

# Quality Assurance Project Plan

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## Pataha Creek Effectiveness Monitoring Total Maximum Daily Load Study

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March 2005

Waterbody Number: WA-35-2013

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## Abstract

The Washington State Department of Ecology is required to develop and implement Total Maximum Daily Loads (TMDLs) for impaired waters, and evaluate the effectiveness of the cleanup plan in achieving the needed improvement in water quality.

Ecology developed ammonia nitrogen ( $\text{NH}_3\text{-N}$ ), chlorine ( $\text{Cl}_2$ ), and biochemical oxygen demand (BOD) TMDLs for Pataha Creek. These TMDLs and associated wasteload and load allocations were approved by the United States Environmental Protection Agency in September 1994.

The allocations were based on the Washington State water quality criteria for acute (daily maximum) and chronic (monthly average) conditions at the edge of the mixing or dilution zone to provide protection for human and aquatic organisms. Evaluation of available data from the facility indicates compliance with the National Pollutant Discharge Elimination System (NPDES) permit limits set for  $\text{NH}_3\text{-N}$  and BOD. Facility improvements and conversion to UV disinfection eliminated the use of chlorine as a disinfectant in October 2002.

This Quality Assurance Project Plan describes the procedure that will be used to monitor the effectiveness of the TMDL in returning the waterbody to its designated use classification. The study will be conducted by the Freshwater Monitoring Unit of Ecology's Environmental Assessment Program.

## Introduction

Over 40% of the Washington State's assessed waters still do not meet the water quality standards. Consequently, under the federal Clean Water Act (CWA) section 304(l)(1)(a)(d), the state is required to prepare a list of waters that cannot reasonably be anticipated to attain or maintain water quality standards due to toxic pollutants after the application of effluent limitations required under section 301(b)(2) of the Act. Subsequently, the state was required to develop individual control strategies that will result in a reduction in the discharge of toxic pollutants from these point sources. A Total Maximum Daily Load (TMDL) is a tool for implementing water quality standards under the CWA and is based on the relationship between pollution sources and instream water quality conditions. It is a summation of the individual waste load allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources, including natural background conditions. Washington State Department of Ecology (Ecology) is required to develop and implement TMDLs for watersheds, and evaluate the effectiveness of the cleanup plan to achieve the needed improvement in water quality. This plan describes the processes to perform an assessment of the effectiveness of the TMDL implemented on Pataha Creek.

## Background

Pataha Creek is a Class A tributary (Table 1) of the Tucannon River, a major salmonid habitat river in southeastern Washington. Pataha Creek drains approximately 200 square miles, originating in the Umatilla National Forest about 10 miles south of Pomeroy. The majority of the drainage of Pataha Creek is composed of rangeland, dryland farms, and immediately bordering the stream, irrigated farmland. The irrigated farmland is primarily pasture and contributes significant non-point sources of pollution. Discharge from the city of Pomeroy's Waste Treatment Facility enters the stream at river mile 23.

**Table 1. Selected Class A Criteria.**

Parameter	Criteria	Comments
Temperature	≤18°C	
Dissolved Oxygen	> 8.0 mg/L	
Fecal Coliform	Mean ≤ 100 cfu/100 mL	<10% samples > 200 Colonies
pH	6.5 -8.5	
Total Phosphorus	≤100 ug/L	EPA recommended
Nitrate (as N)	≤10 mg/L	EPA recommended
Ammonia (as N)	0.042 mg/L(chronic) 5.63 mg/L(acute)	Criteria represents un-ionized fraction @ pH 8 & 18°C

Portions of Pataha Creek were listed as impaired due to dissolved oxygen (DO), ammonia nitrogen (NH<sub>3</sub>-N) and chlorine. In 1991, Ecology's Bob Cusimano conducted a Class II inspection of the city of Pomeroy's waste water treatment plant (WWTP) and its receiving water. Modeling and analysis determined that water quality violations for NH<sub>3</sub>-N, chlorine and DO would occur downstream of the discharge. To protect the waterbody against these violations, a Total Maximum Daily Load (TMDL) was developed for those parameters and submitted to the United States Environmental Protection Agency (EPA) and approved in September 1994. The TMDL was implemented by applying more stringent limits to the effluent from Pomeroy's WWTP. Monthly discharge monitoring reports (DMRs) track compliance of the WWTP to the TMDL.

Since 1994, there has been a major effort to control point source discharge to Pataha Creek. An infiltration and inflow study was completed in 1997 which identified five priority areas in the collection system for rehabilitation. There has also been an emphasis to control non-point discharge to the stream. A farm chemical company has placed secondary containment around tanks with a potential to spill. In 1998 a model watershed plan was developed to control erosion, restore riparian areas and increase streamflow by reducing irrigation withdrawal. The city of Pomeroy received an award from Ecology for maintaining 100% compliance with the permit conditions during 1999. The city has upgraded its wastewater treatment plant to utilize a bio-filter with second stage aeration, UV disinfection and effluent reaeration. This upgrade was finished in 2002.

NPDES permit WA-002116-4, effective May 1, 2001, set the following discharge limits for BOD and NH<sub>3</sub>-N.

Interim limits, through November 30, 2002

BOD 30 mg/L average monthly, 45 mg/L average weekly

NH<sub>3</sub>-N 8.2 mg/L average monthly

Total residual chlorine 0.01 mg/L average monthly, 0.02 mg/L maximum daily

High flow (Dec 1-May 31) final limits

BOD 30 mg/L average monthly, 45 mg/L average weekly

NH<sub>3</sub>-N 3.2 mg/L average monthly 6.5 mg/L maximum daily

Low flow (June 1-Nov-30) final limits

BOD 15 mg/L average monthly, 23 mg/L average weekly

NH<sub>3</sub>-N 2.1 mg/L average monthly, 4.2 mg/L maximum daily

Pomeroy WWTP's UV disinfection went online in early 2002. Chlorine monitoring has been discontinued.

Figure 1 summarizes DMR (Discharger Monitoring Data) for NH<sub>3</sub>-N and Figure 2 summarizes DMR data for BOD<sub>5</sub>.

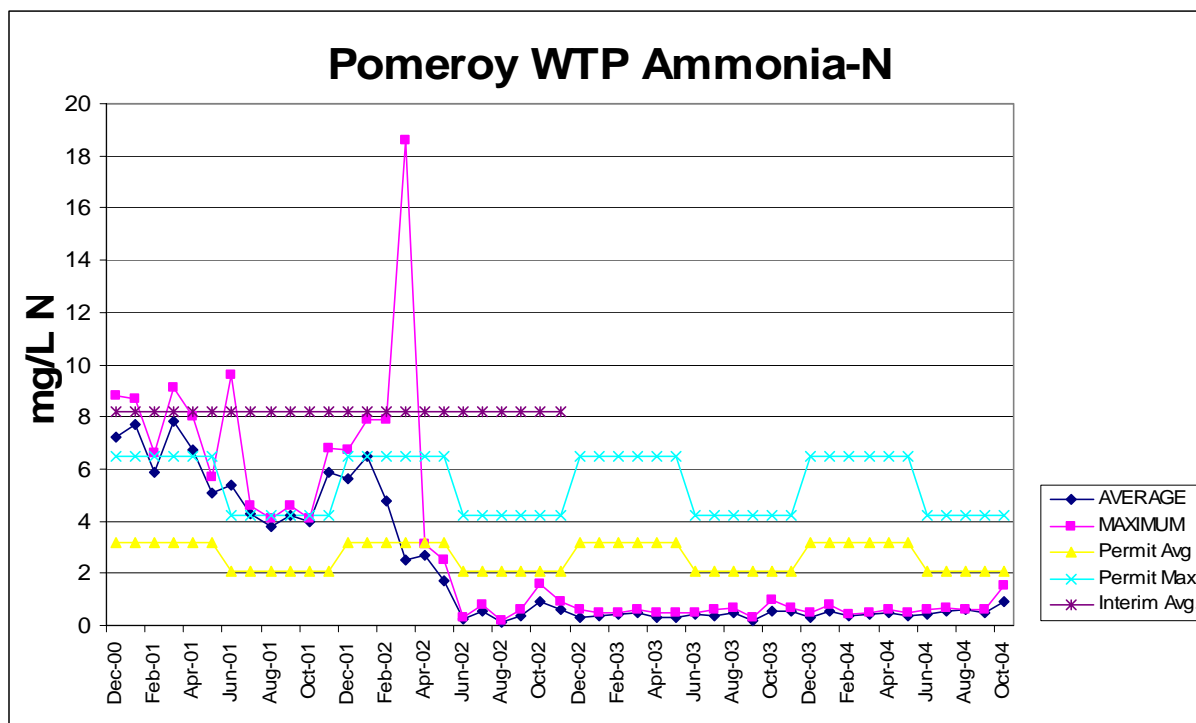
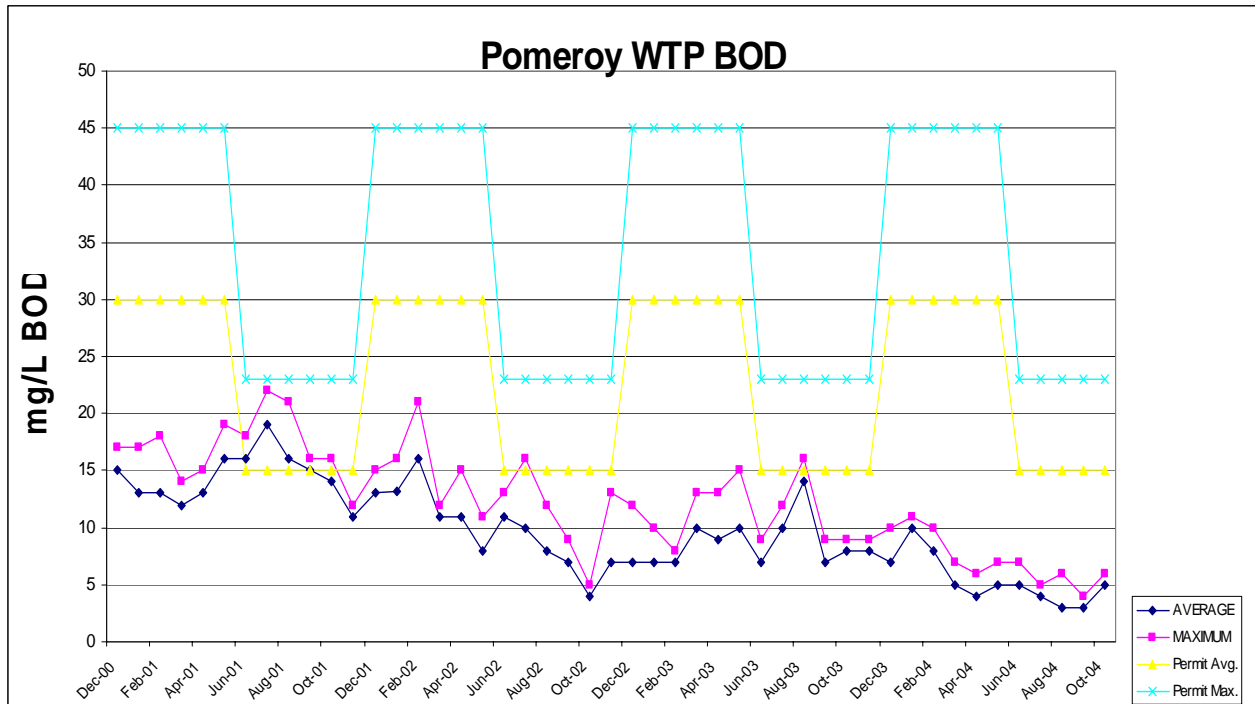


Figure 1. Pomeroy WTP Ammonia-N.





**Figure 2. Pomeroy WTP BOD.**

## Project Description

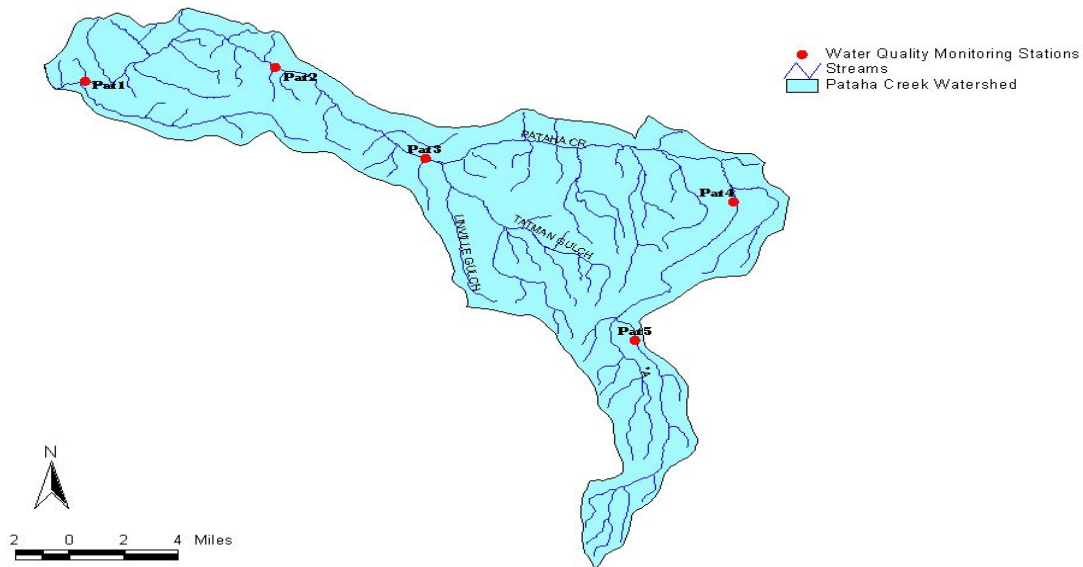
The goal of the study will be to determine if the implementation of the TMDL was effective in restoring Pataha Creek to its designated uses.

The objectives of this study are to:

- Review historic documentation regarding the TMDL.
- Compile data generated after implementation of the TMDL.
- Review existing data for representativeness, comparability, and quality.
- Sample and analyze, as necessary, to fill gaps in the data.
- Analyze and interpret data to evaluate the effectiveness of the TMDL.
- Make recommendations based on information gathered.
- Prepare a final report (technical memorandum) for EPA.

## Post-TMDL Implementation Studies

Besides the monthly DMR reports from Pomeroy’s WWTP (Figures 1 and 2), data has been collected by the Columbia County Conservation District under a grant from the Bonneville Power Administration (Figure 3). The data indicated ammonia levels along the stream met water quality criteria for Class A waters. These data are summarized in Table 2.



**Figure 3. Conservation District Sampling Sites.**

**Table 2. NH3 in Pataha Creek.**

Date	Pat 5	Pat 4	Pat 3	Pat 2	Pat 1
3-99	0.055	0.111	0.111	0.111	0.111
5-99	0.470	0.470	0.221	0.194	0.304
7-99	0.276	0.193	0.331	0.166	0.221
9-99	0.304	0.304	0.331	0.221	0.276

Sampling location Pat 5, the highest in the watershed was located in the foothills of the Blue Mountains, just upstream of Columbia Center. Pat 3 was located four and a half miles downstream of the city of Pomeroy (Figure 4). Pat 2 was set at Dodge Junction and Pat 1 was located about one mile upstream of the confluence with the Tucannon River.

Karen Baldwin of Ecology’s Water Quality Program monitored the same sites during a lapse in

BPA's grant during 2002. The ammonia data results generated during this interim period are summarized in Table 3 below.

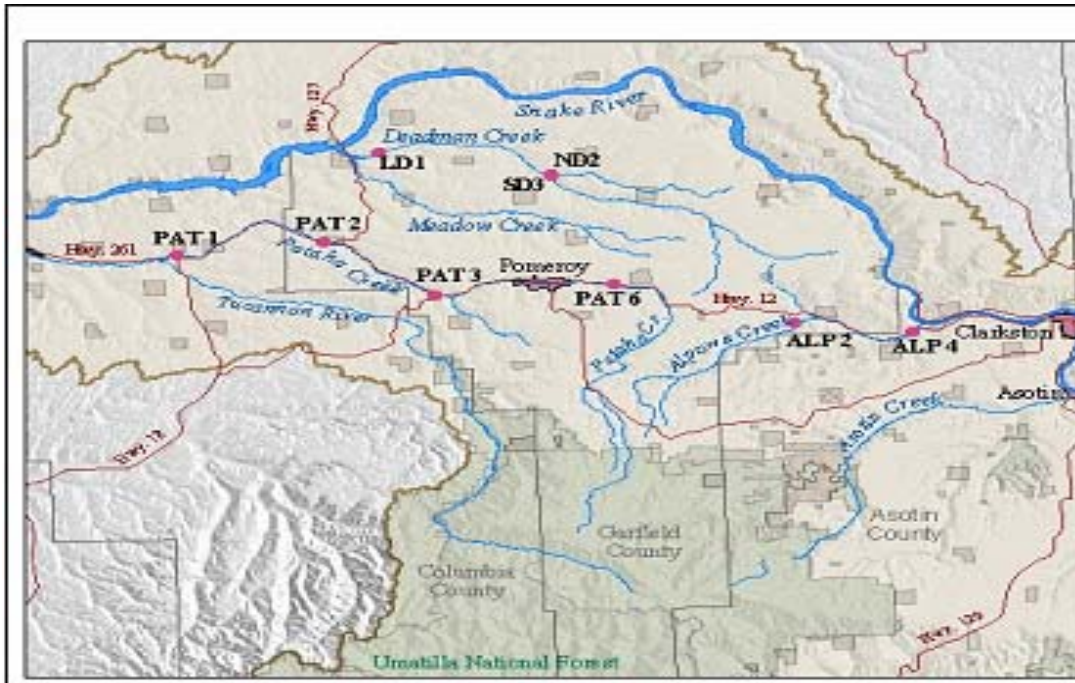


Figure 4. 2002 Sampling Locations.

Table 3. Ecology Monitoring Results from May – December 2002.

Date	Ammonia (mg/L)			
	Pat 6	Pat 3	Pat 2	Pat 1
5/21/2002	0.017	0.026	0.028	0.027
5/21/2002				0.029
6/18/2002	0.013	0.16	0.017	0.016
6/18/2002		0.158		
7/23/2002	0.023	0.018	0.025	0.023
8/20/2002	0.012	0.011	0.013	0.012
9/24/2002	<0.010	<0.010	<0.010	<0.010
10/22/2002	<0.010	<0.010	<0.010	<0.010
11/18/2002	<0.010	<0.010	<0.010	<0.010
12/17/2002	<0.010	<0.010	<0.010	<0.010
12/17/2002	<0.010			

## Organization and Schedule

The proposed sampling schedule is shown in Table 4. Following are the key personnel involved with the project. The total lab budget is \$2822.00

**Table 4. Sampling Schedule and Lab Cost Estimates.**

Date	Samples	QC(field dup)	Field	Lab	Est. Lab Cost (\$)
June 1, 2005	2	1	T,pH,DO	NH3-N, FC,BOD	249
June 15, 2005	2	1	T,pH,DO	NH3-N, FC,BOD	249
June 29, 2005	2	1(blank)	T,pH,DO	NH3-N, FC,BOD	249
July 6, 2005	2		T,pH,DO	NH3-N, FC,BOD	166
July 20, 2005	2		T,pH,DO	NH3-N, FC,BOD	166
August 10, 2005	2		T,pH,DO	NH3-N, FC,BOD	166
August 24, 2005	2	1	T,pH,DO	NH3-N, FC,BOD	249
September 7, 2005	2	1	T,pH,DO	NH3-N, FC,BOD	249
September 21, 2005	2		T,pH,DO	NH3-N, FC,BOD	166
October 12, 2005	2		T,pH,DO	NH3-N, FC,BOD	166
October 26, 2005	2	1(blank)	T,pH,DO	NH3-N, FC,BOD	249
November 2, 2005	2	1	T,pH,DO	NH3-N, FC,BOD	249
November 16, 2005	2	1	T,pH,DO	NH3-N, FC,BOD	249

EAP Project Lead – Jim Ross (509) 329-3425.

Ecology ERO Watershed Lead – Karin Baldwin (509) 329-3472.

Manchester Environmental Laboratory Director – Stuart Magoon (360) 871-8801.

Ecology Quality Assurance Officer – Cliff Kirchmer (360) 407-6455).

## Quality Objectives

Table 5 outlines the measurement quality objectives. All the objectives are standard for the procedures being used. Check standards will be reported in the same units as used for the samples and as percent recovery. For DO, a standard Potassium Biiodate solution is titrated with sodium thiosulfate to determine percent recovery.

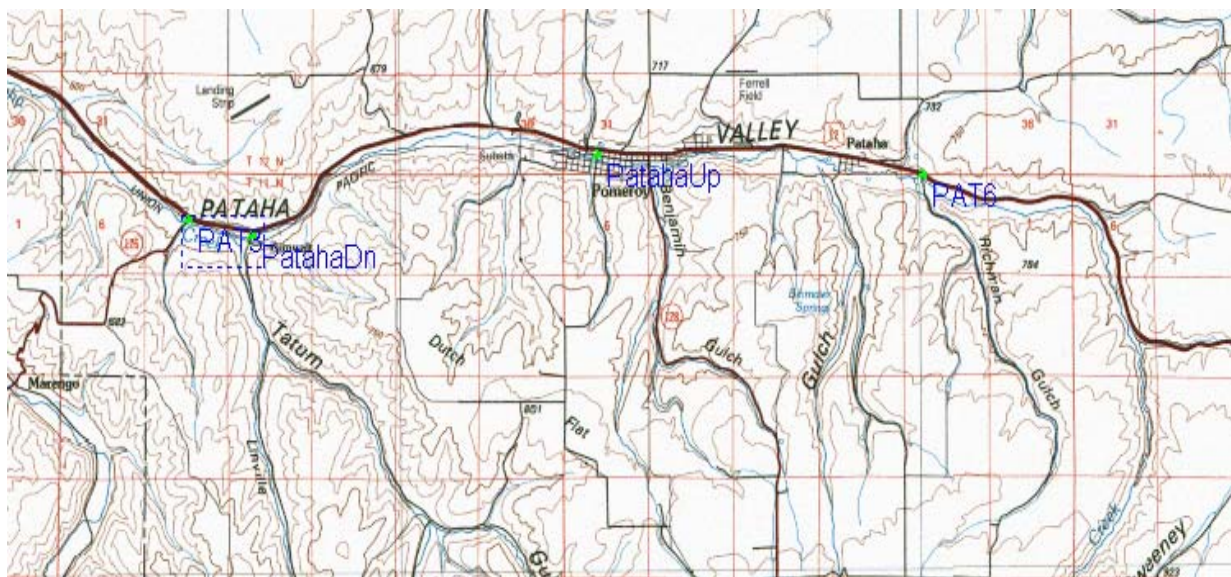
**Table 5. Measurement Quality Objectives.**

<b>Parameter</b>	<b>Check Standard</b>	<b>Duplicate Samples</b>	<b>Matrix Spikes</b>	<b>Reporting Limits</b>
pH	+/- 0.1 SU	+/-0.05 SU	NA	NA
DO	95-105%	+/- 0.2 mg/L	NA	2 mg/L
Temperature	NA*	+/- 0.2 C	NA	NA
NH3-N	80-120%	20% RPD	75-125%	10 µg/L
BOD		+/- 20% 1 mg/L	NA	2 mg/L
Fecal Coliform	NA	+/- 40% RPD	NA	1 CFU/100mL

## Sampling Process Design (Experimental Design)

Data from DMRs and previous sampling indicate water quality criteria for ammonia are being met. The lack of data for dissolved oxygen and BOD trigger a need for additional monitoring.

Samples will be collected every two weeks during the low flow season (June 1 through November 30). Table 4 displays the sample dates in detail. A datasonde will be deployed at the downstream site from August 10 through August 24, to collect continuous dissolved oxygen, pH, and temperature data. Parameters to be monitored are: Ammonia Nitrogen (NH<sub>3</sub>-N), Fecal Coliform (FC) Temperature (T), pH, Dissolved Oxygen (DO) and BOD. While the use of historic PAT 3 and PAT 6 locations would ensure comparability of data between sampling efforts, the distance between PAT 6 and the WWTP is great enough that it warrants a new sampling location (PatahaUp) closer to the plant (Figure 5). Downstream, the amount of water entering Pataha Creek from Tatman Gulch is significant enough to warrant using a site further upstream (PatahaDn) from PAT 3. If landowner permission is obtained, PatahaDn will be moved closer to the WWTP.



**Figure 5. Historic and New Sampling Locations Near the Pomeroy WWTP.**



## Quality Control

Collecting replicate samples will assess total variation for field sampling and laboratory analysis, providing an estimate of total precision. One sample will be replicated during six of the thirteen sampling events (Table 4). Two field blanks will be included during the study. The standard laboratory check standards, method blanks, analytical duplicates, and matrix spikes will be adequate to assess precision, bias and accuracy. Lab staff will notify project lead if quality objectives are not met.

### Field

Standard Ecology protocols (Ward 2001, MEL 2003) will be used to collect, preserve, and ship samples to Manchester Environmental Lab (MEL) for analysis of ammonia, BOD, and coliform, and for the field measurement of pH, temperature, and DO. These procedures meet the objectives from Tables 5, 6, 7, and 8.

### Laboratory

Ammonia-N, BOD, and fecal coliform analysis will be performed at MEL. Standard lab procedures are adequate to meet quality objectives from Tables 5, 7, and 8. MEL staff will contact the project lead if procedural changes are needed or if matrix difficulties arise.

**Table 6. Sample Containers, Preservation and Holding Time.**

Parameter	Matrix	Minimum Quantity Required	Container	Preservative	Holding Time
BOD	Water	2 L	4L cubitainer	Cool to 4° C	2 Days
NH3-N,	Water	125 mL	125 mL Poly	Cool to 4° C H2SO4 to pH <2	28 Days
Fecal Coliform	Water	250 mL	250 mL glass or poly sterilized	Cool to 4° C	24 hours

**Table 7. Laboratory and Field Methodology.**

Analyte	Expected Range	Analytical Method
NH3-N	10 – 250 µg/L	SM 4500-NH3 H
DO	6 -12 mg/L	SM 4500-O C
Temp	4-20 °C	Field thermistor
pH	7-8.5 SU	SM 4500-H <sup>+</sup> B
BOD	2-12 mg/L	SM 5210 B
Fecal Coliform	20-200 CFU/100 mL	SM 9222 D

**Table 8. QC Samples, Types, and Frequency.**

Parameter	Field		Laboratory			
	Blanks	Replicates	Check Standards	Method Blanks	Analytical Duplicates	Matrix Spikes
Temperature	N/A	1/Day	N/A	N/A	N/A	N/A
pH	N/A	1/Day	N/A	N/A	N/A	N/A
DO	N/A	1/Day	N/A	N/A	N/A	N/A
NH3-N	2	See table 4	1/Batch	1/Batch	1/Batch	1/Batch
BOD	2	See table 4	1/Batch	1/Batch	1/Batch	N/A
Fecal Coliform	N/A	See table 4	N/A	N/A	1/Batch	N/A

## Data Verification and Validation

MEL will conduct a review of all laboratory data and provide case narratives. MEL will verify all laboratory data to assure that methods and protocols specified in the QA were followed; that all calibrations, checks on quality control, and intermediate calculations were performed for all samples; and that the data are consistent, correct, and complete, with no errors or omissions. Evaluation criteria will include the acceptability of holding times, instrument calibration, procedural blanks, spike sample analyses, precision data, laboratory control sample analyses, standard reference materials analyses, and data qualifiers assigned.

The project lead will verify the field data for correctness, completeness, and adherence to quality objectives. The project lead will validate the project data, which will include reviewing the laboratory data packages and data verification reports. The project lead will check the data and reports for completeness and reasonableness, and to assure the MQO's have been met. Based on these assessments the data will either be accepted, accepted with appropriate qualifications, or rejected and re-sampling and/or re-analysis considered.

## Data Quality (Usability) Assessment

Once the data have been reviewed, verified and validated, the project lead will make a determination if the data can be used to make the calculations, determinations, and decisions for which the project was conducted. If the results are satisfactory, a technical memo will be drafted, reviewed and submitted to the EPA. The memo will assess the effectiveness of the TMDL in restoring Pataha Creek to its designated uses and meeting state water quality standards.



## References

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MEL, 2003. Manchester Environmental Laboratory Lab Users Manual, Seventh Edition. Washington State Department of Ecology, Manchester, WA.

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