GOLDENDALE ENERGY STORAGE HYDROELECTRIC PROJECT

Federal Energy Regulatory Commission Project No. 14861

Klickitat County, Washington

FINAL LICENSE APPLICATION
Appendix K: KPUD Letter

For:

FFP Project 101, LLC

June 2020

KLICKITAT PUD

Honesty | Accountability | Customer Focused

May 12, 2020

Kimberly Bose,
Secretary Federal Energy Regulatory Commission
888 First Street, N. E.
Washington, DC 20426

RE: Project No. 14861-001 – Washington
and Oregon
Goldendale Energy Storage Project
FFP Project 101, LLC

Public Utility District #1 of Klickitat County (KPUD) is pleased to submit this letter in support of the license application for the Goldendale Energy Storage Project (Project) generally, and to respond to comments regarding water supply to the project submitted by FERC staff in response to FFP Project 101, LLC's Draft License Application (DLA).

As you may be aware, public utility districts in Washington are political subdivisions of the State. KPUD was established in 1938 and is governed by an elected three-member board of directors who each serve six-year terms. We provide retail electric, water and wastewater services in Klickitat County Washington. We also provide transmission services to a significant number of wind generation projects and a natural gas turbine located within Klickitat County, and has experience with the development and operation of hydroelectric, landfill gas and wind generation. Finally, KPUD has recently completed a renewable natural gas facility. KPUD is very familiar with this project as it not only in in our service territory but more significantly KPUD held a preliminary permit for a similar project several years ago prior to making a determination not to proceed with development of the project.

KPUD understands that the America's Water Infrastructure Act (AWIA) of 2018 authorizes the Federal Energy Regulatory Commission (FERC) to use an expedited licensing process for approval of certain closed-loop pumped storage projects. KPUD has thoroughly reviewed FFP Project 101, LLC's Draft License Application (DLA) for the Goldendale Pumped Storage Project (Project). It is a comprehensive document, which fully identifies and analyzes the immense value of this Project, the benefits it would provide, and its environmental effects. Based on KPUD's understanding, the Project easily qualifies for expedited review and decision making under FERC's new AWIA regulations (18 C.F.R. Part 7). We urge FERC to approve FFP Project 101, LLC's request to use these expedited procedures in this matter.

KPUD has also reviewed FERC's comments regarding KPUD's provision of water supply to the Project and appreciates the opportunity to provide clarification to FERC's questions regarding this matter. As noted above KPUD provides water service within Klickitat County. KPUD obtained water rights from the former Goldendale Aluminum Company in 2005. The total water right quantities are 15,591 acre-feet per year and 35.3 cubic feet per second. KPUD subsequently established the Cliffs Water System and the Washington Department of Health approved the Cliffs Water System Plan in 2011. A copy of the cover of the Water System Plan, table of contents, executive summary and map are attached to this correspondence.

FERC staff posed questions regarding the arrangements under which KPUD would provide water to the Project and the facilities by which that water would be provided to the Project. Under agreements negotiated between the aluminum smelter and KPUD, KPUD will acquire the water distribution facilities and the pump station that formerly served the aluminum smelter (currently owned by NSC Smelter LLC). Improvements to those facilities will be made generally in accordance with the Water System Plan and dependent upon the specific needs of specific water customers. KPUD currently serves one commercial customer at the former smelter site.

KPUD acquired the smelter's water rights and established the Cliffs Water System in order to encourage commercial redevelopment of the smelter site (for which KPUD also provides electric service). The closure of the smelter resulted in significant economic dislocation in Klickitat County from which we have not yet fully recovered. While the clean-up of portions of the former aluminum smelter have taken longer than KPUD originally intended, KPUD is confident that this property has significant industrial re-development potential which will in turn have beneficial economic impacts for Klickitat County.

Given KPUD's experience in renewable energy development, we have long been interested in and supportive of the development of pumped storage hydro (PSH) at this site. KPUD is aware that the site is one of the most attractive PSH sites in the U.S. We are also aware that electrical energy storage projects are essential if our state and region are to achieve their greenhouse gas reduction and renewable energy development goals dictated by recent legislation. This is evidenced by KPUD's above referenced previous investigation of a PSH project at this location. In addition to energy storage, KPUD is supportive of other redevelopment and water use at the former aluminum smelter site. KPUD has engaged in recent discussions with parties interested in pursuing the development of a data center facility and a renewable energy powered hydrogen electrolyzer on lands adjacent to the proposed energy storage project. We anticipate providing water service to these and other commercial water customers at the former aluminum smelter site, including the Project under the terms, conditions and rates for water service as approved by the KPUD Board of Commissioners for the Cliffs Water System. To answer directly FERC staff's inquiry, there are and KPUD anticipates there will be additional water system customers at Cliffs, irrespective of the development of the Project. KPUD has been working toward that goal for over a decade, as has NSC Smelter LLC, the owner of the property.

Attached to this document is a map of the Cliff's water system infrastructure. It is my understanding that Rye Development will also be providing maps and information regarding water infrastructure that will connect their project to KPUD's facilities. These maps show the construction of a new water line connecting to an existing line to the former smelter location

from the intake structure (which we anticipate will be upgraded as necessary). That new line will interconnect to existing water storage facilities and proceed west to provide service to the Project and other anticipated customers. Note also that KPUD anticipates serving potable water to the Project and other potential customers utilizing existing and new facilities as necessary and in accordance with the Water System Plan.

It is KPUD understanding that FERC requested the Project developer to "explain why these water conveyance facilities should remain outside of the project boundary. KPUD strongly opposes any suggestion that facilities owned by KPUD should be included in an expanded Project boundary. These facilities are or will be owned by KPUD on property which KPUD has or will have leases and easements. As noted above these facilities serve multiple customers, of which the Project is but one. The Project will simply be a retail customer of KPUD. As such, we do not believe FERC has jurisdiction over this matter, and the suggestion that KPUD's facilities be within the Project is inappropriate.

Your consideration of these comments are appreciated.

Jim Smith

General Manager
PUD #1 of Klickitat County

Cliffs Comprehensive Water System Plan

Klickitat PUD No. 1

June 2010

John Grim & Associates
John Grim P.E.

Klickitat PUD
Owned By Those It Serves

Cliffs Comprehensive Water System Plan

Klickitat PUD No. 1

April 2010 KPUD Final Draft Submittal
June 2010 DOH 1st Submittal
December 2010 KPUD DOH/DOE Revision Submittal
February 2011 DOH 2nd Submittal
May 2011 Revised DOH 2nd Submittal

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Chapter-1. Executive Summary

1.1 - Introduction

The primary purpose of the Comprehensive Water System Plan (Plan) is to comprehensively evaluate and identify improvements for the Cliffs water system. The improvements will ensure the system meets the state's mandate that municipal water systems supply adequate, safe, and reliable water to their customers.

The evaluation included seven broad objectives:

1) Supply: Identify the adequacy of water supply and water rights to meet existing and future demands.
2) Storage: Identify the adequacy of storage to meet existing and future peak day demand and fire demand.
3) Distribution: Identify the adequacy of transmission and distribution water mains to convey existing and future peak demands and fire flow demand.
4) Water quality: Identify the adequacy of the water source to meet all water quality standards.
5) Operations and Maintenance: Identify and document existing and future operations and maintenance needs.
6) Policies: Identify key policies necessary to ensure the water utility can supply adequate, safe, and reliable water to its customers.
7) Financial: Identify financial requirements necessary to implement this Plan and ensure the utility remains financially viable.

This is the first Water System Plan for the new Cliffs water system.

1.2 - How to Use This Plan

A brief summary of each major section of the Plan follows. The chapters were structured to present planning information in a logical organized manner. The Plan outline generally follows the States suggested outline for water system plans with some exceptions to improve readability and flow.

- Chapter I (this chapter) summarizes the results of the planning effort in a format which will allow the reader to quickly review key issues and conclusions reached in the planning process.

- Chapter II discusses the planning area and service area delineation for the water system. Data from this chapter is used as a basis for identifying improvements needed to accommodate growth in the water system planning area. This chapter includes planning data and zoning information used to develop the service area boundaries. It also presents a brief description of the ownership and history of the water system.

- Chapter III presents an evaluation of water system demands. The water system population forecasts are developed as are demand criteria. The population and demand criteria are used to forecast demands, which are the basis for evaluating the facilities needed for growth. Chapter III also includes the Water Use Efficiency program.

- Chapter IV evaluates the system's water resources. It includes a water rights assessment, a Wellhead Protection Program, and a description of current water quality regulations and the existing water quality. In addition, it contains a proposed Aquifer Performance Monitoring Program.

- Chapter V presents a description of the existing system and the evaluation of the supply, distribution, and storage systems. A general description of the analysis methodology is first presented followed by a narrative that describes the existing facilities and the analysis of each major system component. Both the surface water and ground water facilities are evaluated.

- Chapter VI presents the capital improvements necessary to correct deficiencies and comply with policy requirements, laws, and anticipated future conditions.

- Chapter VII presents the proposed operations and maintenance program and includes an evaluation of necessary staffing to perform the proposed preventative maintenance program. This chapter includes a description of the proposed Facilities Transfer Agreement. This chapter also includes water quality monitoring programs, cross connection control, and emergency response plans.

- Chapter VIII presents an evaluation of the water utility's finances and forecasts revenues (in terms of rates) needed for the next six years.

- The Appendices include plan approval correspondence, PUD Policy Bulletins, a copy of the well logs and relevant water right documentation, and various legal agreements.

1.3 - DOH & DOE Revisions

The Plan was finished in June of 2010 and submitted to the State Department of Health Drinking Water Program and the State Department of Ecology at that time for review and approval. Although the Plan has been revised subsequent to this submittal; the official Plan date is June, 2010. The content in the Plan is fixed based on information available prior to this date. This approach is used to prevent moving target syndrome; or in other words the constant revision of the Plan based on new information that becomes available prior to the Plan being approved by the State. Submittal dates to both the KPUD and the State are shown on the inside cover.

Revisions to the Plan based on DOH and DOE comments are shown throughout the Plan in this specific font and color for ease of review. DOH and DOE review correspondence has been added to the Appendices. The original DOE review letter was amended by a superseding letter dated 1/26/11. DOE issued a recommendation of approval of the Plan to DOH on April 25th, 2011.

The KPUD made some minor last minute revisions to the Plan on May 3rd, 2011. These revisions were made subsequent to the 2nd submittal of the Plan to DOH and DOE. The KPUD requested that DOH stop their review of the 2nd submittal in order to submit a revised 2nd submittal for review. This version of the Plan is the revised 2nd submittal. All KPUD revisions are shown in this text font and color.

1.4 - Results and Recommendations

1.4.1 Service Area Definitions

The water system plan is based on facilities necessary to provide water within the existing and future service areas and water rights within satellite service areas. Each of these areas are defined as follows:

- The existing service area is defined as parcels of land: currently served by, or adjacent to, the water distribution system, within the water right place of use, within the proposed pumped storage project boundaries, and within the area zoned for industrial development. This area is approximately 2,025 acres. **The existing service area is equivalent to the retail service area as defined in the Municipal water law.**
- The future service area is defined by property currently owned by the CGAC, lands zoned industrial, *privately owned lands*, and adjacent US Government owned lands. This is property which has the potential to develop in the future. The gross area is about 7,200 acres. Actual buildable land is much lower.
- The satellite service areas include other municipal water systems outside of the future service area which could someday logically be served indirectly by the existing water rights but not via pumps and pipes. Each of the satellite service areas are bounded by their respective water system service areas as defined in approved water system plans. **The KPUD has no legal obligation to provide water rights to the satellite service areas; but will consider requests for water right service on a case by case basis.**

1.4.2 Water Right Plan

This Plan is a direct result of the KPUD's success preventing relinquishment of the substantial surface and ground water rights previously owned by the Columbia Gorge Aluminum Company (CGAC). The KPUD now owns the aluminum company's former water rights. These water rights have been placed into the State's water right trust program. The water rights are part of a Determined Future Development (DFD) plan. *Clarification of the DFD status is provided in a letter from Ecology dated 1/26/11 and included in the appendices.* The DFD plan is fixed and requires that the KPUD take specific steps within the authorized water right development schedule to perfect development of the water rights or risk partial or full relinquishment. The steps are comprised of:

1. Develop this Plan.
2. Form a municipal water system.
3. Complete the Cliffs Energy Project.
4. Demonstrate beneficial use of the water for municipal purposes.
5. Complete all of the above by the year 2028.

The total water right quantities are 15,591 acre-feet per year and 35.3 cubic feet per second.

It is the intention of the KPUD to utilize the Cliffs water rights *for municipal purposes as necessary* to meet the water demands of the Cliffs water system and its Satellite Service Areas; such as the City of White Salmon. The KPUD will provide water rights to municipal water systems or other KPUD projects within its service area if feasible and available.

1.4.3 Capital Improvement Plan (CIP) Overview

Chapter VI describes the CIP in detail. A CIP is a list of the proposed improvements necessary to meet the planning objectives within the 20-year planning period. The CIP is structured to provide a detailed improvement plan for the ground water and surface water systems within the 20-year planning period (2010-2030). Improvements are prioritized and scheduled for each system.

A Facility Inspection and Testing (FIT) program was developed for both the surface and ground water systems. This is the number one priority for both systems and is key to refining and updating the CIP. The goal of the FIT program is to thoroughly test and inspect recommended water system infrastructure to identify its condition and the need for improvements.

The KPUD intends to modify the ground and surface water systems as needed to form a municipal water system. The ground water system will be utilized to provide potable water service to existing and new developments. The surface water system will be utilized to provide industrial process water, fire suppression, power production, irrigation, *and other municipal purposes*. Parallel surface and ground water pipelines will be extended to new developments.

The cost of each improvement is based on the costs of similar projects and quotes from suppliers and contractors. These are planning-level cost estimates for use in annual budgeting and funding acquisition. The costs are not based on a detailed evaluation of each improvements scope and characteristics. Property acquisition is not built into the cost of any of the improvements. Estimates are based on 2010 dollars and do not consider inflation. Improvements to the water system necessary to serve new development *may* be funded by developers.

1.4.3.1 CIP Prioritization

Generally, improvements which are needed immediately to acquire and operate the water systems and to comply with water right obligations were given the highest priority. Improvements necessary for future growth only were not prioritized. Growth-related improvements will be implemented when necessary based on development pressure. The overall priority of any improvement was adjusted based on the judgment of KPUD staff and engineering experience.

1.4.3.2 CIP

Overall, the water systems are in poor condition. Most of the system is relatively old and there is evidence that major improvements are needed at key facilities such as source pump stations. In addition formation of a municipal water system will require separation of private facilities from public facilities including the construction of new distribution system improvements. The KPUD intends to implement the following improvements if and when resources are available (in order of priority):

1. Facilities Transfer Agreement. This is essential to acquire ownership of key supply, storage, and distribution facilities as necessary to utilize the water right and operate the water system.
2. Facility Inspection and Testing Program. This is required to determine necessary improvements to key facilities.
3. Operations and Maintenance Agreement. This is necessary to ensure the current owner is operating the water system consistent with the provisions of the KPUD owned water rights.
4. Surface Water System Improvements:
    a. Columbia River Pump Station Improvements.

   b. Reservoir No. 1 Improvements.
   c. Transmission Main Improvements.
   d. Cliffs Energy Project.
   e. Pipeline Appurtenances.
   f. Distribution System Extensions.
5. Ground Water System Improvements (concurrent with the surface water CIP):
   a. Well No. 3 Improvements.
   b. Distribution System Improvements.
   c. Elevated Tank Improvements.
   d. Distribution System Extensions.
   e. Reservoir No. 2 Construction.
   f. Well No. 4 Construction.

The total estimated cost of the CIP is $3,963,500. Much of this cost should be borne by developers.

1.4.4 Financial Planning

The financial plan provides a framework and policies for funding capital improvements and the ongoing operation, maintenance, and general administration of the water system. The plan is very tenuous because the nature of the customers to be served in the future is unknown and could vary significantly (industrial, commercial, residential, etc.). The plan assumes that the aluminum company will re-develop in a different form and request service from the KPUD. Upon KPUD acquisition and initiation of water system operations, the cost to operate, maintain, and administrate the water system is estimated to be approximately $60,000 per year.

The KPUD is funding: this Plan, the expense of preserving the water right, the proposed operations and maintenance and facility transfer agreements, and the proposed facility inspection and testing program, by means of a KPUD interfund loan. All other capital improvement expenses *may* be funded by contributions from the aluminum company and/or other developers. The KPUD will utilize water *system* revenue, in part, as a financial resource to recover its interfund loan cost.

Chapter-2. Water System Background & Planning Data

This chapter presents definitions and characteristics of the service areas that are important to this planning process. This chapter also presents an analysis of the existing customer base and an estimate of future growth. In addition it provides a brief historical overview and description of the water system; its ownership, and transfer of facilities. This chapter forms the basis for the eventual classification of the Cliffs water system as Group A Community.

2.1 - System Background

2.1.1 History of the Water System

The water system was constructed in 1969 by Harvey Brothers Inc., and sold to Martin Marietta, a corporation. Water system construction was part of the overall construction of a large aluminum manufacturing plant (smelter). The water system was integral to the overall operation of the smelter. Ownership of the plant has changed several times. It is now owned by Columbia Gorge Aluminum Company or CGAC for short. The previous owner, Golden Northwest Aluminum, went bankrupt in December 2003 and ceased all operations.

Both surface water (SW) and ground water (GW) systems were constructed to provide water to the aluminum plant. The surface water system generally provided all of the industrial water needs. The ground water system generally provided all of the potable water system needs. The ground water system was constructed with the capability of providing backup water to the smelter for emergencies. The water system and water rights have been owned and operated by the various aluminum plant owners since its inception.

2.1.1.1 Bankruptcy & Restart

In response to historically high electricity rates, partial curtailment of the smelter operations occurred in December 2000. The smelter continued to produce aluminum for more than two years after initiation of the partial curtailment. The last aluminum ingot was produced in March 2003. In December 2003, the smelter was forced into Chapter 11 bankruptcy.

In May of 2005, the company emerged from bankruptcy under new ownership. No operations occurred during this period or to date. There had been some efforts made towards a re-start including contract negotiation with Bonneville Power Administration for affordable power service. However, at this time no aluminum production is taking place and the CGAC has initiated salvage and decommissioning operations

2.1.1.2 Regulatory History

Until August of 2003 the ground water system was classified as a Group A Non-Transient Non-Community (NTNC) water system by the Washington State Department of Health (DOH). The DOH identification number for this system is PWS 224608. Historically, the surface water system has not fallen under the regulatory purview of the DOH.

Shortly after the declaration of bankruptcy the DOH re-classified the ground water system as a Group B system due to the small number of employees.

The Cliffs water system will become a Group A Community water system in the future assuming this Plan is implemented. The Cliffs water system is a municipal water system as defined by the Municipal Water Law (MWL). Ecology recently affirmed this in its approval of the water right change in purpose of use to municipal. Ecology has issued an Interpretive and Policy Statement (Policy 2030) which provides definitions of municipal water suppliers and municipal water supply purposes. Public utility districts are on an exclusive list of governmental entities considered municipal water suppliers. A municipal water supplier is defined, in part, as a governmental entity providing water to a Group A water system serving 15 or more residential service connections or 25 or more people for 60 or more days per year. The KPUD is a municipal water supplier and intends to provide municipal water supply from its surface water and ground water rights. Therefore this plan is written for a new Group A Community water system.

2.1.2 Water System Ownership

As a result of the curtailment and bankruptcy there was very little water use for nearly five years. CGAC became aware that their substantial SW and GW rights were subject to potential relinquishment for non use. In 2005 the KPUD was asked to assist CGAC with its water right problem as necessary to prevent relinquishment. As a result of this request, CGAC transferred ownership of all of its GW and SW rights to the KPUD in December 2005 via Quit Claim Deed; see **Appendix**. Ownership of the water rights allowed the KPUD to proceed with preservation efforts including a successful water right change application in 2007 for the SW right. As a result of this successful change application, the risk of relinquishment of the SW right has been eliminated; at least through 2028.

2.1.2.1 Terms for Facility Operation & Ownership

CGAC remains the owner of all physical water system facilities which are described later in this chapter. Therefore at this time, CGAC controls the facilities which are dependent on the KPUD owned water rights. A "Term Sheet" was executed between the KPUD and CGAC which lists the conditions under which the KPUD will provide water to the CGAC. The conditions relevant to this plan are as follows:

- The KPUD will provide water service to CGAC or a successor within the aluminum smelter site up to the full quantity of water authorized under the water right at cost of service and on a first call priority basis provided that CGAC requests water service on or before December 31st, 2010.
- After December 31st, 2010, CGAC or its successor has the right of first refusal to request water service to the extent the KPUD has not already committed that water for service to CGAC or another customer. Prior to providing water service to another customer the KPUD must give CGAC two months notice to exercise its right of first refusal in whole or in part.
- *As per existing agreements*, CGAC and KPUD intend to negotiate terms for transfer of the physical facilities used for diversion or withdrawal of water associated with the KPUD owned water rights. A transfer agreement will require that that all facilities subject to transfer meet the design standards of the DOH. This term also provides for negotiation of the operation and maintenance of the transferred facilities which may include an option wherein CGAC performs contract operation and maintenance. *Note the KPUD has developed a list of suggested terms and a proposed extent of transfer; see Chapter 6.*

- Proceeds from water service provided to other users shall first be applied to reimburse the KPUD for all of its costs in providing water service. Any additional proceeds shall be paid to CGAC as additional payments for transfer of physical facilities.
- The KPUD is required to develop a Water System Plan.

2.1.2.2 KPUD Ownership

The KPUD is run under the leadership of a three-member board of commissioners. The KPUD owns and operates seven Group A water systems within Klickitat County. It is also the sole electrical utility within the County. All of the water systems, including Cliffs, are in unincorporated communities.

The KPUD created the Cliffs Water System via resolution of the KPUD Board in December 2005. The intent of the resolution was to create a Group A municipal water system to provide water service directly within the retail service area of Cliffs and to provide water supply, indirectly, to satellite water systems *and* the Cliffs future service area.

At this time the KPUD does not own any physical facilities. The KPUD does own surface water right S3-00845C and ground water right G4-01130C. Use of this water is currently controlled by CGAC. Pre-approval of the water use is required by the KPUD.

2.1.2.3 Facility Ownership Transfer

The KPUD intends to obtain ownership of some of the surface water and ground water facilities including tanks, wells, the surface water pump station and some portions of the transmission and distribution piping. The extent and basis for this proposed ownership is described in Chapters 5 and 6.

2.1.3 Existing System Description

The Cliffs water system is *bounded on the south by U.S. Government lands*, next to the John Day Dam, and bordering Highway 14. There are two water systems that are interconnected; a ground water system and a surface water system.

Generally, the groundwater system provides water for potable demands. Three wells (Well No. 1, No. 2, and No. 3) have all provided the smelter with drinking water, emergency industrial process water, to a small extent industrial process water and fire fighting capacity. Currently Well No. 1 is providing potable water supply. Each well has had a series of water quality and/or water quantity problems. All of the wells are active and can be utilized at any time. The GW system includes an extensive distribution system with interconnections to the SW system. Most of the distribution system is within the footprint of the smelter. It also includes an elevated 100,000 gallon standpipe. Chlorination is the only form of treatment.

Generally, the surface water system provides water for industrial demands. A very large pump station *on U.S. government lands* conveys water from the *Columbia* river to the smelter via twin 24-inch diameter concrete transmission mains. This facility is located on leased U.S. Government land. The intake structure is located on a backwater slough created by a railroad rock crib crossing of the John Day pool. Historically the majority of this water has been used for the primary scrubbers with lesser amounts used for direct chill ingot casting quench. Surface water is distributed via approximately

three miles of pipeline located primarily within the foot print of the smelter. Two large steel tanks provide storage of the surface water for use by the smelter.

Figure 2-1 illustrates the existing ground water and surface water systems. Mapping data was limited due to record keeping problems and a loss of institutional knowledge due to the laying off of employees after the bankruptcy.

2.2 - Planning Analysis

2.2.1 Retail Service Area & Future Service Area Analysis

The water system plan is based on facilities necessary to provide water within the existing and future service areas and water rights within satellite service areas. Each of these areas are defined as follows:

- The existing service area is defined as parcels of land: currently served by, or adjacent to, the water distribution system, within the water right place of use, and within the area zoned for industrial development. This area is approximately 2,025 acres. **The existing service area is equivalent to the retail service area as defined in the Municipal water law.**
- The future service area is defined by property currently owned by the CGAC, lands zoned industrial*, privately owned lands*, and adjacent US Government owned lands. This is property which has the potential to develop in the future. The gross area is about 7,200 acres. Actual buildable land is much lower.
- The satellite service areas include other municipal water systems and municipal purposes of use outside of the future service area which could someday logically be served indirectly by the existing water rights but not via pumps and pipes. Most of the satellite service areas are bounded by their respective water system service areas as defined in approved water system plans.

2.2.1.1 Retail Service Area Description

Cliffs is located in the Columbia River Gorge on Highway 14. The existing service area encompasses approximately 2,025 acres. **Figure 2-2** illustrates the service area boundary. The existing service area coincides with the extent of the industrial zoning, the extent of the distribution system, the extent of the proposed pumped storage project, and the extent of the water right place of use. This area is most likely to be provided water service now or in the near future. This plan is based on directly providing water (via pumps and pipes) within the retail service area.

The KPUD has committed to extending the water system as necessary to provide water service within the retail service area. However, all water system extensions *may* require developer contributed facilities to be feasible. It is not possible to identify the size, location, and configuration of these facilities since they will be based on the nature of the development. However, the plan does identify the necessary capacity of the existing facilities to assimilate growth in the retail service area.

2.2.1.2 Future Service Area and Satellite Service Area Description

The KPUD is committed to providing water service directly within the future service area and indirectly within the satellite service area which includes water systems that are remote from the Cliffs water system.

The future service area is comprised of those lands: currently owned by Columbia Gorge Aluminum Company; adjacent U.S. Government lands, *privately owned lands*, and industrial zoned lands. The future service area boundary is illustrated on **Figure 2-2**. Much of this area is not buildable due to steep slopes. In addition most of this area is zoned for open space and would need to be re-zoned to allow for development. Originally there were several residential plats within this service area. Because of the potential for the land to change ownership, the affordability of the land, and the excellent views of the river it is possible that this property will develop sometime in the future. It appears that the CGAC has permanently shut down. Much of the aluminum industry in the Northwest has experienced similar problems. In some cases the owners have marketed their land for re-development to maximize their property investment. This plan does not attempt to identify how the Cliffs water system will provide direct water service within the future service area. Service requests in this area may not occur for many years and will necessitate an update of this plan.

Water service within the satellite service areas will be characterized by providing water indirectly via changes in the points of diversion to the Cliffs water rights. The satellite areas include the KPUD owned satellite water systems and other water systems such as the City of White Salmon. **Figure 2-3** illustrates the satellite water systems.

2.2.1.3 Physical Character of Service Areas

The Cliffs retail service area topography is characterized by a flat bench of land at the smelter location at an elevation of approximately 600 feet, which quickly slopes upwards into the Columbia Hills to the North away from the river. Elevations within the existing service area range from approximately 260 feet at the pump station (John Day Pool elevation) to over 600 feet above sea level at the highest point.

Much of the future service area (those lands owned by CGAC) encompasses the Columbia Hills and a narrow bench of land between the hills and the river. Most of this property is not developable due to the steep slopes. However there are parcels in this area which are located on buildable land that has good access to roads, the railroad, and the river. It is quite possible that this land could be re-zoned for development sometime in the future.

The climate of the service area is arid with light rainfall. The average annual precipitation is 10 inches. The landscape is best described as semi-arid desert.

2.2.1.4 Zoning & Existing Landuse

About one-half of the retail service area is zoned Industrial Park (1,160 acres). The remaining areas are zoned for Open Space and Extensive Agriculture. Most of the Open Space zoned land is owned by the U.S. Government and includes areas near the John Day Dam. The future service area is zoned Open Space and Extensive Agriculture. The satellite areas are zoned for urban development and are served by municipal water systems.

- The Industrial Park zone is a light industrial zoning classification suitable for the manufacture, distribution and assembly of finished products.
- Open space zoning is generally intended to preserve or retain the open character of the designated land.
- Extensive Agriculture is generally intended to encourage the continued practice of farming on lands best suited for agricultural.

Figure 2-4 illustrates the County zoning.

The zoning outside of the retail service area does not have adequate density to support public water infrastructure. Therefore the KPUD has not evaluated the impact of development within the future service area. However; the KPUD is committed to extending the water system as necessary to provide water service directly within the future service area and indirectly within the SSA. The KPUD believes that the industrial zoned land has great potential for extensive development and re-development. Klickitat County, historically, has demonstrated flexibility in the re-zone of lands as necessary to accommodate economic development. As the industrial zoned lands develop, therefore, it is possible the County will re-zone bordering lands as needed for continued growth in this area. All water system extensions *may* require developer contributed facilities to be feasible.

Currently landuse in the existing retail service area is comprised entirely of the aluminum smelter, associated support offices, waste sites, and transportation facilities. The aluminum smelter is a very large factory with three cell lines over one-half mile in length each. BPA has a substation yard adjacent to the smelter. BNSF has railway lines in this area. There are several vacated residential plats within the existing retail service area to the west of the smelter. Some of the lands zoned industrial are located along the Columbia River on Army Corp lands and are designated for recreational use. No development is likely on these lands; with the exception of recreational use facilities.

The future service area is largely undeveloped but does include a few farms. The existing surface water pump station and a portion of the transmission pipelines are located on leased U.S. Government lands. Ownership and operation of these facilities by the KPUD *will* require a new lease agreement with the U.S. Government.

2.2.1.5 Adjacent Systems/Agreements

The Army Corp of Engineers owns and operates a Group B water system at John Day Dam just to the south of the service area. The WFI shows one inactive well in Section 28. The status of this water system is unknown.

The smelter leases land from the U.S. Government for surface water facilities including the Columbia River pump station and parts of the transmission main. The operation and maintenance of these facilities are governed by a lease agreement (No. DACW57-1-69-75) which includes the following provisions:

- Term – 50 years.
- Cost - $6,000/year to be negotiated every 10 years.
- Requires restoration of property upon termination.
- Requires approval prior to transferring lease.
- Solely for industrial purposes.
- Improvements must be approved by Army Corp of Engineers.

The KPUD entered into a Water Service Agreement with the City of White Salmon on March 9th, 2010. The City operates a municipal water system in Klickitat County and has a significant water

right deficit. The KPUD has agreed to provide the City with water rights from its Cliffs surface water right to meet water demands within the City that exceed its water rights.

The KPUD will provide water right quantities not to exceed 1,800 gpm and 500 acre feet per year. The water will be provided to the City by the KPUD as surface water in the Columbia River where it flows past the City, including the reach of the River that would be impacted by the City's use of the water supply. The City will only remove the quantity of water it shall require for immediate actual use to avoid any non-use of the water for any time period the water right is not in trust that may cause a relinquishment of the water right. The use of the water supply by the City shall be considered to be a perfection of that portion of the KPUD water right, and any application filed by the City shall include a request of Ecology to recognize such water supply as applied to beneficial use. The City shall pay for the water supply. The cost to be paid to the KPUD shall be at a rate of $100 per acre foot of water used subject to annual increases based on the consumer price index.

2.2.2 Planning Consistency/Service Policies

2.2.2.1 Klickitat County Planning Consistency & Duty to Serve

Klickitat County is partially planning County under the State's Growth Management Act. The County does have a comprehensive plan which is older and not germane to water system planning. The County has a Zoning Ordinance which sets forth zoning classifications for all land areas within the County boundaries. This ordinance was used to identify the zoning designations in and around the water system. The zoning boundaries were used, in part, to delineate the retail service area.

The Klickitat County Government is supportive of the Cliffs Water System formation and development. The County adopted, via resolution, formal support for the KPUD acquisition of the CGAC water system with the goal that the water right be preserved for industrial development at the Cliffs site and for the purposes of providing municipal water supply via water right changes throughout the County.

The municipal water law requires that water system plans be consistent with local landuse planning and watershed plans. A consistency checklist must be completed and submitted with the plan. Klickitat County completed and signed this checklist. The Consistency Checklist is included in the **Appendix**.

The KPUD intends to maintain service area consistency as required by the municipal water law (RCW 90.03.386(2)) with the goal that the water right place of use be expanded to equal the service areas defined in this plan; including the satellite systems.

The KPUD has a duty to provide water service within its retail service area. Requests for new water service will be processed based on service policies as described in Chapter 7. The KPUD has verified that it can meet the following duty to serve conditions within the retail service area:

- It can provide water service in a timely and reasonable manner.
- The Cliffs water system has adequate water rights to meet the existing and future demands within the retail service area.
- The GW and SW systems have adequate capacity to provide water service in a safe and reliable manner upon completion of certain specified improvements.

- The Cliffs Water System Plan is consistent with local land use plans and development regulations.

The Duty to Service requirements of the municipal water law do not apply to the Satellite Service Areas.

2.2.2.2 Watershed Planning Coordination

The Cliffs water system is in an area which is a Columbia River tributary drainage basin as defined in local watershed planning documents. Technically the water system is in WRIA 31 – Rock Creek and WRIA 30 – Klickitat. The dividing line for these watersheds is the John Day Dam. The water system service areas are within both of these WRIAs. The KPUD has staff on the management committee for each of the WRIA 30 and 31 watershed groups.

This plan includes recommendations for temporary and/or permanent transfer of surface water rights to other municipalities such as White Salmon and other projects such as the Landfill Gas Project near Roosevelt. Such transfers are discussed in the Watershed plans as a viable means of providing water to local municipalities via surface to ground transfers. A technical memorandum dated Dec. 6th, 2004 from Aspect Consulting to Klickitat County Planning Department; titled "*Strategies for meeting future municipal water demands, WRIA 30*" includes the following statement - "The purpose of this memorandum is to summarize projected future municipal water supply needs within WRIA 30 and identify strategies and constraints for meeting those needs within the context of the ongoing watershed planning process." Each of the Satellite water systems is within WRIA 30 with the exception of the Roosevelt area which is in WRIA 31.

In all respects this plan is consistent with local watershed planning efforts. This plan was provided to Klickitat County watershed planning staff for review and comment.

Chapter-3. Water System Demands

3.1 - Introduction

A detailed analysis of system demands is crucial to the planning efforts of a water supplier. Demands on the water system determine the size of storage reservoirs and distribution piping and the required supply capacity.

Typically, a plan includes demand projections for the 6-year and 20-year levels of service based on the estimated population in those years. In this plan, an evaluation of the system based on demands at full development of the retail service area was more suitable. This was necessary since population growth in this unique service area cannot be estimated with any reasonable degree of accuracy. At this time there is no permanent residential population but rather a transient population comprised of employees at industrial developments. In the future, development is expected to be largely industrial in character. In this Plan the future water demands are dependent, in part, on the buildable land in acres. Although development may include industrial, commercial, residential or any combination of these land uses.

The plan does include an evaluation of the forecasted demands within the Satellite Service Areas (SSAs) at the 20-year level of service. These areas are residential in character and it is reasonable to project future population in these systems. These demands will only be used to determine water right needs in these systems. Therefore the demands have no impact on the physical ground water and surface water system facilities. For these reasons a 6-year level of service forecast was not relevant.

3.2 - Population Analysis

Normally an evaluation of population growth is necessary to estimate future water demands. For industrial areas (the retail service area) the typical analysis doesn't apply. Industrial water demand forecasts are highly variable and depend much more on the type of manufacturing than the population. For the retail service area, standard demand criteria are based on developable land area and historical water use.

The future service area population is not possible to estimate due to the existing zoning designations; which don't allow development at a level requiring a municipal water system. Someday it's possible or even likely, that some of this area will be re-zoned to allow development. An estimate of population and associated demands for this area should be completed at that time.

The existing and predicted population of the Satellite Service Areas (SSA) is described in this chapter. These population estimates are the basis for calculating future water demands in each SSA. While this information is interesting, it's not critical to this plan. Water demands in the satellite areas will be met by either using water rights authorized for each system or if need arises, consideration will be given to transferring Cliffs water rights to those systems. Therefore the future demands of the SSAs on the Cliffs water system may be dependent on the water right need in each satellite service area.

3.2.1 Current Population – Retail Service Area

The CGAC smelter currently has a skeleton crew of about nine employees. One small company (Cascade Solutions) leases a building from CGAC and manufactures chemicals. This company uses the CGAC potable water system for water supply. Cascade Solutions has three or four employees. The entire population within the retail service area is currently industrial users. During peak production at the smelter there were approximately 725 employees. In addition to operation of the smelter, the aluminum plant was in the process of constructing an energy plant; now known as the Cliffs Energy Project (CEP). This project is currently in the planning stage. It is anticipated that this project will not require any full time employees.

3.2.2 Current Population – Future & Satellite Service Areas

The future service area currently has a small population comprised of a few family farms and includes the Towal community. The total population within this area, not including the retail service area, is less than 50 persons.

The satellite service areas are comprised of municipal water systems listed in **Table 3-2 – Satellite Service Areas – Population Estimates**. The estimated number of customers is shown for each water system.

3.2.3 Projected Population – Retail Service Area

The retail service area has the potential for significant and rapid population growth primarily due to the potential for new industrial development and construction of the CEP. In addition there are large areas of industrial zoned land which are not currently developed. Population estimates are inherently difficult for industrial areas. Water use forecasts for industrial lands are typically calculated based on vacant land acreage. Therefore population forecasting isn't necessary. **Table 3-1 – Population Estimates, All Service Areas** lists the potential population and developable acreage in the retail service area. Future water system demands calculations are based, in part, on the CGAC re-developing in a form which will place demands on the water system equivalent to historical peak demands.

Table 3-1 – Population Estimates, All Service Areas

Service Area Item	Existing Population	Future Population	Undeveloped Land (acres)[1]
Retail Service Area	12 persons	730	900
Future Service Area	50 persons	NA	7,700
Satellite Service Areas	3,657 ERUs	4,892 ERUs	NA

[1] This acreage is based on an estimate of developable land, considering constraints such as land ownership, zoning, and topography.

3.2.4 Projected Population - Future Service Area

None of the future service area is zoned for development which would require municipal water service. The type and character of development within this area is not predictable until the zoning changes. Efforts to predict population or water demands within the future service area should be made if the zoning changes.

3.2.5 Projected Population - Satellite Service Areas

The satellite service areas include those water systems currently owned and operated by KPUD and other water systems which are a good fit for water right transfers from the Cliffs water system. Some of the existing and potential municipal satellite water systems are shown in **Table 3-2**. Other water systems may also become satellite water systems in the future such as the Roosevelt Landfill Gas (LFG) energy project. This table includes an estimate of the population growth for each system based on existing planning documents as noted. The predicted population growth in these systems is indirectly linked to water demands from the Cliffs water system; as follows:

1. The predicted population and demand criteria of each system were used to estimate future water demands.
2. The future water demands were compared to authorized water rights in each SSA to identify water right deficits, if any.
3. The water right deficits could possibly be resolved via a transfer of the Cliffs surface water or ground water rights and represent a municipal demand on the Cliffs water system.

Table 3-2 – Satellite Service Areas – Population Estimates

Satellite Service Areas	Existing Population (ERUs)	Future Population [1] (ERUs)	ADD (gpd/ERU)	Reference
Roosevelt	70	240	303	2007 Analysis by KPUD
Wishram	220	281	379	KPUD 2004 Water System Plan
Lyle	321	348	372	KPUD 2004 Water System Plan
Rimrock	22	48	464	KPUD 2004 Water System Plan
Ponderosa	90	205	376	KPUD 2004 Water System Plan
Glenwood	213	275	672	KPUD 2004 Water System Plan
Klickitat	220	275	531	KPUD 2004 Water System Plan
White Salmon	1950	2541	326	White Salmon 2005 Water System Plan
Bingen	551	679	367	Bingen Draft 2008 Water System Plan
Totals	**3,657**	**4,892**		

[1] Based on the 20-year population forecast in each systems water system plan. Roosevelt numbers are based on an update of the demand forecast in 2007.

3.3 - Historical Water Demands

An evaluation of historical water demands was completed to help predict future water consumption.

3.3.1 Data Collection

An extensive evaluation of the smelter surface water demands was conducted in 2002 as part of a water right change application. This evaluation is included by reference and is summarized in this section. This data was used as a basis for identifying water right quantities.

There is no smelter ground water demand data and therefore some assumptions had to be made to identify demands in terms of employment level.

Water demand data for the Satellite Service Areas are based on the demand data presented in each systems' respective Water System Plan. This demand data is included by reference and is summarized in **Table 3-2**. This demand data forms the basis for water right needs in each system.

3.3.2 Surface and Ground Water Demands

The smelter demands on the surface water system are summarized in **Table 3-3 – Surface Water System Demands**. This data is based on the 2002 Record of Examination (ROE) for Change Application No. CS3-00845C@1. The ROE included an engineering report that provided a detailed estimate of the surface water demands from the smelter. The smelter water use does not fluctuate significantly diurnally, daily, or seasonally. The peak year was 1998. In this year the Average Day Demand (ADD) was about 15,368 afy or 9,527 gpm.

The Cliffs Energy Project (CEP) is currently under development. The water demand is based on the water right for this project which is 1,680 afy or 1,041 gpm.

Table 3-3 – Surface Water System Demands

Water Demand (Units)	Smelter Peak Annual Demand	CEP Annual Demand
Acre-feet/year	15,368	1,680
Gallons/day	13,718,732	1,499,705
GPM	9,527	1,041

The ground water system demands are based on industry standard criteria. No historical demand data is available.

3.3.3 Unaccounted-for-Water Use

Unaccounted-for-water use is the difference between the amount of water supplied and the amount of water consumed, as determined by source and customer meters. Typically, it is comprised of leakage, hydrant use, and unauthorized withdrawals.

There is no data available to calculate current unaccounted-for-water use for either of the surface or ground water systems. However, the 2002 ROE did include an evaluation of leakage in the surface water system. In summary one very large leak was estimated to be approximately 2,360 afy or 1,463 gpm. This is based on an evaluation of the leak in 2001. This leak was repaired. The ROE engineering report made a very general assumption that total leakage in the SW system after repair is approximately 5% of the total surface water demand; or approximately 476 gpm. All water demand criteria include unaccounted for water use.

3.4 - Demand Projection Criteria

Demand criteria are necessary to project future demands due to growth. In addition when data is lacking, demand criteria are also used to estimate existing demands. Demand criteria are based on historical demands as described above and industry standards. **Table 3-4 – Demand Criteria** lists the demand criteria used in this plan. *These criteria were used to calculate the projected 20-year demands within the Retail Service Area and the Satellite Service Area for both the surface water and ground water systems.*

The Average Day Demand (ADD) is the average amount of water used by each customer each day of the year. Generally the ADD is used to determine the adequacy of water rights to meet total annual demands and to identify the required amount of standby storage.

Maximum Day Demand (MDD) is the amount of water delivered to the system on the year's maximum water use day. Generally supply sources and reservoirs must be designed for maximum day demands. MDD data was not available, therefore a peaking factor was used to estimate the MDD based on the ADD.

The Peak Hour Demand (PHD) is the peak rate of water use, excluding fire flow, experienced or expected within a defined service area over one hour. For domestic water systems, distributions mains and reservoirs are required to be sized to provide domestic water during PHD conditions.

Peaking factors are needed to estimate the MDD and PHD for the potable ground water system. The Washington State Department of Health (DOH) Water System Design Manual suggests using a peaking factor of between 1.5 and 3 for estimating the MDD from the ADD.

A peaking factor of 1.5 was used to calculate the MDD for the potable water system. The lower end of the range was used because there should not be significant variation in demands on a day to day and seasonal basis in an industrial development with relatively constant employment and no irrigation.

A peaking factor of 2.0 was used to calculate the MDD criterion for the Satellite Service Areas. This peaking factor results in a MDD criterion that is fairly typical for water systems within the SSA.

A peaking factor was used to calculate the PHD based on the MDD. A factor of 2.5 was used. This is a fairly common industry standard value and will be used due to the lack of any historical records. Note that the vacant land potable criterion for MDD was not peaked to calculate PHD. The vacant land criterion of 500 gallons per acre per day generates significant demands and is very conservative. Therefore, for the purposes of analysis, the PHD on the vacant industrial lands was considered to be equivalent to the MDD.

Because demands within the retail service area are not residential in nature, the demand criteria are not expressed in terms of Equivalent Residential Units (ERUs). Different criteria were developed depending on the source of water (ground water or surface water) and on the category of use.

The SSA demand criteria are based on the average of all ADD demand criteria for the water systems in the SSA as listed in Table 3-2 – Satellite Service Areas – Population Estimates. This criterion was used to determine the capacity of the ground water system facilities and the surface water rights in terms of ERUs.

Table 3-4 – Demand Criteria

Service Area	Demand Categories	Water Source	ADD	MDD	PHD	Units
Retail Service Area	Industrial - Smelter	Surface	9,527	9,527	NA	gpm
	Industrial - Fireflow	Surface	NA	NA	1,500	gpm for 4 hours
	Industrial - Cliffs Energy Project	Surface	1,041	1,041	NA	gpm
	Smelter - Potable	Ground	35	52.5	131	gpd/person
	Vacant Land - Industrial Potable Uses	Ground	500	750	NA	gallons per acre per day
Satellite Service Areas	*Municipal*	*Surface*	*421*	*842*	*NA*	*gpd/ERU*
Future Service Area	*No unique criteria were developed for the future service area. This area may be developed at some time if rezoning occurs. No attempt was made to estimate future demands in this area.*					

Potable MDD/ADD Peaking Factor	*1.5*	*Potable PHD/MDD Peaking Factor*	*2.5*	*SSA MDD/ADD Peaking Factor*	*2.0*

3.4.1 Industrial Demand Criteria

For the surface water (SW) system, the industrial demand criteria are based, in part, on historical water use at the smelter and the estimated water need for the CEP. No demands above historical use from these two developments are anticipated nor can they occur due to water right limitations. Therefore the criteria are expressed as an absolute maximum value for these two customers.

The industrial smelter criteria shown in **Table 3-4 – Demand Criteria** includes a large leak (1,463 gpm) that was repaired. This data, as discussed previously, is based on the peak historical use of water at the smelter. Variations in demands at the smelter were minimal on a day to day basis. Therefore, the ADD and MDD criteria will be considered equal for the purposes of planning. The industrial smelter PHD is not germane to this analysis due to the very constant demands throughout a typical day. When projecting future industrial demands from the smelter, the large leak was not included.

The industrial CEP criterion is considered to be constant throughout the year and during any one day period because of the nature of power plant operation. For this reason the CEP demand criteria also was not peaked.

The historical demands of the smelter and future demands of the Cliffs Energy Project can be used to determine the required size of supply, storage, and transmission facilities to provide service at full development of the retail service area.

3.4.2 Potable Demand Criteria - Smelter

For the potable water system, the demand criteria are expressed in terms of gpd/person for the smelter. This criterion is based on the DOH Water System Design Manual Table 5-2 Industrial Employees.

Using this water consumption data, the average daily demand (ADD), maximum daily demand (MDD), and peak hourly demand (PHD) were calculated. The estimates of MDD and PHD are based on the peaking factors described previously.

3.4.3 Potable Demand Criteria – Vacant Industrial Lands

In order to estimate the potable ground water demands resulting from future growth on vacant lands, several documents were reviewed to develop an understanding of likely demands per developed acre of industrial park. Industrial development on vacant lands will use the SW system for industrial process water. Potable water will be supplied by the ground water (GW) system.

Wastewater Engineering: Treatment, Disposal, and Reuse (Metcalf and Eddy, 1991) suggests that the wastewater load rate for light industries with little or no wet processes is generally between 500 and 1,500 gpd per acre. It is expected that potable water demands would be similar to these wastewater load rates. Since the surface water system will be providing all irrigation, industrial process water, and fire flows, an ADD of 500 gallons per acre per day (gpad) was selected.

It is possible that a customer with a demand greater than 500 gpad per acre could request water service. In this event, the ability to service such a customer would have to be evaluated in light of available capacity.

3.4.4 Fire Flow

The fire flow demand will be met by the SW system. Therefore a fire flow criterion for the potable water system was not developed. The existing SW tanks are almost entirely for meeting emergency storage needs of the smelter. This substantial storage volume is available for fighting fires at the smelter and on undeveloped lands as the fire flow storage can be nested in the emergency storage volume.

DOH does not specify a minimum fire flow nor does it specify a minimum duration. These standards are ordinarily established by the Local Fire Authority (LFA) or by county ordinance. The LFA in Klickitat County is the building department. The building department has not established fire flow criteria for developments within the retail service area.

In absence of a standard for minimum fire flow, a minimum level-of-service goal of 1,500 gpm with a 4-hour duration is recommended for future development. This level-of-service goal is to be adopted as KPUD policy. All future tenants shall be informed of the level-of-service goal and future development should be designed in consideration of this policy and the UFC. Note that fire flow requirements for the smelter are much higher; however since it is not in operation and may never be restarted the fire flow criteria are not based on this use. It should be noted that the surface

water system, historically, could provide well over 9,000 gpm continuously for fighting fires at the smelter.

3.4.5 Consumptive Use Analysis

An evaluation of the consumptive and non-consumptive portions of the demands is presented in Chapter 4 – Water Rights Assessment.

3.5 - Demand Projections

3.5.1 Summary of Projected Demands

Table 3-5 – Demand Summary lists the estimated water system demands on both the GW and SW systems combined historically and in 20 years.

Table 3-5 – Demand Summary

Level of Service	ADD (gpm)	MDD (gpm)	PHD (gpm)
Existing Demands	8,064	8,064	NA
20-year Demands	9,956	10,121	NA

Table 3-6 – Projected 20-year Demands lists the calculated demands for each service area and from each water source. The plan is based on the estimated demands in 20 years. The 20-year projection assumes full build-out of the retail service area and is based on the 20-year level of service for each SSA.

Table 3-6 – Projected 20-year Demands

Service Area	Demand Categories	ADD	MDD	PHD	Units
Retail Service Area	20-year Projected SW Demands - Industrial Use				
	Smelter	15,368	NA	NA	afy
	CEP	1,680	NA	NA	afy
	Total SW Demands	**17,048**	Less Repaired Leak =	**14,688**	afy
	20-year Projected GW Demands - Potable Water Supply				
	Smelter	18	27	67	gpm
	CEP	0	0	0	gpm
	Vacant Lands	313	469	469	gpm
	Total GW Demands	**330**	**495**	**535**	gpm
Satellite Service Areas	20-year Projected SW Demands - Municipal Water Rights				
	Water Right Need (Qa & Qi)	***839***	***492***	NA	*afy and gpm respectively*

Potable MDD/ADD Peaking Factor	*1.5*	*Potable PHD/MDD Peaking Factor*	*2.5*

3.5.2 Retail Area

The total SW demand within the retail service area is based on providing industrial water to the CGAC smelter (or an equivalent development) and to the Cliffs Energy Project and fire flows to all existing and future developments. It was assumed that no surface water will be needed for demands

on vacant industrial lands as new developments will utilize dry industrial processes. The quantities are based on the criteria described previously. The elimination of the large leak alone will reduce the estimated demand by about 2,360 afy. This results in a total demand including the CEP of:

17,048 afy - 2,360 afy = 14,688 afy.

The 20-year ADD on the SW system is calculated as follows:

14,688 afy (Smelter peak historical use less leak + CEP)
+ 839 afy (Estimated 20-year municipal ADD)
= 15,527 afy (21.45 cfs)

The MDD is potentially a highly variable calculation. The Columbia River pump station is capable of pumping at much higher rates; possibly as high as 35 cfs. It is not known at this time if demands in this range will be placed on the SW system. If there is another large new development, the projected 20-year MDD should be estimated based on actual peak day demands from the customer(s). The 20-year MDD on the SW system is calculated as follows:

9,105 gpm (Smelter peak historical use less leak + CEP)
+ 492 gpm (Estimated 20-year municipal MDD)
= 9,597 gpm (21.38 cfs)

The total GW demand within the retail service area is based on providing potable water to a new development equivalent to the smelter at full operation and to new industrial development on the approximately 900 acres of buildable land. This demand forecast is very tentative since demands could be highly variable. The forecast is based on the SW system providing all industrial process water, fire flows and irrigation; should it be needed. Consequently the GW system will provide water for potable uses only.

3.5.3 Satellite Service Areas

The total projected demands from the Satellite Service Areas are based on the projected water right deficit in each water system. **Table 3-7 – SSA Water Right Demands** lists the estimated calculation of the water right deficit or surplus. The deficits were calculated as follows:

Qa water right (surplus/deficit) = Qa water right (existing) – Qa ADD (20-year projection)

Qi water right (surplus/deficit) = Qi water right (existing) – Qi MDD (20-year projection)

The KPUD intends to assist its SSAs with water right needs utilizing the Cliffs water right; if feasible. Assistance will be in the form of SW and/or GW water right transfers to the systems in need. Therefore, the total deficit is considered a municipal demand on the Cliffs water system water right but not on the supply, storage, or transmission facilities.

Table 3-7 – SSA Water Right Demands

	Existing Water Rights		*Projected 20-year Demands*		*Water Right Surplus/Deficit*	
Satellite Service Areas	**Qa (afy)**	**Qi (gpm)**	**ADD Qa (afy)**	**MDD Qi (gpm)**	**Qa (afy)**	**Qi (gpm)**
Roosevelt	112	180	81	190	31	-10
Wishram[1]	160	135	153	250	7	-115
Lyle[1]	224	600	170	320	54	280
Rimrock	86	65	24	44	62	21
Ponderosa[1]	97	60	97	111	0	-51
Glenwood	135	503	206	355	-71	148
Klickitat	112	200	163	256	-51	-56
White Salmon	688	1795	1405	2056	-717	-260
Bingen	450	580	282	322	168	258
			Total Deficit all Systems =		**-839**	**-492**

[1] The authorized water rights in these systems were determined from the results of approved water right changes subsequent to the completion of the KPUD Water System Plan. Demand data for these three systems is based on water right reports prepared as part of each water right acquisition project. This data superceded the demand forecasts in the WSP.

3.6 - Water Use Efficiency (WUE) Planning

The following excerpts are taken directly from: the DOH Water Use Efficiency Guidebook Second Edition January 2009.

"A WUE program is a plan your water system follows to increase water supply and water demand efficiency. The intent is to minimize water withdrawals and water use by implementing water saving activities and adopting policies."

WUE requirements for municipal water systems include the following:

1. Planning.
2. Distribution system leakage standard.
3. Customer goal setting.
4. Annual WUE reporting.

"The Municipal Water Law directed that the WUE requirements apply to water systems defined as a MWS. A MWS is "an entity that supplies water for municipal water supply purposes" (RCW 90.03.015(3))."

This section of the plan includes the WUE planning requirements as specified in the DOH guidebook and based on the unique characteristics of the Cliffs water system. Characteristics of this system that were used as a basis to form the WUE plan include:

- The KPUD does not yet own or operate any of the water system facilities.
- Currently water demands are very low.

- Future potable water demand forecasts are based on industry standard criteria not on historical water use.
- Historical water use efficiency data is non-existent.
- The KPUD has implemented a WUE program for its other municipal water systems. This program will be applied to the Cliffs water system upon acquiring ownership of the water system facilities.

3.6.1 Source Metering Program

Source meters are installed at all surface and ground water sources. The KPUD intends to install a new source meter at Well No. 3 and on all new sources. The KPUD will collect monthly and annual water production data upon acquiring ownership of the water system facilities.

3.6.2 Service Metering Program

The KPUD will install service meters on all existing and future customer service connections to both the surface water and ground water systems upon acquisition of the water system. The KPUD will collect service meter (consumption) data including annual totals, variation by customer class, totals by water source, and monthly variations. The KPUD will implement its existing service meter maintenance program as described in Chapter 7.

3.6.3 Interties

The Cliffs water system does not have any physical interties to other water systems. However, as described in Chapter 4, the Cliffs water system does have a water rights exchange and has agreed to sell water rights to the City of White Salmon. The water right agreement specifies that the City of White Salmon must record annual water used in excess of the City's existing water rights. The excess water used will be purchased from the KPUD Cliffs water right exchange.

3.6.4 Reporting

The Capital Improvement Plan (see Chapter 6) specifies a schedule for installation of source and service meters. Upon acquisition of the Cliffs water system facilities, the KPUD will develop a leak detection program and estimate and report leakage in its first WUE report and annually thereafter.

3.6.5 Demand Forecasting

The forecasted 20-year demands are described earlier in this chapter. Six-year demand forecasts were not prepared as part of this Plan for several reasons; including: population growth in this water system will be comprised of industrial development, there is no anticipated development in the next six years, demand forecasts are based on an equivalent customer base to that historically present (the Smelter), this type of forecast means that the development will or won't occur and there will not be any gradual increase in population over time.

No attempt was made to forecast demands with projected water savings from the WUE program. A WUE program will be prepared and implemented once the KPUD acquires ownership of the water system and there is actual water use data that will form the basis for developing water use efficiency measures.

3.6.6 WUE Program

A Water Use Efficiency Program will be developed and implemented when the KPUD acquires ownership of the water system and when there are water system customers. *This approach to the WUE Program was approved by DOH staff.*

The current water system status does present a good opportunity for the KPUD to identify distribution system leakage. The lack of demands results in a static hydraulic environment which will allow the KPUD to easily identify distribution system leakage by simply measuring the change in tank level over time. The KPUD will use this approach to identify distribution system leakage upon acquisition of the water system facilities as described in the Facility Inspection and Testing Program (See Chapter 6).

The KPUD has implemented a WUE goal for all of its water systems. The goal is to reduce customer usage by 25 gpd per connection for a typical residential service and to maintain DSL at less than 15 percent all within the next six years. The WUE goal was adopted by Resolution at a public meeting of the KPUD Board of Commissioners. The WUE efficiency program was presented to the community at various public meetings in 2010. The goal is a system-wide goal established based on the water production and demand characteristics in all of the KPUD's community water systems.

3.6.7 Water Supply Characteristics

This section presents how the characteristics of the water supply sources will affect the resource now and in to the future. There are two sources of supply, the ground water wells and the Columbia River surface water diversion. A detailed description of the supply sources is provided in Chapter 5. The ground and surface water sources are in WRIA 31.

3.6.7.1 Water Quantity

Ground Water Source: It is not known if the planned use of the groundwater resource will affect the quantity of groundwater. Chapter 4 presents an Aquifer Performance and Monitoring Program which identifies data that will be collected and evaluated to determine the sustainability of the groundwater resource. Chapter 4 also describes the local hydrogeology and presents climate data. Historical evidence suggests that groundwater withdrawals have been sustainable; however the Plan is based on greatly increasing the withdrawals as necessary to meet the demands of new development. There is anecdotal evidence that Well No. 1 has experienced capacity issues. It appears that the capacity problems were not related to water level decline but instead caused by well clogging.

Surface Water Source: The surface water source is the Columbia River. Proposed use of this source will not measurably affect the quantity of water available from the river. It is reasonable to assume that the Columbia River will continue to provide an adequate quantity of water within the planning period.

There are no known seasonal variations in water quantity that affect either source.

3.6.7.2 Water Quality:

Ground Water Source: Ground water quality problems are a real possibility in the existing wells; particularly Well No. 3 which the KPUD intends to acquire. This well has a high vulnerability to contamination as described in Chapter 4 Wellhead Protection. There are numerous potential

sources of ground water contamination in the smelter area including documented toxic waste sites. This Plan proposes the development of a new well in a location which will not be vulnerable to contamination from known or suspected waste sources. The well site will be chosen based on a detailed hydrogeologic evaluation including groundwater modeling to ensure it is upgradient from sources of contamination. This approach will minimize the potential for water quality related supply failures.

Surface Water Source: The surface water is intended for use as non-potable water for purposes such as fire fighting and wet industrial processes. Columbia River water quality is not expected to impact the ability to use the source for these purposes.

3.6.7.3Legal Constraints

Ground Water Source: The ground water right assessment identifies an error on the water right which may affect the quantity of water legally available for withdrawal. An analysis of this error is presented in Chapter 4. While the error, if not corrected, could dramatically reduce the water right, it does not significantly affect the plan for the ground water resource. The KPUD will continue its work on the ground water rights in an effort to correct this processing error and also to confirm the rights as municipal purpose of use. There are no other legal constraints that affect the planned use of the ground water resource.

Surface Water Source: The surface water right assessment is presented in Chapter 4. This assessment demonstrates that there is adequate water quantity available for the planned use of the surface water resource. The surface water right is not seasonal or interruptible as it is senior to the adoption of Columbia River instream flows.

The proposed water right exchange could lead to a significant use of the surface water right by other municipal water systems. For example, the KPUD has recently executed an agreement with the City of White Salmon to provide variable water right quantities to the City. This use of a quantity of the surface right does diminish the available water right for use within the Cliffs retail service area. However; the forecasted demands on the surface water system did include a demand component allocated to satellite water systems. Consequently the use of water by the City is consistent with the Plan. The KPUD will evaluate future requests for water rights with the goal of ensuring adequate water is available for the Cliffs water system.

All Sources: The KPUD's ability to utilize the water sources depends entirely on successfully entering into an agreement with CGAC for the transfer of facility ownership. The Facilities Transfer Agreement is described in Chapter 6. Without this agreement the KPUD cannot provide water service to the Cliffs water system.

3.6.8 Reclaimed Water Analysis (NA)

3.6.9 Rate Structure Analysis

The KPUD has an inverted block rate structure for its existing municipal and largely residential water systems. This structure encourages efficient use of water. At this time the KPUD does not intend to implement an inverted rate structure for the Cliffs water system generally because this type of structure is not germane to this type of water system. Chapter 8 presents rate structure

recommendations including justification for not using an inverted block rate. The KPUD will evaluate using an inverted rate structure in the future if and when there are new customers.

Chapter-4. Water Resources

4.1 - Introduction

This chapter evaluates the quantity and quality of the water resource and identifies steps the KPUD will take to ensure it has enough water that is of high quality to meet its needs. Both the SW and GW sources are evaluated. Each of these sources is interconnected from both a water distribution and water right perspective. Therefore the Cliffs water system will depend on both sources to meet projected demands. This Chapter is organized in the following manner:

- Hydrogeology & Resource Monitoring. This section presents a description of the general hydrogeology for the ground water sources and the proposed Aquifer Performance Monitoring Plan.
- Water Rights. This section lists the existing water rights and water right history, and provides a water right assessment.
- Water Quality. This section provides a description and history of water quality based on testing of the ground water wells.
- Wellhead Protection Program. This section presents the Wellhead Protection Program which was developed to minimize the potential for water quality contamination of the aquifer.
- Source Reliability Analysis. This section describes reliability issues and recommendations based on an evaluation of the water rights, water quantity, and water quality. It does not consider facility reliability; which is discussed in Chapter 5.

4.2 - Hydrogeology and Resource Monitoring

A summary of the general hydrogeology of the aquifers is presented below. This information is not required for a water system plan, however the information is useful and it was determined that a summary of this data would be an important resource.

4.2.1 Well Hydrogeology

An aquifer is a saturated underground soil or rock formation that yields water in sufficient quantity to be useful. Generally, the water system wells are developed in fractured basalt and interlaying unconsolidated deposits. The basalt rock was formed from rift volcanic activity and is comprised of numerous lava flows which vary significantly in thickness. Oftentimes, the basalt flows are separated by unconsolidated sedimentary formations generated by river and lake deposits. A typical Pliocene and younger-age basaltic lava flow of the Northwest contains layers of varying permeability. Permeability is greatest near the top and the bottom of the flow and least in the dense, center part of the flow. Basaltic lavas tend to be fluid and they form thin flows that have considerable pore space at the tops and bottoms of the flows. Numerous basalt flows commonly overlap, and the flows are separated by soil zones or alluvial material that form permeable zones. Columnar joints that develop in the central parts of basalt flows create passages that allow water to move vertically through the basalt. Basaltic rocks are the most productive aquifers in volcanic rocks. Those of the Columbia Plateau aquifer system in Washington are more than 8,000 feet thick in places.

Generally, each well is confined by an overlying thick layer of hard basalt, an aquitard. The aquitard is composed of material of low hydraulic conductivity. Because of the low permeability, aquitards limit the quantity of water that can move vertically to the aquifer. Rain and stormwater infiltrate the permeable soil at the surface and travel downward until vertical movement is impeded by the aquitard. Groundwater may then pond and form a perched aquifer, wetland or lake, or the groundwater may move laterally down the gradient within the watershed. Alternatively, it may find a hole in the aquitard (which is prevalent is heavily fractured basalt) and drain to a deeper aquifer.

A hydrogeologic assessment was completed by Kennedy Jenks in 2001 on Well No. 1. The assessment is summarized below:

- Well No. 1 penetrates Grand Ronde (GR) basalts.
- The well penetrated a silt zone interbed with a thickness of 33-feet identified as the Winter Water member of the GR at about 655 feet below ground surface (bgs).
- The well penetrated the Grouse Creek member of the GR basalts.
- Deepening of the well in 2002 may have penetrated the Wapshilla Ridge member of the GR basalts. The deepening may also have penetrated other basalt interbeds. Water encountered in the deepening had very poor water quality including high levels of iron and high temperature. The deepened section was very unstable resulting in difficult drilling.
- There are two faults just west of the smelter which may be hydraulic barriers to flow.

4.2.2 Well Characteristics

Table 4-1 – Ground Water Source Characteristics/History lists the physical characteristics of each of the three wells. Currently Well No. 3 appears to have the best water quality and to be the most reliable well. There is very little information on Wells 2 and 3. Data collection and testing is imperative to allow evaluation of these sources and to identify preferred ground water well improvements. The capacity of Well No. 1 appears to be very limited at this time. Well No. 2 seems to have adequate capacity but there are some questions about its water quality.

Well No. 1 production is much lower than when it was drilled. The original capacity was substantial – over 1,000 gpm. The reduced yield may be caused by bio-fouling due to high levels of iron and associated iron bacteria growth. In 1992 a new 12-inch perforated casing was installed with larger perforations to improve the well yield. There are no records regarding the success of this effort. A deepening of the well in 2002 in an attempt to get additional capacity was unsuccessful. No rehabilitation efforts have been attempted.

Table 4-1 – Ground Water Source Characteristics/History

Item	Well No. 1	Well No. 2	Well No. 3
Location	NW 1/4 SE 1/4 Sec. 20 T3N R17E	NE 1/4 NW 1/4 Sec. 21 T3N R17E	NW 1/4 SE 1/4 Sec. 20 T3N R17E
Depth (bgs)	Original 1128', 2002 deepened to 1245'? [1]	1000', 2000 video log shows filled in at 951'	504'
Drilling History	1971 Originally drilled. 1992 Re-conditioned. 2002 Deepened	1971	1971
Capacity (original). Current capacity is unknown.	1,000 gpm w/238' dd @ 24 hours [2]	840 gpm w/215' dd @ 24 hours.	100 gpm
Pumping System	76 Hp pump w/2 50 Hp motors driven by 2/50 Hp VFDs.	VFD driven submersible 60 Hp pump.	
Pumping Specs	Berkley 7T-60-350 - 14 Stage. 385 gpm	Berkeley 6T, 14 Stage submersible. 200 gpm @ 550' TDH.	100 gpm
Pump Depth (bgs)		462' - 2000 Install	
Static Water Level - original (bgs)	1971: 238', 1992: 298', 2002: 298'	1971: 270', 2000: 245'	243'
Diameter	12" to 8", 8 begins at 547' bgs	16" to 8"	10" to 8"
Casing	20" (0-30'), 12" (2-500')	20" (0-7'), 12" (3-550')	16" (0-23'), 10" (3-23')
Screening	1971: Perf. 380-480', 1992: Perf. 383-485' [3]	Perf. 490-550'	None
Seal	to 50'	to 32'	to 23'

[1] Well No. 1 was deepened in 2002. No well log available. Notes indicate very warm water was found with high levels of iron. Deepening was attempted to obtain more water as well had biofouled. A hydrogeologic review was done by Kennedy Jenks in 2001 with erroneous conclusions.

[2] From original well log. 880 gpm w/167' of drawdown at 6 hours. Note the current capacity is unknown and very low due to biofouling

[3] Well No. 1 was reconditioned in 1992 possibly due to biofouling. It appears that new 12" casing was installed with larger perforations (0.5" x 2.0"). Well log indicates 8" hole alignment is poor and possibly unstable in some locations.

4.2.3 Aquifer Performance Monitoring

The question of how much water is available in the aquifer has not been answered. Well interference tests are imperative for small aquifers, especially if they are confined. Environmental factors such as increased impervious surface and resulting runoff or a general decline in the water table caused by short or long term climatic trends will also reduce well yield. Diminished production capacity can also result from:

1) Well screen corrosion
2) Decrease in pump efficiency

3) Biofouling or encrustation
4) Plugging of well screen with fine sand particles

To determine the aquifer capacity and any long-term change in production well yields, a comparison of well performance over time must be made. Past performance standards are available because conducting a pumping test is part of the completion of every new well. However, since the pump tests for the CGAC wells were limited; the KPUD must perform testing to develop initial benchmarks for performance. Inspection and routine maintenance schedules should also be checked. It is important to note any changes in the operating characteristics of the well and pump, because both can deteriorate to the point where rehabilitation is difficult, if not impossible. When the specific capacity declines 10 to 15 percent, steps will be taken to determine the cause and correct the problem. To protect against the loss of a water supply, good well records will be kept so that any decline in performance will be detected. The well's specific capacity will be measured annually. The following checklist can be used to evaluate the performance of a well and the aquifer.

- What is the static water level in the production well?
- What is the pumping rate after a specified period of continuous pumping?
- What is the pumping water level after a specified period of continuous pumping?
- What is the specific capacity after a specified period of pumping?
- What is the normal pumping rate and how many hours per day does it operate?
- What is the general trend in water levels in wells in the area?
- How much drawdown is created in the production well because of pumping nearby wells?
- How is the water quality changing with time?

The KPUD will monitor for these parameters as part of a proposed Aquifer Performance Monitoring Program (APMP).

4.2.4 Implementation

It is essential that work begin on monitoring and testing the wells. Data must be collected so the KPUD can plan a timely response and collect data to allow evaluation of new ground water sources. The KPUD will perform the following tasks as part of the Aquifer Performance Monitoring Program:

- Install water level recorders in each well to monitor water level fluctuations and long term changes in static water level and maximum drawdown.
- Conduct pump tests to determine the capacity for each well.
- Establish control tests at regular interval for production wells.
- Keep weekly journal or record of pumping rate and how many hours it operates.
- Perform television monitor inspection of wells that have decreased yield.

Staffing and equipment necessary to implement the APMP have been incorporated into the Operations and Maintenance Program, Chapter 7. Well level sensors will be installed as part of the APMP project.

4.3 - Water Rights

This section of the plan provides a description of the Cliffs water rights including: a history, current status, capability to meet future demands, and recommended actions.

4.3.1 Water Right History

Table 4-2 – Water Right Chronology provides a detailed listing of all changes to the water rights since inception. There has been a significant amount of activity on the rights in the last five years. Key changes to the rights are described below.

- In 1992, the surface water right was changed to allow an additional purpose of use – power. Specific quantities of water were allocated exclusively for power production for the Cliffs Energy Project (CEP)
- In 2002, the surface water right was changed to modify the place of use. This change resulted in the relinquishment of about 1/3 of the annual volume. This change application formed the basis for the historical water demands of the smelter as described in Chapter 3.
- In 2005 the KPUD obtained ownership of the SW and GW rights. This was necessary to prevent relinquishment of the rights for non use. The KPUD has either changed or applied to change both the SW and GW rights as described in Table 4-2 – Water Right Chronology and as described in detail in the following sections. The 2005 actions included:

    - The KPUD applied and received approval of a change in purpose of use to municipal for the SW right.
    - The KPUD has placed a large portion of the SW right into trust – 13,911 afy.
    - The KPUD requested that the SW and GW rights be conformed to municipal purpose of use. This request was denied.
    - The KPUD fixed a Determined Future Development (DFD) plan. Completion of this water system plan is a key element of the DFD.
    - The KPUD applied to change the purpose of use of the ground water rights to municipal. This application is pending.

Table 4-2 – Water Right Chronology

			Changes				
Source Name	**Water Right Event**	**Priority Date**	**Rightholder**	**Place of Use**	**Purpose of Use**	**Qi (cfs)**	**Qa (acre-ft)**
Columbia River	Permit 15756	19-Mar-69	Martin Marietta	See Certificate	Industrial & Manuf.		
Columbia River	Certificate - S3-00845C	19-Mar-69	Martin Marietta	See Certificate	Industrial & Manuf.	35.3 cfs	25,416
Two Wells	Permit 9272	18-Mar-69	Martin Marietta	See Certificate	Dom., Manuf., Industrial	2,000 gpm	3,200
Two Wells	G4-01130C [1]	18-Mar-69	Martin Marietta	See Certificate	Dom., Manuf., Industrial	900 gpm	1,440
Columbia River	Change purpose of use - CHS3-00845C	1-May-92	GAC	Added Power Plant location	Added Power (2.3 cfs & 1680 afy)	35.3 cfs	25,416
Columbia River	Extension to CS3-00845C	Approved 5/17/2001 from 1994 to 2002	GAC	*The original deadline for the power facility was 1994. See correspondence in file for extension of deadline to 2002.*			
Columbia River	Change place of use - CS3-00845C@1	19-Feb-02	GAC	GAC Boundary within parcels 19, 23, 24, 26	Year round manuf. and indust. including power	35.3 cfs	17,048
Columbia River	COC Extension - CS3-00845C@1	Approved 9/30/2005: Deadline: 9/1/07	CGAC	*This extension is for completion of the power plant project. DOE letter states that completion will be based on construction of pumps and pipes (not actual power facility).*			
Columbia River	Quit Claim Deed	22-Dec-05	KPUD	*CGAC quit claim to all water rights and KPUD obtained ownership*			
Columbia River/ Two Wells	Application for trust (CS4-00845C@3), request to conform, DFD plan.	30-Dec-05	KPUD	*Applied for a temp. trust donation for 5 years for the purpose of instream flows. Also filed requests to conform.*			
	KPUD Resolution	13-Dec-05		*KPUD adopted resolution creating Cliffs water system*			
Columbia River	Application for Change in Purpose & Place of use. CS3-00845C@2	30-Dec-05	KPUD	Cliffs Water System service areas once the WSP is approved.	Municipal	35.3	15,591
Columbia River	PCHB issues stipulated settlement	16-Oct-07	KPUD	Cliffs Water System service areas once the WSP is approved.	Municipal so long as the DFD is carried out.	35.3	15,591
Columbia River	CEP Extension - CS3-00845C@1	22-Oct-07	KPUD	*The CEP water right completion of construction was approved and the KPUD has until 9/1/28 to put the water to beneficial use.*			
Three Wells	Application for Change in Purpose & Place of use. CG4-01130C [1]	12/30/2005, in process	KPUD	See Certificate	Dom., Manuf., Industrial	900 gpm	1,440

[1] *The Qa under this right will be determined as part of the water right change application project. The certificate states 144 afy. The KPUD believes it should be 1,440 afy.*

4.3.1.1 Surface Water Changes

The KPUD fixed a Determined Future Development (DFD) plan for the Cliffs water system in 2005. The SW right quantities which are composed of two portions; the CEP portion and the Smelter portion, are exempt from relinquishment based on the Determined Future Development (DFD) exemption for non-use. Formation of the municipal water system, development, approval, and implementation of this Plan, and completion of the CEP constitute completion of the DFD project from a water right perspective. The DOE considers the CEP water right to be a separate DFD plan. *Clarification of the DFD status is provided in a letter from Ecology dated 1/26/11 and included in the Appendices.*

The application to change the SW right purpose of use to municipal has been approved after appeal and negotiation by the KPUD and DOE. The change process has included the following major milestones:

1. WCB approval of ROE. Issued ROD on March 13th, 2007.
2. Ecology modification of WCB decision on May 3rd, 2007.
3. KPUD requests that Ecology rescind modification on May 22nd, 2007.
4. KPUD appeals Ecology modification to the PCHB on June 1st, 2007
5. Ecology and KPUD negotiate settlement on September 28th, 2007
6. PCHB issues a stipulated settlement on October 16th, 2007

The development schedule is tied to this plan and requires a demonstration of municipal beneficial use before the project can be considered complete. The change requires that the water be put to full use by December 31st, 2028. The place of use is also connected to this plan. Once the service areas as defined in this plan are approved by DOH, the water right place of use will change accordingly as provided for in the Municipal Water Law. Consequently, the water right place of use will change to include the retail service area, the future service area, and the satellite service areas. Until then the place of use is confined to the CGAC property boundaries. This change application resulted in the relinquishment of about 9% (1,457 afy) of the annual volume. **Table 4-3 – 2007 Surface Water Change Application – Resulting Quantities** described the basis for the approved water right quantities. The reader is referred to the Report of Examination (ROE), and negotiated letter of modification for a detailed description of this change application (see **Appendix**).

Table 4-3 also provide the requisite consumptive use analysis. This analysis is required by the 2007 water right decision (see CS3-00845C@2). The detailed consumptive use calculations were completed as part of the 1992 and 2002 change applications and are available for review upon request. This table provides a summary of the calculations. The estimated consumptive use at each level of service is as follows:

- *Current Level of Service – Consumptive Use = 0 afy. Note there may be a very small volume of water being used at this time for maintenance reasons.*
- *6-Year Level of Service – Consumptive Use = 320 afy. This is the consumptive use quantity of water currently proposed to be leased to the City of White Salmon. The City's consumptive use is estimated to be about 35 percent.*
- *20-year Level of Service – Consumptive Use = 4,851 afy or 35 percent of the total water right. This is the maximum allowable consumptive use under the surface water right. The actual consumptive use at this level*

of service will completely depend on the nature of development; however this limit will not be exceeded. The Plan is based in large part on providing water supply to customers with water-use characteristics similar to historical customers and therefore no attempt was made to estimate future consumptive use under different demand scenarios.

The application to place 13,911 afy of the Smelter portion of the water right into the State's trust program was approved. *The trust is for temporary use of the right for the purposes of instream flows.* The KPUD intends to consider leasing portions of the trust water right to its SSA water systems including the City of White Salmon. The amount to be leased will be determined by calculating the consumptive use portion of quantities applied for in new water right applications. Leasing of the rights will be constrained by the conditions described in the "Term Sheet" between CGAC and the KPUD. These conditions are described in Chapter 2.

In 1992 a change application was filed for an additional purpose of use – power. This change was initiated as a result of the planned gas-fired turbine power facility near the smelter. The aluminum company intended to build this power plant to provide a reliable and affordable source of power for the smelter. Changes in the economic model resulted in delays of the project. The KPUD filed a Completion of Construction Application for the CEP in 2007. This application was approved and Ecology specified a 20-year development schedule. The KPUD has until September 1st, 2028 to demonstrate beneficial use of the CEP portion of the water right for power purposes. A summary of progress in developing this project is required to be included in periodic water system plan updates.

The KPUD obtained funding from BPA to study the feasibility of using Cliffs water system facilities as a pilot scale pumped storage facility. EES prepared a Feasibility Study Report for the Cliffs' Pumped Storage Project in July 2007. The report concluded that a pilot pumped storage project is feasible using existing facilities and installation of new equipment. The cost of the project is estimated to be approximately $700,000 and the project could be completed within two years. Completion of this project will result in a perfected water right for the CEP portion and a change in the purpose of use for this water to municipal. Failure to complete the DFD for either project and put the water to municipal beneficial use could lead to relinquishment of all or a portion of the water right.

Table 4-3 – 2007 Surface Water Change Application – Resulting Quantities

Water Right Elements	2002 Quantities (afy)	Proposed 2007 Quantities (afy)	Comments
NPDES Discharge (NC)	8,514	7,057	*2000 & 2001 data respectively*
Major Leak (NC)	2,360	2,360	*1998 data*
Pond (NC)	1,120	1,120	*1998 data*
Consumptive Use	3,374	3,374	*1998 data*
subtotals	**15,368**	**13,911**	*A reduction of 1,457 afy*
Add in Power Consumptive		1,477	From 1992 change application
Total Consumptive		4,851	Smelter + CEP
Cliffs Energy Project	1,680	1,680	
Total Volume (afy)		**15,591**	
Percent Consumptive		**35%**	

4.3.1.2 Groundwater Changes

In 2005 the KPUD made application to change the ground water right purpose of use to municipal and the place of use to the Cliffs service area. The application should be modified to include an additional point of withdrawal for one of the wells. Action on this application has not yet begun. The ground water rights are part of the DFD plan for the Cliffs water system and are therefore exempt from relinquishment.

4.3.2 Water Right Assessment

Table 4-4 – Water Right Assessment presents a comparison of the existing water rights for the authorized sources to the existing and forecasted demands. From a planning perspective, the instantaneous water right should be compared to the maximum day demand to identify if additional water rights are necessary to meet peak day demands. This comparison can be used to trigger water right acquisition. However, the actual available instantaneous water right is based on the physical capacity installed at the source; usually the pump rate. Sometimes the pump rate will exceed the instantaneous water right, but the MDD will be less than the right. In these instances, the installed capacity will be reduced to below the water right but above the MDD.

This assessment demonstrates that the SW and GW rights are linked since a portion of the ground water right Qa is non-additive to the surface water right. The total Qa utilized from both sources cannot exceed the total Qa of 15,591 afy plus the domestic-use portion of the ground water right. For example if the total non-domestic utilization from the wells was 1,440 acre-feet in any one year, the allowable withdrawal from the SW right would be limited to:

15,591 afy – 1,440 afy = 14,151 afy

Ecology has issued an Interpretive and Policy Statement (Policy 2030) which provides definitions of municipal water suppliers and municipal water supply purposes. Public utility districts are on an exclusive list of governmental entities considered municipal water suppliers. A municipal water supplier is defined, in part, as a governmental entity providing water to a Group A water system serving 15 or more residential service connections or 25 or more people for 60 or more days per year. The KPUD is a municipal water supplier and intends to provide municipal water supply from surface water right S3-00845C and ground water right G4-01130C to water systems serving more than 15 residential connections.

Table 4-4 – Water Right Assessment

Water Right Data									Water Right Volumes	
DOE Water Right Control Number	Source Name	Type of Right	Primary or Supplemental	Name of Right Holder	Priority Date	Purpose	Legal Description (POD or W)	Legal Description (POU)	Qi	Qa (acre-feet)
CS3-00845C@2	Columbia River	Surface	Primary	KPUD	3/19/1969	Municipal	POW: Gov't lot 3, S21, T3N, R17E	GAC Boundary, Parcels 19, 23, 24, 26	35.3 cfs	15,591: 4,851 Consumptive
CG4-01130C	Two Wells	Groundwater	Supplemental?	KPUD	3/18/1969	Dom., Manuf., Industrial	See Certificate	See Certificate	900 gpm	1,440 afy

Comparison of Water Right Volumes to Demands										
	Water Right Volumes		Existing Utilization[1]		6-Year Demand Forecast		20-Year Demand Forecast[2]		Excess/Deficit Water Right Volume - 20 Year Forecast[3]	
Source Name	Qi (cfs SW, gpm GW)	Qa (acre-feet)[4]	Qi (Pump Rate)	Qa (acre-feet)	Qi (cfs SW, gpm GW)	Qa (acre-feet)	Qi (cfs SW, gpm GW)	Qa (acre-feet)	SW, gpm GW)	Qa (acre-feet)
Columbia River	35.3	15,591	20.3	0	4.0	1000	21.4	15,527	14	64
Two Wells	900	1,440	685	0	685	0	495	533	405	907
	Total Qa	**15,591**					**Total Qa**	**16,060**		**-469**

Water Right Applications					
Pending Water Right Application	Name on Permit	Date Submitted	Primary or Supplemental	Qi Requested (gpm)	Qa Requested (afy)
CG4-01130C	KPUD	12/30/2005	Supplemental?	900	1440
Applied for a change in purpose of use to municipal.					

[1] *Actual instantaneous GW and SW use are unknown at this time. Current instantaneous demands are assumed to be equivalent to the historical demands because normal maintenance procedures closely mimic the past operation of the pumping facilities. Currently the existing volume utilized is very low and was therefore considered zero for the purposes of this assessment. Well pumping rates are very rough.*

[2] *Refer to Chapter 3 - Demands.*

[3] *The total 20-year forecast for Qa for both sources must be compared to the total annual volume from both sources, which is non additive.*

4.3.2.1 Surface Water Right Assessment

The 2005 SW change application was approved by the Klickitat County Water Conservancy Board in 2007. The DOE modified the Board's decision in a letter of modification. This modification was appealed to the Pollution Control Hearings Board by the KPUD. Ecology and the KPUD negotiated a settlement of the appeal and a final decision was issued in a stipulated order. The assessment shown in Table 4-4 is based on the conditions set forth in the stipulated order. This entire process included a rigorous and detailed assessment of the SW right. This information is described in the ROE and negotiated stipulation which are included in the **Appendix**. As shown in the assessment table, there is adequate SW rights for the projected 20-year SW demands.

The 6-year demand forecast shown in Table 4-4 for the surface water right is based on the estimated quantity of water to be leased to the City of White Salmon. The City, the KPUD, and DOE are in ongoing negotiations regarding the leased quantity of water. The final amount may be different from that shown on the table. The consumptive use portion of the leased quantity is 35 percent. The DOE issued a decision on the use of the trust water right for the City of White Salmon. This decision also clarified how the trust water right will be administrated. This letter is included in the Appendix.

4.3.2.2 Ground Water Right Assessment

The 2005 GW change application has not yet been acted on by the KPUD and Ecology. The KPUD has assessed this water right based on a detailed review of Ecology's water right file. The assessment shown in Table 4-4 is based on this review. There is a discrepancy in the annual water right quantity (Qa). The KPUD believe the quantity issued on the certificate (144 afy) is in error. The basis for this conclusion is described below:

- Permit No. 9272 was issued for 2,000 gpm and 3,200 afy. A ratio of 0.625.
- A letter from Ecology, dated March 26th, 1974, specified that the certificate will be issued for 900 gpm and 1,440 afy; a ratio of 0.625. This letter was based on a proof of appropriation in which the Qi was reduced to 900 gpm based on the pumping rate of the two wells combined. The Qa must have been based on maintaining the ratio of Qi to Qa.
- The Qi of 900 gpm is equivalent to 1,452 afy if the source is fully utilized. Since the permit was issued based on full utilization of the Qi; it is logical to assume that the certificate would also be issued using the same rationale.
- The Qa issued on the certificate has no documented justification. There are no supporting calculations for this number in the Proof of Appropriation. It appears that an error occurred in the processing of the certificate that consisted of simply leaving off the trailing zero in 1,440 afy.
- The proof of appropriation does specify that the actual measured discharge of the two wells is 880 gpm. This is equivalent to 1,419 afy if fully utilized.

Ecology's opinion is that the annual quantity is 144 afy as stated on the certificate. Resolution of a water right dispute is outside of the scope of work of the water system planning process. The KPUD and Ecology will resolve this issue as part of the pending change application project.

The total SW right authorized in the 2002 decision and changed in the 2005 decision included all water use at the smelter. The calculations were based on discharges from the smelter which

consisted of both SW and GW quantities. *Therefore it could be concluded that the GW right is non-additive to the SW right quantity.* Consequently the total authorized annual water right is 15,591 of which 1,440 afy *or 144 afy* can be withdrawn from the ground water wells. The Qi for each right is additive. *Ecology's review of this Plan included a statement that "…only the domestic supply portion of this water right is additive to CS3-00845C@2. The remaining portion of G4-01130C (144 acre-ft/yr domestic supply use) is a non-additive alternate source (e.g. emergency source of supply) to CS3-00845C@2. The domestic supply portion (quantity) of this water right is not known. Therefore, for simplicity the water right assessment table is based on the entire volume being non-additive. This issue will also be clarified as part of the change application project. The extent and validity of the groundwater right will be evaluated as part of a tentative determination during the change application project.*

The authorized points of withdrawal under the ground water right are "Two Wells". Currently the Cliffs GW system has three active wells. Wells No. 1, No. 2, and No. 3 each provide water supply to the GW system. The water right file indicates that the authorized points of withdrawal are Wells 1 and 2 based on the legal descriptions for the location of each point of withdrawal. However; the proof of appropriation seems to indicate that the intended points of withdrawal were Wells 1 and 3. The KPUD change application will attempt to resolve this issue by obtaining authorization for all three wells. This may require an application for an additional point of withdrawal.

4.3.2.3 Water Right Assessment Conclusions

As shown in the assessment table, full utilization of the GW and SW rights will result in a slight deficit in the annual water right volume based on the sum of the 20-year projected demands. However, the projected 20-year demand on the ground water and surface water systems respectively will not exceed the authorized Qa of each source. The 20-year projected Qi on the ground water system will not exceed the authorized Qi for the wells. The KPUD will monitor development proposals within the Cliffs service areas to identify if water right acquisition becomes necessary in the future.

This plan does not include any acquisition projects due to the uncertainty in demand forecasting for this water system and because of the substantial surplus of water right quantities at this time. In addition, it is quite likely that conservation efforts could be very effective if the service area demands reach these levels in the future. Also the KPUD will have the flexibility to use either the SW or GW systems to meet future demands depending on the nature of the demand. For example, a demand exceeding the GW right could be met by using the SW system and vice versa. Prior to considering water right acquisition projects the KPUD would fully implement aggressive conservation measures.

4.3.3 Cliffs Water System – Water Right Exchange

It is the intention of the KPUD to utilize the Cliffs water rights for municipal purposes to meet the water demands of the Cliffs water system and its Satellite Service Areas. The KPUD will provide water rights to municipal water systems or other KPUD projects within its service area if feasible and available. This exchange of water rights will only occur if the CGAC does not initiate its right of first refusal for use of the water rights. Use of the water rights within the Satellite Service Areas may involve:

- Mitigation of Columbia River instream flows to offset new temporary or permanent water right applications in places such as White Salmon.
- Transfer of a portion of the water rights to a new point of withdrawal or diversion. For example, the KPUD is pursuing a change application for a new point of withdrawal and place of use for the Roosevelt Landfill Gas power project.
- Participation in the Columbia River Water Management Program, Voluntary Regional Agreement program

The KPUD's efforts in this regard are the result of the uncertainty in water rights in the State of Washington. The Department of Ecology only issues new water rights under very limited circumstances such as a public health emergency. The inability to obtain new rights coupled with the difficulty in changing existing rights has resulted in a great deal of uncertainty for municipal water suppliers. The KPUD's management of the Cliffs water rights exchange may help to alleviate some of this uncertainty in Klickitat County. This effort is consistent with the goals of the Columbia River Water Management Program recently enacted by the State of Washington. The 2006 legislative report includes the Columbia River Water Supply Inventory and Long-Term Water Supply and Water Demand Forecast. This inventory and forecast demonstrates the need for additional water supplies in Klickitat County. Some data from this forecast is presented below:

- Klickitat County is expected to grow by 21% by the year 2025.
- There are 34 water right applications within the Columbia River Management Zone in Klickitat County. The Management Zone is within 1-mile of the river. 20 of these applications are for domestic water use.
- The total domestic quantity applied for in the Management Zone is over 17,000 afy.
- The total industrial/commercial quantity applied for in the zone is over 13,000 afy.
- Growth is expected to result in the need for an additional 6,000 afy by the year 2025.

The water right exchange is also consistent with local watershed planning goals. Klickitat County is currently developing watershed plans which include a water banking element. The County and KPUD are working together to prevent any overlap in these efforts and will consider which entity would be best suited for administrating a water bank in the future.

As a public utility district, the KPUD hopes to meet its statutory obligations for providing reliable water service. The Cliffs water rights have the potential to resolve some existing and future water right problems in several communities. In addition the KPUD's efforts at preventing relinquishment of the CGAC water right will help to ensure water is available for the CGAC, the CEP, and other industrial developments within the service area. Consequently, this process may have significant economic benefit to the region. The KPUD is working closely with Klickitat County on these issues and has the full support of the County in this regard as documented by a County resolution passed in late 2005 supporting the acquisition of the CGAC water rights.

Proposed Water Right Exchange Procedures:

When a Satellite Service Area water system requests water from the Water Right Exchange, the KPUD will follow some or all of the following procedures; at its discretion:

The KPUD is required by statute and sound fiscal practice to recover its cost of service. Therefore the water right exchange may include a rate structure which governs the lease and or sale of water to all customers within the service area. Fees will be typical volume based monthly rates for customers within the retail service area. For water right exchanges within the SSA, the KPUD may charge either monthly/annual leases for temporary water right mitigation or it may sell the right for permanent water right changes. Water right exchange fees will be determined on a case by case basis.

The KPUD will form an interlocal agreement with the SSA; unless the SSA is a KPUD owned entity. This agreement will include administrative, regulatory, and legal provisions governing the use of water from the Water Right Exchange. The KPUD has already entered into an agreement with the City of White Salmon; see Chapter 2 for a description of this agreement.

Any request for water from the exchange will be limited by three water right quantities; the instantaneous rate of withdrawal, the annual rate of withdrawal, and the consumptive use. The quantities will be predicated upon the demonstrated need for water as shown in an engineering analysis approved by the KPUD and consistent with local government land use planning.

The SSA must have an approved, current water system plan, if relevant. The SSA must also have an active water use efficiency program. Systems with distribution system leakage exceeding maximum regulated levels will not be eligible for the exchange unless there is an active leak reduction program in place.

For temporary transfers, the SSA must have an action plan in place for acquiring permanent water rights.

Any use of the Cliffs Water Right Exchange water will require Department of Ecology approval. This approval could be acquired several ways; such as a water right change application.

The administrative requirements to be included in the interlocal agreement will, at a minimum, include: water use record keeping, metering provisions, distribution system leakage reporting, and progress reporting (for temporary leases) related to any ongoing projects necessary to acquire a permanent water right.

4.4 - Water Quality

This section presents a description of the water quality history for the ground water system and recommendations for source modification and or improvements based on the water quality analysis. The surface water quality (Columbia River) was not evaluated since it will be used for non-potable demands for the near future. The smelter does treat the surface water to meet manufacturing requirements. Surface water treatment meeting the requirements of the Surface Water Treatment Rule (SWTR) may be part of the long-term water system improvements. This may be necessary if potable demands substantially exceed the capacity of the ground water resource.

4.4.1 Water Quality History

Past water quality testing records were reviewed to determine the Cliffs Water System ground water supply quality. Records indicate that overall water quality is fair. Well No. 3 has a high susceptibility rating due to a shallow casing (23' bgs). Well No. 1 has a low susceptibility rating. Well No. 2 has not been rated or tested as it has not historically been used for potable water supply. A tablet chlorination system is used to disinfect water from Wells 1 and 3.

No water quality testing has been performed since 2004 and none is currently required as the system is classified as Group B at this time. *A summary of past water quality testing is included in the Appendices.* A review of the DOH Sentry database provided the following information.

- All past testing for total coliforms was negative.
- Testing for Inorganic Chemicals (IOCs) was performed four times each for Wells 1 and 3. No primary MCLs were exceeded nor were than any test results which indicate any water quality problems.
- Well No. 1 had an exceedance of the secondary MCL for manganese in July 2000. The measured level was 0.054 mg/l. The MCL is 0.05 mg/l. A review of IOC testing for Well No. 1 indicates that both iron and manganese have increased significantly over time. Iron levels were nearing the MCL in the last IOC test.
- IOC testing of Well No. 1 water indicates that the water is very hard.
- Testing for nitrates was completed for Wells 1 and 3 on numerous occasions. Nitrate levels are very low in Well No. 1 and below the State Reporting Level in Well No. 3.
- Arsenic samples were collected in July 2000 for Wells 1 and 3. Levels in both wells were well below the State Reporting Level.
- VOC testing of Wells 1 and 3 was completed on numerous occasions. In a July 2000 sample from Well 3, methylene chloride, also called dichloromethane, was found at a concentration of 0.90 ug/l. The MCL for this contaminant is 5.0 ug/l. Methylene chloride is used as an industrial solvent and as a paint stripper. It may also be found in some aerosol and pesticide products and is used in the manufacture of photographic film. It is considered a carcinogen. The MCL goal for this contaminant is zero. Levels over the SRL of 0.5 ug/l may result in a requirement for quarterly testing. This chemical is on the primary list of contaminants regulated by the SDWA. This sample was probably due to an operator error. Subsequent sampling did not reveal any more positive detections.
- SOC testing of Wells 1 and 3 was completed on numerous occasions. No analytes were detected in any of the samples.
- Radionuclide testing has not been performed on any of the wells.
- No lead and copper action levels were exceeded in the at-the-tap sample locations for the first and second 6-month sampling periods. About 20 samples were taken in each monitoring period; well more than that required (five). No samples have been collected since 1998. One of the samples for lead did exceed the action level of 0.015 ppm. The sample collected tested at 0.023 ppm.

There is very little anecdotal evidence regarding the quality of the ground water. High levels of iron (about 1 mg/l) and high water temperature were found when Well No. 1 was deepened in the year 2002. There is some speculation that the iron levels in this well have led to biofouling and reduced yield. Because this well has high levels of iron and manganese and is very hard water, the smelter has historically used Well No. 3 for potable water supply and Well No. 1 for supplemental industrial demands.

4.4.2 Water Quality Recommendations

A detailed description of standard SDWA water quality testing requirements is presented in Chapter 7. This section describes planned modifications and improvements to the water system based on the historical analysis of water quality.

Well No. 1 has significant water quality and wellhead protection problems. The water quality suffers from high levels of iron, manganese, and hardness. In addition the water is very warm and the levels of iron and manganese appear to be increasing over time. This may be due to biological growth within the bore hole. Because of these water quality problems and the location of the well (in the middle of an electrical substation yard) the KPUD does not intend to acquire this well.

The KPUD may continue to use this well in the interim prior to developing a new source of supply. The KPUD will investigate the potential for rehabilitating this well prior to using it again. This investigation will include water quality testing, a video inspection, and pump testing. Rehabilitation may prove beneficial if the cause of the reduced yield and water quality problems is biofouling.

Well No. 3 has good quality water. This well has a high susceptibility rating due to the shallow depth of the open interval and its proximity to toxic waste sites. The KPUD will develop a testing plan for this well to verify the presence of the VOC and establish any changes in the concentration over time. Quarterly testing for VOCs may be necessary to comply with DOH requirements. The low levels of iron and manganese indicate that this source may tap a hydraulically independent aquifer from Well No. 1; or simply tap the same aquifer at a much shallower depth. The KPUD will continue to use this well to provide potable water supply to the Cliffs water system until a new source is developed.

Additional water quality testing for Wells 1 and 3 may be required by the State before the wells can be used to supply a Group A water system. This testing, if necessary, will be done when the water system transitions from Group B to Group A.

There are no plans to treat the ground water supply with the exception of disinfection by means of chlorine.

Well No. 2 water quality is largely an unknown. The KPUD will evaluate this well for its potential as a permanent potable water supply source. This evaluation will include a full battery of SDWA testing, hydraulic testing, and an assessment of its susceptibility to contamination. At this time the KPUD does not intend to acquire this well.

There are several resource monitoring wells near the smelter. The KPUD will review testing reports from these wells to identify trends in the water quality contamination over time.

Any new well must be located and constructed in a manner which will minimize the potential for contamination from industrial wastes. A hydrogeologic evaluation will be completed to identify alternatives sites for a new well.

4.5 - Wellhead Protection

4.5.1 Introduction

Congress enacted the Safe Drinking Water Act (SDWA) in 1974 with the goal of providing safe drinking water to all users of public water supplies. The SDWA gave the U.S. Environmental Protection Agency (EPA) the authority to develop a uniform national drinking water program,

and to establish national standards for known or suspected drinking water contaminants. The 1986 SDWA amendments authorized two new provisions for groundwater protection. One of these was the Wellhead Protection (WHP) program. The SDWA allows each state to design its own WHP program in order to maximize program effectiveness at the local level. Each state's WHP activities are designed to protect land areas surrounding public water supply wells in order to prevent groundwater contamination.

The State of Washington requires that all Group A water systems (those serving fifteen or more connections or twenty-five or more people) develop WHP programs, as stated in the Washington Administrative Code (WAC 246-290). The Washington Department of Health (DOH) has established requirements, guidelines and materials to aid water systems in the development of their WHP programs. In order to help systems comply with WHP requirements, Evergreen Rural Water of Washington provides on-site assistance to small water systems. This assistance is provided at no cost to systems through funding provided by the DOH and EPA. This WHP Program is based on a template developed by Evergreen Rural Water. The Klickitat KPUD used the template as a basis for preparing its WHP program for the Cliffs Water System.

4.5.2 Purpose

The purpose of WHP is to provide an organized approach to effectively protect drinking water supplies from contamination. The program seeks to identify and manage potential contaminant sources near public water supply wells in order to prevent future pollution problems. WHP safeguards the health of community residents and avoids negative financial impacts associated with contamination. The costs of contamination typically include the investigation of sites, installing treatment facilities, and/or locating new water sources, to name just a few. In fact, Washington State health officials have identified nearly twenty different direct and indirect costs associated with well contamination. To avoid these costs and ensure a safe, quality water supply, we need to protect groundwater at its source. WHP is a straightforward and cost effective method of accomplishing this goal.

4.5.3 Program Overview

This WHP report includes the following elements:

- The CGAC has previously completed susceptibility assessments for Wells 1 and 3. *Each assessment was submitted to the State with the Plan as a separate attachment.* They are adopted as part of this program by reference and are available for review upon request. A susceptibility assessment for Well No. 2 was not completed as part of this plan since the KPUD does not intend to use this well as a water supply source. *The Assessment will be updated for Well No. 3 (the proposed source of supply) when the water system transitions from a Group B to a Group A water system.*
- Identification of the WHP zones.
- An inventory of potential contaminant sources and land use activities.
- A discussion of the management strategy.
- Contingency and emergency response planning. Note, this planning was included in the overall Emergency Response Plan. Therefore, it is not included in the WHP.
- Supporting information and documentation.

Completion of these elements meets the requirements of Washington State's WHP program.

4.5.4 Susceptibility Assessment

Susceptibility is determined by conditions that affect the movement of groundwater, and thus contaminants, from the land surface into an aquifer. Susceptibility is a qualitative measure of how quickly and how far groundwater must travel to reach a water source (well or spring). Confining units are critical to susceptibility determinations. In general, a confining unit is any earth material that does not readily transmit water. Within bedrock aquifers, the presence of shale usually indicates a zone of confinement. Above the bedrock, glacial material (clay) may also act as a confining unit, depending upon its thickness. When confining layers are present, wells are less susceptible to contamination because they impede the movement of contaminants from the land surface into underlying aquifers. If confining layers are not present above the aquifer, it may be susceptible to contaminants originating at the land surface.

A description of the hydrogeology of each source is included previously in this Chapter. Generally, Wells 1 and 2 have confining layers. For this reason these wells have fairly good protection from surface contaminants. Well 3 has a shallow open interval (23 feet bgs) and is therefore susceptible to contamination. **Table 4-5 – Vulnerability Ratings** summarizes the susceptibility rating of the wells. Susceptibility assessments were completed by the aluminum company for Wells 1 and 3. These assessments are not included in this document, but are available for review upon request.

The KPUD staff and its consultants developed a vulnerability rating for each source; see **Table 4-5 – Vulnerability Ratings**. This rating was based on a qualitative analysis of the potential for contamination due to local land uses and the unique characteristics of each source. Only Well No. 3 was rated as having a "High" vulnerability. This well is located near toxic waste sites and has a shallow open interval with no distinct confining layer. In addition a regulated VOC has been detected in a water test. The CGAC has been classified by the State as a Cleanup Site and is on the Hazardous Site List. Ground water, surface water, and soil contamination from this site has been identified by the DOE. The KPUD's WHP management efforts will be commensurate with the vulnerability rating of each source. Although a source may have a "Low" or "Medium" vulnerability rating the potential for contamination of the source will not be discounted. The KPUD is aware that any isolated event, such as a chemical spill, could pose a threat to any of its sources. Therefore contingency planning for a contamination event will be the same for all sources regardless of the vulnerability rating.

Table 4-5 – Vulnerability Ratings

Water Source	Susceptibility Rating	Vulnerability Rating	Vulnerability Comments
Well 1	Low	Medium	Well 1 has a deep casing prior to an open interval and has confining layers. It is located at a State Cleanup Site.
Well 2	Not yet rated	Medium	Well 2 has a deep casing prior to an open interval and has confining layers. It is located at a State Cleanup Site.
Well 3	High	High	Well 3 has a shallow open interval and is located at a State Cleanup Site. Well 3 has a known VOC hit.

4.5.5 Wellhead Protection Areas

Recharge of aquifers occurs through infiltration of precipitation in areas where the aquifer lies at or near the surface, or where confining units are absent or thin enough to allow groundwater to 'leak' through the confining layer(s) into the aquifer. Ideally, all land areas that contribute recharge to the aquifer would be targeted for WHP. Unfortunately, the identification of precise recharge areas for wells can be a technical and time-consuming process. Further, once identified, they often cover vast areas of land and thus become difficult to manage. These factors combine to make the identification of recharge areas an unrealistic expectation.

Several different methods may be used to determine the WHP areas. The most straightforward method accepted by the State is a calculated fixed radius (CFR). This method is also used within the Susceptibility Assessment, which is used to grant source water monitoring waivers. The CFR serves as a good 'first cut' WHP area delineation because it is easy to apply and inexpensive. Unfortunately, the CFR can over-simplify groundwater flow conditions and may or may not be very accurate depending upon site-specific conditions. Therefore, other more complex delineation methods such as computer modeling and hydrogeologic mapping are encouraged, but not always required for small systems.

Regardless of the method used, the state requires that the WHP areas include the one, five, and ten year time of travel zones for groundwater. 'Time of travel' refers to the amount of time it takes for a particle of groundwater entering the aquifer at the boundary of the WHP zone to reach the well after one, five, or ten years of pumping. The CFRs were evaluated as part of the WHP Program. The CFR utilizes a volumetric flow equation to determine the WHP area radius:

$$\text{Where: } r = \sqrt{Q\,t\ /\ \prod n\,H}$$

r = calculated radius of protection zone (ft)	1 year
	5 year
	10 year
Q = pumping rate of well in cubic ft/year	
t = time of travel (years)	1,5,10
$\prod$ = Pi 3.14	
n = estimated porosity (if unknown = 0.22)	(0.22)
H= Open interval or length of well screen (ft)	Used 10' for all wells

Using the information above, the one, five, and ten year time of travel radiuses were calculated, and the corresponding WHP zones appear on **Figures 4-1** for each system. Once again, it is important to emphasize that the WHP areas demonstrated here are useful planning tools, but do not represent precise groundwater capture zones for the wells. A more accurate WHP area depiction would require more information and resources than are currently available. Further, developing an awareness of the system's contamination potential is a higher priority at this time.

Table 4-6 – Wellhead Protection Area lists the CFRs for each well and the data used in the estimates.

Table 4-6 – Wellhead Protection Area

			CFRs (feet)		
Source Name	**Q (cf/year)[1]**	**Open Interval (ft)**	**1 year TOT**	**5 year TOT**	**10 year TOT**
Well No. 1	1,246,758	10	425	950	1,343
Well No. 2	0	10			
Well No. 3	1,246,758	10	425	950	1,343

4.5.6 Contaminant Inventory

The CGAC smelter is on the DOE list of State Cleanup Sites. It is a hazardous waste site and consequently there is a plethora of information regarding confirmed and suspected contamination. There are many potential sources of contamination within the wellhead protection areas. Rather than attempt to illustrate each source on a map; it was understood that essentially the entire site is a potential source of contamination. Some major potential sources of contamination are shown on the WHP map. The ubiquitous nature of toxic waste and storage sites means that any new source of potable water supply must be located outside of the developed industrial area and upstream from a ground water perspective.

The KPUD conducted an inventory of potential contaminants within the wellhead protection area of each source. This section describes the methods used to conduct the inventory and the results of the inventory. Generally the potential sources of contamination are well understood since there is only one development within the service area; that being the Smelter and it has been thoroughly investigated for potential contamination of the soil, surface water and ground water. The probable recharge zone of the wells is most likely skewed to the north based on the topography of the site. The recharge zone may also extend below the Columbia River. There is no development north, east and west of the Smelter for at least 2 miles. The Army Corp does have facilities nearby to the south at the John Day Dam.

A thorough search of DOE databases was performed in the following sections of Township 3N, Range 17E – Sections 15,16,17,18,19,20,21,29, and 30. These locations are based, in part, on the extent of the 10-year time of travel radius. Discretion was used to limit the search radius in areas where there is little if any existing or historical development. The databases investigated were:

- The well database. A search was performed in areas of interest based on the section, township and range information shown above.
- The DOE Confirmed and Suspected Cleanup Sites (CSCS) database was reviewed to identify the status of the CGAC site.
- The DOE leaking underground storage tank database was filtered for any leaking storage tanks within the 10-year time of travel boundary.

[1] Q is based on the 20-year projected demands on the GW system. For Well No. 2 it was assumed that it will not provide potable water supply. For Wells No. 1 and No. 3 it was assumed that either will provide the potable water demand for the smelter.

- The DOE database of active toxics handlers was also reviewed for any facilities near to the water system.
- And finally, the DOE GIS mapping system was utilized to print out maps of each areas of interest with any potential contaminant sources. Generally, these maps are not all inclusive as they include some of the sites listed in the searched databases but not all of them.

Well Database Search Results:

The most direct pathway of contamination into an aquifer is through surface water seepage along well casings. Poorly sealed wells (both public and private) and wells with deteriorated (rusted and/or cracked) casings can allow surface water to migrate into pristine aquifers below. This is caused by inadequate well construction and pertains to both abandoned wells and wells currently in use. The existence and location of abandoned wells is poorly documented, making this aspect of wellhead protection difficult to address. If any abandoned wells are located, DOE's Eastern Regional Office will be contacted for information regarding proper closure options. Because of the numerous number of active and inactive monitoring wells in the service area, contamination of the aquifer is possible due to deterioration of the casings/seals.

There are a total of 74 wells within the search area. Most of these wells were drilled to monitor ground water for contamination and consequently are shallow. Several are actively monitored by Ecology. The majority are not being monitored. A database of the wells is available for review but is not included in the plan due to its large size. Three of the resource monitoring wells are owned by the Army Corp and are on property next to the Dam. The Army Corp has one or two other wells, one of which is a high capacity deep well for domestic supply. All of the Army Corp wells are in sections 28 and 29. There are only two domestic wells within the search area which are not related to the CGAC or the Army Corp. These are shallow wells in Sections 15 and 16. The resource monitoring well data should be used, in part, to govern locating new potable supply wells based on the presence or absence of contamination.

CSCS Data Review:

The DOE Confirmed and Suspected Contaminated Sites List was reviewed to determine the status of the CGAC State Cleanup Site. The smelter site has been ranked and is awaiting remedial action. Ranking was completed in 1990. The site has a rank of three on a scale of 1-5, one being the most severe ranking. Contamination has been confirmed in the soil and groundwater. The soil is contaminated by Polynuclear Aromatic Hydrocarbons (PAH). This is probably pitch. The ground water has been contaminated with spent potliner which has cyanide in it. The surface water is suspected of being contaminated with organic waste and inorganic non-metallic (bath/cryolite) waste. The ranking has resulted in the site being placed on the State's Hazardous Site List. The site cleanup will be governed by the Model Toxics Control Act.

Underground Storage Tank (UST) Database:

Both the UST and Leaking UST databases were reviewed to identify storage tanks which may be potential sources of contamination. In summary there were at one time three tanks; all of which have been removed. There is no record of any leaking tanks.

Active Toxic Handlers:

This data was reviewed to identify the classification of the CGAC smelter and to determine if there are any other potential sources of toxic chemicals in the area. Only the CGAC is in the State

database of toxic handlers. CGAC is ranked as a Tier 2 handler and is regulated by the DOE hazardous waste program. This classification is based on the use of spent potliner (cyanide), propane storage, alumina storage, cryolite storage, asbestos, etc. The smelter is required to report annually to the State and local emergency response providers.

DOE Map Search:

The smelter also has a large earthen dam called the West Storage Impoundment (WSI) which is a sludge pond. This pond is located near the old Art Colony and is regulated by the DOE dam program. The pond is lined and has leaked. It is used to store and dry sludge waste from the processing wet room roof scrubber water and secondary wet scrubbers return water; which is high in fluoride. This waste material is not toxic. The pond was contour covered with a DOE approved liner and clean closed in 2003. There is a spent potliner storage pile next to the closed WSI. This material is a listed waste containing soluble cyanide.

4.5.7 Management Strategy

Management of the Cliffs' WHP area will focus on monitoring, coordination with the CGAC, coordination with Klickitat County, and contingency planning.

4.5.7.1 Sanitary and Wellhead Protection Areas

The KPUD intends to acquire Well No. 3 for use as the municipal water supply well. This well is located to the west of the Smelter in an undeveloped area characterized by some trees and grass lands. There is a roadway and railroad spur nearby. There are no activities within the sanitary control area. The wellhead is secured safely inside a locked building. No improvements to the management of the sanitary control area are recommended.

Because WHPA's typically include diverse land use areas, it is important citizens and businesses be informed that they can have a direct impact on the quality of groundwater. To accomplish this, a public education campaign is typically required to inform WHP Area residents and businesses of the sensitivity of their location above the drinking water supply. In this water system the WHPA does not include diverse land uses. The WHPA encompasses lands owned and utilized entirely by the Smelter. For this reason public education is not relevant to the Wellhead Protection Program.

4.5.7.2 Notifications

The CGAC was provided an explanatory letter in order to heighten awareness and promote responsible management of potential contaminant sources. A copy of this letter is included in the **Appendix**. The KPUD will work with the CGAC on a coordinated effort to monitor ground water contamination and to identify good sites for new wells.

The DOE will be notified of the WHP areas and potential contaminant sources within these areas as part of the overall Water System Plan approval process. DOH will submit a copy of the plan to DOE for review.

A copy of the WHP areas was sent to Klickitat County planning. The planning department has a sensitive areas ordinance which includes a map of critical aquifer recharge areas. A copy of the submittal letter is included in the **Appendix**.

A copy of the WHP program was also sent to the Klickitat County Health Department. The Health Department administrates septic systems and private water supply wells within the County. A copy of the submittal letter is included in the **Appendix**.

A copy of the WHP program was sent to Klickitat County emergency response officials. This notification is intended to inform emergency response officials of the location, and potential threats to, the KPUD's water system supply sources. A copy of the submittal letter is included in the **Appendix**.

4.5.7.3 Contingency Planning

A contingency plan is needed in the event that a contamination event or natural disaster results in the temporary or permanent loss of a supply source. To this end, the system has a measure of protection to ensure consumers have an adequate supply of water. Contingency planning for all types of emergencies is included in the Emergency Response Plan; See Chapter 7. The CGAC has an Emergency Response Plan for potential hazardous waste spills. The KPUD will work with the CGAC to implement this plan and coordinate response efforts.

The KPUD intends to develop a new ground water source of supply at a location with less vulnerability to contamination. Once the new well is completed, Well No. 3 will become a backup emergency source of supply. Drilling records for Well No. 3 indicate that it most likely withdraws water from a shallower more vulnerable aquifer. If this aquifer is contaminated the proposed new production well could be sited and developed in a deeper more productive and less vulnerable aquifer.

4.6 - Source Reliability Analysis

The infrastructure that conveys source water to a water system plays a significant role in the reliability of the water system. Infrastructure reliability is evaluated in Chapter 5. This section focuses on the reliability of the supply sources with respect to water quantity and water quality. This section evaluates the question of whether there is an adequate quantity of good quality water to meet system demands today and in the future. The Cliffs water system is fortunate to have two reliable sources of water; ground water and the Columbia River. The KPUD intends to eventually improve the water system to allow either ground water or surface water supply systems to be interchangeable. This will require significant capacity improvements to the ground water system and treatment of the surface water.

4.6.1 Wells

The estimated capacity of the existing wells is at best a ballpark guess. Pump testing, as described previously, is needed to accurately identify their capacity. In any event, the wells have had historic problems with decreased yield. In addition, the most stable well from a capacity standpoint – Well No. 3, has a high vulnerability to contamination and may already be experiencing very low concentrations of a contaminant. Wells 2 and 3 also have aesthetic water quality problems which may limit their usefulness for potable supply unless the water is treated. Consequently the existing ground water system is not reliable from either a water quality or quantity standpoint. To adequately supply the future demands will require a new well with greater capacity. From a reliability standpoint, the KPUD will develop at least one new well with the capacity to meet predicted potable demands. This new well will become the primary source of potable water supply. It will be designed to meet future demands. Its location will be carefully evaluated to minimize the potential

for water quality contamination. Well No. 3 will probably become a backup well to provide a reliable source of ground water supply should the new well fail. Well Numbers 1 and 2 will not be acquired by the KPUD. These wells will remain under the ownership of the CGAC. If the smelter restarts they will be used as a backup source of industrial water supply and therefore will also increase the overall reliability of the water system.

The reliability of the wells is also affected by the potential for ground water contamination caused by contaminants already present in the ground water or potential contamination from waste sites. The KPUD will actively coordinate its wellhead protection efforts with the CGAC to minimize this potential risk. The new well will be sited at a location which is considered to have a low vulnerability to contamination.

Chapter-5. System Analyses

5.1 - Introduction

This chapter describes and presents analyses of the existing groundwater and surface water facilities. The analyses are based, in part, on regulatory requirements for water system design and level of service as presented in the DOH Water System Design Manual. Evaluation of the surface water system (which is not regulated by the State) is based on standard engineering practice.

Only those facilities which form the skeleton of the water systems were evaluated by the KPUD. Pipelines, pump stations, tanks, and other infrastructure that are not needed to operate the water systems or are located inside the footprint of the smelter were not evaluated. These facilities will remain privately owned and operated. The separation of the infrastructure into public and private components is necessary to create a typical municipal water system. Therefore a key element of this chapter is a segregation analysis of each water system with the goal of identifying those facilities that the KPUD should acquire and those which should remain private. A central element of the improvement plan was identifying measures necessary to separate the municipal and private water systems.

Although this plan provides steps to separate the water systems, each system is intended to work jointly to meet existing and future municipal demands. Consequently all existing and future development is intended to be served by parallel ground water and surface water systems.

A conditional assessment of the existing facilities was not performed as part of this plan. For this reason, many general assumptions were made regarding necessary improvements to proposed public facilities. A facility inspection and testing program was developed to guide the KPUD in the future assessment of facility condition. The facility inspection and testing program is a major part of the proposed improvement plan.

Evaluation of the surface water system is not required by the DOH since it does not provide potable water supply. Nonetheless, the system is briefly evaluated in this Plan to provide the KPUD with a framework for acquisition, operation, and improvements to the system. The surface water system is a primary component of this municipal water system, with the purpose of providing municipal non-potable water and fire flows within the service areas.

5.2 - Capacity Summary

This chapter includes an analysis of the capacity of the surface water (non-potable) and ground water (potable) sources. This capacity is compared to the projected demands to identify source capacity constraints. **Table 5-1 – Source Capacity Summary** compares the capacity of the sources to demands at existing and future levels of service. See Chapter 3 for a detailed description of demands. See Chapter 4 for a detailed description of the water rights.

Table 5-1 – Source Capacity Summary

Level of Service in ERUs	Source Production (gal/year)	ADD (gpd)	MDD (gpm)	PHD (gpm)	Source Capacity (gpd) [2]	Source Capacity (gpm)	Water Right Qi (gpm)	Water Right Qa (gal/year)
Ground Water System								
Current	0	0	0	0	0	9.9*10^5	685	900	4.7*10^8
6-year	*0*	*0*	*0*	*0*	*0*	9.9*10^5	685	900	4.7*10^8
20 year	*1,130*	1.7*10^8	4.8*10^5	495	535	9.9*10^5	685	900	4.7*10^8
Surface Water System								
Current	0	0	0	0	0	1.4*10^7	10,000	15,843	5.1*10^9
6-year	*2,120*	*3.3*10^8*	*892,682*	*1,800*	*NA*	*1.4*10^7*	*10,000*	*15,843*	*5.1*10^9*
20-year	*32,923*	5.1*10^9	1.4*10^7	9,604	9,604	1.4*10^7	10,000	15,843	5.1*10^9

The level of service shown in the above table in terms of ERUs is based on the ERU based ADD demand criterion developed in Chapter 3 and the projected average day demand on the Ground Water system and on the Surface Water system. This calculation simply provides a comparison of the projected demands to residential units. The 6-year level of service and demands on the SW system are based on the proposed quantity of water to be leased to the City of White Salmon (1,000 afy) from the Cliffs Water Right Exchange.

Table 5-2 – Facility Capacity Summary *lists the capacity of the SW and GW facilities in terms of ERUs. This table does not include the physical SW facilities such as the tanks and the pump station. These facilities were not included since they will not directly provide water to the SSA water systems and they also will not provide potable water to the Cliffs water system retail service area. Worksheets showing the calculation of each facilities capacity are available upon request.*

Table 5-2 – Facility Capacity Summary

Facility	*Capacity (ERUs)*
GW Right (Qa)	*3,053*
GW Right (Qi)	*2,052*
GW Well Capacity	*225*
GW Well Pump Capacity	*205*
GW Tank Capacity	*90*
SW Right (Qa)	*33,059*
SW Right (Qi)	*27,094*

[2] The capacity of the ground water system is based on the installed pumping capacity not well capacity. The actual capacity of the surface water pump station may be much higher. Further testing is needed to verify this facilities capacity.

5.3 - Analysis Methodology/Criteria

This section presents the methodology and criteria used to evaluate the existing surface water and groundwater facilities. The criteria described are the water system design standards. Most of the criteria are taken directly from the DOH Water System Design Manual.

5.3.1 Fire Flow Rate & Storage

Fire Flow demand criteria is described in Chapter 3. Fire flow is the amount of water needed to adequately provide fire protection within the service area of a water system. DOH requires that water systems providing fire protection have sufficient hydraulic capacity to provide the minimum fire flow plus the MDD, while maintaining a minimum pressure of 20 psi at all service connections. The required surface water fire flow storage volume is 1,500 gpm at four hours or 360,000 gallons. This is based on the requirements for fighting a fire at the smelter and was provided by KPUD staff. The fire fighting storage volume will be constructed in accordance with WAC 246-290-230, which requires that 20 psi be maintained throughout the distribution system during fireflow demands plus maximum day demands

The surface water system will be used to provide fire flow to all customers within the retail service area. Since the potable (ground water) and surface water/fire protection systems are separated, the ground water system was not evaluated in terms of fire flow capacity. This approach dictates that the surface and ground water systems must be extended for all new development within the retail service area. The required ground water fire flow storage volume is zero.

5.3.2 Supply

Ground Water: The State DOH requires that potable supply systems be sized to provide at least the maximum day demand supply rate. The MDD was determined using industry standard criteria for existing and future industrial development. See Chapter 3. The required rate of supply historically and in 20-years is as follows:

Required Supply Rate at Historical Level of Service (Smelter at 100%) = 27 gpm
Required Supply Rate at 20-year Level of Service = 495 gpm

Surface Water: The Surface Water system must be capable of providing adequate supply for the CGAC, the Future Service Area, and the Satellite Service Areas. See Chapter 3. The required rate of supply historically and in 20-years is as follows:

Required Supply Rate at Historical Level of Service = 20.3 cfs[3]
Required Supply Rate at 20-year Level of Service = 21.4 cfs

5.3.3 Storage

The necessary potable water system storage quantities are based on DOH criteria presented below, and existing and future demands presented in Chapter 3. The necessary surface water system storage quantities are based on an engineering evaluation of industrial, emergency, equalizing, and fire flow demands on the surface water system both today and in 20 years.

[3] Note, this is based on the smelter re-starting at its historical peak level of operation.

For both water systems the storage requirements are a combination of dead, standby, equalizing, operating, and fire fighting needs. The storage available is the amount of storage above an elevation that maintains the required minimum pressure in the water system. Dead storage was assumed to be zero in both water systems.

5.3.3.1 Fireflow Storage

Ground Water System: The required fire flow storage volume in the ground water system is zero. The ground water system is not intended for fighting fires.

Surface Water System: This required volume is independent of growth within the service area, unless there is a significant development needing fire flow in excess of the established criteria. The required volume is 360,000 gallons as described previously.

5.3.3.2 Standby Storage

Standby storage is defined as emergency storage necessary to meet demands in the event of a supply failure.

Ground Water System: For the potable water system, this storage component is sized based on a DOH formula. The formula requires that the storage volume be calculated based on providing the average day demand for two days. When there is more than one source of water, the standby volume can be reduced by an amount equivalent to the sum total of all source capacities less the largest source capacity. This is only true for continuously available sources (those with emergency power).

Surface Water System: Standby storage volume in the surface water system represents that quantity of water necessary to protect industrial operations during a failure of the supply system. The storage system was designed to provide water for critical smelter functions (rectifier cooling and casting pits) if the surface water pump station failed. The required volume of water is 4,000 gpm for 4 hours or a total of 960,000 gallons.

For the surface water system the standby storage and fire flow storage will be nested; that is the smaller of the two components was eliminated.

5.3.3.3 Equalizing Storage

Equalizing storage is defined as the storage required to meet normal peak day demands. When the water demand exceeds the supply rate, equalizing storage is utilized. This storage component is, therefore, dependent on both the peak day demand and the rate of supply. The equalizing storage is sized for normal demands; consequently it must be utilized at elevations which provide adequate normal water system pressures. The minimum pressure that is required by WAC 246-290-230 during normal demands is 30 psi. Therefore, the equalizing storage was analyzed based on maintaining 30 psi throughout the distribution system during peak hour demands. There is no diurnal demand data available, therefore the DOH formula for calculating the equalizing storage is used in lieu of a mass balance for both the ground and surface water systems.

Ground Water System: The equalizing storage was calculated using the DOH formula ((PHD – Supply Capacity) * 150). The peak hour demand for the smelter was estimated using the demand criteria described in Chapter 3. A PHD/MDD ratio of 2.5 was used. The PHD was used in the

formula for determining equalizing storage from the potable demands of the Smelter. The MDD was used in this formula for determining the equalizing storage from the potable demands of future development. The MDD was not peaked as the demand criteria for future development is conservative.

Surface Water System: The surface water storage system is sized to provide water to the Smelter and the Cliffs Energy Project. Demands from these facilities are described in Chapter 3 and are assumed to be constant around the clock. Therefore the ADD was used to identify equalizing storage needs. The formula for calculating the equalizing storage volume is ((ADD – Supply Capacity) *1440). Since the ADD by definition occurs over a 24 hour period, the required volume is based on 24 hours or 1,440 minutes.

5.3.3.4 Dead Storage

The required dead storage is that volume of water necessary to provide minimum pressures within the distribution system or, for pumped storage, the volume of water necessary to provide the minimum suction head for a booster pump. It is assumed that the dead storage necessary in existing and future reservoir improvements is zero since the improvements will be at an elevation which provides adequate pressure when the reservoir is completely drawn down.

5.3.3.5 Operating Storage

The operating storage is simply that volume of water necessary to adequately control the supply pumps. The volume varies in each of the water system reservoirs, but generally is adequate to provide pump protection.

5.3.4 Transmission & Distribution

In general, transmission and distribution pipe sizing will be based on the peak estimated demands and maintaining flow velocities between 3 and 8 feet per second (fps). The low flow velocity is for maintaining adequate flushing and the higher velocity is for avoiding excessive head loss and transient conditions (water hammers).

Ground Water System: In accordance with DOH requirements, all ground water system distribution mains will be 6 inches in diameter or greater, unless otherwise justified by hydraulic analysis.

Modifications to the ground water distribution system will be designed to meet the estimated flow demands and shown on plans accompanied by written specifications describing the materials to be used, installation procedures, and testing procedures. The materials, installation, and testing shall be consistent with that commonly used for water distribution systems and shall conform to all local, state, and federal requirements for public water systems. The size and location of distribution improvements necessary to provide service to new development will be project specific.

The demands used to evaluate the ground water transmission and distribution pipelines are based on the peak estimated potable water demands for the Smelter at full capacity. There are no existing ground water distribution and transmission mains which would be affected by new development. New development in the ground water system will necessitate new transmission and distribution facilities. Therefore the impacts of future demands from new development on the ground water

transmission and distribution systems were not evaluated. An analysis was performed using the following ground water system demand parameters.

Ground Water Parameters:

PHD	=	68 gpm (Smelter at full occupancy)
PHD	=	500 gpm (Fully developed retail service area)
Fire Flow	=	NA gpm
Pumping Capacity	=	500 gpm (future well)

Surface Water System: The surface water system has ample existing transmission and distribution capacity for existing and future development. Some new pipelines will be needed to circumvent the smelter. Design of these pipelines will be done in accordance with standard engineering practice. These pipelines will be sized using the following surface water system demand parameters:

Surface Water Parameters:

ADD	=	10,000 gpm (supply line capacity)
MDD	=	10,600 gpm (smelter + CEP)
PHD	=	NA
Fire Flow	=	1,500 gpm
Emergency Flow	=	4,000 gpm

5.4 - Surface Water (SW) System Analyses

This section of the plan presents a description of the existing surface water system, the results of the analyses of the surface water system components, and proposed improvements. **Figure 5-1** illustrates the proposed improvements.

5.4.1 SW Improvement History

There is very little historical information with regard to the design and construction of the surface water system. It appears that most of the system was constructed at the time the Smelter was built; around 1970. A 2nd steel storage tank was constructed in 2001. A conditional assessment was not performed as part of this planning process. Some of the surface water facilities are getting old (nearly 40 years) and problems with these facilities should be expected.

5.4.2 SW Supply System

The surface water supply system is comprised of a very large pump station located on a backwater slough created by a railroad rock crib crossing of the Columbia River – John Day Pool. See Figure 2-1. **Picture 5-1 – Columbia River Pump Station** shows a view of the large vertical turbine pumps.

The pump station has six Byron Jackson 600 hp line shaft vertical turbine pumps rated at 3,500 gpm and 520' TDH and connected in parallel. The pump surface elevation is 271 feet. The intake elevation is 243 feet. Water level elevation varies from 257 feet to 268 feet. The pump bowls are set in a 48-inch diameter corrugated perforated iron pipe surrounded by a gravel pad which acts as a course screen for the surface water intake. Each pump appears to be equipped with a surge relief bypass valve, a check valve, and a motorized valve. Anecdotal evidence suggest no more than four

pumps can run at a time. The pumps discharge into twin 24-inch diameter reinforced concrete pipelines.

The electrical and control systems are located in a CMU block building. A flow meter is located on the discharge piping in a below grade vault.

Picture 5-1 – Columbia River Pump Station

5.4.2.1 Condition and Capacity Analysis

The condition of the pump station is very poor. It appears that all but one or two of the pumps are disconnected and that the valves need a complete rebuild. The condition of the pumps and motors is unknown. Because of their age (nearly 40 years) it should be assumed that new pumps/motors will be needed in the near future. The electrical and control room equipment (motor starters, etc.) appears to be in good condition. It appears that a substantial amount of work would be necessary to bring the station up to full capacity.

The hydraulic capacity of this station (in good condition) is estimated to be approximately 10,000 gpm; although currently the actual pumping capacity may be constrained because of limited power service. This estimate is based on the peak historical water use at the Smelter averaged over one year. This is a very approximate estimate and should be considered the minimum capacity. It's quite likely that the peak capacity is higher. The capacity of this facility is adequate for projected demands within the retail service area.

5.4.2.2 Alternatives & Recommendations

The KPUD will conduct meticulous inspection and testing of this facility prior to development of an improvement plan. The proposed inspection and testing should include the following items:

1. Pump/Motor Evaluation: Evaluate motor condition by: measuring the resistance across each of the 3 windings and comparing to manufacturers specs., measuring the full load current across each phase, measuring head and input power to determine efficiency, and any other testing protocols as recommended in the motor manual. Evaluate the pump condition and capacity by testing the rate of flow under normal conditions and comparing to pump curve data and past operating data. Hire a representative of the pump manufacturer to conduct the tests. Review of the maintenance records for each pump will help with the evaluation.
2. Capacity Evaluation: Operate the pump station in all typical pumping configurations (e.g. 2 pumps simultaneously) and measure pumping rate in each configuration. Measure TDH under each pumping scenario.
3. Valve Evaluation: Evaluate the check and butterfly valves for proper operation and condition. Operate each pump and observe valve function. Review maintenance records for each valve. Obtain manufacturers literature for the valves.
4. Electrical and Control System Evaluation: Document the control system logic including all automatic and manual control scenarios. Perform an inventory of the control system equipment and condition including the MCCs. Identify the transformer, MCC, and disconnect ratings. Obtain one-line diagrams and control logic diagrams for the electrical and control systems.

Upon completion of the testing and inspection program the KPUD will develop a detailed Operations and Maintenance Manual for the facility and a programmatic improvement plan.

5.4.3 SW Treatment

The surface water system pumps raw Columbia River water into the system. This water is not treated with the exception of treatment by the Smelter as necessary for some processes. The design of the intake structure and pond results in a fairly constant water quality with low turbidity year round. Since the surface water system will be used for non-potable municipal demands there are no plans to treat this water. Any treatment needed by industry will be accomplished by that industry within their privately owned and operated water system. This water is not suitable for potable consumption without treatment in compliance with the Surface Water Treatment Rule.

5.4.4 SW Storage

The SW system contains two storage reservoirs in the form of steel tanks. **Table 5-3 – SW Storage Tank Data** lists the reservoir/tank data. Figure 2-1 illustrates the location of these tanks which are side by side and hydraulically interconnected. The reservoir site is the highest point within the existing service area, with a ground elevation of approximately 600 feet above sea level. A hard-wired level float switch in the tanks is used to control the SW pump station. There are no level alarms. These reservoirs are hydraulically balanced and serve the entire water system. They provide water to the system via gravity feed and do not contain any dead storage. Tank No. 1 is welded steel and was constructed in 1970. Tank No. 2 is bolted steel and was constructed in 2001.

Table 5-3 – SW Storage Tank Data

Tank Data	Tank 1	Tank 2
Float switch operating range in tank (ft)	10	10
Existing Reservoir Diameter (ft)	52	55
Existing Reservoir Height (ft to O.E.)	36	36
Pump off to O.E. deadband (ft) - Unused storage	2	2
Net Storage Volume (gallons)	540,088	604,203
Total Storage Volume (gallons)	**1,144,291**	

5.4.4.1 Condition and Capacity Analysis

Each tank appears to be in good condition based on a superficial inspection of the exterior of the tanks.

The tanks were built to provide operating storage for the SW pump station. In addition the tanks were intended to provide a backup source of water for the Smelter should the SW pump station fail. The tanks also provide fire flow storage. **Worksheet 5-1 – SW Storage Capacity Evaluation** provides a very approximate analysis of the storage system capacity today and under future operating scenarios. Many assumptions were made in this analysis which should be verified in the future to accurately assess the available capacity of these tanks.

Worksheet 5-1 – SW Storage Capacity Evaluation

Total Supply Capacity			
River Pump Station	10,000	gpm	
Source capacity with primary source out of service	0	gpm	
Fire Flow Requirement	**Rate (gpm)**	**Duration (minutes)**	**Total**
For future development (gallons)	1500	240	360,000
Emergency Storage Requirement			
For Smelter rectifier and casting pits (gallons)	4000	240	960,000

Tank Data	Tank 1	Tank 2	
Float switch operating range in tank (ft)	10	10	
Existing Reservoir Diameter (ft)	52	55	
Existing Reservoir Height (ft to O.E.)	36	36	
Pump off to O.E. deadband (ft) - Unused storage	2	2	**Total**
Net Storage Volume (gallons)	540,088	604,203	1,144,291

					Required Components							
Level of Service Description	**Level of Service**	**ADD (gpm)**	**MDD (gpm)**	**PHD (gpm)**	**Operating Storage (gallons)**	**Equalizing Storage (gallons)**	**Standby Storage (gallons)**	**Fire flow Storage (gallons)**	**Dead Storage (gallons)**	**Total Required Storage (gallons)**	**Existing Storage (gallons)**	**Surplus/Deficit (gallons)**
Smelter at Minimum Capacity (today's situation)	NA	0	0	NA	336,480	-	-	360,000		696,480	1,144,291	447,811
Smelter at Maximum Capacity	NA	9,527	9,527	NA	336,480	-	960,000	360,000		1,296,480	1,144,291	(152,189)
Smelter at Maximum Capacity + Cliffs' Energy Project	NA	10,568	10,568	NA	336,480	817,920	960,000	360,000		2,114,400	1,144,291	(970,109)

5.4.4.2 Alternatives & Recommendations

Tank No. 1 (built in 1970) should be rigorously inspected to determine if corrosion is a problem. It may be necessary to hire tank inspection specialists to investigate the integrity of the tank coatings both inside and out.

The KPUD will conduct meticulous inspection and testing of this facility prior to development of an improvement plan. Upon completion of the testing and inspection program the KPUD will develop a detailed Operations and Maintenance Manual for the facility and a programmatic improvement plan.

No expansion of the storage system capacity is recommended as part of this Plan due to the very tenuous nature of the population and demand projections.

5.4.5 SW Transmission & Distribution

The existing surface water pipelines are shown in plan view on Figure 2-1. Most pipelines were installed in the year 1970 when the Smelter was built. There are twin 24-inch diameter reinforced concrete pipelines which provide transmission conveyance from the SW pump station to the south east corner of the Smelter. At this point the pipelines enter the footprint of the Smelter and become distribution mains. Surface water is conveyed via these pipelines to Tanks No. 1 and No. 2. Both of the pipelines are installed overhead and underground inside the Smelter. The surface water is distributed via approximately three miles of pipeline located primarily within the footprint of the Smelter. There are at least two known ground water/surface water system interties inside or adjacent to the Smelter. Each of these is equipped with isolation and backflow prevention valves. The purpose of these interties is to provide an emergency backup source of water to the Smelter should the surface water system fail.

5.4.5.1 Condition Analysis

There is very little information regarding the condition of the surface water transmission and distribution system pipelines. Only those pipelines outside the footprint of the smelter and necessary to convey water from the SW pump station to the tanks and from the tanks to the first customer were evaluated in this plan. The twin 24-inch diameter reinforced concrete pipe transmission mains were installed in 1970. These two pipelines are operated at high pressure (over 200 psi) and normal velocities (~4 fps). The tanks are fed water from one 18-inch diameter pipeline. Water is discharged from the tanks via two pipelines, one 18-inch and one 14-inch. All of these pipelines were constructed in 1970.

5.4.5.2 Hydraulic Calculations

The surface water distribution and transmission systems outside the footprint of the Smelter are very simple with minimal looping. Since the KPUD will only acquire those pipelines outside of the Smelter footprint, no attempt was made to evaluate the complex distribution system hydraulics within the Smelter itself. A spreadsheet model was used to evaluate the hydraulic conditions of those SW pipelines which may be acquired by the KPUD and to size pipeline improvements necessary to bypass the Smelter. The spreadsheet analysis looked at the existing transmission mains from the SW pump station to the Smelter and at the existing discharge pipelines from the SW tanks to the Smelter. The spreadsheet analysis also included an evaluation of necessary pipe sizes for two

new pipelines; one from the east corner of the Smelter to the tanks circumventing the Smelter and one from the Tanks to new development within the retail service area. **Worksheet 5-2 – Surface Water Pipeline Sizing Analysis** shows the analysis results.

Chart 5-1 illustrates the system head curve for the proposed pipeline from the east corner of the Smelter to the existing tanks plus the existing twin 24-inch pipelines from the SW pump station to the Smelter. This analysis indicates a new single 24-inch pipeline about 4,000 feet in length will be adequate to bypass the Smelter and convey water from the existing transmission system to the tanks. This line would replace the entire 18-inch diameter tank fill pipeline. Note that if the proposed pump rate for the SW pumps exceeds 10,000 gpm a larger pipe size will be needed to prevent excessive velocities.

Chart 5-2 illustrates the system head curve for the two existing pipelines from the tanks to the Smelter. This analysis illustrates that the existing pipelines are adequate for a discharge rate of up to about 9,000 gpm before excessive velocities occur. However, the total discharge rate should be limited to a lower amount if higher pressures are needed for new customers. At a rate of 4,000 gpm the pressure at the Smelter is estimated to be 54 psi. At a rate of 9,000 gpm the pressure at the Smelter is estimated to be 41 psi.

Chart 5-3 illustrates the system head curve for a proposed new 12-inch diameter pipeline necessary to serve new development. The design flow rate for this pipeline is 1,500 gpm as discussed in the planning criteria section. As illustrated on the chart, flows in excess of 2,000 gpm will result in excessive head loss and necessitate a larger pipeline. It is assumed that the peak demands in this pipeline will be fire flows. However; should water be needed for industrial processes; this demand may govern the sizing of the new pipe. The head loss curve shown is based on a 2,000 foot long pipe from the existing tanks to a new development at an elevation of 500 feet. The actual size and length of the pipeline will be dependent on the location of the development and the required water supply.

Worksheet 5-2 – Surface Water Pipeline Sizing Analysis

Pump or Flow Rate (gpm)	Elevation Start	Elevation Finish	Velocity Pipe 1 (fps)	Velocity Pipe 2 (fps)	Velocity Pipe 3 (fps)	Head Loss (ft) Pipe 1	Head Loss (ft) Pipe 2	Head Loss (ft) Pipe 3	System Head Curve (ft)
Transmission Mains (Surface Water Pump Station to Reservoir) - Design Flow = 10,000 gpm									
2000	260	634	0.71	0.71	1.42	0.63	0.63	2.00	377
4000	260	634	1.42	1.42	2.84	2.27	2.27	7.21	386
6000	260	634	2.13	2.13	4.26	4.80	4.80	15.27	399
8000	260	634	2.84	2.84	5.67	8.18	8.18	26.00	416
10000	260	634	3.55	3.55	7.09	12.35	12.35	39.29	438
12000	260	634	4.26	4.26	8.51	17.31	17.31	55.06	464
Distribution Mains (Tanks to Smelter) - Design Flow = 4,000 gpm									
1000	500	634	0.83	0.76	NA	0.42	0.26	NA	133
2000	500	634	1.67	1.51	NA	1.53	0.95	NA	132
3000	500	634	2.50	2.27	NA	3.24	2.02	NA	129
4000	500	634	3.34	3.03	NA	5.52	3.44	NA	125
5000	500	634	4.17	3.78	NA	8.34	5.20	NA	120
6000	500	634	5.00	4.54	NA	11.68	7.28	NA	115
7000	500	634	5.84	5.30	NA	15.54	9.68	NA	109
8000	500	634	6.67	6.05	NA	19.89	12.40	NA	102
9000	500	634	7.50	6.81	NA	24.73	15.42	NA	94
10000	500	634	8.34	7.57	NA	30.05	18.73	NA	85
11000	500	634	9.17	8.32	NA	35.85	22.35	NA	76
12000	500	634	10.01	9.08	NA	42.11	26.25	NA	66
Distribution Mains (Tanks to New Development) - Design Flow = 1,500 gpm									
500	634	500	1.42	NA	NA	2.30	NA	NA	132
1000	634	500	2.84	NA	NA	8.30	NA	NA	126
1500	634	500	4.26	NA	NA	17.57	NA	NA	116
2000	634	500	5.67	NA	NA	29.91	NA	NA	104
2500	634	500	7.09	NA	NA	45.20	NA	NA	89
3000	634	500	8.51	NA	NA	63.33	NA	NA	71

Pipe Length Table		
Pipe Run	**Size (inches)**	**Length (feet)**
Surface Water Pump Station to Smelter	24	4420
Surface Water Pump Station to Smelter	24	4420
Proposed Smelter bypass to Tanks	24	3900
Tanks to Smelter	14	1180
Tanks to Smelter	18	1180
Tanks to New Development	12	2000

Elevation Table	
Facility	**Elevation**
Pump Station	260
Full Tanks	634
Smelter/New Development	500

Friction Table	
Hazen Williams C all pipes	100

Chart 5-1

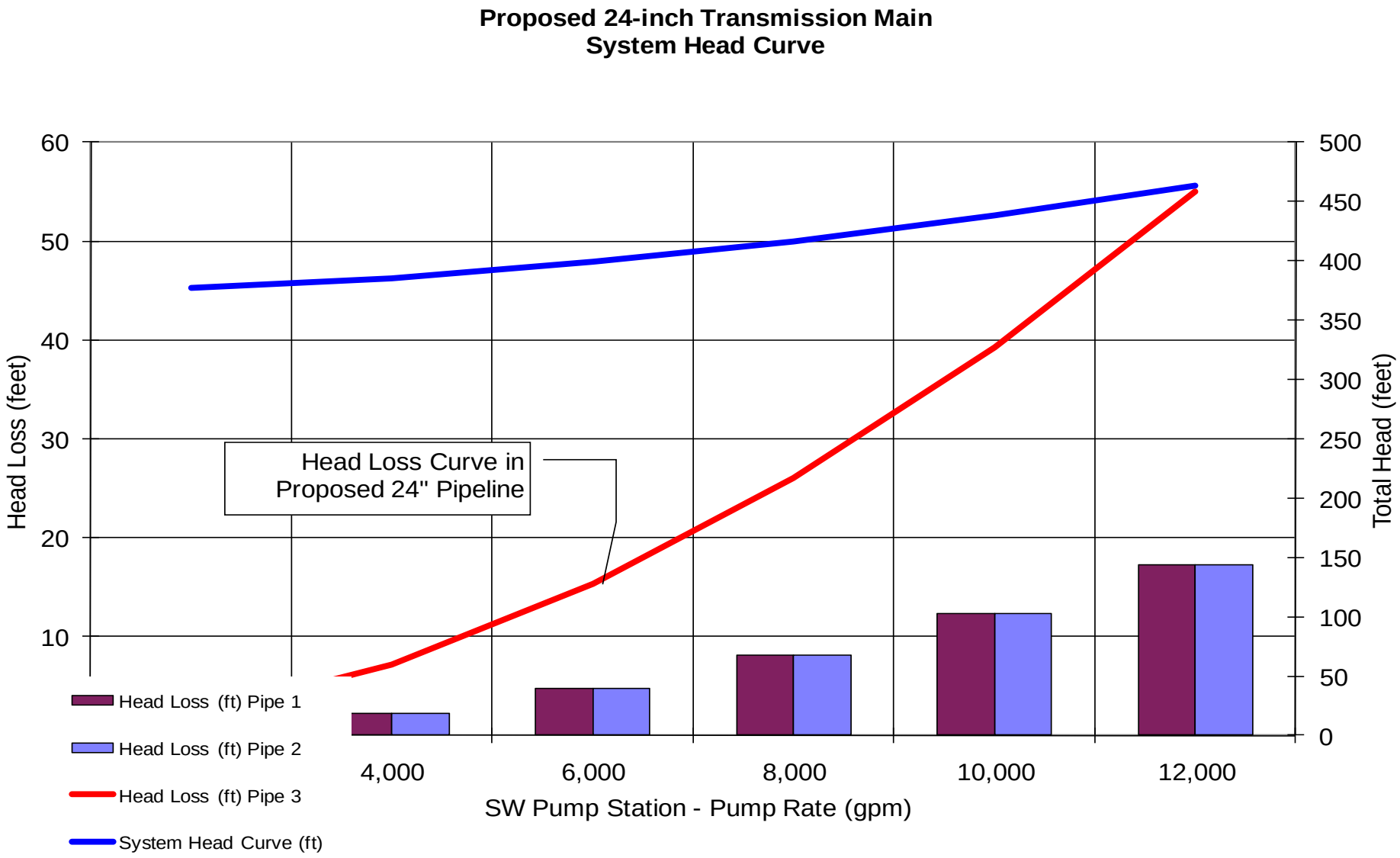

Proposed 24-inch Transmission Main
System Head Curve
Head Loss (feet)
Total Head (feet)
60
50
40
30
20
10
500
450
400
350
300
250
200
150
100
50
0
Head Loss Curve in
Proposed 24" Pipeline
Head Loss (ft) Pipe 1
Head Loss (ft) Pipe 2
Head Loss (ft) Pipe 3
System Head Curve (ft)
4,000
6,000
8,000
10,000
12,000
SW Pump Station - Pump Rate (gpm)

Chart 5-2

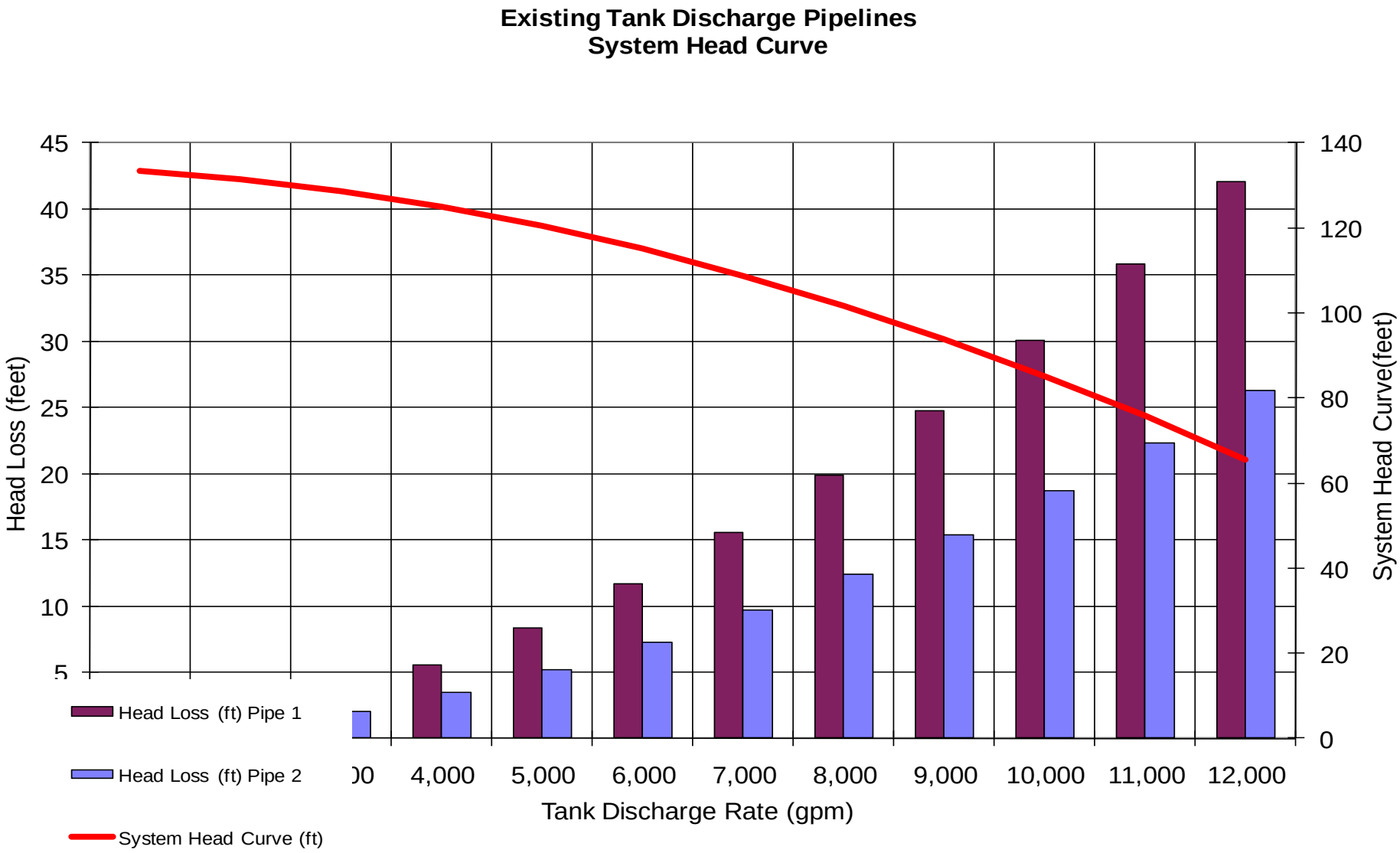
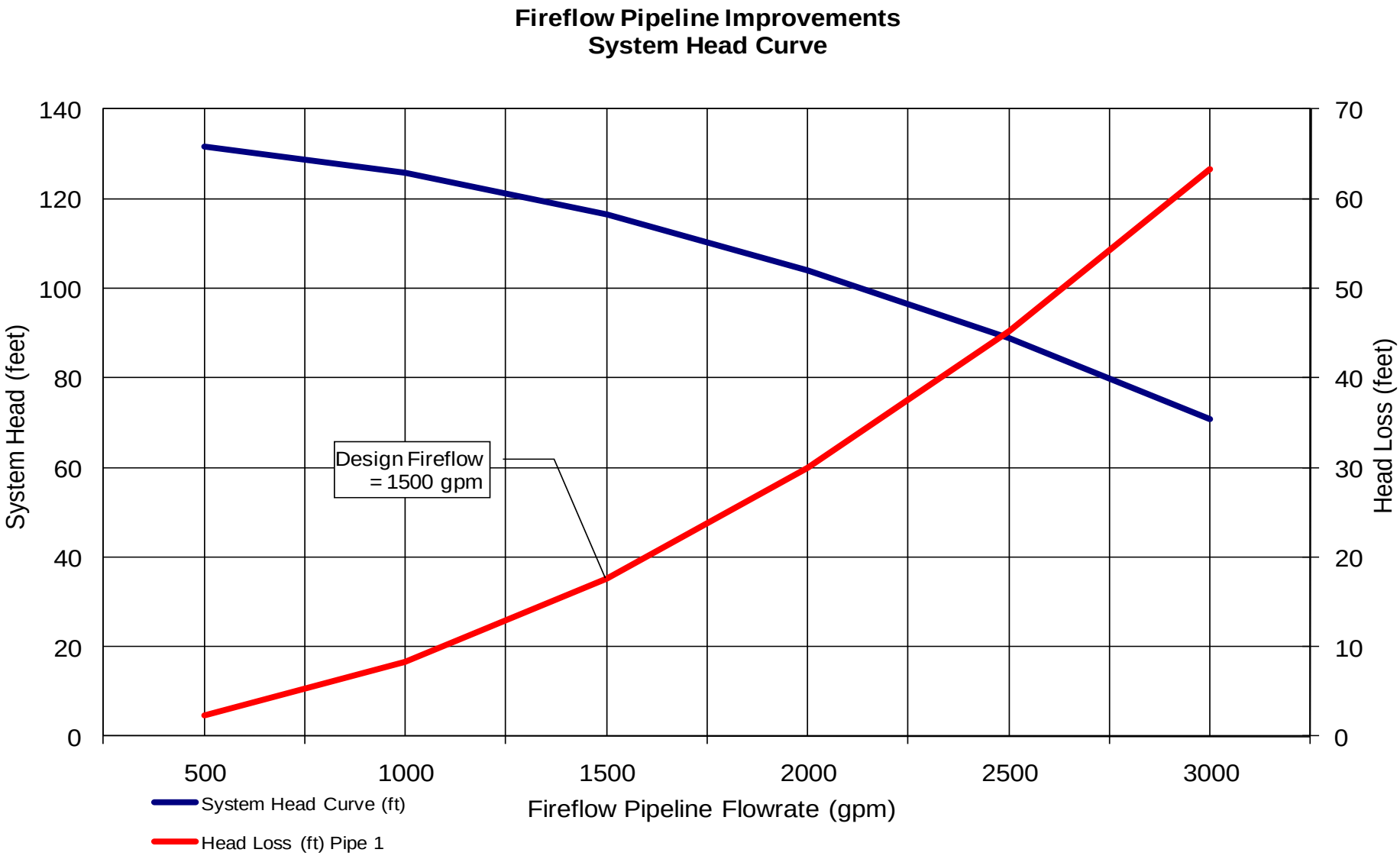

Existing Tank Discharge Pipelines
System Head Curve
Head Loss (feet)
System Head Curve(feet)
45
40
35
30
25
20
15
10
5
140
120
100
80
60
40
20
0
Head Loss (ft) Pipe 1
Head Loss (ft) Pipe 2
System Head Curve (ft)
00
4,000
5,000
6,000
7,000
8,000
9,000
10,000
11,000
12,000
Tank Discharge Rate (gpm)

Chart 5-3


Fireflow Pipeline Improvements
System Head Curve
System Head (feet)
Head Loss (feet)
140
120
100
80
60
40
20
0
70
60
50
40
30
20
10
0
500
1000
1500
2000
2500
3000
Design Fireflow
= 1500 gpm
Fireflow Pipeline Flowrate (gpm)
System Head Curve (ft)
Head Loss (ft) Pipe 1

5.4.5.3 Pressure Zones

Currently there is one pressure zone in the SW system. The transmission main conveys water up about 370 feet in elevation with pressures exceeding 190 psi at the low point. While a single pump station greatly simplifies the hydraulic operation of the SW system it does create unusually high pressures. Any connections to the twin 24-inch pipelines to provide water service at normal pressures (less than 100 psi) will require pressure reducing valves if the connection is made below an elevation of about 450 feet.

Most land within the retail service area which is relatively flat and accessible and therefore easily developable is between elevations 450 feet and 550 feet. Generally these areas can all be served by the existing SW tanks with adequate pressures (>20 psi) during normal demands. The tank zone will be referred to as the 634 Zone; equivalent to the full elevation of the tanks. This zone can provide service down to an elevation of 450 feet before a Pressure Reducing Valve (PRV) will be necessary. At an elevation of 450 feet the pressure will be approximately 80 psi. This is considered the maximum ideal pressure within a typical municipal pressure zone. Lower elevations within the Retail Service Area may need additional PRVs. Generally the pressure zones should be at the following approximate hydraulic elevations:

634 Zone – 600 feet (Tank hydraulic elevation)
519 Zone – 450 feet (80/30 psi boundary)
404 Zone – 335 feet (80/30 psi boundary)
289 Zone – 220 feet (80/30 psi boundary – downstream of John Day Dam)

PRVs should be installed on any pipeline that crosses these elevations.

The tank elevation is adequate to provide service to most of the easily developable land within the retail service area. Nearly all of the industrial zoned lands is below an elevation of 550 feet which is considered the maximum elevation for gravity water service within the SW system. This elevation is based on providing a minimum pressure of 20 psi during fire demands.

5.4.5.4 System Appurtenences

Little is known regarding the type and number of appurtenances installed on the existing SW system. Improvements to the existing and proposed SW transmission system as necessary to ensure a reliable and well designed facility and in addition bypass the Smelter will include several types of appurtenances such as:

- Fire hydrants installed every 1,000 feet near existing and proposed development.
- Air release/air vacuum valves at high points.
- Surge control valves.
- Isolation valves every 1,000 feet and at all tees.
- Commercial type compound and or fire flow meter stations at each customer connection.

5.4.5.5 Transmission and Distribution Alternatives & Recommendatations

Those SW transmission and distribution mains which may be acquired by the KPUD should be rigorously inspected to determine their condition. A video inspection and leak testing program should be developed and implemented.

The KPUD will conduct meticulous inspection and testing of this facility prior to development of an improvement plan. Upon completion of the testing and inspection program the KPUD will develop a detailed Operations and Maintenance Manual for the facility and a programmatic improvement plan.

The following specific improvements will be needed:

1. Facility Inspection & Testing Program.
2. Programmatic Improvement Plan.
3. Transmission Main Bypass (24-inch diameter pipeline).
4. Smelter Isolation Improvements (identified by CGAC).
5. Installation of Pipeline Appurtenances.

The SW distribution system will be extended concurrently and parallel with the GW distribution system as new development occurs. This is necessary as the SW system is intended to provide fire fighting capability and in addition process water for future industrial development. This approach will maximize the considerable existing capacity of the SW system while minimizing the need for ground water system improvements as new development occurs.

5.4.6 Control System

There is very little information regarding the type and character of the existing SW control system. The KPUD will conduct testing and evaluate the existing control system as part of the SW pump station testing program,. Following this work the KPUD will develop an Operations and Maintenance Manual and identify any necessary improvements to the existing control system including the need for telemetry, if any.

5.4.7 Groundwater Backup Supply

It is currently the KPUD's understanding that Well No. 2 is being used to pressurize the SW system. Each of the three groundwater wells can be used to supply water to the SW system via interties with backflow prevention devices. The KPUD does not intend to acquire Wells 1 and 2 for the purposes of supplying the municipal groundwater system. Since the Smelter may at times need groundwater to supply the SW system, it is anticipated that the Smelter will continue to need Wells 1 and 2. Since these wells will remain private they must be disconnected from the municipal groundwater system. The KPUD does not intend to provide backup groundwater supply to CGAC for industrial processes.

5.4.8 Cliffs' Energy Project (CEP) Improvements

The KPUD obtained funding to study the feasibility of using Cliffs water system facilities as a pilot study for the pumped storage facility. EES prepared a Feasibility Study Report for the Cliffs' Pumped Storage Project in July 2007. The report concluded that a pilot pumped storage project is feasible using existing facilities and installation of new equipment. The cost of the project is estimated to be approximately $700,000 and the project could be completed within two years.

5.5 - Ground Water (GW) System Analysis

This section of the plan presents a description of the existing ground water system, the results of the analyses of the ground water system components, and proposed improvements.

5.5.1 GW Improvement History

There is very little historical information with regard to the design and construction of the ground water system. It appears that most of the system was constructed at the time the Smelter was built; around 1970. The elevated steel storage tank was constructed in 1971 and it is 100 feet from the ground surface to the bottom of the tank. A conditional assessment was not performed as part of this planning process. The ground water facilities are getting old (nearly 40 years) and problems with these facilities should be expected particularly with the wells.

The existing GW distribution system (outside of the Smelter foot print) is very limited. Much of the piping is inside the Smelter. The size and material of the existing piping varies throughout the Smelter.

The ground water supply system is comprised of three wells. See Figure 2-1 for locations. **Picture 5-2 – Well No. 1 Building**, **Picture 5-3 – Well No. 2 Building**, and **Picture 5-4 – Well No. 3 Building** show each of the well structures. Well No. 1 pumps directly into the distribution system and into the elevated storage tank. Well No. 3 also pumps directly into the distribution system via a pressure tank and a booster pump station. Well No. 3 water is conveyed to Well No. 1 for chlorination where it then enters the distribution system and/or the elevated storage tank. Well No. 3 is also designed to pump directly to the "old construction office" without the need for pressure boosting. Figure 2-1 provides a rough schematic of the Well No. 1 and Well No. 3 piping system. All three wells are connected to the SW system via backflow prevention devices or in the case of Well No. 2 a removable pipe spool.

In addition to these three wells there is an old well located at the Art Colony. This well is abandoned but may still be connected to the GW distribution system.

Picture 5-2 – Well No. 1 Building

Picture 5-3 – Well No. 2 Building

Picture 5-4 – Well No. 3 Building

5.5.2 GW Supply System

Table 5-4 – Ground Water Source Characteristics/History lists the physical characteristics of each of the three wells. A description of the ground water hydrogeology, water quality, and well capacity is presented in Chapter 4. Well No. 1 has, historically, been the primary source of potable water for the Smelter. Well No. 2 has been used primarily as a backup water supply for the Smelter. Well No. 3 has also been used in the past for potable water supply. Both Wells 1 and 3 can pump water to the elevated tank and are connected to the chlorination system. Well No. 2 water is not chlorinated.

Table 5-4 – Ground Water Source Characteristics/History

Item	Well No. 1	Well No. 2	Well No. 3
Location	NW 1/4 SE 1/4 Sec. 20 T3N R17E	NE 1/4 NW 1/4 Sec. 21 T3N R17E	NW 1/4 SE 1/4 Sec. 20 T3N R17E
Depth (bgs)	Original 1128', 2002 deepened to 1245'? [1]	1000', 2000 video log shows filled in at 951'	504'
Drilling History	1971 Originally drilled. 1992 Re-conditioned. 2002 Deepened	1971	1971
Capacity (original). Current capacity is unknown.	1,000 gpm w/238' dd @ 24 hours [2]	840 gpm w/215' dd @ 24 hours.	100 gpm
Pumping System	76 Hp pump w/2 50 Hp motors driven by 2/50 Hp VFDs.	VFD driven submersible 60 Hp pump.	
Pumping Specs	Berkley 7T-60-350 - 14 Stage. 385 gpm	Berkeley 6T, 14 Stage submersible. 200 gpm @ 550' TDH.	100 gpm
Pump Depth (bgs)		462' - 2000 Install	
Static Water Level - original (bgs)	1971: 238', 1992: 298', 2002: 298'	1971: 270', 2000: 245'	243'
Diameter	12" to 8", 8 begins at 547' bgs	16" to 8"	10" to 8"
Casing	20" (0-30'), 12" (2-500')	20" (0-7'), 12" (3-550')	16" (0-23'), 10" (3-23')
Screening	1971: Perf. 380-480', 1992: Perf. 383-485' [3]	Perf. 490-550'	None
Seal	to 50'	to 32'	to 23'

[1] Well No. 1 was deepened in 2002. No well log available. Notes indicate very warm water was found with high levels of iron. Deepening was attempted to obtain more water as well had biofouled. A hydrogeologic review was done by Kennedy Jenks in 2001 with erroneous conclusions.

[2] From original well log. 880 gpm w/167' of drawdown at 6 hours. Note the current capacity is unknown and very low due to biofouling

[3] Well No. 1 was reconditioned in 1992 possibly due to biofouling. It appears that new 12" casing was installed with larger perforations (0.5" x 2.0"). Well log indicates 8" hole alignment is poor and possibly unstable in some locations.

5.5.2.1 Condition and Capacity Analysis

Each of the three wells was originally drilled in 1971. Substantial efforts have been made to correct a decline in the capacity of Well No. 1 via reconditioning and deepening. No work has been done down the hole on Wells 2 and 3 since they were drilled.

Currently Well No. 3 appears to have the best water quality and to be the most reliable well. There is very little information on Wells 2 and 3. Data collection and testing is imperative to allow evaluation of these sources and to identify preferred ground water well improvements. The capacity of Well No. 1 appears to be very limited with respect to its original capacity. Well No. 2 seems to have adequate capacity but there are some questions about its water quality. Chapter 4 presents results of a water quality analysis for each of these wells.

Well No. 1 production is much lower than when it was drilled. The original capacity was substantial – over 1,000 gpm. The reduced yield may be caused by bio-fouling due to high levels of iron and associated iron bacteria growth. In 1992 a new 12-inch perforated casing was installed with larger perforations to improve the well yield. There are no records regarding the success of this effort. A deepening of the well in 2002 in an attempt to get additional capacity was unsuccessful. No rehabilitation efforts have been attempted. It is possible that this well could be rehabilitated using chemical and/or physical methods. The current capacity is unknown. The KPUD is concerned that this well is vulnerable to water quality contamination due to its location and at this time does not intend to acquire it for use as a potable water source.

Well No. 2 has, historically, been used to provide a backup source of water for the Smelter. This wells location, next to a hazardous waste site, makes it a poor choice as a potable water supply source. This well appears to have significant capacity – over 800 gpm. The KPUD does not intend to acquire this facility.

Well No. 3 has limited capacity – 100 gpm but its location is more favorable as a potable water source than Wells 1 and 2. However, there has been a positive detection of a VOC at very low concentrations. It is currently providing potable water supply to CGAC. The KPUD intends to acquire this well for the purposes of providing potable water supply to the municipal GW system. The estimated historical MDD for the Smelter at full use is 27 gpm. Well No. 3 has adequate capacity to provide for this historical level of service. This well may not have the capacity to provide for growth within the retail service area depending on its characteristics and extent. This well is highly susceptible to contamination due to its location and construction. Therefore a new ground water source is proposed in the future.

Chapter 3 describes the estimated GW system demand at the 20-year level of service – see Table 3-6. The projected MDD is approximately 500 gpm at full development of the service area. A review of existing hydrogeologic data indicates one well could be drilled to provide this projected demand. Therefore this plan includes the construction of a 500 gpm well in the future. The actual design capacity of the well should be based on demand projections based on the type and character of development as it occurs. The well will be carefully located based, in part, on the results of the Wellhead Protection Program, a detailed evaluation of potential sources of contamination, and a hydrogeologic study.

5.5.2.2 Alternatives & Recommendations

The KPUD will conduct meticulous inspection and testing of Well No. 3 prior to development of an improvement plan and acquisition. The proposed inspection and testing should include the following items:

1. Pump Testing: Conduct pump testing to determine specific capacity, estimated pumping rate, and static/pumping water levels. Testing protocol: Measure static water level after 24 hours at rest, pump at sustainable rate using installed pump until pumping water level is stable while measuring water level, measure recovery data until fully recovered. Use valves to throttle pump if necessary to obtain sustainable pump rate. Record pump rate using existing or installed flow meters. Monitor level of nearest adjacent well during the pump test.
2. Water Quality: Conduct water quality testing. Perform full range of SDWA regulated water quality tests.
3. Inspection: Inspect all electrical, control, and mechanical systems to determine condition, operating functionality, and need for improvements. Video inspection would be beneficial. Inspect building and identify need for maintenance, repair, and structural improvements.

Upon completion of the testing and inspection program the KPUD will develop a detailed Operations and Maintenance Manual for the facility and a programmatic improvement plan.

Prior to transition from a Group B to a Group A water system the KPUD will obtain source approval, if necessary, for Well No. 3. The data collected as part of the testing and inspection program outlined above will be useful for obtaining source approval. In addition to this information, the State may require acquisition of restrictive covenants prior to approval. These covenants may already be on file at Office of Drinking Water. All of this information will be submitted to the State in the form of a Project Report.

5.5.3 GW Treatment

The GW system includes a tablet (calcium hypochlorite) chlorinator which provides a chlorine residual in the water system. The chlorinator is located at Well No. 1 and chlorinates water from both Wells No. 1 and No. 3. Water immediately enters the distribution system and the tank after chlorination and therefore the chlorine contact time may not be satisfactory. Since chlorination is not required in this system, contact time is not regulated by the State. However, it is good engineering practice to provide some contact time prior to the first customer. For this reason the KPUD will modify the piping to pump directly to the elevated tank after chlorination. This hydraulic modification will ensure suitable contact time is achieved and help to ensure that the water system can comply with future disinfection rules and regulations.

5.5.4 GW Storage

The GW system contains one storage reservoir in the form of an elevated steel tank. **Picture 5-5 – GW Tank** shows a picture of this tank. **Table 5-5 – GW Storage Tank Data** lists the reservoir/tank data. Figure 2-1 illustrates the location of the tank which is inside an electrical substation yard. The tank is approximately 100 feet above the ground surface. A hard-wired level float switch in the tank is used to control the Well No. 1 and No. 3 pumps. There are no level alarms. The reservoir serves the entire water system. It provides water to the system via gravity feed and does not contain any dead storage. It was constructed in 1971.

Picture 5-5 – GW Tank

Table 5-5 – GW Storage Tank Data

Tank Data	Tank 1
Float switch operating range in tank (ft)	3' (assumed)
Existing Reservoir Diameter (ft)	26'
Existing Reservoir Height (ft to O.E.)	25'
Pump off to O.E. deadband (ft) - Unused storage	2' (assumed)
Elevation above ground surface (ft)	100'
Total Storage Volume (gallons)	~84,000

5.5.4.1 Condition and Capacity Analysis

The tank appears to be in good condition based on a superficial inspection of the exterior. There was no visible rust and the coating appeared to be recent.

Worksheet 5-3 – GW Storage Capacity Evaluation provides a very approximate analysis of the storage system capacity today and under future operating scenarios. Many assumptions were made in this analysis which should be verified in the future to accurately assess the available capacity of

this tank. **Chart 5-4**, **Chart 5-5**, and **Chart 5-6** illustrate the required storage volume under different operating scenarios and at different levels of service.

In summary, the tank has adequate capacity to provide the historical level of service. The storage volume is adequate for some future industrial development including a customer with demands equivalent to historical smelter water use. The most likely scenario is shown in Chart 5-6. In this scenario the Smelter is decommissioned and there is industrial development within the retail service area. In addition it is assumed that a new 500 gpm well is on line and Well No. 3 is available as an emergency backup well. Based on these assumptions, the tank will provide capacity for approximately 200 acres of new development before additional storage is needed. In this scenario a total of nearly 800,000 gallons of storage will be needed at full development. Nearly all of this storage is Standby Storage volume. This volume can be reduced considerably if there is a backup well with greater capacity.

Worksheet 5-3 – GW Storage Capacity Evaluation

Total Supply Capacity			
Well No. 1 Capacity	385	gpm	*To be abandoned, not available for backup supply.*
Well No. 2 Capacity	200	gpm	*For backup supply to the smelter only.*
Well No. 3 Capacity	100	gpm	*Sole source of supply for the potable water system.*
Well No. 4 Capacity (future well)	500	gpm	*Sized to meet the 20-year MDD*
Source capacity with primary source out of service	100	gpm	Well No. 3 will become an emergency backup well

Fire Flow Requirement	Rate (gpm)	Duration (minutes)
Residential	0	0

Tank Data	Tank 1
Float switch operating range in tank (ft)	3
Existing Reservoir Diameter (ft)	26
Existing Reservoir Height (ft to O.E.)	25
Pump off to O.E. deadband (ft) - Unused storage	4
Tank Height (ground to base elevation)	100
Net Storage Volume (gallons)	83,396

					Required Components							
Level of Service Description[1]	Level of Service	ADD (gpm)	MDD (gpm)	PHD (gpm)[2]	Operating Storage (gallons)	Equalizing Storage (gallons)	Standby Storage (gallons)	Fire flow Storage (gallons)	Dead Storage (gallons)	Total Required Storage (gallons)	Existing Storage (gallons)	Surplus/Deficit (gallons)
Potable water for Smelter use only												
Existing level of service (persons) - Smelter Today	12	0.3	0.4	1.1	11,908	-	840			12,748	83,396	70,648
Future level of service (persons)	50	1.2	1.8	4.6	11,908	-	3,500			15,408	83,396	67,988
Future level of service (persons)	100	2.4	3.6	9.1	11,908	-	7,000			18,908	83,396	64,488
Future level of service (persons)	150	3.6	5.5	13.7	11,908	-	10,500			22,408	83,396	60,988
Future level of service (persons)	200	4.9	7.3	18.2	11,908	-	14,000			25,908	83,396	57,488
Future level of service (persons)	250	6.1	9.1	22.8	11,908	-	17,500			29,408	83,396	53,988
Future level of service (persons)	300	7.3	10.9	27.3	11,908	-	21,000			32,908	83,396	50,488
Future level of service (persons)	350	8.5	12.8	31.9	11,908	-	24,500			36,408	83,396	46,988
Future level of service (persons)	400	9.7	14.6	36.5	11,908	-	28,000			39,908	83,396	43,488
Future level of service (persons)	450	10.9	16.4	41.0	11,908	-	31,500			43,408	83,396	39,988
Future level of service (persons)	500	12.2	18.2	45.6	11,908	-	35,000			46,908	83,396	36,488
Future level of service (persons)	550	13.4	20.1	50.1	11,908	-	38,500			50,408	83,396	32,988
Future level of service (persons)	600	14.6	21.9	54.7	11,908	-	42,000			53,908	83,396	29,488
Future level of service (persons)	650	15.8	23.7	59.2	11,908	-	45,500			57,408	83,396	25,988
Future level of service (persons)	700	17.0	25.5	63.8	11,908	-	49,000			60,908	83,396	22,488
Future level of service (persons) - Smelter Max. Capacity	750	18.2	27.3	68.4	11,908	-	52,500			64,408	83,396	18,988

Potable water for Smelter and for newly developed land												
Future level of service - Newly Developed Land (acres)	100	53	79	120	11,908	3,066	8,500			23,474	83,396	59,921
Future level of service - Newly Developed Land (acres)	200	88	132	173	11,908	-	108,500			120,408	83,396	(37,012)
Future level of service - Newly Developed Land (acres)	300	122	184	225	11,908	-	208,500			220,408	83,396	(137,012)
Future level of service - Newly Developed Land (acres)	400	157	236	277	11,908	-	308,500			320,408	83,396	(237,012)
Future level of service - Newly Developed Land (acres)	500	192	288	329	11,908	-	408,500			420,408	83,396	(337,012)
Future level of service - Newly Developed Land (acres)	600	227	340	381	11,908	-	508,500			520,408	83,396	(437,012)
Future level of service - Newly Developed Land (acres)	700	261	392	433	11,908	-	608,500			620,408	83,396	(537,012)
Future level of service - Newly Developed Land (acres)	800	296	444	485	11,908	-	708,500			720,408	83,396	(637,012)
Future level of service - Newly Developed Land (acres) - Max	900	331	496	537	11,908	5,566	808,500			825,974	83,396	(742,579)
Potable water for newly developed land only												
Future level of service - Newly Developed Land (acres)	100	35	52	52	11,908	-	-			11,908	83,396	71,488
Future level of service - Newly Developed Land (acres)	200	69	104	104	11,908	-	56,000			67,908	83,396	15,488
Future level of service - Newly Developed Land (acres)	300	104	156	156	11,908	-	156,000			167,908	83,396	(84,512)
Future level of service - Newly Developed Land (acres)	400	139	208	208	11,908	-	256,000			267,908	83,396	(184,512)
Future level of service - Newly Developed Land (acres)	500	174	260	260	11,908	-	356,000			367,908	83,396	(284,512)
Future level of service - Newly Developed Land (acres)	600	208	313	313	11,908	-	456,000			467,908	83,396	(384,512)
Future level of service - Newly Developed Land (acres)	700	243	365	365	11,908	-	556,000			567,908	83,396	(484,512)
Future level of service - Newly Developed Land (acres)	800	278	417	417	11,908	-	656,000			667,908	83,396	(584,512)
Future level of service - Newly Developed Land (acres) - Max	900	313	469	469	11,908	-	756,000			767,908	83,396	(684,512)

[1] The level of service shown is based on initial growth occurring from today's level of service to full operation of the smelter based on historical occupancy. After that growth is assumed to occur in the undeveloped areas and the demands are based on the acreage of development. See demand criteria tables. Two scenarios are shown (1) the smelter at full capacity plus the new acreage, and (2) new acreage only.

[2] The PHD to MDD peaking factor only applies to the person based demand criteria. It does not apply to the acreage based demand criteria. Actual demands will be determined at the time of development based on the character of the development.

MDD/ADD Peaking Factor	*1.5*	
PHD/MDD Peaking Factor	*2.5*	*Only applies to person based demands*

Chart 5-4

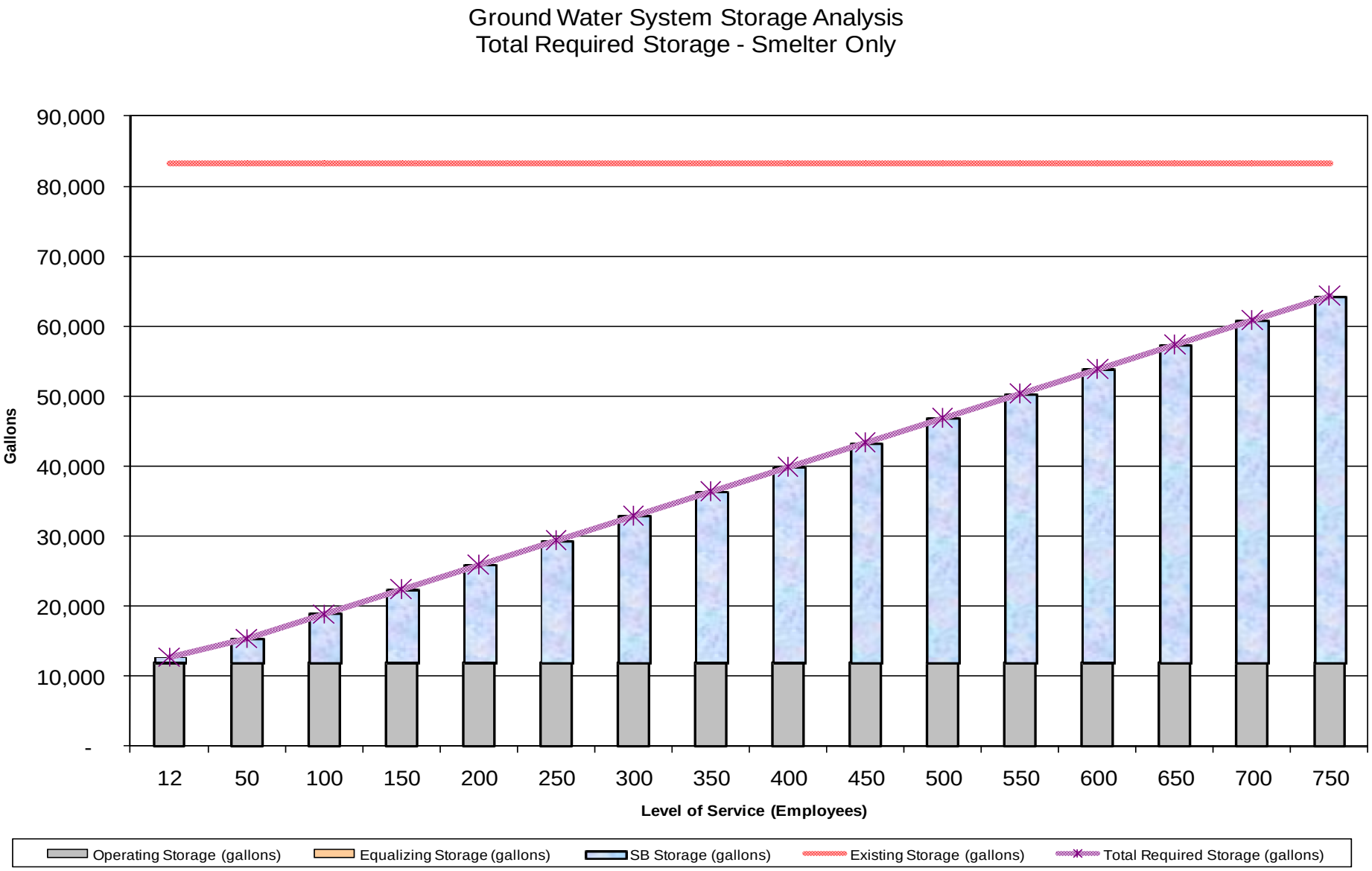

Ground Water System Storage Analysis
Total Required Storage - Smelter Only
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
-
Gallons
12
50
100
150
200
250
300
350
400
450
500
550
600
650
700
750
Level of Service (Employees)
Operating Storage (gallons)
Equalizing Storage (gallons)
SB Storage (gallons)
Existing Storage (gallons)
Total Required Storage (gallons)

Chart 5-5

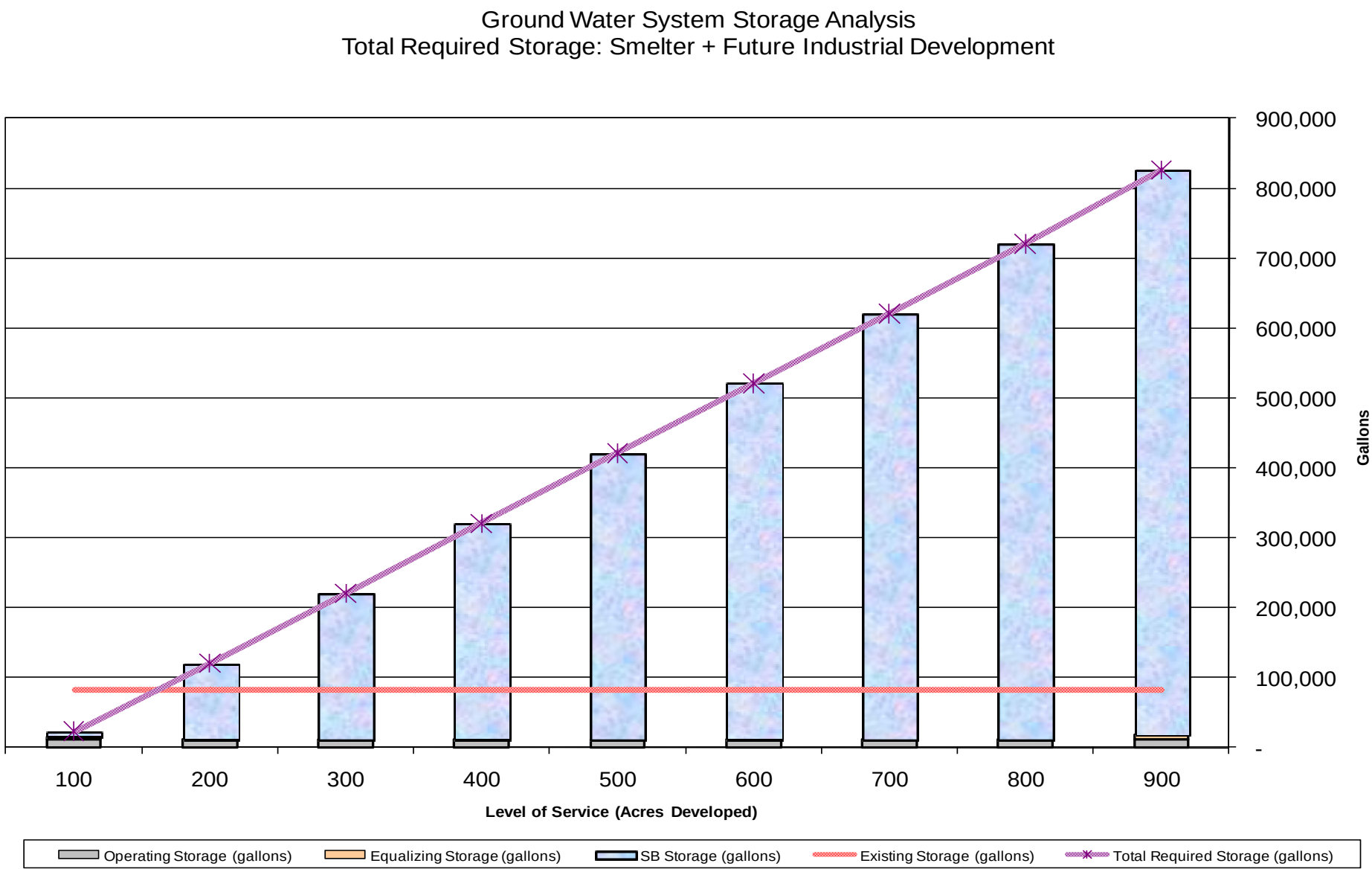
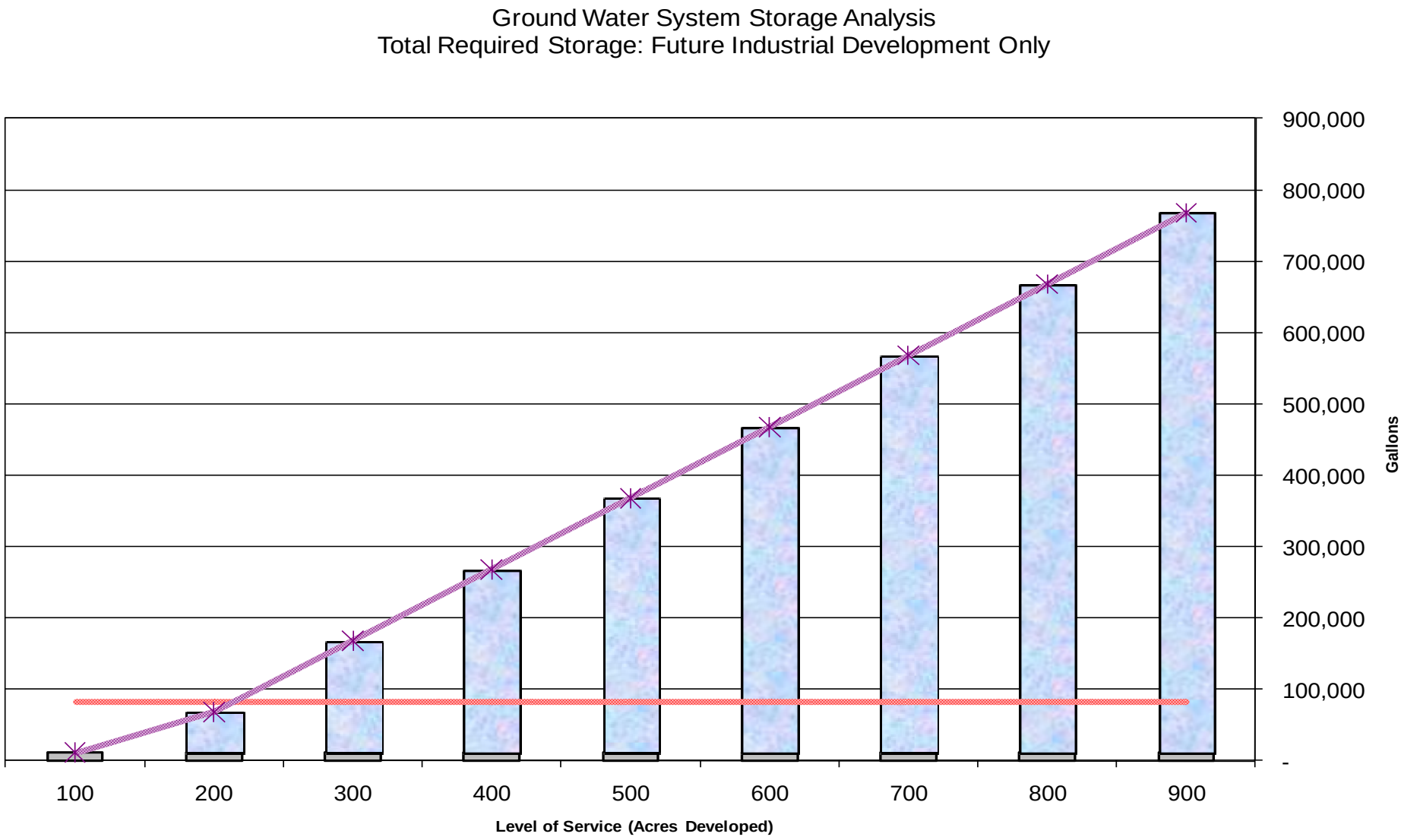

Ground Water System Storage Analysis
Total Required Storage: Smelter + Future Industrial Development
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
-
Gallons
100
200
300
400
500
600
700
800
900
Level of Service (Acres Developed)
Operating Storage (gallons)
Equalizing Storage (gallons)
SB Storage (gallons)
Existing Storage (gallons)
Total Required Storage (gallons)

Chart 5-6


Ground Water System Storage Analysis
Total Required Storage: Future Industrial Development Only
900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
-
Gallons
100
200
300
400
500
600
700
800
900
Level of Service (Acres Developed)
Operating Storage (gallons)
Equalizing Storage (gallons)
SB Storage (gallons)
Existing Storage (gallons)
Total Required Storage (gallons)

5.5.4.2 Alternatives & Recommendations

The GW tank (built in 1971) should be rigorously inspected to determine if corrosion is a problem. It may be necessary to hire tank inspection specialists to investigate the integrity of the tank coatings both inside and out.

The KPUD will conduct meticulous inspection and testing of this facility prior to development of an improvement plan. Upon completion of the testing and inspection program the KPUD will develop a detailed Operations and Maintenance Manual for the facility and a programmatic improvement plan.

The KPUD will build a new GW storage tank if and when development causes storage volume needs to exceed the capacity of the GW tank. The size of a future tank will be dependent on the capacity of the ground water sources and the nature of future development. A sizing analysis will be conducted when the tank is needed. The existing tank will be hydraulically modified to provide adequate chlorine contact time. This will require the construction of a 2nd pipeline to the tank which will be transmission only. This is a low priority improvement and therefore it will be done if and when there is significant development within the service area. If regulations mandate contact time improvements it will be done at that time.

5.5.5 GW Transmission & Distribution

The existing ground water pipelines are shown in plan view on Figure 2-1. Most pipelines were probably installed in the year 1971 when the Smelter was built and the wells were drilled. Most of the GW distribution system is located within the footprint of the smelter.

There are at least two known ground water/surface water system interties inside or adjacent to the Smelter. Each of these is equipped with isolation and backflow prevention valves. The purpose of these interties is to provide an emergency backup source of process water to the smelter should the surface water system fail.

5.5.5.1 Condition Analysis

There is very little information regarding the condition and character of the ground water transmission and distribution system pipelines. Only those pipelines outside the footprint of the smelter and necessary to convey water from Well No. 3 to the tank and from the tank to the first customer were evaluated in this plan.

5.5.5.2 Hydraulic Modifications

Since the KPUD will only acquire those pipelines outside of the Smelter footprint, no attempt was made to evaluate the complex distribution system hydraulics within the Smelter itself. The projected peak hour demand on the GW system at full development is just over 500 gpm. The proposed pump rate for a new 2nd well is 500 gpm. Therefore any new pipelines constructed to convey water from the new well to the tank or from the tank to new development should be at least 6-inches in diameter. Actual pipeline size should be based on projected demands from proposed developments.

Figure 5-2 illustrates an expanded view of the ground water system adjacent to Wells 1 and 3. The figure indicates facilities which should be either disconnected or abandoned. In summary, the following changes to the ground water system are necessary:

1. Disconnect Well No. 1 and Well No. 2 from the potable water system.
2. Relocate the existing tablet chlorinator to Well No. 3 or install a new chlorinator.
3. Install service meters at all customer connections including one for the Smelter, one for the BPA building, and possibly one for the "old construction office". In addition install a source meter at Well No. 3.
4. Abandon the pressure tank and booster pump system at Well No. 3.
5. Install a new submersible pump in Well No. 3.
6. Disconnect the water main to the old Art Colony.
7. Disconnect the interties to the surface water system.
8. Install a new parallel pipeline to the elevated tank and consider the addition of a mixing system in the tank.

5.5.5.3 Pressure Zones

Currently there is one pressure zone in the GW system. Wells 1 and 3 convey water to the elevated tank. The tank overflow elevation is 621 feet. The total pressure head provided by the tank is approximately 125 feet or 54 psi at tank ground surface (elevation 500 feet); approximately the elevation of the smelter.

Most land within the retail service area which is relatively flat and accessible and therefore easily developable is between elevations 450 feet and 550 feet. Most of this area can be served by the existing GW tank with adequate pressure. The tank zone will be referred to as the 621 Zone; equivalent to the overflow elevation of the tank. This zone can provide service down to an elevation of 437 feet before a Pressure Reducing Valve (PRV) will be necessary. At an elevation of 437 feet the pressure will be approximately 80 psi. This is considered the maximum ideal pressure within a typical municipal pressure zone. Lower elevations within the Retail Service Area may need additional PRVs. Generally the pressure zones should be at the following approximate hydraulic elevations:

621 Zone – 596 feet (Tank hydraulic elevation)
506 Zone – 437 feet (80/30 psi boundary)
391 Zone – 322 feet (80/30 psi boundary)
276 Zone – 207 feet (80/30 psi boundary – downstream of John Day Dam)

PRVs should be installed on any pipeline that crosses these elevations.

The tank elevation is adequate to provide service to most of the easily developable land within the retail service area. Nearly all of the industrial zoned lands are below an elevation of 527 feet which is considered the maximum elevation for gravity water service within the GW system. This elevation is based on providing a minimum pressure of 30 psi during normal demands and when the tank is empty. Development above 527 feet in elevation will require either another higher tank or a closed boosted pressure zone.

5.5.5.4 System Appurtenences

Little is known regarding the type and number of appurtenances installed on the existing GW system. Improvements to the existing and proposed GW transmission and distribution system as necessary to ensure a reliable and well designed facility and in addition bypass the smelter will include several types of appurtenances such as:

- Air release/air vacuum valves at high points.
- Surge control valves.
- Isolation valves every 1,000 feet and at all tees.
- Commercial type compound meter stations at each customer connection.
- Note that fire hydrants will be installed on the SW system.

5.5.5.5 Transmission and Distribution Alternatives & Recommendations

Those GW transmission and distribution mains which may be acquired by the KPUD should be rigorously inspected to determine their condition. A leak testing program should be developed and implemented.

The KPUD will conduct meticulous inspection and testing of this facility prior to development of an improvement plan. Upon completion of the testing and inspection program the KPUD will develop a detailed Operations and Maintenance Manual for the facility and a programmatic improvement plan.

The following specific improvements will be needed:

1. Facility Inspection and Testing Program.
2. Programmatic Improvement Plan.
3. Disconnection of Well No. 1 from Well No. 3 and from the tank.
4. Rehabilitation of Well No. 3 (above and below grade).
5. Smelter Isolation Improvements (identified by CGAC).
6. Installation of Pipeline Appurtenances.
7. Replacement of pipelines which are undersized or in poor condition.

5.5.6 Control System

There is very little information regarding the type and character of the existing GW control system. As part of the GW testing program, the KPUD will conduct testing and evaluate the existing control system. Following this work the KPUD will develop an Operations and Maintenance Manual and identify any necessary improvements to the existing control system including the need for telemetry, if any.

5.5.7 SW Backup Supply

The KPUD understands that Well No. 2 is being used to pressurize the SW system. Each of the three groundwater wells can be used to supply water to the SW system via interties with backflow prevention devices. The KPUD does not intend to acquire Wells 1 and 2 for the purposes of supplying the municipal groundwater system. Since CGAC may at times need groundwater to supply the SW system, it is anticipated that CGAC will continue to need Wells 1 and 2. Since these wells will remain private they must be disconnected from the municipal groundwater system. The KPUD does not intend to provide backup groundwater supply for the purposes of industrial operations.

Chapter-6. Capital Improvement Plan (CIP)

6.1 - Overview

This chapter presents the improvements to the water system that are necessary to resolve existing deficiencies and to accommodate growth. The KPUD intends to implement these improvements unless unforeseen circumstances require modification of this plan. No fixed schedule is proposed for implementation of the improvements. However, the priority for each improvement is identified. The schedule is floating (no start date) because the CIP is almost entirely dependent on future development. Most improvements are related to existing deficiencies and thus are not dependent on the number of service connections (level of service). Some improvements are only necessary for growth and are needed by a specific level of service. These improvements will be implemented when this level of service occurs, which may or may not be in the planning period. Improvements dependent on growth levels are not prioritized. The KPUD will monitor growth levels and implement these improvements accordingly.

Each project will require different levels of permitting and approvals. State and County permits and approvals may affect the proposed project site and scope. An analysis of permit and approval requirements for each project was not performed as part of this Plan. The CIP assumes that all projects are feasible as described and at the site shown. If landuse constraints or other permitting barriers prevent implementing the project as planned, the KPUD will revise the Plan and prepare new cost estimates accordingly.

6.2 - Facility Transfer Agreement (FTA)

The term sheet executed between the KPUD and CGAC lists the conditions under which the KPUD will provide water to the CGAC. One condition specifies that the two parties will, at some time in the future, negotiate terms for transfer of the water system facilities. This condition is critical to ensure preservation of the water rights for future use. The KPUD must maintain control over the use of the water to ensure use of the associated rights for municipal purposes. In order for the KPUD to operate a municipal water system and to preserve the water rights it must have ownership and control over key ground water and surface water system facilities; comprised of:

- Reservoirs (tanks)
- Wells
- The Columbia River pump station
- Transmission main piping

The KPUD is not a developer. It cannot subsidize water system improvements with no expectation of revenue to cover its expenses. It follows that required facility improvements such as rehabilitation of the Columbia River pump station must be completed by CGAC or a subsequent developer/customer. For the water system to be transformed into a municipal public water system in conformance with DOH design guidelines and regulations, and to ensure the water rights are used for municipal purposes of use in conformance with Ecology definitions, the following facility acquisition and improvement steps will be followed:

Scenario 1: CGAC Re-development

1. KPUD and CGAC negotiate an interim Operations and Maintenance Agreement.

2. KPUD and CGAC work cooperatively to complete the Facility Inspection and Testing (FIT) program. Funded by KPUD.
3. KPUD develops a programmatic improvement program based on the results of the FIT study which refines the CIP herein. Funded by KPUD.
4. KPUD and CGAC reach consensus on the improvement program.
5. KPUD acquires key supply, transmission, distribution, and storage facilities from CGAC for $1.00 via a negotiated FTA.
6. KPUD implements facility improvements; funding provided by CGAC.
7. KPUD begins operation and maintenance of the acquired facilities.
8. KPUD charges CGAC for water based on a standard cost of service based rate structure.
9. KPUD expands the water systems as necessary to provide service to new customers within the retail service area.
10. KPUD charges future developers for water based on a standard cost of service based rate structure.

Scenario 2: Smelter is decommissioned & not re-developed

1. KPUD acquires key supply, transmission, distribution, and storage facilities from CGAC for $1.00 via a negotiated FTA.
2. KPUD completes the FIT program. Funded by KPUD.
3. KPUD develops a programmatic improvement program based on the results of the FIT study which refines the CIP herein. Funded by KPUD.
4. KPUD performs minimum operation and maintenance of acquired facilities to prevent further degradation.
5. KPUD awaits future potential development.
6. KPUD implements facility improvements; funded by developers.
7. KPUD begins operation and maintenance of the acquired facilities.
8. KPUD expands the water systems as necessary to provide service to new customers with the retail service area.
9. KPUD charges future developers for water based on a standard cost of service based rate structure.

An alternative to Scenario No. 2 would be for the KPUD to develop the water system infrastructure immediately as part of an economic development strategy. The County would participate heavily in this approach as large loans and grants would be required. Then the County/KPUD starts to woo potential businesses to the site; similar to Port property. The Port of Klickitat could be substituted for the County under this approach. In this alternative the KPUD would be taking a significant risk. To be financially viable there must be several sizeable developments. Otherwise the KPUD ends up subsidizing the water system.

6.3 - Cost Estimates

The cost of each improvement is based on the costs of similar projects and quotes from suppliers and contractors. These are planning-level cost estimates for use in annual budgeting and funding acquisition. The costs are not based on a detailed evaluation of each improvements scope and characteristics. The costs identified include the estimated cost of engineering (usually a percentage of the construction cost), the construction cost, equipment purchases, taxes, and a planning contingency. Property acquisition is not built into the cost of any of the improvements. Estimates are based on 2008 dollars and do not consider inflation. As part of project implementation, a

detailed cost estimate will be developed. The costs for normal operations, administration, and maintenance are not included in the CIP. These costs are identified in the Financial Planning Chapter.

Prior to applying for funding for any of the significant projects, the KPUD will refine the cost estimate based on a more rigorous examination of the project's characteristics, inflation, and the latest information available.

The estimated costs for rehabilitation projects such as the Columbia River Pump Station project are ballpark. It is not possible to accurately assess the cost of these projects until the scope of the rehabilitation work is known. The scope will be developed as part of the FIT program.

6.4 - Prioritization/Scheduling

The improvements were prioritized based on the following criteria (ranked in order of most to least important):

1) Public health hazards.
2) Maintaining normal and expected levels of service.
3) Preventing moratoriums on new connections.
4) Regulatory compliance/water rights preservation.
5) Reducing system vulnerability to water supply problems.
6) Compliance with design guidelines/recommendations.
7) Replacing system components due to age-related deficiencies.

The public health criterion was not relevant to any of the proposed projects. Improvements necessary solely for future growth were not prioritized. Growth-related improvements will be implemented at the noted level of service trigger. The overall priority of any improvement was adjusted based on the judgment of KPUD staff and engineering experience.

Since there is one financial, managerial, and operational staff for all the water systems, the ability to implement the improvements is governed by available staff resources. Current staffing levels are maximized based on existing and future available revenue. Therefore, the schedule for implementing future improvements will be based on the existing staff level. Currently, staff has the resources to implement one large water system construction project per year. This resource constraint is a factor in determining the timeframe for completing the improvement schedule. This limitation is due to several factors, most significantly the water system staff are also responsible for managing and operating five wastewater systems.

Projects required prior to acquisition of the GW and SW facilities by the KPUD are the highest priority. Generally, rehabilitation and repair projects must be done subsequent to KPUD acquisition and prior to requests for service. And finally, all growth related improvements will occur last and based on need as determined by requests for service from new developers.

All new water system projects, water right agreements, and distribution system improvements, will require a project report to amend the most current water system plan approved by the DOH.

6.5 - 20-year CIP

Worksheet 6-1 – SW Capital Improvement Program and **Worksheet 6-2 – GW Capital Improvement Program** list the proposed improvements to the surface water and ground water systems respectively. These worksheets also list whether the projects should occur prior to, or after, the execution of the FTA. The Facility Inspection and Testing (FIT) program is a key element of the CIP. Upon completion of the FIT program the KPUD will develop a programmatic improvement program which refines the CIP herein. The FIT program is necessary to accurately assess the condition of the facilities which will be acquired by the KPUD. At this time there is very little information regarding the condition of these facilities and therefore the CIP is a preliminary stab at future improvements. The basis for each improvement is described in Chapter 5. Funding sources for each project are also identified; these are described below:

- KPUD Interfund Loan: The electric utility will loan the water utility funding as necessary to complete small projects such as this Plan, the FIT program, and development of agreements with the owner of the Smelter.
- Columbia Gorge Aluminum Co. (CGAC) or Developer Contributions (DC): The customers (existing and future) will be required to pay for all physical capital improvements necessary to operate the existing SW and GW systems and also necessary for new developments.
- KPUD Electric Utility & Grants: The Cliffs Energy Project will be funded by the KPUD electric utility and loans and/or grants.

As discussed in Chapter 7, it is possible that Washington State economic development grants and/or loans may be a viable source of funding for rehabilitation and expansion projects. Use of these funding sources would necessitate a restructuring of the Cliffs' water system utility in order to be eligible for funding.

Worksheet 6-1 – SW Capital Improvement Program

Item	Project Name	Project Description	Pre-acquisition	Post-acquisition	KPUD Project	CGAC Project	Estimated Cost	Funding Source
Surface Water Projects								
SW-1	Facility Inspection & Testing (FIT)	The FIT program involves a detailed inspection and testing of all facilities to be acquired by the KPUD and development of a programmatic improvement plan.	✓		✓		$ 5,000	KPUD interfund loan
SW-1a	FIT - Columbia River Pump Station	Work includes inspection and testing of the pumps/motors, capacity, valves, and electrical and control systems.	✓		✓		$ 12,000	KPUD interfund loan
SW-1b	FIT - Steel Tanks	Work includes inspection and testing of the two steel tanks.	✓		✓		$ 3,000	KPUD interfund loan
SW-1c	FIT - Transmission	Work includes inspection and testing of the existing transmission piping from the pump station to the NE corner of the smelter.	✓		✓		$ 5,000	KPUD interfund loan
SW-2	Columbia River Pump Station Improvements	The pump station will be rehabilitated based on the results of project SW-1a.		✓		✓	$260,000	CGAC or DC
SW-3	Reservoir No. 1 Improvements	Rehabilitation of Reservoir No. 1.		✓		✓	$206,000	CGAC or DC
SW-4	Transmission Main Improvements	Construction of 4,000 feet of 24-inch diameter pipeline bypass around the Smelter and rehabilitation of the existing transmission main if needed.		✓		✓	$780,000	CGAC or DC
SW-5	Cliffs Energy Project	Installation of a power generator, electrical and control systems, and licensing, permitting, and engineering for a pilot scale pumped storage facility		✓	✓		$700,000	KPUD Electric Utility & Grants
SW-6	Pipeline Appurtenances	Installation of service meters, hydrants, valves, distribution system isolation, and other pipeline appurtenances		✓		✓	$ 100,000	CGAC or DC
SW-7	Distribution System Extensions	Construction of about 2,000 feet of 12-inch diameter pipeline for new development		✓	✓		$ 156,000	DC
						Total	**$**	**2,227,000**

Worksheet 6-2 – GW Capital Improvement Program

Item	Project Name	Project Description	Pre-acquisition	Post-acquisition	KPUD Project	CGAC Project	Estimated Cost	Funding Source
Ground Water Projects								
GW-1	Facility Inspection & Testing (FIT)	The FIT program involves a detailed inspection and testing of all facilities to be acquired by the KPUD.	✓		✓		$ 3,000	KPUD Interfund Loan
GW-1a	FIT - Well No. 3	Work includes inspection and testing of the pumps/motors, pump testing, water quality testing, and mechanical, electrical and control system testing.	✓		✓		$ 9,300	KPUD Interfund Loan
GW-1b	FIT - Elevated Tank	Work includes inspection and testing of the tank.	✓		✓		$ 1,300	KPUD Interfund Loan
GW-1c	FIT - Distribution System	Work includes inspection and testing of the existing groundwater distribution system.	✓		✓		$ 2,000	KPUD Interfund Loan
GW-2	Well No. 3 Improvements	Well No. 3 will be rehabilitated based on the results of project GW-1a.		✓		✓	$ 128,000	CGAC or DC
GW-3	Distribution System Improvements	Modify the distribution system to eliminate connections to Wells No. 1 and 2. Abandon facilities per Figure 5-1. Install water service meters.		✓		✓	$ 12,000	CGAC or DC
GW-4	Elevated Tank Improvements	Install parallel feeder pipe if feasible. Rehabilitate tank based on results of project GW-1b.		✓		✓	$ 132,000	CGAC or DC
GW-5	Distribution System Extensions	Install approximately 2,000 feet of 6-inch pipeline to serve new development.		✓	✓		$ 99,900	DC
GW-6	Reservoir No. 2 Construction	Construct a 2nd Reservoir (500,000 gallons) to serve new development if necessary due to capacity limitations.		✓	✓		$780,000	DC
GW-7	Well No. 4 Construction	Drill a new well to serve new development if necessary due to capacity limitations/water quality concerns.		✓	✓		$569,000	DC
						Total	**$**	**1,736,500**
Both Water Systems								
OMA	Operations & Maintenance Agreement	Develop an integrated O&M agreement with CGAC for operation of the SW and GW facilities if CGAC requires water service and prior to execution of the FTA.	✓		✓	✓	$ 3,000	KPUD Interfund Loan
FTA	Facility Transfer Agreement	Prepare and execute an agreement with CGAC for the transfer of facilities used for the diversion, withdrawal, and conveyance of the surface water and ground water supplies.	✓		✓	✓	$ 3,000	KPUD Interfund Loan

6.6 - Project Descriptions

This section provides a detailed description of each Capital Improvement Project.

6.6.1 SW and GW Improvements

CIP No. OMA – Operations and Maintenance Agreement

Background: The KPUD owns the surface water and ground water rights. If the aluminum company re-develops their employees will operate and maintain the water systems as necessary to meet demands. The KPUD, as owner of the water rights, must have control over the facilities which divert water.

Improvement: The KPUD will negotiate an Operations and Maintenance Agreement with CGAC. The terms of this agreement will include authority for CGAC employees to utilize the KPUD owned water rights. See Chapter 7 for a detailed discussion.

Priority: 1 (overall priority)

Estimated Cost: $3,000

Funding: KPUD interfund loan

Completion: No set date. Must be completed prior to execution of the FTA.

CIP No. FTA – Facilities Transfer Agreement

Background: The KPUD, as owner of the water rights, must acquire ownership of the facilities which divert this water. In addition the KPUD, as a public water purveyor, must acquire ownership of those distribution facilities which convey water to the end user. See detailed discussion earlier in this chapter.

Improvement: The KPUD will negotiate a Facilities Transfer Agreement with CGAC. The terms of this agreement will include transfer of ownership of key water supply, transmission, distribution, and storage facilities.

Priority: 3 (overall priority)

Estimated Cost: $3,000

Funding: KPUD interfund loan

Completion: No set date. To be done after completion of the FIT Program.

6.6.2 Surface Water Improvements

CIP No. SW-1 – Facility Inspection and Testing (FIT) Program

Background: The KPUD does not have a solid understanding of the condition, capacity, operation, and maintenance of the existing Surface Water (SW) facilities to be acquired. Consequently, the scope and cost for repair, rehabilitation, and operation of these facilities is unknown.

Improvement: The FIT program is targeted at those SW facilities which the KPUD intends to acquire as part of the Facility Transfer Agreement (FTA). These facilities include the Columbia River Pump Station, the steel tanks, and the transmission mains. The KPUD will conduct thorough testing and inspection of these facilities and develop a programmatic improvement plan based on the results of this program. Proposed testing and inspection is described in detail in Chapter 5.

SW Priority: 1

Estimated Cost: $25,000 (includes a 30% contingency)

Funding: KPUD interfund loan

Completion: No set date. Must be completed prior to execution of the FTA.

CIP No. SW-2 – Columbia River Pump Station Improvements

Background: A superficial inspection of this facility was performed as part of this planning process. It is clear that rehabilitation is needed prior to re-starting this pump station. Given the stations age and obviously deteriorated condition, significant improvements may be necessary.

Improvement: Project SW-1a will result in a detailed technical report specifying the necessary improvements at this pump station. Until the FIT program is complete, it was assumed the following improvements will be needed at this facility:

- Replace all valves
- Rebuild each pump
- Painting/housekeeping
- Misc. mechanical improvements
- No electrical or control work

SW Priority: 2

Estimated Cost: $260,000 (includes a 50% contingency)

Funding: By CGAC or developer contribution

Completion: No set date.

CIP No. SW-3 – Reservoir No. 1 Rehabilitation

Background: Reservoir No. 1 is a steel tank over 30 years old. It is not known if any rehabilitation has occurred since this tank was constructed. Steel tanks this age typically need to be stripped and re-coated due to corrosion and failure of the tank coating.

Improvement: Project SW-1b will result in a detailed technical report specifying the need for tank rehabilitation. This project cost estimate is based on the assumption that the internal coating has failed and painting of the inside will be necessary. For the purposes of cost estimating it was also presumed that the existing coating is a lead-based paint and that no electrical or control work will be necessary.

SW Priority: 3

Estimated Cost: $206,000 (includes a 30% contingency)

Funding: By CGAC or developer contribution

Completion: No set date.

CIP No. SW-4 – Transmission Main Improvements

Background: A portion of the existing transmission main from the Columbia River Pump Station to the SW tanks goes through the Smelter. In order to directly feed the tanks from the pump station using the proposed KPUD-owned water system, a bypass around the Smelter must be constructed. This will allow the KPUD to provide surface water to the Smelter via metered connections and in addition separate the distribution system from privately owned watermains.

Improvement: A 4,000 foot long 24-inch diameter ductile iron water main will be constructed from the northeast corner of the Smelter to the tanks. The pipeline alignment will be along the north side of the Smelter. For the purposes of cost estimating it was assumed that no improvements to the existing twin 24-inch diameter reinforced concrete transmission main will be necessary. The cost of 24-inch ductile iron pipe material used in this estimate is $77/ft. The maximum design flow is 10,000 gpm.

SW Priority: 4

Estimated Cost: $780,000 (includes a 30% contingency)

Funding: By CGAC or developer contribution

Completion: No set date.

CIP No. SW-5 – Cliffs Energy Project

Background: The KPUD recently completed a wind farm for power generation. The KPUD intends to utilize the capacity in the existing SW system for a pumped storage facility. This use of

the SW system represents completion of the Determined Future Development plan for the power portion of the surface water right.

Improvement: EES consulting engineers completed a Feasibility Study Report for the Cliffs' Pumped Storage Project in July 2007. This report provides a detailed description and cost estimate for the proposed pump storage facility. In summary the existing SW pipelines, tanks, and pump station will be used to store water during times of excess wind energy and low power demands. The stored water will be used to generate power during low wind periods by conveying the stored water through new turbines. This is a pilot scale project to study the benefits of integrating wind and pumped storage energy systems to match demands.

SW Priority: 5

Estimated Cost: $700,000

Funding: KPUD electric utility and loans/grants

Completion: No set date.

CIP No. SW-6 – Pipeline Appurtenances

Background: The existing and proposed transmission mains will need to have fire hydrants and service meters to provide municipal water service to the existing Smelter. In addition the connections to the existing ground water system must be eliminated.

Improvement: This improvement is based on installing six fire hydrants and four large water service meters. In addition work on disconnecting the ground water system will be necessary.

SW Priority: 6

Estimated Cost: $100,000 (includes a 30% contingency)

Funding: By CGAC or developer contribution

Completion: No set date.

CIP No. SW-7 – Distribution System Extensions

Background: Extensions of the SW system may be needed as the retail service area develops. The SW system will be used to provide fire flows for all existing and new development. In addition it may be needed for industrial wet process demands. The extent and size of the extensions will be based on developer needs.

Improvement: This improvement is based on a modest extension of 2,000 feet of 12-inch diameter PVC pipe. The unit price for this extension is $78/ft including contingencies and engineering. The maximum design flow is 1,500 gpm.

SW Priority: NA

Estimated Cost: $156,000 (includes a 30% contingency)

Funding: By developer contribution

Completion: No set date.

6.6.3 Ground Water Improvements

CIP No. GW-1 – Facility Inspection and Testing (FIT) Program

Background: The KPUD does not have a solid understanding of the condition, capacity, operation, and maintenance of the existing Ground Water (GW) facilities to be acquired. Consequently, the scope and cost for repair, rehabilitation, and operation of these facilities is unknown.

Improvement: The FIT program is targeted at those GW facilities which the KPUD intends to acquire as part of the Facility Transfer Agreement (FTA). These facilities include Well No. 3, the elevated steel tank, and limited distribution mains. The KPUD will conduct thorough testing and inspection of these facilities and develop a programmatic improvement plan based on the results of this program. Proposed testing and inspection is described in detail in Chapter 5.

GW Priority: 1

Estimated Cost: $15,600 (includes a 30% contingency)

Funding: KPUD interfund loan

Completion: No set date. Must be completed prior to execution of the FTA.

CIP No. GW-2 – Well No. 3 Improvements

Background: A superficial inspection of this facility was performed as part of this planning process. It is clear that rehabilitation is needed prior to re-starting this well. Given the facilities age, unnecessary complexity, and deteriorated condition, significant improvements may be necessary.

Improvement: Project GW-1a will result in a detailed technical report specifying the necessary improvements at Well No. 3. Until the FIT program is complete, it was assumed the following improvements will be needed at this facility:

- Replace all mechanical equipment
- Replace the pump with a submersible turbine pump
- Eliminate the booster pump and pressure tank
- Painting/housekeeping
- Install a new chlorinator
- Replace electrical and control systems
- It was assumed no work will be necessary down the hole.

GW Priority: 2

Estimated Cost: $128,000 (includes a 30% contingency)

Funding: By CGAC or developer contribution

Completion: No set date.

CIP No. GW-3 – Distribution System Improvements

Background: The existing distribution system includes several connections which must be eliminated to provide a distinct interface between the public and private water systems. As part of this work, new service meters must be installed at customer connections. This will allow the KPUD to provide potable ground water to the Smelter and other customers via metered connections. This project is based on the assumption that no distribution pipeline rehabilitation/replacement is needed. Project GW-1c includes inspection and testing of the existing groundwater system.

Improvement: Connections to Well No. 1, the "tree", and the "Art Colony" will be eliminated. Up to three customer meters will be installed.

GW Priority: 3

Estimated Cost: $12,000 (includes a 50% contingency)

Funding: By CGAC or developer contribution

Completion: No set date.

CIP No. GW-4 – Elevated Tank Improvements

Background: The elevated tank is over 30 years old. It is not known if any rehabilitation has occurred since this tank was constructed. Steel tanks this age typically need to be stripped and re-coated due to corrosion and failure of the tank coating. Well No. 3 pumps directly into the distribution system. Consequently there is very little chlorine contact time. A dedicated feed line to the tank would substantially improve contact time.

Improvement: Project GW-1b will result in a detailed technical report specifying the need for tank rehabilitation. This project cost estimate is based on the assumption that the internal coating has failed and painting of the inside will be necessary. For the purposes of cost estimating it was also presumed that the existing coating is a lead-based paint and that no electrical or control work will be necessary. The cost includes the installation of a feed pipe to the tank for contact time.

GW Priority: 4

Estimated Cost: $132,000 (includes a 50% contingency)

Funding: By CGAC or developer contribution

Completion: No set date.

CIP No. GW-5 – Distribution System Extensions

Background: Extensions of the GW system may be needed as the retail service area develops. The GW system will be used to provide potable water for all existing and new development. The extent and size of the extensions will be based on developer needs.

Improvement: This improvement is based on a modest extension of 2,000 feet of 6-inch diameter PVC pipe. The unit price for this extension is about $50/ft including contingencies and engineering. The maximum design flow is 500 gpm.

GW Priority: NA

Estimated Cost: $99,900 (includes a 30% contingency)

Funding: By developer contribution

Completion: No set date.

CIP No. GW-6 – Reservoir No. 2 Construction

Background: A new tank may be needed in the future if the service area develops. The total volume required is approximately 500,000 gallons. This volume is based on full development of the retail service area and on having two wells with a combined capacity of 600 gpm. The actual required volume will be dependent on source capacity and on the nature of future development.

Improvement: Construct two 250,000 gallon Mount Baker Silos to provide storage as needed for new development. In lieu of constructing one large tank, two or more smaller tanks will be constructed. This approach is based on constructing storage in phases as development occurs so that excess storage volume and associated stagnant water does not become a problem. The new tanks may eventually replace the existing elevated steel tank. Having two or more tanks greatly simplifies maintenance and repair.

GW Priority: NA

Estimated Cost: $624,000 (includes a 30% contingency)

Funding: By developer contribution

Completion: No set date.

CIP No. GW-7 – Well No. 4 Construction

Background: The existing Well No. 3 has limited capacity and is vulnerable to contamination. It is the KPUD's policy to provide at least two sources of supply in every water system to improve reliability.

Improvement: Drill an approximately 800-foot depth 12-inch diameter well with a capacity goal of approximately 500 gpm if needed to provide water for new development. This well will become the primary source of supply and Well No. 3 will become a backup well. A capacity of 500 gpm will be needed if full development of the retail service area occurs. The well will be located based on a hydrogeologic study that takes into account water quality protection and aquifer yield.

GW Priority: NA

Estimated Cost: $569,000 (includes a 30% contingency)

Funding: By developer contribution

Completion: No set date.

Chapter-7. Operation and Maintenance Plan

7.1 - Introduction

This chapter presents the Operations and Maintenance (O&M) plan for the Cliffs' water system. This O&M plan is based on the KPUD approved 2004 Water System Plan. The 2004 O&M Plan was modified herein to reflect the current status of the KPUD's water utility operation and maintenance program. This O&M plan is intended as a guide for operation and maintenance of the Cliffs' water system after it is acquired by the KPUD. It should be noted that the KPUD does not operate or maintain the water system at this time since it does not own it.

Several key elements of the Water System Plan such as the Coliform Monitoring Plan, the Water Quality Monitoring Plan, the Emergency Response Plan, and the Water Shortage Response Plan are included in this Chapter. The KPUD has a Cross Connection Control Plan which is included by reference. The Wellhead Protection Program is incorporated into Chapter 4.

This chapter also presents a proposed temporary integrated O&M program based on KPUD ownership of the CGAC water rights and operation and maintenance by CGAC employees. This approach will only occur if the CGAC requests water service and the KPUD and CGAC execute an operations and maintenance agreement.

7.2 - Water System Structure and Staffing

The KPUD is a public utility which provides electric utility service to all of Klickitat County. Many personnel in the electric utility also occasionally assist with the management, administration, and operation of the water utility. This staffing overlap, while integral to the operation of the water utility, is not a structured permanent element of the water utility. Therefore no attempt was made to provide a detailed description/plan for this staffing overlap herein.

7.2.1 Organizational Structure & Responsibilities

The Board of Commissioners, elected by the customers of the KPUD, directly supervises the KPUD General Manager (GM). The GM directly supervises the Operations Manager who is responsible for oversight of the Water and Wastewater Department. The Water and Wastewater Superintendent is responsible for day-to-day management of eight water and five wastewater systems. The Superintendent's responsibilities related to this water system include:

- Implementation of the policy of the Board of Commissioners.
- Planning, organization, coordination, and control of water system operation.
- Integration of engineering, legal, and accounting services into effective action.
- Management of the water system staff.
- Coordination and outreach to customers.
- Monitoring the financial status of each utility.
- Implementing the CIP, including obtaining necessary funding.

The KPUD accounting department oversees the financial functions of the water utilities, including fiscal record keeping and accounting. The customer service department is responsible for reading water meters and billing the customers on a monthly cycle. The water and wastewater utility has one

administrative staff position responsible for assisting the superintendent with compliance activities and the day-to-day operation of the utilities. The engineering department provides the services of an engineer for improvement design, maintenance and operational troubleshooting as well as mapping services.

The water operations personnel have the following responsibilities:

- Performing emergency maintenance and minor repairs on the water system physical facilities.
- Maintaining operational records.
- Working closely with office personnel in customer relations.
- Collection and analysis of water samples to ensure standards are met.
- Installation of new services.
- Utility locating.
- Installation of minor improvements to facilities as necessary to improve the system operation and to improve the monitoring of the system's performance.
- Implementation of the Preventative Maintenance Program.

The Superintendent oversees the activities of the operators and coordinates these activities with the Operations" Manager. A detailed description of the preventative maintenance program is described later in this chapter.

7.2.2 Staff Certification

The Waterworks Operation Certification Program establishes minimum requirements and standards by which operators in direct responsible charge of public water systems are examined and certified. The KPUD water systems are classified as Group A, requiring certified operators to operate and monitor the water system. Personnel certified as Waterworks Operators by the State of Washington operate and maintain the water systems. Personnel and certification status are listed in **Table 7-1 – Staff Certification**.

Table 7-1 – Staff Certification

Position	Staff	Certification Level
Operations' Manager	Ron Ihrig	
Water and Wastewater Superintendent	Tim Furlong	WDM2
Engineer	Russ Patton P.E.	
Operators	Howard Sinor Tim McMurrin Brandon Walter Greg Watson Rod Kiser	WDM1 WDM2, BTO, CCS WDM2, BTO CCS, BAT WDM1 WDM2, WTPO IT, WDS
Administration	Nancy Mains	
Accounting	Mel Heuberger Anita Thompson	
Customer Service	Nadine Huxley	

Attendance at American Water Works Association (AWWA), Evergreen Rural Water of Washington, and American Public Works Association (APWA) sponsored seminars is encouraged by the District as is course work available through the Washington Environmental Training Resource Center (WETRC). Tuition for job-related seminars and classes is paid for by the District.

7.3 - O&M Program

This section presents a description of the normal operations and maintenance practices, procedures, and resources of the water utility.

7.3.1 Policies and Procedures

Klickitat PUD No. 1 has documents adopted by the Board of Commissioners formally describing the guiding principles for operation of the water system and customer service. Policy Bulletin No. 18, Customer Service Policy for Water Services, was developed to provide a helpful guide for water service customers, building trades, and employees and representatives of the KPUD. The policy scope outlines the procedures to be applied by KPUD staff in providing water service to individual properties served by the KPUD, management of the extension and improvement of the KPUD's water systems, and provide service guidelines to community water systems owned or operated by the KPUD. The policy is revised as needed with the approval of the Board of Commissioners.

7.3.2 Duty to Serve Process

This section describes the policies and processes which govern the KPUD's response to requests for service by new customers. More detailed information regarding new customers and line extensions is included in Policy Bulletin No. 18; see Appendix.

The customer completes a customer information card and a water service application form. The Water Department evaluates the request for service based on the following parameters:

- Is the connection within the Service Area of the water system?
- What is the allowable number of connections as noted on the Washington State Operating Permit?
- How many customers are currently connected?
- Does the Water System Plan hydraulic modeling indicate any problems in this area?
- Does the Water System Plan supply and storage capacity assessment identify any problems?
- Are there any temporary or permanent connection moratoriums?
- What is the available capacity of the Wastewater Treatment Plant, if relevant?

The KPUD does not have a policy governing the time for responding to a service request except that all requests for service are treated on an expedited basis. For granting extensions of time to complete a new water service related project, the KPUD will:

- Require a written request from applicant.
- Review the request.
- Make a recommendation to the KPUD Board of Commissioners.
- Obtain approval by the KPUD Board of Commissioners.
- Notify customer of the decision.

The KPUD has not yet developed formal policies and procedures for operation of the Cliffs water right exchange. The KPUD will consider requests for water rights from water systems within Klickitat County on a case by case basis. The KPUD has no legal obligation to provide this service.

7.3.3 Customer Complaint Response Process

The KPUD has a proactive customer complaint response process. Each complaint is recorded and filed. Staff responds to water quality and other types of complaints with an initial field visit. Following the field visit, corrective action if applicable is taken and a second field visit is performed to determine if any additional action is necessary. Most of the complaints received by the KPUD are related to water quality problems. Typically, the complaints are due to corrosion related taste and odor problems. Consequently, complaints often are the initiative behind the intermittent watermain flushing activities.

7.3.4 Preventative Maintenance Evaluation

Maintenance schedules that meet the objectives of KPUD staff were established for all critical components in each water system. **Table 7-2** through

Table 7-5 present a schedule that will be used as a basis for preventative maintenance. Some items, where noted, are maintenance programs that are currently not being performed. The KPUD will attempt to incorporate these programs into its annual work if staffing resources are available.

The maintenance schedules are based, in part, on the following DOH document:

Preventive Maintenance Program, Guide for Small Public Water Systems Using Ground Water, October 2006.

This is an excellent reference source which also includes a very helpful section on trouble shooting water facility problems.

Table 7-2 – Supply System Maintenance Schedule

Frequency	Preventative Maintenance Activity	Existing or Proposed Program
Weekly	Check security. Record volume delivered. Observe and record pump rate. Record pump motor hours. Fill chlorinator. Record disinfection residual (daily).	Existing
Monthly	Observe and record motor current draw (may require installation of ammeters at each well). Verify alarm operation. Measure and record static and pumping water level; see Chapter 4, Aquifer Performance Monitoring Program.	Proposed
Quarterly	Survey area for potential groundwater contamination threats, such as oil spills, chemical dumping, etc. Test and confirm proper operation of all control system logic.	Proposed
Annually	Perform 24-hour pump test and calculate specific capacity. Perform well rehabilitation if SC is declining.	Proposed
Annually	Operate all valves and bypasses. Perform manufacturer's recommended maintenance on all control valves, air vacs, and other mechanical equipment.	Proposed
As needed	Complete required source water quality testing.	Existing
As needed	Paint structures and piping; maintain electrical and hydraulic controls.	Proposed

Table 7-3 – Distribution System Maintenance Schedule

Frequency	Preventative Maintenance Activity	Existing or Proposed Program
Semi-annual	PRVs. Check operation of each valve; check screens and pressure settings. Perform manufacturer recommended maintenance. Rebuild, as necessary (proposed).	Existing & Proposed
Annual	Isolation Valves. Operate full open/closed; uncover where buried; clean out valve boxes, etc., repair as necessary.	Proposed
Annual	CCC Valves. Follow recommended maintenance program for all cross connection control valves. See CCCP.	Proposed
Annual	AR/AV Valves. Inspect, verify operation, and maintain as needed.	Proposed
Annual	Fire Hydrants. Operate; check drainage; lubricate as necessary; measure pressure and flow; paint as necessary. Coordinate inspection and training with Fire Districts. Replace as needed.	Proposed
Bi-annual	Large Customer Meters. Inspect, calibrate, and repair as needed.	Proposed
Every 7 years.	All Customer Meters. Time and measure volume of flow delivered; dismantle, clean, and inspect all parts, replace worn or defective parts; retest meter for accuracy. Replace as needed.	Proposed
Annual	Pipelines. Flush and disinfect if necessary to prevent biological growth accumulations and associated water quality problems. This activity is based on flushing each water system once per year.	Proposed
NA	Pipelines. Leak repair as needed.	Existing

Table 7-4 – Reservoir Maintenance Schedule

Frequency	Preventative Maintenance Activity	Existing or Proposed Program
Weekly	Inspect and check security. Check for pest intrusion.	Existing
Bi-annual	Drain, inspect and clean. Identify need for rehabilitation work if any. Operate valves, check floats/transducers (semi-annually).	Proposed

Table 7-5 – Treatment System Maintenance Schedule

Frequency	Preventative Maintenance Activity	Existing or Proposed Program
Daily except weekends	Disinfection Systems. Fill solution tank or tablet canister. Adjust feed pump as necessary. Measure and record disinfection residual.	Existing
Annually	Perform manufacturer's recommended maintenance on chlorinators. Calculate disinfection feed rate and compare to design chlorine dose based on chlorine demand estimates.	Annually

A more detailed description of critical O&M activities is described below.

Fire Hydrant Maintenance: Local fire district personnel, with the KPUD's training, will check and maintain fire hydrants annually. This check will include a measurement of hydrant pressure and flow using a hydrant meter. The KPUD is training the local fire district personnel in the use and testing of fire hydrants. The KPUD will store and coordinate use of a hydrant meter by the fire districts. Flow and pressure data will be added to the water utility GIS maps.

Customer Meter Calibration and Maintenance: The KPUD intends to begin checking every customer meter at least once every 7 years for accuracy and defects.

Valve Operation and Maintenance: The KPUD staff intends to begin an annual valve maintenance program which is comprised of: operating each valve fully open and fully closed and checking for valve leaks, repairing defective valves, locating and cleaning out all valve boxes, maintaining backflow valves as recommended by the CCCP, and following manufacturer recommended maintenance guidelines for maintaining pressure reducing valves/control valves and air-release/vacuum valves.

Pipeline Flushing: KPUD staff will flush dead-end and low flow pipelines annually in each water system, if necessary. The frequency of flushing will be based, in part, on water quality problems and complaints. The annual flushing is considered a minimum to prevent bacterial re-growth problems and slime accumulation on pipe walls.

Aquifer Performance Monitoring Program

As discussed in Chapter 4, the KPUD will begin to monitor the source of supply aquifers. This program will require new equipment. Specifically, the KPUD will install a well level transducer in each well. The KPUD has a well level indicator/data logger that can be connected quickly to a level transducer to measure the water level in each well. The transducer may need to be installed in an access tube.

The schedule shown in the above tables was used as a basis for evaluating the necessary staffing to accomplish all of the existing and proposed preventative activities. Water quality sampling activities are discussed in detail later in this Chapter. Staffing resources necessary to perform water quality

testing were estimated and included in the staffing evaluation. The preventative maintenance schedules do not include tasks necessary to perform service requests, construction related activities (such as locates), and unanticipated maintenance. These tasks are not preventative in nature but do require a significant amount of the staffing resources. Therefore an estimate of the time necessary to complete these types of tasks was included in the staffing evaluation. The results are presented in **Table 7-6 – Staffing Evaluation**. Currently the KPUD does not have staff to perform the items noted in **red** text.

In summary, the existing and proposed maintenance activities require about four full-time employees. Currently the utility has the equivalent of two full-time staff dedicated to operation and maintenance of the water utilities. The KPUD does not have the financial resources necessary to hire additional water system operators. Therefore, the proposed maintenance activities will only be performed if and when time is available. This analysis does not include any staffing requirements for general administration, office, and management needs. Meter reading and vehicle and equipment maintenance are not done by the water department.

Table 7-6 – Staffing Evaluation

Operation and Maintenance Item	Frequency days/year	Units number/ day	Time per unit (hours)	Required Crew	Required Man Hours/Year
Sources & Disinfection Systems (13 in all)					
Inspect equipment, record pump run time and water production. Fill and mix hypochlorite solution tank. Security inspection. Record disinfection residual daily.	52	11	2	1	1144
APMP: 24-hour pump test	1	11	8	2	176
Maintain electrical and mechanical equipment (pumps, check valves, isolation valves, meters, etc.)	4	14	4	2	448
Inspect wellhead protection area for potential sources of contamination and security threats	4	14	2	1	112
Inspect, operate, and maintain on-site power (generators, solar power systems, etc.)	12	2	0.5	1	12
Verify alarm operation. Record source water level. Housekeeping: cleaning, site maintenance, etc.	12	14	1	1	168
				Subtotal	2060

Operation and Maintenance Item	Frequency days/year	Units number/ day	Time per unit (hours)	Required Crew	Required Man Hours/Year
Reservoirs					
Inspect and check security. Check for pest intrusion.	52	9	0.5	1	234
Drain, inspect and clean. Identify need for rehabilitation work if any. Operate valves, check floats/transducers.	0.5	9	10	2	90
				Subtotal	324
Treatment Facilities (ni disinfection)					
Pirolusite Treatment: inspect, verify backwash cycle, field test water quality, check pressure drop.	52	2	1	1	104
Pirolusite Treatment: operate valves, inspect and test media, verify hydraulic balance, remove backwash solids.	1	2	4	2	16
				Subtotal	120
Distribution system					
Control Valves: inspection and operation verification.	12	20	0.5	1	120
Control Valves: bi-annual preventative maintenance.	0.5	20	4	2	80
Isolation valves: annually operate.	1	289	0.17	1	48
Isolation valves: repair as needed.	1	5	8	3	120
CCC valves: inspection, maintenance, and testing.	1	22	1	1	22
AR/AV valves: inspection and preventative maintenance.	1	11	2	1	22
Fire Hydrants, standpipes, and blow-offs: coordinate inspection and training with fire districts.	1	6	4	1	24
Fire Hydrants, standpipes, and blow-offs: repair and replace as needed based on notification from FD.	1	3	8	3	72

Operation and Maintenance Item	Frequency days/year	Units number/ day	Time per unit (hours)	Required Crew	Required Man Hours/Year
Customer Meters (large): Inspect, calibrate, and repair/replace once every other year.	0.5	15	2	2	30
Customer Meters (normal): Inspect, calibrate, and repair/replace once every 7 years	0.14	1000	1	1	143
Pipelines: flush dead-end and low flow watermains in water quality problem areas (once per year for each system on the average).	1	8	8	3	192
Pipeline leak repair as needed. Assume one leak repair per month.	12	1	8	2	192
				Subtotal	1065
Water Quality Sampling					
Coliform Sampling (once per month for all systems)	12	8	2	1	192
Tri-annual Sampling (IOCs, VOCs, SOCs, radionuclides, and Lead and Copper.	0.33	14	2	1	9.3
Annual Nitrate Sampling	1	14	2	1	28
				Subtotal	229
Service Requests/Equipment Installation/Unanticipated Maintenance					
Customer service and meter installation.	1	20	8	2	320
Customer water quality complaint field visit (assume once a month on the average for all systems)	12	1	2	1	24
Customer extension request field visit.	1	8	2	1	16
Customer leak report and repair (assume once every two months per system on the average).	6	8	2	1	96
Customer shut offs/turn ons (assume once shutoff or turn-on per system per month)	12	8	0.5	1	48

Operation and Maintenance Item	Frequency days/year	Units number/ day	Time per unit (hours)	Required Crew	Required Man Hours/Year
New hydrant installation (assume one per system per year).	1	5	8	3	120
Watermain installation inspection.	1	2	8	1	16
Watermain locates (assume once a month per system).	12	8	1	1	96
				Subtotal	736

Total Hours/Year All Items	4,534
Total Hours/Year for Current O&M Items	2,835
Available O&M Hours per FTE	1,800
Percent of Drive Time and Office Time per FTE	30%
Available O&M Hours in the field per FTE	1,260
Required Number of FTEs for the Existing O&M Program	2.3
Required Number of FTEs for all O&M Activities	**3.6**

7.3.5 Equipment and Supplies

Equipment available for daily routine operation and maintenance of the water system includes shop tools and other materials. Should other equipment or manpower be required, it is the Districts policy to either lend equipment from the electric utility, rent, or contract with local contractors for those services. Primary equipment includes:

- The KPUD has a portable well level sensor and data logger for monitoring the level of water in wells. This sensor is useful for wells with water levels less than 400 feet below ground surface. It enables staff to easily conduct pump testing while minimizing time at the site.
- The KPUD also has a well tape for manually checking water level in any of its wells.
- A small trackhoe is available and primarily used for small repair and improvement projects.
- A small gas-powered generator is available for portable power needs.
- All staff have shop trucks with a wide variety of on-board tools and equipment necessary for normal operation and maintenance of water systems.
- Hach portable water testing labs are available and used periodically for checking various water quality parameters.
- Utility locating equipment is available for water staff use.

The District maintains an inventory of repair and spare parts. These include:

- Water meters, valves, service line, and service fittings.

- Chlorine for disinfection.
- Bacteriological and chemical analysis kits.
- PVC water pipe of varying sizes and classes.

7.3.6 Safety Procedures

Operator safety programs are comprised of monthly meetings for all KPUD operators (including electric utility staff) and weekly meetings of the water system staff. The monthly meetings generally include a review of current safety issues or accidents and new or revised safety policies. The weekly meetings focus on project specific safety issues such as the need for traffic control or confined space entry requirements.

The KPUD water and wastewater utility conducted a safety study in 1996. This study, developed by a consultant, presented specific procedural and equipment recommendations for normal maintenance tasks. The recommendations in this study have been fully implemented. Primarily the study presented equipment recommendations for confined space entry, trench work, and confined space rescue. In addition, educational materials regarding the use of chlorine (in the form of sodium hypochlorite) were presented to KPUD staff. These materials included warning signs at each facility which utilizes chlorine for disinfection.

7.3.7 System Operation and Control

The KPUD does not have centralized automatic control of the water systems. Each water system operational component, such as pumps and treatment equipment, is controlled by on-site sensors and control relays. Operational setpoints, normal processes, and optional configurations for all facilities are described in Chapter 5. The existing system map illustrates key components in the water system.

7.3.8 Water Use Efficiency (WUE) Plan

The WUE Plan is discussed in detail in Chapter 3. This plan has little impact on the preventative maintenance program. Conservation activities will require additional annual activities by office staff. Generally, office staff will periodically distribute conservation literature in the form of bill stuffers and advertisements in local papers. In addition, office staff will procure and coordinate the distribution of household plumbing retrofit kits. Specifically, in the Cliffs' water system office staff will utilize meter data to evaluate the unaccounted for water use to determine if there is significant water loss warranting further action. At this time the water loss is unknown. In addition office staff who are former Smelter employees, will utilize their knowledge of the Smelter manufacturing process to work with the Smelter in identifying potential conservation measures. Since this water system provides service to industrial customers typical residential type conservation planning is not relevant.

7.3.9 Record Keeping

Currently the KPUD is doing an adequate job of record keeping. The KPUD maintains a notebook for each water system that contains important and recent information such as the water system permit, the latest WQMR, the latest water quality testing results, and other pertinent data. In addition, the KPUD has a substantial filing system for recording information on all water-system related projects. Several additional record keeping processes include:

Water system mapping database
The KPUD maintains and updates an AutoCAD based mapping system. All water system improvements are recorded in the mapping database. Each operator is given a set of maps of the water systems. These maps are used for day-to-day operations and the operators note any discrepancies between mapping data and field data. These discrepancies are utilized to update the AutoCAD database as necessary.

The KPUD will utilize data collected as part of the FIT program to create updated GIS mapping of the surface and ground water systems.

Source Recordkeeping
The KPUD has developed and maintains worksheets for recording source data based on the intervals described in the preventative maintenance schedules. Worksheet data are transferred to electronic format (spreadsheets) no less than once every month. Data which is systematically recorded includes:

- Source meter volume on a weekly, monthly and annual basis.
- Pump rate at startup and at normal drawdown on a weekly basis.
- Well level (static and dynamic) on a monthly basis.
- Pump motor run time and current draw on a weekly basis.
- Water quality testing results.
- Well pump testing results on an annual basis.

7.4 - Water Quality Program

The KPUD's water quality program consists of monitoring for regulated contaminants, response procedures for a water quality problem, a Wellhead Protection Program, a Cross Connection Control Program, and a formal customer complaint record keeping process.

7.4.1 Wellhead Protection Program

The WHPP is included in Chapter 4. Although the WHPP has little impact on the preventative maintenance activities of the water system operators, it does require additional activities by office staff. Generally, office staff will coordinate with Klickitat County, and other relevant agencies, when any proposed development or other land-use activity is within the wellhead protection area of a source of supply. This coordination is a key element of the WHPP and will help to reduce the potential for groundwater contamination.

7.4.2 Coliform Monitoring Program

7.4.2.1 Introduction

The State of Washington requires that all Group A water systems (those serving fifteen or more connections or twenty-five or more people) develop a Coliform Monitoring Plan (CMP), as stated in the Washington Administrative Code (WAC 246-290). The Washington Department of Health (DOH) has established requirements, guidelines and materials to aid water systems in the development of their CMP. This plan was prepared in accordance with these materials. The CMP is subject to review and to revision periodically as characteristics of the system change and as regulations dictate changes. This plan must be kept on file at the KPUD office and made available for review by the DOH as requested.

The objective of the CMP is to provide an organized approach to monitoring microbial water quality in the Cliffs' water system. A description of the water system, sampling information, a sampling map, and plan preparation is presented.

7.4.2.2 System Information

Table 7-7 describes elements of the water system relevant to coliform monitoring plan requirements.

Table 7-7

System Element	Description
Water System Name & ID	Cliffs' Water System – PWS 224608, Klickitat County
Water Source Description	Groundwater: Well No. 3 – S03; Depth 504'; See map for location.
Water Storage Description	Reservoir No. 1; 84,000 gallons.
Water Treatment Description	Tablet chlorinator.
Total Population Served	12 persons at this time
Total Number of Connections	NA
Pressure Zones	One
Population & Number of Connections Served by Each Pressure Zone	12
General Hydraulic Description	Well No. 3 pumps directly into the distribution system while feeding Reservoir No. 1. There is a pressure tank at the wellhead. A booster pump conveys water from the pressure tank to the system.

7.4.2.3 Sampling Information

Routine and repeat sampling sites are described in **Table 7-8**. Locations are based on accessibility, the hydraulic characteristics of the water system, the size of the system and the availability of repeat sample sites. In addition the sampling locations are based on a restart of the Smelter. Because of the small size of the system the KPUD has elected to use one routine sampling site. Since there are currently no "service connections" the KPUD will take repeat samples at accessible locations both upstream and downstream of the Routine sample site. See **Figure 7-1** for sample site locations.

Table 7-8

Routine Samples Required		1 per month	
Number of Routine Sampling Sites		1; See map	
Sample Site Group No. 1	**Sample Type**	**Site ID Number**	**Site Location**
	Routine	R1	Lab
	Repeat	R1-1	Break room
	Repeat	R1-2	Office
	Repeat	R1-3	Cast house

Month Following Unsatisfactory Samples

The following month after a positive coliform sample, the KPUD is required to take five routine samples. The location of these five samples will be selected on a case-by-case basis. The location of this sampling will be dependant on the location of the positive sample and any known factors which may have exacerbated the water quality problem. In all cases the KPUD will collect samples from the source, from hydraulically connected storage, and from previously identified sampling sites.

Table 7-9 summarizes the plan preparation information.

Table 7-9

System Name: Cliffs	Date Plan Completed: August 20th, 2008	Date Plan Modified:
Name of Plan Preparer: John Grim P.E.	Position: Consulting Engineer	Phone Number: (509) 365-5421
State Reviewer:	Date Last Review:	
KPUD Reviewer/Title: Tim Furlong Superintendent Water Utility	Date Last Review:	Phone Number: (509) 773-7639

7.4.3 Disinfection Byproduct (DBP) Monitoring Program

A DBP Monitoring Program was prepared for the Cliffs' water system utilizing the spreadsheet template (DBP monitoringplan.xls) available from the DOH. The monitoring plan is based on the requirements in the Stage 1 DBP Rule which requires monitoring for Total Trihalomethanes (TTHMs) and five Halocetic Acids (HAA5s) in Group A Community water systems using chlorine for disinfection. In addition the Stage 1 rule specifies the Maximum Residual Disinfection Level (MRDL) for chlorine of 4 mg/l. Compliance with the MRDL for chlorine is based upon the running annual average (RAA) of residual measurements taken at the same time and place as routine or repeat coliform samples for 12 consecutive months. The RAA is calculated by finding the average of all included residual measurements for each month, adding 12 consecutive monthly averages together, and dividing the sum by 12. The RAA must be calculated at the end of each calendar quarter.

Since DBPs can continue to form as long as the organic substances and disinfectant are present, the highest concentrations are usually found at the farthest points of the system and therefore monitoring in small groundwater systems is required at the point with the highest residence time.

The DBP Monitoring Program is shown on **Worksheet 7-1**.

Worksheet 7-1

Disinfection Byproducts Monitoring Plan

System Name	Cliffs' Water System	**Type and**	
PWSID#	224608	**Population**	GW only <10,000
Date	8/20/2008	**of System**	
Completed by	John Grim P.E.		

Monitoring requirements are additive; for example a system using ozone and chlorine, or chlorine with conventional filtration must meet the monitoring requirements for both.

Treatment Provided

Chlorine (gas, hypochlorite, etc) or Chloramines

Identify the number of "Treatment Plants" serving your system

A "Treatment Plant" or "TP" may be:
- A single surface water source
- A single well source
- A combination of multiple, individual sources (if all of the water is blended prior to distribution)

1

Enter Description of Treatment Plant Below

TP1	Well No. 3 which will use a tablet chlorinator

Disinfectant Monitoring

Required:

Chlorine residuals must be measured at the same time and place as routine or repeat coliform samples
MRDL for chlorine and chloramines = 4.0 mg/l as Cl2

Compliance

Compliance is based on the running annual average (RAA) of 12 consecutive months
DOH will determine compliance for chlorine MRDL
Daily residual measurements will / will not be included in the compliance calculations (circle one)

Byproduct Monitoring

Required:

TTHM & HAA5 - 1 sample per year during month of warmest water temperature at maximum residence time (MRT).
TTHM MCL = 0.080 mg/l, HAA5 MCL = 0.060 mg/l

Compliance

Must go to quarterly monitoring if annual sample exceeds MCL for either TTHM or HAA5
Compliance is then based on the Running Annual Average (RAA) of quarterly results or averages
DOH will determine compliance for TTHM & HAA5 based on data submitted by the lab

Specify sampling location(s) for:

TTHM & HAA5	Enter Sampling Locations	Enter sampling schedule
TP1 (MRT)	In the Smelter kitchen at the tap	August (warmest water)

No information needed here

Attach a distribution map with sample locations

Reduced Monitoring

To qualify for reduced monitoring the following criteria must be met (and State must approve)
TTHM RAA </= 0.040 mg/l AND HAA5 RAA </= 0.030 mg/l for two consecutive years
OR
TTHM RAA </= 0.020 mg/l AND HAA5 RAA </= 0.015 mg/l for one year
Monitoring may then be reduced to 1 sample per treatment plant per 3-year cycle

7.4.4 Water Quality Monitoring Program

The KPUD relies on the DOH annual Water Quality Monitoring Report (WQMR) to comply with water quality monitoring regulations. The following excerpt was taken from the DOH Publication **Small Water System Management Program Guide: A guide for small non-expanding community Group A water systems, January 2000.** The KPUD's water quality monitoring program will be in accordance with the requirements listed in this excerpt.

Begin Excerpt.

Purpose
To identify the type, frequency and location of baseline water quality monitoring (testing) required by regulations.

Background
The drinking water regulations set water quality standards for public water supplies (MCLs-maximum contaminant levels). They also establish monitoring and public notification requirements for public water systems. Monitoring has 3 levels of activity, which are:

1. initial monitoring,
2. baseline monitoring, and
3. follow-up monitoring.

Initial monitoring applies to new source development and/or new groups of contaminants and is in effect for a short period of time. Baseline monitoring is routine monitoring assigned to a source/system over a long period based upon results of the initial monitoring. Finally, follow-up monitoring reflects an increase in monitoring activity from the baseline because chemicals or contaminants were detected in the water. Whenever a detection is above an identified trigger and/or MCL, the assigned monitoring frequency shifts from the baseline schedule to the appropriate follow-up monitoring schedule.

Element 2 identifies "core" monitoring requirements for existing ground water sources (permanent and seasonal wells, wellfields, and springs). WAC 246-290-300 is the section of the state regulations that outline the water quality monitoring requirements. Each water system is required to develop and carry out a schedule of required monitoring. Systems are not generally required to complete monitoring for purchased, intertie or emergency sources. Water systems are expected to collect the appropriate samples and send them to a DOH certified laboratory for analysis, along with a request for the laboratory to send a copy of the analysis to both the water system and DOH.

For each test conducted, the laboratory report should include:

1. results of the analysis for each of the required compounds, and
2. a list of trigger levels and MCLs for each compound analyzed.

If your test results exceed the "trigger" levels, you will be required to begin a follow-up monitoring program (a program with an increase in the number of samples required). If your test results exceed the MCL, you will be required to:

1. start a follow-up monitoring program,
2. satisfy public notification requirements, and
3. notify DOH and, if appropriate, take steps to correct the problem.

The chart below includes the type of contaminants required to be tested, when to sample, where to sample and if waivers are available. Waivers are the mechanism that allows DOH to reduce monitoring requirements, for selective contaminants, to less than the baseline schedule. Waivers are granted by DOH on a source-specific basis as well as on a state-wide basis where the risk of contamination has been determined to be low.

Contaminant	When to sample	Where to sample	Waiver?
Total Coliform Bacteria (COLI)	Number of samples required in WAC 246-290-300. This monthly requirement to be shown in system's Coliform Monitoring Plan. (Refer to the guidance document, a fill-in-the-blank document, for assistance in completing a Coliform Monitoring Plan.)	From representative points throughout distribution systems as indicated in the Coliform Monitoring Plan.	No
Nitrate (NIT)	Baseline: 1 sample every year * Follow-up: 1 sample every 3 months after a detection above the trigger of 5.0 mg/l **note: nitrate is included as a standard part of a complete inorganic chemical analysis*	From each active permanent & seasonal source after treatment and prior to entering the distribution system.	No
Inorganic Chemicals (IOC)	Baseline (for GW sources): 1 sample every 3 years. Follow- up: 1sample every 3 months after a chemical detection above a trigger value.	From each active permanent & seasonal source after treatment and prior to entering the distribution system.	Yes
Volatile Organic Chemicals (VOC)	Baseline (for GW sources): 1 sample every 3 years. Follow-up: 1 sample every 3 months after a detection of any compound in excess of the trigger of 0.5 ug/l	From each active permanent & seasonal source after treatment and prior to entering the distribution system.	Yes
Synthetic Organic Chemicals (SOC)	Baseline (for systems with a populations < 3,300) 1 set of samples every 3 years.* Follow-up: 1 sample every 3 months for any individual test method that showed a detection above a trigger. **note: a standard set of SOC samples includes test methods: 525.2, 515.1, & 531.1.*	From each active permanent & seasonal source after treatment and prior to entering the distribution system.	Yes
Lead & Copper (LCR)	This is an on-going monitoring program. Sampling requirements may change depending on the findings of previous monitoring. Contact your DOH region for current status and requirements.	Samples taken from the distribution system at targeted in-home taps.	No
Radionuclides (RAD)	Baseline: One sample every 4 years. Contact your DOH regional office for current status of this requirement.	From each active permanent & seasonal source after treatment and prior to entering the distribution system.	No

End excerpt.

A review of DOH water quality records was completed and is presented in Chapter 4. Records indicate that additional testing for VOCs may be warranted at Well No. 3. The KPUD will conduct a full battery of SDWA testing of Well No. 3 as part of the proposed FIT program. This testing will be the baseline for future testing requirements.

7.4.5 General Response Procedures

The State Department of Health under WAC 246-290 has established water quality standards. If the water quality exceeds these standards, the District shall notify the Department of Health and take the following action:

- Notify the State Department of Health at their regional office in Spokane.
- Notify the water consumers served by the system in accordance with WAC 246-290-495.
- Determine the cause of contamination.
- Take action as directed by the Department of Health.

Subsequent to any water quality violation, the KPUD will follow the systematic response procedures outlined in WAC 246-290-495.

The presence of bacteria in routine water quality tests will require the District to submit for analysis a set of repeat samples. These samples shall be collected on the same day and submitted for analysis within twenty-four hours after the notification by the laboratory of a coliform presence. The locations of repeat samples are shown in the Coliform Monitoring Plan. Generally these locations are:

- Site of previous sample with a coliform presence.
- Within five active services upstream of site of sample with a coliform presence.
- Within five active services downstream of site of sample with a coliform presence.
- Within five active services either upstream or downstream of the site with a coliform presence.
- One month after a positive coliform test, the KPUD must collect five samples. The location of the five samples will depend on the nature and location of the original detection.

7.5 - Cross Connection Control Program (CCCP)

The KPUD has adopted Policy Bulletin 33 – Cross Connection Control Policy. It is a part of the water system plan and is adopted by reference.

There are two known interconnections between the surface water and ground water systems. Each of these interconnections has a backflow prevention device. Upon acquisition of the water system by the KPUD, each of these interconnections will be inspected by the KPUD's certified cross connection control specialist. The inspector will identify the level of hazard and any necessary cross connection improvements. The inspector will also perform annual testing of the backflow devices.

7.6 - Emergency Response Plan (ERP)/Water Shortage Response Plan (WSRP)

7.6.1 Introduction

The KPUD completed a joint ERP and a WSRP as part of its Comprehensive Water System Plan – approved in 2004. The WSRP was integrated into the ERP to provide one convenient location for both plans. Each plan was updated as part of the Cliffs' water system planning effort. Generally the update is limited to changes in staff and contact information. The ERP will not be applied to the Cliffs' water system until such time as the KPUD owns it and is operating it.

The purpose of an emergency plan is twofold: (1) establish a protocol for the management and staff of a water system to follow in case of an emergency, and (2) help a water system reduce its vulnerability to emergencies.

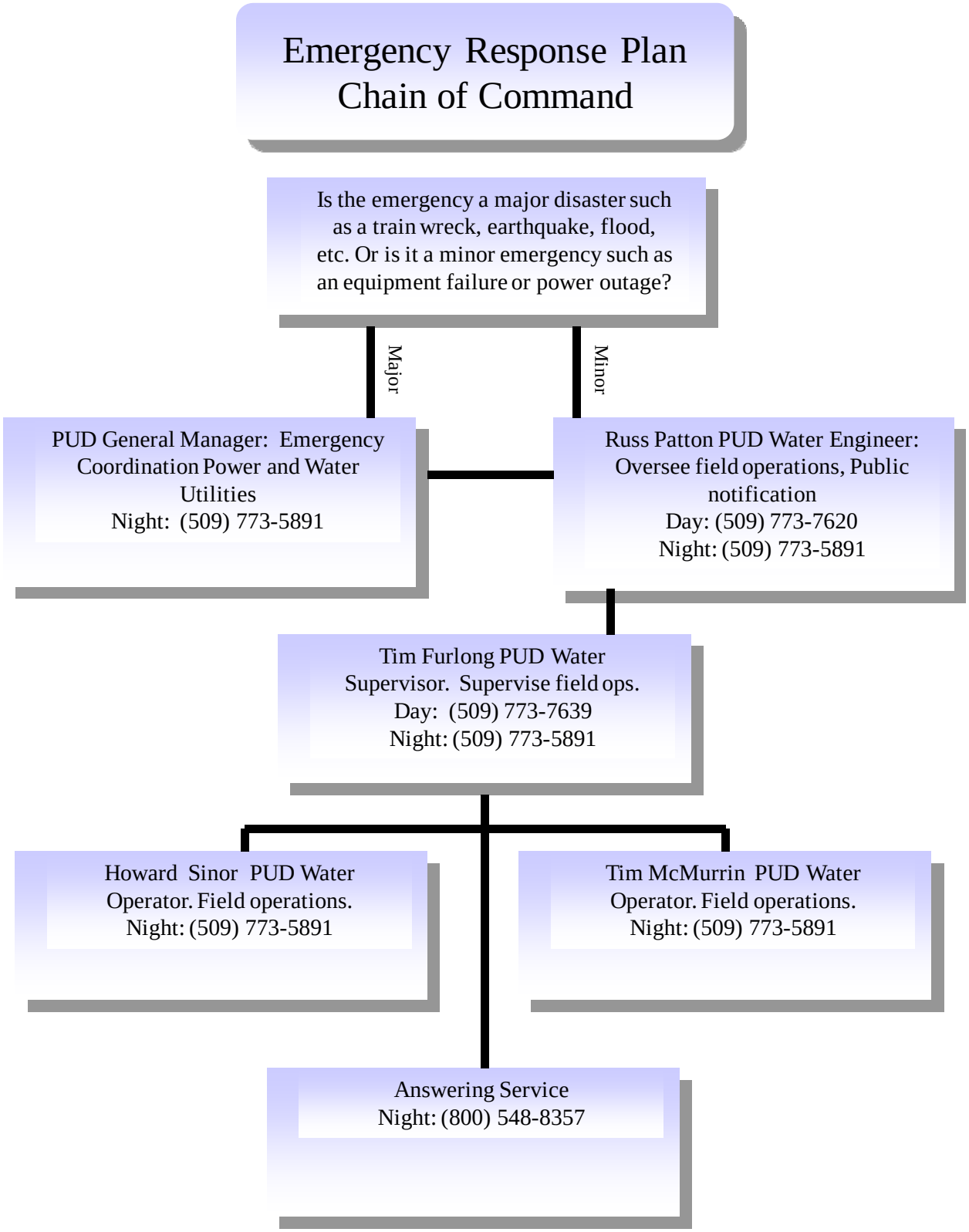
This is not an exhaustive analysis of all types of emergencies which could occur, but focuses on problems most likely to occur in the KPUD's water systems. The likely problems are based on an analysis of the vulnerability of essential facilities. This plan is based on the fact that KPUD staff have knowledge of the intricate characteristics of each water system. The emergency response plan includes the steps to take in the event of a water quality contamination, a long-term power outage, failure of the source, and different levels of water shortages.

The KPUD will rely on coordination with the County Emergency Operations Center during regional emergencies to assess the necessary response. Klickitat County has a Comprehensive Emergency Response Plan, which describes the systematic execution of steps necessary to respond to a large-scale emergency. The KPUD will coordinate directly with the owners of the Smelter which also has an emergency response plan.

7.6.2 Notification Procedures

A water system must have and maintain an up-to-date organizational "chain-of-command" that identifies who is responsible for making decisions during an emergency. The first response step in an emergency is to inform the person at the top of your chain-of-command. This will reduce confusion and optimize response speed and effectiveness. This emergency plan includes a flow chart listing names, titles, and day/night phone numbers of key KPUD staff. **Chart 7-1** identifies the chain-of-command and provides a brief description of each person's responsibilities during an emergency.

Chart 7-1


Emergency Response Plan
Chain of Command
Is the emergency a major disaster such as a train wreck, earthquake, flood, etc. Or is it a minor emergency such as an equipment failure or power outage?
Major
Minor
PUD General Manager: Emergency Coordination Power and Water Utilities
Night: (509) 773-5891
Russ Patton PUD Water Engineer: Oversee field operations, Public notification
Day: (509) 773-7620
Night: (509) 773-5891
Tim Furlong PUD Water Supervisor. Supervise field ops.
Day: (509) 773-7639
Night: (509) 773-5891
Howard Sinor PUD Water Operator. Field operations.
Night: (509) 773-5891
Tim McMurrin PUD Water Operator. Field operations.
Night: (509) 773-5891
Answering Service
Night: (800) 548-8357

General Notification Information

It may be necessary to quickly notify other parties during an emergency situation. Other parties might include water system users, health officials, safety officials, regulatory personnel, the media, and service/repair providers. The following tables list names plus day and night telephone numbers for each of these groups.

Table 7-10 Local Notification List

Fire Dept day - 911	Fire Dept night - 911
Police Dept day - 911	Police Dept night - 911
Ambulance service day - 911	Ambulance service night - 911
Emergency Management Office day Shirley Chapple - County Emergency Management Coordinator - (509) 773-4547 (sheriff dispatch)	Emergency Management Office night - same
Health Office day - (509) 773-4565	Health Office night - same
Local Newspaper day (509) 493-2112 (White Salmon Enterprise)	
Local Newspaper day (509) 773-3777 (Goldendale Sentinel)	
Local Radio Station day (541) 296-2211 KACI	Local Radio Station day (541) 298-5116 KMCQ
Local Radio Station day (541) 773-9102 KYYT	
Klickitat KPUD No. 1 Water Utility Emergency Number: 509-773-5891 (day and night)	

Table 7-11 State Notification List

State Police day - (800) 283-7805	State Police night - Same
DOH day - (509) 456-3115	DOH night - (877) 481-4901
Office of Emergency Management day (800) 562-6108	Office of Emergency Management night Same
DOE Spill Response - (509) 575-2490	

Table 7-12 Service/Repair Notification List

Electrician day - KPUD 509-773-7629	Electrician night - KPUD 509-773-5891
Electrician day – Coburn Electric (541) 386-7866	
Electric Utility day - See attached chart	Electric Utility night - See attached chart
Plumber day - 509-773-7731	Plumber night - Cell 509-261-0001
Pump Specialist #1 day - KPUD 509-773-5891	Pump Specialist #1 night - Same
Pump Specialist #2 day - Fexter in Yakima 509-965-8437	
Soil Excavator #1 day - Robert Mains 509-773-4889	
Hydrogeologic Consultant day - Mark Yinger (541) 352-6015	
Emergency Response Consultant day - John Grim (509) 365-5421	Emergency Response Consultant night - John Grim (541) 993-1045
Equipment Rental day - United Rental – Pasco 509-544-9560	
Bishop Sanitation – Potable Water Tankers (800) 443-3473	

7.6.3 Vulnerability Analysis

7.6.3.1 Overview

The vulnerability of the Cliffs' water systems to failure of the supply source was evaluated to identify weaknesses, if any, at each source. The vulnerability of the water system to supply failure is a gauge of the reliability of the water system. The analysis was based on typical water system problems such as a water quality contamination event, failure of a well, a long-term power outage, and a major mechanical failure. In addition, the vulnerability of the supply sources to constraints imposed by water rights was analyzed. This analysis did not consider the effect of major natural disasters such as earthquakes and flooding. A water system cannot be 100% reliable, therefore this plan focuses on those events deemed likely to occur in typical water systems. Major natural disasters could occur and have a devastating impact on the Cliffs' water system. However, an analysis of the vulnerability of KPUD facilities and associated contingency planning for natural disasters is beyond the scope of the planning effort. The KPUD does not have the resources to design and improve its water systems to be invulnerable to a major natural disaster. The KPUD will continue to rely on local and regional emergency response planning and responders for assistance in confronting the effects of a natural disaster.

7.6.3.2Water Source Quality

The Wellhead Protection Program (WHPP) describes in detail the vulnerability of Wells 1 and 3 to contamination. Sources were classified as having a high, medium, or low vulnerability to contamination. Well No. 3 was considered highly vulnerable to contamination due to its shallow depth and location near a developed industrial area and known waste site. The WHPP includes public education and notification of owners of potential sources of contamination. The notification process combined with informational signing near the sources will help to reduce the potential for contamination of the supply sources. In addition the KPUD has submitted copies of the WHPP to the County Planning Department and the County Emergency Management Office. Coordination between the County and the KPUD will help to minimize the potential for new development to harm the water resources. The KPUD does not have the resources to implement additional water quality protection measures. Moreover, to a large extent, the KPUD cannot control activities most likely to cause contamination of an aquifer. Therefore, even though some of the KPUD sources may be vulnerable to contamination, there are few preventative actions the KPUD can take beyond what is proposed in the WHPP.

The KPUD will pursue a new source of supply in the Cliffs' water system. This project is described in detail in Chapter 6 of the water system plan and in the contingency planning section below. A 2nd permanent source of supply will substantially reduce the vulnerability of the water system to failure of a single source.

The KPUD will work with the owners of the Smelter on reducing the potential for ground water contamination due to contamination from waste sites. KPUD personnel have comprehensive knowledge of waste sites on Smelter property. This knowledge will be advantageous in identifying potential water quality risks, prioritizing cleanup actions, and locating a new well.

7.6.3.3Water Source Quantity

The ability of each aquifer to continue providing a sustainable volume of water to each water source is unknown. The KPUD does not have historical records of aquifer performance. For this reason it is not possible to identify any trends in water resource quantity, either positive or negative. The water system plan includes a proposed Aquifer Performance Monitoring Program (APMP). Monitoring of the aquifers is critical to identify any trend of declining water supply either due to lowering groundwater levels or reduced efficiency of the wells. At this time, it does not appear that any of the sources have a significant vulnerability to a water shortage due to aquifer depletion. However, well efficiencies could also reduce yield. For example, Well No. 1 appears to have had problems with clogging in the past; possibly due to iron bacteria growth. The APMP will ensure that declines in well efficiency does not result in loss of a water source.

The Cliffs' water system may experience a water shortage in the future due to limited physical capacity of existing wells. Generally, the KPUD intends to either pursue new sources of supply in this case or implement moderate conservation measures to create available capacity. The vulnerability to water shortages due to limited capacity of the supply facilities is not part of this analysis since the source capacity far exceeds existing demands and in the future the KPUD intends to further increase the source capacity.

7.6.3.4 Water Rights

The Cliffs' water system has adequate ground and surface water rights for significant levels of development as discussed in Chapter 4. Pursuit of new water rights is a problematic endeavor. Generally, the DOE is not issuing any new water rights. Additional water right volumes can only be obtained on the open market or through the change process. Each of these avenues has potential roadblocks. It would not be unprecedented for a public water system to be required to stop use of a water source due to non-compliance. The KPUD is taking all necessary measures to minimize the potential for relinquishment of the Cliffs' water rights. These measures include preparation of this water system plan, aquifer performance monitoring, implementation of an approved conservation plan, development of the Cliffs' Energy Project water right, and preservation of the water rights by means of a determined future development plan and placement of water into the State trust program. The KPUD believes these measures will minimize the vulnerability of the water system to water right compliance constraints.

7.6.4 Supply Facilities Reliability

Three of the most common causes of supply facility failure were evaluated; long-term failure of the power supply, failure of the source itself due to problems such as well clogging, and mechanical failure of the pumping system.

7.6.4.1 Power Failure

Well 3 is equipped with a port for connection of an engine generator. The KPUD has a portable trailer-mounted engine generator set dedicated to the water and sewer systems. The KPUD can operate one source at a time using the generator. Since the KPUD water systems cover a large geographic area and it is unlikely that a power outage will occur at the same time in several systems, the use of a single engine generator for backup power supply is adequate. The proposed Well No. 4 will be equipped with a permanent engine generator set for backup power.

The KPUD also owns and operates the electric utility in Klickitat County. During an extensive power grid failure, the water utility will coordinate with the power utility as necessary to prioritize system repair based, in part, on preventing water shortages.

7.6.4.2 Pump Failure

The water systems are not equipped with a telemetry and supervisory control system. Consequently, KPUD personnel are not aware of a system problem until customers notice a problem, such as a drop in system pressure, or visual observation of the alarm lights. By relying on customer notification to alarm emergencies, the water system storage is not being used efficiently. For example, if a well pump fails, the reservoir will continue to supply the water system with water, until all of the normal and emergency storage is utilized and the reservoir is empty. At this point, the system pressure will drop, customers will notify the KPUD of a pressure problem and the KPUD will respond to the site. Since the storage is depleted, no water will be available until the pump is repaired or replaced. This may result in cross connection contamination in the distribution system. The lack of a centralized monitoring and alarm system makes the water systems extremely vulnerable to water shortages due to mechanical failure of the pumping systems. The KPUD is implementing a SCADA project as part of its 2004 Water System Plan. A SCADA system will eliminate this vulnerability.

Water systems which have only one pumped source of supply are more vulnerable to pump failure than others. For this reason, and others, the KPUD plans to develop a new ground water source of supply. Well No. 3 will become a backup source of supply and will be available for emergency use if the new well fails for any reason.

A telemetry system which alarms problems to a central location and to on-call staff will allow the operators to respond to a problem, the pump failure in this example, when the pump fails and before the storage volume is depleted, thus preventing a water supply shortage. Not only is water service maintained, but also the potential cross contamination due to low water pressure is eliminated, preventing the emergency from growing into a potential health threat. In this respect, a telemetry system will eliminate some emergency response costs and reduce the potential for a water-borne disease outbreak. The telemetry system is a proposed improvement in the KPUD's 2004 Comprehensive Water System Plan.

7.6.4.3 Failure of the Supply Source

A loss of supply due to aquifer depletion was discussed under the Water Quantity Section. The supply source can also fail due to physical deterioration of the well. Wells often have problems with clogging, encrustation, collapse, etc, which can cause a significant reduction in capacity. The proposed Aquifer Performance Monitoring Program will allow the KPUD to monitor the performance of each supply source and identify problems early before they cause a significant reduction in supply capacity. This program is discussed in detail in Chapters 4.

The KPUD intends to develop a new well. Two sources will substantially reduce the water systems vulnerability to a supply failure, such as a pump failure, a well failure, a groundwater contamination event, etc.

7.6.5 Contingency Plan

Contingency planning is the preparation of procedures to follow in the event of a water supply emergency.

7.6.5.1 Emergency Equipment

The District is equipped with the necessary tools to deal with common emergencies. Spare parts, such as valves, pipe, repair couplings, disinfection equipment, and water-testing devices are stocked by the KPUD. If a serious emergency should develop, the District has the capability to retain a local contractor from its small works roster.

7.6.5.2 Source Water Contamination

The KPUD is well equipped and experienced to deal with microbiological contamination of any of its water systems. In general the KPUD will use the follow-up testing and regulatory/public notification requirements outlined in WAC 246-290. The KPUD will designate one staff person for all media contact. Prior to issuing notice to the public, the media, and regulatory agencies, the KPUD will collect and test a repeat sample to verify the existence of the contaminant. In the event of permanent contamination of the water supply with a regulated contaminant at a level exceeding the MCL, the KPUD will discontinue use of the supply source. For those systems/pressure zones reliant on a single source of supply, the KPUD will take action as described in the emergency source development action plan; see **Chart 7-2**. In addition to emergency source development, the KPUD will take action as dictated by the water shortage response plan described in the following section.

It will take time to develop a new emergency supply source. Unfortunately, in the event of contamination of a sole source of supply, time is a luxury the KPUD will not have. For this reason, the KPUD is placing a high priority on developing a 2nd source of supply for the Cliffs' water system.

This contingency plan is based on a non-transitory water quality problem at the source of supply. Transitory water quality problems such as a cross connection event will be dealt with on a case-by-case basis. The KPUD will procure the services of an experienced hydro-geological consulting firm to develop a plan for addressing a groundwater contamination event. In addition, experts from the DOE will be contacted to assist with the response.

7.6.5.3Water Shortage Response Plan (WSRP)

A water shortage can occur for many reasons and may be minor, moderate, or severe. This section provides a list of actions to take for each level of water shortage, regardless of the cause. The following tables list the type of shortage and the associated action.

- Minor shortage= = 1
- Moderate shortage = 2
- Severe shortage = 3

Table 7-13

Demand Reduction Option	Water Saved (Estimated Percentage)	Water Shortage Stage
Public Information including: • Meeting with community council • Bill stuffers • Issue newspaper/radio news brief KPUD O&M Modifications: • Halt flushing program • Eliminate treatment backwash cycles • Monitor system for leakage • Check meters to identify residential leakage • Assist residents with leakage repairs	5 to 10%	Stage 1 – Minor Shortage Voluntary measures
Adopt and implement water-use curtailment policy, which includes: • No unfixed leaks; • No hosing of paved surfaces; • No fountains except those using re-circulated water; • No water running onto streets; • Adopt landscape irrigation restrictions incorporating time of day limitations (e.g., 7 p.m. to 7 a.m., etc.); • No irrigation runoff. • Reduce pressure setpoints at BPS to a minimum pump-on pressure of 30 psi. • Fines for violating mandatory conservation measures.	Another 5 to 10%	Stage 2 – Moderate Shortage Mandatory measures in addition to above measures.

Demand Reduction Option	Water Saved (Estimated Percentage)	Water Shortage Stage
Draft and adopt ordinances allowing a utility to declare a water emergency and requiring: • Fixed consumption allotments or percentage cutbacks (rationing). • All homes and businesses to have retrofitted showers and toilets. • All public water uses not required for health or safety prohibited unless using tank truck water supplies or reclaimed waste water. • Irrigation of public parks, cemeteries, etc., severely restricted. • Main flushing allowed only for emergency purposes. • Reduce system pressure to minimum permissible levels, e.g. 20 psi. • Rate surcharges. • Disconnection of violators for one day then reconnection after a warning and a house call. • Implement a moratorium on all new connections.	Another 10 to 25%	Stage 3 – Severe Shortage Mandatory measures in addition to above measures.

WSRP Initiation Criteria

The WSRP will be initiated based on a measurable and continuous decrease in the static and/or pumping water levels or the loss of a supply source. The magnitude of the decrease in source capacity that triggers the WSRP will depend on data collected in the proposed Aquifer Performance Monitoring Plan. For wells, the KPUD will be collecting data that will allow them to monitor the head above the pump intake and the water level. This data can be used to identify any negative trends in supply capacity. Water shortage response actions can then be taken based on the unique characteristics of each water system. In general the following actions will be initiated for each stage of water shortage:

Stage 1 - Minor Shortage: Initiate demand reduction if measurement of well water levels indicates a consistent decreasing trend.

Stage 2 - Moderate Shortage: Initiate if static and/or pumping water level continues to decrease (lower) after implementation of the Stage 1 demand reduction measures. If water levels stabilize due to demand reduction actions by the KPUD, maintain Stage 2 status. If water levels stabilize due to seasonal reduction in demand, cancel Stage 2 measures and return to Stage 1 status.

Stage 3 - Severe Shortage: Initiate if static and/or pumping water level continues to decrease (lower) after implementation of the Stage 1 and Stage 2 demand reduction measures. If water levels stabilize

due to demand reduction actions by the KPUD, maintain Stage 3 status. If water levels stabilize due to seasonal reduction in demand, cancel Stage 3 measures and return to Stage 2 status.

If a Stage 3 shortage occurs, the KPUD will immediately begin implementation of the Emergency Source Development Plan as outlined in **Chart 7-2**.

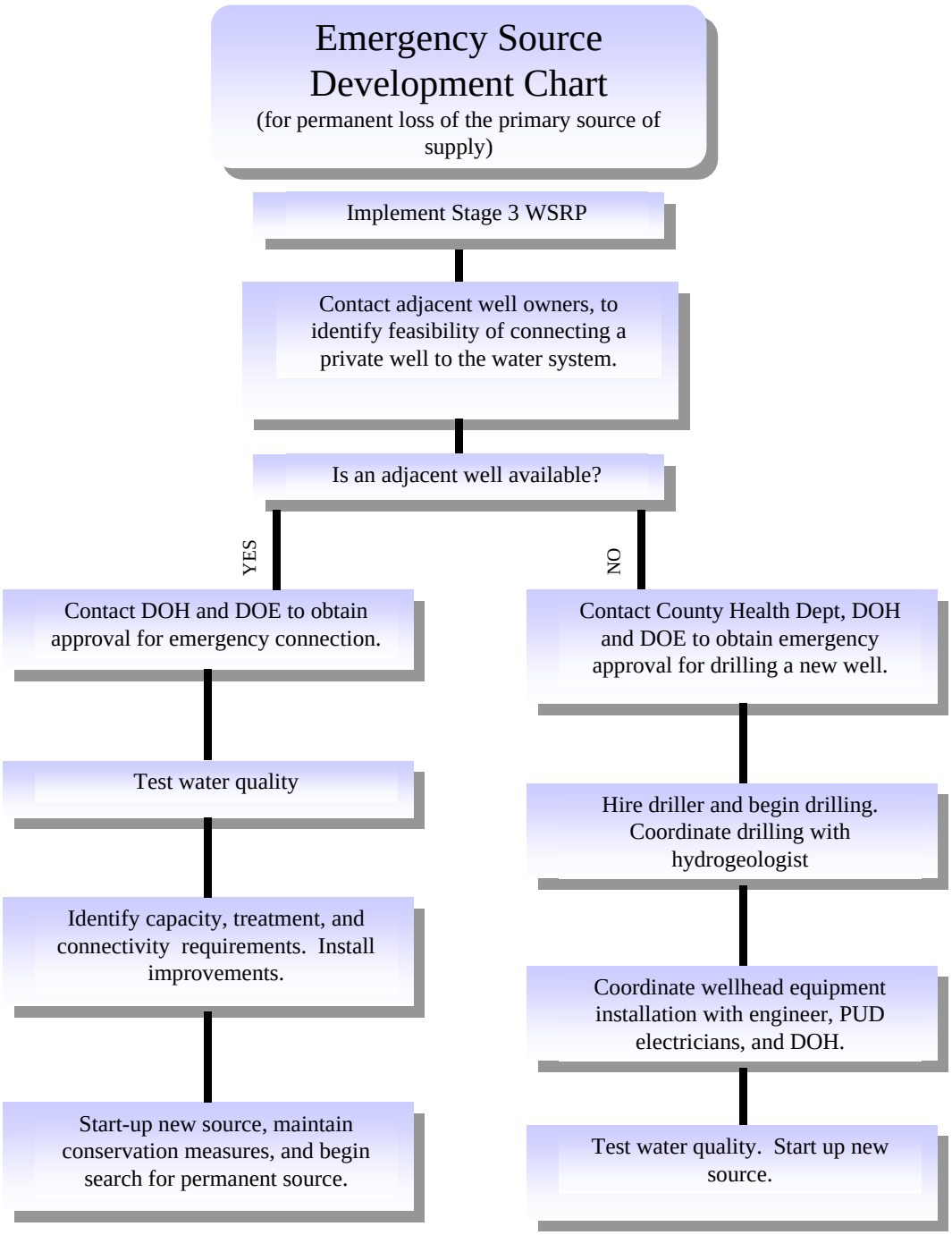
Supply Augmentation Options

Table 7-14 lists supply augmentation options that could be constructed or accomplished by the KPUD.

Table 7-14

Supply Augmentation Option	Additional Water Provided
Rather than providing a generic list of supply augmentation options which may or may not be feasible or necessary, the KPUD will pursue supply augmentation steps on a case-by-case basis. The first step will be meeting with the engineering consultant and hydrologist to develop a supply augmentation work plan. Since a water shortage can have many causes, the supply augmentation solution will vary depending on the cause. The Emergency Source Development Chart presents the systematic steps which will be taken to augment supply in the event of a severe water shortage or loss of the sole source of supply. Reduced capacity at a well could be due to a general lowering of the groundwater table or due to well efficiency problems. Each of these causes will necessitate a unique response. For example, if the well efficiency is decreasing, the KPUD will implement an investigation of the cause of the efficiency reduction, and then take steps to solve the problem. This action will be coordinated with the PUDs consultants.	Unknown

Chart 7-2



Based on the preliminary demand reduction and supply augmentation options identified, a final course of action will be determined. A thorough evaluation of each potential option will be conducted prior to making the final selection. The KPUD will utilize potable water tanker trucks in critical situations as necessary to maintain pressure in the water systems until an emergency supply source is on line.

7.6.5.4 Long-Term Power Outage

The KPUD will utilize its engine generator (EG) set during a power outage to provide temporary power at supply sources as necessary to prevent excessive drawdown of storage volume. As discussed previously, the lack of a centralized monitoring and alarm system makes it difficult to prioritize use of the EG set. Until the SCADA system is installed the KPUD will follow these steps in response to a large long-term power outage:

1) Identify extent of power outage and affected water systems.
2) Assign staff person to each affected system as necessary to monitor the level of water in each storage tank (except for Glenwood).
3) Coordinate allocation of the EG set with the water system supervisor based on the available storage volume in each reservoir.

7.6.5.5 Emergency Source Development

Chart 7-2 describes steps to take to develop an emergency source of supply if a normal supply source fails for any reason.

7.7 - Interim O&M Program Recommendations

The preceding sections of this chapter describe the proposed Operations and Maintenance Plan for the Cliffs' water system assuming it is owned by the KPUD and operating in a normal manner. This O&M Plan will be implemented after the KPUD acquires the water system as described in the Facilities Transfer Agreement in Chapter 6 and upon startup of the systems as necessary to provide water service to new customers.

At this time the surface and ground water systems are not being operated normally. The GW system is being used to provide domestic water to a skeleton crew at the Smelter and at a small manufacturing facility. The SW system is not being used. Currently the small work crew at the Smelter is tasked with maintenance of the entire existing aluminum plant including the water system facilities. This is a huge task for a handful of employees. Consequently, it appears that both the SW and GW systems may not be receiving satisfactory maintenance.

As the owner of the ground and surface water rights, the KPUD must retain authority over use of the water by CGAC during the interim period prior to acquisition of the supply facilities by the KPUD. If the CGAC requests water service, the KPUD will execute an O&M agreement with the owner which provides for temporary O&M of the ground water and surface water facilities by CGAC employees. This agreement will include the following provisions:

- A detailed operations and maintenance schedule for those facilities proposed to be acquired by the KPUD. This program will be similar to that outlined in this chapter.
- A schedule of rates and charges for water used by CGAC.
- A sunset clause which will govern when KPUD employees will assume O&M of the water system facilities. At present the KPUD does not intend to operate or maintain the water system facilities until such time as the proposed programmatic improvement plan has been implemented and the KPUD owns the facilities.
- A training program to ensure KPUD employees are fully prepared to operate and maintain the facilities.
- A reporting requirement to ensure KPUD is notified of the resumption of operation of the water system facilities and receives periodic statements of water use.

At this time, it seems probable that the Smelter will never restart. In this event, the KPUD will acquire ownership of the water system facilities as specified in the Facilities Transfer Agreement section of Chapter 6. Afterward there will almost certainly be a period of time, possibly years, where there are very little if any water demands. If this scenario occurs, the KPUD will need to perform some basic maintenance of the water system to prevent degradation. To do this, the KPUD will acquire the temporary services of a former Smelter employee who will train KPUD staff in the operation and maintenance of the facilities. An O&M schedule will be developed that is applicable to the physical characteristics of the water system facilities to guide KPUD staff during this period.

Chapter-8. Financial Plan

8.1 - General

The engineering elements of the KPUD's Water System Plan address the physical status and needs of the utility to supply, store, treat, and distribute water. The financial element, as outlined in this Chapter, focuses on the utility's ability to fund improvements and ongoing operations. The financial analysis examines future capital needs, capital funding options and future utility revenue requirements. A financing strategy is developed and evaluated, with particular emphasis placed on projected levels of revenues and expenses.

The analysis proceeds in the following manner. Using the projected Operations, Maintenance, and General Administration (OMGA) expenses, the projected Capital Improvement Plan, and assumed funding packages, the required revenue is identified. Next, rates necessary to fund the required revenue are calculated. Since this is a new water system, an analysis of historical financial performance was not done.

The scope of this work is very limited. Therefore, this should not be considered a rate study or a recommended funding program. This chapter simply documents the financial viability of the water utility and identifies revenue requirements. A rate study may be necessary to identify the method(s) which will be used to recover revenue from customers, in a manner which correlates to the costs incurred to serve their unique demands. Funding alternatives will be explored in detail by the KPUD for each project to identify the optimum source of funding for the capital improvement program. In this largely undeveloped water system, most projects will be funded via CGAC/developer contributions

Each of the KPUD's water utilities are an independent financial entity. As enterprises, they should be self-sufficient, meaning revenues received from rates, connection charges, debt and grant proceeds, and interest earnings should fully fund the operating and capital needs of each independent system. Furthermore, the KPUD financially accounts for each utility in their own funds and also tracks cash flow for each system separately for operations and capital. Due to the prudent accounting separation of each system, a financial plan for each utility is independently developed.

8.2 - Guidelines and Policies

The KPUD has financial policies which govern the water utility rates and charges. The KPUD has the following policies associated with water accounts:

- Operation, Maintenance, & General Administration (OMGA). This account should have a minimum reserve at all times of 1/8th the annual OMGA budget, the purpose of which is to provide necessary funds during typical collection cycles and provide an added cushion for seasonal variation in water rate revenues. The account as a whole is used to fund normal expenses and for depositing rate revenue. Transfers from this account to the repair and replacement reserve account will occur annually if funds are available.

- Repair and Replacement Reserve. This account will be funded annually via rates based on the estimated depreciation of the water plant in place. This fund is intended to support capital

reinvestment in utility infrastructure, providing ongoing cash resources for non-growth related projects to replace system components as they wear out.

- Capital Reserve. This account will include all system development charges and other development related contributions in aid of construction. These funds are used to pay for both improvements related to growth and system upgrades.

Policies governing the administration of these accounts were developed by the KPUD. The KPUD does not intend to establish an emergency reserve. Funding for unanticipated projects, such as a pump failure or pipeline break, will be accomplished via the existing electric utility inter-fund loan mechanism. Rates are subsequently adjusted as necessary to repay the inter-fund debt.

8.3 - Financing Alternatives

The KPUD has several financing alternatives available for capital improvement projects and ongoing utility operations in the Cliffs' water system. Each financing alternative has its advantages and disadvantages, and will be reviewed carefully to determine if it is the most effective, appropriate, and least costly way to finance the proposed capital improvements. The following section discusses various financing alternatives, including:

- CGAC Participation
- Developer Participation
- System Development Charges (SDCs)
- State and Federal Grants and Loans
- Long Term Debt Financing
- Water Utility Rates
- Water Right Revenue

8.3.1 CGAC Financing

Chapters 6 and 7 describe an operating scenario in which the CGAC requests water service and the ownership of certain water system facilities is transferred to the KPUD. Once owned and operated by the KPUD, the CGAC will be charged monthly water use rates for both the surface water and ground water services. These rates will be cost-of-service based. This rate revenue will be used to fund the ongoing OMGA of the water systems. If the CGAC restarts it will have directly benefited from the development and implementation of this Plan and the preservation of the Cliffs' water rights. Therefore the rate revenue will also include a component for recovery of these associated expenses.

The CGAC will be required to fund the capital improvements to the SW and GW systems as described in Chapter 6.

8.3.2 Developer Participation

In order to obtain service to their property, developers must comply with the KPUD's requirements to make specific utility improvements. The developer will be asked to either construct the required facilities and then donate them to the KPUD, or contribute their share of the project cost to the KPUD. Sometimes the developer may be asked to construct more facilities than those required by their development in order to: provide an extension of the utility beyond their property or plat,

construct larger pipelines, or rehabilitate the existing SW and GW systems. The KPUD can reimburse the developer for the cost of additional facilities through direct layout, latecomers charges, or reimbursement agreements. The method of payment will be governed by a Developer Extension Agreement prepared by the KPUD.

8.3.3 System Development Charge (SDC)

A System Development Charge, also called a connection charge, is a capital contribution required as a condition of connecting to the utility system. The charge provides two functions to the KPUD, revenue and equity. In terms of revenue, the SDC from new customers provides a source of capital which can be used to support upgrades of the existing system and system expansion. In terms of equity, connection charges provide a mechanism for balancing the capital cost between existing and new customers.

A system development charge may be evaluated by the KPUD as part of a Rate Study. Charges will be developed based on the KPUD's financial policies and standard practice. A Rate Study will identify the equitable share of system upgrade and improvement costs which should be borne by new development. This evaluation is based on growth paying for growth and growth paying for that portion of the existing facilities necessary to serve the new development (reimbursement). While the SDC may be an important source of revenue, it may not be relevant in this system and therefore it was not integrated into the financial forecast. This approach will ensure that the KPUD is not relying on connection charge revenue to fund the CIP.

Calculation of the SDC is, in part, a policy decision. To some extent this policy decision depends on whether the KPUD wishes to recover the maximum reasonable amount from development. If this is the case, the system development charges may be very high. The KPUD may want to perform a comparative analysis of charges in similar rural Washington industrial areas to help identify a reasonable and expected value. It's important to note that extremely high charges may offset development. Therefore, to a certain extent, the policy which defines the SDC is a growth policy. The SDC should be re-evaluated every few years to take into account the actual cost of improvements and the nature of acquired financing.

8.3.4 Grants and Loans

There are several grant and loan programs available through the State of Washington and the United States Government for financing utility and economic development projects. Each program has its individual advantages and disadvantages. For each project, or group of projects, the KPUD will develop a list of relevant and feasible grant and loan funds for which to apply. The impact of each potential source of funding will be evaluated to ensure it does not jeopardize the financial viability of the utility. Funding scenarios can be incorporated into the system's 6-year budget worksheet to evaluate the impact on rates.

The KPUD in-house funding expertise is outstanding, no doubt due to the severe financial viability issues in its water and sewer systems. Therefore, no effort was made to develop a comprehensive list of State and Federal grant and loan options in this plan. KPUD office personnel are familiar with the programs and staff at all relevant funding agencies including: USDA Rural Utilities Service, USFS Rural Communities Assistance Program, Various Community Development Block Grant programs, Public Works Trust Fund programs, Safe Drinking Water Revolving Loan funding, EPA

State and Tribal Assistance Grant funding, and the Klickitat County's economic development funding program. Funding is available for planning, design, and construction related costs.

KPUD water systems, by and large, are eligible for some grant funding of the CIP due to the low-income characteristics of each community. The Cliffs' water system, because of its industrial character, should be eligible for economic development grants and loans. The KPUD will work with Klickitat County on procuring economic development funding for projects in this system.

8.3.5 Debt Financing

For large and infrequent major capital projects, utilities often use long-term debt to spread the cost of the project over a number of years. This is done to keep the annual revenue requirements low and to ensure that future users of the system help pay for the project. Conventional long-term debt financing consists of general obligation bonds and revenue bonds. The benefits and limitations of these two debt financing options are presented below.

General Obligation Bonds. General obligation (G.O.) bonds are debt instruments backed by the full faith and credit of the utility. The interest and principal payments are paid through utility revenues.

Financing costs for G.O. bonds are lower than the cost for revenue bonds because; 1) the interest rates are usually lower, 2) there are no coverage requirements, and 3) there are no reserved requirements.

Revenue Bonds. Revenue bonds are the most common source of funds for construction of major utility improvements. These capital improvement projects are intended to generate revenue that will sustain the payment of both principal and interest of the revenue bonds. There are no statutory limitations on the amount of revenue bonds the KPUD can issue, however, the utility would be required to meet a yearly net operating income coverage requirement of 1.25 times the annual debt service. Utility revenue rates must be set high enough to cover the principal interest coverage and reserve requirements of the revenue bond debt service. Connection charge revenue can also be used for the revenue bond debt service. The terms on revenue bonds are not as favorable as G.O. bonds but carry the advantage of leaving the KPUD's bond debt capacity undisturbed. Interest rates vary depending on market condition and are usually higher than G.O. bonds.

Generally, bond funding is not a feasible option for the water utilities due to the high cost of acquiring the funding and the relatively high interest rates. Bond funding will only be considered for projects which are not eligible for State and Federal funding programs.

In addition to bonds, the KPUD can loan money to the water utility from the electric utility. Typically, the KPUD does this when there are significant unanticipated expenses or emergencies. Current loan terms are set at 4.95% over a 20-year term.

8.3.6 Customer Rates

The KPUD may fund a portion of its capital improvement program through rates. The KPUD may set aside a portion of the utility rate revenue specifically to provide replacement and rehabilitation of the existing utility system. In addition, utility rates may be used to finance small short-term capital improvement projects where it might be unreasonable to acquire long-term financing.

8.3.7 Water Right Revenue

The KPUD will develop, on a case by case basis, a water right rate for those water systems which acquire water rights from the Cliffs' water right exchange. The rate *may* be cost-of-service based. For permanent transfer of water rights the cost *may* be based on a comparative market analysis plus expenses incurred in the water right change process. A water right change, depending on its complexity, could cost anywhere from $5,000 to $50,000. The market rate for Columbia River surface water rights could be in the range of $1,000 to $2,000 per acre foot or more. The proposed water right exchange may be a viable source of long-term revenue in this water system.

8.4 - Financial Analysis Assumptions

Table 8-1 – Financial Analysis Assumptions lists the assumptions used in the financial analysis of the water system.

Table 8-1 – Financial Analysis Assumptions

Financial Analysis Variable	Assumption
Expense Variables	
OMGA Expenses	Utilized the average budget for a typical KPUD water system as a basis for establishing a baseline budget for Cliffs and for predicting the 6-year OMGA expenses.
Taxes	5% of non-debt related expenses.
Power Cost	Annual inflation of 1%.
Materials & Equipment	Annual inflation of 3%.
Wages	Annual increase of 2.5%.
Depreciation	40 year amortization.
Operating Reserve	12.5% of the annual OMGA budget. Funded over 6 years.
Emergency Reserve	Not funded.
Revenue Variables	
PWTF Loans	50% of eligible projects. 20 years at 2%.
PWTF Cash Match	5% of loan amount.
KPUD Electric Utility Loans	20 years at 4.95%. No match.
Grant Funding	50% of eligible projects. Note: there is no guarantee that 50% of costs would be secured through grants.
Interest on reserves	2.5%
Cash Financing	For all projects under $5,000. Also used in lieu of debt financing when feasible.
Water System Growth	Based on the CGAC re-developing and operating at full capacity. Did not include any new customers. Connection charge revenue was assumed to be zero for all systems.

The assumption of 50/50 grant to loan financing of large projects is optimistic. Grant funding programs are very competitive. KPUD projects must demonstrate the need, capacity, readiness, and results necessary to compete for grant money. The KPUD may have to adjust its financial forecasts based on not acquiring grant funding for some projects.

It must be emphasized that the financial analysis is based on no revenue, in the form of system development charges or rates, from new customers. This is a conservative approach which may result in high rate predictions. The basis for this assumption is sound; the KPUD cannot predict or guarantee development within its water system service area.

8.5 - OMGA Expenses

The expenses for Operation, Maintenance, and General Administration (OMGA) of a water system are fixed costs excluding debt. These are the costs to "keep the lights on". The expenses for a typical KPUD water system in the year 2008 are listed in **Table 8-2 – Baseline Expenses**. The data in this table forms the baseline for the Cliffs' water system budget. The expenses are based on the assumption that the KPUD owns and is operating the Cliffs' water system. The expenses were calculated by taking the average of each line item for all of the KPUD's seven water systems. This approach was necessary because:

- Actual operation and maintenance tasks/schedules will not be known until the FIT program has been completed and an O&M agreement has been negotiated with CGAC.
- O&M requirements for all KPUD systems are relatively equal regardless of the water system size since the majority of effort is for O&M of the water supply and treatment facilities and operator windshield time.
- The long-term plan is for the KPUD to take over O&M of the Cliffs' water system. Therefore O&M tasks will be similar to that in other water systems.
- Using the average expenses of the seven KPUD owned and operated water systems ensures that expense anomalies unique to any one system have little impact.
- Since the required O&M tasks are not known at this time, a conservative estimate of the annual expenses is warranted.

Table 8-2 – Baseline Expenses

Expense Items	Year 2008
Materials and Supplies	$8,167
Taxes	$4,076
Wages	$23,556
Transportation	$4,773
Electric charges	$2,176
Fees/Misc	$1,612
Operating Reserve	$1,000
Total Annual Expenses	**~$46,000**

Forecasted expenses for capital improvements and associated debt are listed in the Financial Plan below.

No attempt was made to estimate the O&M expenses in the scenario where the Smelter is mothballed. In this scenario the KPUD may need to perform limited O&M of the water system facilities to prevent degradation. Financial planning for this scenario is not possible since the required commitment of resources is unknown.

8.6 - Financial Plan

The financial plan presented in this section covers the operation, maintenance, and capital improvements proposed for the water system. It does not include an evaluation of the cost of

additional staff. The budget was first completed by forecasting expenses for the next six years. Then the proposed CIP and assumed funding was incorporated into the six-year forecast. Finally, revenue necessary to fund the 6-year expense forecast was estimated and proposed rates were developed.

The expected revenue that will be generated from SDCs is assumed to be zero. There is no anticipated growth within the service area at this time. The nature of development within this water system (industrial and power) is not typical of municipal water systems. It is not easy to predict growth levels and proportion the cost of improvements equitably. For this reason, and others, SDCs may not be an appropriate method of revenue collection to meet capital needs. Developer contributions and associated latecomers fees may be a more suitable method for funding capital improvements. This approach will ensure the KPUD is relying on developer contributions to fund capital projects necessary for growth.

The six-year financial forecast (budget) is presented in **Table 8-3**. This analysis is based on the assumptions listed in **Table 8-1 – Financial Analysis Assumptions**, the fixed expenses listed in **Table 8-2 – Baseline Expenses,** and the proposed CIP from Chapter 6. For simplicity, rate predictions are based on having one customer, the CGAC, during the first six years of operation. Rates will be charged monthly and based on a flat rate structure. A flat rate structure is justified in this system for the following reasons:

- There is only one customer, albeit a huge one.
- Surface and ground water demands are not expected to vary significantly year round.
- Commodity based rates inject too much uncertainty in a system of this nature to ensure adequate revenues are collected.
- There is very little cost impact due to increased water usage
- An inverted rate structure or other structure which encourages conservation (penalizes customers for excessive water use) is not germane in this water system.
- The KPUD will work proactively with the owners of the Smelter and other new customers on reducing water losses. To ensure efficient use of water, the proposed O&M agreement will include a provision that sets a ceiling on water loss in the Smelter water systems.

In this plan, the relatively small capital improvement projects are financed with cash. Cash is used in lieu of debt financing due to the small size of these projects and the high cost of debt financing. Several large projects will be financed by means of contributions from CGAC or its successor as negotiated in the proposed Facilities Transfer Agreement. Other future large projects will be funded by means of developer contributions or economic development funding.

Capital Improvement Projects included in the 6-year financial analysis are listed below. Payment for the cost of these projects will be accomplished by means of a KPUD interfund loan.

1. This Water System Plan.
2. The KPUD expenses incurred in preserving the water rights.
3. The proposed Operations and Maintenance and Facilities Transfer Agreements.
4. The proposed Facility Inspection and Testing Program.

Based on this 6-year forecast, the CGAC's monthly water rate must be approximately $5,000/month. The rates shown are based on collecting sufficient revenue to fund the OMGA and CIP on a year-to-year basis. **It must be emphasized that the Cliffs' financial forecast could change radically if there is a new development or re-development of the Smelter.**

If the Smelter is mothballed, the KPUD will assume responsibility for limited operations and maintenance of the water system infrastructure. The expense of this O&M cannot be determined until the FIT program is completed and the KPUD owns the facilities. A financial plan will be developed by the KPUD for this contingency should it occur. The KPUD will examine utilizing the water rights as a means of revenue under these circumstances.

Table 8-3 – 6-Year Budget

	Planning Year					
Items	**1**	**2**	**3**	**4**	**5**	**6**
OMGA Expenses	$45,973	$47,063	$48,182	$49,329	$50,506	$51,714
Existing Debt and Depreciation Expenses	$0	$0	$0	$0	$0	$0
Subtotal	$45,973	$47,063	$48,182	$49,329	$50,506	$51,714
KPUD Interfund Loan Payments [1]	$12,919	$12,919	$12,919	$12,919	$12,919	$12,919
Total Annual Expenses	**$58,892**	**$59,982**	**$61,101**	**$62,248**	**$63,425**	**$64,633**
Revenue from Rates [2]	$60,000	$60,900	$61,814	$62,741	$63,682	$64,637
Revenue from SDCs	$0	$0	$0	$0	$0	$0
Total Annual Revenue	**$60,000**	**$60,900**	**$61,814**	**$62,741**	**$63,682**	**$64,637**
Revenue less Expenses	$1,108	$918	$712	$493	$257	$4

[1] $161,000 Loan with a 20-year term at 5%.

[2] $5,000/month flat rate. Annual inflationary adjustment of 1.5%

Appendices

1) Water Rights Documentation
    a. Certificates of Water Rights
    b. CGAC Quit Claim Deed
    c. 2007 Surface Water Right ROE/ROD
    d. 2007 Surface Water Right ROE/ROD Ecology Negotiated Letter of Modification
    e. City of White Salmon Water Right Purchase Agreement
2) KPUD Customer Service Policy
3) KPUD Cross Connection Control Policy
4) Local Government Consistency Review Checklist
5) Well Logs
6) Wellhead Protection Correspondence
7) *Water Quality Testing History*
8) *DOH & DOE Correspondance*

SURFACE WATER TANKS #1 AND #2.
BASE EL. = 600', O.F. EL. 636'. BOTH ARE WELDED STEEL.
TANK # 1 (WEST): 500,000 GAL. (1970)
TANK #2 (EAST): 638,000 GAL. (2001)

HWY 14

Well No. 1

GW Tank

Well No. 3

CELL BUILDING D
CELL BUILDING C
CELL BUILDING B
CELL BUILDING A
CELL BUILDING B
CELL BUILDING A
CAST HOUSE

WELL NO.2

SEWAGE TREATMENT PLANT

RW/GW Intertie

John Day Dam Road

Columbia River Pump Station Schematic

COLUMBIA RIVER PUMP STATION.
6– BYRON JACKSON 600 Hp LINE SHAFT VERTICAL TURBINE PUMPS, RATED AT 3500 GPM & 520' TDH. PUMP SURFACE EL. 271'. INTAKE EL. 243'. WATER EL. ~ 257' to 268'. CONSTRUCTED IN 1971.

Twin 24" Diam. RCP Transmission Mains

COLUMBIA RIVER

N

EXISTING WELL AT ART COLONY – ABANDONED
DW-26
GW TANK NO. 1
100,000 GAL. O.F. ELEV. 621'
BASE EL. 596'
RIVER WATER CROSS CONNECTION
RW-63
DW-2
DW-3
DW-4
DW-1
WELL NO.1
DW-5
DW-7
CHLORINATOR
DW-25
POTABLE WATER TANK 18,000 GAL.
B.P.A. BLDG
RECTIFIER ROOM
BOOSTER PUMP 100 GPM @ 200' TDH
DRAIN
TO OLD CONSTRUCTION OFFICE
WELL NO.3

FIGURE 2-1
CLIFFS EXISTING WATER SYSTEM

Legend

- Drinking Water Piping
- River Water Piping
- Drinking Water Valves (DW-#)
- River Water Valves (RW-#)
- Water System Structures
- Smelter Structures

Notes

Dashed lines are U.G.
Solid are above grade.

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Date: 4/09/10
File: water system figures
Scale: NTS

Klickitat PUD
Owned By Those It Serves

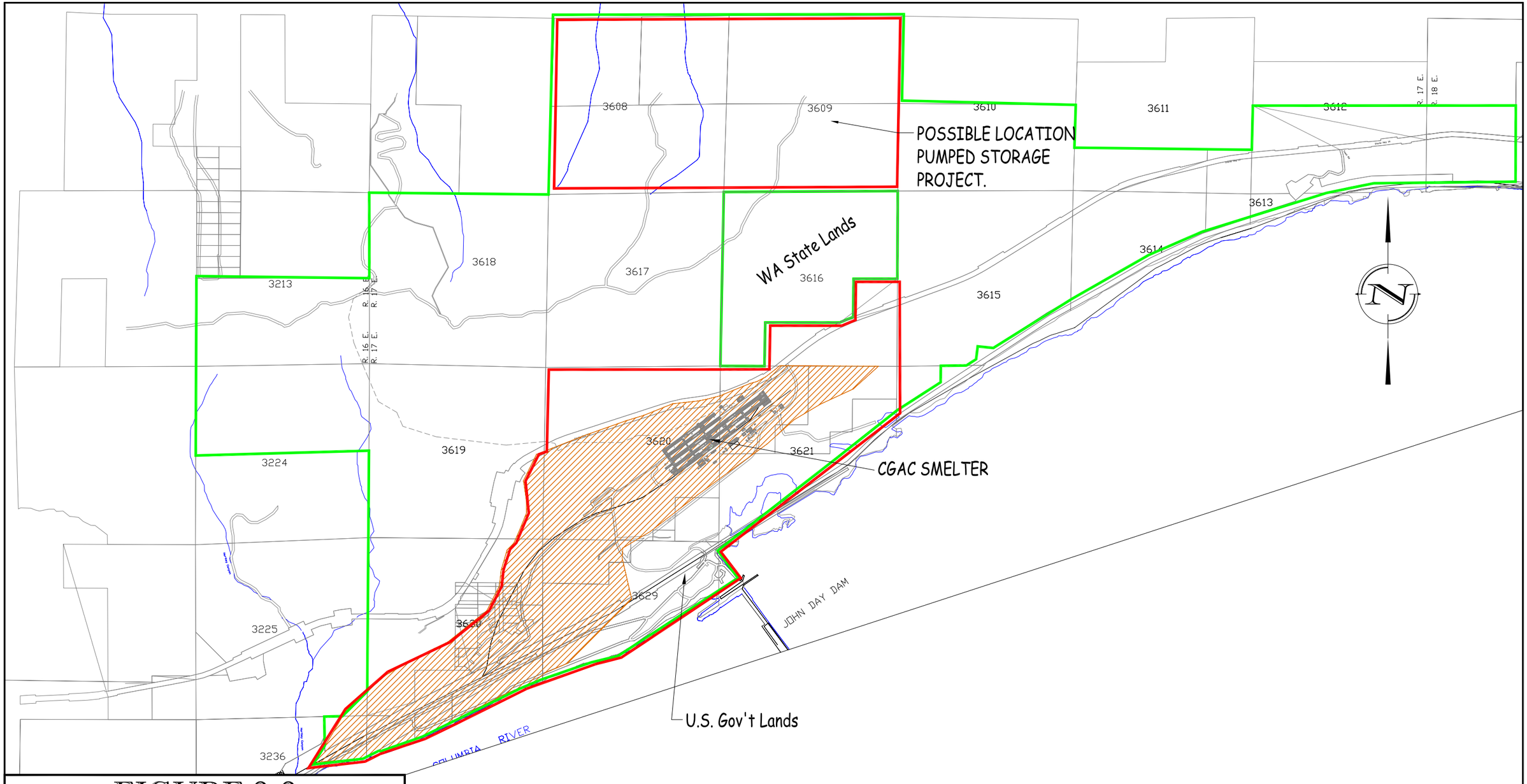

FIGURE 2-2

CLIFFS WATER SYSTEM

BOUNDARIES

		Acreage
Industrial Zoning		1,160 acres
Existing Retail Service Area		3,240 acres
Future Service Area		7,874 acres

(includes all of CGAC property, industrial zoned lands, private lands, and adjacent US Gov't lands)

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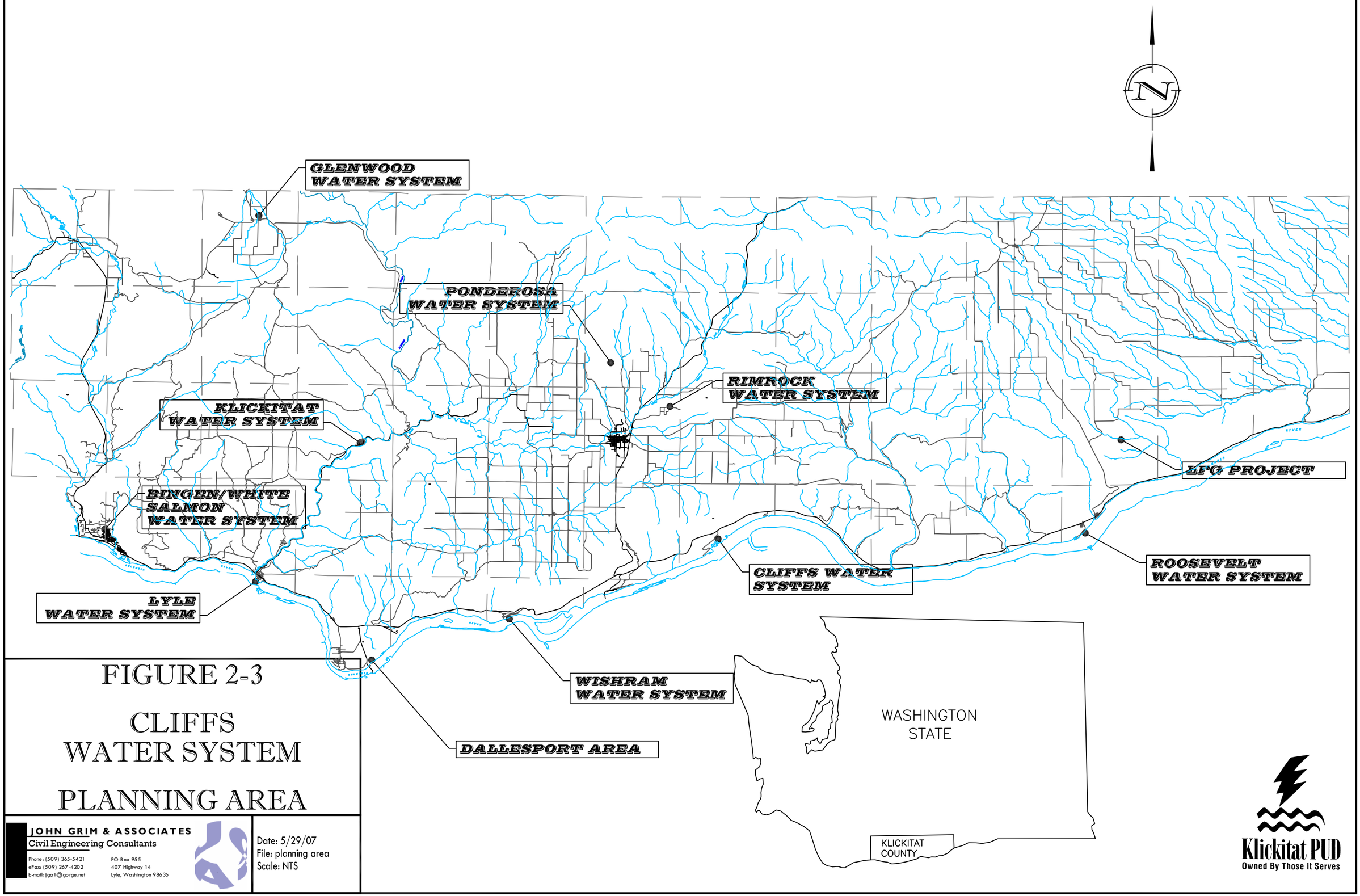

FIGURE 2-3

CLIFFS WATER SYSTEM

PLANNING AREA

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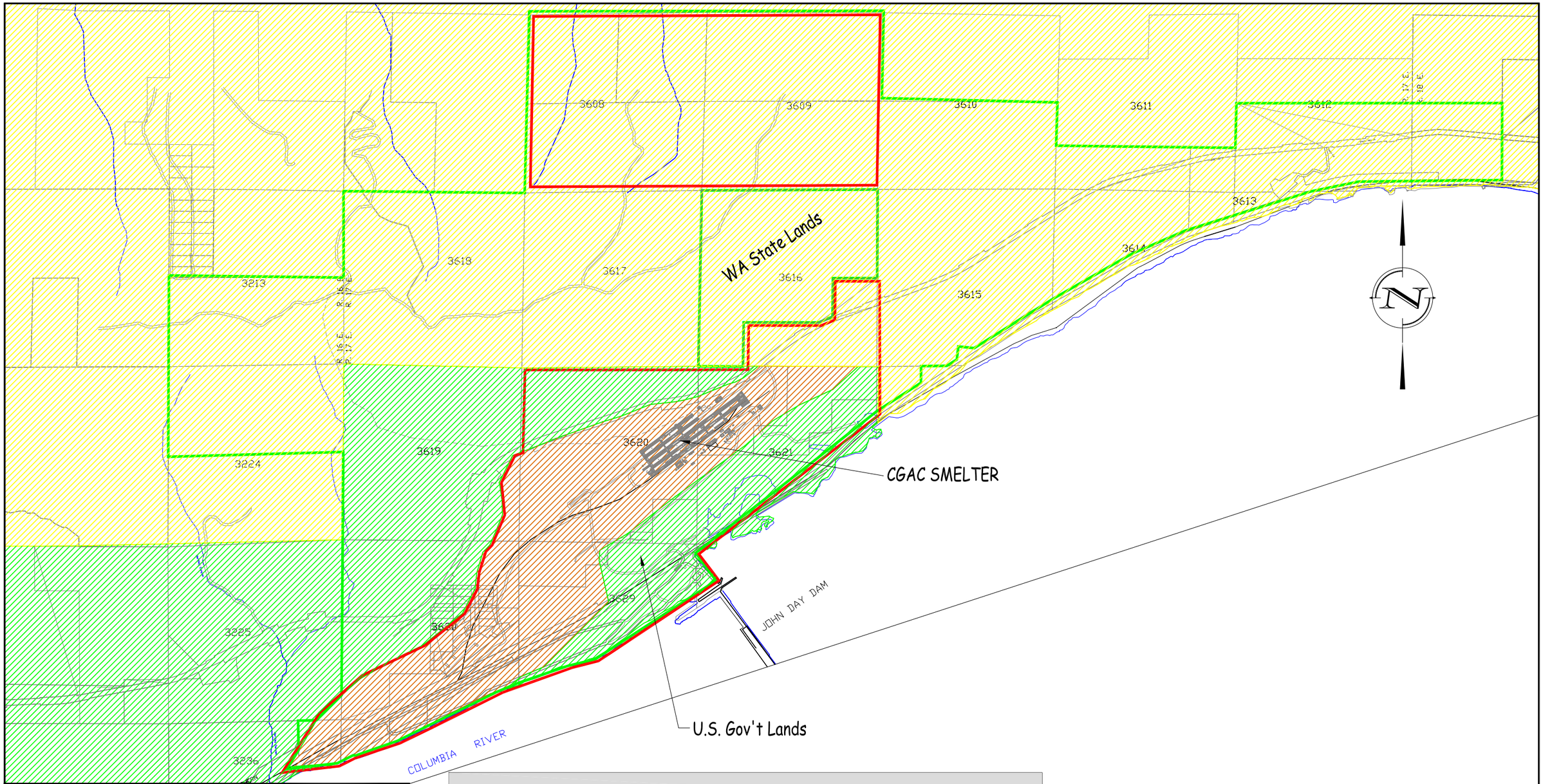

FIGURE 2-4

CLIFFS WATER SYSTEM

ZONING

Industrial Park Zone	
Open Space Zone	
Extensive Agriculture Zone	
Existing Retail Service Area	
Future Service Area	

(includes all of CGAC property, industrial zoned lands, private lands, and adjacent US Gov't lands)

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Date: 5/3/11
File: existing boundaries
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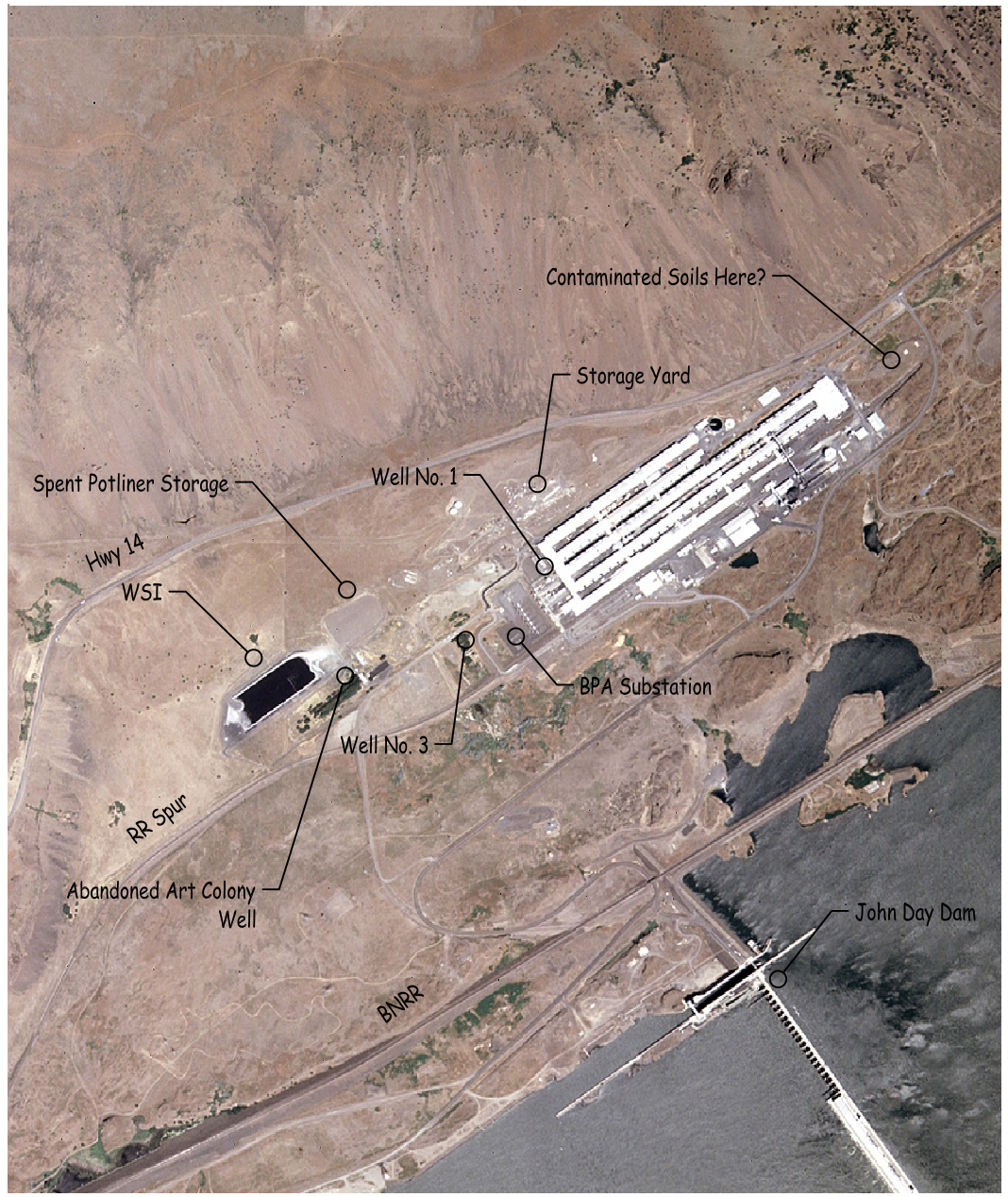

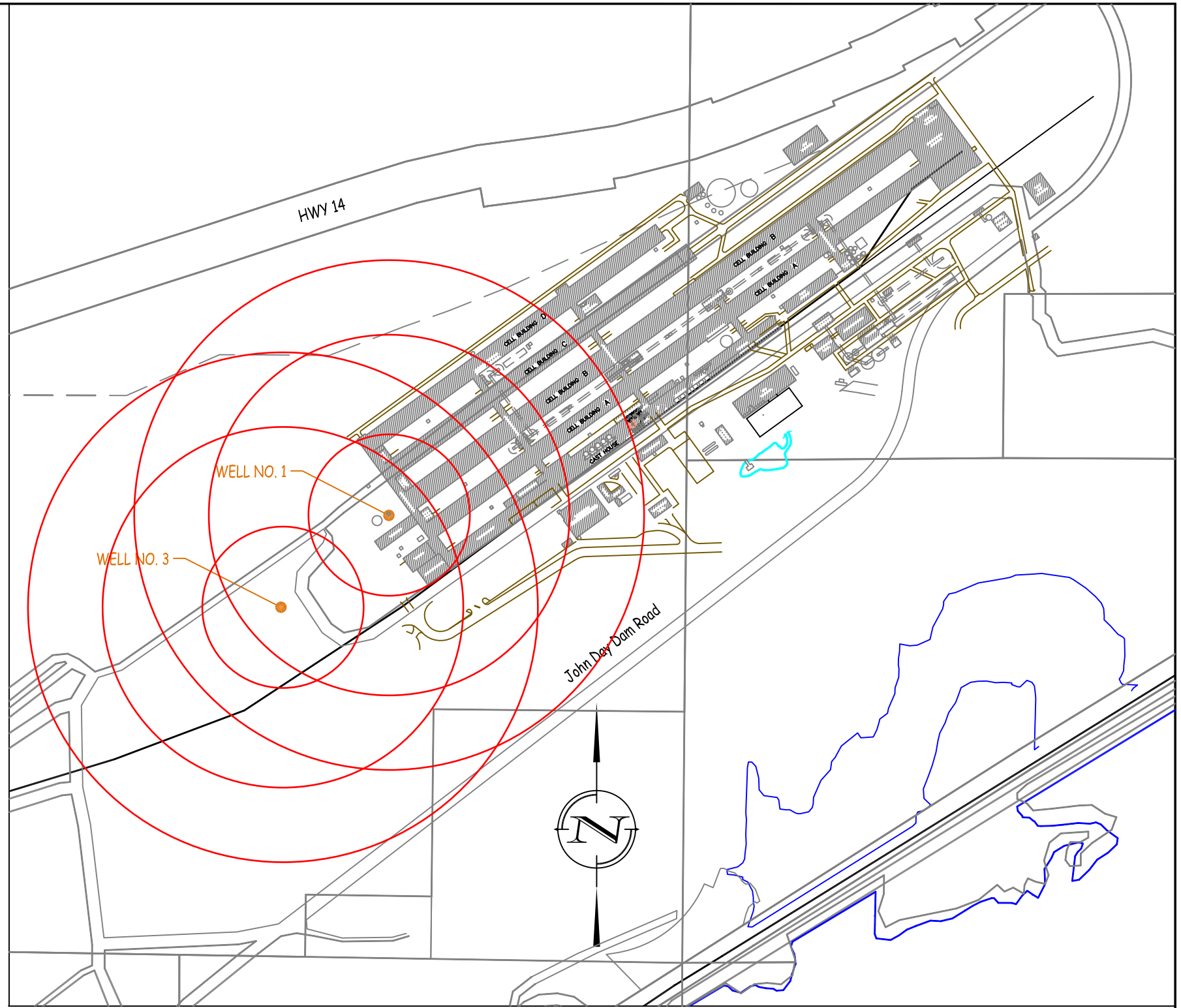

FIGURE 4-1
WELLHEAD PROTECTION

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Date: 4/08/10
File: water system figures
Not To Scale

Notes:

The CFR is shown for Wells 1 and 3. The 1, 5, and 10 year time of travel is shown. The CFRs are the same for each well (425 feet, 950 feet, and 1343 feet).

There are over 70 monitoring wells on CGAC property. In addition there are numerous potential sources of documented and undocumented contamination. For clarity only primary sources of contamination are shown.

Klickitat PUD
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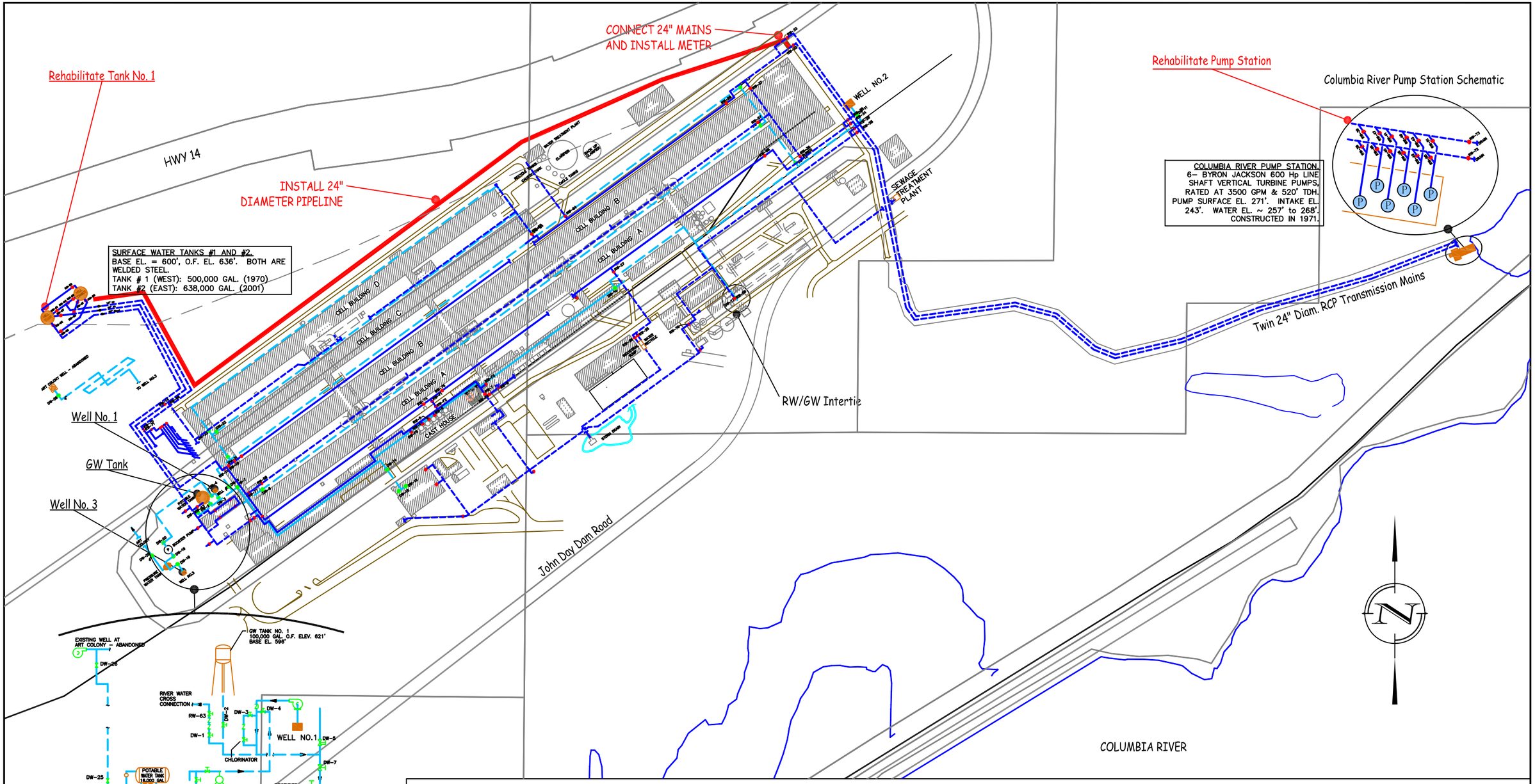

FIGURE 5-1
SW SYSTEM IMPROVEMENTS

Legend	Notes
Drinking Water Piping	Dashed lines are U.G.
River Water Piping	Solid are above grade.
Drinking Water Valves	DW-#
River Water Valves	RW-#
Water System Structures	
Smelter Structures	

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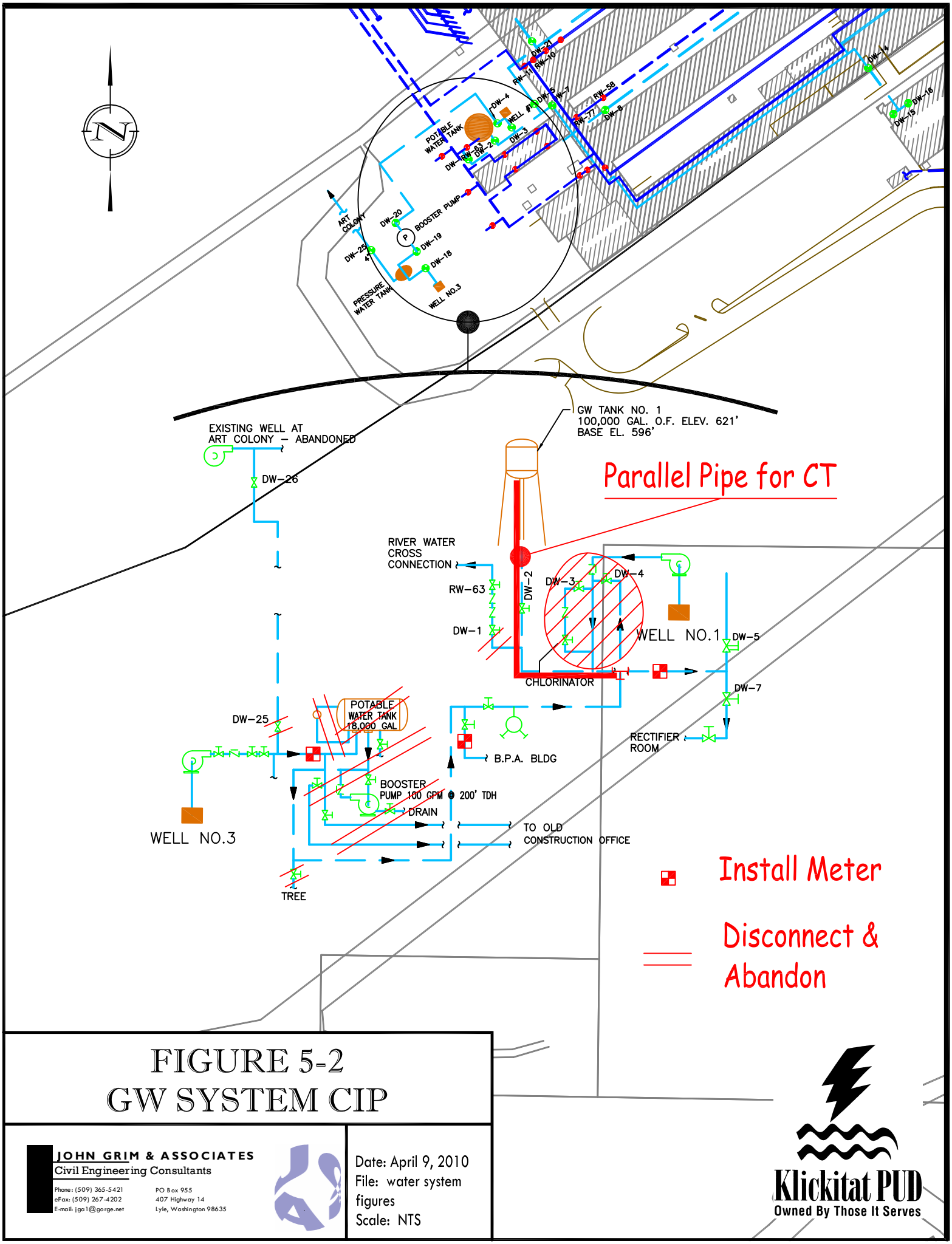

FIGURE 5-2
GW SYSTEM CIP

JOHN GRIM & ASSOCIATES
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eFax: (509) 267-4202
E-mail: jga1@gorge.net
PO Box 955
407 Highway 14
Lyle, Washington 98635

Date: April 9, 2010
File: water system figures
Scale: NTS

Klickitat PUD
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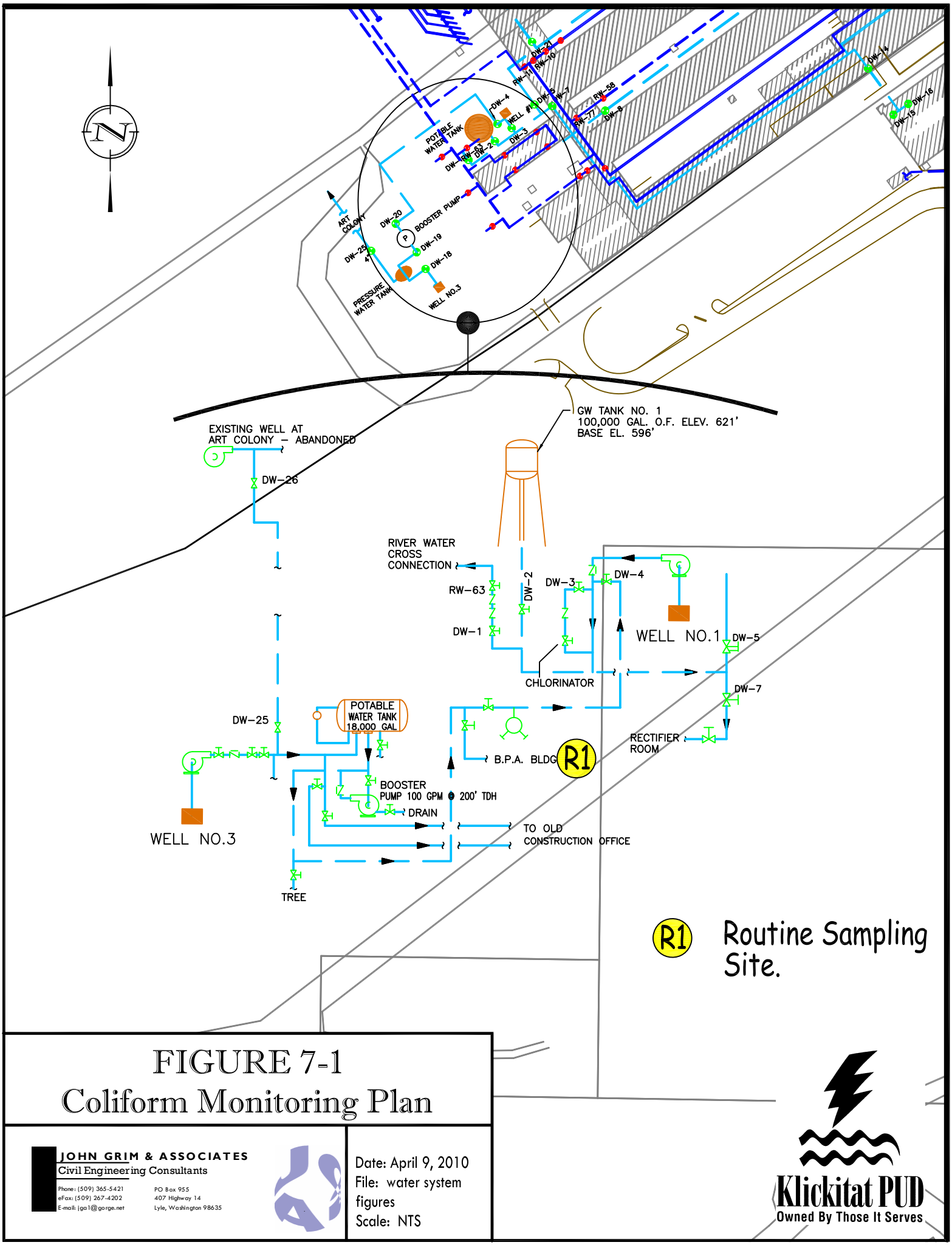

FIGURE 7-1
Coliform Monitoring Plan

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Date: April 9, 2010
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Scale: NTS

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CONNECT 24" MAINS

Rehabilitate Tank No. 1

HWY 14

INSTALL 30" DIA PIPELINE

6" GW to Future Industrial/Energy Facilities (Potable)

SURFACE WATER TANKS #1 AND #2.
BASE EL. = 600', O.F. EL. 636'. BOTH ARE WELDED STEEL.
TANK # 1 (WEST): 500,000 GAL. (1970)
TANK #2 (EAST): 638,000 GAL. (2001)

30" RW to Future Industrial/Energy Facilities

GW Tank

Well No. 3

EXISTING WELL AT ART COLONY – ABANDONED

GW TANK NO. 1
100,000 GAL. O.F. ELEV. 621'
BASE EL. 596'

RIVER WATER CROSS CONNECTION

Water Treatment / Control Plant

WELL NO.1

WELL NO.3

WATER TANK 15,000 GAL.

B.P.A. BLDG

BOOSTER PUMP 100 GPM @ 200' TDH

DRAIN

TO OLD CONSTRUCTION OFFICE

RECTIFIER ROOM

CELL BUILDING A

CELL BUILDING B

CELL BUILDING C

CELL BUILDING D

CAST HOUSE

SITE TREATMENT PLANT

CLARIFIER

SLUDGE DRYING BEDS

WELL NO.2

SEWAGE TREATMENT PLANT

RW/GW Intertie

John Day Dam Road

Rehabilitate Pump Station

Columbia River Pump Station Schematic

COLUMBIA RIVER PUMP STATION.
6– BYRON JACKSON 600 Hp LINE SHAFT VERTICAL TURBINE PUMPS, RATED AT 3500 GPM & 520' TDH. PUMP SURFACE EL. 271'. INTAKE EL. 243'. WATER EL. ~ 257' to 268'. CONSTRUCTED IN 1971.

Twin 24" Diam. RCP Transmission Mains

COLUMBIA RIVER

N

FIGURE 5-1
SW SYSTEM IMPROVEMENTS

Legend	Notes
Drinking Water Piping	Dashed lines are U.G.
River Water Piping	Solid are above grade.
Drinking Water Valves	DW-#
River Water Valves	RW-#
Water System Structures	
Smelter Structures	

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Date: 4/09/10
File: water system figures
Scale: NTS

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KLICKITAT PUD EMPLOYEE PHONE LISTING
March 9, 2020

Goldendale: 1313 S Columbus - 509-773-5891 or 1-800-548-8357
White Salmon: 110 NE Estes - 509-493-2255 or 1-800-548-8358

Web Site: www.klickitatpud.com
Intranet: http:kfiles/web

PICTURE	NAME	TITLE	WORK CONTACT	PERSONAL CONTACT	HIRE DATE
	Adams, Rick	P.C. Technician	Extension 646 509-773-7646 radams@klickpud.com **509-250-1136 (C)**	509-773-5905 (H)	8/8/2011
	Balcom, Jared	Staking Engineer I (WS)	Extension 554 509-493-9554 jbalcom@klickpud.com **509-250-3203 (C)**		8/20/2018
	Batte, Bobby	Substation Journeyman Wireman	(G) Extension 625 bbatte@klickpud.com **541-993-5908 (C)**		9/28/2015
	Beierle, Jess	Apprentice (08/2019)	gcrew@klickpud.com **509-250-6008 (C)**		7/30/2018
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	Cacy, Roberta (Robbie)	Buyer	(G) Extension 619 509-773-7619 rcacy@klickpud.com **509-250-0585 (C)**		7/29/1997
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	Casimiro, Alexandra (Alex)	Eng/Ops Support Assistant I (06/2018)	(G) Extension 632 509-773-7632 acasimiro@klickpud.com **509-250-3862 (C)**		11/13/2017
	Charters, Daniel	Customer Service Field Rep. (WS)	(WS) Extension 550 509-493-9550 dcharters@klickpud.com **509-637-0306(C)**	509-493-2912 (H)	11/1/1990
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	Dechand, Gregory	Apprentice (WS) (08/2019)	wscrew@klickpud.com **509-637-6473 (C)**		7/30/2018
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	Dorais, Robert	Journeyman Lineman (G)	gcrew@klickpud.com **509-261-2653 (C)**		3/20/2017
	Eldred, Del	Mechanic	(G) Extension 624 509-773-7624 deldred@klickpud.com **509-261-0632(C)**		6/13/2016
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	Evans, Chris	Network Administrator	(G) Extension 643 509-773-7643 cevans@klickpud.com **509-250-2556 (C)**	509-773-0134(H)	9/1/2008
	Fahlenkamp, Greg	Staking Engineer I (G)	Extension 633 509-773-7633 gfahlenkamp@klickpud.com **509-250-2446(C)**	509/250-2196	9/12/2016
	Fakesch, Lori	Billing Clerk	(G) Extension 611 509-773-7611 lfakesch@klickpud.com **509-250-1096 (C)**	509-369-2303 (H)	7/9/1996

	Frantum, Doug	Water/Wastewater Trainee	dfrantum@klickpud.com **509-250-0345 (C)**		2/24/2020
	Garner, Mark	Engineering Customer Supervisor	(WS) Extension 613 509-773-7613 mgarner@klickpud.com **509-261-2828 (C)**		4/23/2007
	Garrigus, Tim	Serviceman (Goldendale)	tgarrigus@klickpud.com **509-261-2501 (C)**	509-773-6403 (H)	8/10/2001
	Greenlaw, April	Operations Support Assistant II (01/2019)	(G) Extension 638 509-773-7638 agreenlaw@klickpud.com **253-797-3005 (C)**		7/31/2017
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	Halm, Noah	Water-WW Operator I	nhalm@klickpud.com **509-250-1678 (C)**		12/22/2016

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	Humphreys, Jonah	LFG Field Tech Lead	509-773-7429 (Ext 429) jhumphreys@klickpud.com **509-314-1125 (C)**	509-773-5990 (H)	3/10/2008
	Johnson, Brandon	Engineering Tech I (04/2018)	(G) Extension 615 509-773-7615 bjohnson@klickpud.com **509-250-1274 (C)**		6/16/2007
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	Lantau, Nichole	Accountant	(G) Extension 641 509-773-7641 nlantau@klickpud.com **509-261-2321 (C)**		10/19/2015
	Lexa, Edward	Serviceman (WS) (1/2016)	wscrew@klickpud.com **509-281-0438 (C)**	509-493-3101 (H)	4/16/2001
	Link, Jeff	LFG O&M Tech II	509-773-7425 509-384-5022 (Fax) jlink@klickpud.com **509-250-0116 (C)**	509-773-4850 (H)	9/3/2001
	Lutz, Theodore "TJ"	Journeyman Lineman (WS)	wscrew@klickpud.com **541-490-0327(C)**		5/4/2015

	Madsen, Tim	Metershop Wireman Apprentice (10/2019)	Direct: 773-7429 (Ext 429) tmadsen@klickpud.com **509-314-8130 (C)**		12/23/2013
	Manka, Shelby	Engineering Support Assistant I (6/13/16)	(G) Extension 612 509-773-7612 smanka@klickpud.com **541-993-0588 (C)**		6/22/2015
	Mata, Luann	Executive Assistant / Clerk of the Board (05/ 2017)	(G) Extension 606 509-773-7606 lmata@klickpud.com **509-250-0343 (C)**	509-773-0216 (H)	7/1/2003
	McLagan, Pat	LFG O&M Tech II	pmclagan@klickpud.com	307-259-4210	5/14/2018
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	Moss, Jim	Products & Services Analyst	(G) Extension 608 509-773-7608 jmoss@klickpud.com **509-250-3810 (C)**	509-773-3114 (H)	7/16/1984
	Myers, Brandy	Customer Service Supervisor	(G) Extension 609 509-773-7609 bmyers@klickpud.com **509-948-0369 (C)**		8/1/2012
	Niva, J. Todd	Goldendale Crew Foreman (10/2018)	(G) Extension 626 509-773-7626 gcrew@klickpud.com **509-250-3969 (C)**		7/1/2010
	Noviks, Craig	Journeyman Lineman (G)	gcrew@klickpud.com **509-314-8443 (C)**		2/22/2016
	Ohnstad, Sharon	Accounting Clerk	(G) Extension 644 509-773-7644 slohnstad@klickpud.com	360-600-4808 (C)	3/20/2017

	O'Leary, Kirt	Storekeeper (06/2018)	(G) Extension 627 509-773-7627 koleary@klickpud.com **509-261-1944 (C)**		11/16/2008 Re-Hired 3/24/2014
	Olson, Matt	Meterreader	Ext. 652 (Drive-Up) molson@klickpud.com **509-261-1304 (C)**	509-261-1304	10/3/2018
	Osborne, Craig	Wireman Trainee	509-773-7625 cosborne@klickpud.com	509-788-5026	3/18/2019
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	Predeek, Bernard	White Salmon Crew Foreman (11/2015)	wscrew@klickpud.com (WS) Ext. 557 509-493-9557 **541-490-4442 (C)**		6/10/1998
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	Ricks, Kevin	Generation Assets/Special Projects Manager	Direct: 773-7430 (Ext 430) kricks@klickpud.com **509-261-2063 (C)**	509-773-5480 (H)	5/18/2010
	Rogers, Bill	Sr. Storekeeper 04/2018	(G) Extension 642 509-773-7642 brogers@klickpud.com **509-250-0251 (C)**	509-773-3968 (H)	12/1/1998
	Schmidt, John	ICE Tech/Operator	509-773-7425 509-384-5022 (Fax) jschmidt@klickpud.com	509-947-2161	8/12/2019
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	Schultz, Ronald	Engineering Manager (10/2019)	(G) Extension 631 509-773-7631 rschultz@klickpud.com **541-490-4045 (C)**		3/18/2002
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	Watson, Gregory	W-WW Operator II	gwatson@klickpud.com **509-250-2262 (C)**	509-773-6797 (H)	4/14/2008
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COMMISSIONERS		CURRENT TERM	TELEPHONE	EMAIL
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	Miller, Douglas B. (12/16) (Dist 2 -Cntrl)	12/2016 to 12/2022 (1st term)	509-773-6292 (H) 509-261-2153 (Cell)	dmiller@klickpud.com
	Gunkel, Dan G. (12/90) (Dist 3 - East)	12/2014 to 12/2020 (5th term)	509-773-4698 (W) 541-980-1208 (Cell) 509-773-3991 (Fax)	dgunkel@klickpud.com
	MISC. OFFICES	**NUMBER**	**FAX NUMBER**	**TOLL FREE #**
	BULL ROOM - White Salmon	Ext. 559 509-493-9559		
	BULL ROOM - Goldendale	Ext. 628 509-773-7628		

	COPY ROOM (G)	Ext 653			
	COMMISSION RM	Ext 660			
	MEETING RM (G)	Ext 656			
	ADMIN (G)		509-773-4969		
	OPERATIONS TRLR - Lori K		509-773-3111		
	OPERATIONS TRAILER (J.R.)@ WAREHOUSE		509-773-2000		
	ENGINEERING DEP'T (G)		509-773-6431		
	WATER-WW		509-773-3111		
	WAREHOUSE (G)	509-773-4940	509-773-5889	800-548-8357	
	White Salmon Office	PO Box 187, W.S. 509-493-2255	509-493-1232	800-548-8358	
LFG	LFG I & II - all 3 control rms	502 Roosevelt Grade 509-773-7425	509-384-5022		
	LFG - Low Compression Building	509-773-7432 Ext. 432			
	LFG - Engine Building Office	509-773-7433 Ext. 433			
	LFG Office - Kevin Ricks	509-773-7430 Ext. 430			
	LFG Office #2	509-773-7429 Ext. 429			
	SUBSTATIONS	**NUMBER**	**FAX NUMBER**	**TOLL FREE #**	
	BINGEN SUB	509-493-3215			

	CLEVELAND SUB	509-896-5151			
	DARLAND SUB	509-773-3805			
	E.E. CLOUSE SUB	509-773-4361			
	ENERGIZER SUB	509-773-4064			
	GILMER SUB	509-493-2522			
	GLENWOOD SUB	509-364-3503			
	GOLENDALE SUB	509-773-3503			
	GOODNOE SUB	509-773-6151			
	HARVEST WIND	509-896-5401			
	HUSUM SUB	509-493-3227			
	JOHN DAY SUB	509-773-9135			
	KLICKITAT SUB	509-369-2008			
	LFG SUB- BioGas I	509-384-5023			
	LFG SUB-BioGasII	Direct: 411			
	LINDEN SUB	509-773-4361			
	LYLE SUB	509-365-3200			
	M.A. COLLINS SUB	509-894-4243			
	ROOSEVELT SUB	509-384-5501			
	SPEARFISH SUB	509-767-1435			
	WHITE CRK SUB	509-896-5342			
	WILLIS SUB	509-773-3851			
	WISHRAM SUB	509-748-2027			
	WASTEWATER PLANTS	**NUMBER**	**FAX NUMBER**	**TOLL FREE NUMBER**	
	DALLESPORT	509-767-2132 (Lab)	509-767-2137		
	GLENWOOD	509-364-0027			
	LYLE	509-365-2384	SAME AS PHONE #		
	WISHRAM	509-748-2002	SAME AS PHONE #		

	KLICKITAT	509-369-2209	SAME AS PHONE #		
	WHITE CREEK WIND SITE	**NUMBER**	**FAX NUMBER**	**EMAIL**	
	BJORN HEDGES	509-896-5246	509-896-5263	bjorn.hedges@wcwind1.com	