Cumulative Hydrologic Impact Assessment

Of the

Pacific Coast Coal Company

John Henry No. 1 Mine

Prepared By

United States Department of Interior

Office of Surface Mining Reclamation and Enforcement

Western Region – Denver, Colorado

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1 Introduction

The Office of Surface Mining Reclamation and Enforcement (OSM) is the Regulatory Authority for coal mining operations that occur in the state of Washington. As such, OSM is responsible for the review and decisions on all permit applications to conduct surface coal mining operations. The John Henry No. 1 Mine, operated by the Pacific Coast Coal Company (PCCC), is required to have a Cumulative Hydrologic Impact Assessment (CHIA) prepared by the Regulatory Authority which assesses whether the proposed operation has been designed to prevent material damage to the hydrologic balance outside the permit area (30 C.F.R. § 947.780.21(g)). A CHIA is an assessment of the Probable Hydrologic Consequences (PHC) of the proposed operation and all anticipated mining upon surface and groundwater systems in the Cumulative Impact Area (CIA). The PHC is prepared by the applicant as required by 30 C.F.R. § 947.780.21(f), and approved by the Regulatory Authority. Congress identified in the Surface Mining Coal and Reclamation Act that there is "a balance between protection of the environment and agricultural productivity and the Nation's need for coal as an essential source of energy" (SMCRA, 1977 Sec 102(f)). The Hydrologic Reclamation Plan required by the rules at 30 C.F.R. § 947.780.21(h) recognizes that disturbances to the hydrologic balance within the permit and adjacent area should be minimized, material damage outside the permit area should be prevented, applicable Federal and State water quality laws should be met, and the water rights of present water users protected. Therefore, this document is being prepared in order to comply with specific regulations located at 30 CFR 947.780.21 that require a CHIA to be written or updated, for the purposes of permit approval, by the regulatory authority in order to make the aforementioned finding.

This CHIA is organized as follows:

- Chapter 1 describes information on:
    - CHIA definitions and concepts;
    - Background of coal production and proposed mining at the John Henry No. 1 Mine;
    - Regional conditions for geology, groundwater, climate, surface water, and vegetation;
    - Delineation of the Cumulative Impact Area.
- Chapter 2 provides a description of water resource uses and applicable water quality criteria.
- Chapter 3 presents baseline information provided in the 1984 CHIA.
- Chapter 4 contains an impact assessment of the operation on surface and groundwater quantity and quality, and includes a determination of:
    - The minimization of impacts within the permit area;
    - The impact designations for each potential effect on the hydrologic balance;
    - The impacts of coal mining within the Cumulative Impact Area;
- Chapter 5 provides the material damage finding and impact criterion.

1.1 Definitions

1.1.1 Cumulative Impact Area (CIA)

A CIA is defined at 30 C.F.R. § 947.701.5 as, ". . . the area, including the permit area, within which impacts resulting from the proposed operation may interact with the impacts of all anticipated mining on surface- and ground-water systems." The CIA is an area where impacts from the coal mining operation, in combination with adjacent coal mining operations, may cause material damage. The size and location of a given CIA will depend on the surface water and groundwater system characteristics, the hydrologic resources of concern, and projected impacts from the operations included in the assessment (OSM, 2007).

1.1.2 Material Damage to the Hydrologic Balance

Sections 507(b) (11) and 510(b) (3) of SMCRA, and 30 C.F.R. § 947.780.21 (g) require OSMRE to determine that a mining and reclamation operation has been designed to prevent material damage to the hydrologic balance outside the permit area. "Hydrologic balance" is defined at 30 C.F.R. § 947.701.5 as, "the relationship between the quality and quantity of water inflow to, water outflow from, and water storage in a hydrologic unit such as a drainage basin, aquifer, soil zone, lake or reservoir. It encompasses the dynamic relationships among precipitation, runoff, evaporation, and changes in ground and surface water storage."

"Material damage to the hydrologic balance" is not defined in SMCRA or at 30 C.F.R. § 947.701.5. The intent of not developing a programmatic definition for "material damage to the hydrologic balance" was to provide the Regulatory Authority the ability to develop a definition based on regional environmental and regulatory conditions. Although the definition of material damage as it pertains to surface water and groundwater in the CIA is at the discretion of the regulatory agency, some generally accepted interpretations will be outlined and following this a working definition will be stated for use in this evaluation.

There are performance standards located in 30 C.F.R. § 947.816.41 that protect against coal mining impacts to water resources, specifically impacts that would preclude an existing water use associated with a water right or render a water supply unable to support the post-mining land use. It is stated in 30 C.F.R. § 947.816.42 that "discharges of water from areas disturbed by surface mining activities shall be made in compliance with all applicable State and Federal water quality laws and regulations and with the effluent limitations for coal mining promulgated by the U.S. Environmental Protection Agency set forth in 40 C.F.R. § 434." Water quality standards are developed and implemented by the U.S. Environmental Protection Agency (EPA) and applicable State regulatory authorities in order to protect water bodies from degradation that could potentially impact designated uses of that water (EPA, 1993). These water quality standards are designed to prevent impacts to water bodies that could occur from discharges, runoff, or other water migration from point sources and non-point sources of pollutants.

Therefore, for the purpose of this CHIA;

> **<u>Material Damage to the hydrologic balance outside the permit area</u>** means any quantifiable adverse impact from surface coal mining and reclamation operations on the quality or quantity of surface water or groundwater that would preclude any existing or reasonably foreseeable use of surface water or groundwater outside the permit area.

1.1.3 Material Damage Criteria

Except for water quality standards and effluent limitations established at 30 C.F.R. § 947.816.42, the determination of material damage criteria is at the discretion of the regulatory authority (48 FR 43972-43973, 1983 and 48 FR 43956, 1983). Material damage criteria for both groundwater and surface water quality should be related to existing standards that generally are based on the maintenance and protection of specified water uses such as public and domestic water supply, agriculture, industry, aquatic life, and recreation. A CHIA also can include material damage standards for parameters of local significance to water use (OSM, 2007).

1.2 CHIA Revision Rationale

This 2014 CHIA for John Henry No. 1 Mine provides an update to the 1984 John Henry CHIA and reflects a current hydrologic assessment of the mine operation and reclamation plan provided as part of a significant permit revision submitted by PCCC on April 18, 2011. The Federal regulations at 30 C.F.R. § 947.773.15 state that no permit application or application for a significant revision of a permit shall be approved until the regulatory authority makes an assessment of all anticipated mining within the CIA and makes a finding that the coal mining operation has been designed to prevent material damage to the hydrologic balance outside the permit area. The finding that the proposed operation has been designed to prevent material damage to the hydrologic balance outside the permit area is supported by an evaluation of potential impacts due to coal mining operations in the CIA, and impact minimization techniques taken by the coal operator within the permit area.

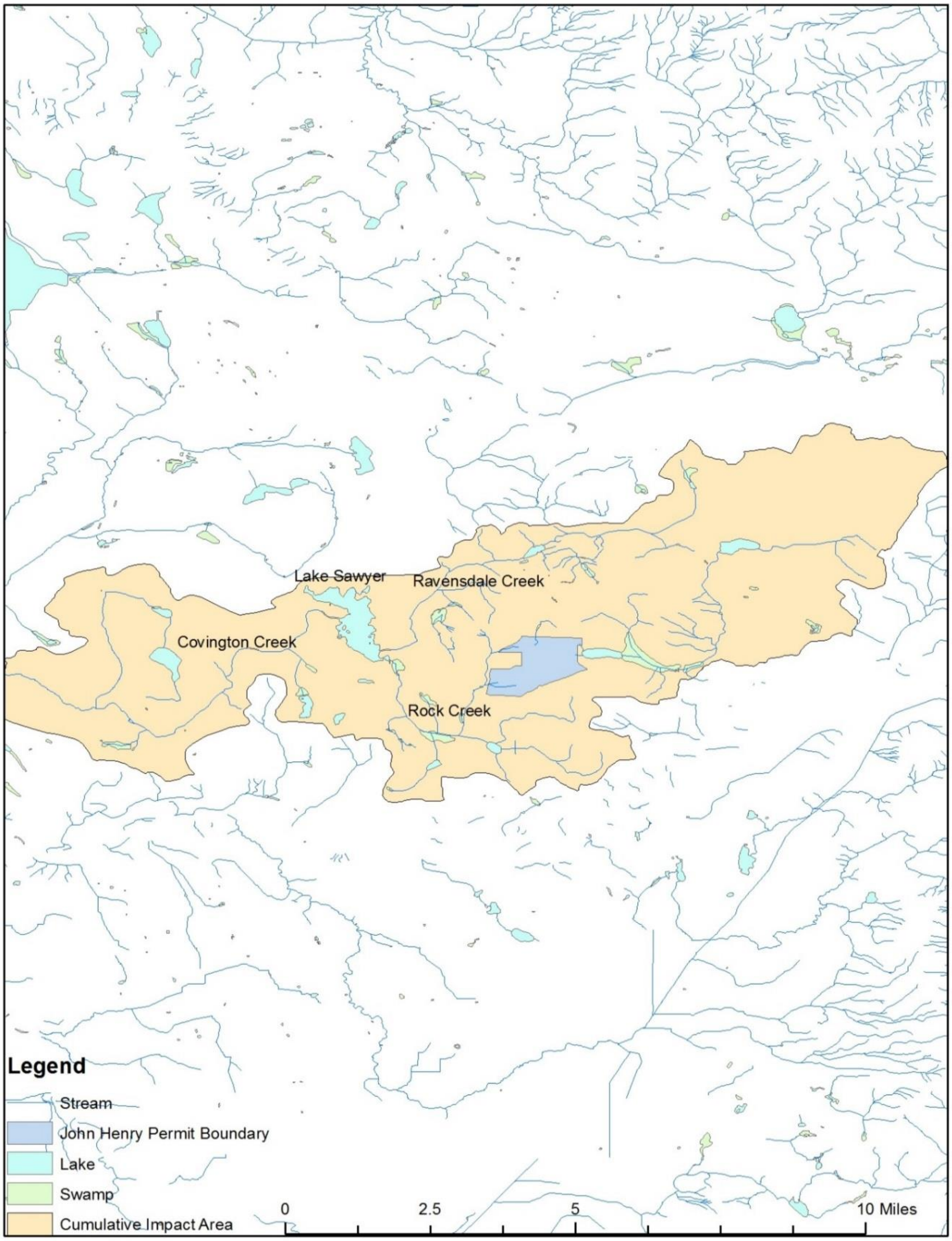
The 2014 CHIA for John Henry No. 1 Mine:

1) Evaluates phosphorous loading impacts from the mine to Lake Sawyer;
2) Identifies material damage thresholds and limits;
3) Expands the 1984 CIA to include Lake Sawyer and the associated HUC 12 watershed;
4) Considers information provided in the April 2011 significant permit revision submitted by PCCC;
5) Considers water quality and quantity datasets that have been collected at the mine since 1993.

1.3 Cumulative Impact Area Delineation

The John Henry No. 1 Mine CIA is modified from the previous CHIA to assess potential hydrologic impacts within a larger watershed area than was delineated for the 1984 CHIA. The extent of the expanded CIA for the mine is the same as that of the Ravensdale Creek HUC 12 watershed. The watershed is approximately 21,743 acres, and includes Ravensdale Creek, Covington Creek, Ginder Creek, Rock Creek, Lake Sawyer, and Lake No. 12. Although there are no neighboring or proposed mining operations within the CIA, downstream impacts could potentially exist on a larger scale and are evaluated accordingly. The 2014 John Henry No. 1 Mine CIA is illustrated in Figure 1.

Figure 1: 2014 John Henry No. 1 Mine Cumulative Impact Area



1.4 Background

PCCC proposes to resume surface coal mining and reclamation at the John Henry No. 1 Mine in King County, Washington, located west of Kent Washington near the City of Black Diamond (Figure 2). Coal production began to taper down in the late 90's, eventually ceasing after 1999. Proposed mining will occur to a small extent in Pit 1 and predominantly in Pit 2, where an estimated 440,000 tons of coal reserves are projected for removal over a 6-year period. PCCC projects the coal reserves are economically recoverable due to changes in market conditions. PCCC submitted a significant permit revision application for the John Henry No. 1 Mine, Federal Permit No. WA-0007D, dated April 18, 2011. OSM determined that the application was administratively complete on April 28, 2011.

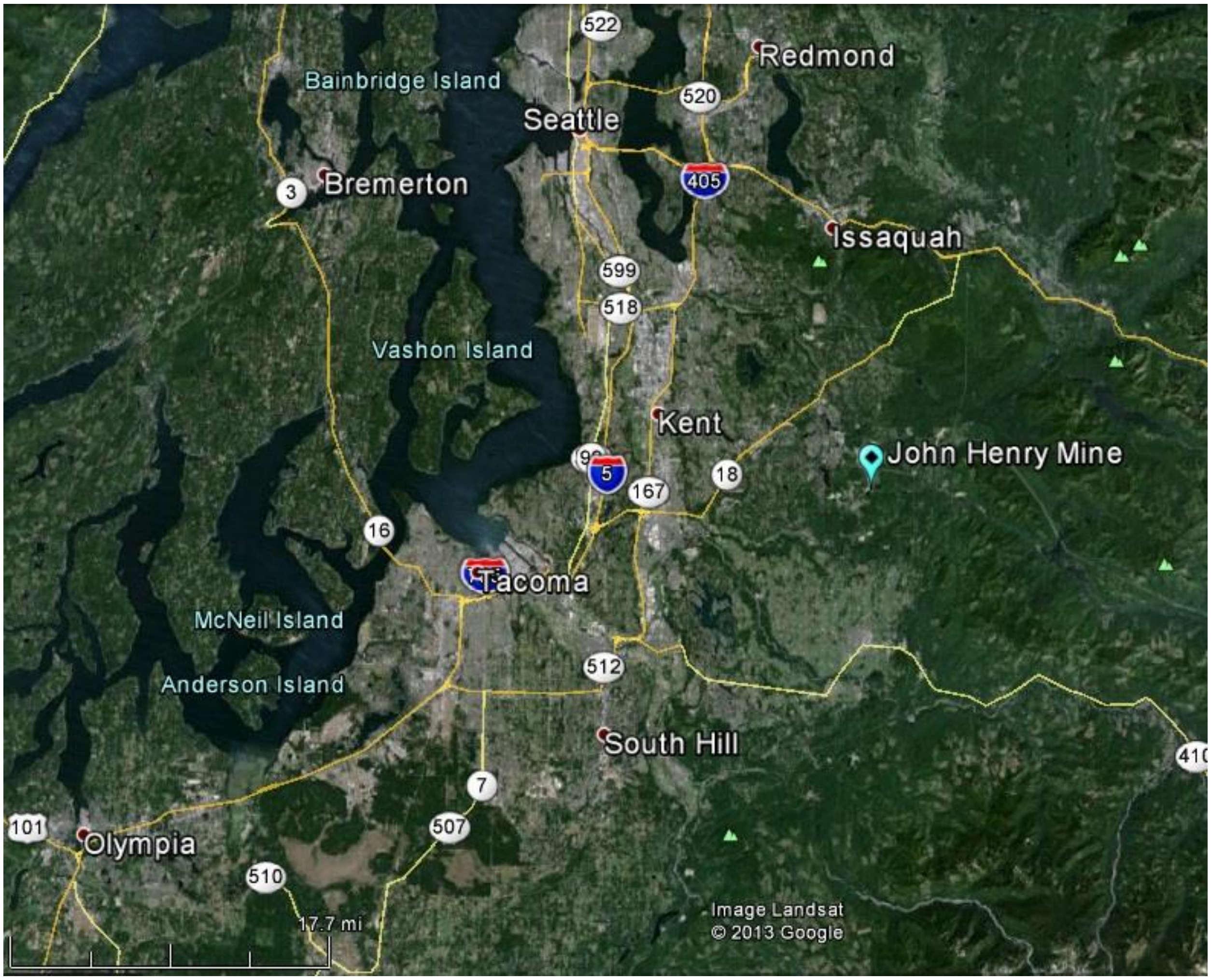
The John Henry No. 1 Mine consists of approximately 480 acres located in south King County, Washington. It was first permitted in 1986 and operated through the late 1990's. The permit was successively renewed in five year intervals with the most recent renewal approved December 7, 2006. To date, approximately 1.9 million tons have been removed from the mine area (PCCC, John Henry No. 1 Permit). The general location of the property is shown on Figure 2.

The approved mining permit contains a mining and reclamation plan that PCCC followed during active mining and reclamation. The permit details a mining and reclamation plan that serves to assist in calculating the amount of the reclamation bond necessary to achieve final reclamation. In April 2009, OSM issued a permit revision order requiring PCCC to either resume mining or take measures toward final reclamation of all operations. OSM also required PCCC to demonstrate a market for its coal existed through documentation of a sales contract. In December 2009, PCCC notified OSM of its intent to resume mining, but had not secured a contract to sell the coal. OSM determined that a contract was required, and through a series of administrative actions required PCCC to revise its permit to stop mining and proceed with final reclamation.

PCCC negotiated and signed a coal supply contract with Lehigh Hanson Cement in April 2011 and submitted a permit revision application and a copy of the signed coal supply contract. The revision application proposed an estimated extraction of 84,000 tons of coal per year.

The following assessment includes information from the previous 1984 John Henry CHIA, the final Environmental Impact Statement, and documents prepared under the initial Small Operators Assistance Program (SOAP) (Geoengineers, 1983)(Systems Architects Engineers, 1983)(US Dept. of the Interior, 1985)(OSM, 1984). The updated PHC determination prepared by PCCC and surface and groundwater quality data collected since 1993 were also used to make this assessment of hydrologic impacts.

Figure 2: Location of the John Henry Mine Site



1.4.1 History

Underground coal mining and logging were historically the major land uses within the CIA. Residential development and forestry are the major land uses in the area surrounding the CIA today. To facilitate land development, Mud Lake was created in the early 1900's as a fresh water source for the town of Black Diamond. In 1968, Mud Lake was a shallow reservoir, with plant growth in and around the edge of the water body. Wetlands were established in the lake area after an upstream dam washed out following a large rain event in 1971. The resultant wetland area is dominated by typical western Washington wetland plant species, and there is no open water remaining in Mud Lake today. Ginder Lake, a man-enlarged lake at the northwest corner of the permit area, is within approximately 300 feet of a spoil rock disposal area, and approximately 1,000 feet from the pit operations area.

1.4.2 Geology

The coal beds mined at John Henry No. 1 Mine are within the sedimentary bedrock of the Puget Group, deposited during the late Eocene, approximately 40 million years ago. The strata were faulted and folded during Oligocene and late Eocene. The main structural feature in the area is the Black Diamond Anticline, which exhibits an axis that trends southwest to northeast across the area. The dip range on the southeast limb of the asymmetrical anticline is steeper than the northwest limb, trending at 45-60 degrees and 20-45 degrees respectively. This anticline is truncated on the north by the east-west trending Ginder Lake Fault. The rock strata area approximately 55 percent sandstone, 35 percent siltstone, and 10 percent shale, carbonaceous claystone, and coal. Overlying the Puget Group are Pleistocene age glacial drift deposits ranging from 0 feet to 70 feet in thickness. Depressions in the drift form lakes and marshy sections within the permit area. Coal seams mined at the John Henry No. 1 Mine include the Big Dirty and Franklins No. 7, 8, 9, 10, and 12 (Vine, 1979). An illustration of the stratigraphic sequence at the John Henry No. 1 Mine is shown in Figure 3.

Figure 3: Stratigraphic Section of the John Henry No. 1 Mine (US Dept of the Interior, 1985)

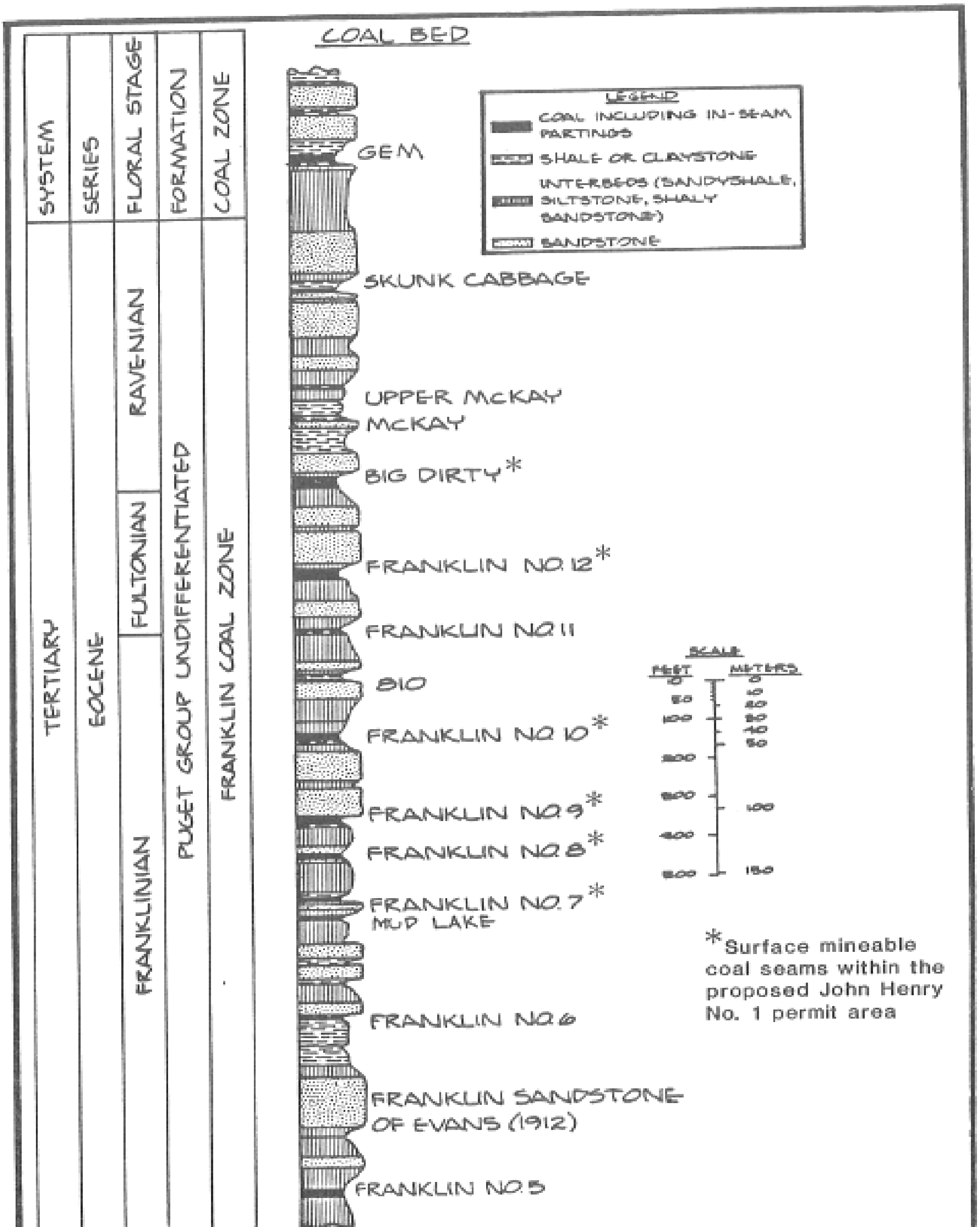


Figure 3.2-1.--Typical stratigraphic section of the Black Diamond anticline (Source: Modified from King County, Washington, 1982).

1.4.3 Groundwater

Groundwater flow in the Puget formation occurs as a combination of inter-granular flow that results from primary permeability and fractured flow that results from secondary permeability. Due to the high clay and silt content of the overburden, fracturing controls most of the flow of the groundwater in the subsurface. Permeability from field tests in the upper zone (base of glacial till to about 135 feet) of the overburden range from about 9.2 to 149 feet/year, with an average of 57 feet/year. The lower permeability zone (135 feet to approximately 260 feet below ground surface) has very low values, with a range of 0.4 to 6.6 feet per year with an average of 2.6 feet/year (OSM, 1984) (Geoengineers, 1983).

The glacial till, averaging less than 40 feet thick in the permit area, can be subdivided into two zones. In the lower zone, it is dense and poorly sorted and is known as lodgement till. The upper zone is oxidized to a brown color, is less dense, and has interbedded lenses of sand and gravel. Permeability testing produced values of 18 feet/year and 31 feet/year, respectively. These low values are due to the poorly sorted, dense nature of the material. Vertical permeability is estimated to be at least one order of magnitude less than the horizontal values. This anisotropy results in reduced water infiltration into the Puget group, and the till cannot be considered an aquifer since it cannot yield enough to provide for a significant water use (Vine, 1979).

1.4.4 Climate

The area around Black Diamond receives an average of 48 inches of rainfall a year. Runoff is estimated at 20 inches per year and evapotranspiration is 23 inches per year. The months of October through March have the highest mean total precipitation, with November through March having four or more inches. July and August are usually the driest months. The rainfall patterns in the area affect surface water runoff volumes throughout the year (PCCC, John Henry No. 1 Permit).

1.4.5 Surface Water

The permit area is located in three sub-watersheds: Ginder Lake, Mud Lake, and Lake No. 12. Ginder Lake and Mud Lake both drain to the west via Ginder and Mud Lake Creeks, eventually flowing to Lake Sawyer. Lake No. 12 is situated just east of the permit area and discharges to the east through a wetland area, eventually flowing to the Green River. Lake No. 12 Creek originates on the permit area and flows east into Lake 12. Ginder Creek and Mud Lake Creek originate at the outflow points of Ginder Lake and Mud Lake and flow west from the permit area. The surface water regime in the area is dominated by the effects of the Pacific Northwest climate.

1.4.6 Vegetation

Thirteen plant associations have been identified within the permit area. Eleven of these 13 are the result of timber harvesting or clearing for farming in what would otherwise be a community consisting of western hemlock, salmonberry, swordfern. Historically, much of the area supported Douglas fir, western red cedar, and possibly Sitka spruce as well as western hemlock. The site was initially logged in the 1880's for Douglas fir timbers. Logging continued on the site until 1971, when the last of the timber harvesting was done. Today, bigleaf maple and red alder dominate most of the areas previously dominated by conifer (US Dept of the Interior, 1985).

2 Water Resource Uses and Applicable Water Quality Criteria

2.1 Significant Water Uses

2.1.1 Black Diamond Water Supply

The City of Black Diamond obtains water for its residents from three sources. The primary source is a series of natural springs known as the Black Diamond Spring Field, located approximately two miles southeast of the city, on both the north and south sides of the Green River just east of SR-169. The water is pumped to a reservoir tank constructed in 2006, located on Lawson Road near the city limits. This location also provides access a secondary source of water, through an intertie with the adjacent City of Tacoma Second Supply Pipe Line. This pipeline was completed in 2005 and is used to transport water for the City of Tacoma from its source on the Green River. The residents of the Lake Sawyer area, located northwest of the original city and annexed by Black Diamond in 1998, continue to be served by the Covington Water District. The Covington Water District serves a large area north and west of Black Diamond, including the cities of Covington, Maple Valley and unincorporated King County (PacWest Engineering, 2008).

2.1.2 Lake Sawyer

Lake Sawyer is within the HUC12 watershed where John Henry No. 1 Mine is located, adjacent to the city of Black Diamond. It has a surface area of approximately 280 acres and an upstream watershed area of 8130 acres. The lake's main inlets are Ravensdale and Rock Creek which enter from the south and the main outlet is Covington Creek which drains to the west.

Lake Sawyer has had water quality problems since the 1970s related to eutrophication, with phosphorous the primary cause of the water quality problem. After an initial problem with poorly designed septic systems in the area, a wastewater treatment plant was installed to mitigate the increased phosphorous loads to the lake. Unfortunately, the plant was subject to design flaws, dismantled shortly after construction, and the wastewater re-routed to another watershed. Although phosphorous flux is no longer occurring from the waste water treatment plant, a significant amount phosphorous continues to the lake from natural conditions in the surrounding area.

This natural loading of phosphorous, in addition to the gradual urbanization of the area, prompted the Washington Department of Ecology (WDOE) to conduct a study on Lake Sawyer and institute a Total Maximum Daily Load (TMDL) for phosphorous on the incoming streams in 1991 (Shoblom, 2009). A loading model was developed to gain an understanding of the mechanisms controlling phosphorous loading in the lake, and a TMDL with a concentration no greater than 16 µg/L of phosphate as P was instituted for Lake Sawyer.

2.1.3 Other Water Users

The following private wells and small public water systems were identified in the City of Black Diamond Water System Comprehensive Plan:

Table 1: Additional Water Systems in the Black Diamond Area

Water System Name	Type	No. Connections	Source
Diamond Springs Water Association	A	43	Groundwater
Sawyerwood Estates Water System	A	22	Well
Sawyerwood Water System	A	11	Well
Aqua Dolce Water System	B	6	Well
Beadle Freshwater Water System	B	3	Well
Boondocks Tavern	B	2	Well
Britton/Lenton Water System	B	2	Well
Callero, A	B	4	Well
Diamond Acres	B	4	Well
Diamond Ridge	B	5	Well
Henry Community WS	B	2	Well
Joyce Water System	B	1	Well
Maier/Brazier Water System	B	7	Groundwater
Oosterink Water System	B	2	Well
Pacific Coast Coal Company	B	1	Well
Palmer Spring	B	9	Groundwater
Smith, Claude	B	3	Well
Stuth Company	B	3	Well
W. & S. #1	B	5	Groundwater
Williams, C. (Comm.) Water System	B	4	Well

Database searches and neighborhood surveys were conducted to identify wells and water users in the vicinity of the permit area during preparation of the original PHC and 1984 CHIA. Table 2 provides results of an updated WDOE database search of registered wells conducted in February 2012 for Sections 11, 12, 13, & 14, T21N, R6E; and Section 7, T21N, R7E.

Table 2: Registered Wells near the John Henry No. 1 Mine

Well Log ID	Well Tag No.	Well Depth	Diam	Well Owner	Twp	Rng	Sct	Qtr Sect	Qtr-Qtr Sect	Compl. Date
90592		240	6	Don Fisher	21N	6E	11	NE	SE	11/20/86
190722	AFA730	100	6	B & M Investments	21N	6E	11	NE	SW	8/24/99
96501		127	6	Ray Cheathour *(sic – Cheatham)*	21N	6E	11	NE	SW	3/11/81
109289	ABE831			Sammamish Plateau Wtr & Swr Dist. Test Well Program	21N	6E	11	NW	NE	11/17/94
94056		300	6	Ken Marshall	21N	6E	11	SE	SW	4/13/92
94589		240	6	Lee Riechert *(sic - Reichert)*	21N	6E	11	SE	SW	2/4/80
93015		243	6	Jerry Carstems	21N	6E	12	NE	NE	8/28/90
98276		180	6	Tim Buckley	21N	6E	12	NE	NE	5/19/80
98277		240	6	Tim Buckley	21N	6E	12	NE	NE	7/30/80
88630		300	6	Bob Morris/Pacific Ceast Conl *(sic - Pacific Coast Coal)*	21N	6E	12	NE	NW	10/9/84
95122		300	6	Mary Lee	21N	6E	12	NE	NW	9/24/85
91193		318	6	Esko Café *(sic - Cate)*	21N	6E	12	NE	SE	1/7/93
96843		96	6	Rick Schultz	21N	6E	12	NE	SE	1/15/93
89297		200	6	Cheryl & Randy Gramley	21N	6E	12	SE	NE	12/2/91
91462		80	6	Fred Brown	21N	6E	12	SE	NE	10/6/80
713181	BCB374	209	6	Terry Hildebrand	21N	6E	12	SE	NE	3/22/11
445451	AKG058	137	6	Gregory Stichney	21N	6E	12	SW	SE	11/22/04
664510	BBK350	6		BD Lawson Partners | Golder Associates	21N	6E	13	NW	NW	6/22/10
105569				Mining Exproration *(sic - Exploration)*	21N	6E	14	NW	NE	
589554	BAA642	148	6	Claire Ashton	21N	7E	7	NW	NW	5/28/09
96821		200	6	Rick Kelly	21N	7E	7	NW	NW	9/19/83
304334	AFJ832	220	6	Quad C LLC	21N	7E	7	NW	SW	10/24/00
304336	AFJ833	155	6	Quad C LLC	21N	7E	7	NW	SW	9/18/00
314607	AFJ834	620	6	Quad C LLC	21N	7E	7	NW	SW	9/14/01
304367	AFJ828	400	6	Quad LLC	21N	7E	7	NW	SW	10/31/00
* Wells are located by Qtr-Qtr Section only.										

2.1.4 Designated Uses

WDOE divided the state into different Water Resource Inventory Areas (WRIA) to delineate the state's major watersheds. All streams within the City of Black Diamond area are part of WRIA 9 – Duwamish-Green River Watershed. As unnamed surface waters, they are to be protected for the following designated uses: salmonid spawning, rearing, and migration; primary contact recreation; domestic, industrial, and agricultural water supply; stock watering; wildlife habitat; harvesting; commerce and navigation; boating; and aesthetic values. Because they are lakes and feeder streams to lakes they are also protected for the designated uses of core summer salmonid habitat and extraordinary primary contact recreation (PCCC, 2012).

Table 3: Designated Uses of Tributaries to the Green River

	Use Designations for Fresh Waters by Water Resource Inventory Area (WRIA)	Green River above junction with unnamed tributary to Flaming Geyser State Park	Green River above Flaming Geyser State Park
Aquatic Life	Char Spawning/Rearing		
	Core Summer Habitat	X	X
	Spawning/Rearing		
	Rearing/Migration Only		
	Redband Trout		
	Warm Water Species		
Recreation	Ex Primary Cont		X
	Primary Cont	X	
	Secondary Cont		
Water Supply	Domestic Water	X	X
	Industrial Water	X	X
	Agricultural Water	X	X
	Stock Water	X	X
Miscellaneous	Wildlife Habitat	X	X
	Harvesting	X	X
	Commerce/Navigation	X	X
	Boating	X	X
	Aesthetics	X	X

2.2 Water Monitoring Program

Surface water quality is monitored under sampling programs established by both OSM and WDOE through NPDES permit No. WA-003083-0. Figure 4 shows surface and groundwater monitoring locations. From June 1992 through February 2008, the OSM and WDOE programs both monitored surface water discharges at the same monitoring points, and according to the following schedules.

<u>Discharge Locations</u>

(001) – Ginder Lake (Ponds B, F & G)

(002) – Mud Lake Creek (Ponds H1, H2 & I)

(003) – Unnamed tributary to Lake 12 (Pond A)

(008/010) – Unnamed tributary to Lake 12 (Pond A')

Figure 4: Water Monitoring Locations (PCCC, John Henry No. 1 Permit, Ch 6)

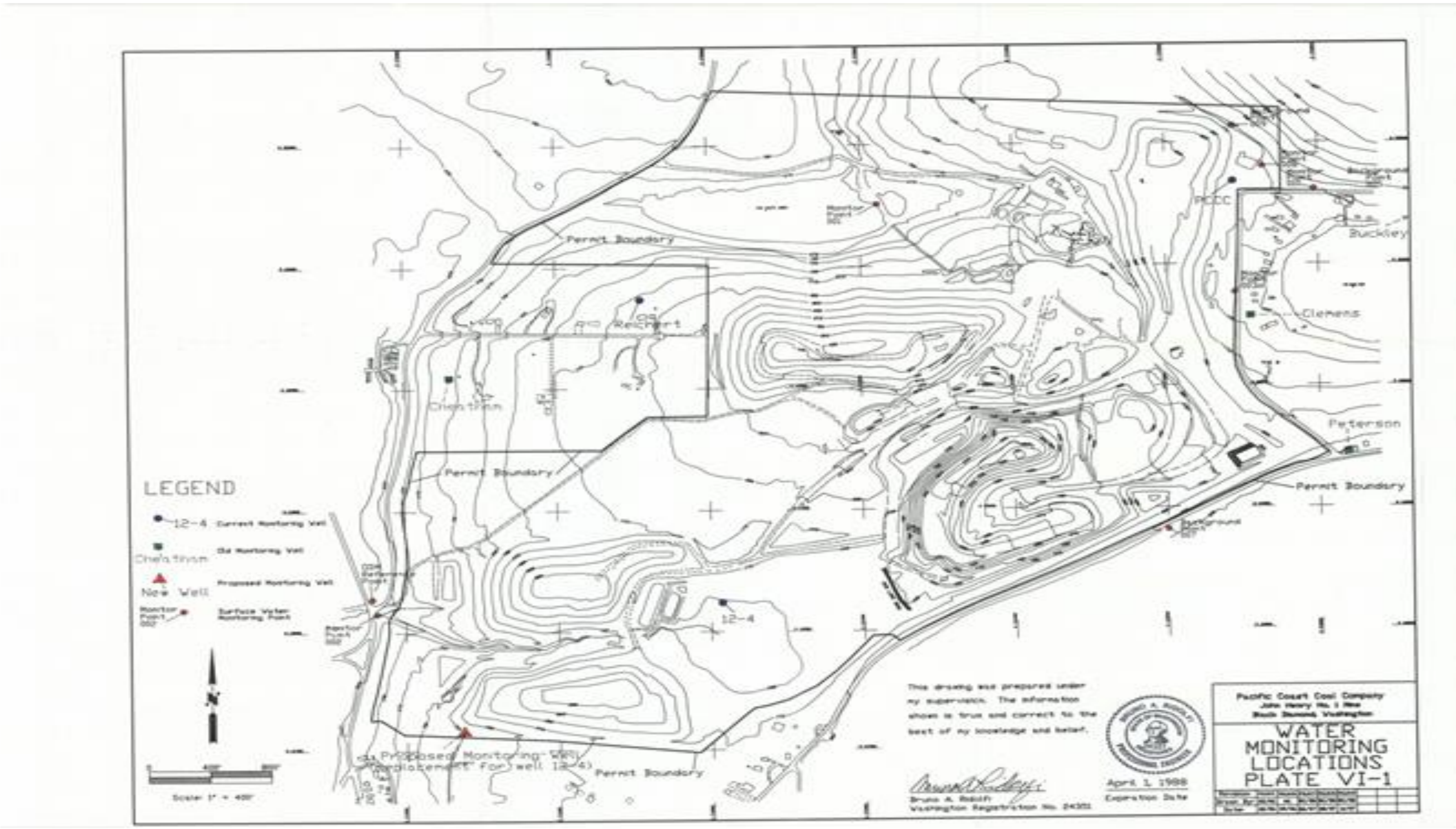


Table 4; OSM Surface Water Monitoring

Discharge Point	001	002	003	008/010	OSM Reference
Parameter					
Flow	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
pH	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Specific Conduct.	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Iron	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Manganese	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Phosphorous	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Zinc	Annual	Annual	Annual	Annual	Annual
Arsenic	Annual	Annual	Annual	Annual	Annual
Chromium	Annual	Annual	Annual	Annual	Annual
Copper	Annual	Annual	Annual	Annual	Annual
Calcium	Annual	Annual	Annual	Annual	Annual
Sodium	Annual	Annual	Annual	Annual	Annual
Magnesium	Annual	Annual	Annual	Annual	Annual
Potassium	Annual	Annual	Annual	Annual	Annual
Chloride	Annual	Annual	Annual	Annual	Annual
Sulfate	Annual	Annual	Annual	Annual	Annual
Nitrate	Annual	Annual	Annual	Annual	Annual
Carbonate	Annual	Annual	Annual	Annual	Annual
Bicarbonate	Annual	Annual	Annual	Annual	Annual

Table 5: 1992-2008 WDOE Surface Water Monitoring

Discharge Point	001	002	003	008/010
Parameter				
Flow	Daily	Daily	Monthly	Monthly
PH	Daily	Daily	Monthly	Monthly
Specific Conduct.	Daily	Daily	Monthly	Monthly
TSS	Monthly	Monthly	Monthly	Monthly
Phosphorous	Monthly	Monthly	Quarterly	Quarterly
Hardness	Quarterly	Quarterly	2/year	2/year
Iron	Quarterly	Quarterly	2/year	2/year
Zinc	Quarterly	Quarterly	2/year	2/year
Arsenic	Quarterly	Quarterly	N/A	N/A
Chromium	Quarterly	Quarterly	N/A	N/A
Copper	Quarterly	Quarterly	N/A	N/A

In March 2008 WDOE implemented a new NPDES permit which mandated an event-driven program (first two storm events of greater than 0.5” rainfall each month) directly sampling the discharge from each sediment pond on the active portion of the permit.

Table 6: 2008 – Current WDOE Surface Water Monitoring

Discharge Point	Pond B (001)	Pond F&G (001)	Pond H1 (002)	Pond H2 (002)	Pond I (002)
Parameter					
Flow	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall
PH	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall
Specific Conduct.	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall
Turbidity	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall
Dissolved Oxy.	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall
Oil Sheen	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall
Phosphorous	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall
Lead*	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall
Zinc*	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall
Arsenic*	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall
Chromium*	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall
Copper*	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall	0.5”Rainfall

* Maximum of one sample per month

Table 7: NPDES Effluent Limitations Permit No. WA-003083-0

Parameter	Effluent Limitations	
Phosphorous	Monthly Average	Maximum Daily
	41 µg/L	82 µg/L
pH	6.5-8.5	
Turbidity	Turbidity in the receiving water shall not exceed 5 NTU over background when background turbidity is 50 NTU or less, and shall not exceed background turbidity by more than 10% when background turbidity exceeds 50 NTU	
Dissolved Oxygen	Minimum 9.5 mg/L	
Total Petroleum Hydrocarbons (TPH)	5 mg/L	
Hexavalent Chromium	15.3 µg/L[1]	
Copper	5.5 µg/L[1]	

[1] The limit on Hexavalent Chromium and Copper was 16 µg/L until September 30, 2010

2.2.1.1 Groundwater Monitoring Program

Groundwater is monitored under sampling programs established by both OSM and WDOE through NPDES permit No. WA-003083-0.

Table 8: OSM Groundwater Monitoring

STATION NAME>	REICHERT WELL	PCCC WELL	12-4
parameter			
WATER level	QUARTERLY	QUARTERLY	QUARTERLY
SPECIFIC COND.	QUARTERLY	QUARTERLY	QUARTERLY
HARDNESS	QUARTERLY	QUARTERLY	QUARTERLY
pH	QUARTERLY	QUARTERLY	QUARTERLY
ARSENIC	QUARTERLY	QUARTERLY	QUARTERLY
IRON	QUARTERLY	QUARTERLY	QUARTERLY
MANGANESE	QUARTERLY	QUARTERLY	QUARTERLY
LEAD	ANNUAL	ANNUAL	ANNUAL
MERCURY	ANNUAL	ANNUAL	ANNUAL
CHROMIUM	ANNUAL	ANNUAL	ANNUAL
CALCIUM	ANNUAL	ANNUAL	ANNUAL
SODIUM	ANNUAL	ANNUAL	ANNUAL
MAGNESIUM	ANNUAL	ANNUAL	ANNUAL
POTASSIUM	ANNUAL	ANNUAL	ANNUAL
CHLORIDE	ANNUAL	ANNUAL	ANNUAL
SULFATE	ANNUAL	ANNUAL	ANNUAL
NITRATE	ANNUAL	ANNUAL	ANNUAL
CARBONATE	ANNUAL	ANNUAL	ANNUAL
BICARBONATE	ANNUAL	ANNUAL	ANNUAL

Table 9: WDOE Groundwater Monitoring

STATION NAME	REICHERT WELL	PCCC WELL	12-4	PIT 2
parameter				
WATER LEVEL	MONTHLY	MONTHLY	MONTHLY	N/A
SPECIFIC COND.	MONTHLY	MONTHLY	MONTHLY	MONTHLY
HARDNESS	QUARTERLY	QUARTERLY	QUARTERLY	QUARTERLY
pH	MONTHLY	MONTHLY	MONTHLY	MONTHLY
ARSENIC	QUARTERLY	QUARTERLY	QUARTERLY	QUARTERLY
IRON	QUARTERLY	QUARTERLY	QUARTERLY	QUARTERLY
MANGANESE	QUARTERLY	QUARTERLY	QUARTERLY	QUARTERLY
LEAD	2/YEAR	2/YEAR	2/YEAR	QUARTERLY
MERCURY	2/YEAR	2/YEAR	2/YEAR	QUARTERLY
CHROMIUM	2/YEAR	2/YEAR	2/YEAR	QUARTERLY

WDOE requires monitoring of Pit 2 water under the NPDES permit. The monitoring regime for groundwater established in NPDES permit No. WA-003083-0 is one where regular samples are taken according to the schedule in the table above. Exceedence of the triggering limits in two consecutive samples causes the monitoring frequency to be increased to one sample per week until the limit drops below the triggering limit for four consecutive samples or PCCC can provide an explanation for the cause which demonstrates that PCCC's discharge is not the cause of the exceedance. Four consecutive exceedances of the triggering limit is considered a permit violation. There has been no change in groundwater monitoring requirements or limits from the old 1992 NPDES permit to the new 2008 permit.

Table 10: Triggering Limits for Groundwater Monitoring

Triggering Limits for Additional Groundwater Monitoring				
Parameter	Reichert Well	PCCC Well	12-4 Well	Pit 2
pH	6.5 to 8.5			
Arsenic	0.05 mg/L	0.05 mg/L	0.122 mg/L	0.05 mg/L
Lead	0.05 mg/L	0.05 mg/L	0.05 mg/L	0.05 mg/L
Chromium	0.05 mg/L	0.05 mg/L	0.05 mg/L	0.05 mg/L
Mercury	0.002 mg/L	0.002 mg/L	0.002 mg/L	0.002 mg/L
Manganese	0.05 mg/L	0.05 mg/L	0.05 mg/L	0.05 mg/L
Visible Sheen	No Sheen	No Sheen	No Sheen	No Sheen

2.2.2 EPA, WDOE, and OSM Water Quality Criteria

Table 11: New Source Coal Mining Water Quality Standards (40 CFR § 434.35)

Pollutant	**Maximum for any 1 day**	**Average of daily values for 30 consecutive days**
	Concentration in mg/L	
Iron, total	6	3
Manganese, total	4	2
TSS	70	35
pH	6.0 - 9.0	6.0 - 9.0

Table 12: USEPA and WDOE Groundwater Standards

Parameters (units in mg/L unless otherwise specified)	Groundwater Quality Guidelines (mg/L)	
	USEPA (MCL)	State of Washington
pH	6.5-8.5	6.5-8.5
Field Conductivity (µmho/cm)		
Specific Conductance (µS/cm)		
Total Dissolved Solids	500	500
Total Hardness		
Alkalinity		
Total Alkalinity ($CaCO_3$)		
Carbonate (CO_3)		
Bicarbonate (HCO_3)		
Hydroxide (OH)		
Cyanide	0.2	
Dissolved Chloride	250	250
Nitrate (N)	10	10
Nitrite (N)	1	
Nitrate + Nitrite (N)		
Ortho Phosphorus (P)		
Total Dissolved Phosphorus (P)		
Total Phosphorus (P)		
Sulfate	250	250
Dissolved Aluminum	0.05-0.2	
Dissolved Arsenic		0.010
Dissolved Barium	2	1
Dissolved Beryllium	0.004	
Dissolved Boron		
Dissolved Cadmium	0.005	0.01

Dissolved Calcium		
Dissolved Chromium	0.1	0.05
Dissolved Copper	1.3	1
Dissolved Iron	0.3	0.3
Dissolved Lead	0.015	0.05
Dissolved Magnesium		
Dissolved Manganese	0.05	0.05
Dissolved Mercury	0.002	0.002
Dissolved Molybdenum		
Dissolved Nickel		
Dissolved Potassium		
Dissolved Selenium	0.05	0.01
Dissolved Silver	0.10	0.05
Dissolved Sodium		
Dissolved Zinc	5	5

3 Characterization of Baseline Hydrologic Conditions

3.1 Surface Water

Data representative of baseline conditions was provided in the 1984 CHIA for the John Henry No. 1 Mine (OSM, 1984). Surface and groundwater conditions in the permit area are similar to other areas in central Washington: very little total dissolved solids, low concentrations of iron and manganese, low trace metals, and low alkalinity. Table 13 provides the baseline surface water quality condition in the vicinity of the mine.

Table 13: Baseline Water Quality Averages for the John Henry No. 1 Mine

	Average Values for Select Baseline Stations			
Parameter	Ginder Creek (Outlet of Ginder Lake)	Mud Lake Creek (Outlet of Mud Lake)	Inlet to Lake No. 12	Average for Entire Mine
pH	7.4	7.1	6.5	7
Conductivity (µmhos/cm)	138	87	63	96
Total Iron (mg/L)	0.82	0.78	0.29	0.63
Dissolved Iron (mg/L)	0.28	0.28	0.17	0.24
Total Manganese (mg/L)	0.06	0.07	0.03	0.05
Dissolved Manganese (mg/L)	0.02	0.019	0.015	0.018
Alkalinity (mg/L as $CaCO_3$)	66	27	13	35.3
Total Suspended Solids (mg/L)	7	17	35	19.6
Total Dissolved Solids (mg/L)	108	58	52	72.6
Arsenic (mg/L)	0.0025	0.001	0.0025	0.002

The water quantity varies seasonally at the John Henry No. 1 Mine due to the precipitation patterns in the area. The highest average runoff occurs in January whereas the lowest tends to occur in September towards the end of summer (PCCC, John Henry No. 1 Permit).

The acreages for the three sub-watersheds at the mine, Ginder Lake, Mud Lake, and Lake No. 12, have been modified from their original layout due to earth movement activities associated with surface mining. Calculations were made in the original PHC to ascertain the differences between pre-mine and post-mine acreages, and they are shown in Table 14.

Table 14: Pre Mine and Post Mine Drainage Basin Acreages

Drainage Basin	Pre-Mining Acres	Post-Mining Acres
Lake 12	382	372
Grinder Creek	923	920
Mud Creek - Lake	401	188
Final Cut Lake	NA	226
Total	1706	1706

3.2 Groundwater

The dominant groundwater system within the CIA is the Puget Group which contains interbedded sandstone, shale, siltstone, and coal. Water movement is mainly due to secondary permeability within the rock. Nine domestic wells were identified in the baseline inventory in the original CHIA. Groundwater gradients are generally towards the major drainages in the CIA. Recharge to the groundwater is estimated at 5 inches per year, about ten percent of the precipitation. The hydraulic conductivities of test holes and monitoring wells range from 4 to 660 feet/year, demonstrating the wide variability in water yields and flow rates that occurs in a fracture-controlled system (Geoengineers, 1983).

The baseline studies indicate no regional aquifer exists and the glacial drift deposits overlying the area limit groundwater movement and recharge. The Puget Group bedrock is characterized as having poor water-bearing characteristics due to the generally poor permeability. Groundwater quality in the area has a variable pH (6.5-9.0), presumably due to differences in bicarbonate concentrations (140 – 640 ppm), and also variable iron and manganese concentrations (0.05-13 ppm and 0.02-0.18 ppm, respectively) (Systems Architects Engineers, 1983). Given the stratigraphy and structure of the Puget Group, considerable heterogeneity and variable water quality are typical occurrences in the groundwater surrounding the permit area due to the lack of continuity within the aquifer. Highly localized conditions exist within the Puget Group that make it irrelevant to associate the aquifer with a “typical” water flow and water quality condition.

4 Hydrologic Impact Assessment

To evaluate the potential hydrologic impacts of the mining operation within the permit and adjacent area, impacts are described in both duration (short-term and long-term) and magnitude (negligible, minor, moderate, or major). These impacts are defined as follows for the purpose of the CHIA:

Short-term impact **--** Impact occurs during or after the activity or action, but not projected to persist after the reclamation liability period.

Long-term impact -- Impact projected to persist after the reclamation liability period.

Negligible, Minor, Moderate, Major Impact – These impact categories are defined quantitatively and qualitatively based on water quantity and water quality assessment approaches for groundwater and surface water described in Table 15.

Groundwater and surface water quantity and quality are evaluated based on metrics developed specifically for this CHIA. These metrics are defined for each water resource and the type of potential impact (i.e. water quality or quantity) as well as for the impact designation; negligible, minor, moderate, or major. Assessment depends on considerations such as the feasibility of the assessment method, the inclusiveness of the assessment method to determine a wide range of possible impacts, and the availability of data to determine impacts according to the assessment method. Impacts are determined by evaluating the available dataset that covers 1993-2011 and making reasonable assumptions based on these evaluations. The assessment approaches, impact designation metrics, impact minimization techniques, and coal operator responsibilities are describe in Table 15.

Table 15: Impact Intensity Designation and Minimization Techniques for Preventing Material Damage

Water Resource		Groundwater Quantity	Surface Water Quantity	Surface Water Quality	Groundwater Quality
Assessment Approach		Water level trend data at PCCC well, 12-4 well, and Reichert wells	Comparison of surface water discharge quantity at NPDES points in the permit area during active and inactive mining periods	Comparison of baseline (non-mining impacted) water quality to non-baseline (NPDES outfalls) water quality and comparison to NPDES, WDOE, and OSM water quality standards.	Comparison of water quality at individual wells to NPDES and other WDOE water quality standards
Impact Intensity Designation	**Major**	Mining related aquifer drawdown that precludes the use of a water supply well	Changes in yearly average flow from NPDES discharges which preclude a designated use in downstream watersheds	Changes in water quality at NPDES outfalls that consistently (>66%) exceed applicable water quality standards	Changes in water quality that consistently (>66%) exceed applicable water quality standards and are attributable to mining
	Moderate	Mining related drawdown compromises the water supply well yield as designed	Changes in yearly average flow from NPDES discharges which diminish or effect a designated use in downstream watersheds	Changes in water quality at NPDES outfalls that regularly (33-66%) exceed applicable water quality standards	Changes in water quality that regularly (33-66%) exceed applicable water quality standards and are attributable to mining
	Minor	Mining related drawdown which can be quantified at water supply wells outside the permit area	Changes in yearly average flow from NPDES discharges which have a measurable effect on downstream watersheds	Changes in water quality at NPDES outfalls that sometimes (0-33%) exceed applicable water quality standards	Changes in water quality that occasionally (0%-33%) exceed applicable water quality standards and are attributable to mining
	Negligible	Mining related drawdown does not occur outside the permit area	Changes in yearly average flow which have no measureable effect on downstream watersheds	NPDES outfalls never exceed applicable water quality standards	No documented changes in water quality that are attributable to mining

Impact Minimization Techniques	Contemporaneous Reclamation; reclamation to approximate original contour (AOC); use of sediment control structures, application of flocculants to aid in sediment settling, following coal processing waste and spoil handling plan
Coal Operator Responsibilities to Prevent Material Damage	Replacement of water rights, maintenance of sedimentation structures, proper handling of spoil, topsoil, and coal processing waste materials, continued water monitoring, meeting the requirements of the NPDES permit and subsequent water quality standards, and timely revegetation/stabilization of disturbed areas

4.1 Surface Water

4.1.1 Lake Sawyer

4.1.1.1 Total Maximum Daily Load

In 1991, a study was conducted by WDOE to determine appropriate implementation and development of a TMDL in order to protect and improve water quality within the Lake Sawyer. In 1993, the TMDL listing was approved for Lake Sawyer by the EPA (Onwumere, 2002). The target concentration for phosphorous within Lake Sawyer was set at 16 µg/L, and this concentration has a corresponding loading value of 1.94 kg total phosphorous per day (King County Surface Water Management, 2000). Therefore, if a steady state loading of 1.94 kg/day total phosphorous is maintained, the target concentration will be achieved. Of the loading, 1.4 kg/day was assumed to originate from external loading (i.e. streamflow) and 0.54 kg/day assumed to originate from internal loading within the lake sediments.

In 2002, WDOE concluded that continued phosphorous control was needed in the Lake Sawyer watershed to assure the lake could meet water quality standards in the future. Storm water runoff in the winter months, aquatic plant decay, and resuspension of phosphorous-laden sediment within the lake itself in the fall were identified as the primary sources of phosphorous for the lake.

Based on the initial study conducted in 1991, it was determined that the diversion of a wastewater treatment discharge for the city of Black Diamond from the natural wetland above Lake Sawyer to a sewer line could significantly improve the eutrophication issues within the lake. This determination was confirmed in the years following the action, although urban growth in the Lake Sawyer watershed could potentially reverse the improvements that have been achieved.

A TMDL implementation plan has since been developed by WDOE as result of the 1991 study, which characterized the nature of the problem. The implementation plan provides a list of corrective actions in order to address phosphorous loading to Lake Sawyer from the surrounding watershed and also considers recommendations from the initial Lake Sawyer Management Plan and other documents developed for Lake Sawyer. Phosphorous concentrations within the lake itself are monitored through the King County Lake Stewardship Program, a volunteer program that has a goal of tracking trends in lake quality (Shoblom, 2009).

4.1.1.2 TMDL Modeling of Phosphorous into Lake Sawyer

An analytical modeling effort was conducted to evaluate the effect coal mining and reclamation at the John Henry No. 1 Mine has had on the phosphorous concentrations in nearby Lake Sawyer. The surface area of the watershed for Lake Sawyer is 8,130 acres, of which the John Henry permit area encompasses 480 acres, or 6-percent of the total area (King County Surface Water Management, 2000).

The model is used to estimate input loading from all sources, changes in concentration in Lake Sawyer over time, attenuation rates within the lake, and the effect activities at the John Henry No. 1 Mine have on the phosphorous concentrations in the lake. The model is not empirical in nature; rather it is based on physical relationships between inflows, outflows, degradation and re-suspension rates, and other parameters specific to Lake Sawyer. The model uses a step loading derivation and a loading function to determine how different inputs of phosphorous affect the concentration over time. The loading function is found in "Surface Water Quality Modeling", by Steven Chapra (2008) and is derived from the continuity equation. A step loading function assumes that for a given time period (each year in this case), loading remains constant until the next time period. Therefore, yearly averages for in-lake concentrations, in-stream concentrations, and in-stream flow rates were used as input parameters in the model. Although this simplification results in the model not demonstrating seasonal variations in phosphorous loading/attenuation mechanisms, it reasonably portrays the effect of the John Henry No. 1 Mine on the phosphorous loading issue. The model results indicate that the model is an appropriate tool as part of OSM's decision making process. The relevant equations for the model are as follows:

<u>Masss Balance and Equations</u>

- VdC/dt = QCin – QCout – vsCoutAs + vrCsedimentsAs
    - V = Volume of Lake Sawyer
    - C = Concentration
    - Q = Flow (volume/time)
    - As = Surface Area of Lake Sawyer
    - vs = Settleing Velocity
    - vr = Resuspension Velocity (length/time)
    - λ = Q/V + vs/H (1/time)
        - H = average lake depth
- The mass balance converts to dC/dt + λC = W(t)/V
    - W(t) is the mass loading function

<u>Step Function Solution</u>

$$c_p = \frac{\overline{W}}{\lambda V}(1 - e^{-\lambda t})$$

- Cp = concentration as a function of the variables
- W = loading in mass/time
- V = volume
- t = time

The majority of the input parameters for the model were derived from the Lake Sawyer Management Plan compiled by the Washington Department of Ecology, USEPA, and King County Surface Water Management Division (Shoblom, 2009). Studies conducted by these organizations have determined that a phosphorous load of 1.94 kilograms per day should yield a steady state concentration of 16 micrograms per liter of phosphorous in Lake Sawyer. This loading rate and concentration data from the King County monitoring program were used to calibrate the model to steady state conditions within the lake, and model calculated concentrations in the lake were derived from adjusting the loading rate. This derivation of the input loads to the lake was necessary because of the lack of flow and phosphorous concentration data for Rock Creek and Ravensdale Creek, which provide the bulk of the inflow to the lake.

Data from the John Henry No. 1 Mine hydrologic monitoring program was used to estimate loading rates from the two NPDES outfalls that flow into Rock Creek; point 1 and point 2. Yearly average stream flow rates from background point 7 were subtracted from the flow rates at NPDES point 2 to account for flow from the watershed outside of the influence of the John Henry No. 1 Mine. The two NPDES outfalls flow into Ginder Lake, which turns into Ginder Creek, and Mud Lake Creek, respectively, before flowing into Rock Creek. Under the previous NPDES permit that was effective from 1992-2008, phosphorous samples were collected monthly from the two outfalls. The phosphorous concentration and flow data were averaged for each individual year of interest from 1993-2010 and used to estimate the loading impacts to Lake Sawyer.

One challenge with processing the data collected since 2008 is a stipulation in the new NPDES permit that states a sample will only be collected following a 0.5-inch rainfall event, or greater. Since the monitoring program at the OSM reference point was unchanged after 2008, the loading rates from the two points were compared. A coefficient of determination (R squared) value of 0.4 was produced when comparing the dataset up to 2007, whereas a value of 0.69 was produced when comparing all but the 2008 and later data.

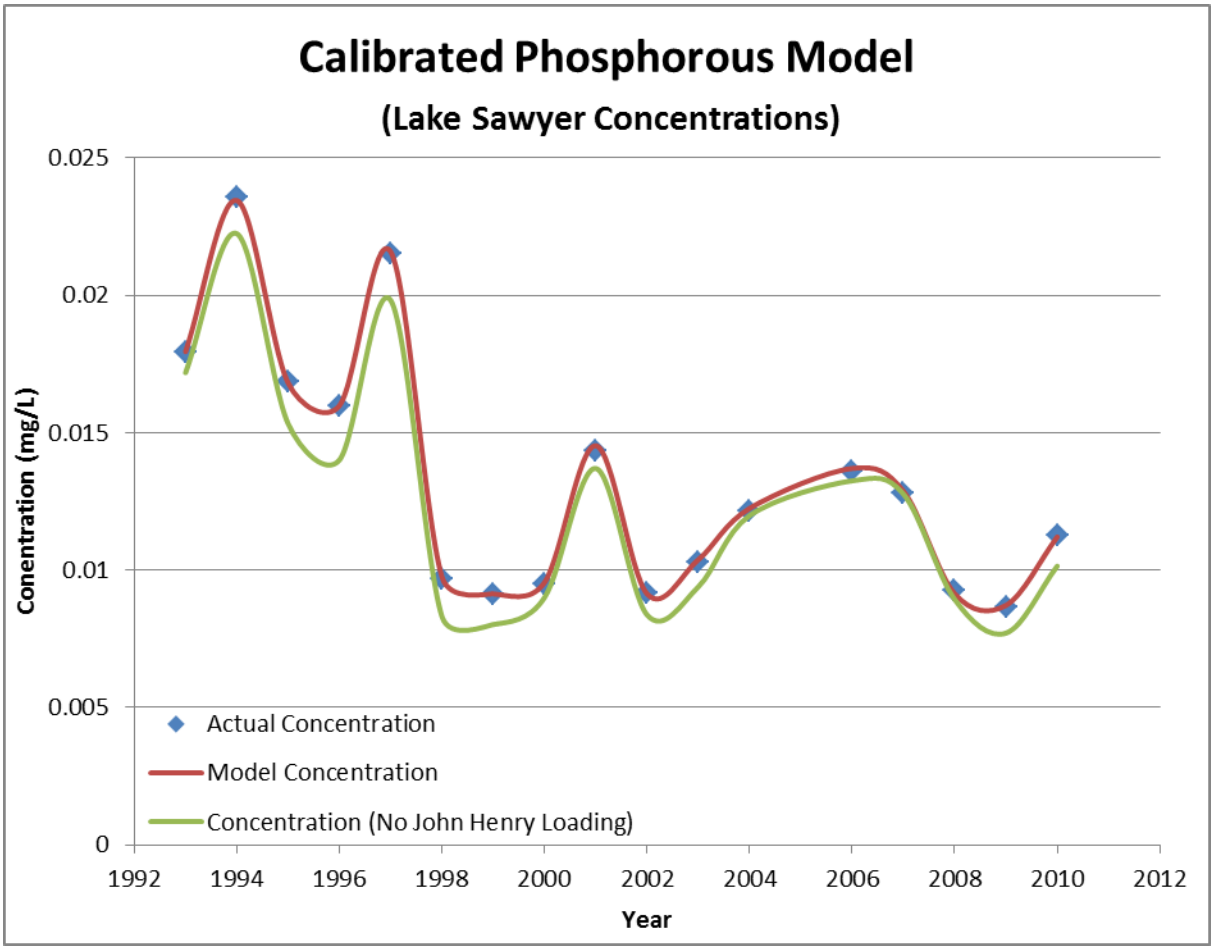
A number of results were determined from the model that are important factors in making an assessment of the potential hydrologic impacts of the John Henry No. 1 Mine. Of particular importance is the percentage of phosphorous loading that the mine contributes to Lake Sawyer relative to the total mass input into the lake on an annual basis. Although the permit area of the John Henry No. 1 Mine comprises approximately 6-percent of the Lake Sawyer Watershed, it was determined from the model that it may contribute as much as 15-percent of the yearly phosphorous loading to the lake. The calibrated model is shown in Figure 5.

The primary conclusion drawn from the phosphorous loading model is that a high natural variability associated with the phosphorous levels in Lake Sawyer exists. The total loading percentage from the mine operation has tended to be higher when the mine is operating, and a decline in loading can be observed in the years from 2000 to 2010 (Table 16). Therefore, phosphorous loading contributions are expected to increase slightly from the resumption of mining at the John Henry No. 1 Mine. Although phosphorous loading from mining could potentially have an effect on Lake Sawyer, the outfalls are regulated by an NPDES permit which limits the maximum concentration to 82 µg/L. Additionally, sediment-laden phosphorous loading is minimized through the Sediment Control Plan and through water quality management practices such as flocculation in the sedimentation ponds. Finally, it should be noted that since no water quality/quantity monitoring data is available at the inflow points to the lake, possible attenuation of phosphorous through wetlands present south of Lake Sawyer cannot be accounted for in the model.

Table 16: Percentage of Phosphate Loading to Lake Sawyer from John Henry Mine

Year	Monitoring Points 001 and 002 (g/day)	Total loading for Lake Sawyer (g/day)	Percentage of loading from John Henry No. 1 Mine
1993	92.8	2175	4.3
1994	145	2825	5.1
1995	178.5	2025	8.8
1996	238.3	1925	12.4
1997	212.7	2600	8.2
1998	174	1175	14.8
1999	134.4	1100	12.2
2000	66.5	1150	5.8
2001	99.7	1750	5.7
2002	91.9	1100	8.3
2003	119	1250	9.5
2004	31.5	1475	2.1
2005	10.3	NA	NA
2006	54.2	1650	3.3
2007	12.2	1550	0.8
2008	24.9	1100	2.3
2009	121.8	1050	11.6
2010	127.9	1350	9.5

Figure 5: Calibrated Phosphate Model of Lake Sawyer



Other contributions of phosphorous to Lake Sawyer may occur through a 220 acre sand and gravel pit mine located near the south end of the Lake. It is operated by Palmer Coking Coal Company and does not have an industrial NPDES permit. Rather, it is covered under the Sand and Gravel General Permit, NPDES Permit No. 50-0000, issued by WDOE which manages it and other similar operations throughout the state. Consequently, no NPDES data is collected from the sand and gravel mine, but turbidity is limited to 50 nephelometric turbidity units which should likely reduce phosphorous loading to Lake Sawyer.

4.1.2 Surface Water Quality

Mining activities may alter the chemical characteristics of the surface water runoff and baseflow discharge from a disturbed area. Elevated concentrations of TDS and some changes in pH have been observed at John Henry No. 1 Mine through the monitoring program. Concentrations of arsenic, iron, and manganese, are parameters of water quality concern in the mine area. Sediment loading is also a primary water quality concern, especially during the active mining and reclamation phases when spoil material comes into contact with precipitation prior to vegetation establishment. Water quality monitoring has been required since mining began to track changes in these parameters, and the dataset being evaluated in this document is from 1993 to 2011.

At the John Henry No. 1 Mine, disturbed runoff is managed through a system of constructed sedimentation ponds prior to discharge. In addition to surface water runoff, groundwater inflow to the pits is also routed through the sediment ponds when necessary. These ponds are designed to contain the 10-year, 24-hour storm event, and to reduce the sediment load by providing sufficient detention time and storage capacity to allow the sediment to settle. The drainage control plan map is shown in Figure 15. The treatment capabilities of the sedimentation ponds have been improved by adopting a variety of additional enhancements including constructing sumps just before the ponds, adding polymers to aid in settling the sediment, placing gravel packs around the discharge standpipes to capture suspended solids, and equipping the discharge pipes with valves to help control the outflow volumes. The NPDES permit includes limits on the parameters pH, dissolved oxygen, turbidity, chromium, copper, and phosphate as P which are listed in Section 2.2.1.1.

Surface water quality data covering monitoring points 001, 002, 003, and 008 was evaluated to determine the performance of the PCCC in reducing surface water impacts over the life of mine. Comparison of monitoring data from 1993 to 2011 to applicable water quality standards and baseline data collected in the 1984 CHIA is summarized in tables provided in Appendix A. Applicable water quality criteria used for comparison was from the NPDES permit, OSM regulations located at 30 C.F.R. § 947.816.42 regarding iron and manganese, and WDOE criteria listed in WAC-173-201A-240 regarding toxic constituents. The NPDES water quality standards are especially important at John Henry No. 1 Mine since all surface water exits the mine through a number of NPDES outfalls. Monitoring point 001 is located at the outfall of Pond B and flows into Ginder Lake, which in turn flows into Ginder Creek. Monitoring point 002 is located below the I-pond series along Mud Lake Creek, which flows into Ginder Creek and ultimately into Rock Creek. Monitoring points 003 and 008 are located at the eastern end of the permit area on respective NPDES outfalls that flow into Lake No. 12.

<u>Ginder Creek/Mud Lake Creek Watershed</u>

Water quality impacts have been limited principally to sediment load increases, measured as turbidity. Although the potential effects of resumed surface mining activities on surface water will be increased compared to the recent period of inactivity, hydrologic effects are anticipated to be less than those experienced during prior periods of active mining. Predicted reduction in impact potential is due both to the limited scope of mining area proposed, and the experience gained in controlling and treating the surface water runoff during periods of previous operation. Additionally, no new external spoil piles will be created and all mine overburden will be directly backfilled into the mining pits, which provide physical techniques to manage the impact potential.

Phosphate concentrations indicate a negative trend at monitoring points 001 and 002 (Figures 6 and 7). Mining ceased in 1999, and phosphate concentrations have trended lower since that time. Lower concentrations with the same volumetric discharge rate will result in reduced phosphate loading. Therefore, it's anticipated that loading will increase as mining resumes, but not likely to the levels observed during the pre-1999 period of mining. John Henry No. 1 Mine is the only operation within the Lake Sawyer basin that has specific limits set for phosphate; however, the rest of the watershed is under a general mandate to reduce phosphorous levels by 50-percent. Additionally, a requirement exists in the NPDES permit stating that four consecutive exceedances of 41 µg/L for phosphate concentrations is considered a violation, which helps to protect the watershed for extended phosphate loading impacts.

Comparing surface water monitoring point 001 water quality data to baseline data (data collected before mining commenced) resulted in the identification of numerous constituent exceedances. The concentrations in water quality data from 1993-2011 are greater than the concentrations in the baseline dataset for iron in 4.7 percent of all samples, for manganese in 44 percent of all samples, and for specific conductivity in 100 percent of all samples. The increase in specific conductivity relative to baseline is consistent with increases in total dissolved solids due to exposed reactive surface area of the spoil material. The average measured concentrations of sodium, calcium, magnesium, sulfate, and bicarbonate in the 1993-2011 dataset compared to the baseline dataset indicate increases in total dissolved solids occur during periods of mine operation. Average concentrations of sodium, calcium, magnesium, sulfate, and bicarbonate of 66, 39, 43, 124, and 269 mg/L respectively, were observed in the 1993-2011 dataset. However, no water quality criteria were exceeded for the aforementioned water quality parameters. Exceedances of applicable water quality criteria at monitoring point 001 from 1993-2011 were limited to copper in 3.5 percent of samples, and phosphorous in 1.2 percent of samples. For the purposes of this assessment, water quality conditions at monitoring point 001 from 1993-2011 constitute a minor impact to the hydrologic balance based on the impact intensity designation on Table 15. As such, a short-term minor impact to the hydrologic balance is predicted when mining resumes at the John Henry No. 1 Mine.

Comparing surface water monitoring point 002 water quality data to baseline data (data collected before mining commenced) resulted in the identification of numerous constituent exceedances. The concentrations in water quality data from 1993-2011 are greater than the concentrations in the baseline dataset for iron in 15.5 percent of all samples, for manganese in 49 percent of all samples, and for specific conductivity in 100 percent of all samples. Similar to water quality conditions at point 001, point 002 exhibited an increase in specific conductivity and TDS attributable to increase in bicarbonate, calcium, magnesium, sulfate, and sodium concentrations. Exceedances of applicable water quality criteria at monitoring point 002 from 1993-2011 were limited to copper in 3.8 percent of samples, and phosphorous in 2.2 percent of samples. For the purposes of this assessment, water quality conditions at monitoring point 002 from 1993-2011 constitute a minor impact to the hydrologic balance based on the impact intensity designation on Table 15. As such, a short-term minor impact to the hydrologic balance is predicted when mining resumes at the John Henry No. 1 Mine.

Figure 6: Phosphate Concentration at Monitoring Point 001

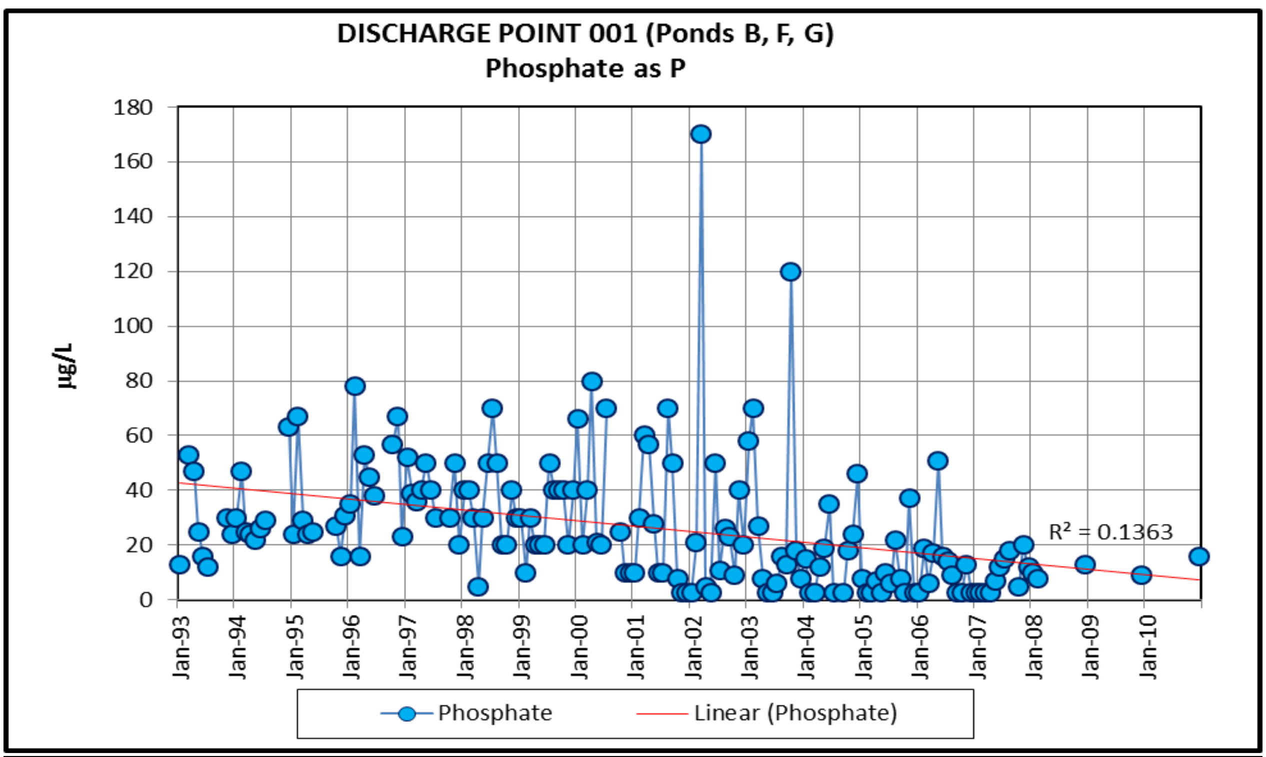
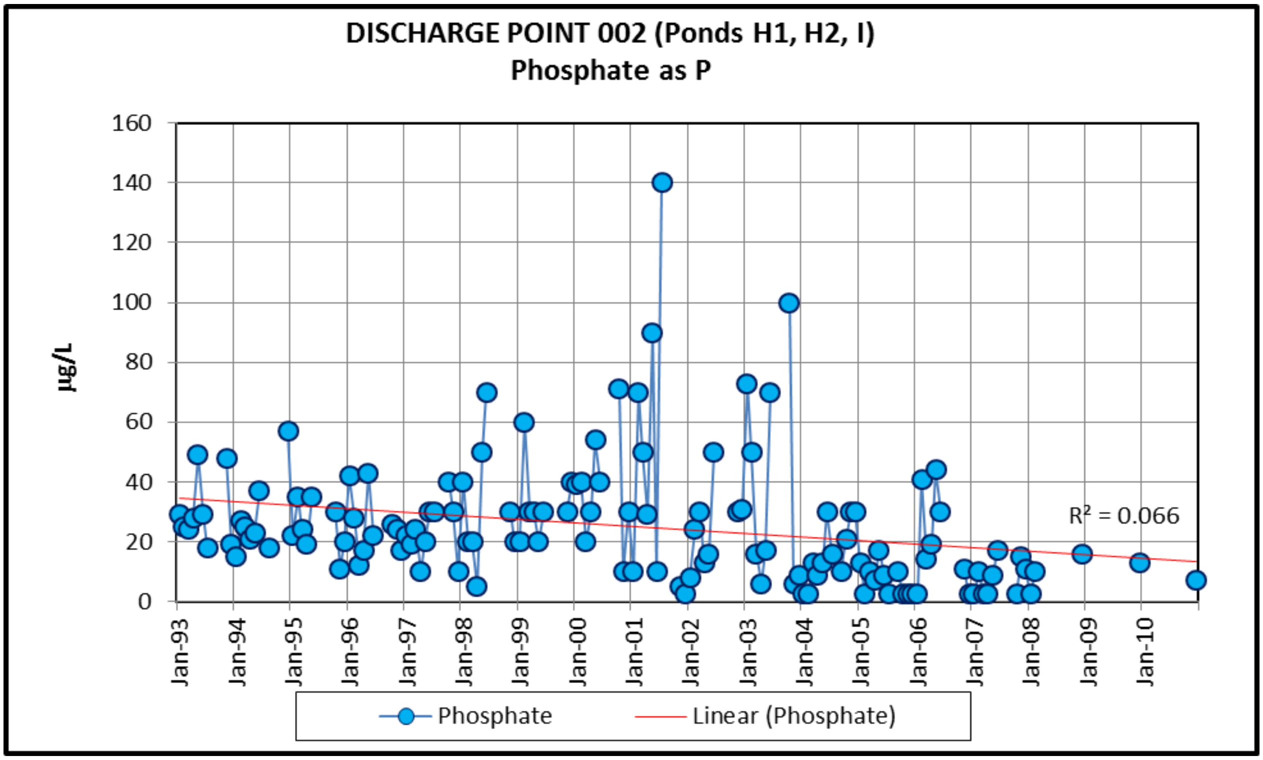


Figure 7: Phosphate Concentration at Monitoring Point 002



Lake No. 12 Watershed

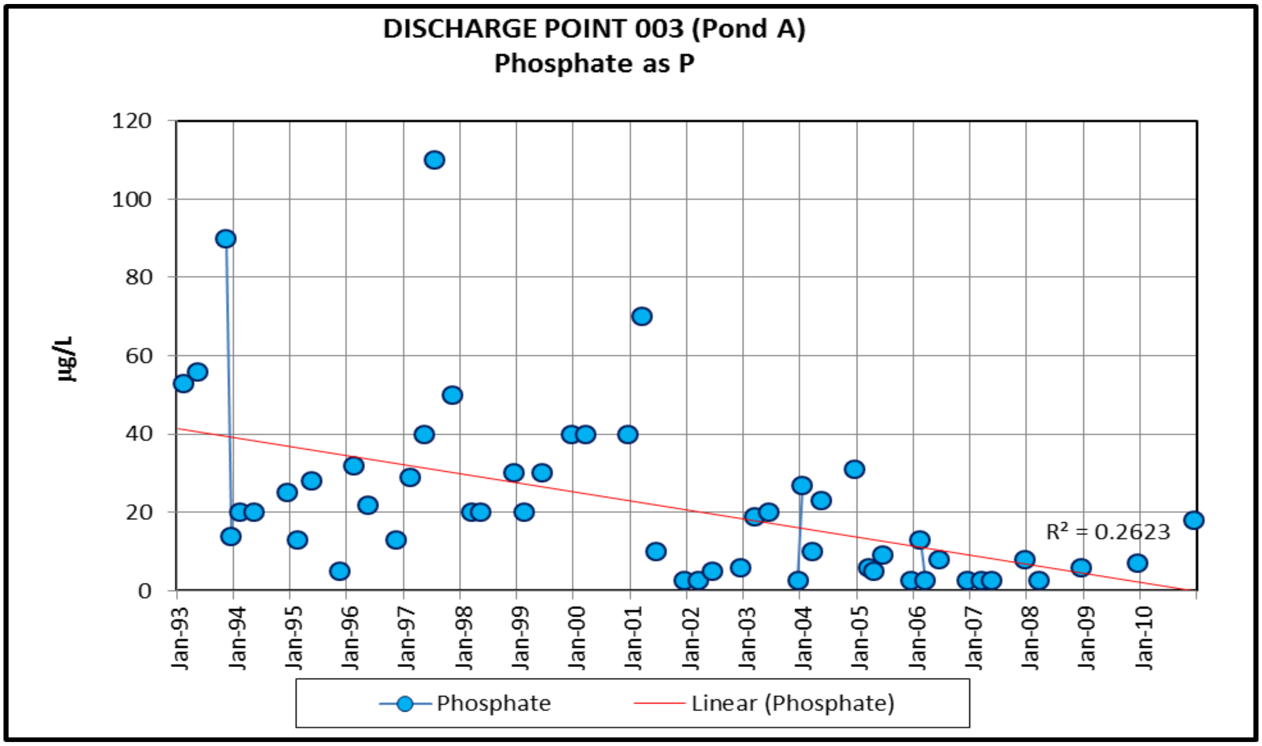
The proposed John Henry No. 1 Mine operations will occur entirely within the Rock Creek/Lake Sawyer watershed. Since additional surface area will not be disturbed by the resumed mining activity within the Lake 12 watershed, water quality impacts are not anticipated.

Historically, water quality impacts have been limited principally to increases in sediment load as measured by turbidity. Phosphate levels have occasionally exceeded NPDES limits, but indicate a negative trend since coal production tapered down at the mine in the late 90s, illustrated in Figure 8.

Comparing surface water monitoring point 003 water quality data to baseline data (data collected before mining commenced) resulted in the identification of numerous constituent exceedances. The concentrations in water quality data from 1993-2011 are greater than the concentrations in the baseline dataset for iron in 3.8 percent of all samples, for manganese in 87 percent of all samples, and for specific conductivity in 100 percent of all samples. Iron concentrations seem to have increased within this watershed much less than manganese, although concentrations of both parameters are still within the range of compliance related to water quality standards. Similar to water quality conditions at point 001 and point 002, point 003 exhibited an increase in specific conductivity and TDS attributable to increase in bicarbonate, calcium, magnesium, sulfate, and sodium concentrations. Exceedances of applicable water quality criteria at monitoring point 003 from 1993-2011 were limited to copper in 5 percent of samples, and phosphorous in 3.8 percent of samples. For the purposes of this assessment, water quality conditions at monitoring point 003 from 1993-2011 constitute a minor impact to the hydrologic balance based on the impact intensity designation on Table 15. However, since additional surface area will not be disturbed by the resumed mining activity within the Lake 12 watershed, future water quality impacts are anticipated to diminish from minor to negligible.

Monitoring point 008 shows similar trends to others. The concentrations in water quality data from 1993-2011 are greater than the concentrations in the baseline dataset for iron in 6 percent of all samples, for manganese in 64 percent of all samples, and for specific conductivity in 100 percent of all samples. The only water quality criterion that was exceeded at point 008 in the 1993-2011 dataset was for copper in 5.2 percent of all samples. For the purposes of this assessment, water quality conditions at monitoring point 008 from 1993-2011 constitute a minor impact to the hydrologic balance based on the impact intensity designation on Table 15. However, since additional surface area will not be disturbed by the resumed mining activity within the Lake 12 watershed, future water quality impacts are anticipated to diminish from minor to negligible.

Figure 8: Phosphate Concentration at Monitoring Point 003



4.1.3 Surface Water Quantity

Impacts to surface water quantity are estimated to be minor, attributable to the dewatering of Pit 1 and Pit 2 as mining resumes. Removal of vegetation and mining-related disturbance of the land may result in local changes in transpiration, infiltration, and runoff, but the effect is anticipated to be minor given the limited area of disturbance proposed and the positive net water balance in the area. Impact minimization measures include limiting vegetation clearing and removal to only those areas immediately required for mining, re-establishing vegetative cover on disturbed areas as quickly as possible by grass seeding and planting trees, and controlling runoff through the sediment and drainage control plan.

The original PHC and SOAP reports projected that mining activities at the John Henry No. 1 Mine would have some impacts on surface water quantity. Water quantity impacts due to changes in drainage areas have been negligible and have not adversely impacted water uses in the Rock Creek/Lake Sawyer watershed. The Ginder Lake and Mud Lake sub-drainages combine just beyond the permit boundary, and local precipitation is sufficiently high to ensure consistent water flow throughout much of the year.

Since no mining is projected to occur in the Lake No. 12 watershed and the area has been reclaimed, no disturbances to the hydrologic balance are predicted. Impacts to water quantity in the Lake No. 12 watershed due to mining have been minor based on the impact intensity designation on Table 15, and have not adversely affected the uses in the Lake 12 watershed (Figure 11). Consequently, it is anticipated that there will be negligible impacts to the hydrologic balance in this area when mining resumes at the John Henry No. 1 Mine.

The de-watering of mine pits and pumping of water throughout the mine site had an observed effect on discharge in the Mud Lake and Ginder Lake sub-watersheds (Figure 9 and 10). Both of these subwatersheds discharge into Ginder Creek, which in turn discharges into Rock Creek and Lake Sawyer. Figures 9 and 10 illustrate that discharge was higher during the mining years (up to 1999), compared to the 2000-2011 timeframe when mining was limited or not occurring. Recorded flow at the OSM reference point at Ginder Creek just outside of the permit area has averaged 8.9 CFS from 2002-2010. Flow contributions in the Ginder Creek watershed from the John Henry No. 1 Mine discharges average 17-34 percent of the total flow, as measured at the OSM reference point, depending on whether the mine is active. Because the large scale effects of runoff variations at the John Henry No. 1 Mine are minimal when evaluated for their effect in the entire CIA, let alone in the local area, the observed trends for maximum and average flow in the 1993-2011 dataset constitute a short-term minor impact based on the impact intensity designation on Table 15. The proposed resumption of mining at the John Henry No. 1 Mine will likely result in a similar surface water quantity impact conditions observed during the previous mining period.

Figure 9: Discharge at Monitoring Point 001

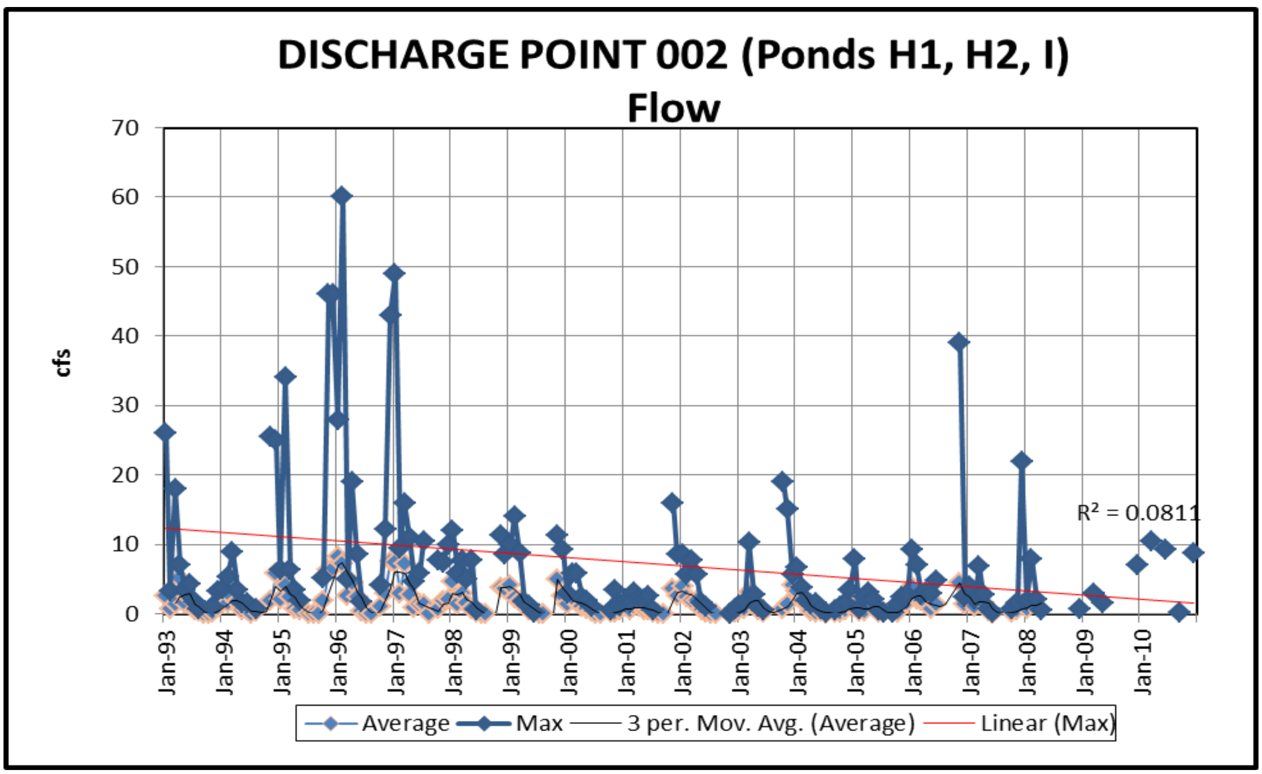


Figure 10: Discharge at Monitoring Point 002

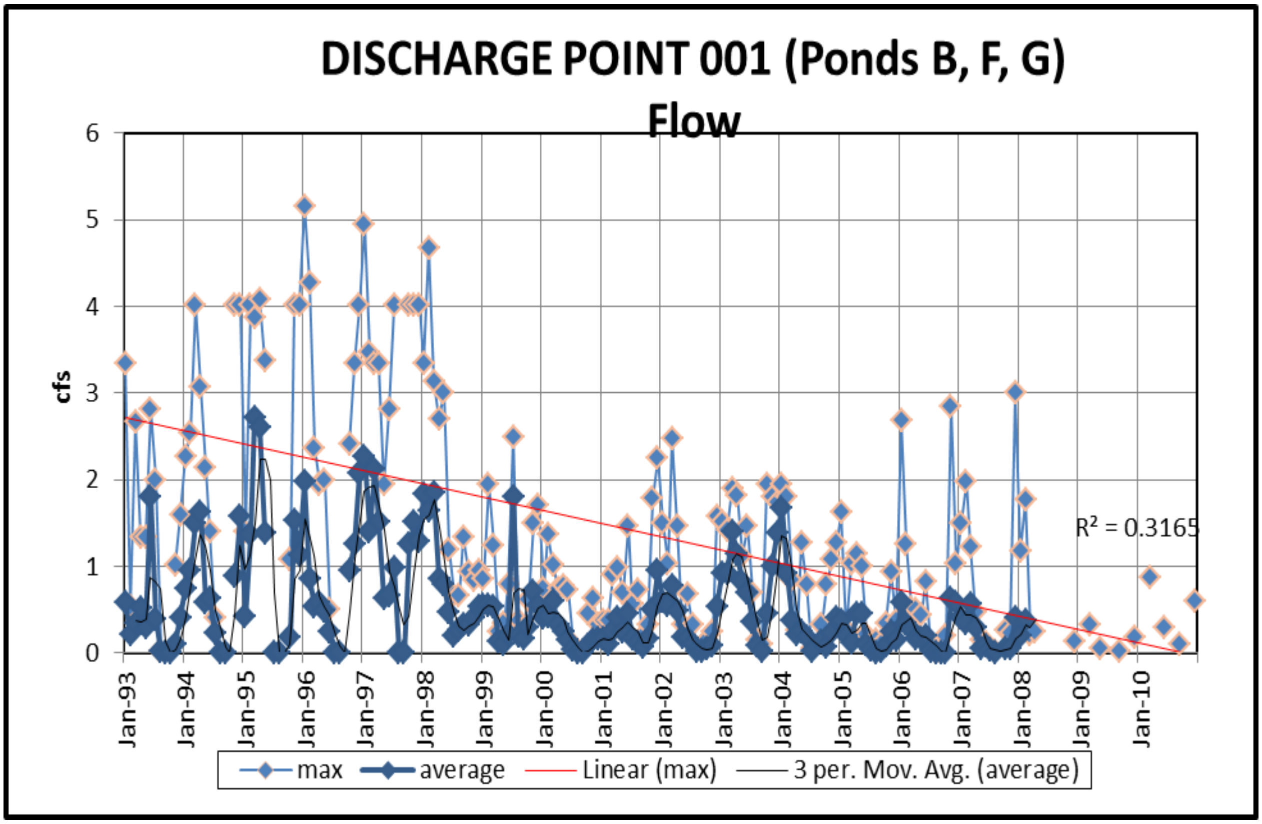
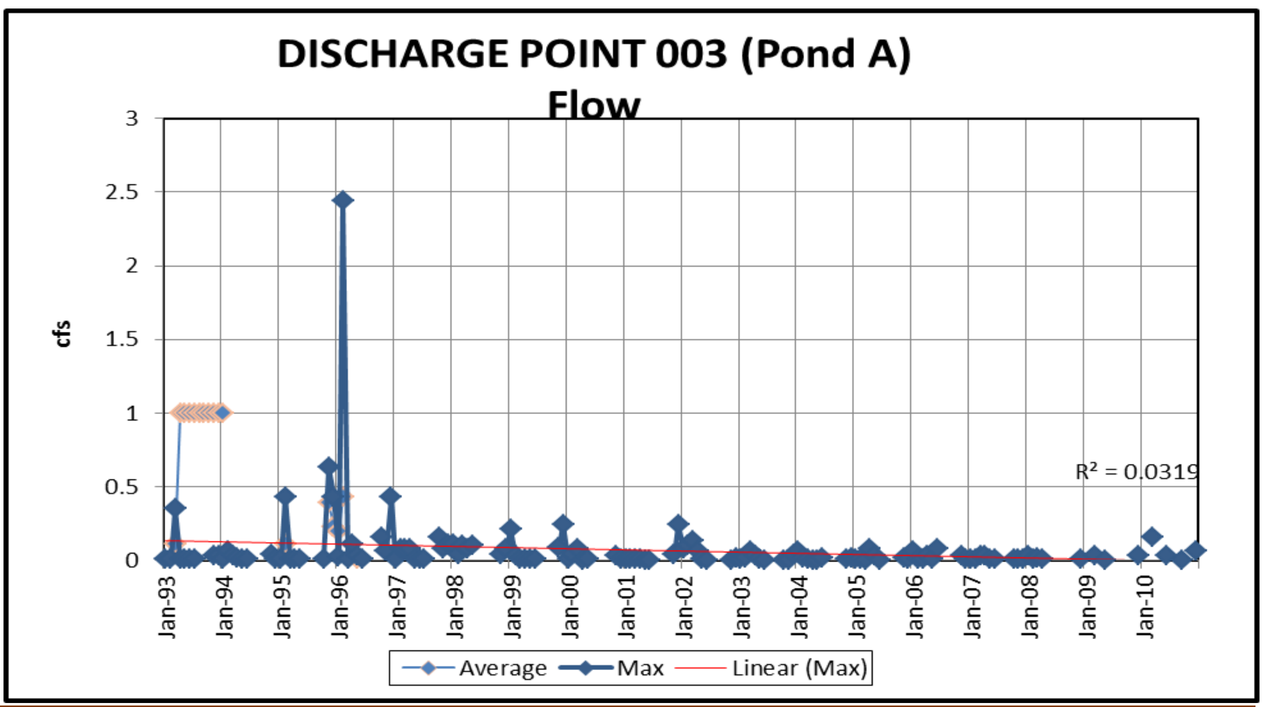


Figure 11: Discharge at Monitoring Point 003



4.2 Groundwater

4.2.1 Groundwater Quality

The quality of groundwater in an area adjacent to mining activity may be affected due to the addition of various chemical constituents from exposed surface area of the spoil material, and is dependent on the solubility of the minerals in the disturbed overburden. The majority of the strata in the John Henry No. 1 Mine area are alkaline, which limits the potential for additional dissolved metals in the groundwater. Groundwater monitoring of wells within the permit and adjacent area has been conducted at the mine since it was permitted in 1986. The dataset is evaluated from the year 1993 to 2011 in this assessment.

Groundwater quality data from Reichert Well, PCCC Well, 12-4 Well, and Pit 2 was evaluated to determine whether the John Henry No. 1 Mine operation has been designed to minimize groundwater quality impacts to the hydrologic balance outside the permit area. Comparison of monitoring data from 1993 to 2011 to applicable water quality standards is summarized in tables provided in Appendix A. Applicable water quality criteria used for comparison was based on NPDES permit and WDOE criteria listed in WAC-173-200-040 regarding groundwater quality guidelines for drinking water supplies. These drinking water standards adequately protect the designated use of the groundwater resource in the area. The current NPDES permit for the John Henry No.1 Mine indicates that exceedances of water quality criteria will result in increased monitoring until such time as the standards are met. The NPDES standards are utilized to determine whether negligible, minor, moderate, or major impacts have occurred and can be expected to occur at the John Henry No. 1 Mine.

The data collected at the Reichert Well, PCCC Well, and the 12-4 Well was compared to water quality criteria to determine impact designations. Exceedances of water quality criteria at the Reichert well from 1993-2011 were limited to iron in 2.9 percent of samples, mercury in 2.6 percent of samples, and for manganese in 4.2 percent of samples. For the purposes of this assessment, groundwater quality conditions at the Reichert Well from 1993-2011 constitute a minor impact to the hydrologic balance based on the impact intensity designation on Table 15. As such, a minor impact to the hydrologic balance is predicted when mining resumes at the John Henry No. 1 Mine.

Exceedances of water quality criteria at the PCCC well from 1993-2011 occurred with iron in 14.5 percent of samples, mercury in 2.6 percent of samples, and in manganese in 1.4 percent of samples. For the purposes of this assessment, groundwater quality conditions at the PCCC Well from 1993-2011 constitute a minor impact to the hydrologic balance based on the impact intensity designation on Table 15. As such, a minor impact to the hydrologic balance is predicted when mining resumes at the John Henry No. 1 Mine.

Exceedances of water quality criteria at the 12-4 well from 1993-2011 occurred with iron in 25.7 percent of samples, mercury in 2.56 percent of samples, and in manganese in 1.4 percent of samples. For the purposes of this assessment, groundwater quality conditions at the 12-4 Well from 1993-2011 constitute a minor impact to the hydrologic balance based on the impact intensity designation on Table 15. As such, a minor impact to the hydrologic balance is predicted when mining resumes at the John Henry No. 1 Mine.

Overall, the measured impacts to groundwater quality in the area surrounding the John Henry No. 1 Mine have been minor. In the baseline study conducted for the 1984 CHIA, it was demonstrated that the groundwater conditions within the Puget Group are highly heterogeneous and a high degree of natural variability is present in terms of water quality parameter concentrations. To date, only short-term minor impacts regarding groundwater quality have been observed in wells listed in the OSM and NPDES monitoring programs.

4.2.2 Groundwater Quantity

Due to low hydraulic conductivity of saturated portions of the Puget Group, minimal impact on groundwater quantity has been observed throughout the life of the John Henry No. 1 Mine. The 1984 CHIA predicted small temporary drawdown of local wells in the adjacent area could occur due to mine dewatering activities as mining progressed through potential recharge areas. The proposed resumption of mining may result in a small localized impact on water levels in wells at residences on SE 310th Street, based on a report prepared by GeoEngineers in 1983. The report estimated that water levels in these wells could drop 5 to 15 feet as mining in Pit 2 advances through the recharge area. Original estimates indicated seepage into the mining pits was projected to be between 3 and 5 gallon per minute; however, during actual mining of the two pits visual observation indicates that the projections were overstated. Pit 1 was excavated to a depth of over 325 feet with only a few minor wet spots apparent on the pit walls and no measurable groundwater discharge into the mine pit. Figures 12, 13, and 14 illustrate the trends of water levels in the Reichert, PCCC, and 12-4 wells.

The 1984 CHIA predicted that after 19 years of mining there would be up to 200 feet of drawdown within the CIA area. However, data from the monitoring program indicates the impact to the potentiometric surface in the area is less than predicted. The depth of the Reichert well is 240 feet, and water level measurements in Figure 12 illustrate the groundwater levels at the location are seasonally lowest during August through October, and otherwise stable from 1993 – 2011. It is possible that the Reichert well may be affected by mine operations at the John Henry No. 1 Mine and will continue to be monitored; however, the projected impact for the Puget Group and groundwater resource outside the permit area is considered negligible.

Depth to water in the 12-4 well near Mud Lake has been consistent from 1993 to 2011, fluctuating less than 5-feet both seasonally and during the period of record. The water level in this area was originally predicted to be the most impacted by mining operations based on the 1984 CHIA, which assumed that mining would commence in the Mud Lake Wetlands. However, no mining occurred in this area. The resumption of mining operations at John Henry No. 1 Mine may impact water level at well 12-4, but to date, the observed impacts have been negligible.

During mining operations, the PCCC well is used for drinking water and mine water supply. The water level in the PCCC well has been as low as 270 feet below ground surface during periods of active mining, and has recovered to within 10 feet below ground surface after mining.

Figure 12: Reichert Well Water Depth

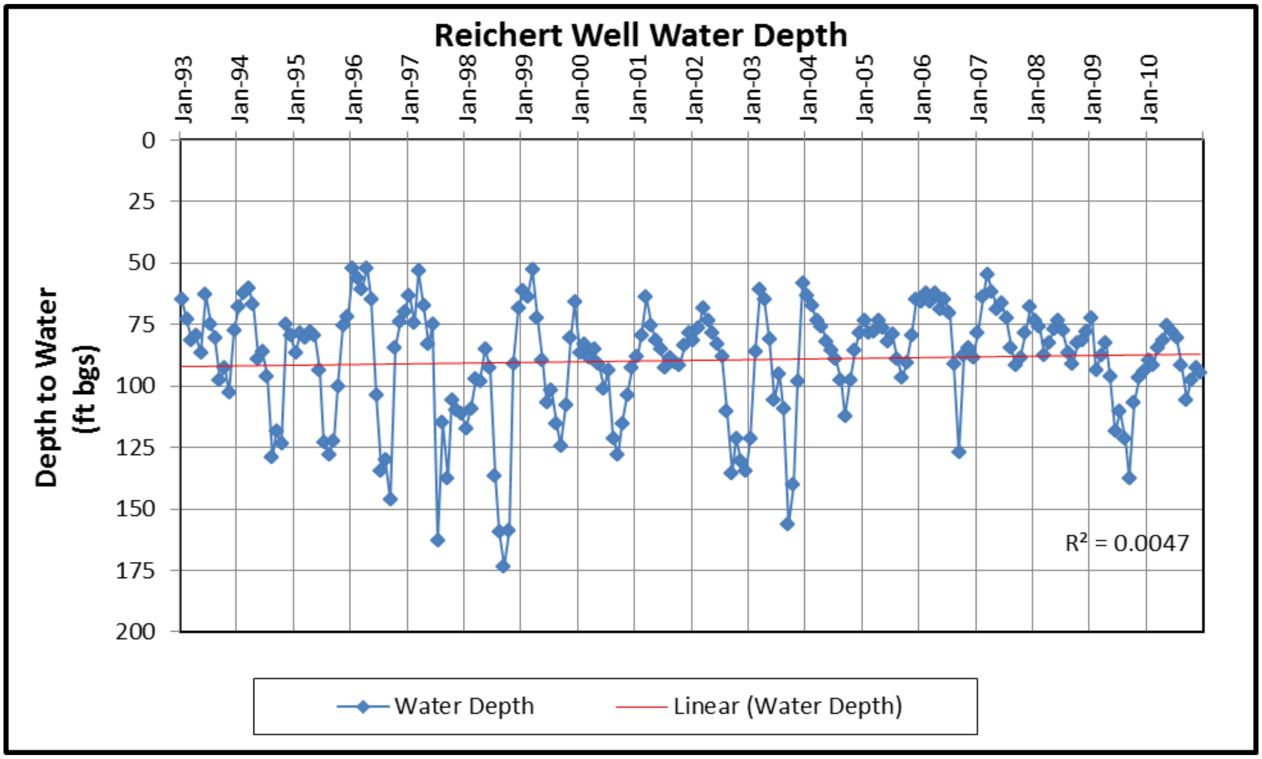


Figure 13: PCCC Well Water Depth

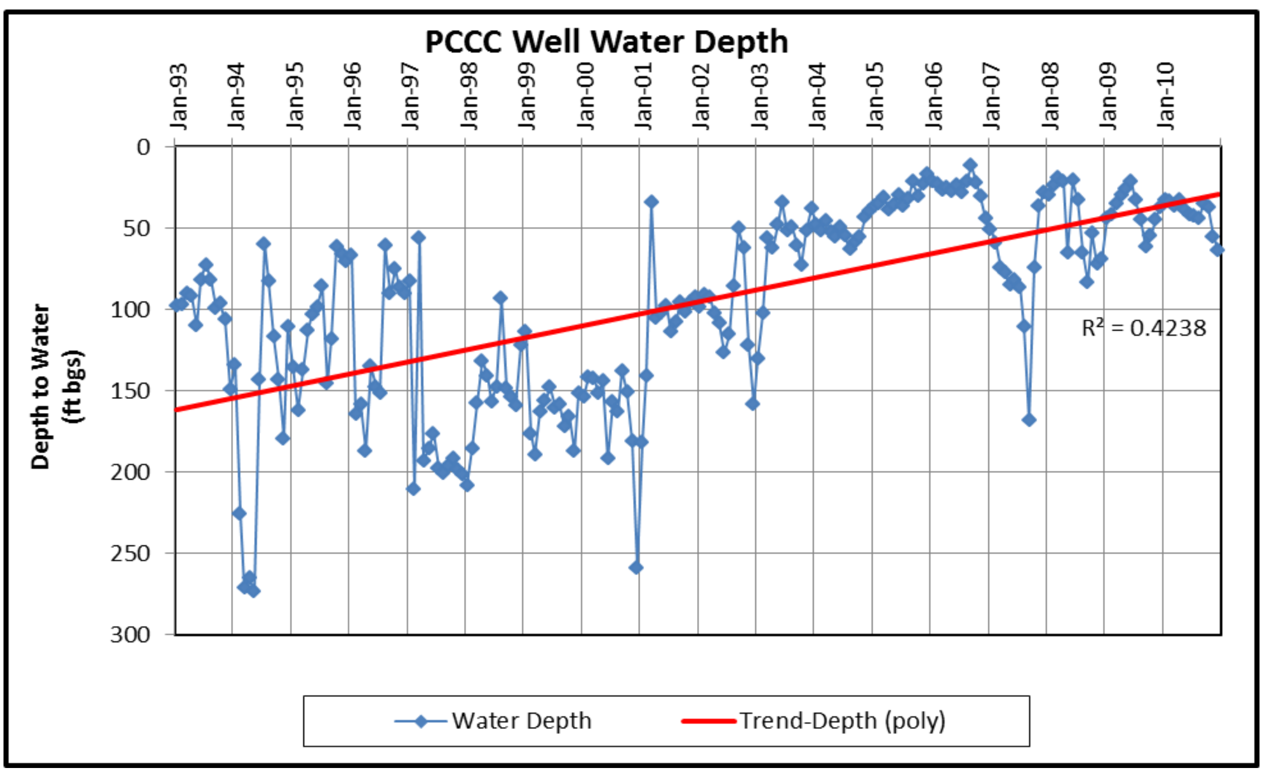


Figure 14: 12-4 Well Water Depth

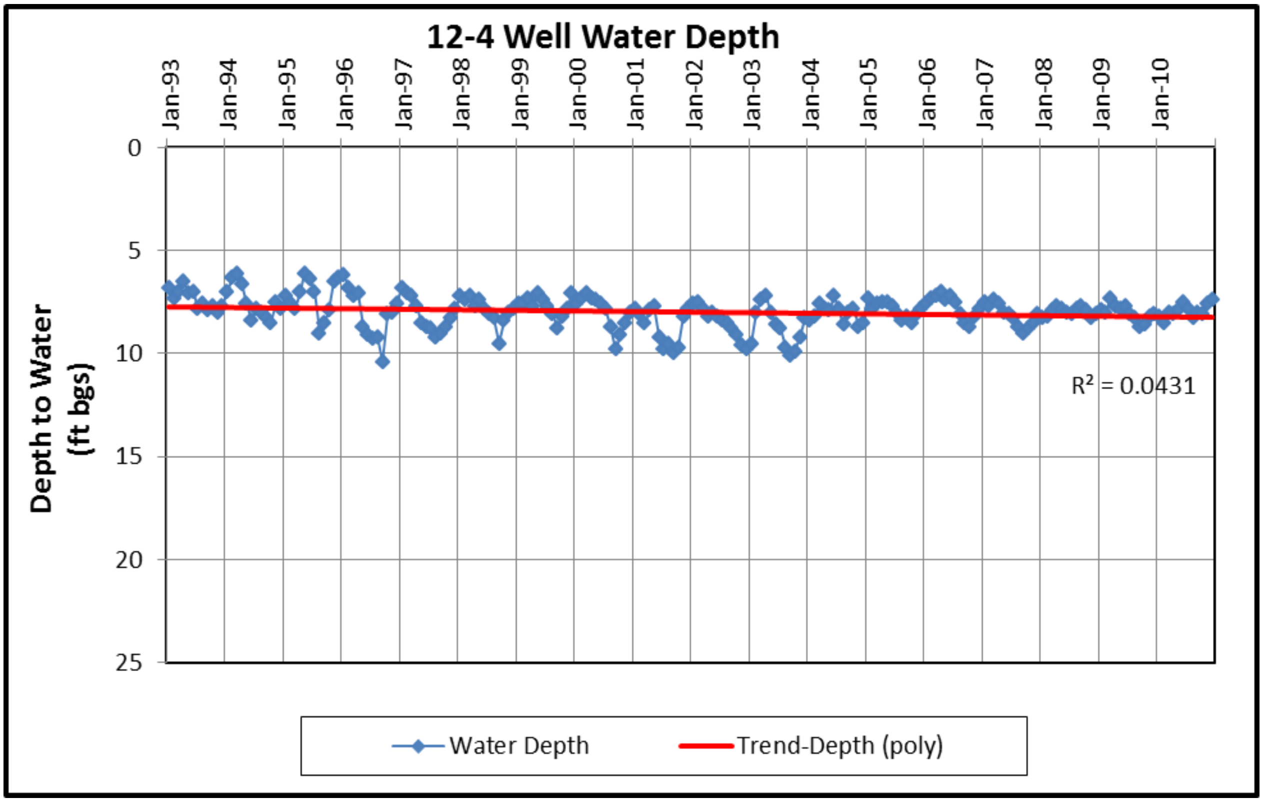
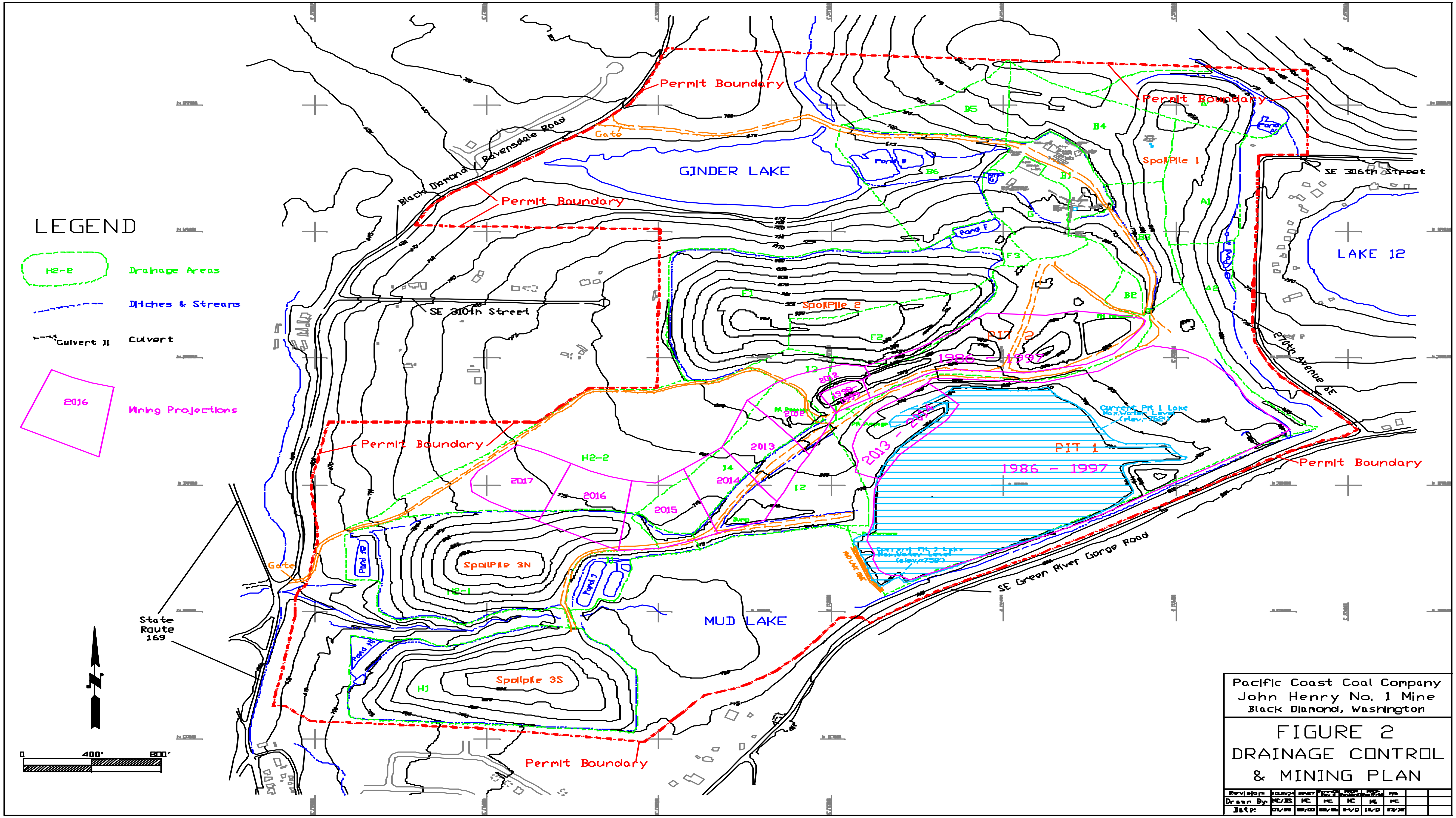


Figure 15: Drainage Control Plan (PCCC, John Henry No. 1 Permit)



5 Material Damage Criteria

5.1 Material Damage Definitions

OSM has identified both material damage thresholds and material damage limits for the John Henry No. 1 Mine. A material damage limit is an impact on the hydrologic balance by the mining operation which permanently precludes a beneficial or designated use outside of the permit area or a water use associated with the designated post-mining land use, which cannot be effectively mitigated by the coal operator. Material damage limits are also designated as major or long-term impacts with respect to the impact intensity designations in Table 15.

Material damage thresholds constitute long-term (i.e. beyond the reclamation liability period) changes to the hydrologic balance caused by the mining operation that are indicative of potential permanent changes. The purpose of material damage thresholds is to provide a mechanism for PCCC and OSM address areas of potential concern prior to the occurrence of material damage to the hydrologic balance outside the permit area. If a material damage water resource threshold is reached, then measures will be taken to ensure material damage to the hydrologic balance outside of the permit area is prevented. Material damage thresholds are designated as moderate impacts in Table 15. Material damage thresholds and limits are defined in Table 17.

Table 17: Material Damage Criteria for the John Henry No. 1 Mine

Material Damage Criteria	
Limit	irretrievable loss or degradation of a water resource such that it is incapable of supporting an existing or reasonably foreseeable use that cannot be provided by alternate water supplies
Threshold	any loss or degradation of a water resource that renders the water unsuitable for its current use or any modorate impacts to the hydrologic balance, as defined in Table 15

5.2 Material Damage Summary Statement

After review of the available hydrologic information, OSM finds that the PCCC John Henry No. 1 Mine has been designed to prevent material damage to the hydrologic balance outside the permit area. It is anticipated that short-term minor impacts will occur to surface water quality, surface water quantity, and groundwater quality (Table 18). Negligible impacts to groundwater quantity resources are anticipated. The mine operator will continue the approved hydrologic monitoring program, and provide data necessary information to ensure the prevention of material damage.

Table 18: Material Damage Summary

Water Resource	Impact Intensity Designation	Impact Duration Designation	Material Damage Threshold Reached	Material Damage Limit Reached
Surface Water Quality	Minor	Short-term	No	No
Surface Water Quantity	Minor	Short-term	No	No
Groundwater Quality	Minor	Short-term	No	No
Groundwater Quantity	Negligible	Short-term	No	No

6 References

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7 Appendix A

Discharge Point 001 (B, F, and G Ponds) [1993 - 2011]	Units	Min	Avg	Max	Std. Dev.	Count	Baseline	Criteria	Criteria Source	Number Exceedances of Baseline	Percent Exceedance of Baseline	Number Exceedances of Criteria	Percent Exceedance of Criteria
Alkalinity, Bicarb (as CaCO3)	mg/L	72	268.750	420	93.52	16							
Alkalinity, Carb (as CaCO3)	mg/L	0.5	3.143	24	6.72	14							
Arsenic, Total Recoverable	µg/L	2.5	9.193	50	10.62	57		190	WDOE				
Cadmium	mg/L	0.001	0.002	0.002	0.00	2							
Calcium	µg/L	13000	39411	88000	15053	34							
Chloride	mg/L	1.4	4.306	14	3.30	16							
Chromium, Total Recoverable	µg/L	0.5	2.667	14	2.46	57		16	NPDES				
Copper	µg/L	0.5	4.325	25	5.08	57		16	NPDES			2	3.5
Flow, Ave.	cfs	0	0.536	2.72	0.58	176							
Flow, Max.	cfs	0.01	1.431	5.16	1.28	175							
Hardness (as CaCO3)	mg/L	68	262.286	500	97.04	56							
Iron	mg/L	0.0025	0.221	1.5	0.23	64	0.63	6	30 CFR 816.42	3	4.7		
Lead	mg/L	0.005	0.009	0.0125	0.00	3							
Magnesium	µg/L	8400	43411	87000	17120	35							
Manganese	µg/L	0.5	225.383	2200	345.59	60	53	4000	30 CFR 816.42	44	73.3		
Mercury	mg/L	0.0005	0.001	0.0005	0.00	2							
Nitrate + Nitrite (as N)	mg/L	0.06	0.595	3	0.80	17							
Oil & Grease	mg/L	0.25	2.320	19	2.41	161							
DO, Min.	mg/L	8.5	9.979	11.9	0.49	166							
DO, Ave.	mg/L	8.6	10.226	12.4	0.57	159							

DO, Max.	mg/L	8.8	10.583	12.8	0.71	166							
pH, Min.	S.U.	6.9	7.866	8.5	0.32	175							
pH, Max.	S.U.	7.4	8.235	8.5	0.18	175							
Phosphate, Total (as P)	µg/L	2.5	26.473	170	23.39	164		82	NPDES			2	1.2
Potassium	µg/L	1400	3870.588	7400	1443.85	17							
Selenium	mg/L	0.0025	0.003	0.0025	0.00	2							
Sodium	µg/L	15000	65882	200000	46354	17							
Solids, Settleable, Average	ml/L	0.25	0.250	0.25	0.00	164							
Solids, Settleable, Maximum	ml/L	0.25	0.250	0.25	0.00	164							
Solids, Total Suspended	mg/L	0.5	5.355	70	7.02	163	20			2	1.2		
Sp.Cond., Ave.	µmho/cm	436	726.543	954	98.01	164	96			164	100		
Sp.Cond., Max.	µmho/cm	575	795.531	1089	104.75	175	96			175	100		
Sulfate (SO4)	mg/L	6.6	123.979	260	73.36	19							
Discharge Turb, Ave.	N.T.U.	1	10	26	6.93	154							
Discharge Turb, Max.	N.T.U.	1	16.907	64	11.61	173							
Zinc	mg/L	0.0005	0.0212	0.38	0.05	57							

Discharge Point 002 (H1, H2, and I Ponds) [1993 - 2011]	Units	Min	Avg	Max	Std. Dev.	Count	Baseline	Criteria	Criteria Source	Number Exceedances of Baseline	Percent Exceedance of Baseline	Number Exceedances of Criteria	Percent Exceedance of Criteria
Alkalinity, Bicarb (as CaCO3)	mg/L	64	163.176	260	58.55	17							
Alkalinity, Carb (as CaCO3)	mg/L	0.5	17.269	200	55.09	13							
Arsenic, Total Recoverable	µg/L	2.5	8.923	50	10.89	52		190	WDOE				
Cadmium	mg/L	0.001	0.001	0.001	0.00	2							
Calcium	µg/L	12000	24566	41000	6683	30							
Chloride	mg/L	0.5	2.624	5.1	1.07	17							
Chromium, Total Recoverable	µg/L	0.5	2.663	13	2.79	52		16	NPDES				
Copper	µg/L	0.5	5.577	82	13.64	52		16	NPDES			2	3.8
Flow, Ave.	cfs	0	1.591	8.26	1.76	157							
Flow, Max.	cfs	0.09	7.336	60	10.29	148							
Hardness (as CaCO3)	mg/L	68	161.843	280	47.74	51							
Iron	mg/L	0.104	0.441	1.6	0.32	58	0.63	6	30 CFR 816.42	9	15.5		
Lead	mg/L	0.005	0.009	0.0125	0.00	4							
Magnesium	µg/L	9300	24267	47000	9174	31							
Manganese	µg/L	4.5	63.792	197	44.69	53	53	4000	30 CFR 816.42	26	49.1		
Mercury	mg/L	0.0005	0.001	0.0005	0.00	2							
Nitrate + Nitrite (as N)	mg/L	0.005	0.451	0.96	0.29	17							

Oil & Grease	mg/L												
DO, Min.	mg/L	9	10.181	11.5	0.45	143							
DO, Ave.	mg/L	9.1	10.493	12.4	0.55	136							
DO, Max.	mg/L	9.5	10.88	13.3	0.69	143							
pH, Min.	S.U.	7	7.904	8.3	0.25	148							
pH, Max.	S.U.	7.8	8.264	8.8	0.12	148							
Phosphate, Total (as P)	µg/L	2.5	25.169	140	20.85	139		82	NPDES			3	2.2
Potassium	µg/L	1400	2500	3700	664.27	17							
Selenium	mg/L	0.0025	0.003	0.0025	0.00	2							
Sodium	µg/L	11000	45705	81000	19826	17							
Solids, Settleable, Average	ml/L	0.25	0.250	0.25	0.00	138							
Solids, Settleable, Maximum	ml/L	0.25	0.250	0.25	0.00	138							
Solids, Total Suspended	mg/L	0.5	3.812	21	3.93	137	20			1	0.7		
Sp.Cond., Ave.	µmho/cm	255	508.754	982	135.11	138	96			138	100		
Sp.Cond., Max.	µmho/cm	290	581.480	1041	143.27	148							
Sulfate (SO4)	mg/L	19	68.211	140	39.22	19							
Discharge Turb, Ave.	N.T.U.	2	7.594	20	4.54	128							
Discharge Turb, Max.	N.T.U.	2	13.158	68	10.32	146							
Zinc	mg/L	0.0005	0.016	0.34	0.05	52							

Discharge Point 003 (Pond A) [1993 - 2011]	Units	Min	Avg	Max	Std.Dev.	Count	Baseline	Criteria	Criteria Source	Number Exceedances of Baseline	Percent Exceedance of Baseline	Number Exceedances of Criteria	Percent Exceedance of Criteria
Alkalinity, Bicarb (as CaCO3)	mg/L	152	263.647	340	61.51	17							
Alkalinity, Carb (as CaCO3)	mg/L	0.5	26.346	320	88.32	13							
Arsenic, Total Recoverable	µg/L	2.5	6.125	25	6.56	20		190	WDOE				
Cadmium	mg/L	0.001	0.001	0.001	0.00	2							
Calcium	µg/L	29000	42428	52000	7365	21							
Chloride	mg/L	1	3.013	5.7	1.34	16							
Chromium, Total Recoverable	µg/L	0.5	2.05	13	2.75	20		16	NPDES				
Copper	µg/L	0.5	4.4	40	8.69	20		16	NPDES			1	5
Flow, Ave.	cfs	0.01	0.675	1	0.41	17							
Flow, Max.	cfs	0.005	0.07	2.44	0.22	136							
Hardness (as CaCO3)	mg/L	140	274	460	64.63	35							
Iron	mg/L	0.0025	0.259	3.6	0.53	52	0.63	6	30 CFR 816.42	2	3.8		
Lead	mg/L	0.005	0.005	0.005	0.00	3							
Magnesium	µg/L	26000	42695	68000	9669	23							
Manganese	µg/L	0.37	246.81	3300	496.83	49	53	4000	30 CFR 816.42	43	87.8		
Mercury	mg/L	0.0005	0.001	0.0005	0.00	2							
Nitrate + Nitrite (as N)	mg/L	0.042	0.613	2.6	0.65	16							
Oil & Grease	mg/L												
DO, Min.	mg/L	9.5	10.015	11.4	0.37	132							
DO, Ave.	mg/L	9.6	9.8	10.2	0.21	6							
DO, Max.	mg/L	9.5	10.026	11.4	0.36	132							

pH, Min.	S.U.	6.6	7.599	8.1	0.24	136							
pH, Max.	S.U.	6.6	7.608	8.1	0.23	136							
Phosphate, Total (as P)	µg/L	2.5	22.33	110	22.27	53		82	NPDES			2	3.8
Potassium	µg/L	1200	2164.706	3900	705.28	17							
Selenium	mg/L	0.0025	0.003	0.0025	0.00	2							
Sodium	µg/L	19000	40941	120000	24757	17							
Solids, Settleable, Average	ml/L												
Solids, Settleable, Maximum	ml/L												
Solids, Total Suspended	mg/L	0.5	3.72	28	3.98	127	20			1	0.8		
Sp.Cond., Ave.	µmho/cm						96						
Sp.Cond., Max.	µmho/cm	280	663.044	1170	129.88	136	96			136	100		
Sulfate (SO4)	mg/L	29	85.632	170	39.92	19							
Discharge Turb, Ave.	N.T.U.												
Discharge Turb, Max.	N.T.U.	1	4.963	17	3.58	134							
Zinc	mg/L	0.0005	0.017	0.32	0.05	35							

Discharge Point 008 (Pond A') [1993 - 2011]	Units	Min	Avg	Max	Std. Dev.	Count	Baseline	Criteria	Criteria Source	Number Exceedances of Baseline	Percent Exceedance of Baseline	Number Exceedances of Criteria	Percent Exceedance of Criteria
Alkalinity, Bicarb (as CaCO3)	mg/L	60	160.438	350	84.16	16							
Alkalinity, Carb (as CaCO3)	mg/L	0.5	0.667	1	0.25	12							
Arsenic, Total Recoverable	µg/L	2.5	6.316	25	6.69	19		190	WDOE				
Cadmium	mg/L	0.001	0.001	0.001	0.00	2							
Calcium	µg/L	14000	33095	74000	15668	21							
Chloride	mg/L	0.9	2.013	5	1.18	15							
Chromium, Total	µg/L	0.5	1.711	4	1.16	19		16	NPDES				

Recoverable													
Copper	µg/L	0.5	3.974	21	4.87	19		16	NPDES			1	5.3
Flow, Ave.	cfs	0.01	0.086	0.21	0.08	7							
Flow, Max.	cfs	0.005	0.037	1.55	0.14	128							
Hardness (as CaCO3)	mg/L	76	188.618	420	78.74	34							
Iron	mg/L	0.025	0.321	1.5	0.25	50	0.63	6	30 CFR 816.42	3	6		
Lead	mg/L	0.005	0.005	0.005	0.00	3							
Magnesium	µg/L	10000	26000	59000	11968	22							
Manganese	µg/L	1.5	232.747	2000	386.69	47	53	4000	30 CFR 816.42	30	63.8		
Mercury	mg/L	0.0005	0.001	0.0005	0.00	2							
Nitrate + Nitrite (as N)	mg/L	0.005	0.598	1.7	0.53	16							
pH, Min.	S.U.	6.5	7.536	8.3	0.28	128							
pH, Max.	S.U.	6.5	7.545	8.3	0.27	128							
Potassium	µg/L	930	1768.125	2700	543.22	16							
Selenium	mg/L	0.0025	0.003	0.0025	0.00	2							
Sodium	µg/L	4500	9968	24000	4845	16							
Solids, Total Suspended	mg/L	0.5	3.828	40	4.72	119	20			2	1.7		
Sp.Cond., Ave.	µmho/cm					11	96			7	63.6		
Sp.Cond., Max.	µmho/cm	149	460.591	906	150.00	127	96			127	100		
Sulfate (SO4)	mg/L	3.6	31.661	94	30.64	18							
Zinc	mg/L	0.0005	0.019	0.34	0.06	34							

Reichert Well [1993 – 2011]										
Analyte	**Units**	**Min**	**Avg**	**Max**	**Std. Dev.**	**Count**	**Criteria**	**Criteria Source**	**Number Exceedances of Criteria**	**Percent Exceedance of Criteria**
Water Depth	feet	52.1	89.537	173.4	22.93	216				
pH	S.U.	7	7.376	8	0.14	216				
Specific Conductance	µmho/cm	460	595.185	683	36.92	216				
Temperature	deg F	35	53.686	72.6	6.12	215				
Hardness (CaCO3)	mg/L	270	350.299	470	33.39	67				
Arsenic	mg/L	0.0025	0.009	0.05	0.01	71	0.05	NPDES		
Iron	mg/L	0.0025	0.056	0.53	0.09	69	0.3	WAC 173-200-040	2	2.9
Lead	mg/L	0.0025	0.011	0.04	0.01	37	0.05	NPDES		
Chromium	mg/L	0.0005	0.004	0.031	0.01	37	0.05	NPDES		
Mercury	mg/L	0.00005		0.005	0.00	38	0.002	NPDES	1	2.6
Manganese	mg/L	0.00025	0.018	0.101	0.02	71	0.05	NPDES	3	4.2
Calcium	mg/L	35	81.95	130	13.68	40				
Sodium	mg/L	6.8	19.573	180	44.39	15				
Magnesium	mg/L	29	36.049	43	2.72	41				
Potassium	mg/L	1.1	1.593	5.3	1.04	15				
Chloride	mg/L	0.5	2.644	6.5	1.42	16	250	WAC 173-200-040		
Sulfate	mg/L	11	16.556	33	5.52	18	250	WAC 173-200-040		
Nitrate (+Nitrite)	mg/L	0.025	0.089	0.3	0.06	16				
Carbonate (C-Alk.)	mg/L	0.5	0.75	2	0.45	12				
Bicarbonate	mg/L	180	323.846	400	59.1	13				
TDS	mg/L	320	346.667	390	37.86	3				
TSS	mg/L	2	2.333	3	0.58	3				
Barium	mg/L	0.34	0.34	0.34	N.A.	1				

Cadmium	mg/L	0.002	0.002	0.002	N.A.	1				
Selenium	mg/L	0.0025	0.003	0.0025	N.A.	1				
Copper	mg/L	0.005	0.005	0.005	N.A.	1				

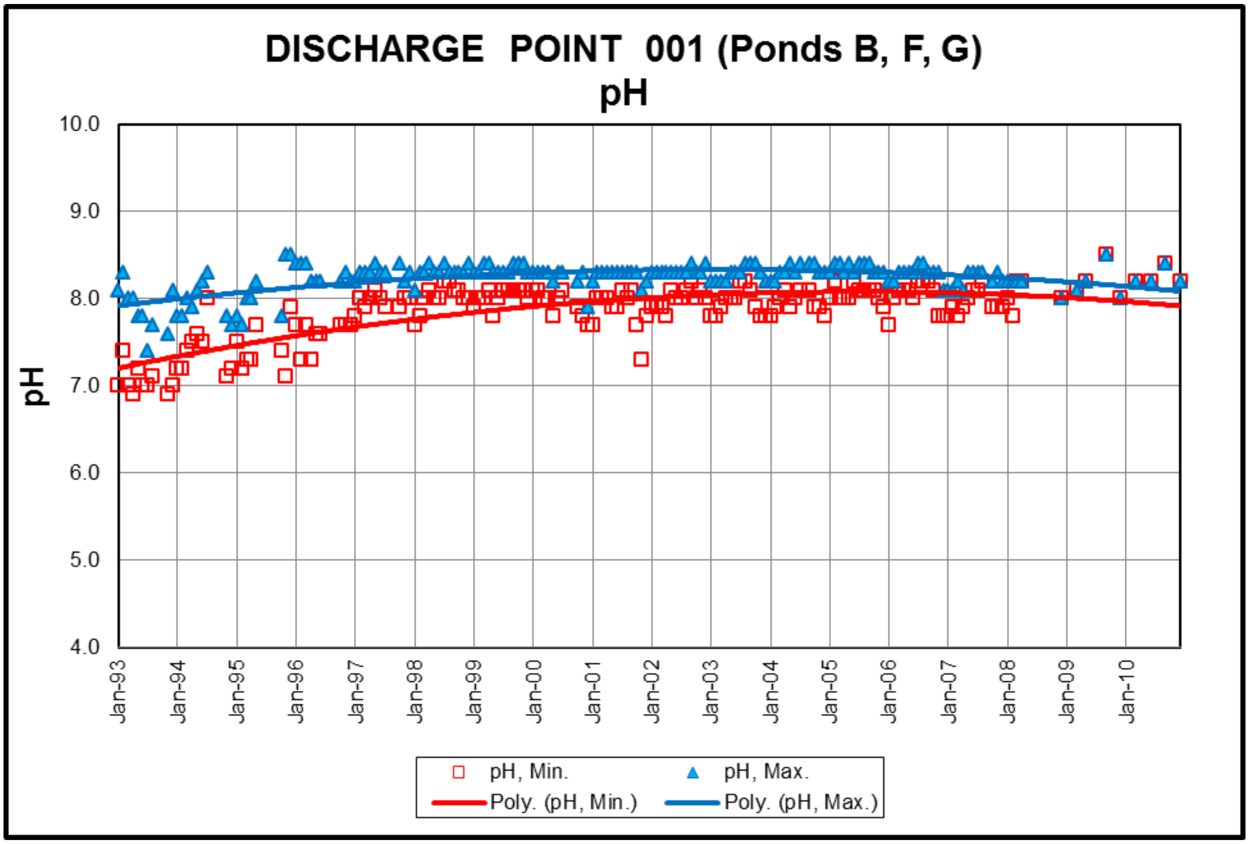
		PCCC Well [1993 – 2011]								
Analyte	**Units**	**Min**	**Avg**	**Max**	**Std. Dev.**	**Count**	**Criteria**	**Criteria Source**	**Number Exceedances of Criteria**	**Percent Exceedance of Criteria**
Water Depth	feet	11.5	95.666	273.2	59.1	216				
pH	S.U.	7.3	7.92	8.5	0.18	216				
Specific Conductance	µmho/cm	336	426.5	578	35.21	216				
Temperature	deg F	43.3	52.787	71	4.18	216				
Hardness (CaCO3)	mg/L	0.5	87.831	180	38.06	68				
Arsenic	mg/L	0.0025	0.009	0.05	0.01	71	0.05	NPDES		
Iron	mg/L	0.0125	0.318	4.04	0.73	69	0.3	WAC 173-200-040	10	14.5
Lead	mg/L	0.0025	0.008	0.025	0.01	37	0.05	NPDES		
Chromium	mg/L	0.0005	0.003	0.025		37	0.05	NPDES		
Mercury	mg/L	0.00005		0.005		38	0.002	NPDES	1	2.6
Manganese	mg/L	0.00025	0.009	0.07	0.01	70	0.05	NPDES	1	1.4
Calcium	mg/L	9.1	20.678	37	7.96	40				
Sodium	mg/L	50	68.333	95	13.46	15				
Magnesium	mg/L	5	11.285	21	4.54	41				
Potassium	mg/L	1.1	1.493	2.1	0.31	15				
Chloride	mg/L	0.5	1.906	4.7	1	16	250	WAC 173-200-040		
Sulfate	mg/L	0.5	5.122	11	3.98	18	250	WAC 173-200-040		
Nitrate (+Nitrite)	mg/L	0.005	0.04	0.11	0.04	16				
Carbonate (C-Alk.)	mg/L	0.5	2.792	21	5.94	12				
Bicarbonate	mg/L	210	228.462	260	14.05	13				
TDS	mg/L	230	276.667	360	72.34	3				

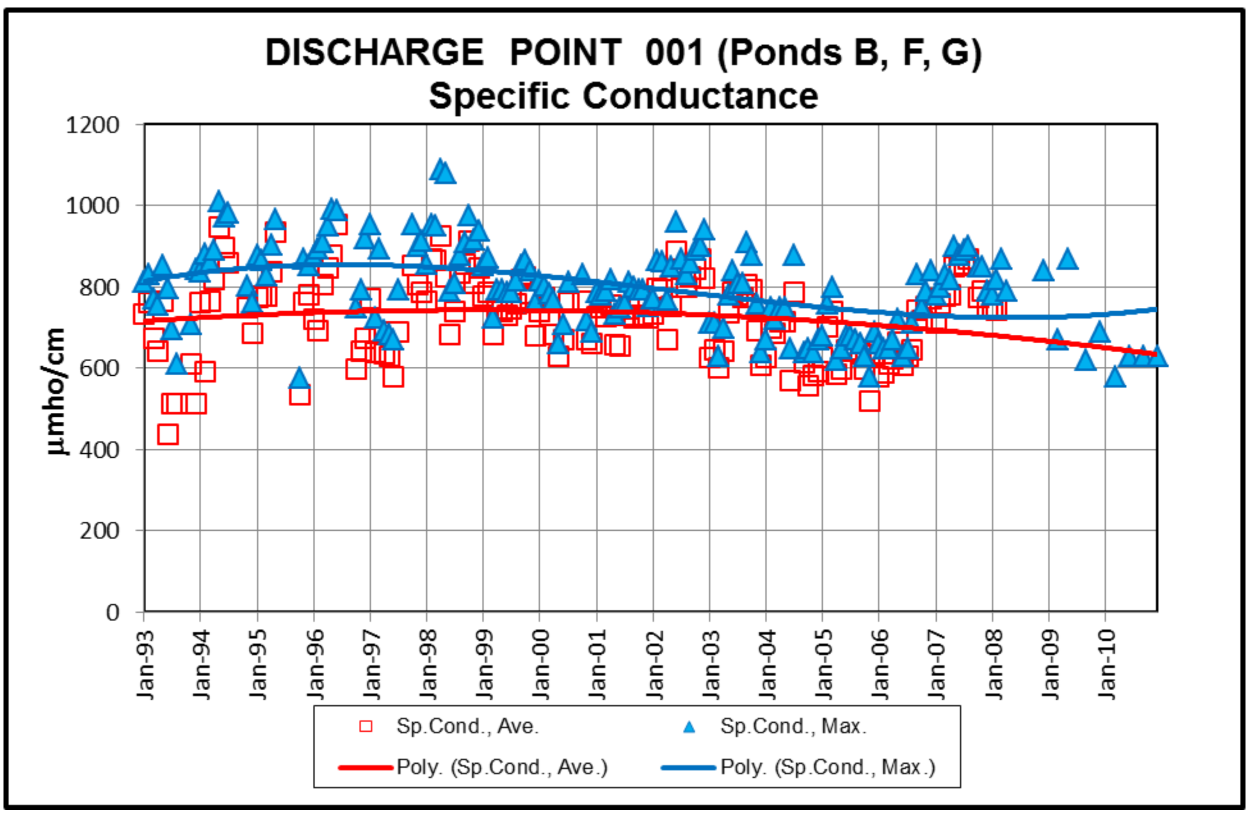
TSS	mg/L	2	2.667	4	1.15	3				
Barium	mg/L	0.05	0.05	0.05	N.A.	1				
Cadmium	mg/L	0.001	0.001	0.001	N.A.	1				
Selenium	mg/L	0.0025	0.003	0.0025	N.A.	1				
Copper	mg/L	0.001	0.001	0.001	N.A.	1				

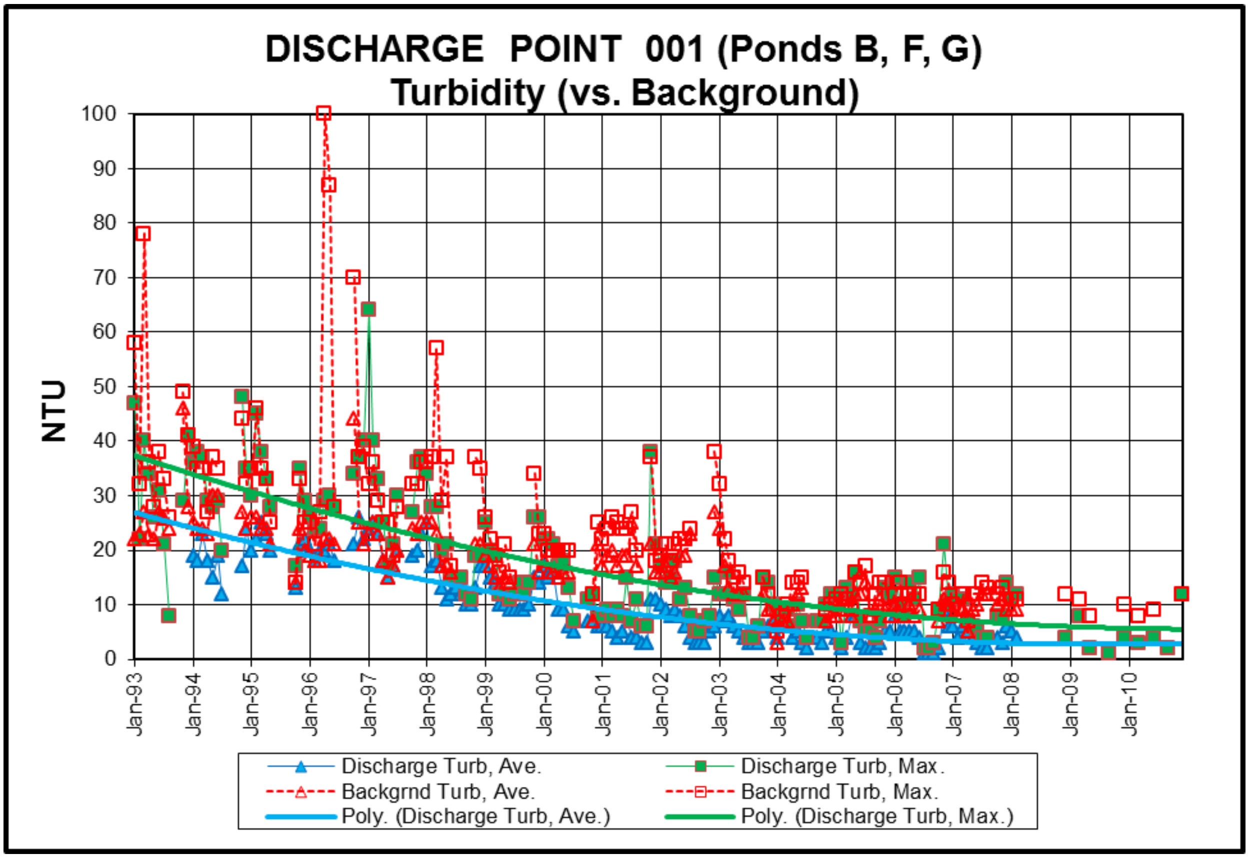
	12 - 4 Well [1993 – 2011]									
Analyte	**Units**	**Min**	**Avg**	**Max**	**Std. Dev.**	**Count**	**Criteria**	**Criteria Source**	**Number Exceedances of Criteria**	**Percent Exceedance of Criteria**
Water Depth	feet	6.1	7.98	10.4	0.77	216				
pH	S.U.	8.3	8.784	9	0.1	216				
Specific Conductance	µmho/cm	350	452.833	944	98.3	216				
Temperature	deg F	38.8	53.254	73.4	5.13	216				
Hardness (CaCO3)	mg/L	0.5	15.6	140	27.08	68				
Arsenic	mg/L	0.0025	0.026	0.058	0.01	72	0.122	NPDES		
Iron	mg/L	0.025	0.360	3.8	0.63	70	0.3	WAC 173-200-040	18	25.7
Lead	mg/L	0.0025	0.008	0.025	0.01	38	0.05	NPDES		
Chromium	mg/L	0.000025	0.003	0.025		38	0.05	NPDES		
Mercury	mg/L	0.00005		0.005		39	0.002	NPDES	1	2.6
Manganese	mg/L	0.00025	0.007	0.086	0.01	71	0.05	NPDES	1	1.4
Calcium	mg/L	1.3	2.427	19	3.31	41				
Sodium	mg/L	82.1	104.569	140	15.82	16				
Magnesium	mg/L	0.006	1.151	15	2.57	42				
Potassium	mg/L	1.2	2.25	10.5	2.28	16				
Chloride	mg/L	0.5	8.341	54	12.02	17	250	WAC 173-200-040		
Sulfate	mg/L	0.25	8.261	110	26.01	19	250	WAC 173-200-040		
Nitrate (+Nitrite)	mg/L	0.005	0.162	1.7	0.42	17				

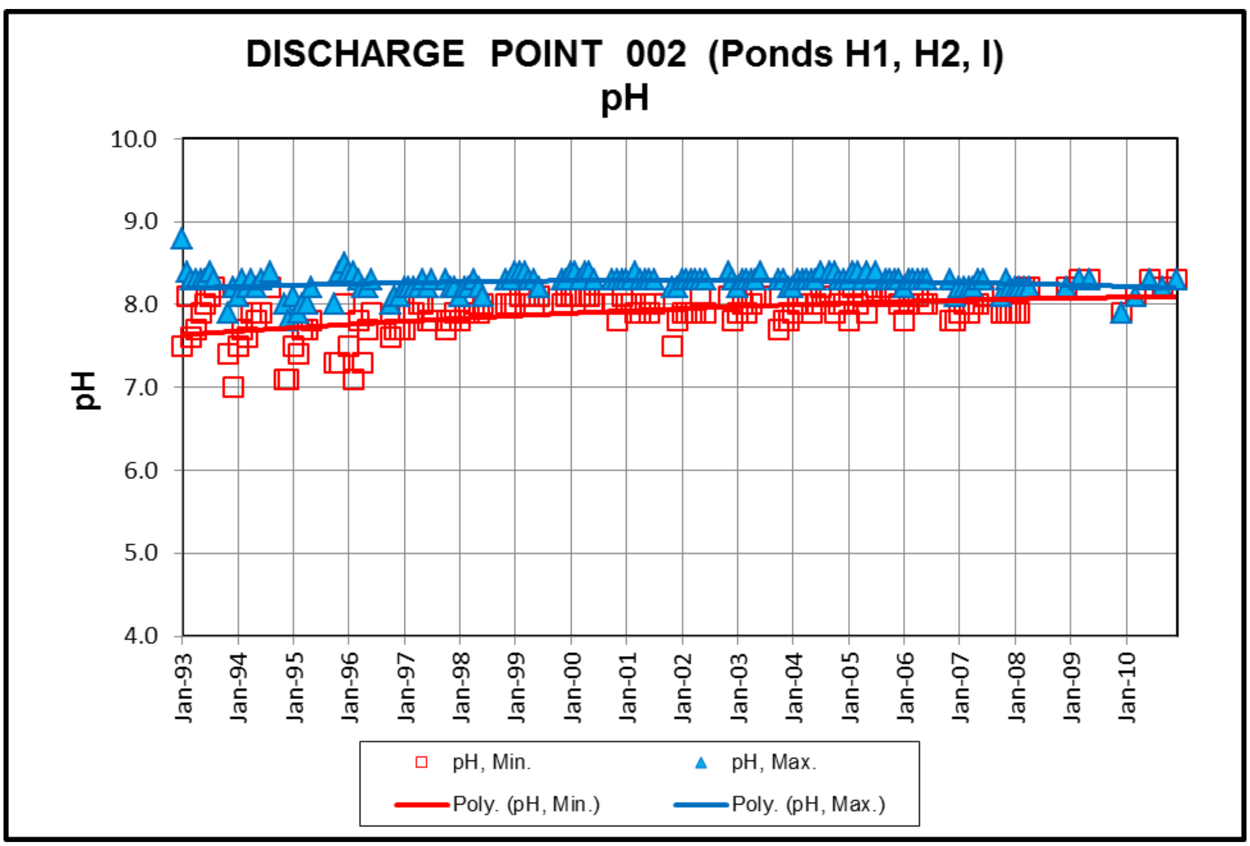
Carbonate (C-Alk.)	mg/L	0.5	19.2	58	18.89	15				
Bicarbonate	mg/L	170	219.286	280	28.41	14				
TDS	mg/L	220	266	314	38.61	4				
TSS	mg/L	1	3	6	2.65	3				
Cadmium	mg/L	0.0005	0.001	0.001		2				
Selenium	mg/L	0.0005	0.002	0.0025		2				

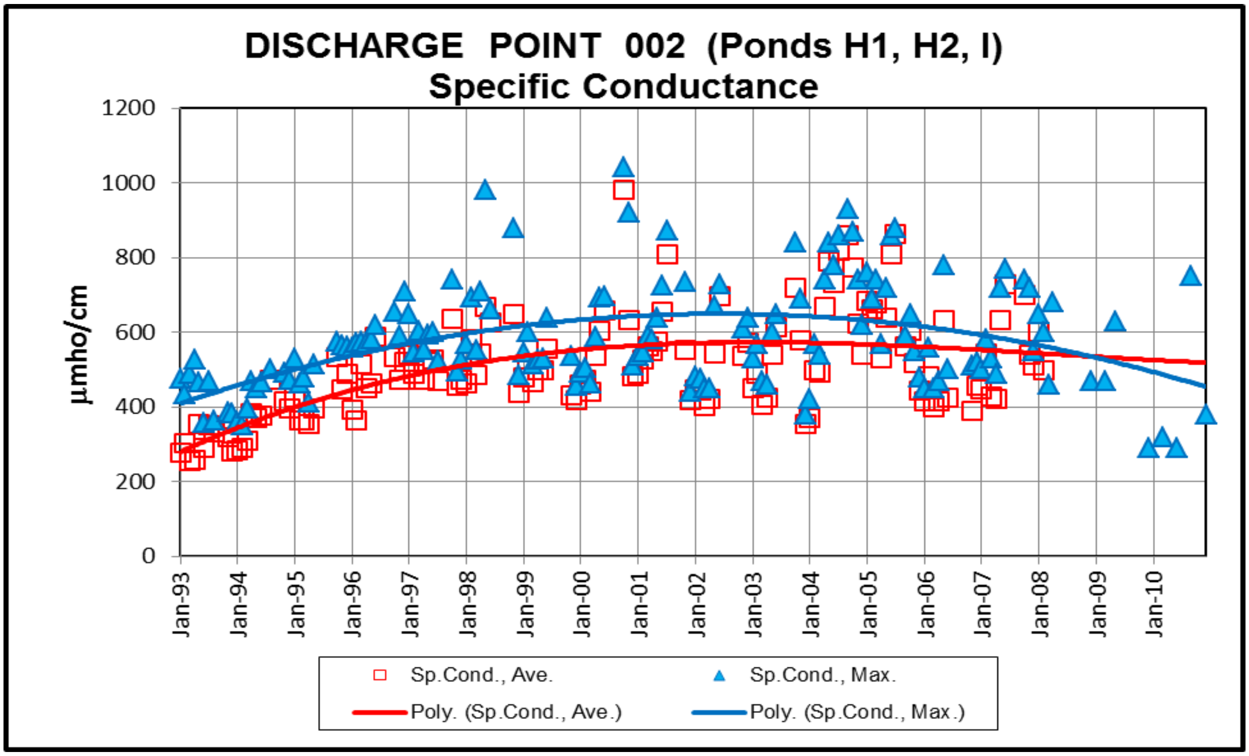
		Pit 2 [1993 – 2011]								
Analyte	**Units**	**Min**	**Avg**	**Max**	**Std. Dev.**	**Count**	**Criteria**	**Criteria Source**	**Number Exceedances of Criteria**	**Percent Exceedance of Criteria**
pH	S.U.	7.6	8.5	8.8	0.19	216				
Specific Conductance	µmho/cm	442	820.796	1200	145.07	216				
Temperature	deg F	37	55.454	76.5	10.25	203				
Hardness (CaCO3)	mg/L	0.5	249	400	91.15	68				
T.D.S.	mg/L									
Arsenic	mg/L	0.0025	0.009	0.05	0.01	71	0.05	NPDES		
Iron	mg/L	0.0025	0.119	0.65	0.15	71	0.3	WAC 173-200-040	9	12.6
Lead	mg/L	0.0025	0.012	0.04	0.01	70	0.05	NPDES		
Chromium	mg/L	0.00025	0.002	0.025		70	0.05	NPDES		
Mercury	mg/L	0.00005		0.005		71	0.002	NPDES	2	2.8
Manganese	mg/L	0.00025	0.008	0.07	0.01	71	0.05	NPDES	2	2.8
Calcium	mg/L	13	27.65	69	9.84	40				
Sodium	mg/L	8	87.5	200	57.23	14				
Magnesium	mg/L	11	53.659	73	15.69	41				
Potassium	mg/L	1.6	4.357	7.7	1.38	14				
Chloride	mg/L	0.05	1.683	4	1.05	15	250	WAC 173-200-040		
Sulfate	mg/L	100	185.333	310	66.85	15	250	WAC 173-200-040	3	20
Nitrate (+Nitrite)	mg/L	0.015	0.984	3.9	1.53	15				
Carbonate (C-Alk.)	mg/L	0.5	17.846	48	16.79	13				
Bicarbonate	mg/L	200	271.538	340	42.4	13				

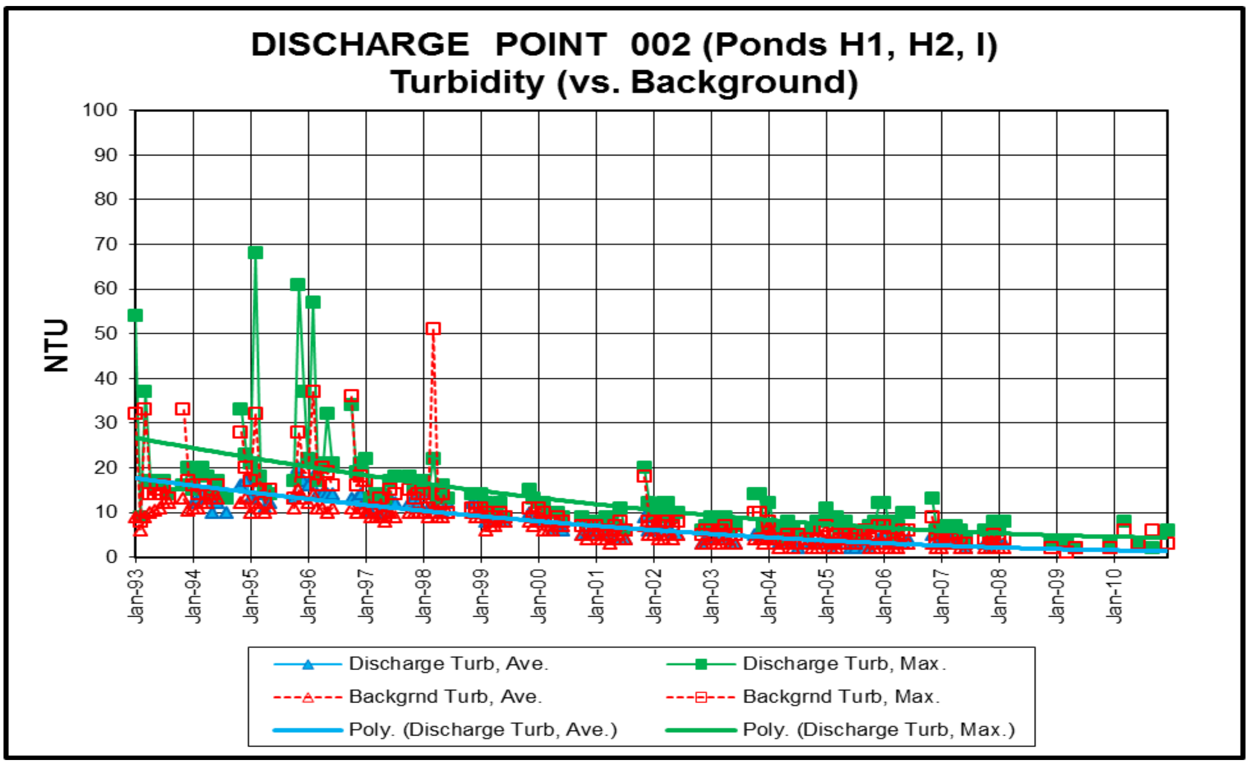

DISCHARGE POINT 001 (Ponds B, F, G)
pH
10.0
9.0
8.0
7.0
6.0
5.0
4.0
pH
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
pH, Min.
pH, Max.
Poly. (pH, Min.)
Poly. (pH, Max.)

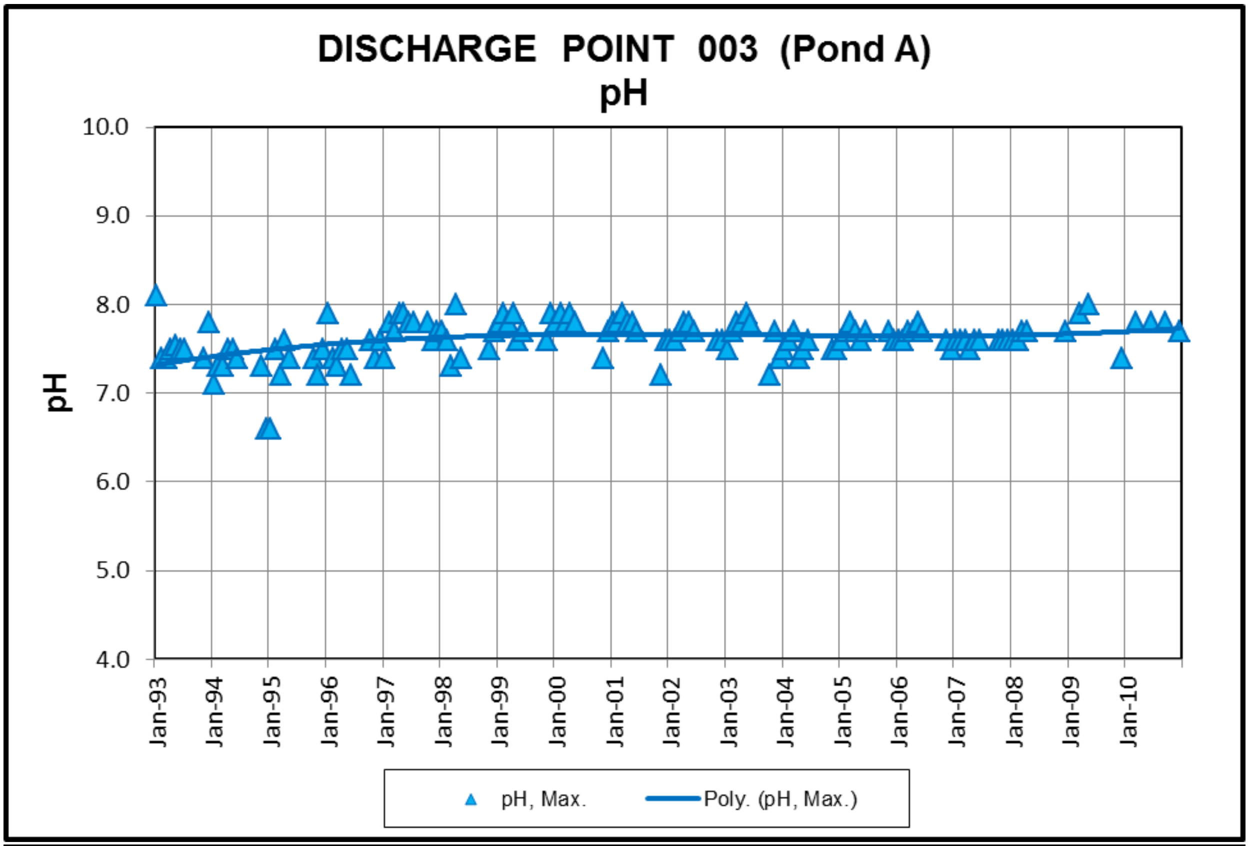

DISCHARGE POINT 001 (Ponds B, F, G)
Specific Conductance
1200
1000
800
600
400
200
0
µmho/cm
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Sp.Cond., Ave.
Sp.Cond., Max.
Poly. (Sp.Cond., Ave.)
Poly. (Sp.Cond., Max.)

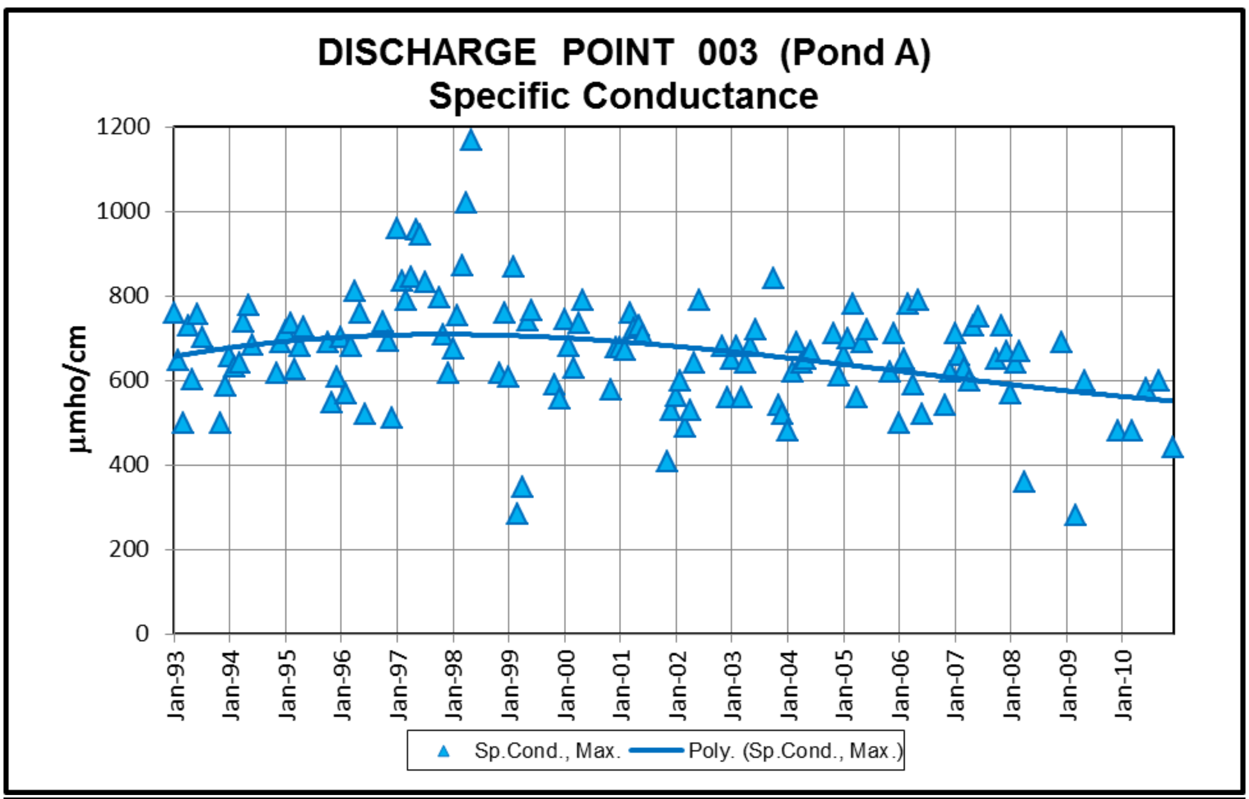

DISCHARGE POINT 001 (Ponds B, F, G)
Turbidity (vs. Background)
NTU
100
90
80
70
60
50
40
30
20
10
0
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Discharge Turb, Ave.
Discharge Turb, Max.
Backgrnd Turb, Ave.
Backgrnd Turb, Max.
Poly. (Discharge Turb, Ave.)
Poly. (Discharge Turb, Max.)

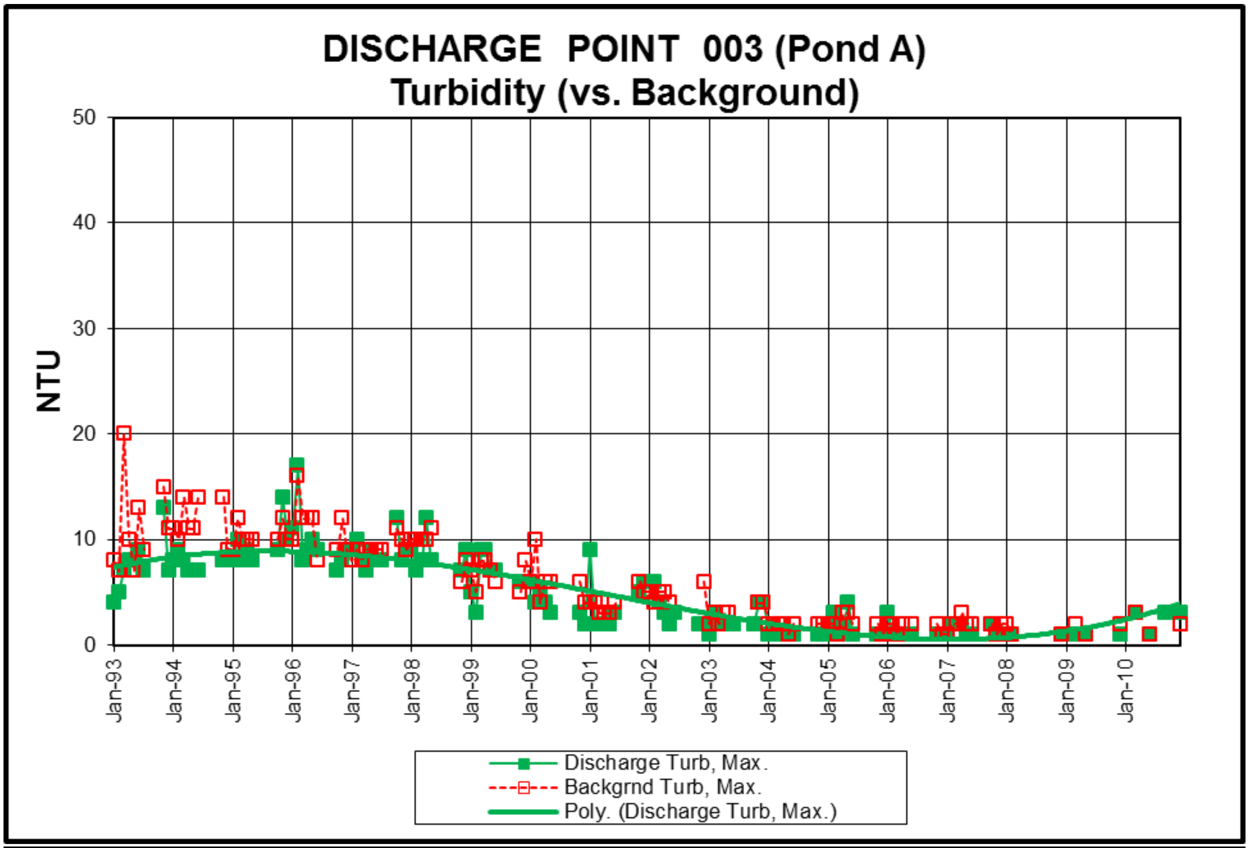

DISCHARGE POINT 002 (Ponds H1, H2, I)
pH
pH
10.0
9.0
8.0
7.0
6.0
5.0
4.0
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
pH, Min.
pH, Max.
Poly. (pH, Min.)
Poly. (pH, Max.)

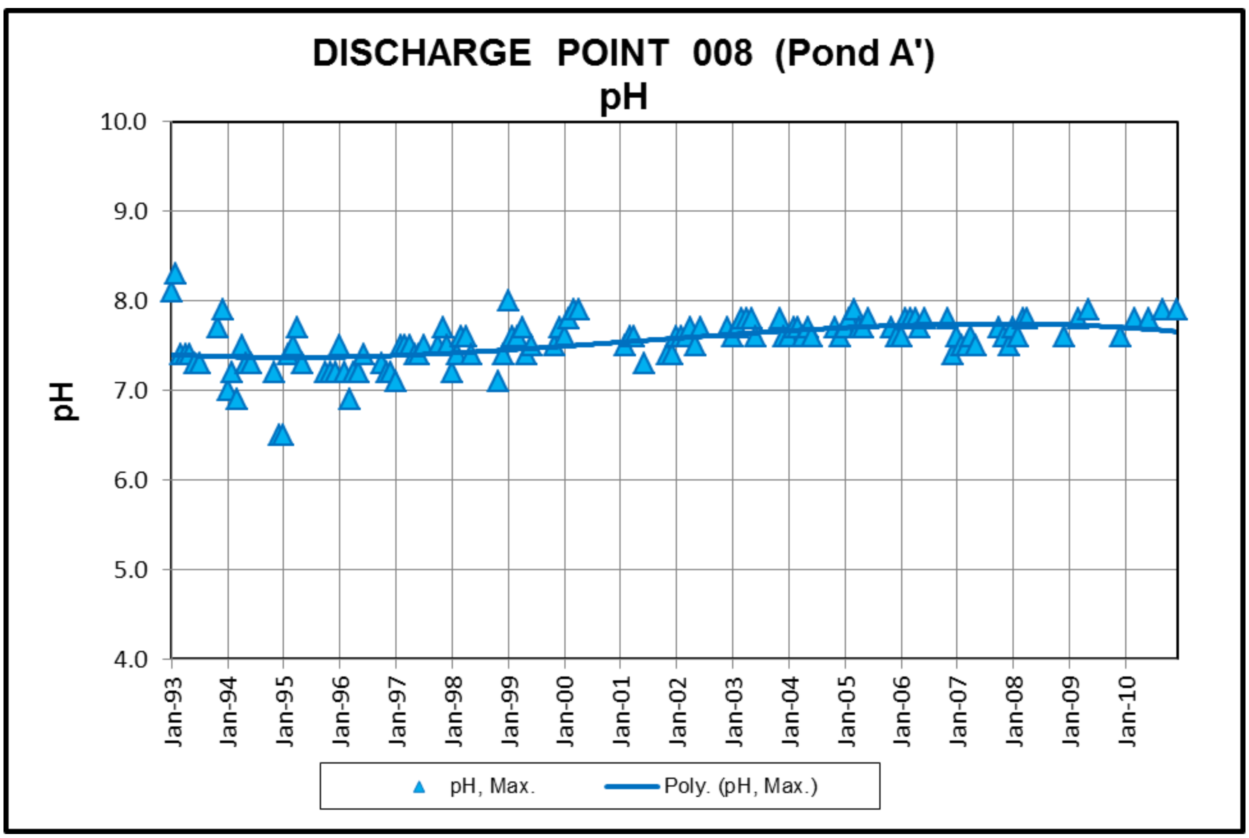

DISCHARGE POINT 002 (Ponds H1, H2, I)
Specific Conductance
µmho/cm
1200
1000
800
600
400
200
0
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Sp.Cond., Ave.
Sp.Cond., Max.
Poly. (Sp.Cond., Ave.)
Poly. (Sp.Cond., Max.)

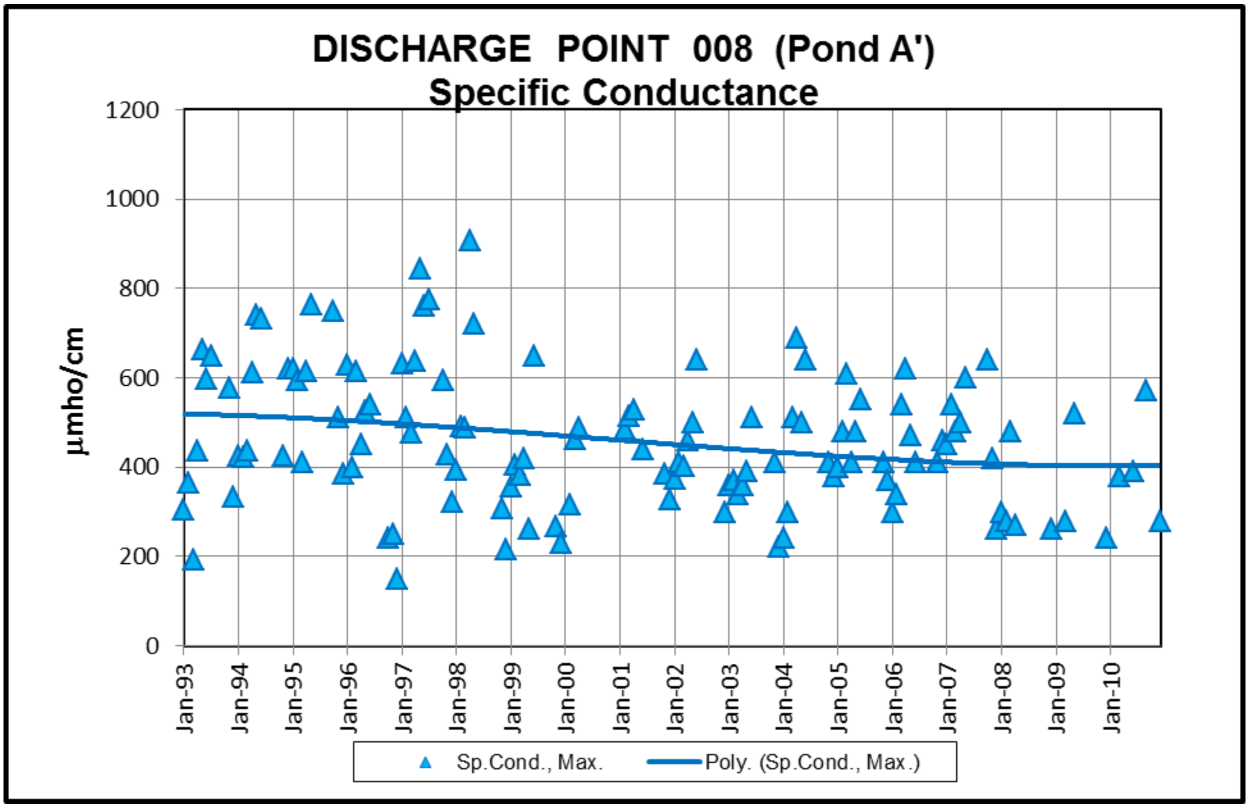

DISCHARGE POINT 002 (Ponds H1, H2, I)
Turbidity (vs. Background)
NTU
100
90
80
70
60
50
40
30
20
10
0
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Discharge Turb, Ave.
Discharge Turb, Max.
Backgrnd Turb, Ave.
Backgrnd Turb, Max.
Poly. (Discharge Turb, Ave.)
Poly. (Discharge Turb, Max.)

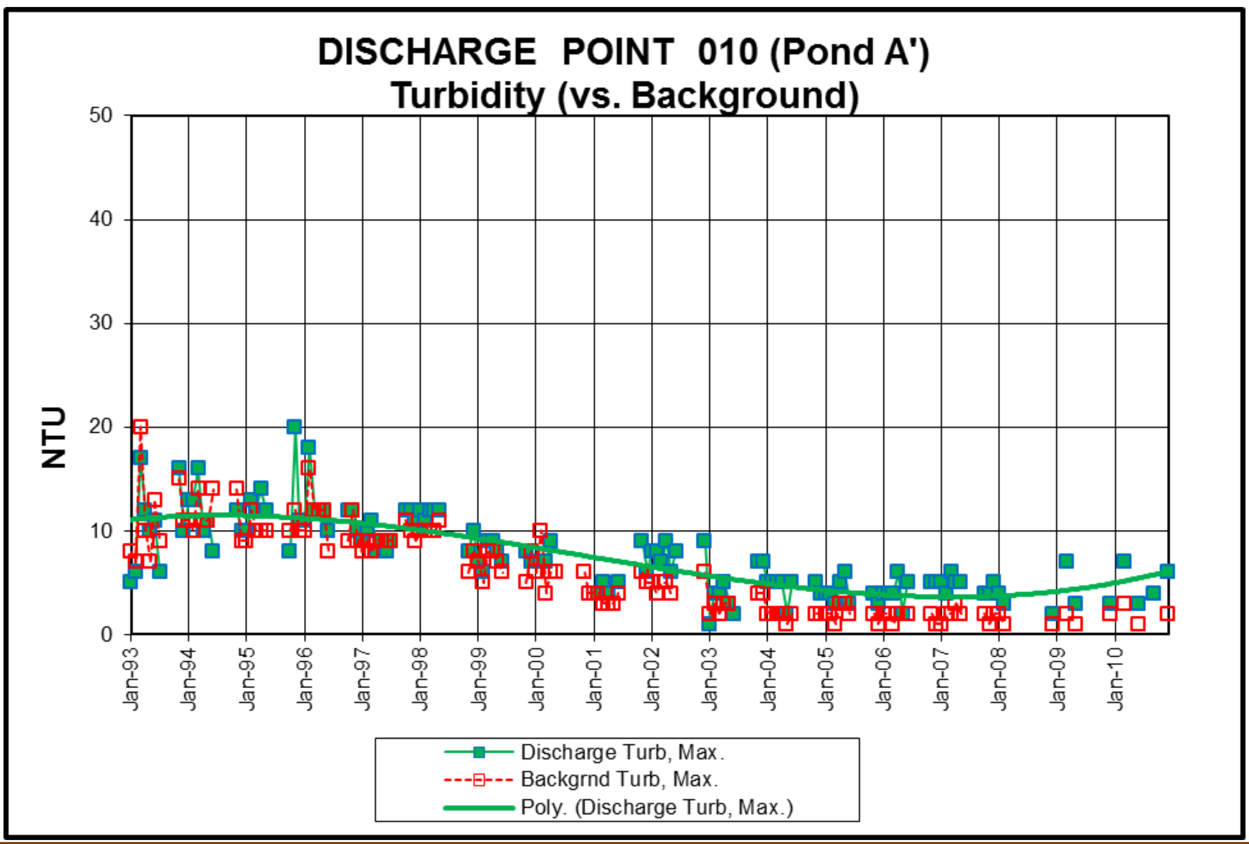

DISCHARGE POINT 003 (Pond A)
pH
pH
10.0
9.0
8.0
7.0
6.0
5.0
4.0
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
pH, Max.
Poly. (pH, Max.)

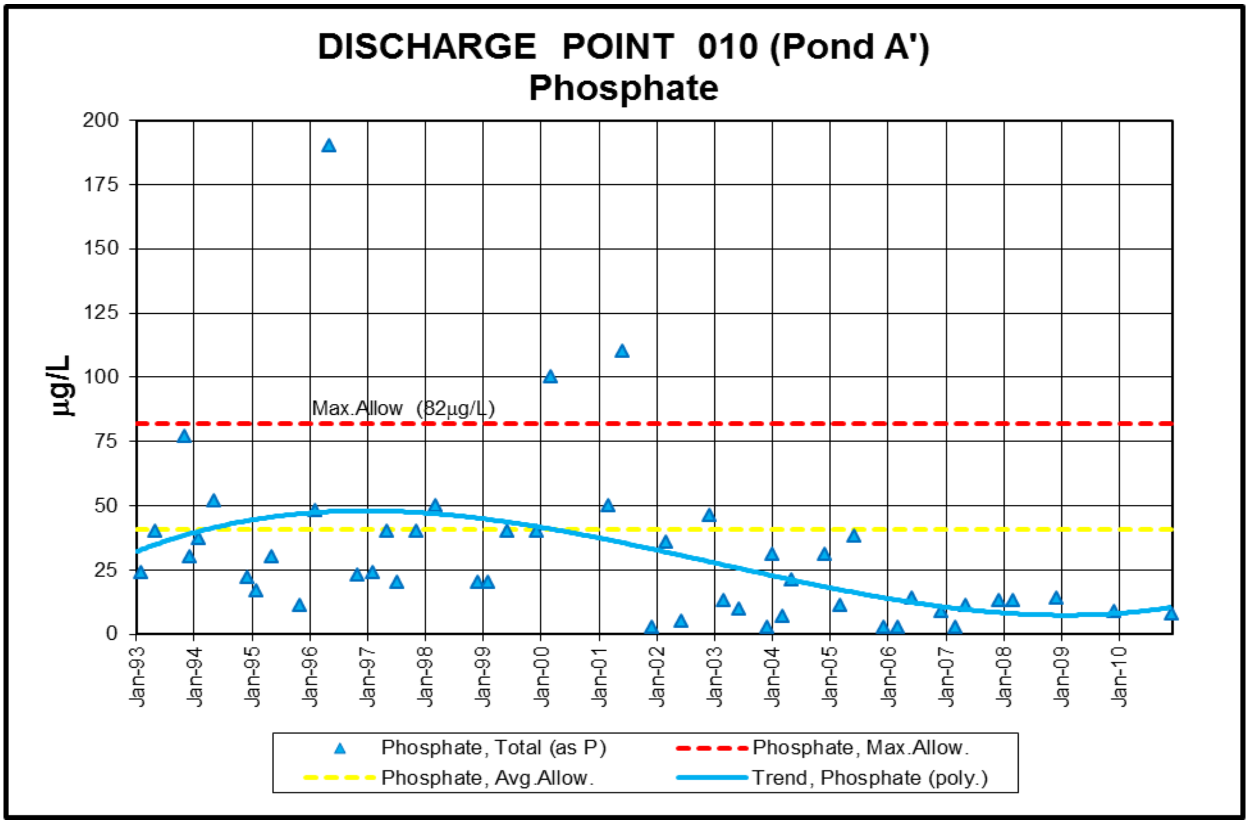

DISCHARGE POINT 003 (Pond A)
Specific Conductance
µmho/cm
1200
1000
800
600
400
200
0
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Sp.Cond., Max.
Poly. (Sp.Cond., Max.)

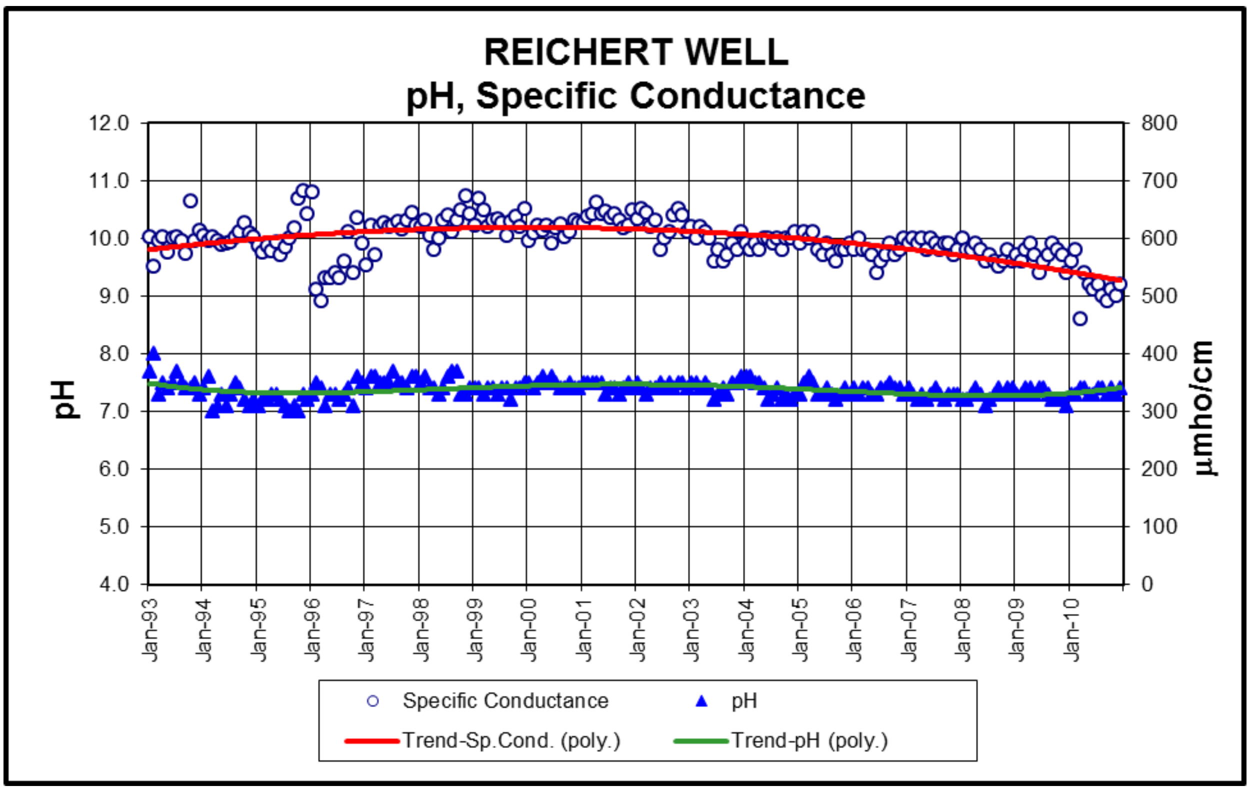

DISCHARGE POINT 003 (Pond A)
Turbidity (vs. Background)
NTU
50
40
30
20
10
0
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Discharge Turb, Max.
Backgrnd Turb, Max.
Poly. (Discharge Turb, Max.)

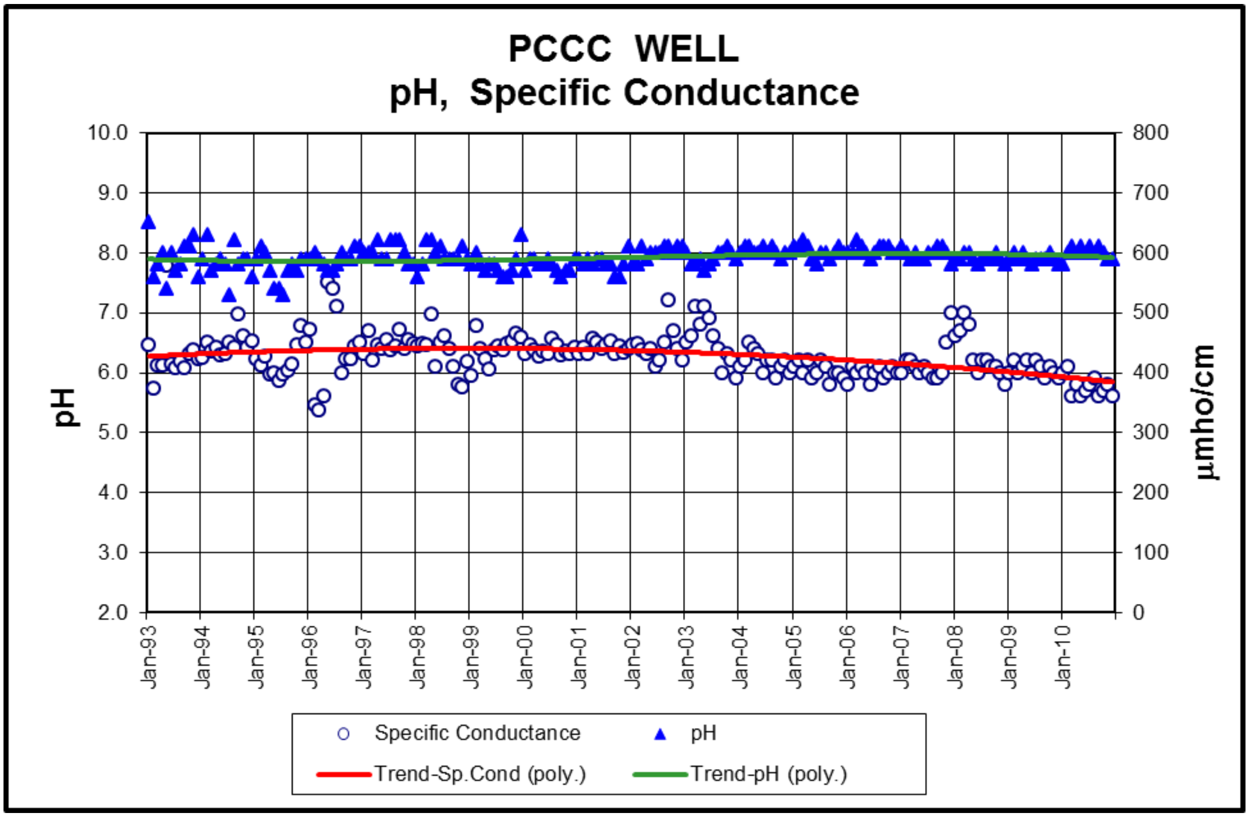

DISCHARGE POINT 008 (Pond A')
pH
pH
10.0
9.0
8.0
7.0
6.0
5.0
4.0
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
pH, Max.
Poly. (pH, Max.)

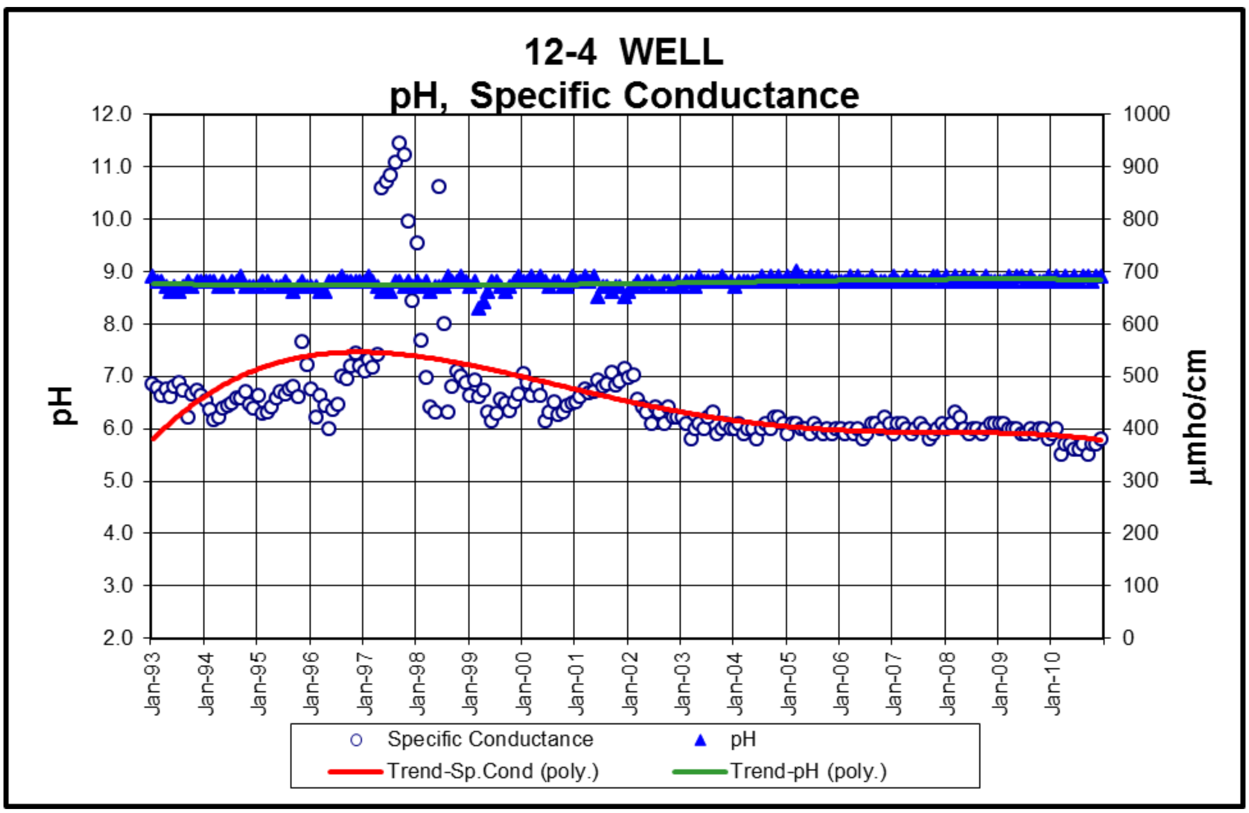

DISCHARGE POINT 008 (Pond A')
Specific Conductance
µmho/cm
1200
1000
800
600
400
200
0
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Sp.Cond., Max.
Poly. (Sp.Cond., Max.)

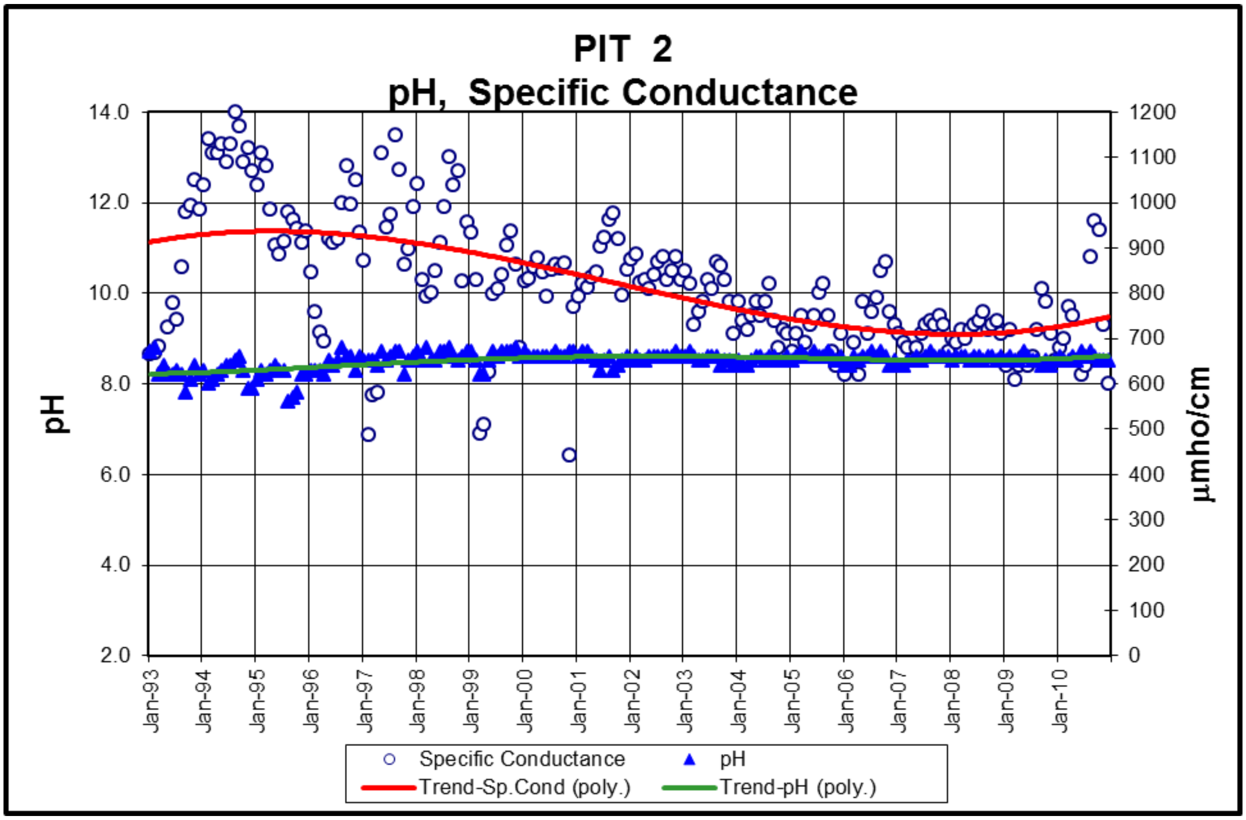

DISCHARGE POINT 010 (Pond A')
Turbidity (vs. Background)
NTU
50
40
30
20
10
0
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Discharge Turb, Max.
Backgrnd Turb, Max.
Poly. (Discharge Turb, Max.)

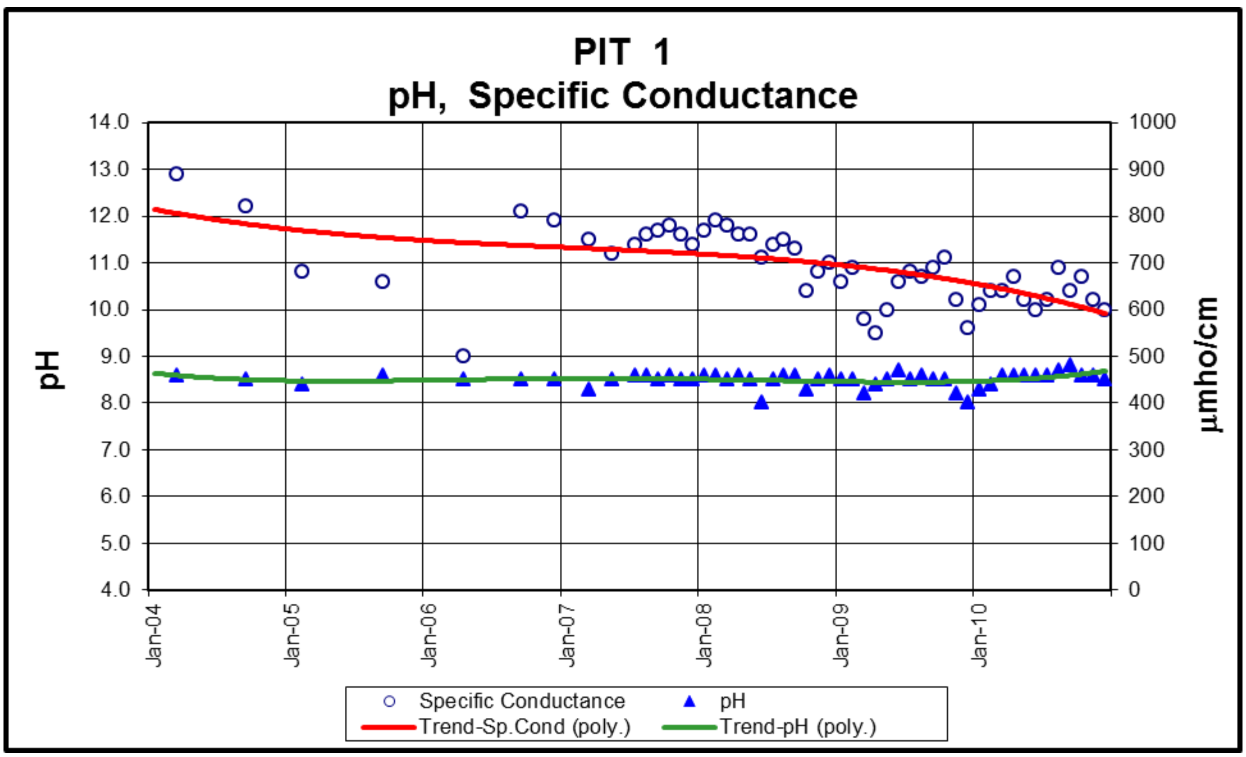

DISCHARGE POINT 010 (Pond A')
Phosphate
µg/L
Max.Allow (82µg/L)
Phosphate, Total (as P)
Phosphate, Max.Allow.
Phosphate, Avg.Allow.
Trend, Phosphate (poly.)


REICHERT WELL
pH, Specific Conductance
pH
µmho/cm
Specific Conductance
pH
Trend-Sp.Cond. (poly.)
Trend-pH (poly.)


PCCC WELL
pH, Specific Conductance
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
pH
800
700
600
500
400
300
200
100
0
µmho/cm
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Specific Conductance
pH
Trend-Sp.Cond (poly.)
Trend-pH (poly.)


12-4 WELL
pH, Specific Conductance
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
pH
1000
900
800
700
600
500
400
300
200
100
0
µmho/cm
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Specific Conductance
pH
Trend-Sp.Cond (poly.)
Trend-pH (poly.)


PIT 2
pH, Specific Conductance
pH
µmho/cm
14.0
12.0
10.0
8.0
6.0
4.0
2.0
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
Jan-93
Jan-94
Jan-95
Jan-96
Jan-97
Jan-98
Jan-99
Jan-00
Jan-01
Jan-02
Jan-03
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Specific Conductance
pH
Trend-Sp.Cond (poly.)
Trend-pH (poly.)


PIT 1
pH, Specific Conductance
pH
µmho/cm
14.0
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
1000
900
800
700
600
500
400
300
200
100
0
Jan-04
Jan-05
Jan-06
Jan-07
Jan-08
Jan-09
Jan-10
Specific Conductance
pH
Trend-Sp.Cond (poly.)
Trend-pH (poly.)