygen in the Spokane River and Lake Spokane (Long Lake)" to address requirements that the lake and river attain a natural lake and river DO level of at least eight parts per million (mg/L) on a year-round, full-depth basis. Because the TMDL limits appeared to create unattainable standards for point sources, the City of Spokane led an effort to petition WDOE to perform a Use Attainability Analysis (UAA) of the Spokane River and Lake Spokane. The UAA process allows the Clean Water Act to determine achievable water quality levels when an impaired water cannot achieve the approved water quality standard. Following submittal of a draft UAA, WDOE withdrew the 2004 draft TMDL and the dischargers, WDOE, and other public and private stakeholders entered into a collaborative process to address the low DO concerns in the Spokane River and Lake Spokane. The effort was called the "Spokane River TMDL Collaboration" and began in May 2005.

Post Falls and Coeur d'Alene were full participants in funding and collaboration efforts, along with all Washington dischargers. EPA, IDEQ, the Sierra Club, the Spokane Tribe of Indians, and Avista also participated. WDOE funded 50 percent of the collaborative expense and co-chaired the effort with Spokane County. HARSB participated in the collaboration and agreed to fund a portion of the expenses at its February 2008 Board meeting.

The collaboration led to a document titled "Foundational Concepts for the Spokane River TMDL Managed Implementation Plan" (MIP) on June 30, 2006. The MIP stated "Currently, there is not well-established technology that can reliably treat a variety of wastewater discharges and achieve the river phosphorus levels required to improve DO sufficiently to meet Water Quality Standards." There is, however, technology that significantly reduces phosphorus from effluent and that can bring current discharges much closer to the levels required by Water Quality Standards. The collaboration refers to the difference between what technology improvements can achieve and the TMDL levels to meet Water Quality Standards as the "delta." The MIP provides reasonable assurance that Water Quality Standards can be achieved during the first ten years of the MIP effort by installing the most effective feasible phosphorus removal treatment technology and completing a scheduled group of actions aimed at eliminating the delta. The MIP assumes that efforts to control phosphorus will also control 5-day carbonaceous biochemical oxygen demand ($CBOD_5$) and ammonia.

The MIP was presented to the full participant group and the public on July 12, 2006. At that meeting, EPA discussed the status and relationship between the MIP collaboration and the re-issuance of the Idaho NPDES Permits. EPA is responsible for Idaho Permits, with IDEQ responsible for reviewing proposed permits and issuing 401 Water Quality Certification requirements under the Federal Clean Water Act. EPA stated that Idaho NPDES Permits will be written to meet Washington Water Quality Standards at the Idaho State border and to not create more than 0.2 mg/L degradation in Lake Spokane. This would be accomplished using specific permit limits and timeframe agreed to by IDEQ and EPA using the most current models for the basin. The MIP Foundational Concepts Memorandum of Understanding (MOU) was signed by the WDOE, Spokane County, Liberty Lake Sewer and Water District, City of

Spokane, Kaiser Aluminum, and Inland Empire Paper Company authorized representatives on March 7, 2007. The MIP is available on WDOE's Eastern Regional Office website.

Table 2-1 compares the water quality standards for Idaho and Washington.

Table 2-1 – Dissolved Oxygen and pH Criteria for Spokane River and Lake Spokane

Parameter	Idaho Criterion	Washington Criterion
Spokane River		
DO	Concentrations exceeding 6.0 mg/L at all times. [1]	DO shall exceed 8 mg/L. If natural conditions are less than the criteria, the natural conditions shall constitute the water quality criteria. [2]
pH	Within the range of 6.5 to 9.0.	The pH shall be within the range of 6.5 to 8.5…with a human-caused variation within the above range of less than 0.5 units.
Lake Spokane (Washington Water Quality Standards)		
DO	No measurable decrease from natural conditions. [2, 3]	

Notes:

[1] *The Idaho Water Quality Standards, like the Washington Standards, include a "Natural Background Conditions" provision (IDAPA 58.01.02.200.09), but this provision is not invoked for DO or pH, since the natural condition of the Spokane River is of higher quality than the numeric criteria for DO and pH.*

[2] *The Water Quality Standards for Surface Waters of the State of Washington (Chapter 173-201A of the Washington Administrative Code, or WAC) defines "natural conditions" as the surface water quality that was present before any human-caused pollution.*

[3] *For DO, Ecology has interpreted a "measurable decrease" from natural conditions to be a 0.2 mg/L decrease from natural conditions (Cusimano, 2004).*

Although Idaho dischargers, IDEQ, and EPA were not signatories to the MIP, it is clear that they incorporated the general approach of the MIP into Idaho Discharge Permit requirements. EPA issued those permits for public comment on February 16, 2007. WDOE also re-issued their "Spokane River and Lake Spokane Dissolved Oxygen TMDL" as well as NPDES Permits for existing Washington dischargers in September 2007. The permits and TMDL have received significant comments from the dischargers, the Sierra Club, and the Spokane Tribe. The TMDL was revised and reissued in May 2008 and the comment period was extended to June 24, 2008. The TMDL appears on WDOE's website. The crux of the arguments is essentially:

1. Is the EPA's approach for issuing separate permits to Idaho dischargers that meet Washington's Water Quality Standards at the Idaho border without creating greater than 0.2 mg/L decrease in DO anywhere in the Spokane River or Lake Spokane consistent with the MIP, TMDL, and the Federal Clean Water Act?
2. Is Washington's application of natural lake DO conditions of 8.0 mg/L (full depth) legitimate and achievable in the Lake Spokane hydroelectric impoundment?
3. Can and should the public economically support the rapidly diminishing returns required by the MIP and 2008 draft TMDL with their resulting NPDES Permit conditions?

These questions were summarized by the November 13, 2007, TMDL comment letter to WDOE submitted by Post Falls Mayor Clay Larkin and Hayden Mayor Ronald McIntire. A copy of that letter appears in **Appendix C**. These are substantive and contentious issues that resulted in legal actions, which caused EPA to reconsider their permitting approach. Although the TMDL and MIP concepts may be promulgated into Idaho Discharge Permits, the EPA withdrew the draft permits in September 2008. EPA, IDEQ, and WDOE are currently preparing a Work Plan to address the draft permit comments. The TMDL will also be revisited as part of this process. The public statement issued by EPA regarding the permit process appears in **Appendix C**.

2.3 Anticipated NPDES Permit Conditions

As discussed in previous sections, the EPA withdrew the 2007 draft discharge permits for the HARSB and Post Falls WWTPs to continue discharging into the Spokane River. The permits are directly influenced by Water Quality Standards in both Idaho and Washington. The Idaho standards are generally being met, but not the Washington DO standards. Therefore, Washington has developed a TMDL for its “impaired” water body.

The draft TMDL has not been finalized, so Washington has not sought approval of the TMDL from EPA. Even so, EPA utilized the technical analysis from the TMDL along with the computer model originally developed for the TMDL to evaluate the “reasonable potential” that Idaho dischargers may have “to cause or contribute to an excursion above any State water quality standard” (EPA, 2007). EPA issued draft NPDES Permits to Idaho dischargers for public comment on February 16, 2007, and conducted a Public Hearing on them on April 4, 2007, in Coeur d’Alene. The Public Comment period closed on May 17, 2007, with comments received from the dischargers as well as numerous other public and private entities. EPA withdrew the draft permits in September 2008 to address the accumulative effects of all dischargers. It is likely that the re-evaluation process will take 12 to 18 months and result in further restrictions. The 2007 draft permits will still serve as a benchmark for this study. Caution must be exercised so that future permit limitations can still be attained.

2.3.1 HARSB 2007 Draft NPDES Permit (withdrawn)

HARSB WWTP’s draft NPDES Permit appears on EPA’s Region 10 website (http://yosemite.epa.gov/r10/water.nsf/NPDES+Permits/DraftPermitsID). Upon finalization, the permit would have authorized discharge of pollutants from Outfall 001 subject to the conditions of the permit. Only the discharge of those pollutants resulting from facility processes, waste streams, and operations that have been clearly identified in the permit application process would be authorized.

The NPDES Permit, together with its Fact Sheet, described in full detail the conditions and requirements imposed upon the operating authority. Permit requirements were organized into the following basic sections:

- Limitations and Monitoring Requirements (Part I)
- Special Conditions (Part II)
- Monitoring, Recording, and Reporting Requirements (Part III)
- Compliance Responsibilities (Part IV)
- General Provisions (Part V)

The complete list of effluent limits and monitoring requirements were specified in the draft permit and listed in Part 1.B.1, Table 1. **Table 2-2** summarizes the effluent limitations that are of primary concern in the daily operation of the facility. HARSB will also likely be required to monitor several additional parameters even though there are no permit limits. HARSB's draft NPDES Permit included several significant modifications to the current NPDES Permit. The important changes were:

- Test for 5-day carbonaceous biochemical oxygen demand ($CBOD_5$) rather than BOD_5.
- Year-round discharge was allowed at very low TP limits (0.14 lbs/day) from June through September (10 µg/L @ 1.65 mgd). This condition may or may not be allowed in a future permit.
- Significant TP restrictions in the "shoulder" months (6.9 lbs/day in April and May and 13.8 lbs/day in March and October). These limits may be tightened in the revised permit.
- Ammonia restrictions of 138 lbs/day (10 mg/L) from March through October will likely be tightened somewhat in the revised permit.

One of the most important aspects of the 2007 draft permit was that TP restrictions were based solely on a load in pounds per day rather than a concentration. When plant flows increase beyond the currently permitted flow of 1.65 mgd, concentrations in the effluent would have to decrease by a proportionate amount to stay within the mandated limit. Conversely, HARSB would have been allowed to discharge at a proportionately higher concentration and correspondingly lower flow rates. Recognizing this condition, HARSB requested that EPA's future permit for their facility reflect the capacity upgrades of Phase IIIC improvements. If granted, the modified permit would rate the plant at 2.4 mgd.

Summer discharges for total phosphorus were calculated at 10 µg/L, but they have never been achieved in any full-scale, full-time operations. Therefore, achieving lower concentrations from June through September in order to discharge at a higher flow rate is currently not feasible. Meeting the shoulder month restrictions below 500 µg/L and 1,000 µg/L is achievable with currently available and demonstrated technology, but not without significant investment.

Another critical element of the 2007 draft NPDES Permit was that HARSB was to meet several interim requirements as part of a schedule of compliance. These interim requirements were listed in Part I.C and I.D of the draft permit and summarized in **Table 2-3**.

As a method of assuring adequate progress would have been made by HARSB to comply with the NPDES Permit, HARSB would have one year from the date of issuance to provide a Preliminary Engineering Report to EPA and IDEQ. The report would outline estimated costs and schedules for completing any current capacity expansion and implementation of technologies to achieve final effluent limitations. By the expiration of the 5-year permit, HARSB must have conducted and submitted results for pilot testing of phosphorus removal technologies to EPA and IDEQ with an implementation plan addressing financial plans.

Table 2-2 – HARSB WWTP 2007 Draft NPDES Effluent Limits (withdrawn)

Parameter	Unit of Measurement	Effluent Limits		
		Average Monthly Limit	Average Weekly Limit	Maximum Daily Limit
1. Flow	mgd	Report	---	Report
2. Receiving Water Flow	cfs	Report average, minimum, and maximum daily flows for the month		
3. Five-day Carbonaceous Biochemical Oxygen Demand ($CBOD_5$) (November – February)	mg/L	25	40	---
	lbs/day	344	550	---
	% removal	85% (min.)	---	---
4. $CBOD_5$ (March – October)	mg/L	15	24	---
	lbs/day	138	220	---
	% removal	85% (min.)	---	---
5. TSS	mg/L	30	45	---
	lbs/day	413	619	---
	% removal	85% (min.)	---	---
6. pH (November – March)	s.u.	6.3 – 9.0 at all times		
7. pH (April – June)	s.u.	6.0 – 9.0 at all times		
8. pH (July – October)	s.u.	6.4 – 9.0 at all times		
9. E. Coli Bacteria	#/100 mL	126	---	406
10. Total Chlorine Residual (July – October)	µg/L	78.4	---	384
	lbs/day	1.08	---	5.28
11. Total Chlorine Residual (November – June)	µg/L	500	750	---
	lbs/day	6.88	10.3	---
12. Total Ammonia N (March – October)	mg/L	10	---	22.9
	lbs/day	138	---	315
13. Total Ammonia N (November – February)	mg/L	78.7	---	250
	lbs/day	1083	---	3440
14. Total Phosphorus as P (March)	µg/L	Report	Report	---
	lbs/day	13.8	20.6	---
15. Total Phosphorus as P (April – May)	µg/L	Report	Report	---
	lbs/day	6.9	10.3	---
16. Total Phosphorus as P (June – September)	µg/L	Report	Report	---
	lbs/day	0.14	0.21	---
17. Total Phosphorus as P (October)	µg/L	Report	Report	---
	lbs/day	13.8	20.6	---
18. Total Phosphorus as P (November – February)	µg/L	Report	---	Report
	lbs/day			
19. Lead	mg/L	2.19	---	4.94
	lbs/day	0.030	---	0.068
20. Zinc	mg/L	88.2	---	112
	lbs/day	1.21	---	1.54

Table 2-3 – HARSB 2007 Interim Effluent Limits/Compliance Schedule (withdrawn)

Parameter	Unit of Measurement	Effluent Limits		
		Average Monthly Limit	Average Weekly Limit	Maximum Daily Limit
CBOD$_5$ March-May and October until 4 years after the effective date of the final Permit.	mg/L	25	40	---
	lb/day	344	550	---
	% removal	85% (min.)	---	---
CBOD$_5$ June-September, River Flow >2,000 CFS until 4 years after the effective date of the final Permit.	mg/L	25	40	---
	lb/day	344	550	---
	% removal	85% (min.)	---	---
CBOD$_5$ March-May and October from 4 years after the effective date of the final Permit until 9 years after the effective date of the final Permit.	mg/L	15	24	---
	lb/day	206	330	---
	% removal	85% (min.)	---	---
CBOD$_5$ June-September, River Flow >2,000 CFS from 4 years after the effective date of the final Permit until 9 years after the effective date of the final Permit.	mg/L	15	24	---
	lb/day	206	330	---
	% removal	85% (min.)	---	---
Total Phosphorus as P March-May and October until 3 years after the effective date of the final Permit.	mg/L	Report	Report	---
	lb/day	Report	Report	---
Total Phosphorus as P June-September, River Flow >2,000 CFS until 3 years after the effective date of the final Permit.	mg/L	Report	Report	---
	lb/day	Report	Report	---
Total Phosphorus as P March-May and October from 3 years after the effective date of the final Permit until 6 years after the effective date of the final Permit.	mg/L	2.0	3.0	---
	lb/day	27.5	41.3	---
Total Phosphorus as P June-September, River Flow >2,000 CFS from 3 years after the effective date of the final Permit until 6 years after the effective date of the final Permit.	mg/L	2.0	3.0	---
	lb/day	27.5	41.3	---
Total Phosphorus as P March-May and October from 6 years after the effective date of the final Permit until 9 years after the effective date of the final Permit.	mg/L	1.2	1.8	---
	lb/day	16.5	24.8	---
Total Phosphorus as P June-September, River Flow >2,000 CFS from 6 years after the effective date of the final Permit until 9 years after the effective date of the final Permit.	mg/L	1.2	1.8	---
	lb/day	16.5	24.8	---
Total Ammonia as N March-May and October until 2 years after the effective date of the final Permit.	mg/L	78.7	---	250
	lb/day	985	---	3128
Total Ammonia as N June-September, River Flow >2,000 CFS until 2 years after the effective date of the final Permit.	mg/L	78.7	---	250
	lb/day	985	---	3128
Total Ammonia as N March-May and October from 2 years after the effective date of the final Permit until 6 years after the effective date of the final Permit.	mg/L	15	---	34.4
	lb/day	206	---	473
Total Ammonia as N June-September, River Flow >2,000 CFS from 2 years after the effective date of the final Permit until 6 years after the effective date of the final Permit.	mg/L	15	---	34.4
	lb/day	206	---	473

Within the first year of the next NPDES Permit (six years after issuance), HARSB must have provided written notice that designs are complete and construction contracts have been awarded to build the facilities necessary to comply with the final effluent limitations. Construction and startup of the facilities were to be completed by nine years after issuance of the final NPDES Permit. These rigorous and aggressive compliance activities would have required significant capital and operational commitments by HARSB entities and staff. They would have likely involved a combination of technologies, including, but not limited to, BNR, chemical coagulation, filtration (single or dual pass), and expanded reuse operations. Reuse will be examined more closely in later sections of this Technical Memorandum. It is likely that a similar compliance schedule will be included with the future draft permits. Some of the timeframes may be shortened because of capacity improvements already completed by HARSB and increasing pilot testing and research available for ultra-low level phosphorus treatment.

2.3.2 Post Falls 2007 Draft NPDES Permit (withdrawn)

Post Falls WWTP's draft NPDES Permit included significant modifications to the current permit requirements. It appears on EPA's Region 10 website (http://yosemite.epa.gov/r10/water.nsf/NPDES+Permits/DraftPermitsID). Upon finalization, the permit would have authorized discharge of pollutants from Post Falls WWTP Outfall 001 subject to the conditions of the permit. As with the HARSB draft permit, it authorized the discharge of only those pollutants resulting from facility processes, waste streams, and operations that have been clearly identified in the permit application process and is organized into the following sections:

- Limitations and Monitoring Requirements (Part I)
- Special Conditions (Part II)
- Monitoring, Recording, and Reporting Requirements (Part III)
- Compliance Responsibilities (Part IV)
- General Provisions (Part V)

The monitoring requirements and frequency were specified in the permit and listed in Part 1.B.1 in Table 1. Of primary concern in the proposed draft permit are:

- Five-day carbonaceous biochemical oxygen demand ($CBOD_5$) would have been 12 mg/L from March through October compared to 30 mg/L BOD_5 year round in the current permit.
- TP restrictions from March through October between 50 µg/L and 1,000 µg/L that are well beyond the current 70 percent minimum removal.

The effluent limitations that were of primary concern in the daily operation, expansion, and management of the facility are listed in **Table 2-4**. In addition, the TP limits were based on loading (lbs/day) rather than concentration (µg/L) for March through May and a total flow of 3.48 mgd. This means that as Post Falls WWTP exceeds 3.48 mgd for those months, effluent TP concentrations would have to decrease proportionately. Conversely, flows less than 3.48 mgd would have allowed proportionately greater phosphorus concentration. June through October limits included both loading and concentration. Therefore, both conditions would have applied during those months and required proportionate TP reductions when effluent flows exceed 3.48 mgd and 50 µg/L average effluent concentrations until that time.

Table 2-4 – Post Falls WWTP 2007 Draft NPDES Effluent Limits (withdrawn)

Parameter	Unit of Measurement	Effluent Limits		
		Average Monthly Limit	Average Weekly Limit	Maximum Daily Limit
1. Flow	mgd	Report	---	Report
2. Five-day Carbonaceous Biochemical Oxygen Demand (CBOD_5) (November – February)	mg/L	25	40	---
	lbs/day	726	1161	---
	% removal	85% (min.)	---	---
3. CBOD_5 (March – October)	mg/L	12	19	---
	lbs/day	290	464	---
	% removal	85% (min.)	---	---
4. TSS	mg/L	30	45	---
	lbs/day	871	1306	---
	% removal	85% (min.)	---	---
5. pH (November – March)	s.u.	6.3 – 9.0 at all times		
6. pH (April – June)	s.u.	6.2 – 9.0 at all times		
7. pH (July – October)	s.u.	6.5 – 9.0 at all times		
8. E. Coli Bacteria	#/100 mL	126	---	406
9. Total Chlorine Residual (July – October)	µg/L	36	---	161
	lbs/day	1.04	---	4.67
10. Total Chlorine Residual (November – June)	µg/L	147	---	662
	lbs/day	4.27	---	19.2
11. Total Ammonia N (March – October)	mg/L	8.2	---	29.5
	lbs/day	29.5	---	856
12. Total Ammonia N (November – February)	mg/L	25.4	---	91.7
	lbs/day	737	---	2661
13. Total Phosphorus as P (March)	µg/L	Report	Report	---
	lbs/day	29.0	43.5	---
14. Total Phosphorus as P (April – May)	µg/L	Report	Report	---
	lbs/day	7.26	10.9	---
15. Total Phosphorus as P (June – September)	µg/L	50	75	---
	lbs/day	1.45	2.18	---
16. Total Phosphorus as P (October)	µg/L	1000	1500	---
	lbs/day	29	43.5	---
17. Total Phosphorus as P (November – February)	µg/L	Report	---	Report
	lbs/day			
18. Lead	µg/L	2.05	---	3.79
	lbs/day	.059	---	0.110
19. Zinc	µg/L	84.3	---	115
	lbs/day	2.45	---	3.34
20. Copper	mg/L	13.8	---	27.7
	lbs/day	0.40	---	0.80

As more research, pilot testing, and full-scale operational data become available for these ultra-low effluent TP limits, it will be possible to project the proportionate flow increase that Post Falls could have expected to treat and discharge into the Spokane River. On the other hand, the TMDL and MIP in Washington have forced EPA and WDOE to re-evaluate their permits and will likely lead toward even more strict future limits. Therefore, it is not yet realistic to anticipate significantly higher June through September WWTP effluent flows beyond the 3.48 mgd currently permitted. This will likely force a stronger emphasis on both water conservation and reuse.

If the draft NPDES Permit had been finalized, Post Falls would have been required to meet several interim requirements according to the schedules listed in Part I.C and I.D. **Table 2-5** below lists the schedule for compliance with the previously proposed limits:

Table 2-5 – Post Falls 2007 Interim Effluent Limits/Compliance Schedule (withdrawn)

Parameter	Unit of Measurement	Effluent Limits		
		Average Monthly Limit	Average Weekly Limit	Maximum Daily Limit
$CBOD_5$	mg/L	25	40	---
March-October until 4 years after the effective date of the final Permit.	lb/day	726	1161	---
	% removal	85% (min.)	---	---
$CBOD_5$	mg/L	12	19	---
March-October from 4 years after the effective date of the final Permit until 9 years after the effective date of the final Permit.	lb/day	348	557	---
	% removal	85% (min.)	---	---
Total Phosphorus as P	µg/L	Report	---	Report
March-October until 4 years after the effective date of the final Permit.	lb/day	Report	---	Report
	% removal	70% (min.)	---	---
Total Phosphorus as P	mg/L	1.2	1.8	---
March-October from 4 years after the effective date of the final Permit until 6 years after the effective date of the final Permit.	lb/day	34.8	52.2	---
Total Phosphorus as P	mg/L	1.0	1.5	---
April-September from 6 years after the effective date of the final Permit until 9 years after the effective date of the final Permit.	lb/day	29.0	43.5	---

As with the HARSB draft permit, Post Falls would have had one year to provide a Preliminary Engineering Report to EPA and IDEQ outlining estimated costs and schedules for completing an expansion as well as technologies to achieve compliance with final effluent limitations. Phosphorus removal pilot studies would have been completed by the end of the first 5-year permit cycle. Design and bidding of the facilities would have occurred by the sixth year and construction by the eighth year. Nine years after permit issuance, Post Falls would have fully complied with the final effluent limits. Complying with these limits would have required significant capital and operational investment. The investment will still likely be a combination of technologies for BNR, filtration, chemical coagulation, and wastewater reuse. Reuse will be examined more closely in the following sections. A similar compliance schedule will likely be included in any future permit, but the timeframes may be shorter due to the time currently available to Post Falls to expand the WWTP.

2.4 Wastewater Reclamation and Reuse Standards

The wastewater reclamation and reuse standards for the study area are governed by the Idaho Administrative Procedures Act (IDAPA) Part 58, Title 01. IDAPA is available on the State of Idaho website at http://adm.idaho.gov/adminrules/rules/idapa58/58index.htm. The primary IDAPA chapters that apply are:

- Chapter 2 – "Water Quality Standards"
- Chapter 8 – "Idaho Rules for Public Drinking Water Systems"
- Chapter 11 – "Groundwater Quality Rules"
- Chapter 16 – "Wastewater Rules"
- Chapter 17 – "Rules for the Reclamation and Reuse of Municipal and Industrial Wastewater"

Table 2-6 provides a brief summary of the requirements for reuse of municipal reclaimed wastewater under Chapter 17. It subdivides reuse into five classes (A through E) from the most stringent treatment and reliability standards to the least stringent treatment standard with the most restrictive buffer zones and access requirements, respectively. Currently, HARSB practices Class C reuse. With coagulation, filtration, and enhanced disinfection, both HARSB and Post Falls could practice Class B or even Class A reuse, depending on their available treatment trains and reuse location. **Figure 2.1** provides a pictorial representation of how Class A reclamation and reuse may be presented to potential users and the general public.

2.4.1 Reclamation and Reuse Over the Rathdrum Prairie Aquifer

It is important to recognize that the study area is over the Rathdrum Prairie Aquifer (RPA), also known as the Spokane Valley-Rathdrum Prairie Aquifer (SVRPA). It is the only designated "Sensitive Resource Aquifer" in Idaho. As such, there are several special provisions that impact reuse practices in the study area. In particular, the "Reuse Rules" (IDAPA 58.01.17) allows groundwater recharge using surface spreading, seepage ponds, unlined surface water features, or subsurface distribution. The recharge activities must meet the "Groundwater Quality Rule" (IDAPA 58.01.11) and must be located at least 1,000 feet and at least six months of travel time from any downgradient drinking water.

IDAPA 58.01.11.300-350 also requires the following:

- The aquifer shall not be degraded, as it relates to beneficial uses, as a result of point source or non-point source activity unless it is demonstrated by the person proposing the activity that such change is justifiable as a result of economic or social development.
- Activities with the potential to degrade Sensitive Resource Aquifers shall be managed in a manner that maintains or improves existing groundwater quality.
- Sensitive Resource Aquifer groundwater is of better quality than the groundwater quality standards in Section 200, and maintenance of this quality is needed to protect an identified beneficial use.

Table 2-6 – Summary of Requirements for Direct Use of Municipal Reclaimed Wastewater

Classification	Class A	Class B	Class C	Class D	Class E
Treatment (Municipal Wastewater must be treated by the following:)	• Oxidized, clarified, and coagulated, with filtration approval requirement or treated by an equivalent process. • Highest level reliability. • Nitrogen removal requirements. • Turbidity limits below 2 NTU. • Adequately disinfected and tested. • Pilot testing required.	• Oxidized, coagulated, clarified, and filtered or treated by an equivalent process. • Turbidity limits below 2 NTU. • Adequately disinfected and tested. • Pilot testing required.	• Oxidized and adequately disinfected.	• Oxidized and adequately disinfected.	• At least primary effluent quality.
Disinfection	Total Coliform not to exceed two and two tenths (2.2) per one hundred (100) milliliters.	Total Coliform not to exceed two and two tenths (2.2) per one hundred (100) milliliters.	Total Coliform not to exceed twenty three (23) per one hundred (100) milliliters.	Total Coliform not to exceed two hundred and thirty (230) per one hundred (100) millimeters.	Total Coliform organisms up to “too numerous to count.”
Uses	• Irrigation at individual homes. • Groundwater recharge using surface spreading, seepage ponds, unlined surface water features, or subsurface distribution. • Fire suppression from dedicated, marked hydrants. • Dust suppression at construction sites. • Toilet flushing at some industrial and commercial sites. • Class B, C, D, or E uses.	• May contact any edible portion of raw food crops. • Irrigation for golf courses, parks, playgrounds, or schoolyards. • Class C, D, or E uses. • Toilet flushing at some industrial and commercial sites.	• Irrigation for orchards and vineyards during the fruiting season if no fruit harvested for raw use comes in contact with the irrigation water or ground or will contact the edible portion of raw food crops. • Irrigation for cemeteries or roadside vegetation. • Toilet flushing at some industrial and commercial sites. • Class D or E uses.	• Irrigation for fodder, seed, or processed food crops. • Class E uses.	• Irrigation for forested sites.
Access Restriction	Irrigation during periods of non-use.	Irrigated during periods of non-use by public.	Irrigated during periods of non-use by public.	Public access restricted.	Public access restricted.
Buffer Distances	None, except no spray to contact drinking fountains, picnic tables or public eating facilities. Also, no effluent is allowed to be applied to surface waters where a NPDES Permit is required. One hundred feet minimum to drinking water wells (1,000 feet for recharge).	Site specific (see IDAPA 58.01.17). No effluent is allowed to be applied to surface waters where a NPDES Permit is required.	Site specific (see IDAPA 58.01.17). No effluent is allowed to be applied to surface waters where a NPDES Permit is required.	Site specific (see IDAPA 58.01.17). No effluent is allowed to be applied to surface waters where a NPDES Permit is required.	Site specific (see IDAPA 58.01.17). No effluent is allowed to be applied to surface waters where a NPDES Permit is required.
Grazing	Grazing allowed only with approved grazing management plan.	Grazing allowed only with approved grazing management plan.	Grazing allowed only with approved grazing management plan.	Grazing not allowed.	Grazing not allowed.

The net result of these rules is that groundwater recharge is not feasible in most instances over the RPA for two reasons. First, the high quality and readily available quantity of water has led to a proliferation in the number of drinking water wells present. Second, horizontal hydraulic conductivities in the study area range from an estimated 12,100 to 22,100 feet per day, so groundwater travels very quickly (USGS, 2007). These two facts make it unlikely that a recharge site could be located less than six months travel time from a downgradient drinking water well. As a result, this Master Plan concentrates on irrigation and other reuse practices that will not lead to groundwater recharge.

2.4.1.1 SVRP Aquifer Special Supplemental Guidelines

Reuse is a permitted activity in Idaho under IDAPA 58.01.17.300, which references the "Idaho Guidance for Reclamation and Reuse of Municipal and Industrial Wastewater" (IDEQ, 2007). The IDEQ Guidance "provides assistance in applying and interpreting" the Reuse Rules for permitting and operating reclamation and reuse facilities. Of particular importance to this Master Plan is Section 12.11, titled "Wastewater Land Application Sites Overlying Designated Special Resource Water." It outlines the background behind the need for possible "special considerations" for nutrient management of land application reuse over the RPA, including calculation of the nitrogen and phosphorus balance and calculation of loss to groundwater. Section 12.11 of the Guidance includes the "Spokane Valley-Rathdrum Prairie Aquifer Wastewater Land Application Special Supplemental Guidelines" (IDEQ, 1995). The Special Supplemental Guidelines were developed by a Technical Advisory Group and IDEQ's Northern Idaho Regional Office from information gathered in two earlier studies—the "Rathdrum Prairie Land Application Feasibility Study" (CH2M Hill, 1990) and the "Hayden Land Application Pilot Study" (CH2M Hill and Riley, 1994). Conclusions and recommendations of the Special Supplemental Guidelines include the following:

Conclusions:

1. Land application of treated effluent has occurred over the Rathdrum Prairie Aquifer under carefully managed conditions with limited increases for monitored constituents in vadose zone water.
2. Irrigation scheduling using daily soil moisture measurements can be used to minimize migration of nutrients past the root zone.
3. Nutrients can be applied with wastewater effluent with little or no observable migration beyond the root zone of the crops.
4. The tradeoffs between crop production and fertilizer use should be evaluated for each site considering the potential for nutrient migration and the need to establish and maintain vigorous crops.
5. Crop selection is critical to the successful operation of a land application system.

Recommendations:

1. Limit the hydraulic loading rate to the mean monthly crop water requirement. (Initial design should be based on a 5- to 10-year precipitation occurrence interval with daily irrigation based on soil moisture monitoring always greater than 10 centibars.)

2. Limit nitrogen to crop nitrogen requirements. (Include a fraction above crop uptake to allow for losses that occur in the soil, initially 10 to 20 percent.)
3. Select deep rooting crops with high uptake rates.
4. Apply effluent with an irrigation system that is well maintained and efficient in distributing water evenly across the site. (Allow for supplemental irrigation water in years with less than design precipitation rates.)
5. Assess the site soils, hydrology, and climate. (An unacceptable evaluation on soil, buffer zones, land use, or wellhead protection can eliminate a site from consideration.)
6. Prepare a management plan that integrates effluent management with suitable agricultural best management practices (BMPs). (Include harvest schedule, hydraulic requirements, nutrient requirements, crop rotation, and pest control.)
7. Phosphorus should also be monitored, but annual application rates need not be limited to agronomic rates.
8. To determine acceptability of loading rates beyond the agronomic rates recommended, additional studies are needed.
9. Provide lagoon storage for all systems. Size the storage to retain all reclaimed water (in a single outfall system) or at least one week's flow to accommodate temporary irrigation cessation due to weather or harvest schedules (multiple outfall system). Construct all lagoons with a synthetic liner. Lagoons greater than 500,000 gallons must be constructed with a second level of protection approved by DEQ.
10. A monitoring and sampling program should include wastewater effluent sampling, soil moisture monitoring, soil water sampling, soil sampling, and groundwater monitoring in accordance with the "Interpretive Supplement to the Guidelines for Land Application of Municipal and Industrial Wastewater, March 1988" (Idaho Division of Environmental Quality, 1994).

It is important to note that the "Interpretive Supplement" referred to above has been superseded by the current IDEQ Guidance for Reclamation and Reuse. The IDEQ Guidance provided the necessary protocols to evaluate the proposed HARSB land application site in 1996.

2.4.1.2 HARSB Land Application/Reuse

It is instructive to review the HARSB reuse practices since they are the only current reuse activities near the study area. IDEQ issued the current HARSB Wastewater Land Application Permit (WLAP) on August 13, 2003, which means it expires August 13, 2008. HARSB has applied for a new permit but will continue to operate under the existing WLAP LA-000109-03 until a new permit is issued. The WLAP appears with the other discharge permits on the IDEQ website (IDEQ 2003). IDEQ reviewed HARSB's 2007 Annual Report, and their comment letter appears with the Annual Report excerpts in **Appendix D**.

HARSB irrigates approximately 300 acres of timothy hay, orchard grass, alfalfa hay, and hybrid poplar trees. The 476-acre site is located at the southeast corner of Huetter Road and Boekel Road. The hay and grass receives center pivot type irrigation while the hybrid poplar trees receive water through drip irrigation, as shown on **Figure 2.2**. The combination of drip irrigation and disinfection levels to achieve 2.2 total coliform bacteria per 100 ml allows HARSB to utilize a buffer zone distance of 50 feet to the nearest residence and 0 feet to public access areas. Hydraulic loading rates are based on soil moisture probes in each hydraulic management unit (HMU). If either the shallow or intermediate depth probes in 25 percent or more of the monitoring sites within a HMU have readings less than 10 centibars, irrigation cannot occur in that HMU until at least 75 percent of the sites within the HMU have readings on both probes of greater than 10 centibars. The maximum nitrogen and phosphorus that can be applied to any crop is 125 percent of that crop's uptake or as defined by the University of Idaho's Fertility Guide. The growing season is defined as April 1 through October 15.

HARSB has completed all the Compliance Activities (CAs) listed in the WLAP. They include:

- CA-00109-01 – revised Operations and Maintenance Manual, May 2005
- CA-00109-02 – constructed dedicated downgradient monitoring well in June 2005
- CA-00109-03 – lagoon leakage test completed and results submitted to IDEQ in June 2005
- CA-00109-04 – revised Land Application Site Instrumentation Plan submitted as part of O&M Manual
- CA-00109-05 – instruments recommended in O&M Manual installed prior to 2005 growing season

HARSB's biggest challenges in the reuse operation are centered around balancing permit activities with the need to grow and harvest a crop. HARSB contracts with a local farmer to plant, fertilize, and harvest their center pivot crops. Standard farming practice is to estimate the fertilizer application based on the crop type and anticipated yield. Farmers do not typically review the application rate in comparison to crop yield and crop tissue analysis. This annual "post mortem" review of yield requires close coordination between HARSB and their farmer. HARSB typically requires lower rates of supplemental fertilizer to maintain WLAP compliance than the farmer would normally apply.

HARSB's poplar tree cropping plan presents several challenges as well as benefits. The trees grow vigorously and demand large volumes of water after approximately five years from establishment. They also do not require annual harvesting, so irrigation proceeds uninterrupted until they are fully mature. On the other hand, poplars require several years to establish their vigorous root and stem mass, so early years require very little water. They are somewhat more problematic to control pests such as voles and leaf-eating insects. There is also a limited market for the mature poplar trees for either chips (pulp) or as lumber (molding). Because of their rapid growth, there may be an eventual market for carbon trading or sequestering, but that market is currently highly speculative.

Based on HARSB's 2007 Wastewater Reuse Report, they were able to irrigate 160 MG to 300 acres over a 136-day period. The HMU breakdown appears in **Table 2-7**. From these values, it appears that HARSB could develop their entire 476-acre reuse site to receive approximately 1.87 mgd from mid-May through September. This does not fully support their current plant rating of 2.0 mgd. In addition, the summer of 2007 was extremely dry and hot in North Idaho.

Therefore, 1.65 mgd should continue as the reuse limitation until further data supports a higher irrigation rate. This reuse rate corresponds to 17.2 ER/acre at 200 gpd/ER. The treatment plant is now rated at 2.0 mgd with potential to expand to 2.4 mgd. Consequently, HARSB will need significant additional reuse acreage to continue expanding their service while removing most or all of their flow from the Spokane River during June through September.

Table 2-7 – HARSB 2007 Reuse Irrigation Volumes

HMU	Location	Reuse Area (acres)	Crop	Reclaimed Water (MG)	Well Makeup Water (MG)	Total Irrigation Volume (MG)	Irrigation Rate (in/acre)
0109-01A	East Pivot	66	Alfalfa	28.96	0.91	29.87	19.30
0109-01B	East Pivot	33	Orchard Grass	27.26	0.80	28.06	18.41
0109-02A	West Pivot	33	Alfalfa	26.20	0.88	27.08	15.11
0109-02B	West Pivot	57	Alfalfa/Orchard Grass	23.30	0.40	23.70	26.40
0109-03	West Pivot	57	Alfalfa	14.79	0.40	15.19	16.95
0109-04A	Zone 1 - W	3.7	Poplars – old	3.88	0.08	3.96	39.41
0109-04B	Zone 2 - NW	11.0	Poplars	10.14	0.35	10.49	35.12
0109-04C	Zone 3 - N	27.0	Poplars	17.64	0.66	18.30	24.72
0109-04D	Zone 4 - NE	12.0	Poplars - young	2.76	0.10	2.86	8.78
	Grand Total	299.7		154.93	4.58	159.51	

2.4.1.3 Anticipated Wastewater Reclamation and Reuse Standards over the Rathdrum Prairie Aquifer

Regulators continue to trend toward tighter discharge restrictions into the Spokane River. Consequently, reuse over the RPA will likely become an ever-increasing part of the long-term management strategy for Hayden, Post Falls, Rathdrum, and Kootenai County. Anticipated regulations to govern reuse over the RPA also become more important in planning that strategy. Since only one reuse site is active over the main body of the aquifer, evaluating additional reuse sites will be critically important.

Under a grant made available through the IDEQ and administered by the City of Post Falls, J-U-B ENGINEERS, Inc. (J-U-B); Golder Associates (Golder); and Cascade Earth Science (CES) are providing an Addendum to the 1995 Supplemental Guidelines. The Addendum will provide a site suitability screening tool for use by IDEQ and the regulated community to evaluate potential reuse sites. The work is divided into four tasks and will be completed in 2008.

Task 1 focused on data review and collection at the HARSB reuse site. Existing monitoring well sampling determined that measurable aquifer stratification exists. The uppermost 10 feet of the aquifer is expected to be most representative of the input from activities on an overlying site. Task 1 also required the siting, design, drilling, and sampling of a dedicated upgradient monitoring well at HARSB. The new well is in place and HARSB samples it along with the original upgradient drinking water well for comparison purposes. HARSB soil, cropping, and irrigation data for their reuse operations also provided valuable insight into the measures necessary to properly manage and monitor reuse practices over the RPA. The data showed that soil moisture monitoring is the key to maximize crop production while minimizing residual moisture and nutrients in the soil prior to the non-growing season when excess precipitation will tend to leach mobile constituents like nitrate and sulfate.

Task 2 focused on the analyses and reporting necessary to properly evaluate potential reuse sites over the RPA. CES developed a soil, irrigation, nutrient, and crop evaluation protocol from the water source through the root zone of potential RPA reuse sites. Golder developed an analytic evaluation tool for the vadose (unsaturated) zone and through the uppermost 10 feet of the aquifer. Both evaluation tools were built off previous work done by IDEQ and others but focused the tool to conditions specific to the RPA. The evaluation tools were then tested against known and expected results from the HARSB site. The tools have been reviewed by IDEQ with modifications proposed by Golder and CES.

Task 3 applied the evaluation tool to the proposed Post Falls reuse site to indicate the potential for any impacts to groundwater quality from a properly managed reuse site. As with Task 2, IDEQ has provided comments to the preliminary application of the evaluation tool. Possible tool modifications and application criteria are being refined at this time, with draft results due by the end of 2008.

Task 4 will summarize the information and recommendations from Tasks 1 through 3. Preliminary indications are that reuse irrigation can be properly managed over the RPA to protect the aquifer from degradation.

Although every activity over the aquifer has the potential to degrade it, reuse practices are some of the most carefully managed and controlled. That management and control appears to be warranted in order to balance the need for proper wastewater management with the protection of this exceptional water resource. Key actions that balance reuse irrigation with aquifer quality appear to include:

- Site-specific soil sampling and testing to a depth of 60 inches to characterize the physical and chemical characteristics of all soil types composing 10 percent or more of the site as part of the reuse proposal
- Site-specific crop selection and agronomic and/or silvicultural plan to balance water and nutrient uptake to those available in reuse water, supplemental irrigation, and supplemental fertilizer
- Establishing and sampling a representative dedicated monitoring well network prior to reuse activities to adequately characterize background water levels and constituents in the uppermost 10 feet of the aquifer
- Developing a site-specific soil moisture monitoring and irrigation management strategy so that water is applied within the water-holding capacity of the soil and depleted prior to the non-growing season
- Conducting soil and soil water sampling to establish existing conditions and manage to reduce or eliminate potential ongoing leaching losses to the aquifer
- Conducting ongoing monitoring well sampling and analysis to verify no significant impact to the RPA as a result of the reuse activities

The proposed characterization and monitoring of reuse activities over the RPA may be reduced for Class A reuse water that includes nutrient reduction. The Class A standard in all other parts of the State already allows for such “unrestricted” reuse. Previous calculations show that nutrient removal standards would likely be required in order to be protective of

RPA water quality due to the non-degradation standard. In such instances, it may also be necessary to exercise some level of control over supplemental fertilizer addition to meet the non-degradation standard. This would certainly be possible on publicly controlled spaces (parks, play fields, rights-of-way, etc.) and may be possible with contractual water sale agreements as well.

In summary, reuse activities over the Rathdrum Prairie Aquifer are likely to increase over time due to population growth and tightening restrictions on discharge to the Spokane River. Stringent regulations designed to protect the high quality of the RPA also mean that reuse water quality, monitoring, and management practices will be held to a higher standard than in other areas of the State. In reviewing current HARSB reuse practices and the proposed Post Falls reuse site, these standards can be met but will require significant initial background work to characterize the soil and groundwater as well as propose a suitable cropping and monitoring plan. Class A reuse water with nutrient removal may alleviate a number of groundwater protection concerns. However, even Class A reuse water may require a management agreement with the end users to avoid overloading the soil system with nitrogen or other constituents of concern.

Section 3 – Wastewater Treatment Flow and Load Generation

The hydraulic model developed as part of the Technical Memorandum Nos. 1 and 2 projected the maximum build-out flows throughout the existing and future service areas. The results were totalized at their respective treatment locations. The flow values also provide a basis to compute WWTP loads for critical parameters. This section quantifies the flow and load parameters of most concern for Hayden, Post Falls, and Rathdrum's wastewater treatment.

3.1 Wastewater Treatment Plant Loads

There are several key parameters utilized to characterize wastewater. The Rathdrum Prairie Wastewater Master Plan assumes that the characteristics of wastewater still remain typical of the historical characteristics as observed at the HARSB and Post Falls WWTP.

3.1.1 Existing Wastewater Characteristics

Wastewater is composed of both liquid and solid fractions. The liquid originates primarily in the water supply. The water supply typically contains only solids in the dissolved form plus trace amounts of organic and inorganic compounds. Human waste, as well as industrial and commercial liquids are also discharged to the sewer system. Most of the contaminants in wastewater originate from human, commercial, and industrial wastes. While all the individual constituents may or may not be specifically known, they are part of important aggregate parameters that characterize wastewater in order to meet appropriate parameters that characterize wastewater in order to meet appropriate treatment and discharge standards. Typical parameters and concentrations for municipal wastewater appear in **Table 3.1** along with measured values for the existing HARSB and Post Falls WWTPs. It is likely that both WWTPs will need to characterize their influent wastewater more fully as they meet increasingly stringent discharge requirements in the future.

Table 3-1 – Typical Influent Wastewater Characteristics

Constituent	Unit	Range [a]	Typical [b]	HARSB/Post Falls [d]
Solids, total (TS)	mg/L	390-1230	720	---
Dissolved, total (TDS)	mg/L	270-860	500	---
Fixed TDS	mg/L	160-520	300	---
Volatile TDS	mg/L	110-340	200	---
Suspended solids, total (TSS)	mg/L	120-400	210	250
Fixed TSS	mg/L	25-85	50	---
Volatile TSS	mg/L	95-315	160	---
Settleable solids	mg/L	5-20	10	---
Biochemical oxygen demand (BOD_5)	mg/L	110-350	190	275
Total organic carbon (TOC)	mg/L	80-260	140	---
Chemical oxygen demand (COD)	mg/L	250-800	430	---
Nitrogen (total as N)	mg/L	20-70	40	---
Free ammonia (NH_3-N)	mg/L	12-45	25	40
Nitrites (as NO_2-N)	mg/L	0-trace	0	---
Nitrates (NO_3-N)	mg/L	0-trace	0	---
Organic Nitrogen (TN – NH_4 – NO_2 – NO_3)	mg/L	8-25	15	---
Phosphorus (total as P)	mg/L	4-12	7	7.5
Inorganic Phosphorus (as P)	mg/L	3-10	5	---
Organic Phosphorus (TP – Inorganic, as P)	mg/L	1-4	2	---
Alkalinity (total as $CaCO_3$)	mg/L	---	---	245
Chlorides [c]	mg/L	30-90	50	---
Sulfate [c]	mg/L	20-50	30	---
Oil and grease	mg/L	50-100	90	---
pH	Standard	---	---	7.2
Volatile organic compounds (VOCs)	mg/L	<100->400	100-400	---
Total coliform	no./100 mL	10^6-10^9	10^7-10^8	---
Fecal coliform	no./100 mL	10^3-10^7	10^4-10^5	---
Cryptosporidium oocysts	no./100 mL	10^{-1}-10^2	10^{-1}-10^1	---
Giardia lamblia cysts	no./100 mL	10^{-1}-10^3	10^{-1}-10^2	---

[a] *Metcalf and Eddy, 2007*

[b] *Based on an approximate flow rate of 460 L/capita•d (120 gal/capita•d).*

[c] *Values should be increased by amount of constituent present in domestic water supply*

[d] *Regularly measured and reported values. HARSB/Post Falls average value for 2007 were: TSS = 222/256; BOD_5 = 279/275; NH_3 = 46.6/34.2; TP = 7.7/7.4; Alkalinity = 253/250 pH = 7.1/7.5*

Hayden, Post Falls, and Rathdrum generate wastewater primarily from residential and commercial activities. This fact tends to make their flows and loads consistent and predictable. They are also stable because the collection systems are less than 25 years old and constructed almost exclusively above the groundwater table, reducing the likelihood of infiltration and inflow (I/I).

This Study's sponsors have relatively low levels of industrial activities in their respective service areas. However, industrial wastewater can vary dramatically in both strength and volume. The limited assimilative capacities for both surface water and reuse discharge strategies requires that the WWTP's exercise vigilance and tight controls over industrial users.

EPA has already mandated that Post Falls actively manage an industrial pretreatment program within their service area. Rathdrum will necessarily come under this regulatory umbrella as part of their Intergovernmental Agreement with Post Falls. HARSB will also likely be required to develop and implement an industrial pretreatment program as part of their next NPDES Permit.

Source control of influent contaminants is not limited to only industrial users. Commercial users, kitchens and restaurants can contribute significant concentrations of fats, oils, and great (FOG) as well as phosphate-laden detergents. FOG is a significant maintenance problem as it accumulates in pipes, pumps, and other infrastructure components. It can create clogging, electrical malfunctions, and odors. FOG also contributes significant BOD_5 and chemical oxygen demand (COD) in the treatment plant.

Phosphate laden detergents can contribute up to half of the influent inorganic phosphorus load to a WWTP. All the communities in Kootenai County and Spokane County instituted a phosphorus ban in laundry detergents in the 1980's. The ban reduced loading to the WWTPs and the chemicals needed to reduce loads into the Spokane River and Long Lane (Lake Spokane). On July 1, 2008, Spokane County and the cities discharging treated effluent into the Spokane River also instituted a phosphorus ban for dishwashing detergents. Less than 1 percent by weight of phosphorus can be present compared to the more typical concentrations of between 4 percent and 7 percent by weight. It is likely that most dish washing detergents in Kootenai County will also become phosphorus free since Spokane is the distribution hub and largest market for these products. It would be advantageous for Kootenai County and its communities to follow Spokane County's lead in banning phosphate dishwashing detergent so that distributors and consumers receive consistent products throughout the region.

The other significant pretreatment constituents of concern are dissolved metals. Metals are already present in the Spokane River above accepted concentration limits due primarily to mining activities in the Silver Valley region of the Coeur d'Alene River drainage. Zinc, lead, and cadmium limits at the HARSB and Post Falls WWTPs require careful monitoring and control over industries like metal finishing. Post Falls has also had additional copper in influent to their WWTP from aggressive source water in their southwest service area. Alkalinity and pH control, as well as changing the area's source water, should alleviate their elevated copper concerns. In other WWTPs, silver and mercury can be a problem due to dental offices discharging amalgam tooth filling residues. Again, active pretreatment programs are necessary to assure compliance with strict effluent limitations on discharges to the Spokane River.

3.1.2 Water Conservation Effects

Water users and purveyors in the United States have historically regarded water conservation efforts as temporary responses to drought or infrastructure weaknesses. Increasingly, consumers, purveyors, and regulators see the benefits of conservation being more fundamental to the wise and efficient use of a limited resource. One of the largest impacts seen in this study originates with adoption of the Uniform Plumbing Code (UPC) or International Plumbing Code (IPC) requirements for low-flow fixtures in all new construction and remodeled structures. **Table 3-2** summarizes how these fixtures can reduce the traditional flow volumes generated by domestic activities. **Table 3-2** also lists potential water conservation for efficient clothes washers, dish washers and leak repairs. Total residential flow reductions could reach 32 percent. Even larger flow reductions may be achievable in commercial and industrial water demands through automatic urinals and sink shut-offs as well as careful process controls.

Table 3-2 – Water Conservation in Single Family Homes [a]

	Typical Single Family Home Water Use			
	Without Water Conservation		With Water Conservation	
Water Uses	gpd/Person	Percent	gpd/Person	Percent
Toilets	20.1	27.7	9.6	19.3
Clothes washers	15.1	20.9	10.6	21.4
Showers	12.6	17.3	10.0	20.1
Faucets	11.1	15.3	10.8	21.9
Leaks	10.0	13.8	5.0	13.8
Other domestic	1.5	2.1	1.5	3.1
Baths	1.2	1.6	3.8	2.4
Dish washers	1.0	1.3	1.0	2.0
Total	72.5	100	49.6	100

[a] *Metcalf and Eddy, 2007*

The resulting per capita flows seem to correlate with the observations discussed earlier in this memo. Both Post Falls and HARSB WWTPs have connected larger numbers of users than influent flow rates would indicate. Influent wastewater BOD_5 concentrations also increased noticeably between 2005 and 2007. Post Falls BOD_5 has risen from an annual average of 257 mg/L to 275 mg/L (7.4 percent). HARSB influent BOD_5 has risen from 211 to 279 mg/L (32.2 percent). However, average influent suspended solids, ammonia, and total phosphorus have not demonstrated any clear trends during this period. Only HARSB's influent phosphorus showed an increase (14.2 percent).

While single family water conservation could reduce residential flows to treatment facilities by up to 32 percent, there is no clear correlation between flow reduction and increases in TSS, ammonia, and phosphorus. Therefore, HARSB's and Post Falls' current flow and load planning parameters should remain in place. BOD_5 on the other hand has exhibited a clear upward trend. Assuming that residential and commercial flow reduction measures are mostly in place at this time, BOD_5 in the study area should remain consistent with 2007 values. Post Falls and HARSB should continue to monitor the values listed in **Table 3-1** in order to establish their typical values and track trends relative to growth and influent flows.

The largest water conservation opportunity in the study area centers on water reclamation and reuse to reduce peak seasonal irrigation demands. Since only Post Falls owns and operates both complete water and complete wastewater facilities, many of the traditional reuse incentives and controls are distributed among numerous public entities. Only the responsible wastewater entities will be able to generate the reuse water. Therefore, conservation opportunities through reuse will likely be complicated and slower than might otherwise occur. The potential policy implications and entity cooperation measures will be discussed in Technical Memorandum No. 5.

3.1.3 Emerging Contaminants of Concern

Emerging contaminants of concern is a general term used for chemicals and microorganisms that have only recently been identified or come under consideration for regulation. Subgroups such as endocrine disrupting compounds (EDCs) and pharmaceutically active compounds (PhACs) are often aggregated with human commercial products in a grouping called pharmaceuticals and personal care products (PPCPs).

Endocrine disrupting compounds mimic, block, stimulate, or inhibit natural hormones in the endocrine systems of animals. They originate in pharmaceuticals, personal care products, household chemicals, pesticides, herbicides, industrial chemicals, disinfection by-products, naturally-occurring hormones, and metals (Metcalf and Eddy, 2007). PhACs are synthesized for medical purposes such as antibiotics, anti-inflammatory, x-ray contrast media and antidepressants. Personal care products include compounds used in sunscreens, fragrances, anti-bacterial soaps and lotions. Other indications of human activities such as caffeine may also persist for long periods in the environment.

The list of individual compounds is too extensive to attempt to enumerate with as many as 10,000 new organic chemicals developed each year (Metcalf and Eddy, 2007). Instead, it is important to realize that wastewater treatment and reclaimed water will come under increasing scrutiny as our ability to detect trace concentrations of these compounds improves. We will also develop a more thorough understanding of their fate through various treatment processes as well as in the water environment and the soil column.

There has also been an increase in concern over new and re-emerging pathogenic micro-organisms in the United States and world wide. Viruses such as West Nile and those causing SARS, “Bird” flu, and small pox typically get the most public attention. However, bacteria such as Legionella, e. coli, tuberculosis, and salmonella also create significant public health concerns. Protozoan cysts and oocysts, including Giardia and cryptosporidium, are a third group of pathogens that pose significant risk to humans in the environment. Since wastewater can carry these organisms, it is important to operate treatment processes that provide a high degree of protection to the receiving water and reuse location.

Treatment processes are specifically designed to remove and inactivate pathogens. Success can be achieved only through consistent application of multiple removal and disinfection processes. Secondary treatment followed by chlorine disinfection has long been the standard treatment train for this purpose. As more water becomes recycled back into the environment through discharge to surface waters or reuse, additional processes and barriers may be needed to meet public health requirements and/or public concerns over these emerging contaminants of concern. **Table 3-3** lists a range of typical and emerging contaminants as well as typical effluent levels following increasingly extensive treatment processes. Only the highest levels of advanced wastewater treatment (AWT) remove trace constituents to near undetectable levels.

AWT processes are expensive to construct as well as operate. They are both energy-intensive and chemical intensive. They also create significant reject water, difficult to treat side streams, and increased solids discharges. Usually, AWT is driven by additional mitigating circumstances such as a need to inject the treated water into the groundwater to protect a vulnerable water source or to facilitate an economically viable industrial activity.

Constituent	Unit	Untreated Wastewater	Conventional activated sludge [b]	Conventional activated sludge with filtration [b]	Activated sludge w/BNR [c]	Activated sludge with BNR and filtration [c]	Membrane bioreactor	Activated sludge with microfiltration and reverse osmosis [a]
Total suspended solids (TSS)	mg/L	120-400	5-25	2-8	5-20	1-4	≤2	≤1
Colloidal solids	mg/L		5-25	5-20	5-10	1-5	≤1	≤1
Biochemical oxygen demand (BOD_5)	mg/L	110-350	5-25	<5-20	5-15	1-5	<1-5	≤1
Chemical oxygen demand (COD)	mg/L	250-800	40-80	30-70	20-40	20-30	<10-30	≤2-10
Total organic carbon (TOC)	mg/L	80-260	10-40	8-30	8-20	1-5	0.5-5	0.1-1
Ammonia nitrogen (NH_3-N)	mg N/L	12-45	1-10	1-6	1-3	1-2	<1-5	≤0.1
Nitrate nitrogen (NO_3-N)	mg N/L	0-trace	10-30	10-30	2-8	1-5	<10[d]	<1
Nitrite nitrogen (NO_2-N)	mg N/L	0-trace	o-trace	0-trace	0-trace	0-trace	o-trace	0-trace
Total nitrogen (TN)	mg N/L	20-70	15-35	15-35	3-8	2-5	<10 [d]	≤1
Total phosphorus (TP)	mg P/L	4-12	4-10	4-8	1-2	<2	<0.3 [e]-5	<0.5
Turbidity	NTU		2-15	0.5-4	2-8	0.3-2	≤1	0.01-1
Volatile organic compounds (VOCs)	µg/L	<100->400	10-40	10-40	10-20	10-20	10-20	≤1
Metals	mg/L	1.5-2.5	1-1.5	1-1.4	1-1.5	1-1.5	Trace	≤?
Surfactants	mg/L	4-10	0.5-2	0.5-1.5	0.1-1	0.1-1	0.1-0.5	≤1?
Totals dissolved solids (TDS)	mg/L	270-860	500-700	500-700	500-700	500-700	500-700	≤5-40
Trace constituents [g]	µg/L	10-50	5-40	5-30	5-30	5-30	0.5-20	≤0.1
Total coliform	No./100 mL	10^6-10^9	10^4-10^5	10^3-10^5	10^4-10^5	10^4-10^5	<100	~0
Protozoan cysts and oocysts	No./100 mL	10^1-10^4	10^1-10^2	0-10	0-10	0-1	0-1	~0
Viruses	PFU/100 mL [f]	10^1-10^4	10^1-10^3	10^1-10^3	10^1-10^3	10^1-10^3	10^0-10^3	~0

[a] *Advanced Wastewater Treatment (AWT).*

[b] *Conventional secondary is defined as activated sludge treatment with nitrification.*

[c] *BNR is defined as biological nutrient removal for the removal of nitrogen and phosphorus.*

[d] *With anoxic stage.*

[e] *With coagulant addition.*

[f] *Plaque forming units.*

[g] *Includes PPCPs, EDCs, and PhACs*

Increased regulation and/or public concerns may also drive the utilization of AWT processes. There will be a continuing tradeoff between costs and benefits to address the emerging contaminants in reuse water.

3.1.4 Expected WWTP Flows and Loads

Technical Memorandums #1 and #2 detailed the development of flows within Hayden's, Post Falls', and Rathdrum's ACIs (Exclusive Tiers). The memos also calculated shared tier flows (maximum build-out) that would be generated in the Kootenai County planning area between the cities' ACIs. They were then routed to the HARSB and Post Falls WWTPs. **Table 3-4** combines that flow information with the expected concentrations listed previously in **Table 3-1** to project maximum flows and loads into the HARSB WWTP. **Table 3-5** shows expected maximum flows and loads for the Post Falls WWTP, including the City of Rathdrum. It is important to note that while the influent flows and loads will increase proportionately, effluent loads to the Spokane River and reuse areas will remain relatively fixed or even decline. Treatment processes will necessarily become more extensive in order to meet those increasingly stringent standards.

Table 3-4 – Projected HARSB WWTP Influent Flows and Loads

Constituent	Expected Concentration (mg/L)	Existing Permit (lb/day @ 1.65 mgd)	Exclusive Tier (ACI) Build-Out (lb/day @ 3.48 mgd)	Shared Plus Exclusive Tier Build-Out (lb/day @ 4.61 mgd)
Total Dissolved Solids (TDS)	500	6,881	14,512	19,224
Total Suspended Solids (TSS)	250	3,440	7,256	9,612
Biochemical Oxygen Demand (BOD_5)	275	3,784	7,981	10,573
Total Organic Carbon (TOC)	140	1,927	4,063	5,383
Total Nitrogen (TN)	55	757	1,596	2,115
Ammonia (NH_3)	40	550	1,161	1,538
Total Phosphorus (TP)	7.5	103	218	288

Table 3-5 – Projected Post Falls WWTP Influent Flows and Loads (including Rathdrum)

Constituent	Expected Concentration (mg/L)	Existing Permit (lb/day @ 3.48 mgd)	Exclusive Tier (ACI) Build-Out (lb/day @ 13.16 mgd)	Shared Plus Exclusive Tier Build-Out (lb/day @ 22.89 mgd)
Total Dissolved Solids (TDS)	500	14,512	54,877	95,451
Total Suspended Solids (TSS)	250	7,256	27,439	47,726
Biochemical Oxygen Demand (BOD_5)	275	7,981	30,182	52,498
Total Organic Carbon (TOC)	140	4,063	15,366	26,726
Total Nitrogen (TN)	55	1,596	6,036	10,500
Ammonia (NH_3)	40	1,161	4,390	7,636
Total Phosphorus (TP)	7.5	218	823	1,432

3.2 Flow Planning Scenarios for the Rathdrum Prairie

Four wastewater flow and treatment scenarios for Rathdrum Prairie build-out appear in the following sections. The scenarios were reviewed with the TAC to represent a realistic range of potential build-out conditions and the resulting treatment needs. It is important to note that the scenarios assume that the NPDES Permits will be enacted as they were drafted in 2007. While that approach may be somewhat optimistic, the permits are the current national benchmark and generally agreed with the technological limit currently achievable for total phosphorus treatment at 50 µg/L. Total phosphorus discharge limits to the Spokane River will be the most critical parameter driving treatment efforts over the next several permit cycles (10+ years).

Biological nutrient removal followed by clarification, chemical coagulation, and dual-pass filtration is the likely treatment train to meet phosphorus restrictions for both HARSB and Post Falls WWTPs. **Figure 3.1** graphically displays the 2007 draft NPDES Permit limitations for phosphorus at the HARSB WWTP through exclusive and shared tier build-out. **Figure 3.2** depicts the draft permit phosphorus limits for the Post Falls WWTP. It is important to note that HARSB's draft permit limit was based solely on loading (lbs/day) while Post Falls' draft permit limit was based on both concentration and loading. Consequently, HARSB would have been allowed to discharge at a lower flow rate with proportionately higher concentrations while Post Falls must limit both their concentration and load to the river. In the long-term, this has very little impact on facility construction or operation. In the short-term, the loading-based discharge would offer HARSB some additional operational flexibility.

Since reuse will become an increasing portion of the overall seasonal discharge strategy, it is important to establish the allowable irrigation rates in order to estimate the land required under each development scenario. For the purposes of this analysis, the existing HARSB reuse values will form the basis to project future reuse area needs. Section 2.4.1 detailed HARSB current operations. It indicated that 1.87 mgd could be irrigated on 476 acres. However, HARSB's 2007 Annual Report also showed some potential for over-application of water at that rate and the summer was exceptionally dry. Therefore, this analysis de-rates the site to 1.65 mgd until ongoing operational data supports a higher build-out capacity. The resulting 476 acres per 1.65 mgd (290 acres/mgd) means we will utilize one acre of reuse land to accommodate 17.2 equivalent residences (200 gpd/ER) in Hayden and 20.8 service units (165 gpd/SU) in Post Falls and Rathdrum.

Of course, an almost infinite number of possible development scenarios exist for the study area. They range from the current "5-acre Rule" with one equivalent residence per five acres up to the maximum projected build-out of Scenario No. 1. These four scenarios presented here were selected to be a representative and realistic range of those possibilities. They should serve as guidelines to develop land use and treatment strategies that will be protective of the Rathdrum Prairie Aquifer while remaining economically sustainable.

3.2.1 Scenario No. 1 – Complete Build-out

The complete build-out of the Rathdrum Prairie study area consists of the planning scenario recommended by the Technical Advisory Committee and approved by the sponsoring entities on April 16, 2007. Scenario No. 1 applies the TAC-recommended equivalent population assumptions over the entire study area. Scenario No. 1 results in the largest land requirements for land application/reuse of any evaluated option; therefore, it serves as the upper limit "bookend" scenario. Resulting land requirements from this scenario are summarized in **Table 3-6.**

Table 3-6 – Flow Scenario No. 1 – Flow and Land Requirement Summary

Flow Scenario No. 1	HARSB WWTP including City of Hayden			Post Falls WWTP including City of Rathdrum		
	WWTP Flow (mgd)	Reuse Flow (mgd)	Additional Land Requirement [1] (acres)	WWTP Flow (mgd)	Reuse Flow (mgd)	Additional Land Requirement [2] (acres)
Anticipated Discharge Permit	1.65	1.32	NONE	3.48	0	NONE
Existing ACI (Exclusive Tier) Build-out	3.48	3.15	440	13.16	9.68	1,875
Complete Exclusive and Shared Tier Build-out	4.61	4.28	765	22.89	19.41	4,700

[1] *Additional to existing 476-acre reuse site at 290 acres/mgd*

[2] *Additional to Rathdrum's currently owned 314 acres plus Post Falls' 618 acres (3.2 mgd reuse at 290 acres/mgd)*

Pressure to develop on the Rathdrum Prairie continues to drive up land costs and reduce the availability of the additional land required for reuse. Flow Scenario No. 1 results in almost 5,500 acres of additional reuse land with less than 11,000 acres in the study area. These results indicate the need to look at planning scenarios requiring less land for reuse.

3.2.2 Scenario No. 2 – Exclude Existing Mining and Reuse Areas

The required land for reuse at complete build-out of the Rathdrum Prairie appears to be too extensive to be implemented in the study area. Scenario No. 2 reduces the complete build-out scenario by assuming existing mining (660 acres) and reuse areas (932 acres) will not contribute to the future build-out flows. This scenario reduces the flow for the shared tier build-out but not for the exclusive tier build-out since the existing mining and reuse areas are all outside the existing Areas of City Impact. Results from this scenario are summarized in **Table 3-7.**

Table 3-7 – Flow Scenario No. 2 – Flow and Land Requirement Summary

Flow Scenario No. 2	HARSB WWTP including City of Hayden			Post Falls WWTP including City of Rathdrum		
	WWTP Flow (mgd)	Reuse Flow (mgd)	Additional Land Requirement [1] (acres)	WWTP Flow (mgd)	Reuse Flow (mgd)	Additional Land Requirement [2] (acres)
Anticipated Discharge Permit	1.65	1.32	NONE	3.48	0	NONE
Existing ACI (Exclusive Tier) Build-out	3.48	3.15	440	13.16	9.68	1,875
Complete Exclusive and Shared Tier Build-out	4.61	4.28	765	21.50	18.02	4,295

[1] *Additional to existing 476-acre reuse site at 290 acres/mgd*

[2] *Additional to Rathdrum's currently owned 314 acres plus Post Falls' 618 acres (3.2 mgd reuse at 290 acres/mgd)*

3.2.3 Scenario No. 3 – Exclude All Mining and Expanded Reuse Areas

While Scenario No. 2 reduced flow from the future Post Falls/Rathdrum service area, it had no affect on HARSB or Hayden because there is no existing reuse or mining is their portion of the study area. Flow Scenario No. 3 would further reduces the Rathdrum Prairie build-out flow and subsequently the additional land requirement for reuse by assuming that all future reuse areas will be located within the study area. It further assumes that all mining agreements (950 acres) will become active mining operations so that those acreages will not be served by municipal sewers. This is an iterative process since the future reuse needs decrease as the reuse areas are removed from flow-generating areas. Results from the Scenario No. 3 iterations are summarized in **Table 3-8.**

Table 3-8 – Flow Scenario No. 3 – Flow and Land Requirement Summary

	HARSB WWTP including City of Hayden			Post Falls WWTP including City of Rathdrum		
Flow Scenario No. 3	WWTP Flow (mgd)	Reuse Flow (mgd)	Additional Land Requirement [1] (acres)	WWTP Flow (mgd)	Reuse Flow (mgd)	Additional Land Requirement [2] (acres)
Anticipated Discharge Permit	1.65	1.32	NONE	3.48	0	NONE
Existing ACI (Exclusive Tier) Build-out	3.48	3.15	440	13.16	9.68	1,875
Complete Exclusive and Shared Tier Build-out	4.04	3.71	600	17.83	14.35	3,230

[1] *Additional to existing 476-acre reuse site at 290 acres/mgd*

[2] *Additional to Rathdrum's currently owned 314 acres plus Post Falls' 618 acres (3.2 mgd reuse at 290 acres/mgd)*

Flow Scenario No. 3 results in a reduction in the additional land requirement for reuse for the complete Rathdrum Prairie build-out only because it assumes all reuse land will be in the exclusive or shared tier so it reduces the flow contribution area. In addition, it removes all mining areas from the flow generation. If reuse land is utilized outside the current study area, commensurate flow increases may result at build-out.

3.2.4 Scenario No. 4 – Exclude All Mining and Expanded Reuse Plus Improved Phosphorus Treatment Technology

This flow scenario is similar to Scenario No. 3 with the added assumption that phosphorus removal technology will improve and produce reliable reductions in phosphorus down to 25 µg/L while the permit limits will remain as they were drafted in 2007. Scenario No. 4 would result in the ability to double the flow rates to the river and further reduce the reuse area needed. Results from this scenario are summarized in **Table 3-9.**

Table 3-9 – Flow Scenario No. 4 – Flow and Land Requirement Summary

Flow Scenario No. 4	HARSB WWTP including City of Hayden			Post Falls WWTP including City of Rathdrum		
	WWTP Flow (mgd)	Reuse Flow (mgd)	Additional Land Requirement [1] (acres)	WWTP Flow (mgd)	Reuse Flow (mgd)	Additional Land Requirement [2] (acres)
Anticipated Discharge Permit	1.65	1.00	NONE	3.48	0	NONE
Existing ACI (Exclusive Tier) Build-out	3.48	2.82	340	13.16	6.20	870
Complete Exclusive and Shared Tier Build-out	4.14	3.48	535	18.53	11.58	2,430

[1] *Additional to existing 476-acre reuse site at 290 acres/mgd*

[2] *Additional to Rathdrum's currently owned 314 acres plus Post Falls' 618 acres (3.2 mgd reuse at 290 acres/mgd)*

3.3 Recommended Flow Planning Scenario

The recommended flow scenario for Rathdrum Prairie wastewater master planning is Scenario No. 3. Scenario No. 3 results in a more manageable amount of land required for reuse than required for Scenarios No. 1 and No. 2. This is accomplished by excluding existing and planned mining areas within the study area from ever receiving municipal wastewater service. Scenario No. 3 also forever excludes reuse land from receiving municipal wastewater service. It further assumes that reuse areas will all be within the study area. The reuse areas could be used for parks, golf courses, agriculture, silviculture, green belts, or other reuse activities. Of course, mining operations are likely to continue for decades before the land would be reclaimed. At that time, it could be converted to a reuse activity or subdivided in 5-acre tracts without municipal sewer service. A summary of the recommended flow planning is provided **Table 3-10**. Further discussion of existing and potential future reuse opportunities occurs at the end of this Technical Memorandum.

Table 3-10 – Recommended Flow and Land Requirement Summary

Flow Scenario No. 3	HARSB WWTP including City of Hayden			Post Falls WWTP including City of Rathdrum		
	WWTP Flow (mgd)	Reuse Flow (mgd)	Additional Land Requirement [1] (acres)	WWTP Flow (mgd)	Reuse Flow (mgd)	Additional Land Requirement [2] (acres)
Existing ACI (Exclusive Tier) Build-out	3.48	3.15	440	13.16	9.68	1,875
Shared Tier Build-out	0.56	0.56	160	4.67	4.67	1,355
Complete Exclusive and Shared Tier Build-out	4.04	3.71	600	17.83	14.35	3,230

[1] *Additional to existing 476-acre reuse site at 290 acres/mgd*

[2] *Additional to Rathdrum's currently owned 314 acres plus Post Falls' 618 acres (3.2 mgd reuse at 290 acres/mgd)*

Section 4 – Treatment Systems for Shared Tier Study Area

Section 1 of this Technical Memorandum described the existing and planned wastewater treatment systems at HARSB and Post Falls. Treatment process evaluations over the last two years determined that they will continue with oxidation ditches and clarifiers for secondary treatment and biological nutrient removal at the existing WWTP locations. Filtration alternatives will be evaluated in pilot testing to meet anticipated low phosphorus requirements in upcoming permits. This section further details the anticipated process stages needed to meet the draft NPDES Permit requirements as well as the recommended treatment process for potential satellite treatment plants.

4.1 HARSB WWTP Improvement Increments

Hayden and HARSB will need to revise their ultimate capacity planning to allow for the additional flow from the shared tier study area. As summarized in the previous section, the recommended average annual capacity for the HARSB WWTP is 4.04 mgd at complete build-out. This could rise to as much as 4.61 mgd if reuse areas are not located within the service boundary, thus increasing the service needs. Phase IIIC capacity upgrades are now complete up to 2.0 mgd. Several options are available for expansion towards build-out. First, HARSB must complete the upgrades necessary for firm capacity of 2.4 mgd while meeting expected discharge limits. The upgrades will include additional outfall capacity, expanded solids handling, BNR treatment for nitrogen and phosphorus, additional reuse area, a fifth clarifier, filtration, and possibly expansion to Class "A" reuse.

Two future expansions of 0.82 mgd increments each would reach the build-out goal. The first expansion would result in 3.22 mgd and be within 0.26 mgd of the capacity required for build-out of the City's exclusive tier. The second expansion would increase capacity to 4.04 mgd and provides capacity for complete build-out, including build-out of the shared tier study area. These recommended upgrades appear on **Figure 4.1**, which provides a color-coded representation of the improvements, and are summarized in **Table 4-1** below. Note that the site layout schematic shows an additional oxidation ditch and clarifier beyond the 4.04 Scenario No. 3 capacity. An additional treatment train or alternate discharge location and irrigation water source is currently required by IDEQ to meet Class "A" reuse requirements. The expansion could also provide added secondary capacity should HARSB grow beyond Scenario No. 3 flows and loads.

Table 4-1 – HARSB WWTP Capacity Planning Stages

Flow Scenario No. 3	Flow Capacity Improvement (mgd)	HARSB WWTP Flow (mgd)
Secondary Capacity in 2008	0.35	2.00
Clarifier, BNR and Filtration Expansion to Class "A" [1]	0.40	2.40
Secondary and Tertiary Expansion to serve existing ACI (most of Exclusive Tier)	0.82	3.22
Secondary and Tertiary Expansion to serve complete build-out (Exclusive and Shared Tier)	0.82	4.04
Optional Expansion for Expanded Service Area	0.82	4.86

[1] *Class "A" requires complete treatment train redundancy or full capacity alternate discharge location such as river or Class "B" reuse.*

The recommended expansion increments for the treatment plant only indicates the requirements for sizing. The previously summarized NPDES Permit and reuse regulations have a huge impact for wastewater treatment planning. Revision of the NPDES Permit will determine the required process upgrades to reach permit limits. Future treatment process requirements are expected to include both nitrogen and phosphorus reduction.

4.1.1 Nitrogen Removal

Nitrogen removal is not explicitly required in the draft NPDES Permit. However, it indicates HARSB can expect increased total ammonia-nitrogen concentration discharge limits. The current limit of 78.7 mg/L (year round) is anticipated to drop to 10 mg/L (March – October) and 78.8 mg/L (November – February) at average monthly flows. The anticipated ammonia discharge limits can be met by modifying the operation in the existing oxidation ditches now that the Phase IIIC improvements are complete. Reduction of the nitrate to nitrogen gas has added benefits.

Ammonia-nitrogen removal is a 2-step process. The first step consists of the biological oxidation of ammonia into nitrite followed rapidly by the oxidation of nitrite into nitrate (nitrification). Nitrification will occur in an aerobic environment of the existing oxidation ditches. Denitrification is the second step that reduces the nitrates into gaseous nitrogen. Denitrification requires an anoxic basin where oxygen is available only from the nitrate molecules rather than dissolved oxygen. Maintaining a reliable population of denitrifying bacteria requires careful control of dissolved oxygen and a carbon source, usually from a portion of the raw wastewater.

While denitrification is not required as part of any anticipated permit, it would benefit in three ways. As described in Section 1 of this Technical Memorandum, the denitrification process continues to oxidize the incoming wastewater while using nitrate as the oxygen source. This effectively recovers 2.9 mg of oxygen for every milligram of nitrate consumed. Oxidation of ammonia to form nitrate requires significant energy input to provide approximately 4.6 mg of oxygen per milligram of ammonia-nitrogen reduced. Recovering up to 63 percent of that oxygen translates into significant energy recovery.

Denitrification also recovers 3.6 mg of calcium carbonate alkalinity for every milligram of nitrate-nitrogen consumed. Since nitrification destroys 7.1 mg of alkalinity, denitrification recovers 51 percent of what was lost. Alkalinity is crucial to most biological and chemical processes in wastewater treatment. It is perhaps most crucial as a buffering agent to maintain a stable pH in the discharge. Without denitrification, treatment plants often have to add alkalinity in the form of sodium hydroxide, magnesium hydroxide, or soda ash. Denitrification should eliminate that chemical additive.

Last, denitrification removes nitrate-nitrogen from HARSB's reuse water. While nitrate is valuable and necessary as a fertilizer, it is also the primary pollutant concern with respect to protecting groundwater quality. Therefore, denitrification could remove one obstacle to broaden reuse application in the future.

4.1.2 Phosphorus Removal

The 2007 draft NPDES Permit indicated HARSB can expect additional phosphorus discharge limits. The requirements varied throughout the year, as summarized in **Table 4-2**. The anticipated discharge limits would have required the addition of enhanced biological phosphorus removal in the BNR process plus filtration to remove particulate phosphorus.

Table 4-2 – Anticipated HARSB Phosphorus Requirements

Effluent Characteristics	Unit of Measurement	Effluent Limits		
		Average Monthly Limit[1]	Average Weekly Limit[1]	Maximum Daily Limit
Total Phosphorus as P	µg/L	Report (1,000)	Report (1,500)	---
(March)	lbs/day	13.8	20.6	---
Total Phosphorus as P	µg/L	Report (500)	Report (750)	---
(April – May)	lbs/day	6.9	10.3	---
Total Phosphorus as P	µg/L	Report (10)	Report (15)	---
(June – September)	lbs/day	0.14	0.21	---
Total Phosphorus as P	µg/L	Report (1,000)	Report (1,500)	---
(October)	lbs/day	13.8	20.6	---
Total Phosphorus as P (November – February)	µg/L lbs/day	Report	---	Report

[1] *Concentrations in parentheses not part of draft Permit. Calculated at 1.65 mgd.*

To remove phosphorus biologically, Section 1 detailed how the wastewater must first enter an anaerobic basin to generate volatile fatty acids (VFAs). Phosphorus-accumulating organisms (PAOs) coming in with the return activated sludge give up their phosphorus in favor of VFAs. The PAOs then utilize the stored VFAs as a carbon and energy source in the aerobic zone to grow and multiply. The growth will take up all the phosphorus they lost plus additional phosphorus present in the influent wastewater. The high rate of PAO cell growth is often termed “luxury uptake.” The phosphorus-enriched bacteria is then separated from the activated sludge as part of waste activated sludge.

Enhanced biological phosphorus removal (EBPR) can generally remove total phosphorus to between 1 and 2 mg/L (1,000 µg/L), as previously listed in **Table 3-3**. Long-term averages with oxidation ditch processes at Post Falls and Moscow, Idaho show final effluent values approaching 0.5 mg/L. However, EBPR performance can suffer from unexpected process upsets and take several weeks to re-establish consistent performance. Post Falls data from 2004-2007 demonstrates this fact with the effluent phosphorus standard deviation values equal to the annual average values. Therefore, it is necessary to include additional phosphorus removal using chemical coagulation and filtration from April through September when HARSB is discharging to the Spokane River.

Coagulation and single-pass filtration following EBPR should remove total phosphorus to between 0.1 and 0.3 mg/L (100 to 300 µg/L). An additional coagulation and filtration step should remove total phosphorus to between 30 and 70 µg/L on a monthly average basis (EPA, 2007; Reynolds and Clark, 2006; Correll, 2004). The reported levels of treatment vary widely, with significant new research in both treatment and testing methods arriving almost daily.

Consequently, a rigorous pilot testing methodology is crucial before selecting the final chemical coagulation and filtration steps for these low phosphorus removal requirements.

Anticipated permit levels depend directly on technology that is largely unproven for large-scale, day-to-day wastewater treatment. Currently-accepted tertiary technology for wastewater treatment has yielded average annual total phosphorus effluent levels around 50 µg/L, well above the anticipated regulation. Consequently, reuse, ultra filtration, or other treatment methods will be required to serve the projected HARSB build-out requirements.

4.2 Post Falls WWTP Improvement Increments

Post Falls' capacity planning will need to be revised to allow for the additional flow from the shared tier study area. As summarized previously, the recommended flow to Post Falls WWTP capacity is 17.83 mgd at complete build-out. Current capacity planning indicates phased upgrades from its existing 3.1 mgd to 4.1 mgd and then 5.1 mgd for HARSB WWTP with a larger oxidation ditch process plus full BNR and filtration per the earlier discussion. This report extends that planning to complete the phased upgrades through build-out of both the Exclusive and Shared Tiers. The upgrades are listed on **Table 4-3** below as well as depicted graphically on **Figure 4.2.**

Table 4-3 – Post Falls WWTP Capacity Planning Stages

Flow Scenario No. 3	Flow Capacity Improvement (mgd)	Post Falls WWTP Flow (mgd)
Existing Secondary Treatment Capacity	NONE	0
Secondary Capacity and Full BNR Expansion (2008-2009) w/outfall headworks and solids handling	1.0	4.1
Filtration and Expansion to Class "A" [1]	0	4.1
Secondary and Tertiary Capacity Expansion	1.0	5.1
Primary Clarifier and Anaerobic Digestion Capacity Expansion	37%	7.0
Secondary and Tertiary Capacity Expansion	2.7	9.7
Secondary and Tertiary Capacity Expansion	2.7	12.4
Secondary and Tertiary Capacity Expansion	2.7	15.1
Secondary and Tertiary Capacity Expansion to Serve Complete Build-out (Exclusive and Shared Tiers)	2.7	17.8

[1] *Class "A" requires complete treatment train redundancy or full capacity alternate discharge location such as river or Class "B" reuse.*

Recommended upgrades for Post Falls WWTP mimic HARSB in most regards. The primary difference between the two facilities will be the overall plant sizes. Because Post Falls will expand to almost 18 mgd at the recommended build-out scenario, primary treatment and anaerobic solids digestion become cost effective. Primary treatment removes settleable solids before the BNR and aerobic oxidation processes. It typically removes enough biological loading to the secondary processes that hydraulic loading can increase between 30 and 40 percent. The anaerobic digestion also reduces total biosolids volume through more complete volatile solids destruction. The primary disadvantages are the additional complex treatment processes as well as the odors associated with handling putrescible primary solids and anaerobic gas production (primarily methane). Odors can be successfully managed through diligent housekeeping, covers, and active odor control systems. An additional concern is managing the sidestream flows associated with digester decanting and solids dewatering. These sidestreams can contain significant phosphorus loads that may require additional treatment units.

Table 4-4 lists the total phosphorus treatment requirements proposed in Post Falls' draft NPDES Permit. It shows that there will be somewhat less flexibility for Post Falls than HARSB because effluent limits are both concentration and loading based. These phosphorus discharge limits are reaching the boundaries of conventional secondary and tertiary wastewater treatment processes. Therefore, filter and coagulant pilot testing is critical for final equipment and process selection. Reuse and/or dramatically improved process performance will be needed for long-term treatment and discharge strategies to accommodate growth for Post Falls and Rathdrum.

Table 4-4 – Post Falls WWTP Phosphorus Effluent Limits

Parameter	Unit of Measurement	Effluent Limits		
		Average Monthly[1] Limit	Average Weekly[1] Limit	Maximum Daily Limit
Total Phosphorus as P (March)	µg/L	Report (1,000)	Report (1,500)	---
	lbs/day	29.0	43.5	---
Total Phosphorus as P (April – May)	µg/L	Report (250)	Report (375)	---
	lbs/day	7.26	10.9	---
Total Phosphorus as P (June – September)	µg/L	50	75	---
	lbs/day	1.45	2.18	---
Total Phosphorus as P (October)	µg/L	1,000	1,500	---
	lbs/day	29	43.5	---
Total Phosphorus as P (November – February)	µg/L	Report	---	Report
	lbs/day			

[1] *Concentrations in parentheses are not part of the draft Permit. Calculated at 3.48 mgd.*

4.3 Satellite Wastewater Treatment Facilities

Previous sections discussed flow generation from Hayden's, Post Falls', Rathdrum's Exclusive Tiers plus flow that the Shared Tier would generate. The hydraulic model developed in Technical Memorandums No. 1 and No. 2 routed all flow to the existing HARSB and Post Falls WWTPs. An additional task in this Technical Memorandum is to recommend a location and preferred treatment technology for a "satellite" treatment facility.

Satellite treatment facilities are also referred to as "de-centralized" when they operate completely independent of the central WWTP with dedicated local collection, treatment, discharge, and solids handling facilities. These situations are typically driven by remoteness and/or difficult construction conditions, making the satellite facility significantly less costly. Economic advantages from a strategic commercial or industrial endeavor may also make a stand-alone satellite plant the best option.

More commonly, satellite facilities operate in a seasonal or year-round “scalping” mode. Scalping plants “mine” a portion of the wastewater out of an adjacent sewer (collector, trunk, or force main). The treated water then usually flows to a nearby reuse site (golf course, park, industry, agricultural or commercial irrigation). Satellite facilities typically discharge waste solids and sidestreams back into the central collection system for processing at the larger central WWTPs.

Satellite treatment provides several advantages for long term master planning. Strategically located, they reduce wastewater flows and loads to the main WWTP. Lower flows minimize the required size of gravity and pressure conveyance to the main WWTP. This section summarizes recommendations for publicly-owned and operated satellite treatment. While private ownership and operation of satellite treatment plants has occurred in numerous other areas of the county, their location, size, process type, and discharge scenarios are as variable as the developments they serve. Cohesive implementation of long-term wastewater master planning across multiple jurisdictional boundaries is more suited to the existing public entities. They are already successfully operating regional facilities surrounding the potential satellite plant locations and have dedicated land for current and future reuse.

A satellite WWTP located over the Rathdrum Prairie Shared Tier Study Area, adjacent to a land application site could be advantageous. Some of the potential advantages are listed below:

- Scalped flow at the satellite WWTP can be reused adjacent to the scalping plant and tailored to the quality of reuse water required (i.e., Class “A,” “B,” or “C”).
- Satellite plants reduce flows and loads to the centralized WWTP and conveyance of reuse wastewater back to the reuse sites.
- Solids can be routed through the collection system, consolidating all solids handling requirements at the centralized WWTP.
- Scalping operations can utilize the central collection system as a 100 percent redundancy alternate discharge point to minimize the needed facilities to meet Class A requirements.
- Satellite plants are generally constructed in smaller increments than central WWTP expansions. The resulting lower initial capital investment may facilitate earlier reuse implementation at the extremities of the service area.

Although satellite WWTPs are advantageous in several ways, they also present several disadvantages. Their drawbacks include:

- Solids and sidestream discharged into the collection system will increase TSS, BOD_5, and other constituent concentrations at the central WWTP influent that could degrade treatment effectiveness.

- Increased BOD_5 and TSS concentrations in the collection system produce additional maintenance concerns related to solids settling out, flushing, odors, and corrosion.
- Future regulation changes could force modifications at multiple facilities.
- Remote infrastructure increases the labor requirements and maintenance costs.
- Seasonal reuse demands could require shutdowns with full flows bypassed to the central WWTP, negating any capacity benefit of the satellite plant.
- Satellite plants can also create additional permitting, testing, and good neighbor concerns.

4.3.1 Satellite WWTP Location for HARSB/Hayden

The City of Hayden's future H-10 Lift Station will be the largest regional lift station on the City's current western ACI border of Huetter Road. Additional flow from the Shared Tier Study Area results in an increase of 4.12 cfs to the previously planned peak capacity of 4.5 cfs. Although the required peak capacity for H-10 could approach 8.6 cfs (5.55 mgd), it will be located only one mile west of the HARSB WWTP and one mile south of the HARSB reuse site. Unless the City obtains reuse land adjacent to the future H-10 Lift Station, it is advantageous for the City to continue to route their wastewater flow to the HARSB WWTP for treatment and discharge. A more likely location for Hayden's satellite treatment plant would be on or east of the existing HARSB reuse site. Up to 2 cfs (1.3 mgd) peak flow will be present at the future H-11 lift station on Lancaster Road. A satellite plant at either H-10 or H-11 could produce reuse water as needed locally and then discharge finished water back to HARSB during the off-season through the existing reuse force main for direct discharge to the Spokane River.

4.3.2 Satellite WWTP Location for Post Falls/Rathdrum

A satellite WWTP centrally located over the Rathdrum Prairie Shared Tier Study Area on Post Falls' or Rathdrum's currently-owned future reuse sites could be advantageous to the Post Falls WWTP. The majority of Rathdrum's wastewater will be conveyed through this property. Build-out flow projections indicates 10.2 cfs of peak flow (3.29 mgd average) could be treated if a satellite treatment plant was located on the southern end of Post Falls' future reuse site (¼ mile west of Idaho Street). Flow from Rathdrum's exclusive tier (approximately 0.4 mgd currently and 3.87 mgd future average flow) could also be routed to the same location with modifications to their force main alignment.

Other locations in the future service area may also bear consideration for satellite treatment. However, no other locations have the advantage of being municipally owned for the express purpose of future reuse as well as the existing Rathdrum force main that would provide predictable flow rates. A satellite plant using existing Rathdrum flows would also remove current and future flows from the Post Falls WWTP. It may also be possible to utilize the existing Rathdrum force main to deliver treated final effluent to the Post Falls WWTP for final disinfection and discharge to the Spokane River from this location.

4.3.3 Satellite WWTP Technology Selection

Many different types of treatment technologies can be used for satellite WWTP systems. In general, the biological treatment falls into two major categories—suspended growth systems and attached growth systems.

Attached growth systems include trickling filters, rotating biological contactors, submerged biological contactors, and numerous packed-bed and fluidized-bed contactors. In each case, the cultivated microorganisms attach themselves to the media and form a biofilm. The aerated liquid comes in contact with the microorganisms and they oxidize the organic matter. As the biofilm grows, it occasionally sloughs off the media surface and becomes part of the recirculated liquid suspension. The solids are separated from the liquid by a gravity-settling device (clarifier) or filter for further processing and disposal. Attached growth systems are effective at oxidizing organic matter and ammonia to form nitrate. They are not particularly well suited for denitrification without methanol addition as part of an additional post-anoxic treatment step. Neither are attached growth systems well suited to enhanced biological phosphorus removal. BNR is considered an integral component for reuse over the Rathdrum Prairie Aquifer as well as for Spokane River discharge in this study. Therefore, attached growth systems will not be considered further.

Suspended growth systems maintain the microorganisms in a liquid/solid suspension with a combination of mechanical mixing and aeration to match the required treatment step. They are typically continuous flow systems like Post Falls' and HARSB's oxidation ditch WWTPs. However, the sequencing batch reactor (SBR) uses a batch process in a single tank. All suspended growth systems considered here are well understood and suitable for BNR of total nitrogen and total phosphorus. There are too many variations of suspended growth systems to evaluate in this broad-scale planning study. However, three variations represent the spectrum of available options. Based on anticipated permit conditions, ease of operation, future flexibility, and ease of expansion, three alternatives are considered for satellite treatment process options:

- Conventional activated sludge (submerged diffusers or oxidation ditch), with secondary clarifiers and filters
- Sequencing batch reactors with filters
- Membrane bioreactors

4.3.3.1 Conventional Activated Sludge

Conventional activated sludge treatment comes in many variations, including both coarse and fine bubble submerged air diffusers for mixing and aeration. Fine bubble systems require higher operating pressure to create the smaller bubbles. Therefore, they are normally utilized in basins from 15 to 20 feet deep to give the fine bubbles more opportunity for utilization by the activated sludge microorganisms. The depth increases process and energy efficiency. Oxidation ditches and coarse bubble diffusers are generally shallower with lower oxygen transfer efficiency. Each process has advantages and disadvantages, but oxidation ditches are well suited for smaller satellite plants (Metcalf and Eddy, 2007). In addition, oxidation ditches have the overriding advantage of intimate familiarity to both the HARSB and Post Falls operating staffs. Therefore, an oxidation ditch is the selected conventional activated sludge process for this evaluation. **Figure 4.3** shows a process flow schematic for a satellite oxidation ditch WWTP. It includes biological nutrient removal and filtration for potential Class A reuse and discharge to the Spokane River. The unit processes were detailed in the previous section of this Technical Memorandum.

4.3.3.2 Sequencing Batch Reactors

Sequencing batch reactors are not continuous flow processes like most activated sludge alternatives. Instead, they are fill-and-draw, complete-mix reactor systems utilizing a single basin to perform each step of the activated sludge process in sequence. For continuous flow, at least two basins would be required so that there is always a basin ready to accept the incoming flow. A scalping satellite plant would not need multiple basins as long as the central treatment plant could accept the flow when the satellite is not in the fill mode. Downstream storage or equalization would also be needed to eliminate the pulsed output from an SBR plant.

Table 4-5 lists the basic sequence, timing, and purpose for each of the steps in SBR treatment. **Figure 4.4** shows a process flow schematic for such a satellite WWTP. Mixed liquor remains in the reactor during all cycles, eliminating the need for separate clarifiers and solids recycling systems. Sludge wasting can be done during the aeration, settling, or decant cycle, but should be done before any anaerobic conditions could occur and release accumulated phosphorus. The SBR process provides a high degree of flexibility for nitrogen and phosphorus removal by cycling the basin in sequential anaerobic, anoxic, and aerobic modes. However, SBRs often require significant optimization because of the variability of each timing sequence to match the available food and microorganism growth rates. Single basin systems are much more suited to BOD_5 and ammonia oxidation, with multiple basin systems providing better complete BNR optimization.

4.3.3.3 Membrane Bioreactors

Membrane bioreactors are a high-rate, continuous-flow activated sludge process that utilize a physical membrane barrier for separating the solids from the treated water. The membranes eliminate the need for gravity clarifiers and provide tertiary filtration in a single step. Because the solids separation process is not limited by settling characteristics, the mixed liquor suspended solids concentration is typically between 8,000 and 12,000 mg/L compared to between 2,500 and 5,000 mg/L for conventional activated sludge systems. Therefore, the biological mass necessary to oxidize organics and ammonia can be contained in a smaller basin. Eliminating secondary clarifiers and reducing the aerobic reactor size means MBRs occupy significantly smaller areas than conventional activated sludge processes with tertiary filters. **Figure 4.5** shows a process flow schematic for an MBR satellite plant.

Membrane manufacturer’s typically require a fine screen (i.e., 2 mm) prior to the MBR process to remove solids and debris that may damage or foul the membranes. The BNR process proceeds much the same as any other continuous flow suspended growth system. First, the screened influent is mixed in an anaerobic tank to increase volatile fatty acids for the PAOs. Then, in the anoxic basin, the screened wastewater is mixed with recycled mixed liquor that has been nitrified from the MBR basins. The anoxic conditions in this basin allow for denitrification to occur. The anoxic basin also improves the filterability characteristics of the mixed liquor and helps regenerate alkalinity to maintain a stable pH. A mixer is typically used in the anoxic basin to provide adequate mixing and contact for this process. The wastewater may flow by gravity or be pumped from this basin to the aeration basins.

Table 4-5 – Typical Steps for an SBR Cycle to Achieve BNR [1]

Step	Conditions	Purpose
Unaerated Fill	• Influent flow to SBR • No aeration • Mixed • Approximately 1.5 hours	• Addition of wastewater to SBR • Anoxic or anaerobic conditions to allow denitrification and encourage growth of phosphorus-removing bacteria
Aerated Fill	• Influent flow to SBR • Aeration • Cycle time – half of total time minus unaerated fill	• Addition of wastewater to SBR • BOD removal • Nitrification • Phosphorus uptake
React	• No influent flow to SBR • Aeration and mixing • Sludge may be wasted • Cycle time – 30% of total	• BOD removal • Nitrification • Phosphorus uptake
Settle	• No influent flow to SBR • No aeration • Sludge is wasted • Cycle time – 10% of total	• Settling of suspended solids to yield a clear supernatant • Decrease dissolved oxygen levels to encourage denitrification • Waste sludge under aerobic conditions when microorganisms have maximum phosphorus content
Draw	• No influent flow to SBR • No aeration • Sludge is wasted • Cycle time – 10% of total	• Decant clarified supernatant from tank • Decrease dissolved oxygen levels further to encourage denitrification and growth of phosphorus-removing bacteria
Idle	• No influent flow to SBR • No aeration • Cycle time – 1 to 15 minutes (varies)	• Coordinate cycles between tanks • Maintain low dissolved oxygen levels to encourage denitrification and growth of phosphorus-removing bacteria

[1] *Adopted from Sequencing Batch Reactors for Nutrification and Nutrient Removal, EPA 832 R-92-002, September 1992*

The membranes can be submerged in the aeration basin or located in a separate tank. Within the MBR basins, the wastewater is aerated and mixed in the traditional activated-sludge manner. Within this tank, nitrification occurs and a majority of the BOD_5 is biologically removed. Air for mixing and oxygen is typically supplied using blowers and fine bubble diffusers. The rising air bubbles also provide cleaning of the membranes by continuously scouring the membrane surfaces. Separation of the solids and effluent occurs through the membranes. The driving force across the membrane is typically a negative pressure created by permeate pumps.

Sludge is generally removed directly from the MBR basins. Due to the higher solids retention time (i.e., 10 to 20 days), the sludge is typically more stabilized than in a conventional system. As a result, it is reported that the sludge production may be up to 10 to 20 percent less than from a conventional activated-sludge plant that uses chemical addition for phosphorus removal. Without chemical addition, reductions of sludge production as high as 30 to 40 percent have been reported.

Additional phosphorus removal can be achieved in an MBR process by using chemical addition and filtration through the membranes. Several chemicals are available for this purpose (i.e., ferric chloride, alum, polymers, etc.). The type of chemical to use and required dose are dependent on the characteristics of the wastewater and typically require bench- or pilot-scale testing. Typically, the chemical will be added in a pre-aeration step prior to the MBR basins to ensure adequate mixing and contact.

The membranes may be constructed of polyethylene, polypropylene, or polysulphone and typically have a pore size of 0.01 to 0.4 micrometers. Typical configurations include flat plate and frame, tubular or hollow fiber membranes arranged horizontally or vertically in the tank. Since this is a relatively new process in the municipal wastewater industry, there is still some uncertainty regarding the useful life of the membranes. A useful life of 8 to 10 years has been reported.

The membranes are typically able to provide some disinfection of the effluent by physically straining pathogenic organisms through the small pores and cake layer. It has been reported that MBRs are capable of 4- to 6-log removal of pathogenic organisms. This may reduce the disinfection requirements for the treated effluent.

The membranes are typically back pulsed and/or relaxed a few minutes every hour for cleaning and to maintain the biofilm on the membrane surface at an optimum thickness. Over time, the membranes will eventually become fouled and will not recover the design flux (i.e., typically 10 to 15 gallons per square foot per day) at a reasonable trans-membrane pressure. At that point, a more aggressive cleaning of the membranes is performed. The cleaning is usually conducted in place using acids, chlorine, or a proprietary cleaning solution. This recovery cleaning is typically required every 3 to 6 months.

Typical advantages and disadvantages of an MBR system appear in **Table 4-6**.

Table 4-6 – MBR Advantages and Disadvantages

Alternative	Advantages	Disadvantages
Membrane Bioreactor (MR)	• Capable of BNR • Siting near developments • Phased/modular implementation • Small footprint • Tertiary effluent filtration not required • Potential for less sludge production than from SBR • Provides some effluent disinfection • Problems with conventional clarification not an issue (i.e., sludge bulking or rising) • High MLSS capable of handling variations in loadings • Packaged instrumentation lends itself to remote monitoring	• Operational complexity • Higher level of maintenance associated with sophisticated controls • More energy intensive than other systems when entire system considered (i.e., solids handling and disposal, building heating/cooling, etc.) • Sole source or proprietary membranes • Membrane fouling and decline in permeability over time • Potentially more chemical required for phosphorus removal • Relatively new technology in municipal wastewater • Life of membranes unknown

MBRs are a somewhat more expensive, proprietary system, and the membranes typically require replacement every 8 to 10 years. However, the costs are falling with an increase in the number of reputable manufacturers and are mostly outweighed by the reduction in basins and processes. Membranes can also be readily coupled with anaerobic and anoxic basin for full BNR. MBRs lend themselves well to remote sensing and satellite operation because the MLSS concentration can vary widely while the submerged membrane barrier provides consistently high-quality reuse water.

4.3.3.4 Satellite WWTP Process Recommendation

In addition to conventional secondary treatment components, BNR components are included to meet anticipated permit requirements. Ancillary processes such as screening, grit removal, flow measurement, pumping, etc. are similar for all options and are not specifically addressed here. Screening and grit removal are most critical for MBR facilities in order to maximize the lifespan of the membranes. **Table 4-7** lays out the evaluation criteria and rates each alternative from 1 to 5, with 5 considered the best score possible.

Table 4-7 – Satellite Wastewater Treatment Alternative Evaluation

Evaluation Criteria	Conventional Activated Sludge/Oxidation Ditch Plus Granular Filtration	Sequencing Batch Reactor Plus Granular Filtration	Membrane Bioreactor
TSS/Turbidity Removal	4	3	5
BOD/Organic Removal	4	4	5
Total Nitrogen Reduction	5	4	5
Total Phosphorus Reduction	5	4	5
Preliminary Treatment Required	5	5	4
Accept Variable Loading	5	5	5
Simplicity of Operation	4	3	5
Allow Seasonal Operation	4	5	3
Remote Sensing & Operation	4	4	5
Footprint Size	2	4	5
Modularity/Ease of Expansion	3	4	5
Operation Familiarity	5	2	3
Expected Capital Cost	4	5	3
Expected O&M Cost	4	5	3
Total Score	58	57	61

Although each satellite alternative has advantages, oxidation ditches and MBRs are the leaders. Oxidation ditches have an excellent track record at the existing HARSB and Post Falls WWTPs. The operators are familiar and comfortable with their unit process requirements. MBRs, on the other hand, provide a flexible, high-rate process with a physical membrane barrier to separate solids from liquid. Their small footprint also means the facilities can be more easily enclosed to blend with neighborhood settings. Excellent performance to produce high quality reuse water combined with good remote sensing for part-time operations gives MBRs a scoring advantage in this evaluation. Therefore, MBRs are recommended for satellite treatment in the shared tier study area.

Section 5 – Potential Reuse Opportunities in the Study Area

Wastewater treatment systems have long utilized land application as the final treatment step in Idaho and around the United States. However, land application is now part of the broader scope of wastewater reclamation and reuse. Reuse is increasingly being used to meet non-potable irrigation demands in areas of the country where water resources are constrained. Seasonal reclamation and reuse will be imperative to serve the projected level of build-out over the Rathdrum Prairie while protecting the assets of the Rathdrum Prairie Aquifer as well as the Spokane River.

5.1 Existing and Potential Reuse Irrigation Areas

The cities of Post Falls, Rathdrum, and Hayden have realized the availability of large parcels of land on the Rathdrum Prairie is rapidly diminishing while the land costs are escalating. The cities have taken a proactive approach to secure land for future reuse. As previously discussed, HARSB currently owns 476 acres and is actively growing forage crops and trees with reuse water on 300 acres. Future expansions will utilize the entire 476 acres, resulting in a reuse capacity of at least 1.65 mgd. Post Falls and Rathdrum currently own a total of 932 acres intended for reuse with an estimated future capacity of 3.2 mgd.

The land and its corresponding acreage appear on **Figure 5.1**. To serve the growth outlined in Flow Scenario No. 3 from the Rathdrum Prairie study area, each entity will need to obtain or have access to additional land for reuse. **Table 5-1** summarizes the necessary acreage from Section 3 of this Technical Memorandum.

Table 5-1 – Recommended Reuse Land Acquisition Summary

	HARSB WWTP including City of Hayden			Post Falls WWTP including City of Rathdrum		
Flow Scenario No. 3	WWTP Flow (mgd)	Reuse Flow (mgd)	Additional Land Requirement [1] (acres)	WWTP Flow (mgd)	Reuse Flow (mgd)	Additional Land Requirement [2] (acres)
Existing ACI (Exclusive Tier) Build-out	3.48	3.15	440	13.16	9.68	1,875
Shared Tier Build-out	0.56	0.56	160	4.67	4.67	1,355
Complete Exclusive and Shared Tier Build-out	4.04	3.71	600	17.83	14.35	3,230

[1] *Additional to existing 476-acre reuse site at 290 acres/mgd*

[2] *Additional to Rathdrum's currently owned 314 acres plus Post Falls' 618 acres (3.2 mgd reuse at 290 acres/mgd)*

Additional land acquired adjacent to existing and future reuse sites would be ideal. It would allow conveyance, storage, and irrigation infrastructure to be efficiently consolidated while minimizing unused land due to setback requirements. While those sites are ideal and should be prioritized for the entities, there is also potential for reuse at existing large irrigated sites in the study area.

Existing parks, schools, transportation corridors, and golf courses are all potential candidates for reuse water. Aerial photographs, maps, and site visits were utilized to determine the potential large irrigation sites in the study area. The grassy areas were then reduced to account for impervious surfaces. **Table 5-2** is a summary of the potential irrigable acres summarized by each entity for their respective exclusive and shared tier. Additional detail for the potential acreage for reclaimed wastewater is available in **Appendix E** of this Technical Memorandum. Their corresponding locations also appear on **Figure 5.1**.

Table 5-2 – Potential Irrigable for Reuse

Entity	Potential Irrigable Acres
Hayden Exclusive Tier	317
Hayden Shared Tier	59
Post Falls Exclusive Tier	754
Post Falls Shared Tier	195
Rathdrum Exclusive Tier	191
Rathdrum Shared Tier	80

Although there are 1,220 acres listed within the Post Falls and Rathdrum Exclusive Tier and Shared Tier areas, the reality for serving all of the acreage with reuse water irrigation is unlikely. **Figure 5.1** shows the area in light green and demonstrates that the acreage is fairly dispersed. Large piping and pumping infrastructure would be required to gain relatively few acres in some locations like the Highlands Golf Course. In other locations, like the Prairie Falls Golf Course and River City Middle School, reuse piping may be routed fairly close to the irrigation need. The same is true for Hayden’s 376 acres of potential reuse. It is much more likely that reuse near the HARSB WWTP will be realized for Kootenai County Airport clear zones, Croffoot Park, and the future Huetter Bypass rights-of-way than delivering water three miles east to Avondale and Hayden Lake Golf Courses. To maximize reuse opportunities, reclaimed water infrastructure should be included with other utility and infrastructure planning wherever practicable.

Another reuse opportunity may be associated with the large mining operations in the study area. Mining generally consists of the production of sand, gravel, concrete, and asphalt. Significant setbacks are typically required as part of the mining Conditional Use Permit and/or mining agreement. Therefore, mining zones and operation tend to occupy large parcels of land. Mining also is done in phases that develop over time, often five to ten years or longer. The phases not currently mined are usually leased to farmers or allowed to remain fallow. Mining permits also require a reclamation plan to return the land to some productive use once the extraction is complete. Reclamation involves replacing the topsoil layer that was originally removed, then replanting for agriculture, silviculture, commercial, industrial, or even residential development. Reclaimed mining sites may also be a great location for large storage volumes since excavation, removal, and screening would be essentially complete. Consequently, it may be possible to utilize mining properties for reuse both before and after extraction, and these agreements should be top priority for the entities. **Figure 5.2** shows where the largest mining interests are located relative to existing and proposed reuse sites.

Technical Memorandums No. 1 and No.2 also listed the 20 largest landowners in the Shared Tier as of late 2007. **Figure 5.2** shows where their 2,460 acres of additional land is located relative to the existing municipal property, mining interests, and the other potential reuse opportunities. The largest land owners include several farmers as well as some development interests. The largest mining operations and municipal owners are also part of this group, but they are shown and accounted for separately. **Figure 5.2** shows that the largest owners' parcels abut one another in many instances. Within the regulatory framework for land use and water resources, the long-term fate of the Prairie will lie mostly in these owners' control. Kootenai County took that fact into account in their rewriting of the Comprehensive Plan over the past two years (http://www.co.kootenai.id.us). They met with all the property owners and have attempted to craft a plan that would facilitate reasonable development levels in concentrated areas while retaining corridors to foster public and open spaces. Those spaces may agree well with the need to provide land for reuse if agreements can be worked out to accomplish appropriate goals with the largest land owners. Without exception, the largest tract owners should be the highest priority for entity contact and on-going discussions of their long-term agricultural, development, or other plans.

Finally, reuse water must be transported from where it is treated to where it will be stored and utilized. **Figure 5.2** shows the proposed locations of storage ponds and transmission main alignments to provide reuse wastewater to centralized locations for each entity. Wastewater treated at the Post Falls Wastewater Treatment Plant is pumped from the treatment plant to the Post Falls and Rathdrum proposed reuse sites. Mining corridors on the western portion of the study area would also be an appropriate location for storage if/when reuse agreements can be forged with those land owners. A portion of the wastewater treated at the HARSB Wastewater Treatment Plant is currently pumped from the treatment plant to the existing land application site where it is stored and land applied. Additional capacity for flow resulting from the shared tier study area must be provided with additional transmission mains and pumping capacity. These transmission main alignments are shown adjacent to their existing transmission mains and provide capacity for the additional flow of the shared tier study area.

The storage capacity requirement for land application of reuse wastewater is summarized in **Table 5-3**. It also sets the minimum pumping and transmission rates that will be required to deliver reuse water from the reclamation plants to the irrigated land.

Table 5-3 – Pumping, Transmission, and Storage Capacity Requirements

Entity	Average Daily Reuse Flow (mgd)	Required Class "A" Non-Compliance Storage (MG)	Existing Storage (MG)	Remaining Storage Needed (MG)
HARSB w/Hayden	3.71	26	9.3	16.7
Post Falls w/Rathdrum	14.35	100	NONE	100

5.2 Potential Reuse at Power Generation Facilities

Two natural gas-fired turbine power generation facilities currently exist adjacent to the study area in Rathdrum's Exclusive Tier. Cogentrix Energy's Rathdrum Power facility is one mile north of Rathdrum's proposed reuse property along Greensferry Road. Avista Corporation's Rathdrum Generating Station is one mile west of HARSB's reuse site along Boekel Road. They are strategically located next to the Bonneville Power Administration's (BPA's) high voltage transmissions lines as well as Pacific Gas Transmission's (PGT's) pair of 48-inch natural gas transmission mains, as shown on **Figure 5.2**.

With the BPA and PGT infrastructure available and large volumes of excellent quality groundwater seemingly available, North Idaho Power (a Cogentrix subsidiary) and Kootenai Generation proposed two larger gas-fired turbines alongside the existing facilities in 2001. Their request for more than 17 mgd of groundwater led to a protest and request for a moratorium from the Kootenai Environmental Alliance and the Sierra Club. Numerous community groups supported the protest but did not support the moratorium request. The Idaho Department of Water Resources (IDWR) denied the request for a moratorium in 2002, but they also denied the water withdrawal request and formed a Groundwater Management Area (GMA) over the Rathdrum Prairie Aquifer. The GMA led to a water rights adjudication process for Northern Idaho, which has begun on the Rathdrum Prairie. The water request denial, adjudication, price of natural gas, and tumultuous electrical energy markets have dramatically cooled the push to construct new gas-fired turbine generators.

However, with its strategic location along the BPA and PGT transmission facilities and the region's growing energy demands, the Rathdrum Prairie remains a good long-term candidate for additional generating facilities. One of the key missing elements for their development remains a reliable and high quality water source. Reclaimed water has historically been utilized in power generation facilities for process cooling water and should be seriously considered for additional generating facilities. Cogentrix currently utilizes reclaimed water at its 330 MW Indiantown, Florida pulverized coal co-generation facility. While it can present several challenges to both the reuse facility and the power plant operator, it also has the following advantages:

- IDWR has stated that municipal water rights are maintained to reuse water "to extinction" for the original water right holder.
- Reuse treatment requires consistent water quality.
- Wastewater flows provide a consistent, reliable supply.
- The reuse entities become motivated purveyors to avoid land purchase.

The following sections detail the current facilities and their potential reuse water needs.

5.2.1 Cogentrix Energy's Rathdrum Power Generating Facility

The potential to utilize reclaimed wastewater at Cogentrix Energy's (Rathdrum Power, LLC) generating facility was investigated at a site tour on December 7, 2007, and in follow-up discussions. Rathdrum Power has the ability to respond to power demands within hours up to their maximum output of 270 megawatts (MW). It utilizes a single General Electric Model

MS7001FA “combined cycle” combustion turbine (CCCT) generator. The natural gas combustion exhaust first turns the turbine (simple cycle) up to 170 MW of output. Then the hot flue exhaust gas produces steam and augments the shaft power to the generator (combined cycle). The second cycle produces 100 MW of additional power without adding fuel input. The combined cycle dramatically improves the facility’s overall energy efficiency from under 37 percent to 56 percent (General Electric, 2008). The waste steam is then exhausted to the atmosphere.

The Rathdrum Power facility went on-line in 2001 with Cogentrix as a 51 percent owner and Avista Energy as a 49 percent owner. In 2006, Cogentrix acquired sole ownership of the facility. Avista controls plant operations under a tolling arrangement through 2026 (Avista, 2007).

Rathdrum Power is considered a “dispatchable” facility with demands unpredictably varying to match the power production costs and benefits to the energy market’s power demand and power availability. The dispatchable nature of the plant could be detrimental for the application of reuse water, since reuse water production is relatively consistent to match wastewater flows.

Rathdrum Power consumes about 1 mgd of water on an annual average basis, with a peak day between 1.3 and 1.4 mgd (Neff, 2008). Its capacity factor usually runs from 70 to 75 percent of its full-time potential, with three to four weeks off-line each year for maintenance. Typically, the plant goes off line for the month of June because the weather is mild and power demands are low. June river flows are typically high as well making inexpensive hydroelectric power readily available.

The chemistry of the water used for process cooling water is also a crucial factor in the plant’s operations. The existing generation facility was constructed with process cooling water from their dedicated Rathdrum Prairie Aquifer groundwater well. The facility’s additional water treatment processes are proprietary for the most part and provided by Eutech Partners. They include ion exchange softening, chemical precipitation, clarification, filtration and evaporation designed around the specific aquifer water quality to make it a “zero discharge” facility. No liquid or solid streams are discharged locally to the ground or any wastewater systems. All the water utilized is discharged to the air as stream or reduced to the solid or sludge phase and landfilled at Arlington, Oregon.

Continuing as a zero discharge facility would be crucial for Post Falls and HARSB in order to avoid the potential concentrated brine and solids that would return to their WWTPs. As such, utilizing reclaimed water could significantly modify the facility’s processes due to address the water chemistry. Of particular concern are changes in carbonate chemistry and increases in sulfate, total dissolved solids, nitrates, chlorides, and total organic carbon. **Table 5-4** lists Cogentrix’s parameters of concern and the current final effluent quality at Post Falls. Of course, utilizing full BNR processes to produce the reuse water will reduce nitrates to 5-10 mg/L and retain over half of the alkalinity of the source water. Chlorides, sulfates, total dissolved solids, organic carbon and polymers will still be a concern and should be targeted for reduction wherever practical as part of reuse water production.

Although Cogentrix's water rights provide sufficient capacity and a water quality matched to current operations, they would not allow expansion of the facility. Cogentrix initially developed plans to double the facility size by essentially mirroring it to the west. Company officials continue to indicate an interest in future expansion to serve consumer demands. Post Falls WWTP has provided final effluent water quality data to Cogentrix to evaluate the potential for reuse water to generate steam. The energy markets are extremely dynamic and forecasting them is beyond the scope of this study. For a comprehensive example of regional power needs and supplies, Avista Corporation's "2007 Electric Integrated Resource Plan" reviews their needs and sources of supply through 2017 (Avista, 2007). Avista calls Cogentrix's Rathdrum Power facility the Lancaster Generating Facility and allocates their contractual supply with the rest of the Avista system. Because Avista has fully allocated the output from Rathdrum Power for at least the next 10 years and Cogentrix has expressed interest in eventually completing the mirroring of the facility, this study recommends continued cooperation and negotiation with Cogentrix to provide reuse water for their expansion.

Table 5-4 – Water Quality Parameters of Concern for Turbine Generator Supply

Parameter of Concern	Units	Post Falls Effluent 2/21/08
pH	Standard	7.64
Conductivity	uS/cm	567
Calcium	mg/L	27.5
Magnesium	mg/L	20.7
Sodium	mg/L	45.3
Iron	mg/L	0.015
Potassium	mg/L	12.5
Ammonia (as N)	mg/L	0.09
Barium	mg/L	0.014
Strontium	mg/L	0.078
Silica (as SiO_2)	mg/L	17.0
Dissolved Organic Carbon	mg/L	7.99
p-Alkalinity (as $CaCO_3$ – end point 8.3)	mg/L	ND (<0.05)
m-Alkalinity (as $CaCO_3$ – end point 4.5)	mg/L	122
Chloride	mg/L	60
Sulfate	mg/L	28
Fluoride	mg/L	0.3
Nitrate (as N)	mg/L	18
Total CO_2	mg/L	113
Sulfide	mg/L	0.02

5.2.2 Avista Corporation's Rathdrum Generating Station

Avista Corporation's Rathdrum Generation Station entered service in 1995 and is located at the northeast corner of Boekel Road and Meyer Road in Rathdrum's Exclusive Tier. The facility is a two-unit, simple-cycle natural gas-fired plant with a maximum output of 176 MW. Avista currently operates the Rathdrum facility only for peaking and emergency power since their contract with Cogentrix provides ample generation capacity at much higher efficiencies. While the Rathdrum plant has potential to improve overall energy efficiency by adding the combined cycle processes and equipment, it is an older generation of turbine technology so the improvement would only be from its current level of about 30 percent to approximately 40 percent (Gonnella, 2007). However, Avista shows that by 2012, all of their current supplies will be needed to meet the projected demand (Avista, 2007). It may be advantageous for them to modify the Rathdrum Generating Station in anticipation of that demand and produce an additional 58 MW of power without additional energy input.

Expanding to a combined cycle facility would result in the need for up to 0.85 mgd of process cooling water. The process additions could be designed to utilize reuse water and still operate as a "zero discharge" facility with no additional water right requirement. Reuse water will require additional chemicals, clarification and filtration to function equally to the unaltered Rathdrum Prairie Aquifer water as discussed for the potential Cogentrix expansion.

Avista Corporation's intentions for expansion are unknown at this time. However, their Integrated Resource Plan indicates that they will require significant additional energy sources and/or energy conservation over the next 5-10 years. Their existing Rathdrum plant is in Rathdrum's Exclusive Tier and a mile from HARSB's existing reuse site. It appears to be under-utilized with more than adequate available land for expansion. It could also be made considerably more efficient with the availability of high quality reuse water and no additional energy input or water right requirement. Therefore, it is important to foster a dialogue and continuing relationships between Avista, the City of Rathdrum and HARSB to explore those opportunities.

The future of reuse water at existing and planned Rathdrum Prairie power generation facilities should not be ignored. A continual relationship between the power producers and the Cities of Post Falls, Rathdrum, and Hayden is highly recommended.

Figures

(Figures Bound Separately)

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Appendices

(Appendices Bound Separately)

Appendix A –	1986 HARSB Joint Powers Agreement and Addenda
Appendix B –	Post Falls/Rathdrum Intergovernmental Agreement for Treatment and Discharge of Wastewater
Appendix C –	Post Falls/HARSB TMDL Comment Letter and EPA Public Statement for Withdrawal of 2007 Draft NPDES Permits
Appendix D -	HARSB 2007 Annual Wastewater Reuse Report and IDEQ Comments
Appendix E -	Potential Reuse Irrigation of Existing Sites