Tammany Creek Watershed
(HUC 17060103)

TMDL Addendum

Department of Environmental Quality

September 2010

Tammany Creek Watershed

TMDL Addendum

September 2010

Prepared by:
Lewiston Regional Office
Department of Environmental Quality
1118 F. Street
Lewiston, ID 83501

This page intentionally left blank for correct double-sided printing.

Acknowledgments

The Idaho Department of Environmental Quality extends our sincere gratitude to the combined Hatwai/Lindsay/Tammany Creek Watershed Advisory Group. Their participation is critical to the successful completion and implementation of this Watershed Improvement Plan. The result is a community-led effort that focuses on an achievable collaborative approach to meeting the goals and requirements of the Idaho State Water Quality Standards and the Federal Clean Water Act.

This page intentionally left blank for correct double-sided printing.

Table of Contents

List of Tables

List of Figures

Abbreviations, Acronyms, and Symbols

§303(d) Refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section

BMP best management practice

cfs cubic feet per second

DEQ Department of Environmental Quality

DO dissolved oxygen

EPA United States Environmental Protection Agency

IDAPA Refers to citations of Idaho administrative rules

LA load allocation

LC load capacity

mg/L milligrams per liter

MOS margin of safety

NPDES National Pollutant Discharge Elimination System

SCR secondary contact recreation

TMDL total maximum daily load

TP total phosphorus

TSS total suspended solids

WLA wasteload allocation

WQS water quality standard

This page intentionally left blank for correct double-sided printing.

Executive Summary

This addendum analyzes current water quality data for the Tammany Creek watershed and amends nutrient and *E. coli* bacteria Total Maximum Daily Loads (TMDLs) to the Tammany Creek Sediment TMDL: Subbasin Assessment and Total Maximum Daily Load Analysis (DEQ 2001). The Tammany Creek sediment TMDL was approved in February 2002. The beneficial uses for Tammany Creek are secondary contact recreation and the support of cold water aquatic life.

Watershed at a Glance

Tammany Creek is a third order tributary to the Snake River within the impact zone of the City of Lewiston in Nez Perce County, Idaho. The creek originates in the farm lands southeast of Lewiston and flows in a predominantly northwesterly direction until it joins the Snake River within Hells Gate State Park. The main stem is approximately 13 miles long and includes ephemeral, intermittent, and perennial channels. The watershed is approximately 35 square miles and is predominantly agricultural land, including both cultivated crop and livestock range uses. Figure 1 generally displays the location of the Tammany Creek watershed within Idaho and in relation to Lewiston.

Key Findings

Nutrient and bacteria analyses were completed with the 2001 sediment TMDL as supplemental appendices. The 2001 nutrient analysis highlighted the significant relationship between in-stream phosphorus and total suspended solids concentrations, and stated that through sediment reductions by implementation of best management practices, significant reductions in phosphorus loading would likely occur. The original analysis found nutrient concentrations, both in the forms of phosphorus and nitrogen, were elevated significantly in relation to recommended levels. An instantaneous dissolved oxygen measurement of 5.9 milligram per liter (mg/L) (below standard of 6.0 mg/L) was also documented within Tammany Creek. Based on the analyses, Tammany Creek was placed in Section 5 of Idaho's 2008 Integrated Report for nutrients.

The original bacteria analysis identified that in-stream bacteria levels were considerably higher than Idaho's surface water quality criteria trigger level, established to support the secondary contact recreation beneficial use. Based on the analyses, Tammany Creek was placed in Section 5 of Idaho's 2008 Integrated Report for *E. coli* bacteria.

The 2001 TMDL did not provide a wasteload allocation for storm water or an allocation for future growth. This amendment includes provisions for a wasteload allocation for storm water and a reserve of the total load capacity for future growth.

Based on the available in-stream monitoring data generated at the monitoring station, nutrient TMDLs were developed for total phosphorus (TP) and nitrite plus nitrate as nitrogen(NO_2+NO_3-N). A bacteria TMDL was developed for *E. coli* bacteria. Additionally, the original sediment TMDL has been revised to establish a wasteload allocation (WLA) for point sources of sediment to Tammany Creek (Table I).

Table I. Summary of assessment outcomes.

Water Body Segment/ AU	Pollutant	TMDL(s) Completed	Recommended Changes to §303(d) List/ Integrated Report	Justification
Tammany Creek, WBID 015 to unnamed tributary ID17060103SL014_02 ID17060103SL014_03	TP, NO_2+NO_3-N, *E. coli* bacteria	Yes	Move to section 4a	Violation of DO and bacteria standards
Tammany Creek, source to mouth ID17060103SL016_02	TP, NO_2+NO_3-N, *E. coli* bacteria	Yes	Move to section 4a	Violation of DO and bacteria standards
Tammany Creek, source to mouth, ID17060103SL014_02 ID17060103SL014_03 ID17060103SL016_02	Sediment	LA and WLA revised	Leave in section 4a	LA and WLA revised for stormwater allocations

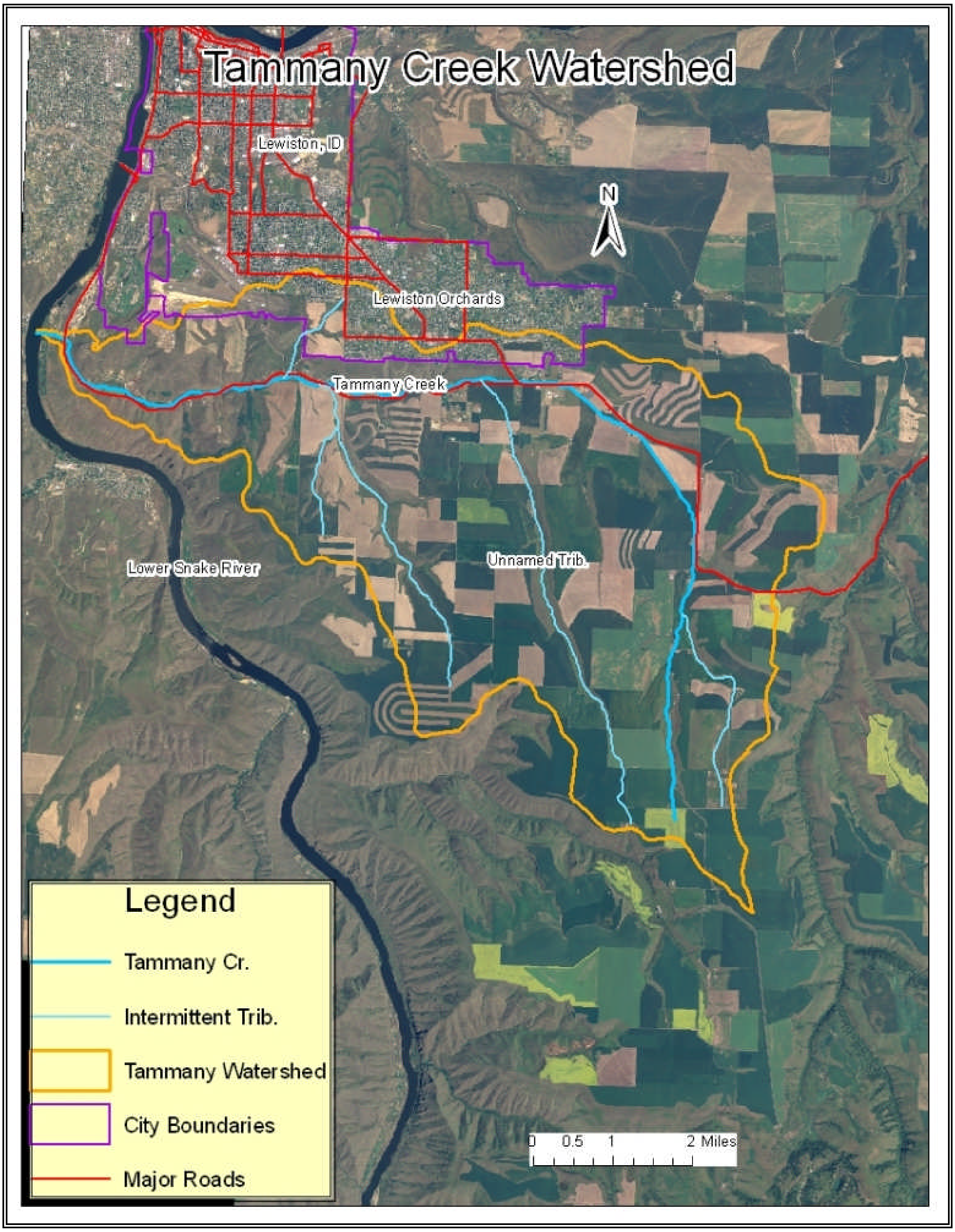

Figure 1. Tammany Creek Watershed

This page intentionally left blank for correct double-sided printing.

Organization of This Report

This TMDL is an addendum to the Tammany Creek Sediment TMDL Subbasin Assessment and Total Maximum Daily Load (DEQ 2001). That document, like all Idaho TMDL documents that combine a subbasin assessment with a TMDL determination, has five sections, the first four of which are the subbasin assessment. This document contains only a TMDL determination section, (section 5), which is based on the original subbasin assessment and monitoring data collected from Tammany Creek.

This page intentionally left blank for correct double-sided printing.

5. Total Maximum Daily Loads

Three assessment units within the Tammany Creek watershed are listed in Section 5 of Idaho's 2008 Integrated Report for nutrients and *E. coli* bacteria (Table 1). Section 5 of the integrated report is Idaho's "303(d) list" of impaired waters that need TMDLs. The original sediment TMDL has been revised to establish a wasteload allocation (WLA) for point sources of sediment to Tammany Creek. Nutrient and *E. coli* bacteria data were generated at an established monitoring station, near the mouth within Hells Gate State Park, to assess the section 5 listings (Appendix B). Based on the available in-stream monitoring data generated at this monitoring station, nutrient TMDLs were developed for total phosphorus and nitrite plus nitrate as nitrogen (NO_2+NO_3-N), and a bacteria TMDL was developed for *E. coli* bacteria.

Table 1. §303(d)-listed segments in the Tammany Creek watershed.

Stream Name	Assessment Unit(s)	Description	2008 Integrated Report Listing
Tammany Creek	ID17060103SL014_02 ID17060103SL014_03	WBID 015 to unnamed tributary	*E. coli* bacteria, Nutrients
Tammany Creek	ID17060103SL016_02	Source to Mouth	*E. coli* bacteria, Nutrients

5.1 Sediment Load and Wasteload Re-Allocations

The 2001 sediment TMDL did not include a WLA for point sources. This TMDL amendment reduces and re-assigns 6% of the 2001 TMDL nonpoint source sediment load allocation to a point source wasteload allocation for storm water discharge and reserves 1.5% of the load capacity for future growth. The WLA of 6% and a reserve for growth of 1.5% were estimated using the percentage of land area in the Tammany Creek watershed that is currently within the city of Lewiston impact zone, and accounts for an additional 300 acres (1.5%) that may be incorporated within the city in the near future. The WLA and reserve for growth can be adjusted in the future when land use changes or changes to Idaho code warrant such a revision. Table 2 displays the new sediment load analysis and allocation summary for point and nonpoint sources in the watershed.

Table 2. Sediment load and wasteload allocations.

Month	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep
Load Capacity (lbs/day)	171	224	346	419	672	913	1139	672	313	171	120	120
Existing Load	109	189	497	775	2192	3958	5813	2192	395	109	57	57

(lbs/day)												
Load Allocation (lbs/day)	141	185	286	346	554	753	940	554	258	141	99	99
Wasteload Allocation (lbs/day)	10	13	21	25	40	55	68	40	19	10	7	7
Necessary reductions	-	-	38%	52%	73%	80%	83%	73%	30%	-	-	-

5.2 Bacteria TMDL

In-stream *E .coli* bacteria samples were collected at the established monitoring station (TC-1) near the mouth of Tammany Creek in 2007-08. Based on the bacteria concentrations measured during this monitoring, additional *E. coli* samples were collected every three to seven days over a 30-day period from October through November of 2008 to evaluate compliance with the geometric mean criterion in Idaho Water Quality Standards. *E. coli* concentrations in Tammany Creek are currently above the geometric mean criterion. This TMDL addendum applies a bacteria TMDL from the monitoring station near the mouth upstream to the headwaters of Tammany Creek to restore in-stream bacteria concentrations to levels allowed by the Idaho Water Quality Standards. Because the TMDL bacteria load capacity is expressed as a concentration equal to the state standard, the bacteria TMDL allocates the allowable 30-day *E. coli* bacteria concentration to all sources contributing *E. coli* bacteria to the Tammany Creek watershed.

To augment the bacteria sampling effort by further investigating the source of the bacteria, DEQ had DNA analysis performed on bacteria samples taken from Tammany Creek. Samples were tested for the presence or absence of human Bacteroidetes, human Enterococcus, cow Bacteroidetes, cow Enterococcus, bird Bacteroidetes and bird Enterococcus gene biomarkers. The only positive results from these tests showed the presence of bird gene biomarkers (Table 3). Fecal Bacteroidetes bacteria are considered a good measure of recent bacteria loading because they do not survive for long outside of the host animal. The fecal Enterococcus analysis is used primarily to further confirm test results. Each sample must be tested for the presence or absence of DNA from a single animal species. The human, cow and bird DNA tests DEQ had performed were intended to help guide the implementation of BMPs designed to reduce bacteria loading. Small scale ranches with horses, cattle, llamas and dog kennels exist in the watershed. However, tests for each of these species were highly cost prohibitive and simply could not be performed.

The DNA analysis, rather than distinguishing a known nonpoint source within the watershed such as an animal feeding operation or septic tanks, added another nonpoint source of bacteria pollution to the list of contributors. When considered with the existing *E. coli* data, where contact recreation criteria were exceeded 48% of the time, it is unlikely that any one of these nonpoint sources was responsible for each and every criteria exceedance. Therefore, rather than focusing implementation efforts on one set of contributors, all non-point sources of *E coli* bacteria in the watershed should be encouraged to voluntarily install BMPs aimed at achieving the necessary load reductions.

Table 3. Results from Tammany Creek DNA testing.

Sample Date	Human B* Result	Human E** Result	Cow B* Result	Cow E** Result	Bird B* Result	Bird E** Result
October 2, 2008	Negative	Negative				
November 14, 2008			Negative	Negative	Positive	Positive

B* denotes Bacteroidetes testing, E** denotes Enterococcus testing

Target

The Idaho water quality standard for *E. coli* bacteria, used as the target for the development of the TMDL, is a 30-day geometric mean concentration of 126 colony forming units per 100 milliliters (cfu/100ml) (IDAPA 58.01.02. 251.02).

A single water sample in which either the primary or secondary recreation use criterion is exceeded does not in itself constitute a violation of WQS; rather, it requires that additional samples be taken every three to seven days over a 30-day period. Those five sample concentrations are then used to calculate a geometric mean concentration to compare against the criterion. A geometric mean is applied to minimize random variability in data associated with surface waters prone to short-term episodic spikes in bacteria concentrations.

Load Capacity

The *E. coli* bacteria load capacity is expressed as the geometric mean concentration of 126 cfu/100 ml. The load capacity is expressed as a concentration (in cfu/100 ml) because it is difficult to calculate a mass load because several variables (i.e., temperature, moisture conditions, flow) influence the die-off rate of *E. coli* bacteria in the environment (Table 4). In spite of these uncertainties, where a mass loading analysis is required, the load capacity is expressed as the product of the target minus the margin of safety multiplied by the measured flow for that sampling date (Table 5).

Estimates of Existing Pollutant Loads

Forty-eight percent of the *E. coli* bacteria samples collected during the 2007-2008 monitoring season were found to have concentrations greater than Idaho's instantaneous water quality trigger level of 576 cfu/100 ml for secondary contact recreation. The additional monitoring required because of these results was conducted in 2008 and showed the geometric mean for *E. coli* bacteria in Tammany Creek was above Idaho's water quality standard of 126 cfu/100 ml.

Load Allocations

This TMDL allocates a 30-day *E. coli* bacteria concentration equal to the State standard to all sources contributing *E. coli* bacteria to the Tammany Creek watershed. The available data cannot be analyzed to split out individual loads for individual sources, point or nonpoint, and the use of the geometric mean necessarily minimizes the results of episodic spikes from point sources or overland runoff events. A 10% MOS has been subtracted from the target in order to ensure the secondary contact beneficial use is supported throughout the year. As such, the combined contribution of all sources upstream from the monitoring station should be reduced by 72% (Table 4).

In order to illustrate how bacteria loading needs to be controlled on a daily basis, Table 5 presents a flow-based, instantaneous mass loading analysis. First, the flow is converted from cubic feet per second to milliliters per second. Then, the number of colony forming units (cfu/100ml) measured during each monitoring event in the month long geometric mean sampling effort is multiplied by the measured flow for that monitoring event. A 10% margin of safety is subtracted to ensure necessary reductions account for uncertainties in the sampling process. The results illustrate how bacteria loads tend to fluctuate over the course of a month's time (Table 5).

Table 4. Bacteria load allocations.

Location (monitoring station)	Existing Load (#/100 ml)	30-day Load Capacity (#/100 ml)	30-day Load Allocation (#/100 ml)	Margin of Safety (MOS)	Required Load Reduction (#/100 ml)
Tammany Creek	407 cfu/100 ml	126 cfu/100 ml	126 cfu/100 ml	10%	294 cfu/100 ml or 72 percent

[1]=Existing load is based on *E. coli* bacteria samples collected from October-November 2008

Table 5. Mass Bacteria load allocations for sampling events.

Date	cfu/100 ml	30 day geomean (cfu/100ml)	Flow (cfs)	Flow (mls)	Existing Load cfu @ flow	Load Cap-MOS cfu @ flow	Load Reduction (cfu@flow)	Percent Reduction %
10/16/2008	687		0.18	5097	35001	5780	29221	83
10/23/2008	308		0.15	4248	13065	4817	82489	63
10/27/2008	326		0.12	3398	11061	3853	7207	65
10/30/2008	1120		0.13	3681	41226	4175	37051	90
11/3/2008	96		0.14	3964	3802	4496	0	meets
11/6/2008	613		0.14	3964	24305	4496	19810	82
Oct-08		407	0.14	3964	16135	4496	11639	72

Margin of Safety

The establishment of a TMDL requires that a margin of safety (MOS) be identified to account for uncertainty. An MOS is expressed as either an implicit or explicit portion of a water body's load capacity that is reserved to account for the uncertainty about the relationship between the pollutant loads and the quality of the receiving water body.

By utilizing the State's water quality criterion for the contact recreation beneficial use, DEQ has established a conservative target load for this *E. coli* TMDL. Development of the load capacity and load allocation is in accordance with Idaho Water Quality Standards, where the geometric mean target concentration for *E. coli* bacteria was used and allocated to any 30-day time period for nonpoint sources. The load allocations and reductions called for apply from the permanent monitoring station near the mouth upstream to the headwaters. In addition, DEQ has subtracted an explicit margin of safety (10%) from the target, thereby increasing the required load reduction in order to ensure the secondary contact beneficial use is supported throughout the year.

Critical Time Period

The *E. coli* bacteria allocations apply to any 30-day time period, since secondary contact recreation may occur at any time of year. This allocation ensures water quality standards are attained for the protection of public health.

5.3 Nutrient TMDL

Idaho's narrative standard for nutrients states "surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses" (IDAPA 58.01.02). Nitrogen and phosphorus concentrations at the levels measured in Tammany Creek can cause visible slime growths, and nuisance aquatic growths that cause dissolved oxygen (DO) to sag below the criterion of 6.0 mg/L, thereby impairing the creek's existing beneficial uses. Violations of the 6.0mg/L criterion have been documented for both instantaneous DO measurements and 24-hour diurnal DO studies (Figure 2).

Targets

Diurnal DO sags were recorded in Tammany Creek during water quality monitoring conducted in August 2008 (Figure 2). DO concentrations were measured at levels below concentrations required by the Idaho Water Quality Standards (6.0 mg/L).

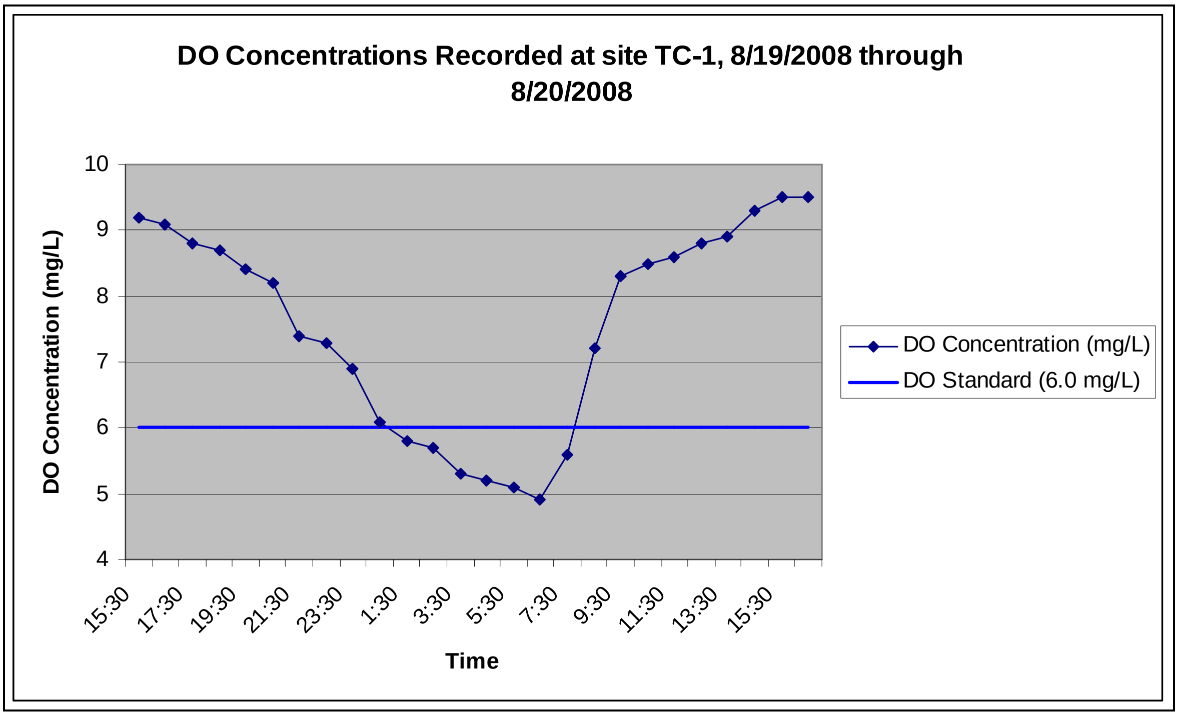

Figure 2. Diurnal DO Concentrations measured at monitoring point TC-1 (August 19-20, 2008)

The diurnal DO sags in combination with observed nuisance aquatic growths and measured nutrient concentrations higher than recommended targets indicate nutrient impairment to Tammany Creek's water quality. To minimize excessive nutrients that impair the cold water beneficial use of Tammany Creek and restore the Creek's water quality to compliance with the Idaho Water Quality Standards, this TMDL applies the nutrient criteria recommended by the Environmental Protection Agency (EPA) as the TMDL target.

The EPA Ambient Water Quality Criteria Recommendations set forth nutrient criteria recommendations for reference rivers and streams in different ecoregions (EPA 2000). Ecoregions are based on general similarities in geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology (Table 6). The Tammany Creek watershed lies within the Columbia Plateau ecoregion, and more specifically the Lower Snake and Clearwater Canyons sub-ecoregion.

The Columbia Plateau is an arid sagebrush steppe and grassland surrounded on all sides by moister, predominantly forested, mountainous ecological regions. This region is underlain by lava rock up to two miles thick and is covered in some places by loess soils that have been extensively cultivated for wheat, particularly in the eastern portions of the region where precipitation amounts are greater. The Lower Snake and Clearwater Canyons sub-ecoregion consists of deep canyons cut through the basalts of the Columbia Plateau by the Snake and Clearwater rivers. Canyon depths exceed 1,400 feet and create drier conditions than in neighboring regions; mean annual precipitation is only 12 to 25 inches per year. Precipitation within the Tammany Creek watershed is approximately 12.7 inches per year.

The Columbia Plateau reference criteria targets have been used to develop the nutrient TMDLs, and should restore full support of the aquatic life beneficial use when these in-stream target levels are met and maintained through the implementation of best management practices.

Table 6. EPA water quality reference criteria recommendations by ecoregion.

Ecoregion	Description	NO_2+NO_3-N (mg/L)	Total Phosphorus (mg/L)
10	Columbia Plateau	0.072	0.03
11	Blue Mountains	0.01	0.0325
12	Snake R. Basin	0.272	0.0425
15	Northern Rockies	0.02	0.0077

(EPA 2000)

Load Capacity

A daily pound per day flow-based nutrient load capacity has been calculated using the TMDL target for the respective nutrient and the in-stream flow measurements recorded by the monitoring program conducted in 2008. Nutrient concentrations were converted to pounds per day by multiplying the measured concentrations by the flow recorded during sample collection and a conversion factor (5.39 is the constant used to convert cfs * mg/L to lbs/day).The daily load capacities are presented in Tables 7 and 8 for both nitrogen and phosphorus.

Monthly load capacities have been developed for each month using monthly average flows and monthly average concentrations from those measured during the 2007-08 monitoring year. The following equation describes how the existing loads were generated:

> Existing load (lbs./month)=average monthly concentration(mg/L)* average monthly flow(cfs)*5.39*30(days)
>
> Where: 5.39= conversion factor (converts equation results to pounds per day).

Monthly load capacities are presented in Tables 9 and 10.

Estimates of Existing Pollutant Loads

The average nitrite plus nitrate as nitrogen (NO_2+NO_3-N) concentration measured in Tammany Creek during the 2007-08 monitoring year was 2.73mg/L, nearly 40 times higher than the EPA recommendation of 0.072mg/L. The highest measured NO_2+NO_3-N concentrations occurred during late winter and early spring, when the Tammany Creek watershed receives the most precipitation. The average total phosphorous (TP) concentration measured during the same monitoring year was 0.174 mg/L, also significantly higher than the EPA reference condition of 0.03 mg/L. Measured TP concentrations were higher in the late fall and winter. As the loading tables illustrate, both TP and NO_2+NO_3-N concentrations remained consistently higher than desired target concentrations throughout the sampling year. Estimates of the existing pollutant daily loads are presented for both nitrogen and phosphorus in Tables 7 and 8. Monthly loads are presented in Tables 9 and 10.

Nutrient Load and Wasteload Allocations

The nutrient TMDLs allocate approximately 82.5% of the load capacity to nonpoint sources, and provide a 6% WLA for potential inclusion into future storm water National Pollution Discharge Elimination System (NPDES) permits. The WLA of 6% and a reserve for growth of 1.5% were estimated using the percentage of land area in the Tammany Creek watershed that is currently within the city of Lewiston impact zone, and accounts for an additional 300 acres (1.5%) that may be incorporated within the city in the near future. The WLA and reserve for growth can be adjusted in the future when land use changes or changes to Idaho code warrant such a revision.

Tables 7 and 8 display the existing load, load capacity, load allocation (LA), and WLA, and load reductions in NO_2+NO_3-N and TP that are needed to comply with the TMDL. Average monthly loads are shown in Tables 9 and 10. Table 11 displays the summary of assessment outcomes.

Table 7. Nitrite+Nitrate-N load and wasteload allocations.

Sample date	Flow (cfs)	NO_2+NO_3-N (mg/L)	Existing Load (lbs/day)	Load Capacity (lbs/day)	Load Allocation (lbs/day)	Wasteload Allocation (lbs/day)	Percent Reduction
6/26/2007	0.42	1.81	4.137	0.165	0.136	0.010	96.48
7/11/2007		1.99	NA	NA	NA	NA	NA
7/25/2007		0.83	NA	NA	NA	NA	NA
8/22/2007	0.04	1.55	0.334	0.016	0.013	0.001	95.89
10/17/2007		2.65	NA	NA	NA	NA	NA
10/29/2007	0.12	2.98	1.927	0.047	0.038	0.003	97.86
11/4/2007	0.22	3.76	4.459	0.085	0.070	0.005	98.31
1/9/2008	0.68	5.23	19.169	0.264	0.218	0.016	98.78
1/24/2008	Frozen		NA	NA	NA	NA	NA
2/11/2008		4.61	NA	NA	NA	NA	NA
2/20/2008	1.33	4.53	32.474	0.516	0.426	0.031	98.59
3/3/2008	0.78	4.12	17.321	0.303	0.250	0.018	98.45
3/18/2008	0.46	3.85	9.546	0.179	0.147	0.011	98.34
4/2/2008	1.22		NA	0.473	0.391	0.028	NA
4/15/2008	0.24	3.76	4.864	0.093	0.077	0.006	98.31
5/1/2008	0.48	3.15	8.150	0.186	0.154	0.011	97.98
5/13/2008	0.58	2.42	7.565	0.225	0.186	0.014	97.37
5/27/2008	0.34	1.55	2.841	0.132	0.109	0.008	95.89
6/10/2008	0.34	1.46	2.676	0.132	0.109	0.008	95.64
6/24/2008	0.30	1.43	2.312	0.116	0.096	0.007	95.54
7/7/2008	0.19	2.20	2.253	0.074	0.061	0.004	97.10
7/23/2008	0.13	3.03	2.123	0.050	0.042	0.003	97.90
8/5/2008	0.15	2.93	2.369	0.058	0.048	0.003	97.83
8/18/2008	0.15	1.74	1.407	0.058	0.048	0.003	96.34
9/4/208	0.15	2.25	1.819	0.058	0.048	0.003	97.17
9/18/2008	0.16	1.68	1.449	0.062	0.051	0.004	96.21
10/2/2008	0.07	1.68	0.634	0.027	0.022	0.002	96.21
10/16/2008	0.18	2.58	2.503	0.070	0.058	0.004	97.53

Table 8. Total phosphorus load and wasteload allocations.

Sample Date	Flow (cfs)	Total Phosphorus (mg/L)	Existing Load (lbs/day)	Load Capacity (lbs/day)	Load Allocation (lbs/day)	Wasteload Allocation (lbs/day)	Percent Reduction
6/26/2007	0.424	0.126	0.288	0.069	0.057	0.004	78.93
7/11/2007		0.184	NA	NA	NA	NA	NA
7/25/2007		0.216	NA	NA	NA	NA	NA
8/22/2007	0.04	0.176	0.038	0.006	0.005	0.000	84.91
10/17/2007		0.383	NA	NA	NA	NA	NA
10/29/2007	0.12	0.172	0.111	0.019	0.016	0.001	84.56
11/4/2007	0.22	0.179	0.212	0.036	0.029	0.002	85.17
1/9/2008	0.68	0.243	0.891	0.110	0.091	0.007	89.07
1/24/2008	Frozen		NA	NA	NA	NA	NA
2/11/2008			NA	NA	NA	NA	NA
2/20/2008	1.33	0.212	1.520	0.215	0.177	0.013	87.48
3/3/2008	0.78	0.198	0.832	0.126	0.104	0.008	86.59
3/18/2008	0.46	0.177	0.439	0.074	0.061	0.004	85.00
4/2/2008	1.22		NA	0.197	0.163	0.012	NA
4/15/2008	0.24	0.143	0.185	0.039	0.032	0.002	81.43
5/1/2008	0.48	0.181	0.468	0.078	0.064	0.005	85.33
5/13/2008	0.58	0.166	0.519	0.094	0.077	0.006	84.01
5/27/2008	0.34	0.169	0.310	0.055	0.045	0.003	84.29
6/10/2008	0.34	0.167	0.306	0.055	0.045	0.003	84.10
6/24/2008	0.3	0.137	0.222	0.049	0.040	0.003	80.62
7/7/2008	0.19	0.177	0.181	0.031	0.025	0.002	85.00
7/23/2008	0.13	0.191	0.134	0.021	0.017	0.001	86.10
8/5/2008	0.15	0.123	0.099	0.024	0.020	0.001	78.41
8/18/2008	0.15	0.11	0.089	0.024	0.020	0.001	75.86
9/4/208	0.15	0.0825	0.067	0.024	0.020	0.001	67.82
9/18/2008	0.16		0.000	0.026	0.021	0.002	NA
10/2/2008	0.07	0.0846	0.032	0.011	0.009	0.001	68.62
10/16/2008	0.18	0.115	0.112	0.029	0.024	0.002	76.91

Table 9. Monthly Nitrite+Nitrate-N load and wasteload allocations.

Month	Ave. Flow (cfs)	Ave. Concentration (mg/L)	Existing Load (lbs/month)	Load Cap. (lbs/month	Load Allocation (lbs/month)	Waste Load Allocation (lbs/month)	Load Reduction %
January	0.34	5.23	287.5	3.95	3.27	0.237	98.7
February	0.67	4.57	495.1	7.8	6.44	0.468	98.6
March	0.62	3.99	400	7.2	5.96	0.433	98.4
April	0.73	3.76	443.8	8.5	7	0.510	98.3
May	0.47	2.37	180.1	5.5	4.5	0.328	97.3
June	0.35	1.57	88.9	4.14	3.36	0.245	95.9
July	0.16	2.01	52	1.86	1.54	0.112	96.8
August	0.11	2.07	36.8	1.28	1.1	0.077	96.9
September	0.16	1.97	51	1.86	1.54	0.112	96.7
October	0.12	2.47	48	1.4	1.15	0.084	97.4
November	0.22	3.76	133.8	2.56	2.1	0.154	98.3
December	0.45	4.5	327.4	5.24	4.3	0.314	98.5

Table 10. Monthly Total Phosphorus load and wasteload allocations.

Month	Ave. Flow (cfs)	Ave. Concentration (mg/L)	Existing Load (lbs/month)	Load Cap. (lbs/month	Load Allocation (lbs/month)	Waste Load Allocation (lbs/month)	Load Reduction %
January	0.34	0.243	13.36	1.65	1.36	0.1	89.1
February	0.67	0.212	22.97	3.25	2.68	0.19	87.5
March	0.62	0.188	18.85	3.01	2.48	0.18	85.9
April	0.73	0.143	16.88	3.54	2.92	0.21	81.4
May	0.47	0.174	13.22	2.28	1.88	0.14	84.7
June	0.35	0.143	8.09	1.7	1.4	0.10	81.4
July	0.16	0.192	4.97	0.78	0.64	0.05	86.2
August	0.11	0.136	2.42	0.53	0.44	0.03	80.5
September	0.16	0.0825	2.13	0.78	0.64	0.05	67.8
October	0.12	0.189	3.67	0.58	0.48	0.03	85.9
November	0.22	0.179	6.37	1.07	0.88	0.06	85.2
December	0.45	0.211	15.35	2.18	1.8	0.13	87.4

Margin of Safety

An explicit margin of safety of 10% was deducted from the load capacity to determine both the total phosphorous and nitrogen allocations. The explicit margin of safety accounts for uncertainties about the relationship between physical, chemical, and hydrological factors such as higher ambient air and water temperatures, length of day, and decreased stream flows during the summer growing season, which influence aquatic plant growth cycles, biochemical oxygen demand, and in-stream dissolved oxygen.

Critical Time Period

Instantaneous DO concentrations measured at the monitoring site illustrate that late summer appears to be the time when DO has the greatest potential to sag below the DO standard of 6.0 mg/l. Although the loading tables illustrate that nutrient loading remains relatively constant throughout the year, it is during the summer months when temperatures increase and flows decrease that diurnal DO can sag below the state water quality standard. Nutrient loading needs to be controlled and managed to ensure DO concentrations remain adequate during this critical period. Adverse effects of excess TP loads are not anticipated to occur during the cool months of theyear because of non-optimal aquatic plant growing conditions. Target loads set in this TMDL are protective during the critical time period (summer months). Consequently, these loads are anticipated to also be protective during the cool months.

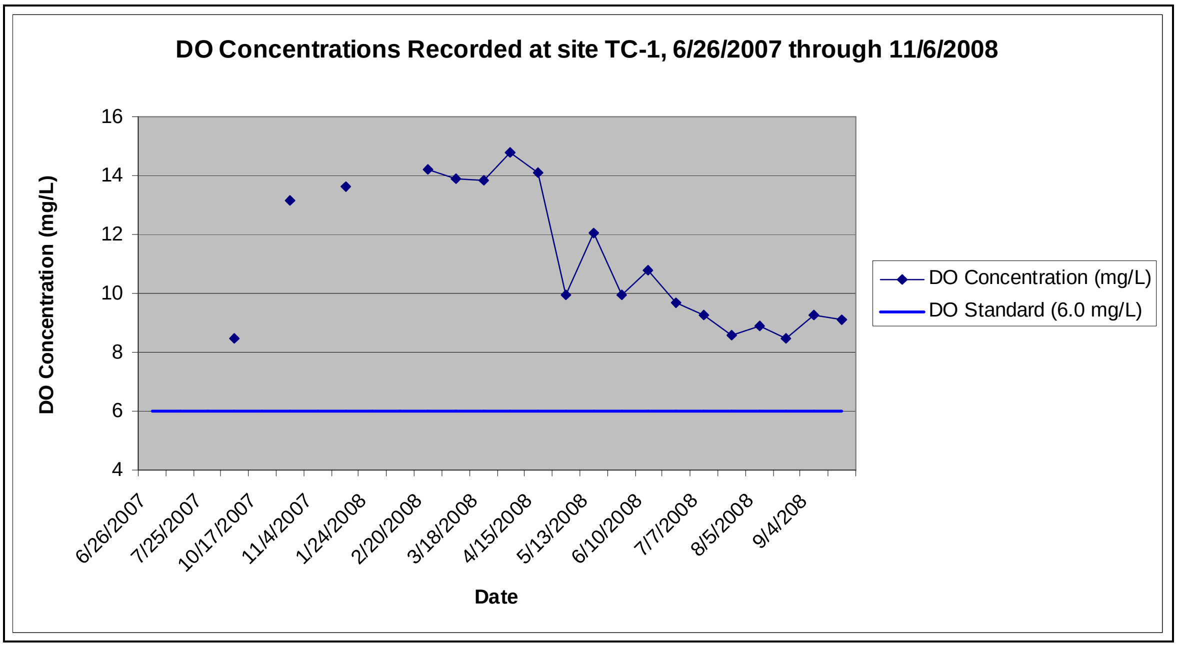

Figure 3. Instantaneous DO Concentrations measured at monitoring point TC-1 (2008)

5.4 Storm Water Permits

The Clean Water Act requires NPDES permit coverage for discharging storm water to a water body. There are three types of storm water permits available: Municipal, Construction, and Multi-sector Industrial.

Storm Water Wasteload Allocation

Wasteload allocations for sediment and nutrients have been provided in anticipation of future storm water permits, and represent a percentage of the overall load capacity. The sediment and nutrient load allocations of 6% and a reserve for growth of 1.5% were estimated using the percentage of land area in the watershed with current storm water drainage systems and the land area currently lacking significant drainage systems that may be developed in the future. The estimated percent of the watershed for these two land areas are considered to reflect the percent potential for contribution to Tammany Creek and the Tammany Creek TMDL storm water load and provide a means to develop a wasteload allocation as a percentage of the load capacity. The wasteload allocation and reserve for growth should be considered temporary until more current and applicable data becomes available.

Because the TMDL bacteria load capacity is expressed as a concentration equal to the state standard, the bacteria TMDL allocates the allowable 30-day *E-Coli* bacteria concentration to all sources contributing *E. coli* bacteria to the Tammany Creek watershed.

Construction Storm Water

In Idaho, EPA has issued a general permit for storm water discharges from construction sites. If a construction project disturbs more than one acre of land (or is part of larger common development that will disturb more than one acre), the operator is required to apply for permit coverage from EPA after developing a site-specific Storm Water Pollution Prevention Plan. When a stream is on Idaho's § 303(d) list and has a TMDL developed DEQ may incorporate a gross WLA for anticipated construction storm water activities. TMDLs developed in the past that did not have a WLA for construction storm water activities will also be considered in compliance with provisions of the TMDL if they obtain a Construction General Permit under the NPDES program and implement the appropriate BMPs.

Typically, there are specific requirements you must follow to be consistent with any local pollutant allocations. Many communities throughout Idaho are currently developing rules for post-construction storm water management. Sediment is usually the main pollutant of concern in storm water from construction sites. The application of specific best management practices from *Idaho's Catalog of Storm Water Best Management Practices for Idaho Cities and Counties* is generally sufficient to meet the standards and requirements of the General Construction Permit, unless local ordinances have more stringent and site specific standards that are applicable.

Storm Water Pollution Prevention Plan

In order to obtain the Construction General Permit operators must develop a site-specific Storm Water Pollution Prevention Plan (SWPPP). The operator must document the erosion, sediment, and pollution controls they intend to use, inspect the controls periodically and maintain the best management practices (BMPs) through the life of the project.

Multi-sector Industrial Storm Water

There are currently no known regulated industrial storm water dischargers within the Tammany Creek watershed. Similar to Construction Storm Water, industrial discharges are allowed by this TMDL provided such facilities fully comply with the EPA NPDES Multi-sector General Permit for Idaho.

5.5 Implementation Strategies

Idaho Code, in 39-3611 and 39-3612, provides guidance on the development and implementation of TMDLs in Idaho. The guidance contained in code relies on the participation and assistance of watershed advisory groups (WAGs) and designated management agencies (DMAs).

Reasonable Assurance

Nonpoint sources will be managed by applying the combination of authorities the state has included in the Idaho Nonpoint Source Management Plan (DEQ 1999). Section 319 of the federal Clean Water Act requires each state to submit to EPA a management plan for controlling pollution from nonpoint sources within the state. Idaho's authority for implementing the Idaho Nonpoint Source Management Plan has been certified by the Idaho Attorney General. The plan has been submitted to and approved by EPA as complying with Section 319 of the Clean Water Act.

Nonpoint source pollutant controls or best management practices determined to be ineffective in achieving the desired load reductions are subject to the feedback loop process, or adaptive management, to ensure load reductions are achieved (IDAPA 58.01.02.350). The feedback loop provides for water quality improvements and maintenance through installation, evaluation, and modification of best management practices. Implementing the feedback loop to modify best management practices until water quality standards are met results in compliance with the water quality standards.

Time Frame

A schedule for implementation of best management practices, pollution control strategies, assessment reporting dates, and evaluation of progress will be developed with appropriate designated management agencies and the Lindsay/Hatwai/Tammany Creek Watershed Advisory Group. Based on such assessments and evaluations, implementation strategies for TMDLs may need to be modified if monitoring shows that the water quality standards are not being met.

Approach

This TMDL focuses on implementation of load allocations for *E. coli* bacteria, nutrients, and sediment. Both the biological and numeric water quality data analyzed for this project suggests that poor habitat conditions and the exceedance of numeric standards are impairing the designated beneficial uses in some segments of Tammany Creek.

Nonpoint source best management practices for activities with the potential to contribute bacteria, nutrients, and sediment will be evaluated for application within the watershed by the DMAs responsible for such activities.

Responsible Parties

Idaho Code 39-3612 states designated management agencies are to use TMDL processes for achieving water quality standards. The Department of Environmental Quality will rely on the designated management agencies to implement pollution control measures or best management practices for pollutant sources they identify as priority.

The Department of Environmental Quality also recognizes the authorities and responsibilities of local city and county governments as well as applicable state and federal agencies, and will enlist their involvement and authorities for protecting water quality through implementation of Idaho Administrative Procedures Act 58.01.02 and Clean Water Act Section 401.

The designated state agencies listed below are responsible for assisting and providing technical support for the development of specific implementation plans and other appropriate support to water quality projects. General responsibilities for Idaho designated management agencies are:

- Idaho Soil and Water Conservation Commission: grazing and agriculture.
- Idaho State Department of Agriculture: aquaculture and animal feeding operations.
- Idaho Transportation Department: public roads.
- Idaho Department of Lands: timber harvest, oil and gas exploration, and mining.
- Idaho Department of Water Resources: stream channel alteration activities.
- Department of Environmental Quality: all other activities.

Monitoring Strategy

Idaho Code 39-3611 requires the Department of Environmental Quality to review and evaluate each Idaho TMDL, supporting assessment, implementation plan, and all available data periodically, at intervals no greater than five years. Such reviews are to be conducted using the Beneficial Use Reconnaissance Program protocol and the Water Body Assessment Guidance methodology to determine beneficial use attainability and status, and whether state water quality standards are being achieved.

Permanent monitoring stations for water quality monitoring should be established at the mouth and at the assessment unit boundary. These would be used for long term monitoring to assess trends in cumulative pollutant loading identified by this TMDL. Beneficial use support status monitoring and assessment will be conducted within each assessment unit of the watershed and evaluated using the Water Body Assessment Guidance for compliance with Idaho state water quality standards.

Idaho Code 39-3621 requires designated agencies, in cooperation with the appropriate land management agency, ensure best management practices are monitored for their effect on water quality. The monitoring results should be presented to the Department of Environmental Quality on a schedule agreed to between the designated agency and the Department. The designated management agency should report the effectiveness of the measures or practices implemented to the Department in the form of load reductions applicable to the TMDL.

Pollutant load reductions gained by the application of pollutant controls and best management practices will be monitored by the Department of Environmental Quality through reports provided by designated management agencies. Information reported will be compiled and tracked over time to determine measurable pollutant load reductions relative to the total maximum daily load allocations.

DEQ recognizes that implementation strategies for TMDLs may need to be modified if monitoring shows that the TMDL goals are not being met or significant progress is not being made toward achieving the goals.

5.6 Conclusions

Based on the available in-stream monitoring data generated at the monitoring station, nutrient TMDLs were developed for total phosphorus and nitrite plus nitrate as nitrogen, and a bacteria TMDL was developed for *E. coli* bacteria. Additionally, the original sediment TMDL has been revised to establish a wasteload allocation (WLA) for point sources of sediment to Tammany Creek(Table 11).

Table 11. Summary of assessment outcomes.

Water Body Segment/ AU	Pollutant	TMDL(s) Completed	Recommended Changes to §303(d) List/ Integrated Report	Justification
Tammany Creek, WBID 015 to unnamed tributary ID17060103SL014_02 ID17060103SL014_03	TP, NO_2+NO_3-N, *E. coli* bacteria	Yes	Move to section 4a	Violation of DO and bacteria standards
Tammany Creek, source to mouth ID17060103SL016_02	TP, NO_2+NO_3-N, *E. coli* bacteria	Yes	Move to section 4a	Violation of DO and bacteria standards
Tammany Creek, source to mouth, ID17060103SL014_02 ID17060103SL014_03 ID17060103SL016_02	Sediment	LA and WLA revised	Leave in section 4a	LA and WLA revised for stormwater allocations

This page intentionally left blank for correct double-sided printing.

6.0 Public Participation

This TMDL Addendum has been developed with the assistance of the Lindsay and Tammany Creek Watershed Advisory Group. The Watershed Advisory Group represents agriculture, local government, federal government, the Nez Perce Tribe, recreation, forestry, point source discharges, environmental, mining, livestock, and residential interests**.** The Watershed Advisory Group has met, and through their established operating procedures, provided concurrence to complete this TMDL.

The Watershed Advisory Group voted to provide a 30 day public comment period for the Tammany Creek Total Maximum Daily Load Addendum document during the May 13, 2010 Watershed Advisory Group meeting. Notice was provided to the general public through the Lewiston Morning Tribune and individual notices and documents were provided to the public through the Lewiston and State Offices of the Department of Environmental Quality, the Nez Perce Soil Water Conservation District Office, the Lewiston City Library, Clearwater Basin Advisory Group Members, and the US Environmental Protection Agency's Idaho Operations Office. The public comments received and associated responses are included in Appendix C.

This page intentionally left blank for correct double-sided printing.

References Cited

DEQ. 2001. Tammany Creek Sediment TMDL, Subbasin Assessment and Total Maximum Daily Load Analysis. Idaho Department of Environmental Quality. Lewiston, Idaho.58p.

EPA (U.S. Environmental Protection Agency) 2000. Nutrient criteria: technical guidance for streams and small rivers. EPA 822-B-96-001. Washington, DC. U.S. Environmental Protection Agency, Office of Water. Washington. DC.

IDAPA 58.01.02. Idaho water quality standards and wastewater treatment requirements.

GIS Coverages

Restriction of liability: Neither the state of Idaho nor the Department of Environmental Quality, nor any of their employees make any warranty, express or implied, or assume any legal liability or responsibility for the accuracy, completeness or usefulness of any information or data provided. Metadata is provided for all data sets, and no data should be used without first reading and understanding its limitations. The data could include technical inaccuracies or typographical errors. The Department of Environmental Quality may update, modify, or revise the data used at any time, without notice.

Glossary

§303(d)

Refers to section 303 subsection "d" of the Clean Water Act. 303(d) requires states to develop a list of water bodies that do not meet water quality standards. This section also requires total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and the TMDLs are subject to U.S. Environmental Protection Agency approval.

Aerobic

Describes life, processes, or conditions that require the presence of oxygen.

Algae

Non-vascular (without water-conducting tissue) aquatic plants that occur as single cells, colonies, or filaments.

Ambient

General conditions in the environment (Armantrout 1998). In the context of water quality, ambient waters are those representative of general conditions, not associated with episodic perturbations or specific disturbances such as a wastewater outfall (EPA 1996).

Anaerobic

Describes the processes that occur in the absence of molecular oxygen and describes the condition of water that is devoid of molecular oxygen.

Assessment Unit (AU)

A segment of a water body that is treated as a homogenous unit, meaning that any designated uses, the rating of these uses, and any associated causes and sources must be applied to the entirety of the unit.

Beneficial Use

Any of the various uses of water, including, but not limited to, aquatic life, recreation, water supply, wildlife habitat, and aesthetics, which are recognized in water quality standards.

Best Management Practices (BMPs)

Structural, nonstructural, and managerial techniques that are effective and practical means to control nonpoint source pollutants.

Clean Water Act (CWA)

The Federal Water Pollution Control Act (commonly known as the Clean Water Act), as last reauthorized by the Water Quality Act of 1987, establishes a process for states to use to develop information on, and control the quality of, the nation's water resources.

Criteria

In the context of water quality, numeric or descriptive factors taken into account in setting standards for various pollutants. These factors are used to determine limits on allowable concentration levels, and to limit the number of violations per year. The U.S. Environmental Protection Agency develops criteria guidance; states establish criteria.

Discharge

The amount of water flowing in the stream channel at the time of measurement. Usually expressed as cubic feet per second (cfs).

Dissolved Oxygen (DO)

The oxygen dissolved in water. Adequate DO is vital to fish and other aquatic life.

E. coli

Short for *Escherichia coli*, *E. coli* are a group of bacteria that are a subspecies of coliform bacteria. Most *E. coli* are essential to the healthy life of all warm-blooded animals, including humans, but their presence in water is often indicative of fecal contamination. *E. coli* are used by the state of Idaho as the indicator for the presence of pathogenic microorganisms.

Ecosystem

The interacting system of a biological community and its non-living (abiotic) environmental surroundings.

Ephemeral Stream

A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long continued supply from melting snow or other sources. Its channel is at all times above the water table (American Geological Institute 1962).

Exceedance

A violation (according to DEQ policy) of the pollutant levels permitted by water quality criteria.

Existing Beneficial Use or Existing Use

A beneficial use actually attained in waters on or after November 28, 1975, whether or not the use is designated for the waters in Idaho's *Water Quality Standards and Wastewater Treatment Requirements* (IDAPA 58.01.02).

Fecal Coliform Bacteria

Bacteria found in the intestinal tracts of all warm-blooded animals or mammals. Their presence in water is an indicator of pollution and possible contamination by pathogens (also see Coliform Bacteria, *E. coli*, and Pathogens).

Fully Supporting

In compliance with water quality standards and within the range of biological reference conditions for all designated and exiting beneficial uses as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).

Fully Supporting Cold Water

Reliable data indicate functioning, sustainable cold water biological assemblages (e.g., fish, macroinvertebrates, or algae), none of which have been modified significantly beyond the natural range of reference conditions.

Geographical Information Systems (GIS)

A georeferenced database.

Geometric Mean

A back-transformed mean of the logarithmically transformed numbers often used to describe highly variable, right-skewed data (a few large values), such as bacterial data.

Hydrologic Basin

The area of land drained by a river system, a reach of a river and its tributaries in that reach, a closed basin, or a group of streams forming a drainage area (also see Watershed).

Hydrologic Unit	One of a nested series of numbered and named watersheds arising from a national standardization of watershed delineation. The initial 1974 effort (USGS 1987) described four levels (region, subregion, accounting unit, cataloging unit) of watersheds throughout the United States. The fourth level is uniquely identified by an eight-digit code built of two-digit fields for each level in the classification. Originally termed a cataloging unit, fourth field hydrologic units have been more commonly called subbasins. Fifth and sixth field hydrologic units have since been delineated for much of the country and are known as watershed and subwatersheds, respectively.
Hydrologic Unit Code (HUC)	The number assigned to a hydrologic unit. Often used to refer to fourth field hydrologic units.
Hydrology	The science dealing with the properties, distribution, and circulation of water.
Instantaneous	A condition or measurement at a moment (instant) in time.
Intermittent Stream	1) A stream that flows only part of the year, such as when the ground water table is high or when the stream receives water from springs or from surface sources such as melting snow in mountainous areas. The stream ceases to flow above the streambed when losses from evaporation or seepage exceed the available stream flow. 2) A stream that has a period of zero flow for at least one week during most years.
Load Allocation (LA)	A portion of a water body’s load capacity for a given pollutant that is given to a particular nonpoint source (by class, type, or geographic area).
Load(ing)	The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Loading is the product of flow (discharge) and concentration.
Load(ing) Capacity (LC)	A determination of how much pollutant a water body can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, and a margin of safety, it becomes a total maximum daily load.
Margin of Safety (MOS)	An implicit or explicit portion of a water body’s loading capacity set aside to allow the uncertainly about the relationship between the pollutant loads and the quality of the receiving water body. This is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The MOS is not allocated to any sources of pollution.
Mean	Describes the central tendency of a set of numbers. The arithmetic mean (calculated by adding all items in a list, then dividing by the number of items) is the statistic most familiar to most people.

Milligrams per Liter (mg/L)

A unit of measure for concentration. In water, it is essentially equivalent to parts per million (ppm).

Mouth

The location where flowing water enters into a larger water body.

National Pollution Discharge Elimination System (NPDES)

A national program established by the Clean Water Act for permitting point sources of pollution. Discharge of pollution from point sources is not allowed without a permit.

Nitrogen

An element essential to plant growth, and thus is considered a nutrient.

Nonpoint Source

A dispersed source of pollutants, generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernable point or origin. They include, but are not limited to, irrigated and non-irrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.

Not Assessed (NA)

A concept and an assessment category describing water bodies that have been studied, but are missing critical information needed to complete an assessment.

Not Fully Supporting

Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).

Not Fully Supporting Cold Water

At least one biological assemblage has been significantly modified beyond the natural range of its reference condition.

Nuisance

Anything that is injurious to the public health or an obstruction to the free use, in the customary manner, of any waters of the state.

Nutrient

Any substance required by living things to grow. An element or its chemical forms essential to life, such as carbon, oxygen, nitrogen, and phosphorus. Commonly refers to those elements in short supply, such as nitrogen and phosphorus, which usually limit growth.

Pathogens

A small subset of microorganisms (e.g., certain bacteria, viruses, and protozoa) that can cause sickness or death. Direct measurement of pathogen levels in surface water is difficult. Consequently, indicator bacteria that are often associated with pathogens are assessed. *E. coli*, a type of fecal coliform bacteria, are used by the state of Idaho as the indicator for the presence of pathogenic microorganisms.

Perennial Stream

A stream that flows year-around in most years.

Phosphorus	An element essential to plant growth, often in limited supply, and thus considered a nutrient.
Point Source	A source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable “point” of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater.
Pollutant	Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.
Pollution	A very broad concept that encompasses human-caused changes in the environment which alter the functioning of natural processes and produce undesirable environmental and health effects. This includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.
River	A large, natural, or human-modified stream that flows in a defined course or channel or in a series of diverging and converging channels.
Runoff	The portion of rainfall, melted snow, or irrigation water that flows across the surface, through shallow underground zones (interflow), and through ground water to creates streams.
Sediments	Deposits of fragmented materials from weathered rocks and organic material that were suspended in, transported by, and eventually deposited by water or air.
Spring	Ground water seeping out of the earth where the water table intersects the ground surface.
Stream	A natural water course containing flowing water, at least part of the year. Together with dissolved and suspended materials, a stream normally supports communities of plants and animals within the channel and the riparian vegetation zone.
Stream Order	Hierarchical ordering of streams based on the degree of branching. A first-order stream is an unforked or unbranched stream. Under Strahler’s (1957) system, higher order streams result from the joining of two streams of the same order.
Storm Water Runoff	Rainfall that quickly runs off the land after a storm. In developed watersheds the water flows off roofs and pavement into storm drains that may feed quickly and directly into the stream. The water often carries pollutants picked up from these surfaces.

Subbasin	A large watershed of several hundred thousand acres. This is the name commonly given to 4th field hydrologic units (also see Hydrologic Unit).
Subbasin Assessment (SBA)	A watershed-based problem assessment that is the first step in developing a total maximum daily load in Idaho.
Subwatershed	A smaller watershed area delineated within a larger watershed, often for purposes of describing and managing localized conditions. Also proposed for adoption as the formal name for 6th field hydrologic units.
Surface Runoff	Precipitation, snow melt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of nonpoint source pollutants in rivers, streams, and lakes. Surface runoff is also called overland flow.
Surface Water	All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors that are directly influenced by surface water.
Suspended Sediments	Fine material (usually sand size or smaller) that remains suspended by turbulence in the water column until deposited in areas of weaker current. These sediments cause turbidity and, when deposited, reduce living space withIn-streambed gravels and can cover fish eggs or alevins.
Total Maximum Daily Load (TMDL)	A TMDL is a water body's load capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual bases. A TMDL is equal to the load capacity, such that load capacity = margin of safety + natural background + load allocation + wasteload allocation = TMDL. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.
Total Dissolved Solids	Dry weight of all material in solution in a water sample as determined by evaporating and drying filtrate.
Total Suspended Solids (TSS)	The dry weight of material retained on a filter after filtration. Filter pore size and drying temperature can vary. American Public Health Association Standard Methods (Franson et al. 1998) call for using a filter of 2.0 microns or smaller; a 0.45 micron filter is also often used. This method calls for drying at a temperature of 103-105 °C.
Tributary	A stream feeding into a larger stream or lake.
Wasteload Allocation (WLA)	The portion of receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. Wasteload allocations specify how much pollutant each point source may release to a water body.

Water Body

A stream, river, lake, estuary, coastline, or other water feature, or portion thereof.

Water Pollution

Any alteration of the physical, thermal, chemical, biological, or radioactive properties of any waters of the state, or the discharge of any pollutant into the waters of the state, which will or is likely to create a nuisance or to render such waters harmful, detrimental, or injurious to public health, safety, or welfare; to fish and wildlife; or to domestic, commercial, industrial, recreational, aesthetic, or other beneficial uses.

Water Quality

A term used to describe the biological, chemical, and physical characteristics of water with respect to its suitability for a beneficial use.

Water Quality Criteria

Levels of water quality expected to render a body of water suitable for its designated uses. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, or industrial processes.

Water Quality Limited

A label that describes water bodies for which one or more water quality criterion is not met or beneficial uses are not fully supported. Water quality limited segments may or may not be on a §303(d) list.

Water Quality Management Plan

A state or area-wide waste treatment management plan developed and updated in accordance with the provisions of the Clean Water Act.

Water Quality Standards

State-adopted and U.S. Environmental Protection Agency-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.

Water Table

The upper surface of ground water; below this point, the soil is saturated with water.

Watershed

1) All the land which contributes runoff to a common point in a drainage network, or to a lake outlet. Watersheds are infinitely nested, and any large watershed is composed of smaller “subwatersheds.” 2) The whole geographic region which contributes water to a point of interest in a water body.

Water Body Identification Number (WBID)

A number that uniquely identifies a water body in Idaho and ties in to the Idaho water quality standards and GIS information.

Appendix A. Unit Conversion Chart

This page intentionally left blank for correct double-sided printing.

Table A-1. Metric - English unit conversions.

	English Units	Metric Units	To Convert	Example
Distance	Miles (mi)	Kilometers (km)	1 mi = 1.61 km 1 km = 0.62 mi	3 mi = 4.83 km 3 km = 1.86 mi
Length	Inches (in) Feet (ft)	Centimeters (cm) Meters (m)	1 in = 2.54 cm 1 cm = 0.39 in 1 ft = 0.30 m 1 m = 3.28 ft	3 in = 7.62 cm 3 cm = 1.18 in 3 ft = 0.91 m 3 m = 9.84 ft
Area	Acres (ac) Square Feet (ft^2) Square Miles (mi^2)	Hectares (ha) Square Meters (m^2) Square Kilometers (km^2)	1 ac = 0.40 ha 1 ha = 2.47 ac 1 ft^2 = 0.09 m^2 1 m^2 = 10.76 ft^2 1 mi^2 = 2.59 km^2 1 km^2 = 0.39 mi^2	3 ac = 1.20 ha 3 ha = 7.41 ac 3 ft^2 = 0.28 m^2 3 m^2 = 32.29 ft^2 3 mi^2 = 7.77 km^2 3 km^2 = 1.16 mi^2
Volume	Gallons (gal) Cubic Feet (ft^3)	Liters (L) Cubic Meters (m^3)	1 gal = 3.78 L 1 L= 0.26 gal 1 ft^3 = 0.03 m^3 1 m^3 = 35.32 ft^3	3 gal = 11.35 L 3 L = 0.79 gal 3 ft^3 = 0.09 m^3 3 m^3 = 105.94 ft^3
Flow Rate	Cubic Feet per Second (cfs)[a]	Cubic Meters per Second (m^3/sec)	1 cfs = 0.03 m^3/sec 1 m^3/sec = 35.31 cfs	3 ft^3/sec = 0.09 m^3/sec 3 m^3/sec = 105.94 ft^3/sec
Concentration	Parts per Million (ppm)	Milligrams per Liter (mg/L)	1 ppm = 1 mg/L[b]	3 ppm = 3 mg/L
Weight	Pounds (lbs)	Kilograms (kg)	1 lb = 0.45 kg 1 kg = 2.20 lbs	3 lb = 1.36 kg 3 kg = 6.61 lb
Temperature	Fahrenheit (°F)	Celsius (°C)	°C = 0.55 (F - 32) °F = (C x 1.8) + 32	3 °F = -15.95 °C 3 °C = 37.4 °F

[a] 1 cfs = 0.65 million gallons per day; 1 million gallons per day is equal to 1.55 cfs.

[b] The ratio of 1 ppm = 1 mg/L is approximate and is only accurate for water.

This page intentionally left blank for correct doubled-sided printing.

Appendix B. Tammany Creek Monitoring Data

This page intentionally left blank for correct doubled-sided printing.

Table B-1. Tammany Creek Monitoring Data.

Sample Date	Sample Time	Temp (Celsius)	D.O. (mg/L)	NO_2+NO_3-N (mg/L)	TP (mg/L)	NH_3-N (mg/L)	E. coli (cfu/100 ml)	TSS (mg/L)	Flow (cfs)
6/26/2007	3:30			1.81	0.126	0.074	547.2	23.2	0.424
7/11/2007	12:15			1.99	0.184	0.089	1119.9	40.5	
7/25/2007	12:05			0.829	0.216	0.167	1046.9	72.2	
8/22/2007	1:00	19.5	8.5	1.55	0.176	ND	157.6	28.7	0.04
10/17/2007	1:00			2.65	0.383	ND	1413.6	14.6	
10/29/2007	11:45	6.1	13.2	2.98	0.172	ND	20.3	4.11	0.12
11/4/2007	10:30			3.76	0.179	ND	201.4	3.49	0.22
1/9/2008	1:00	4.3	13.6	5.23	0.243	0.337	1119.9	5.03	0.68
1/24/2008	11:00								Frozen
2/11/2008	11:40			4.61			16.1	7.05	
2/20/2008	10:15	3.9	14.2	4.53	0.212		15.8	7.74	1.33
3/3/2008	11:15	6.4	13.9	4.12	0.198	0.063	63.8	4.52	0.78
3/18/2008	11:00	7.9	13.9	3.85	0.177	ND	38.9	6.67	0.46
4/2/2008	9:30	4.3	14.8						1.22
4/15/2008	2:00	10.6	14.1	3.76	0.143	ND	74.9	10.4	0.24
5/1/2008	1:15	13.2	10.0	3.15	0.181	ND	54.5	12	0.48
5/13/2008	10:15	10.5	12.1	2.42	0.166	ND	137.4	8.68	0.58
5/27/2008	10:30	16.6	9.9	1.55	0.169	ND	139.6	16.2	0.34
6/10/2008	8:45	10.9	10.8	1.46	0.167	ND	95.9	6.88	0.34
6/24/2008	11:00	16.8	9.7	1.43	0.137	0.066	648.8	13.1	0.3
7/7/2008	10:30	18.3	9.3	2.2	0.177	0.15	920.8	47	0.19
7/23/2008	9:15	16.2	8.6	3.03	0.191	0.204	1732.9	135	0.13
8/5/2008	11:30	18.4	8.9	2.93	0.123	0.163	>2419.2	72.3	0.15
8/18/2008	10:30		8.5	1.74	0.11	ND	>2419.2	17.4	0.15
9/4/208	1:00	16.2	9.2	2.25	0.0825	ND	1046.2	17.6	0.15
9/18/2008	1:30	15.3	9.1	1.68			1986.3		0.16
10/2/2008	1:15	14.5	9.2	1.68	0.0846	ND	>2419.2		0.07
10/16/2008	11:45			2.58	0.115	ND	686.7		0.18
10/23/2008	11:00	5.7	12.4				307.6		0.15
10/27/2008	8:45	3.8	13.5				325.5		0.12
10/30/2008	10:45	5.9	12.4				1119.9		0.13
11/3/2008	9:00	7.8	11.5				95.9		
11/6/2008	2:00						613.1		
12/2/2008	11:50			3.95	0.249	ND	410.6	9.69	

This page intentionally left blank for correct doubled-sided printing

Appendix C. Public Comment

This page intentionally left blank for correct doubled-sided printing.

A 30 day public comment period was provided for the draft of the Tammany Creek TMDL Addendum from July 2 through August 2, 2010. Notice was provided to the general public through the Lewiston Morning Tribune and the document was made available through the Lewiston and State Offices of the Department of Environmental Quality, the Nez Perce Soil and Water Conservation District Office and the Lewiston City Library, and through DEQ's website at www.deq.idaho.gov/public/comment.cfm.

The received comments and DEQ's responses are recorded in this appendix.

Name: Ged W Randall

Email Address: ged_r@yahoo.com

Affiliation: None

Comments: I believe that livestock should not be allowed to have any direct contact with the waters of the Tammany Creek Watershed. I also believe that no grazing or pen areas should be within 100 ft of the center line of the streambed. As far as farming, I suggest that the base of the hillsides closest to the steambeds should be planted in Legumes, and the farmers should be provided with online access to farming techniques(low fertilizer crops, organic farming, etc) that would help reduce the need for fertilizers, with particular emphasis on the cost reductions.

DEQ Response: The implementation activities you suggest are similar to the agricultural best management practices prescribed by agencies like the Nez Perce Soil and Water Conservation District. As the TMDL moves into the implementation stages, the Watershed Advisory Group will work to find landowners who wish to install and use best management practices on their lands in the Tammany Creek watershed. Thank you for your comment.

Name: William C. Stewart, Environmental Specialist

Address: United States Environmental Protection Agency

1435 N. Orchard

Boise, ID 83706

Affiliation: Federal

Comments: EPA 1) Section 5.1 titled Sediment Load and Wasteload Re-Allocations needs to be fleshed out a bit more. A map showing the locations of the stormwater outlets would be helpful. What is the basis for choosing the value of 6% of the total allocation to be assigned to stormwater? While accounting for the point source is a good idea, a paragraph or two explaining the reasoning would be helpful. Having a small reserve for growth is also a good idea.

DEQ Response: Section 5.1 has been amended to include an explanation of how the WLA was derived. A reserve for growth was included in the original draft Section 5.4.

EPA 2) Section 5.2 titled Bacteria TMDL is interesting and I think there is some good logic in the development of the allocations. I question the utility of the DNA analysis of bacteria to determine sources. It appears to the reader that there are some substantial experimental errors in the development of this DNA study. Amazingly, the tests for humans and bovines were negative and only birds were positive. Was there any effort to look at other species? Personal experience indicates that there are lots of horses in the watershed (if not in the actual creek). What about dogs and cats or other wildlife? It appears not to matter because the conclusion seems to be that all nonpoint sources of fecal bacteria need to be reduced. We agree that the critical time period seems to be year round. There needs to be a mass daily load of cfu's in the document. Recent court decisions require a mass daily load in TMDLs. A table with numbers in scientific notation will fulfill this requirement.

DEQ Response: We agree that the results of the DNA study did not fit the hypothesis that generated the sampling in the first place. The results were presented as an example of the data gathering effort DEQ initiated to complete this TMDL Addendum. Each DNA test is performed for each individual species, at a significant cost. Although DEQ would have continued testing for different species, further tests proved cost prohibitive.

Section 5.2 has been amended to include Table 5, an example of mass cfu loading analysis for the days on which the geometric mean samples were taken.

EPA 3) The nutrient TMDL in this watershed is well thought out and the targets and allocations seem to be appropriate. It would be helpful to include an explanation of how the allocations by sample date relate to the target concentrations, margin of safety, and the conversion from mg/l to lbs/day. I believe this explanation would be helpful to members of the public that may read the document.

DEQ Response: Section 5.3 has been amended to include a discussion of how the loads were derived and the conversions were made. The draft included Tables 7 and 8, which illustrate how the concentrations sampled on each sampling date relate to the load capacity, margin of safety, etc. Monthly loads have been calculated and added to the document as Tables 9 and 10.

EPA 4) Again, I believe this is a well thought out document and I appreciate the efforts made by the DEQ staff and the Watershed Advisory Group.

DEQ Response: We appreciate your prompt response and substantive comments.

Appendix D. Distribution List

This page intentionally left blank for correct doubled-sided printing.

Department of Environmental Quality - Lewiston Regional Office, 1118 F Street, Lewiston, Idaho 83501

Department of Environmental Quality - State Office, 1410 North Hilton, Boise, Idaho 83706

US Environmental Protection Agency - Idaho Operations Office, 1435 North Orchard, Boise, Idaho 83706

Clearwater Basin Advisory Group Members

Tammany Creek Watershed Advisory Group Members