DEPARTMENT OF
ECOLOGY
State of Washington

Quality Assurance Project Plan

Little Spokane River Fish Hatchery

Water Quality Monitoring for Nutrients

December 2008

Publication No. 08-03-120

Publication Information

This plan is available on the Department of Ecology's website at www.ecy.wa.gov/biblio/0803120.html.

Data for this project will be available on Ecology's Environmental Information Management (EIM) website at www.ecy.wa.gov/eim/index.htm. Search User Study ID, jos0003.

Ecology's Project Tracker Code for this study is 09-180.

Waterbody Number: WA-55-1010

Author and Contact Information

Jim Ross
Eastern Operations Section
Environmental Assessment Program
Eastern Regional Office
Washington State Department of Ecology
Spokane, WA 99205-1295

For more information contact: Carol Norsen, Communications Consultant
Phone: 360-407-7486

Washington State Department of Ecology - www.ecy.wa.gov/

o	Headquarters, Olympia	360-407-6000
o	Northwest Regional Office, Bellevue	425-649-7000
o	Southwest Regional Office, Olympia	360-407-6300
o	Central Regional Office, Yakima	509-575-2490
o	Eastern Regional Office, Spokane	509-329-3400

Quality Assurance Project Plan

Little Spokane River Fish Hatchery
Water Quality Monitoring for Nutrients

December 2008

Approved by:

Signature: Date: December 2008
Jon Jones, Client, WQP, ERO

Signature: Date: December 2008
David Knight, Client's Unit Supervisor, WQP, ERO

Signature: Date: December 2008
James Bellatty, Client's Section Manager, WQP, ERO

Signature: Date: December 2008
Jim Ross, Author/Principal Investigator/Project Manager/EIM Data Engineer, EAP, ERO

Signature: Date: December 2008
Joe Joy, TMDL Lead for this Project, EAP, HQ

Signature: Date: December 2008
Gary Arnold, Author's Unit Supervisor and Section Manager, EAP, ERO

Signature: Date: December 2008
Stuart Magoon, Director, Manchester Environmental Laboratory, EAP

Signature: Date: December 2008
Bill Kammin, Ecology Quality Assurance Officer

Signatures are not available on the Internet version.
WQP - Water Quality Program
ERO - Eastern Regional Office
EIM - Environmental Information Management system
EAP - Environmental Assessment Program
HQ - Headquarters

Table of Contents

Abstract

Each study conducted by the Washington State Department of Ecology (Ecology) must have an approved Quality Assurance Project Plan. The plan describes the objectives of the study and the procedures to be followed to achieve those objectives.

A lack of data on nutrient loads from the Griffeth Springs Fish Hatchery to the Little Spokane River is a significant issue that needs to be addressed in order to refine the Little Spokane River Total Maximum Daily Load (TMDL; water cleanup plan). Ecology staff will monitor (1) the springs feeding the hatchery and (2) discharge points from hatchery rearing pens. Staff will then estimate total nutrient loads from the hatchery complex where it enters the Little Spokane River.

Samples collected will be tested for these nutrients (pollutants): biological oxygen demand, nitrogen, and phosphorus. Data will be summarized for use in developing the Little Spokane River TMDL.

Additional parameters will be collected from the spring to support the Hangman Creek TMDL. These are total and dissolved organic carbon, total suspended solids, alkalinity, and chloride.

Background

The Little Spokane River drains 700 square miles in Spokane, Pend Oreille, and Stevens Counties in northeast Washington, as well as Bonner County in the state of Idaho. The river is one of the two major tributaries to the Spokane River (Hangman Creek being the other). The river discharges into the Spokane River at River Mile (RM) 56.3 downstream of Nine Mile Dam.

The State of Washington Water Research Center (SWWRC), in cooperation with the Washington State Department of Ecology (Ecology) Environmental Assessment Program, conducted a water quality study for the basin (SWWRC, 2006). At the end of SWWRC's data collection effort, it was determined that a lack of nutrient and biochemical oxygen demand (BOD) load data from the Griffeth Springs Hatchery was a significant gap that needed to be addressed to refine the study. These data were especially needed for setting loads for the *Spokane River Dissolved Oxygen Total Maximum Daily Load (TMDL)* study.

Nutrients are essential for plant growth but excess amounts can lead to eutrophication. Nutrient concentrations in the Little Spokane River increased from upstream to downstream, possibly due to the result of urbanization and agricultural practices. Nutrients are also a concern in the tributaries of the Little Spokane River such as in Dragoon Creek, Deadman Creek, and Little Deep Creek. Nutrient concentrations are usually higher in the winter (January to April), likely as a result of runoff carrying the nutrient to the stream. While these months do not represent the most critical periods in terms of algae growth, the role of nutrient cycling may make nutrients available in later months.

Nutrient and BOD loads could be significant for the *Spokane River and Long Lake Dissolved Oxygen TMDLs* (Ecology, 2008). No Washington State surface water criterion for rivers and streams has been established for nutrients, although historically the U.S. Environmental Protection Agency (EPA) recommended 100 ug/L as the upper limit for total phosphorus. Under new guidelines, the recommended value for the Little Spokane River would be reduced to 10 ug/L. Although nitrogen is not a primary concern, the interaction between nitrogen and phosphorus will require that nitrate and ammonia are also measured in the samples taken during this study. The *Spokane River and Long Lake Dissolved Oxygen TMDLs* also require BOD load allocations for the Little Spokane River to reduce the downstream oxygen demand, so BOD will be sampled as well.

The Griffeth Springs (Spokane) Hatchery is located at river mile 6.9 of the Little Spokane River. Its wastewater discharge to the river is regulated by Ecology under general permit WAG137007D. Permit limits are listed in Table 1. The hatchery receives all of its water from the springs. Spring water is directed to hatchery facilities, and wastewater is discharged from various points (Figure 1) The compliance point for the permit is located in a channel downstream of the outfalls before travelling another 900 feet and entering the mainstream Little Spokane River.

Table 1. Permit limits (mg/L) for Griffeth Springs Hatchery.

Constituent	Permit Average	Permit Maximum
Settleable solids	0.1	NA
Total suspended solids	5	15

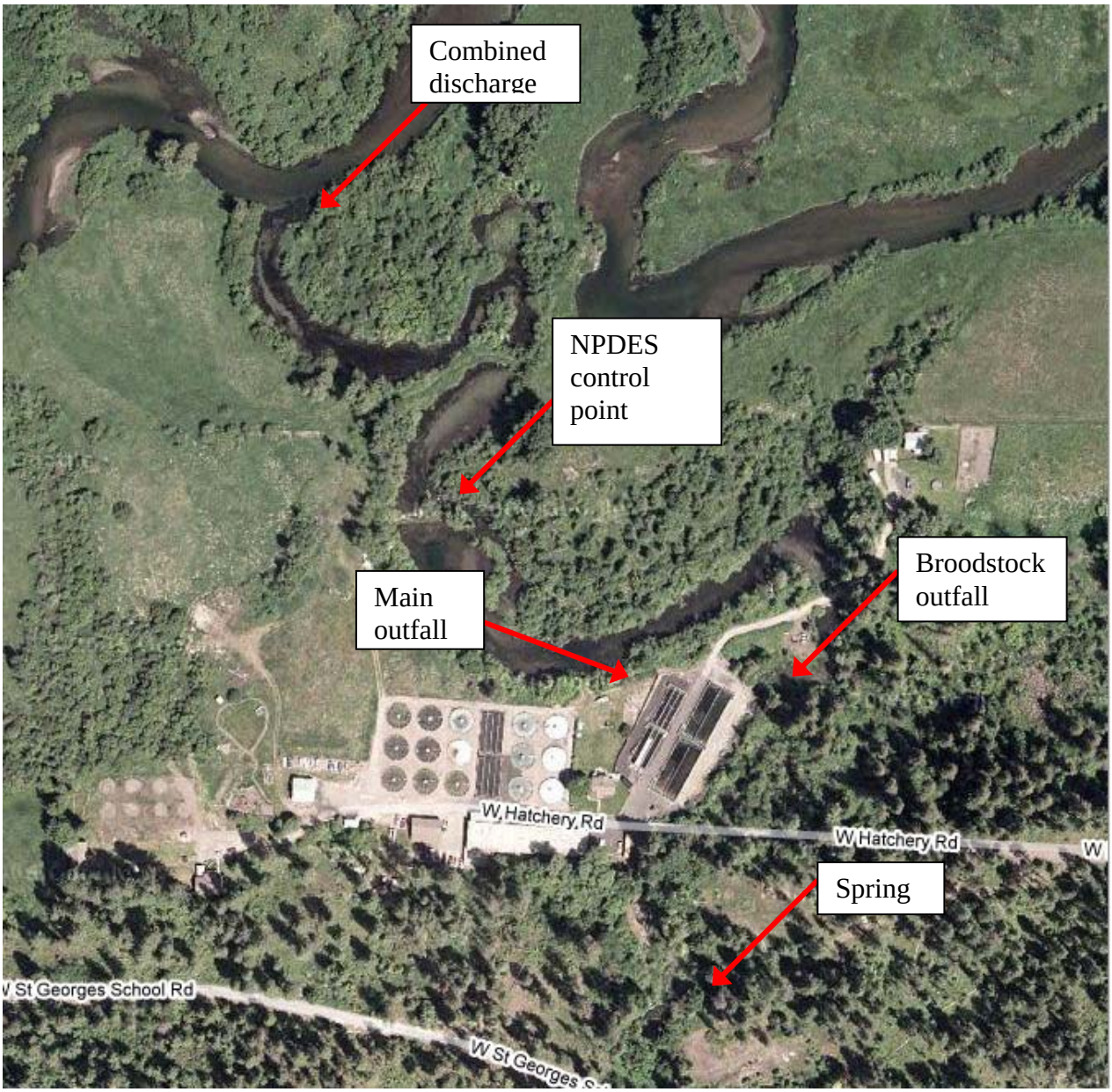

Figure 1. Griffeth Spring Fish Hatchery and sampling locations.

Project Description and Sampling Design

The project goal is to collect data from the Griffeth Spring Hatchery, which will be used to refine nutrient loads to the Little Spokane River and ultimately the Spokane River.

Samples will be taken from four locations around the fish hatchery: intake water, two effluent outfalls, and at the confluence of the tributary channel and the Little Spokane River. Figure 1 shows the locations of the surface water sites. Table 2 describes the surface water sampling locations. This sample coverage will allow Ecology to evaluate the water quality impact of the hatchery effluent relative to (1) background values in the springs and (2) any additional changes between the outfalls and the confluence with the Little Spokane River.

Nutrient samples will be collected twice a month from January to October 2009. BOD samples will be collected once a month. The operational changes from raising seasonal fish stocks, their food consumption and waste generation, and the fluctuation in ambient spring and stream conditions should be addressed at this level of sampling intensity. Hatchery operations (e.g., fish present, feeding, cleaning) will be recorded in the field notes. Appendix A tabulates a summary of discharge monitoring reports (DMR) that include pounds of food fed and average pounds of fish at the hatchery.

Table 2. Surface water sampling locations.

Station Name	Description	Latitude	Longitude
Spring	Water supply to hatchery	47 45.903’	-117 27.546’
Broodstock outfall	Small discharge from broodstock pens	47 45.992’	-117 27.511’
Main outfall	Large discharge from main raising pens	47 45.994’	-117 27.581’
Combined discharge	Point where spring and discharges enter the Little Spokane River		

Organization and Schedule

The following people are involved in this project. All are employees of the Washington State Department of Ecology.

Table 3. Organization of project staff and responsibilities.

Staff (all are EAP except client)	Title or Role	Responsibilities
James Ross Eastern Regional Office (509) 329-3425	Project Manager and Principal Investigator	Writes the QAPP, conducts QA review of data, analyzes and interprets data, and writes the data memo. Conducts field sampling and transportation of samples to the laboratory, conducts QA review of data, analyzes and interprets data, and enters data into EIM.
Joe Joy Eastern Regional Office 360 407-6486	TMDL Lead	Reviews QAPP, reviews data, and incorporates data into the Little Spokane River TMDL technical report.
Gary Arnold Eastern Regional Office (509) 454-4244	Section Manager	Reviews the project scope and budget, tracks progress, reviews the draft QAPP, and approves the final QAPP.
Jon Jones WQP Eastern Regional Office (509)329-3518	TMDL Lead WQP	Reviews QAPP, monitors progress of project, and communicates results with TMDL advisory groups.
David Knight WQP Eastern Regional Office (509) 329-3500	Client	Clarifies scopes of the project, provides internal review of the QAPP, and approves the final QAPP.
Stuart Magoon Manchester Environmental Laboratory (360) 871-8801	Director	Approves the final QAPP.
William R. Kammin (360) 407-6964	Ecology Quality Assurance Officer	Reviews the draft QAPP and approves the final QAPP.

EAP – Environmental Assessment Program
EIM – Environmental Information Management system
QAPP – Quality Assurance Project Plan
WQP – Water Quality Program
TMDL – Total Maximum Daily Load

Table 4. Proposed schedule for completing field and laboratory work, data entry into EIM, and reports.

Field and laboratory work	
Field work commences	10/1/2009
Field work completed	10/31/2009
Laboratory analyses completed	12/31/2009
Environmental Information System (EIM) system	
EIM data engineer	Jim Ross
EIM user study ID	jros0003
EIM study name	Little Spokane River TMDL
Data due in EIM	3/31/2010
Final report	
Author lead	Joe Joy
Schedule	
Draft due to supervisor	6/30/2010
Draft due to client/peer reviewer	7/30/2010
Draft due to external reviewer(s)	NA
Final report due on web	9/30/2010

Table 5. Laboratory cost* estimate.

Sample type	Parameter	Sites	QC	Visits	Analytical cost per sample	Misc. cost	Subtotal
Surface water	Nutrients	4	1	18	76	0	$6,840
Surface water	BOD	4	1	9	55	0	$2,475
Surface water	Alkalinity, chloride, TOC, DOC, TSS	1	2/project	13	109	0	1635

QC = Quality control
*Costs include 50% discount for Manchester Laboratory

Quality Objectives

By properly following laboratory and field standard operating procedures (SOPs) normal to this type of project, the quality objectives outlined in Table 6 should be met.

Table 6. Measurement quality objectives.

Analysis	Method	Accuracy	Precision RSD	Bias	Reporting Limits
Field Measurements					
Streamflow	In-house	20%	20%	NA	
pH	In-house	±0.2 s.u.	±0.2 s.u	NA	1-14 s.u.
Temperature	In-house	0.2°C	0.1°C	NA	0.02°C
Conductivity	In-house	5%	5%	NA	0.1 umho/cm
Dissolved Oxygen	In-house	10%	10%	NA	0.2 mg/L
Laboratory Analyses					
Total Persulfate Nitrogen	SM 4500-N B	20%	<20%	±20%	25 ug/L
Ammonia Nitrogen	SM 4500-NH3 H	20%	<20%	±20%	10 ug/L
Nitrate & Nitrite Nitrogen	SM 4500-NO3 I	20%	<20%	±20%	10 ug/L
Orthophosphate (OP)	SM 4500-P G	20%	<20%	±20%	3 ug/L
Total Phosphorus (TP)	SM 4500-P F	20%	<20%	±20%	5 ug/L
BOD	SM 5210-B	20%	<20%	±20%	2 mg/L
Total Suspended Solids	SM 2540 D	20%	<20%	±20%	1 mg/L
Total and Dissolved Organic Carbon	SM 5310 B	20%	<20%	±20%	1 mg/L
Alkalinity	SM 2320	20%	<20%	±20%	20 mg/L
Chloride	EPA 300.0	20%	<20%	±20%	0.3 mg/L

.

Sampling Procedures

Samples will be taken approximately twice a month, weather permitting, from January through September 2009 (Table 7).

Table 7. Proposed sampling schedule.

Date	Field (pH, dissolved oxygen, conductivity, temperature)	Nutrients	BOD	TOC, DOC, TSS, Alkalinity, Chloride
January 28	X	X	X	X
February 11	X	X	--	X
February 25	X	X	X	X
March 11	X	X		X
March 25	X	X	X	X
April 8	X	X	--	X
April 22	X	X	X	X
May 6	X	X	--	X
May 20	X	X	X	X
June 3	X	X	--	--
June 17	X	X	X	X
July 8	X	X	--	--
July 22	X	X	X	X
August 5	X	X	--	--
August 19	X	X	X	X
September 2	X	X	--	--
September 16	X	X	X	X
September 30	X	X	--	--

Table 8 lists the sample size, containers, preservation, and holding time for each parameter in this study. Sample containers will be provided by Manchester Laboratory. Surface water sampling procedures will follow the guidance in Ecology's stream sample collection SOP (Ward, 2007). Sample containers will then be filled, tagged and put on ice. A GPS will be used to record the coordinates of the sampling locations.

Table 8. Sample containers, preservation, and holding times.

Parameter	Container	Preservative	Holding time
Total Persulfate Nitrogen	125 poly	H_2SO_4 to pH < 2, 4°C	28 days
Ammonia Nitrogen			
Nitrate & Nitrite Nitrogen			
Orthophosphate (OP)	125 poly	Filter, Cool to 4°C	48 hours
Total Phosphorus (TP)	125 poly	HCL to pH < 2, 4°C	28 days
BOD	1 gal cubitainer	Cool to 4°C	48 hours
TOC	60 mL poly	HC1 to pH < 2, 4°C	28 days
DOC	60 mL poly	Filter, HCL to pH < 2, 4°C	28 days
TSS	1000 mL poly	Cool to 4°C	7 days
Alkalinity & Chloride	500 mL poly	No headspace, cool to 4°C	14 days

Measurement Procedures

Streamflow measurements will be taken when sampling whenever possible. In-situ temperature, pH, dissolved oxygen, and conductivity measurements will be taken using a pre-calibrated multiprobe meter (Hydrolab minisonde or In-Situ). Nutrients and BOD will be analyzed by Ecology's Manchester Laboratory according to their current SOPs. Methods will be selected that will meet reporting limits in Table 6.

Quality Control Procedures

Manchester Laboratory will follow their SOPs as described in their *Quality Assurance Manual* (MEL, 2006). Laboratory quality control will consist of lab control samples, method blanks, analytical duplicates, and matrix spikes where appropriate and using their standard practice. (See Table 9).

Table 9. Quality control samples.

Parameter	Field	Laboratory			
	Replicate or field blank	Check Standards	Method Blanks	Analytical Duplicates	Matrix Spikes
Nutrients	1/trip	1/batch	1/batch	1/batch	1/batch
BOD	1/trip	1/batch	1/batch	1/batch	1/batch
TSS	2/project	1/batch	1/batch	1/batch	1/batch
Alkalinity & Chloride	2/project	1/batch	1/batch	1/batch	1/batch
TOC/DOC	2/project	1/batch	1/batch	1/batch	1/batch

Data Management Procedures

Case narratives included with the data package from Manchester Laboratory will discuss any problems encountered with the analysis, corrective action taken, changes to the requested analytical method, and a glossary for data qualifiers.

Laboratory data and quality control results, with any qualifiers noted, will be included in the data package. This information will be used to evaluate data quality and will act as acceptance criteria for the project data.

Field and laboratory data will be entered into Ecology's Information Management System (EIM). Laboratory data will be downloaded directly into EIM from Manchester Laboratory's data management system (LIMS). Field data will be reviewed then entered into EIM by the project manager.

Data Verification and Validation

Verification of laboratory data is normally performed by a Manchester Laboratory unit supervisor or an analyst experienced with the particular method. It involves a detailed examination of the data package to determine whether method quality objectives (MQOs) have been met. Manchester Laboratory's SOPs and EPA's functional guidelines will be used in the data assessment. Manchester Laboratory staff will provide a written report of their data review. This report will include a discussion verifying if: MQOs were met, proper analytical methods and protocols were followed, calibrations and control were within limits, and data were consistent, correct, and complete.

The project manager is responsible for final acceptance of the project data. The project manager will assess the complete data package for completeness and reasonableness. Based on these assessments, the data will be accepted, accepted with qualifications, or rejected.

Data Quality (Usability) Assessment

After the project data have been reviewed and verified, the project lead will determine if the data are of sufficient quality to make decisions for which the study was conducted. The project memo from the project lead to the TMDL lead will discuss data quality and whether project objectives were met. It will also note any limitations in the data.

Audits and Reports

Manchester Laboratory participates in performance and system audits of their routine procedures. Results of these audits are available upon request.

At the end of the 2009 study, the project results will be merged with other data for the Little Spokane River TMDL technical report and will contain at a minimum:

- Map and photos of sampling locations.
- Summary table of data, as well as pertinent field notes.
- Discussion of data quality and the significance of problems encountered.
- Evaluation of significant findings and recommendations for further action.

The final report will be prepared by March 31, 2010.

References

MEL, 2006. Manchester Environmental Laboratory Quality Assurance Manual. Manchester Environmental Laboratory, Washington State Department of Ecology, Manchester, WA.

SWWRC, 2006 State of Washington Water Research Center, Washington State University. Little Spokane River Watershed TMDL Study, revised Quality Assurance Project Plan. October 2005. Publication SWWRC-04-006.

Ward, W., 2007. Standard Operating Procedures for Collection, Processing and Analysis of Stream Samples. Ward. SOP EAP034. www.ecy.wa.gov/programs/eap/qa/docs/ECY_EAP_SOP_034CollectionandProcessingofStreamSamples.pdf

Appendix A. Griffeth Springs Hatchery DMR Summary

Month	Flow, (mgd)	Avg. SS (mg/L)	Avg. TSS (mg/L)	MAX TSS (mg/L)	Avg. lbs. fish	Lbs. food fed
2006						
July	9.21	.05	0.2	0.2	43787	8646
August	9.21	.05	0	0	57614	10955
September	9.21	.05	0.6	0.6	61730	11910
October	9.21	.05	1.0	1.0	51998	5233
November	9.21	.05	1.0	1.0	38577	2535
December	9.21	.05	0.5	0.6	41272	4283
2007						
January	9.21	.05	0.8	0.8	36318	6402
February	9.21	.05	1.2	1.2	43835	7384
March	9.21	.05	0.6	0.6	46996	7283
April	9.21	.01	0	0	39181	6993
May	9.21	.01	1.2	1.2	42530	9306
June	9.21	.01	0.4	0.3	43958	8039
July	9.21	.01	0.2	0.2	44662	5892
August	9.21	.01	0.2	0.2	60304	12628
September	9.21	.01	0.2	0.2	75651	10767
October	9.21	.01	0.8	0.8	44730	3009
November	9.21	.01	1.4	1.4	47020	2661
December	9.21	.01	0.6	0.6	49294	3129
2008						
January	9.21	.01	0.8	0.8	29158	4116
February	9.21	.01	0	0	36253	6115
March	9.21	.01	0.8	0.8	35394	5760
April	9.21	.01	0.4	0.4	27751	7207
May	9.21	.01	0.8	0.8	28159	8769
June	9.21	.01	1.8	2.4	26113	5300
July	9.21	.01	0	0	30909	11466
August	9.21	.01	0.6	0.6	43349	10292
September	9.21	.01	0	0	65968	13326

mgd = million gallons per day

Appendix B. Glossary, Acronyms, and Abbreviations

BOD – biochemical oxygen demand

DOC – dissolved organic carbon

Ecology – Washington State Department of Ecology

EIM – Environmental Assessment Program

EPA – U.S. Environmental Protection Agency

Eutrophication – An increase in productivity resulting from nutrient loads from human activities such as fertilizer runoff and leaky septic systems.

National Pollutant Discharge Elimination System (NPDES) – National program for issuing, modifying, revoking and reissuing, terminating, monitoring, and enforcing permits, and imposing and enforcing pretreatment requirements under the Clean Water Act. The NPDES program regulates discharges from wastewater treatment plants, large factories, and other facilities that use, process, and discharge water back into lakes, streams, rivers, bays, and oceans. Nutrient

RM – river mile

SOP – standard operating procedure

SWWRC – State of Washington Water Research Center

TOC – total organic carbon

Total Maximum Daily Load (TMDL) – A distribution of a substance in a waterbody designed to protect it from exceeding water quality standards. A TMDL is equal to the sum of all of the following: (1) individual wasteload allocations for point sources, (2) the load allocations for nonpoint sources, (3) the contribution of natural sources, and (4) a Margin of Safety to allow for uncertainty in the wasteload determination. A reserve for future growth is also generally provided.

TSS – total suspended solids