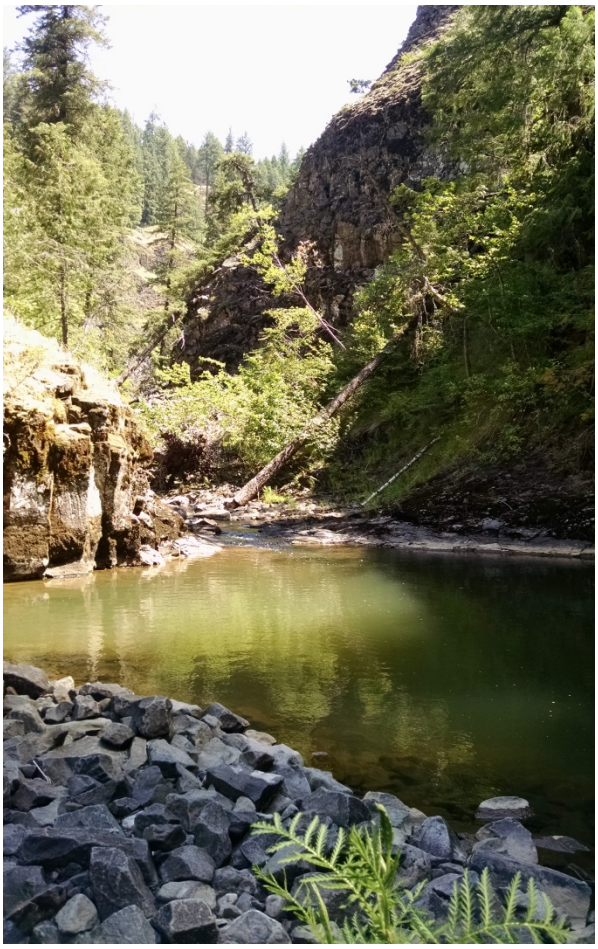
Jim Ford Creek Watershed

TMDL Five-Year Review



Final

Department of Environmental Quality

September 2016



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TMDL Five-Year Review

September 2016

Prepared by
Idaho Department of Environmental Protection
Lewiston Regional Office
1118 F Street
Lewiston, ID 83501

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Table of Contents

Executive Summary v
Watershed at a Glance vi
1 Introduction 1
Assessment Units 1
2 TMDL Review and Status 2
2.1 Watershed Characteristics 2
2.2 TMDL Review and Status by Pollutant 4
2.2.1 Bacteria 4
2.2.2 Nutrients 7
2.2.3 Coarse Sediment 9
3 Beneficial Use Status 19
3.1 Beneficial Uses 19
3.2 Summary and Analysis of Current Water Quality Data 23
4 Review of Implementation Plan and Activities 23
4.1 Background 23
4.2 Pollutants of Concern 24
4.3 Summary of Past and Present Pollution Control Efforts 24
4.4 Natural Resource Partnerships 26
4.5 Restoration Activities 26
4.6 Empire Lumber Company—Enhancements in Stormwater Planning and Management 37
5 Summary of TMDL Review 38
5.1 Water Quality Trend 39
5.2 Review of Pollutant Targets 39
5.3 Review of Beneficial Uses 39
5.4 Watershed Advisory Group Consultation 40
5.5 Recommendations for Further Action 40
Appendix A. Bacteria Data 43
Appendix B. Phosphorus Data 49
Appendix C. Implementation Monitoring in Jim Ford Creek (Idaho Association of Soil Conservation Districts) 53
Appendix D. Calculations and Cumulative Grain-Size Distributions for the 2016 Grain-Size Data 58

List of Tables

Table A. Existing TMDLs and general status. vi
Table B. Watershed at a glance. vii
Table 1. Assessment units with E. coli bacteria TMDLs. 4
Table 2. E. coli bacteria. 6
Table 3. Assessment units with nutrient TMDLs. 8
Table 4. Assessment unit pollutant loads for total phosphorous. 9
Table 5. Biological and habitat data for Jim Ford Creek. 11
Table 6. Fish data for Jim Ford Creek. 12
Table 7. Grain-size classes from Wolman pebble count for Jim Ford Creek. 14
Table 8. Sum and percentage of grain-size class, Wolman pebble count for Jim Ford Creek. 15
Table 9. Comparison of channel geometry and grain-size data. 16
Table 10. Comparison of bankfull width and depth ratio. 17
Table 11. Beneficial uses of TMDL water bodies. 20
Table 12. Selected numeric criteria supportive of designated beneficial uses in Idaho water quality standards. 21
Table 13. Beneficial Use Reconnaissance Program data for the Jim Ford Creek watershed. 23
Table 14. Natural resource partnerships. 26
Table 15. Summary of recommended changes for AUs based on TMDL review. 38

List of Figures

Figure 1. Location of watershed. 3
Figure 2. Jim Ford Creek watershed monitoring points. 6
Figure 3. Segments and reaches monitored in the original TMDL (DEQ et al. 2000). 13
Figure 4. Cumulative grain-size distribution for reach 1. 15
Figure 5. Determination steps and criteria for determining support status of beneficial uses in wadeable streams (Grafe et al. 2002). 22
Figure 6. Riparian restoration strategy and feedback process. 25
Figure 7. Riparian fencing. 30
Figure 8. Bennett Creek Grazing Association—new corral and loading chute. 31
Figure 9. Newly installed culvert. 32
Figure 10. Streambank stabilization (rock riprap). 33
Figure 11. Feedlot condition before project. 34
Figure 12. Feedlot project under construction. 34
Figure 13. Barn complex after feedlot restoration project. 35
Figure 14. Beginning stage of wetland restoration. 36
Figure 15. Completed Chapman Road wetland. 36

Executive Summary

This review of the *Jim Ford Creek Total Maximum Daily Load* (DEQ et al. 2000) addresses water bodies in the Jim Ford Creek watershed that are in Category 4(a) of the most recent Integrated Report (DEQ 2014a). This 5-year review complies with Idaho Code §39-3611(7) and describes current water quality status, pollutant sources addressed by established total maximum daily loads (TMDLs), and recent pollution control efforts in the Jim Ford Creek watershed, located in northern Idaho. The assessment units (AUs) in the TMDL subject to review are shown in Table A. The Jim Ford Creek TMDL was approved by the United States Environmental Protection Agency in June 2000.

Three AUs in the Jim Ford Creek TMDL were not intended to be listed with sediment as a pollutant in Idaho's Integrated Report. In the Jim Ford Creek TMDL (DEQ et al. 2000), the existing data indicated that fine sediment was not degrading the water quality of Jim Ford Creek or tributaries; therefore, it was determined that no TMDL was necessary for fine sediments. A channel stability analysis and habitat survey indicated coarse sediment impairment in the lower Jim Ford Creek (ID17060306CL034_04). This Jim Ford TMDL 5-year review provides the opportunity to correctly align the AUs to accurately represent the findings of the TMDL, and DEQ will remove sediment as a pollutant from three AUs: ID17060306CL035_02, ID17060306CL035_03, and ID17060306CL035_04.

An agricultural implementation plan was developed in 2000 and revised in 2014 for the Jim Ford Creek TMDL (Clearwater SWCD 2014).

Table A. Existing TMDLs and general status.

Stream	Assessment Unit	Pollutants
Jim Ford Creek—waterfall (12.5-miles upstream) to mouth	ID17060306CL034_04	Bacteria (fecal), nutrients, and coarse sediment
Heywood, Wilson Creeks and tributaries	ID17060306CL035_02	Coarse sediment, temperature, bacteria (fecal), and nutrients
Jim Ford Creek—source to Jim Ford Creek waterfall (12.5 miles)	ID17060306CL035_03	Bacteria (fecal), nutrients, coarse sediment, and temperature
Jim Ford Creek—source to Jim Ford Creek waterfall	ID17060306CL035_04	Bacteria (fecal), nutrients, coarse sediment, and temperature
Grasshopper Creek—source to mouth	ID17060306CL036_02	Bacteria (fecal), nutrients, and temperature
Grasshopper Creek—source to mouth	ID17060306CL036_03	Bacteria (fecal), nutrients, and temperature
Winter Creek	ID17060306CL037_02	Category 3 (BURP site 2014SLEWA008)
Winter Creek—waterfall (3.4-miles upstream) to mouth	ID17060306CL037_03	Bacteria (fecal), nutrients, and temperature
Winter Creek—source to Winter Creek waterfall	ID17060306CL038_02	Bacteria (fecal), nutrients, and temperature

Watershed at a Glance

Jim Ford Creek is a tributary of the Clearwater River in the southern part of Clearwater County, Idaho. The creek drains a 65,838-acre watershed that has two distinct portions. In the upper portion, Jim Ford Creek flows through rolling forested uplands and the Weippe Prairie until it reaches the city of Weippe. Below Weippe, the creek enters a narrow, steep basalt canyon nearly 14 miles long. A 65-foot waterfall at the top of the canyon restricts fish passage upstream.

Currently, two point sources are identified in the Jim Ford Creek watershed. The Weippe wastewater treatment plant (ID0020354) is located along Jim Ford Creek at the confluence with Grasshopper Creek. Another point source within the Jim Ford Creek watershed is the stormwater runoff from Empire Lumber Company (formerly Hutchins Lumber). To determine loads and allocations, runoff from this facility was grouped with nonpoint source stormwater discharge activities in the TMDL. Timberline High School discharged as a point source to Grasshopper Creek when the TMDL was written but has replaced the system with a drainfield and no longer discharges to Grasshopper Creek. The primary nonpoint sources of pollutants in the Jim Ford Creek watershed are grazing, timber harvest activities, nonirrigated croplands, urban runoff, land development activities, and hydropower.

Table B provides the status and recommendations for the Jim Ford Creek watershed.

Table B. Watershed at a glance.

TMDL	TMDL Status	Pollutants	Assessment Unit Recommendation
Jim Ford Creek TMDL (DEQ et al. 2000)	Jim Ford Creek TMDL (DEQ et al. 2000): Approved by EPA June 2000	Bacteria (fecal), nutrients, coarse sediment, and temperature	• Move from Category 4a to 2 in Integrated Report for bacteria and contact recreation for two AUs: ID17060306CL034_04 ID17060306CL037_03 • Remove coarse sediment as impairment from Jim Ford Creek AU: ID17060306CL034_04 • Remove nutrients as impairment from Jim Ford Creek AU: ID17060306CL034_04 • Move from Category 3 to 4a in Integrated Report for cold water aquatic life and contact recreation use support: ID17060306CL037_02

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1 Introduction

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the CWA, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. CWA §303(d) establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards.

Idaho Code §39-3611(7) requires a 5-year cyclic review process for Idaho TMDLs:

> The director shall review and reevaluate each TMDL, supporting subbasin assessment, implementation plan(s) and all available data periodically at intervals of no greater than five (5) years. Such reviews shall include the assessments required by section 39-3607, Idaho Code, and an evaluation of the water quality criteria, instream targets, pollutant allocations, assumptions and analyses upon which the TMDL and subbasin assessment were based. If the members of the watershed advisory group, with the concurrence of the basin advisory group, advise the director that the water quality standards, the subbasin assessment, or the implementation plan(s) are not attainable or are inappropriate based upon supporting data, the director shall initiate the process or processes to determine whether to make recommended modifications. The director shall report to the legislature annually the results of such reviews.

To meet the intent and purpose of Idaho Code §39-3611(7), this report documents the review of the *Jim Ford Creek Total Maximum Daily Load* (DEQ et al. 2000) and addresses the water bodies in the Jim Ford Creek watershed that are in Category 4(a) of Idaho's most recent Integrated Report (DEQ 2014a). This report reviews the approved TMDL and implementation plan, considers the most current and applicable information in conformance with Idaho Code §39-3607, evaluates the appropriateness of the TMDL to current watershed conditions, evaluates the implementation plan, and provides for watershed advisory group (WAG) consultation. TMDL modifications are decided by the Idaho Department of Environmental Quality (DEQ) director. Approval of TMDL modifications is decided by the United States Environmental Protection Agency (EPA) with consultation by DEQ.

Assessment Units

Assessment units (AUs) are groups of similar streams that have similar land use practices, ownership, or land management. Stream order is the main basis for determining AUs—even if ownership and land use change significantly, the AU usually remains the same for the same stream order.

Using AUs to describe water bodies offers many benefits primarily that all waters of the state are defined consistently. AUs are a subset of water body identification numbers, which allows them to relate directly to the water quality standards.

2 TMDL Review and Status

2.1 Watershed Characteristics

Jim Ford Creek is a tributary of the Clearwater River in the southern part of Clearwater County, Idaho (Figure 1). It drains a 65,838-acre watershed that has two distinct portions. In the upper portion, Jim Ford Creek flows through rolling forested uplands and the Weippe Prairie until it reaches the city of Weippe. Below Weippe, the creek enters a narrow, steep basalt canyon nearly 14 miles long. A 65-foot waterfall at the top of the canyon restricts fish passage upstream.

Currently, two point sources are identified in the Jim Ford Creek watershed. The city of Weippe wastewater treatment plant (WWTP) (ID0020354) is located along Jim Ford Creek at the confluence with Grasshopper Creek. Another point source within the Jim Ford Creek watershed is the stormwater runoff from Empire Lumber Company (formerly Hutchins Lumber). To determine loads and allocations, runoff from this facility was grouped with nonpoint source stormwater discharge activities in the TMDL. Timberline High School discharged as a point source to Grasshopper Creek when the TMDL was written but has replaced the system with a drainfield and no longer discharges to Grasshopper Creek. The primary nonpoint sources of pollutants in the Jim Ford Creek watershed are grazing, timber harvest activities, nonirrigated croplands, urban runoff, land development activities, and hydropower.

The *Jim Ford Creek Total Maximum Daily Load* (DEQ et al. 2000) is found at *www.deq.idaho.gov/media/454495-_water_data_reports_surface_water_tmdls_jim_ford_creek_jim_ford_entire.pdf*.

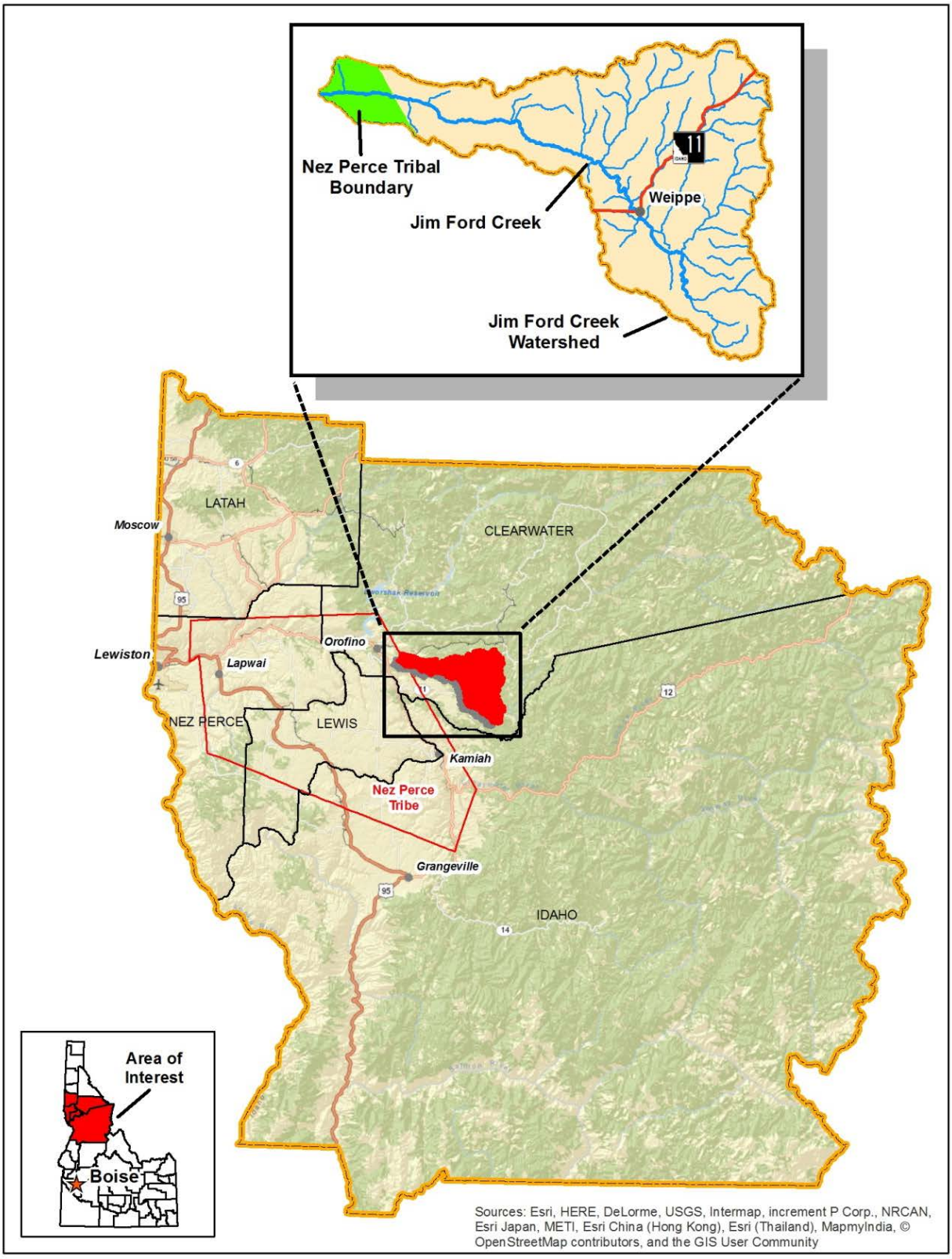


Figure 1. Location of watershed.

2.2 TMDL Review and Status by Pollutant

2.2.1 Bacteria

2.2.1.1 Instream Water Quality Targets

When the Jim Ford Creek TMDL was written, the State of Idaho was in the process of updating the recreation contact criteria from fecal coliform numeric criteria to *Escherichia coli* (*E. coli)* numeric criteria. *E. coli,* more than fecal coliform, reflects direct contamination from feces of warm-blooded animals and is considered a better indicator of potential human health risks in recreational use waters. EPA recommends using *E. coli* as the water quality criteria for pathogens (EPA 1986). The proposed criteria were not in effect when the TMDL was being finalized, and the bacteria TMDL was based on the fecal coliform criteria. Anticipating the rule change, a load analysis based on *E. coli* was conducted in the TMDL, and the current *E. coli* numeric criteria was used for this review.

Instream water quality targets for the listed streams in the Jim Ford Creek TMDL for *E. coli* bacteria were set from the Idaho water quality standards. Waters designated for primary or secondary contact recreation must not to contain *E. coli* bacteria in concentrations exceeding a geometric mean of 126 colony forming units/100 milliliters (cfu/100 mL) based on a minimum of five samples taken every 3–7 days over a 30-day period (IDAPA 58.01.02.251.01.a).

The AUs listed for bacterial impairment in the Jim Ford Creek TMDL are shown in Table 1. The load capacity used to establish the instream target and allocations for these streams is based on the Idaho geometric mean criterion of 126 cfu/100 mL for *E. coli* bacteria.

Table 1. Assessment units with *E. coli* bacteria TMDLs.

Assessment Unit Name	Assessment Unit Number	Beneficial Use	Type of Use	*E. coli* Bacteria Numeric Criteria (cfu/100 mL)	Critical Period
Jim Ford Creek	ID17060306CL034_04	PCR	Designated	126	Year-round
Heywood Creek Kamiah Gulch Miles Creek Wilson Creek	ID17060306CL035_02	PCR	Designated	126	Year-round
Jim Ford Creek	ID17060306CL035_03	PCR	Designated	126	Year-round
Jim Ford Creek	ID17060306CL035_04	PCR	Designated	126	Year-round
Grasshopper Creek	ID17060306CL036_02	PCR	Designated	126	Year-round
Grasshopper Creek	ID17060306CL036_03	PCR	Designated	126	Year-round
Winter Creek	ID17060306CL037_02	SCR	Presumed	126	Year-round
Winter Creek	ID17060306CL037_03	SCR	Presumed	126	Year-round
Winter Creek	ID17060306CL038_02	SCR	Presumed	126	Year-round

Notes: colony forming unit/100 milligrams (cfu/100 mL), primary contact recreation (PCR); secondary contact recreation (SCR)

2.2.1.2 Monitoring Points and Sampling Process

Water quality monitoring for bacteria occurred at nine sites on Jim Ford Creek and tributaries listed in Table 1. The monitoring schedule was designed to capture two geometric means during spring and fall (Appendix A). The established monitoring sites used in the TMDL are also the compliance points. Because bacteria can travel throughout the entire stream, beneficial uses must be met throughout each §303(d) stream; therefore, each monitoring site is a compliance point for the bacteria TMDLs. Figure 2 provides the monitoring points.

2.2.1.3 Load Capacity

The *E. coli* bacteria load capacity for the listed AUs in the Jim Ford Creek TMDL is a geometric mean of 126 cfu/100 mL. The load capacity is expressed as a concentration (cfu/100 mL) because the calculation of mass load is difficult due to the variability of temperature, moisture conditions, and flow, which can all influence the die-off rate of *E. coli* bacteria in the environment (EPA 2001).

2.2.1.4 Load Allocation

Bacteria are living organisms, and varying water quality and atmospheric conditions, which fluctuate continuously, dictate the actual mass of bacteria in the water. This fluctuation can complicate the load allocation process. For this TMDL review, the daily load allocation for nonpoint and point sources is 126 cfu/100 mL, which is the geometric mean concentration currently allowed by Idaho's water quality standards.

Table 2 lists the existing *E. coli* monthly geometric mean bacteria concentrations calculated from measurements at the monitoring points established in the Jim Ford Creek TMDL. The table also shows the load reduction needed to comply with the 126 cfu/100 mL criterion. A full data set is provided in Appendix A.

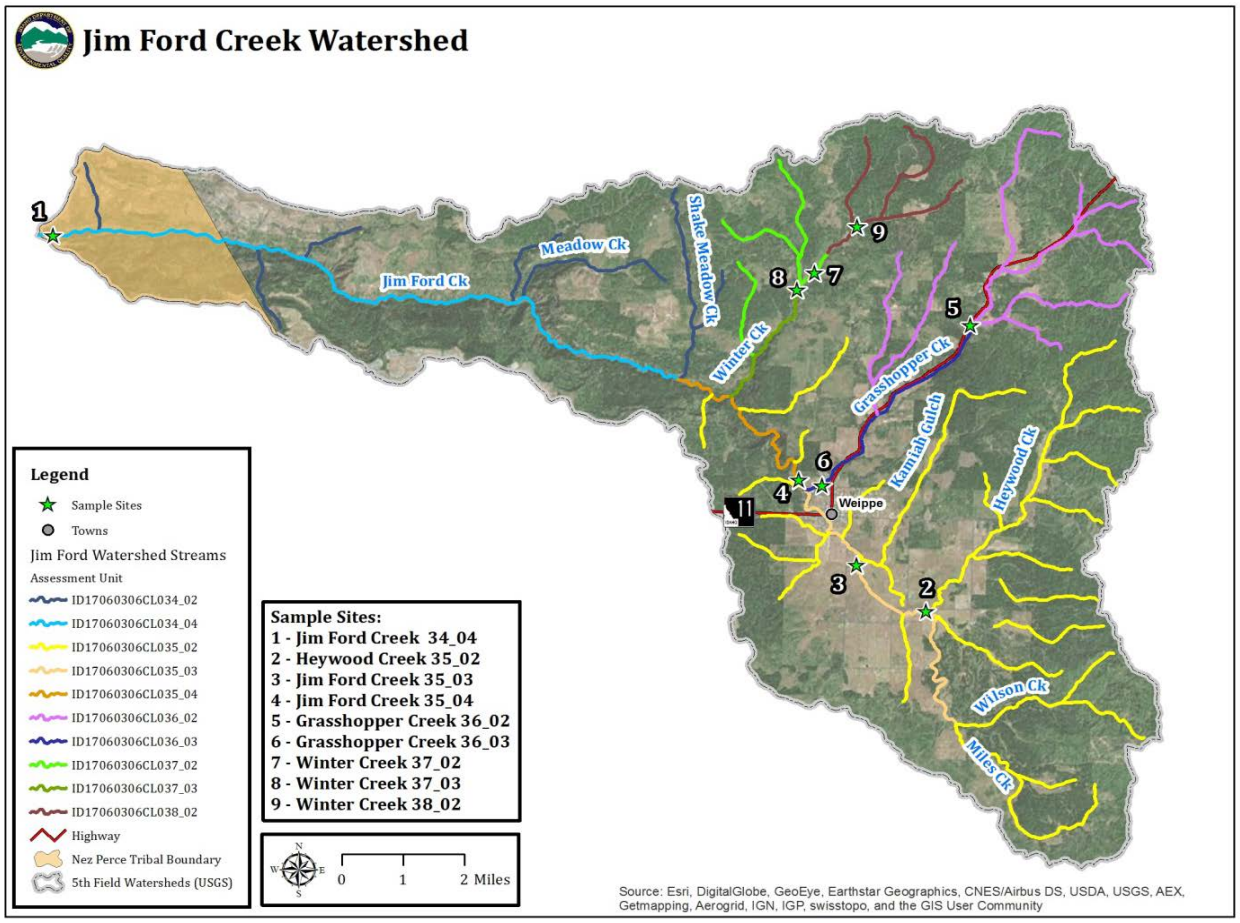


Figure 2. Jim Ford Creek watershed monitoring points.

Table 2. *E. coli* bacteria.

Stream Name and Monitoring Point	Assessment Unit Number	Existing Load (May/June) (cfu/100 mL)	Existing Load (November) (cfu/100 mL)	Load Capacity (cfu/100 mL)	Load Reduction (May/June) (%)	Load Reduction (November) (%)
Jim Ford Creek	ID17060306CL034_04	50	28	126	0	0
Heywood Creek Kamiah Gulch Miles Creek Wilson Creek	ID17060306CL035_02	365	330	126	65	62
Jim Ford Creek	ID17060306CL035_03	59	395	126	0	68
Jim Ford Creek	ID17060306CL035_04	38	300	126	0	58
Grasshopper Creek	ID17060306CL036_02	62	132	126	0	5
Grasshopper Creek	ID17060306CL036_03	120	148	126	0	15
Winter Creek	ID17060306CL037_02	61	166	126	0	24
Winter Creek	ID17060306CL037_03	37	114	126	0	0
Winter Creek	ID17060306CL038_02	127	126	126	1	0

Notes: colony forming unit/100 milligrams (cfu/100 mL)

The *E. coli* bacteria TMDL for the Jim Ford Creek TMDL allocates a daily concentration to all nonpoint sources of *E. coli* bacteria upstream from the sample site. The sources extending upstream from these locations must be managed to reduce the instream *E. coli* bacteria concentrations according to the load reductions in Table 2. To ensure the criterion is not exceeded, this allocation will apply daily throughout the year.

2.2.1.5 Wasteload Allocation

Wasteload allocations were provided for the Weippe WWTP (ID0020354). Wasteload allocations were based on the numeric standard of an allowable monthly geometric mean concentration of 126 cfu/100 mL with a maximum daily limit of 406 cfu/100 mL. For further discussion, see the Jim Ford Creek TMDL (DEQ et al. 2000).

2.2.1.6 Margin of Safety

In the case of *E. coli*, the pollutant load capacity has been calculated for the most critical time periods identified and is applied year-round. Existing loads are based on recent data and the geometric mean. The margin of safety (MOS) for point and nonpoint sources is provided using recent data and the geometric mean. The load capacity of the effluent is the wasteload allocation for the point sources. The application of the conservative geometric mean criteria methods for TMDL calculations provides an implicit MOS.

2.2.2 Nutrients

2.2.2.1 Instream Water Quality Targets

In Idaho, a narrative water quality standard is used to protect cold water aquatic life beneficial uses from excessive nutrients. 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 58.01.02.200.06). Aquatic life beneficial uses can be impaired when excessive algae decompose, depleting dissolved oxygen in the water column.

Monitoring data in the TMDL indicated that phosphorous was the limiting nutrient for aquatic plant growth in the subbasin. Total phosphorus (TP) was used as a surrogate target for nutrients in the Jim Ford Creek TMDL. A TP target of 0.075 mg/L was used for the Jim Ford Creek TMDL based on EPA guidance recommendations that TP levels do not to exceed 0.10 mg/L (EPA 1986). An explicit 25% MOS was incorporated to reach the current TP target.

The AUs listed for nutrient impairment in the Jim Ford Creek TMDL are shown in Table 3. The TP target is 0.075 mg/L with a critical time period of April through July.

Table 3. Assessment units with nutrient TMDLs.

Assessment Unit Name	Assessment Unit Number	Beneficial Use	Type of Use
Jim Ford Creek	ID17060306CL034_04	CW	Designated
Heywood Creek Kamiah Gulch Miles Creek Wilson Creek	ID17060306CL035_02	CW	Designated
Jim Ford Creek	ID17060306CL035_03	CW	Designated
Jim Ford Creek	ID17060306CL035_04	CW	Designated
Grasshopper Creek	ID17060306CL036_02	CW	Designated
Grasshopper Creek	ID17060306CL036_03	CW	Designated
Winter Creek	ID17060306CL037_02	CW	Presumed
Winter Creek	ID17060306CL037_03	CW	Presumed
Winter Creek	ID17060306CL038_02	CW	Presumed

Note: cold water aquatic life (CW)

2.2.2.2 Monitoring Points

Water quality monitoring for nutrients occurred at nine sites on Jim Ford Creek and tributaries listed in Table 3. The monitoring schedule was designed to collect nutrient data as long as flow was present in the streams (Appendix B). The established monitoring sites used in the TMDLs are also the compliance points and beneficial uses must be met throughout each §303(d) stream; therefore, each monitoring site is a compliance point for the nutrient TMDLs. Figure 2 provides the monitoring points.

2.2.2.3 Load Capacity

The TP load capacity was developed for each monitoring point using flow and TP data collected during the critical time period listed in the TMDL. Daily load was estimated by multiplying the measured concentration of TP and streamflow estimates:

> Existing load (pounds per day) = daily concentration (mg/L)* daily flow (cfs)* 5.39 (conversion factor).

Background loads are included as part of the load capacity. An explicit MOS of 25% was built into the 0.075 mg/L load allocation. Some of the methods used in the initial TMDL are not comparable to the currently used methods. As a result, the TMDL may not be comparable and different outcomes may occur.

2.2.2.4 Load Allocation

Pollutant loads for TP are presented in Table 4. Because specific source load data are not available, listed loads are comprehensive estimates between each monitoring station. These gross allocations account for all sources, such as stormwater runoff, agricultural practices, septic systems, and livestock operations. Load capacities include background conditions. A 25% MOS

was built in to the 0.075 mg/L load allocation. Additional TP data and flow measurements are provided in Appendix B.

Several point sources in the Jim Ford Creek watershed were documented and assigned wasteload allocations in the Jim Ford Creek TMDL.

Table 4. Assessment unit pollutant loads for total phosphorous.

Assessment Unit Name	Assessment Unit Number	Average Daily Flow (cfs)	Average Available Load Capacity (lb/day)	Average Existing Load (lb/day)	Load Reduction (%)
Jim Ford Creek	ID17060306CL034_04	5.94	2.4	0.89	0
Heywood Creek Kamiah Gulch Miles Creek Wilson Creek	ID17060306CL035_02	1.08	0.44	0.43	0
Jim Ford Creek	ID17060306CL035_03	1.43	0.58	0.61	5
Jim Ford Creek	ID17060306CL035_04	3.25	1.31	1.03	0
Grasshopper Creek	ID17060306CL036_02	0.69	0.28	0.19	0
Grasshopper Creek	ID17060306CL036_03	1.58	0.64	0.34	0
Winter Creek	ID17060306CL037_02	0.38	0.16	0.06	0
Winter Creek	ID17060306CL037_03	0.5	0.2	0.08	0
Winter Creek	ID17060306CL038_02	0.34	0.14	0.09	0

Notes: cubic feet per second (cfs); pounds per day (lb/day)

2.2.2.5 Wasteload Allocation

A wasteload allocation for nutrients (TP) of 30 pounds per month seasonal average from April 1 through July 31 was provided for the Weippe WWTP (ID0020354). The TP wasteload allocation was based on the existing nutrient load from the Weippe WWTP. Further discussion is provided in the Jim Ford Creek TMDL (DEQ et al. 2000).

2.2.2.6 Margin of Safety

An explicit 25% MOS was built in to the 0.075 mg/L load allocation.

2.2.3 Coarse Sediment

AUs are groups of similar streams that have similar land use practices, ownership. or land management. AUs were established in the 2002 Integrated Report and now define all the waters of Idaho. The methodology used to describe AUs is found in the *Water Body Assessment Guidance* (Grafe et al. 2002). Using AUs to describe water bodies offers many benefits, primarily that all the waters of the state are defined consistently. Because AUs are a subset of water body identification numbers, a direct tie exists to the water quality standards for each AU so that uses defined in the standards are clearly tied to streams on the landscape.

Originally, streams not meeting beneficial uses were placed on Idaho's §303(d) list as a *water quality-limited segment*. A water quality-limited segment was defined as "a stretch or area of surface water where technology-based controls are not sufficient to prevent violations of water quality standards. In such cases, new permit limitations are based on ambient water quality considerations." Due to the nature of the court-ordered 1994 listings, all water quality-limited segments were added to Idaho's §303(d) list with boundaries from "headwaters to mouth."

To deal with the vague boundaries in the listings and to complete TMDLs at a reasonable pace, DEQ wrote TMDLs at a watershed scale ("headwaters to mouth"). Starting in 2000, DEQ began reconciling the framework of AUs for reporting and communicating with the legacy §303(d) water quality-limited segments.

For the 2002 Integrated Report, the boundaries from a §303(d) listed water quality-limited segment were transferred to the new AU framework using an approach similar to how DEQ currently writes subbasin assessments and TMDLs. An attempt was made to ensure all AUs contained in the listed water quality-limited segment were carried forward to Category 5 of the Integrated Report. AUs not wholly contained within a previously water quality-limited segment but partially contained (even minimally) were also included in Category 5 of the Integrated Report. This inclusion was necessary to maintain the integrity of the 1998 §303(d) listing and maintain continuity with the TMDL program because AUs were not based upon §303(d) listing, rather on the factor described above.

While the new AU framework led to better assessments for listing and delisting, not all water quality-limited segment-to-AU carry overs aligned with the TMDL analysis. In the Jim Ford Creek TMDL (DEQ et al. 2000), the existing data indicated that fine sediment was not degrading the water quality of Jim Ford Creek or tributaries; therefore, it was determined that no TMDL was necessary for fine sediments. A channel stability analysis and habitat survey indicated coarse sediment impairment in the lower Jim Ford Creek (ID17060306CL034_04).

Three AUs in the Jim Ford Creek TMDL were not intended to be listed with sediment as a pollutant in Idaho's Integrated Report. This Jim Ford TMDL 5-year review provides the opportunity to correctly align the AUs to accurately represent the findings of the TMDL, and DEQ will remove sediment as a pollutant from three AUs: ID17060306CL035_02, ID17060306CL035_03, and ID17060306CL035_04.

The only AU impaired by coarse sediment in the Jim Ford Creek TMDL was the lower portion, Jim Ford Creek–waterfall to mouth (ID17060306CL034_04). The goal of the Jim Ford Creek sediment TMDL was to stabilize the response reaches. Methods used for analyzing channel stability are documented in Appendix C. The instream load analysis for coarse sediment was documented in Appendix F of the original TMDL (DEQ et al. 2000). This analysis concluded that by reducing the bedload transport rate, reducing the bankfull width-to-depth ratio, and increasing the residual pool volume, the targets would be achieved. Findings for the load reduction are as follows:

- The median particle diameter was 118 millimeters (mm).
- A 70% reduction was required to reduce the existing load of 75 tons per day to the load capacity of 23 tons per day—applies to transport reaches.

The following assumptions were used in this analysis:

- Channel instability resulted from management.
- Channel widening and shallowing led to a loss of pools and pool volume, which would adversely affect salmonid spawning and coldwater biota.
- Improved stability would improve salmon rearing habitat.

Targets for residual pool volume and bankfull width-to-depth ratio applied to the response reaches. These targets were set using regional reference conditions and theoretical thresholds:

- The mean residual pool volume in cubic yards was 99, but 196 was the desired value, which would equal a 49% increase.
- The mean bankfull width-to-depth ratio was 90, the desired value was less than 40, which would equal a 56% decrease.

For this TMDL review, the following was concluded:

- Channel stability has been achieved.
- Potential sediment sources adjacent to the channel have been removed.
- Watershed improvement efforts should focus on the upper reaches of Jim Ford Creek, where adding riparian vegetation to increase shade will also stabilize streambanks and decrease the sediment load to the lower channel.

AU ID17060306CL034_04 can be recommended for delisting in the next Integrated Report cycle.

2.2.3.1 Beneficial Use Support

Habitat and biological assessments show a passing score for 4 out of 6 locations evaluated by Beneficial Use Reconnaissance Program (BURP) (DEQ 2013). Results are shown in Table 5. An average score ≥2 indicates that a water body is supporting cold water aquatic life uses.

Table 5. Biological and habitat data for Jim Ford Creek.

BURP ID	Location	SMI Rating	SFI Rating	SHI Rating	Average Score
1995SLEWB011	Upper	3	—	1	2
1997SLEWZ005	Mouth	3	0	2	0
1998SLEWA005	Upper	0	—	3	0
1998SLEWT003	Middle	2	2	3	2.33
2004SLEWA027	Mouth	3	1	3	2.33
2014SLEWA015	Mouth	2	1	3	2

Notes: stream macroinvertebrate index (SMI); stream fish index (SFI); stream habitat index (SHI)

The passing score for the 2014 BURP site indicates that the Jim Ford Creek AU ID17060306CL034_04 is currently fully supporting cold water aquatic life. Fish species, counts, and lengths for salmonids shown in Table 6.

Table 6. Fish data for Jim Ford Creek.

BURP ID	Common Name	Scientific Name	Count	Fish Lengths for Salmonids (millimeters)
1997SLEWZ005	Bridgelip Sucker	*Catostomus columbianus*	4	
	Northern Pikeminnow	*Ptychocheilus oregonensis*	1	
	Pacific Salmon/Trout	*Oncorhynchus* sp.	8	5, 5, 5, 5, 45, 45, 55, 55
	Paiute Sculpin	*Cottus beldingi*	6	
	Sculpin	*Cottus* sp.	10	
	Speckled Dace	*Rhinichthys osculus*	6	
	Sucker	*Catostomus* sp.	9	
1998SLEWT003	Bridgelip Sucker	*Catostomus columbianus*	4	
	Chinook Salmon	*Oncorhynchus tshawytscha*	12	85, 85, 85, 95, 95, 95, 105, 105, 105, 105, 105, 105
	Chiselmouth	*Acrocheilus alutaceus*	2	
	Pacific Salmon/Trout	*Oncorhynchus* sp.	24	55, 55, 65, 65, 75, 75, 75, 125, 135, 135, 135, 135, 145, 145, 155, 155, 155, 155, 155, 165, 165, 165, 165, 175
	Paiute Sculpin	*Cottus beldingi*	4	
	Rainbow Trout	*Oncorhynchus mykiss*	3	145, 145, 165
	Sculpin	*Cottus* sp.	10	
	Speckled Dace	*Rhinichthys osculus*	9	
2004SLEWA027	Largescale Sucker	*Catostomus macrocheilus*	2	
	Northern Pikeminnow	*Ptychocheilus oregonensis*	4	
	Paiute Sculpin	*Cottus beldingi*	1	
	Rainbow Trout	*Oncorhynchus mykiss*	10	50, 50, 80, 120, 130, 140, 150, 160, 180, 200
	Smallmouth Bass	*Micropterus dolomieu*	3	
	Speckled Dace	*Rhinichthys osculus*	10	
2014SLEWA015	Chinook Salmon	*Oncorhynchus tshawytscha*	1	100
	Mountain Sucker	*Catostomus platyrhychus*	3	
	Rainbow Trout	*Oncorhynchus mykiss*	3	50, 60, 65
	Smallmouth Bass	*Micropterus dolomieu*	3	
	Speckled Dace	*Rhinichthys osculus*	1	

2.2.3.2 Channel Stability Trends

The channel stability analysis in Appendix D of the original TMDL focused on classifying source, transport, and response reaches at a channel reach level. Figure 3 shows the 5 segments and 22 reaches that were monitored for the 1999 evaluation.

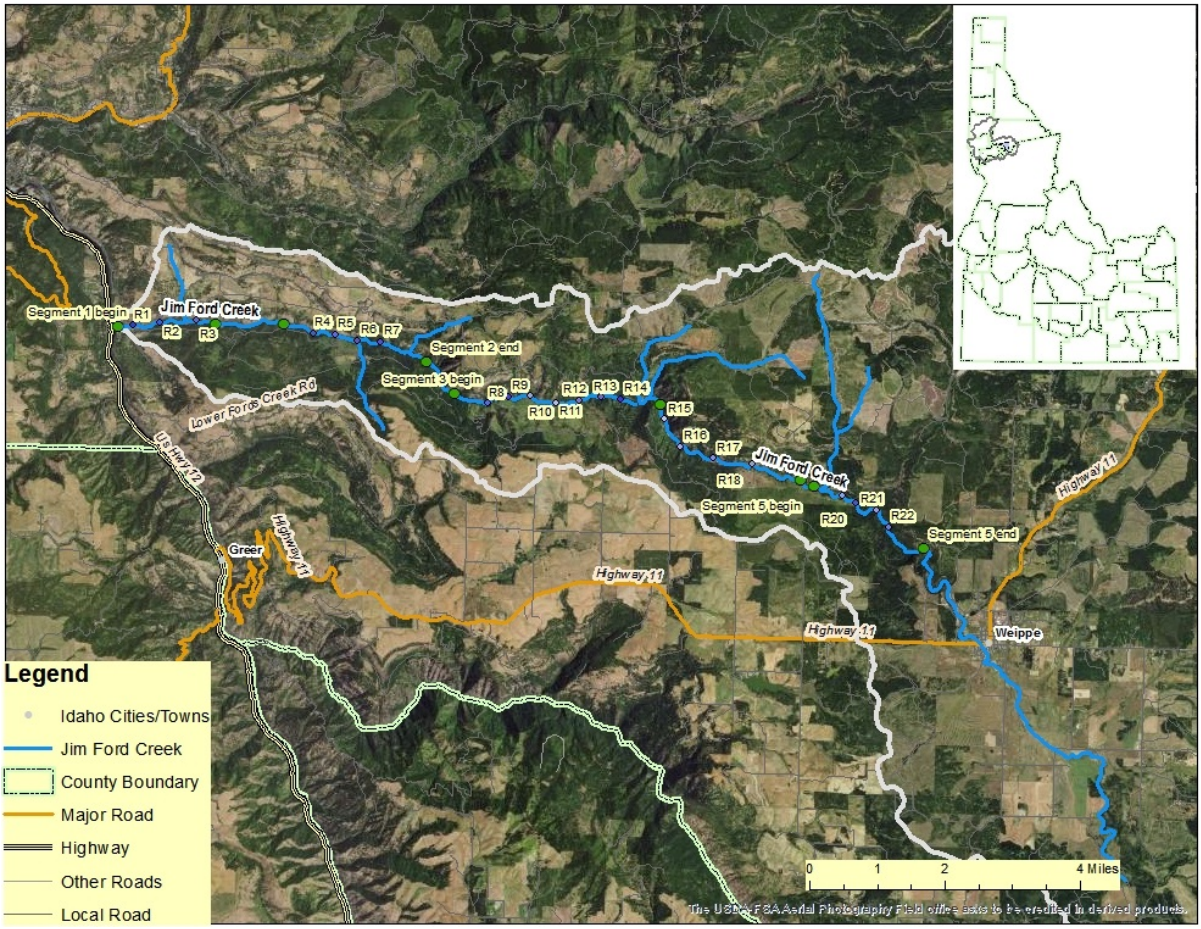


Figure 3. Segments and reaches monitored in the original TMDL (DEQ et al. 2000).

2.2.3.3 Grain-Size Classification

To evaluate trends for the review, the disparate sediment evaluation methods must be coordinated. Substrate on a streambed can be described as sediment, pebbles, gravels, or grain size—all equivalent terminologies. For BURP data (DEQ 2013), DEQ collects grain-size data based on the Wolman method of pebble counts, which follow the size classes:

- Silt/clay <1 mm
- Sand <2.5 mm
- Very fine pebble <6 mm
- Pebble <16 mm
- Coarse pebble <32 mm
- Very coarse pebble <64 mm

- Small cobble <128 mm
- Large cobble <256 mm
- Small boulder <512 mm
- Medium boulder <1,024 mm
- Large boulder >1,024 mm

The Jim Ford Creek channel stability analysis used a different grain-size nomenclature scheme and identified the grain-size classes:

- d_{16}—16% of the sample is finer
- d_{50}—median diameter
- d_{84}—84% of the sample is finer

Common grain-size classes follow a geometric scale based on powers of two. Grain-size distributions are typically plotted on cumulative curves, with grain size on the x-axis and "cumulative percent finer" on the y-axis. Calculating these grain-size classes from Wolman pebble count data requires finding the cumulative percentage of pebble counts in each class, then interpolating to find the 16th, 50th, and 84th percentiles. Table 7 shows how these counts were calculated for reach 1 data collected by DEQ for the review.

Table 7. Grain-size classes from Wolman pebble count for Jim Ford Creek.

Reach 1						
Size Class	Wetted Width		Calculations			
	Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size (millimeter)
Silt/clay	—	—	0	0.0	0.0	1
Sand	2	—	2	3.8	3.8	2.5
Very fine pebble	—	—	0	0.0	3.8	6
Pebble	2	—	2	3.8	7.7	16
Coarse pebble	1	1	2	3.8	11.5	32
Very coarse pebble	6	6	12	23.1	34.6	64
Small cobble	5	12	17	32.7	67.3	128
Large cobble	2	11	13	25.0	92.3	256
Small boulder	—	4	4	7.7	100.0	512
Medium boulder	—	—	0	0.0	100.0	1024
Large boulder	—	—	0	0.0	100.0	2048
	Totals		52	100		

The wetted width columns are the raw data from the Wolman pebble count. The sum and percentage of each size class was calculated, and the cumulative percentage for each size class was found (Table 8). These cumulative percentages are read as "3.8% of the sample is finer than 6 mm, 7.7% is finer than 16 mm, and 11.5% is finer than 32 mm." Next, the grain sizes and cumulative percentage were interpolated for the d_{16}, d_{50}, and d_{84} particle sizes as shown in Table 8.

Table 8. Sum and percentage of grain-size class, Wolman pebble count for Jim Ford Creek.

Interpolated Cumulative Percentage	Interpolated Grain Size
0	1
3.8	2.5
3.8	6
7.7	16
11.5	32
16.0	38.2
34.6	64
50.0	94.1
67.3	128
84.0	213.5
92.3	256
100	512
100	1024
100	2048

Plotting these grain-size data on a log base 2 scale results in an S-shaped curve for a well-distributed dataset for the reach 1 data as shown in Figure 4.

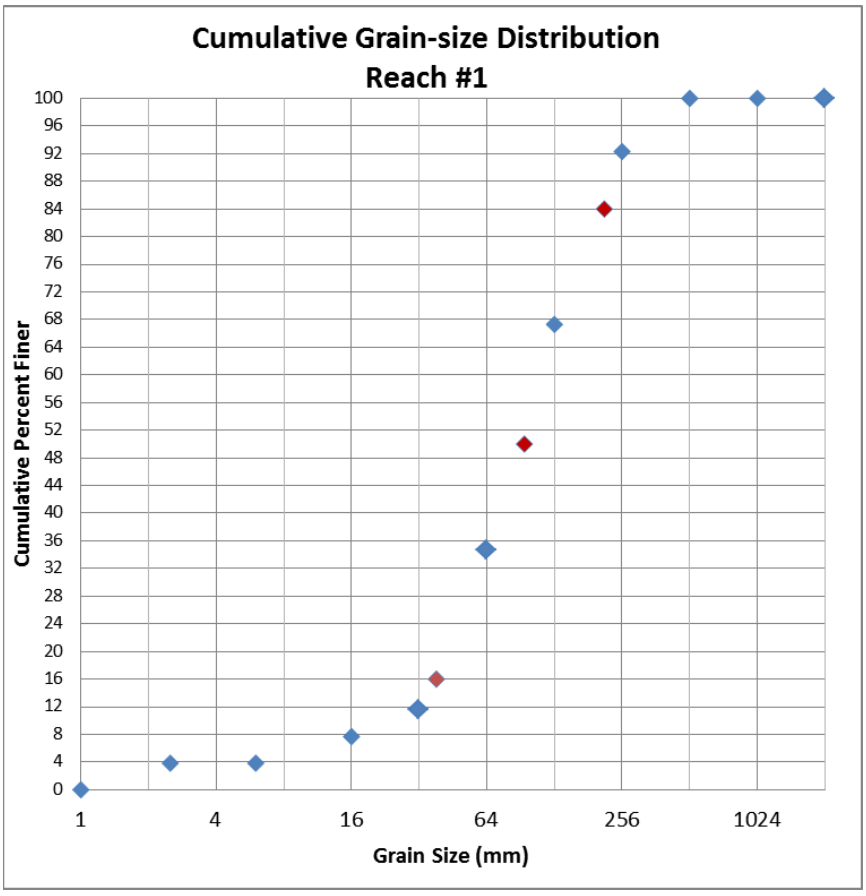


Figure 4. Cumulative grain-size distribution for reach 1.

2.2.3.4 Comparison of 1999 and 2016 Channel Geometry and Grain-Size Data

In summer 2016, DEQ field crews revisited 22 reaches to observe trends in channel geometry and sediment for the TMDL review. DEQ collected Wolman pebble count data and channel parameters such as bankfull width and depth and channel slope.

A comparison of the results from the original survey and the review is shown in Table 9. The calculations and cumulative grain-size distributions for the 2016 grain-size data are given in Appendix D.

Table 9. Comparison of channel geometry and grain-size data.

Reach	Type	1999 Channel Geometry and Grain-Size Data					2016 Channel Geometry and Grain-Size Data				
		Bankfull Width (ft)	Slope (%)	d_{16} (mm)	d_{50} (mm)	d_{84} (mm)	Bankfull Width (ft)	Slope (%)	d_{16} (mm)	d_{50} (mm)	d_{84} (mm)
R1	Transport	51	2	45	109	300	12	2	38	94	214
R2	Transport	34	2	39	109	300	15	2	19	80	208
R3	Transport	38	2	24	109	300	11	3	23	103	345
R4	Source	45	4	45	240	300	16	4	27	70	168
R5	Source	48	5	68	135	240	18	3	42	96	230
R6	Transport	37	2	55	109	300	18	1	39	72	110
R7	Transport	70	2	64	128	300	17	3	58	140	369
R8	Transport	45	3	19	54.5	135	13	3	41	90	181
R9	Transport	36	2	32	90	154	12	2	116	187	252
R10	Transport	45	2	32	90	300	20	1	43	79	164
R11	Response	48	1	32	64	109	19	3	61	122	236
R12	Source	38	3	27	195	1050	17	2	41	80	206
R13	Source	65	6	32	2000	10000	11	6	79	299	1565
R14	Response	63	1	16	45	214	27	1	45	89	187
R15	Response	45	2	17	64	135	16	2	28	61	117
R16	Response	70	2	27	64	90	14	2	50	126	357
R17	Response	128	1	32	109	154	11	3	30	88	180
R18	Transport	51	3	64	128	180	19	3	24	70	157
R19	Source	28	4	45	180	300	12	2	73	140	252
R20	Transport	35	2	39	128	218	19	2	60	151	307
R21	Source	36	4	68	214	300	9	6	91	189	1180
R22	Transport	33	3	77	240	300	12	3	47	104	210
	Average of transport reaches				118					106	
	Average of source reaches				494					146	
	Average of response reaches				69					97	

Notes feet (ft); millimeter (mm)

It is apparent from these data that the source, transport, and response reaches have become more stable. Reductions in median grain-size show that the excess coarse sediment bedload is moving out of the transport and source reaches. The median grain size in transport reaches has decreased

from 118 mm to 106 mm. The median grain-size in source reaches has decreased from 494 mm to 146 mm. Because bankfull width is reducing as banks restabilize, there is a concomitant reduction in the source of coarse sediment to fill in the reach. The median grain size in response reaches has increased from 69 mm to 97 mm, which is a consequence of the coarse particles moving from source and transport reaches to the response reaches. These median grain-size trends show the following percent changes:

- 10% transport reach reduction in grain size
- 70% source reach reduction in grain size
- 29% response reach increase in grain size

The original sediment TMDL set a 70% sediment load reduction that would be achieved by reducing the bedload transport rate—this target applies to transport reaches.

Trends of bankfull width, slope, and median grain size are evaluated according to transport, source, and response reaches in Table 10.

Table 10. Comparison of bankfull width and depth ratio.

Reach	Type	1999 Bankfull Width/ Depth Ratio	2016 Bankfull Width/ Depth Ratio
R1	Transport	62	58
R2	Transport	30	99
R3	Transport	29	46
R4	Source	38	62
R5	Source	61	44
R6	Transport	35	24
R7	Transport	106	19
R8	Transport	54	17
R9	Transport	32	18
R10	Transport	41	29
R11	Response	69	20
R12	Source	50	22
R13	Source	38	15
R14	Response	151	39
R15	Response	78	40
R16	Response	103	36
R17	Response	107	28
R18	Transport	51	48
R19	Source	20	16
R20	Transport	32	25
R21	Source	26	11
R22	Transport	27	15
Average of transport reaches		46	36
Average of source reaches		39	28
Average of response reaches		101	32

The sediment TMDL set a sediment target for response reaches to have less than a 40-foot width-to-depth ratio. This target has been achieved: the average width-to-depth ratio for the response reaches is now 32. The average width-to-depth ratio decreased 21% for transport reaches, 27% for source reaches, and 68% for response reaches.

One discrepancy between the 1999 and 2016 datasets is that Appendix D of the Jim Ford Creek TMDL (DEQ et al. 2000) documents ocular estimates of particle sizes for most reaches and performing random pebble counts to validate the ocular estimates. However, for the review, DEQ performed full pebble counts for each reach. The biggest weakness of the earlier ocular estimates was that the d_{84} particle size was often listed as ">300" or "<300," but the current data list actual particle sizes up to 2,048 mm.

Limitations include the following:

- Wolman pebble count is not an ideal method of evaluating fine sediment in spawning gravels. The preferred DEQ method looks at subsurface fine sediment through the McNeil sediment core (DEQ 2014b).

2.2.3.5 Sediment Analysis Conclusions

The 1999 sediment analysis concluded that by reducing the bedload transport rate, reducing the bankfull width-to-depth ratio, and increasing the residual pool volume, the targets would be achieved. The load reduction was as follows:

- The median particle diameter was 118 mm.
- A 70% reduction was required to reduce the existing load of 75 tons per day to the load capacity of 23 tons per day.

From 2016 data, the median particle diameter has only been reduced by 10% rather than the targeted 70% reduction; however, other targets for channel stability have been achieved. Trends toward finer particle sizes in source and transport reaches and larger particle sizes in the response reaches show that the entire stream is stabilizing. The sediment TMDL target to reduce bankfull width-to-depth ratio in the response reaches has been achieved. The average width-to-depth ratio decreased 61 feet for response reaches.

The 1999 sediment analysis assumed the following:

- Channel instability resulted from management.
- Channel widening and shallowing led to a loss of pools and pool volume, which would adversely affect salmonid spawning and coldwater biota.
- Improved stability would improve salmon rearing habitat.

Channel instability in 1999 may not have been due to management issues only. This channel widening was the likely source of excess coarse sediment from adjacent streambanks.

Because the sediment load capacity identifying a 70% reduction had been established using conservative values derived from theoretical thresholds and regional reference conditions, it may be that the TMDL goals have been met by achieving the other targets for channel stability. The residual pool volume target used a theoretical threshold approach. The bankfull width-to-depth target was established using regional reference conditions and conservative target values. The

load capacity had been established using an inferential link between measured channel stability, habitat conditions, and bedload transport rates. The linkage was supported by a qualitative conceptual model and a series of simplifying assumptions.

Forestry activity has been removed in the reach. In the 1999 sediment analysis, notes about mass wasting referenced recent clear-cuts and road cuts. However, in the 2016 field season, crews saw no evidence of mass wasting, clear-cuts, or adjacent roads. In fact, accessing each of the 22 reaches was difficult because no access roads were available, likely due to road closure over time. Roads crossed only reaches 1 and 22, and one bridge was between reach 14 and 15. All of the other reaches were accessed by hiking.

The TMDL review conclusions are listed below:

- Channel stability has been achieved.
- Potential sediment sources adjacent to the channel have been removed.
- Watershed improvement efforts should focus on the upper reaches of Jim Ford Creek, where adding riparian vegetation to increase shade will also stabilize streambanks.

3 Beneficial Use Status

Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing, designated, and presumed uses. The *Water Body Assessment Guidance* (Grafe et al. 2002) gives a detailed description of beneficial use identification for use assessment purposes.

Existing uses under the CWA are "those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards." Designated uses are specifically listed for Idaho water bodies in tables in Idaho's water quality standards (IDAPA 58.01.02.003.27 and .02.109–.02.160 in addition to citations for existing and presumed uses).

Undesignated uses are to be designated. In the interim, and absent information on existing uses, DEQ presumes that most waters in the state will support cold water aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01). To protect these so-called "presumed uses," DEQ will apply the numeric cold water aquatic life criteria and primary or secondary contact recreation criteria to undesignated waters.

3.1 Beneficial Uses

Table 11 lists the AUs and associated beneficial uses and use support.

Table 11. Beneficial uses of TMDL water bodies.

Assessment Unit Name	Assessment Unit Number	Beneficial Uses	Type of Use	Use Support
Jim Ford Creek—waterfall (12.5-miles upstream) to mouth	ID17060306CL034_04	CW, PCR, SS	Designated, Existing	NFS (CW,SS) FS (PCR)
Heywood, Wilson Creeks and tributaries	ID17060306CL035_02	CW, PCR	Designated	NFS
Jim Ford Creek—source to Jim Ford Creek waterfall (12.5 miles)	ID17060306CL035_03	CW, PCR	Designated	NFS
Jim Ford Creek—source to Jim Ford Creek waterfall	ID17060306CL035_04	CW, PCR	Designated	NFS
Grasshopper Creek—source to mouth	ID17060306CL036_02	CW, PCR, DWS	Designated	NFS
Grasshopper Creek—source to mouth	ID17060306CL036_03	CW, PCR	Designated	NFS
Winter Creek	ID17060306CL037_02	CW, SCR	Presumed	NFS
Winter Creek—waterfall (3.4-miles upstream) to mouth	ID17060306CL037_03	CW, SCR	Presumed	NFS (CW) FS (SCR)
Winter Creek—source to Winter Creek waterfall	ID17060306CL038_02	CW, SCR	Presumed	NFS

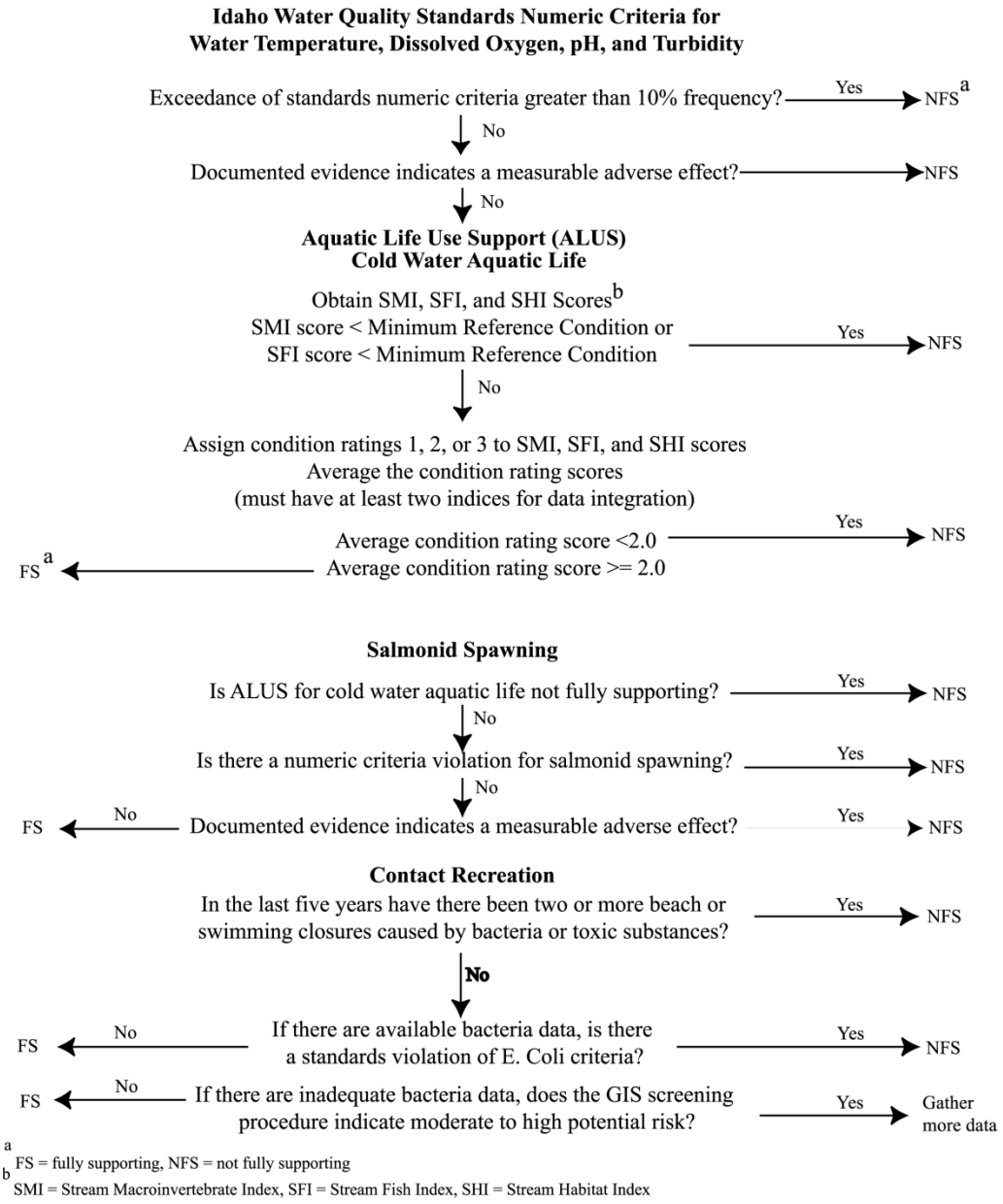
Notes: cold water aquatic life (CW); primary contact recreation (PCR); secondary contact recreation (SCR); domestic water supply (DWS); salmonid spawning (SS); fully supporting (FS); not fully supporting (NFS)

Beneficial uses are protected by a set of criteria, which include *narrative* criteria for pollutants such as sediment and nutrients and *numeric* criteria for pollutants such as bacteria, dissolved oxygen, pH, ammonia, temperature, and turbidity (IDAPA 58.01.02.250). Table 12 includes numeric criteria used in TMDLs; Figure 5 provides the stream assessment process for determining support status of the beneficial uses of cold water aquatic life, salmonid spawning, and contact recreation.

Table 12. Selected numeric criteria supportive of designated beneficial uses in Idaho water quality standards.

Parameter	Primary Contact Recreation	Secondary Contact Recreation	Cold Water Aquatic Life	Salmonid Spawning[a]
Water Quality Standards: IDAPA 58.01.02.250–251				
Bacteria				
Geometric mean	<126 *E. coli*/100 mL[b]	<126 *E. coli*/100 mL	—	—
Single sample	≤406 *E. coli*/100 mL	≤576 *E. coli*/100 mL	—	—
pH	—	—	Between 6.5 and 9.0	Between 6.5 and 9.5
Dissolved oxygen (DO)	—	—	DO exceeds 6.0 milligrams/liter (mg/L)	**Water Column DO**: DO exceeds 6.0 mg/L in water column or 90% saturation, whichever is greater **Intergravel DO**: DO exceeds 5.0 mg/L for a 1-day minimum and exceeds 6.0 mg/L for a 7-day average
Temperature[c]	—	—	22 °C or less daily maximum; 19 °C or less daily average **Seasonal Cold Water**: Between summer solstice and autumn equinox: 26 °C or less daily maximum; 23 °C or less daily average	13 °C or less daily maximum; 9 °C or less daily average **Bull Trout**: Not to exceed 13 °C maximum weekly maximum temperature over warmest 7-day period, June–August; not to exceed 9 °C daily average in September and October
Turbidity	—	—	Turbidity shall not exceed background by more than 50 nephelometric turbidity units (NTU) instantaneously or more than 25 NTU for more than 10 consecutive days.	—
Ammonia	—	—	Ammonia not to exceed calculated concentration based on pH and temperature.	—
EPA Bull Trout Temperature Criteria: Water Quality Standards for Idaho, 40 CFR Part 131				
Temperature	—	—	—	7-day moving average of 10 °C or less maximum daily temperature for June–September

[a] During spawning and incubation periods for inhabiting species
[b] *Escherichia coli* per 100 milliliters
[c] Temperature exemption: Exceeding the temperature criteria will not be considered a water quality standard violation when the air temperature exceeds the ninetieth percentile of the 7-day average daily maximum air temperature calculated in yearly series over the historic record measured at the nearest weather reporting station.



a FS = fully supporting, NFS = not fully supporting

b SMI = Stream Macroinvertebrate Index, SFI = Stream Fish Index, SHI = Stream Habitat Index

Figure 5. Determination steps and criteria for determining support status of beneficial uses in wadeable streams (Grafe et al. 2002).

3.2 Summary and Analysis of Current Water Quality Data

The data listed in section 2.2 were collected for this review. Table 13 provides the BURP data related to the cold water aquatic beneficial use support that were collected for this review.

Table 13. Beneficial Use Reconnaissance Program data for the Jim Ford Creek watershed.

Assessment Unit Name	Assessment Unit Number	SMI	SFI	SHI	Average	Current Integrated Report Category
Jim Ford Creek—waterfall (12.5-miles upstream) to mouth	ID17060306CL034_04	2	1	3	2	4a, 4c
Heywood, Wilson Creeks and tributaries	ID17060306CL035_02	1/0	NA/0	1/1	1/0	4a, 4c
Jim Ford Creek—source to Jim Ford Creek waterfall (12.5 miles)	ID17060306CL035_03	0	0	1	0	4a, 4c
Jim Ford Creek—source to Jim Ford Creek waterfall	ID17060306CL035_04	0	0	2	0	4a, 4c
Grasshopper Creek— source to mouth	ID17060306CL036_02	NA	NA	NA	NA	4a, 4c
Grasshopper Creek— source to mouth	ID17060306CL036_03	0	0	1	0	4a, 4c
Winter Creek—Winter Creek waterfall (3.4-miles upstream)	ID17060306CL037_02	1	NA	1	1	3[a]
Winter Creek—waterfall (3.4-miles upstream) to mouth	ID17060306CL037_03	1	0	3	0	4a, 4c
Winter Creek—source to Winter Creek waterfall	ID17060306CL038_02	NA	NA	NA	NA	4a, 4c

a. This assessment unit was listed as unassessed in error when assessment units were delineated. DEQ recommends moving this assessment unit to Category 4a.
Notes: Stream macroinvertebrate index (SMI); stream fish index (SFI); stream habitat index (SHI); not assessed (NA)

4 Review of Implementation Plan and Activities

The Jim Ford Creek TMDL was approved by EPA in May 2000. The revised *Jim Ford Creek TMDL Ag Implementation Plan* (Clearwater SWCD 2014) addresses load capacities for pollutants in Jim Ford Creek and the necessary best management practices (BMPs) needed to meet those load reductions. This section discussed the targets, load analyses, and load allocations as well as implementation efforts by the Clearwater Soil and Water Conservation District (Clearwater SWCD), agency partners, and local landowners to meet the goals of the TMDL since 2000.

4.1 Background

Jim Ford Creek is a 3rd-order tributary of the Clearwater River in the southern part of Clearwater County, Idaho. The creek flows 20 miles northwest from an elevation of 4,068 feet to 1,050 feet at its confluence with the Clearwater River near Orofino, Idaho. It drains a 65,838-acre watershed that has two distinct land types. In the upper segment, Jim Ford Creek flows through

rolling forested uplands and through the Weippe Prairie until it reaches the city of Weippe. Below Weippe, the creek enters into a narrow steep basalt canyon nearly 14 miles long. A 65-foot waterfall at the top of the canyon restricts fish passage upstream. Primary land uses in the watershed consist of timber production, grazing, recreation, dryland agriculture, and a small urban area in Weippe. In the lower segment of the watershed, a small hydropower facility is located along the creek 2 miles downstream from Weippe. The majority of the watershed projects implemented since 2000 were focused on riparian areas in the forested uplands and Weippe Prairie.

4.2 Pollutants of Concern

The pollutants of concern identified in the Jim Ford Creek TMDL were pathogens (bacteria), excess nutrients, coarse sediment, and temperature. An in depth discussion about the limiting factors and the pollutants of concern is found in the Jim Ford Creek TMDL (DEQ et al. 2000).

4.3 Summary of Past and Present Pollution Control Efforts

Watershed projects implemented since 2000 included partnerships with the Idaho Department of Lands (IDL), Clearwater Highway District (CHD), Potlatch Corporation, Nez Perce Tribe, Idaho Department of Fish and Game (IDFG), and private landowners. The Clearwater SWCD has sponsored the majority of funding through the EPA §319 Clean Water Grant, Idaho State Agriculture Water Quality Program, and Idaho Water Quality Program for Agriculture (WQPA).

Federal program funding was provided and administered by the Natural Resources Conservation Service (NRCS) and Farm Service Agency for programs consisting of the Environmental Quality Incentive Program (EQIP), Conservation Reserve Program, and Continuous Conservation Reserve Program.

In 2000, the Clearwater SWCD received $275,000 from the Idaho Soil and Water Conservation Commission (ISWCC) for the WQPA as part of the Jim Ford Creek Watershed Enhancement Project. In 2001 the Clearwater SWCD received $400,000 from the EPA §319 Clean Water Grant to supplement work that was accomplished through the Jim Ford Creek Watershed Enhancement Project. These funds were dispersed over a 5-year period from 2000 to 2005 between the two funding sources and assisted by the strong partnerships of the agencies listed in section 4.4, Table 14 (Clearwater SWCD 2014)

To aid in developing the Jim Ford Creek implementation plan, the WAG helped develop a Watershed Restoration Strategy (WRS) to ensure reasonable progress toward attaining water quality standards through watershed improvement projects, restoration activities, and management practices. The WRS provided the framework for the implementation plan and focused on riparian restoration.

Figure 6 illustrates an example of the WRS for riparian restoration and the feedback process.

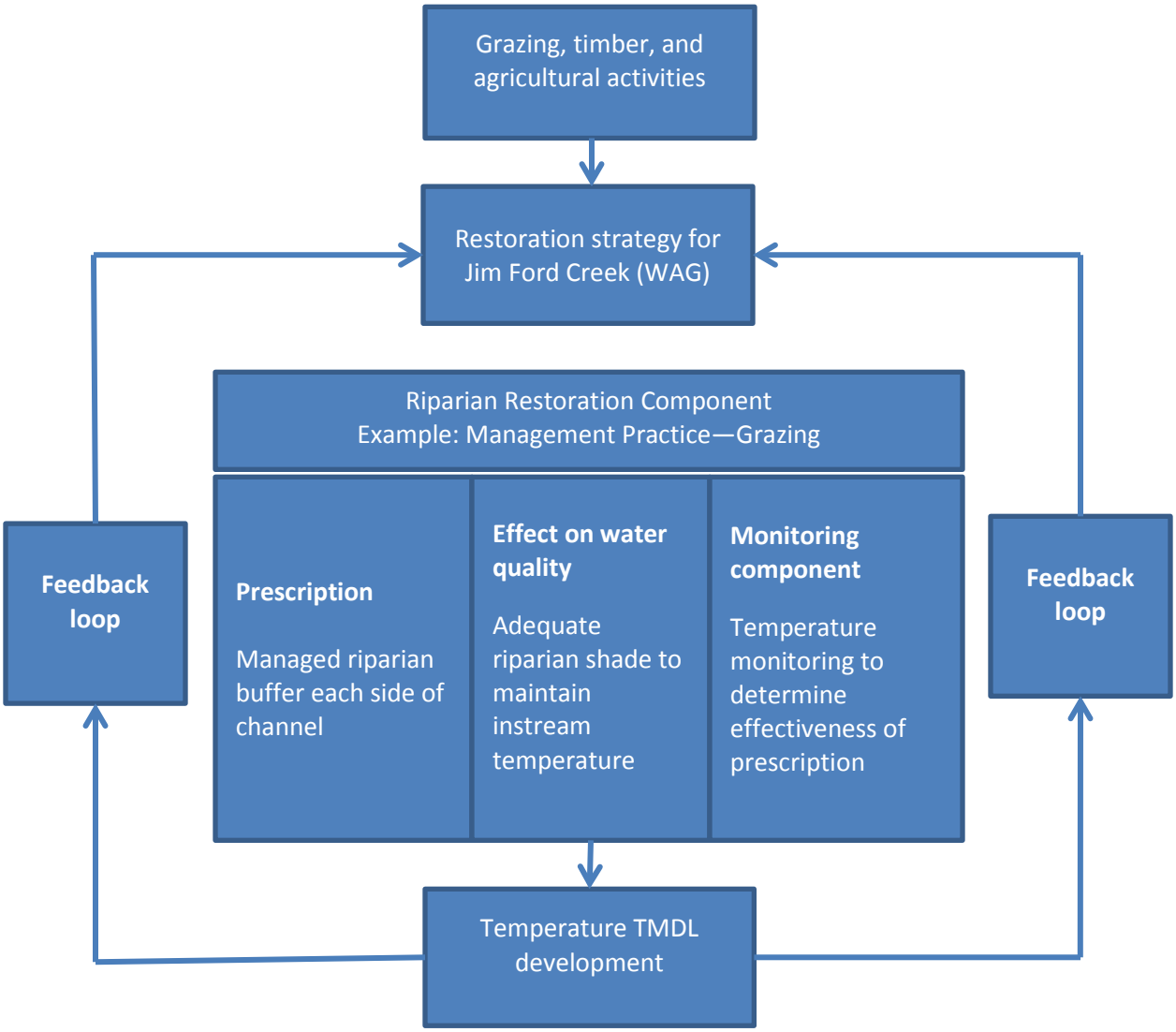


Figure 6. Riparian restoration strategy and feedback process.

The WRS focused on reducing sediment, temperature, nutrients, and bacteria. BMPs included in the WRS were prescribed grazing, nutrient management, alternate livestock water supplies, ponds, livestock exclusions, riparian buffers, tree and shrub planting, riparian fencing, streambank stabilization, conservation cropping, tillage practices and wetland enhancements.

The effects of some BMPs such as riparian plantings, bank stabilization, and thermal load reduction may take years to be fully realized. Although specific targets and allocations were identified in the TMDL, the ultimate success of the TMDL is not whether the specific targets and allocations were met, but whether beneficial uses and water quality standards were achieved.

4.4 Natural Resource Partnerships

Since 2000, pollution control efforts within the Jim Ford Creek watershed have been examined according to land use and activities, which are divided between point and nonpoint sources. Table 14 lists the designated management agencies, natural resource responsibility represented, and type of involvement.

Table 14. Natural resource partnerships.

Designated Management Agency	Resource Responsibility	Type of Involvement (regulatory, funding, and assistance)
Idaho Soil and Water Conservation Commission	Agriculture, grazing, forestry, roads, and wetlands	Funding and technical and administrative assistance
Clearwater Soil and Water Conservation District	Agriculture, grazing, forestry, roads, and wetlands	Funding and technical and administrative assistance
Idaho Department of Lands	Grazing, forestry, and roads	Regulatory, matching funds, and technical oversight
Potlatch Corporation	Grazing, forestry, and roads	Matching funds and technical oversight
Clearwater Highway District	Roads	Matching funds and technical oversight
Private Landowners	Agriculture, grazing, and forestry	Matching funds
Idaho Fish and Game	Wetlands	Matching funds and technical oversight
Natural Resource Conservation Service	Agriculture	Matching funds and technical oversight

4.5 Restoration Activities

Funding from the WQPA focused on agricultural practices within the Weippe Prairie and surrounding uplands. In many instances, the NRCS used their EQIP program funding to compliment the WQPA BMPs implemented among the private landowners in the watershed. Between 2000 and 2005, the Clearwater SWCD worked with landowners and installed BMPs to address nonpoint source pollution impacting water quality in Jim Ford Creek, primarily high instream temperatures and excessive nutrients and bacteria.

Dove-tailing into the WQPA and EQIP practices were projects funded by the EPA §319 Clean Water Grant. A compilation of program funding for BMPs installed and projects completed over 5 years is provided below.

Water Quality Program for Agriculture (2000–2005)

The Clearwater SWCD had a total of 15 contracts with private landowners that treated over 2,350 acres. Of the BMPs installed, 19 were management practices and 53 were structural practices. Most of the practices were installed through landowner contracts between the Clearwater SWCD and the landowner. In some instances, NRCS had supplemental contracts with the same landowner for other practices relating to agriculture, pasture and hay land, and forestry. All practices were installed in numerous tributaries to Jim Ford Creek including Grasshopper, Heywood, Miles, and Wilson Creeks.

The Clearwater SWCD and NRCS worked together to address the natural resource concerns of the watershed and toward the goals of improving the overall water quality and habitat of the tributaries to Jim Ford Creek and main stem Jim Ford Creek (Clearwater SWCD 2014).

Natural Resource Concerns and Goals

Beneficial uses in Jim Ford Creek and its tributaries were impaired for coldwater biota, salmonid spawning, and contact recreation.

Resource concerns focused in the watershed consisted of the following:

- Habitat quality—streambank erosion and degradation
- Surface water quality—nutrients (mainly phosphorous), bacteria (primarily fecal coliform and *E. coli*), sedimentation (limiting the salmonid spawning), and water temperature extremes (limiting coldwater biota and salmonid spawning)

Goals Associated with the Natural Resource Concerns

1. To control erosion and trap sediment with crop residue management, permanent vegetative plantings, and maintenance of the stream buffers and filter areas. Turbidity goals were not to exceed background by more than 50 nephelometric turbidity units (NTU) instantaneously or 25 NTU for more than 10 consecutive days.
2. Lower or modify water temperature and stream recharge by improving upland vegetative cover in the watershed, improving infiltration rates of soil water, providing multilayer shading along stream buffers, water spreading in meadows, constructing wetlands, and other ways to flatten the stream hydrograph. Coldwater biota maximum daily temperatures should not exceed 22 °C (72°F) at any one time. For salmonid spawning, the daily average temperatures should not exceed 9 °C (48°F) as a daily average or 13 °C (55°F) as the daily maximum. These daily averages applied to steelhead from February 1 to July 15, spring Chinook Salmon from August 1 to April 1, and fall Chinook Salmon from August 15 to June 15.
3. Apply comprehensive nutrient management plans with landowners and remove nutrients through controlled harvesting or grazing. Surface waters were to be free from excess nutrients that could cause visible slime growth or other nuisance aquatic growths impairing designated beneficial uses.
4. Reduce bacteria in surface water by eliminating direct discharges from sources, constructing wetlands, improving filter areas and buffers, and better distributing livestock.

The NRCS staff worked with the landowners in the Jim Ford Creek watershed to install the following BMPs:

- Stream buffers and filter strips—134 acres
- Prescribed grazing—8,172 acres
- Comprehensive nutrient management plans—10,910 acres
- Crop residue management—3,716 acres
- Fence—24,844 feet

These practices complimented the efforts the Clearwater SWCD implemented through the WQPA. The Clearwater SWCD, using state WQPA funds, worked with the landowners in the

Jim Ford Creek watershed to install the following NRCS-approved agricultural practices from 2000 to 2005:

- Access roads—56 feet
- Fence—40,381 feet
- Grade stabilization structures—10 each
- Heavy use area protection—17 each
- Pasture and hay land planting—240.3 acres
- Pipeline—1,996 feet
- Pond—5 each
- Pumping plant for water control—2 each
- Riparian forest buffer (riparian plantings)—8,780 each
- Roof runoff structure—2 each
- Spring development—2 each
- Stream channel stabilization—62 feet
- Subsurface drain—4,700 feet
- Tree/shrub establishment—1,875 each
- Waste management system upgrades (animal feeding operation [AFO])—2 each
- Waste storage facility—3 each
- Watering facility—9 each
- Wetland restoration/enhancement—12 acres

Monitoring activities specifically related to the riparian restoration tasks targeted in the implementation plan were conducted through joint efforts between the Clearwater SWCD, ISWCC, Nez Perce Tribe, Idaho Association of Soil Conservation Districts (IASCD), and DEQ (Appendix C).

The NRCS field staff has their own protocols for follow-up field evaluations on their installation of management and structural practices (Clearwater SWCD 2000).

Jim Ford Creek Watershed Enhancement Project (2001–2002)

The Clearwater SWCD received funding through the EPA §319 Clean Water Grant to implement the WQPA on Jim Ford Creek. The §319 grant funds furthered the work in the Jim Ford Creek watershed to address nonpoint source pollution and improve water quality. The Jim Ford Creek Watershed Enhancement Project consisted of four major subprojects partnering with IDL, CHD, IDFG, Potlatch Corporation, and private landowners.

Subproject 1 (Idaho Department of Lands)

IDL implemented three projects on state endowment land in the Jim Ford Creek watershed that were consistent with those BMPs identified in the WRS developed for Jim Ford Creek as part of the TMDL implementation plan. These practices focused primarily on riparian areas in the upper portion of the watershed and targeted nonpoint source pollution conditions detrimental to water quality identified in the Jim Ford Creek TMDL. Those conditions included high instream temperatures and excessive nutrients and bacteria.

The three projects were located on Miles Creek (tributary to Jim Ford Creek), Wilson Creek (tributary to Miles Creek), and Space Creek (tributary to Grasshopper Creek). All three of these projects were completed between 2000 and 2002.

Miles Creek Project—The project area contained natural meadows along Miles Creek that have historically been grazed by livestock. IDL leases grazing rights to a local cattlemen's association that was responsible for livestock management and control and fence maintenance. The association had been active in helping IDL develop a pasture system of fences to protect water quality and tree plantings in the area. However, it is difficult to keep livestock out of the meadows and streams, which are primary sources of both forage and water.

This project rehabilitated 3.64 miles of stream reach by constructing livestock exclusion fences, planting a riparian zone with woody plants and trees, reestablishing nonfunctional portions of the stream, replacing outdated and undersized culverts to meet 50-year flood events, and raising and rocking a section of road where it is close to and crosses Miles Creek. Two cattle guards were also installed on the main Winter Creek Road.

In places, the existing state gravel road has been impeding stream flow due to improperly sized culverts, as well as a source of sediment when the creek exceeded its banks at high flow. Water backed up behind a portion of the road during snowmelt in the spring, inundating the meadow and becoming a source of nutrients and bacteria into Miles Creek. Multiple culverts were installed at five locations to allow a natural drainage pattern. The road was raised in places to allow for larger culverts to fit properly in the road system.

The following is a composite of work completed:

- Installed road rocking and culvert.
- Completed 3.64 miles of riparian fence construction.
- Planted 9,200 willow cuttings.
- Planted 3,300 lodgepole pine seedlings.
- Planted 1,100 dogwood seedlings.
- Planted 2,500 hawthorn seedlings.
- Planted 100 alders, 100 cottonwoods, and 200 spirea.
- Completed one-quarter mile of stream rehabilitation and realignment.

Wilson Creek Project—This project rehabilitated 1.5 miles of stream reach by planting a riparian zone with woody plants, and the surrounding meadows with conifer trees. IDL leases grazing rights to the same cattlemen's association as in Miles Creek. The riparian plantings served as both a source of shade to cool the stream and a filtration zone for nutrients and bacteria. The willow and other brush plantings along with the conifers were planted within a 16-acre area of adjacent meadows along Wilson Creek. No livestock exclusion fences were necessary along Wilson Creek after the cattlemen's association constructed a pasture division fence that provided for total livestock exclusion since 2000.

Space Creek Project—The Space Creek project was similar to the Miles and Wilson Creeks projects in scope; 1.18 miles of riparian fence was built on a 25-foot setback on either side of Space Creek. The riparian zone was planted with woody plants and conifer trees and two rocked water gaps for livestock watering were installed.

Monitoring of all the component practices that were installed on all three projects was jointly accomplished by the IDL staff and the grazing allotment leaseholder. The leaseholder monitored and maintained the entire riparian fence that had been installed. The IDL field staff monitored all of the riparian plantings for survival and heartiness. Nutrients, pathogens, and temperature monitoring were completed by the IASCD monitoring staff during the 2003 and 2004 field seasons (IASCD 2005). These data are discussed in Appendix C.

Subproject 2 (Potlatch Corporation)

The Potlatch Corporation completed two projects on Potlatch-owned land in the Jim Ford Creek watershed in 2002. Like the projects implemented by IDL above, these projects addressed nonpoint source pollution associated with grazing issues and excessive nutrients, bacteria, and temperature near Winter Creek and sediment transport issues and potential mass slope failure on a section of steep gradient on Green Road connecting to Jim Ford Creek.

Winter Creek Project—This project improved 6 miles of riparian zone adjacent to Winter Creek. All grazing was permanently eliminated in the Winter Creek watershed. The overall stream health and water quality has improved with natural vegetation regeneration, improved and stabilized stream banks, and the reduction in sediment and nutrients entering Winter and Jim Ford Creeks.

The following BMPs have been completed on this project:

- Built 6 miles of riparian fence (Figure 7)
- Relocated and built new livestock corrals (Figure 8)
- Installed 2 new cattle guards on Winter Creek Road
- Built an off-site livestock watering pond
- Planted 3,000 pine seedlings along Winter Creek



Figure 7. Riparian fencing.

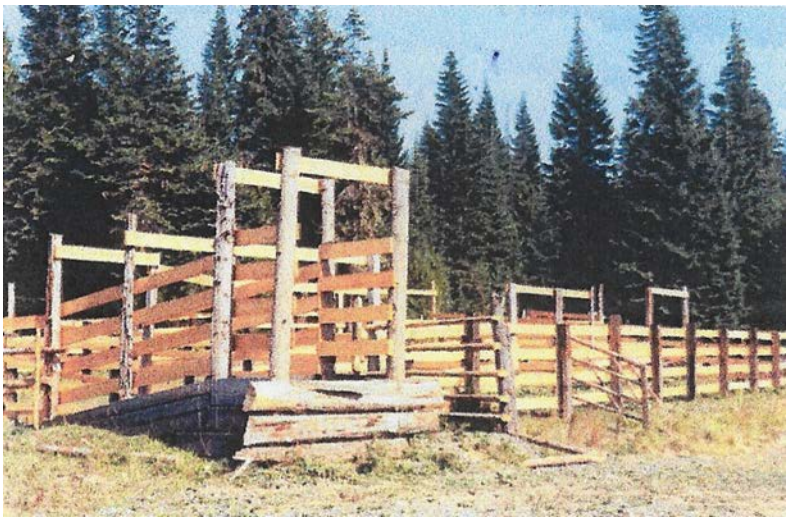


Figure 8. Bennett Creek Grazing Association—new corral and loading chute.

Green Road Project—An existing road (Green Road) on Potlatch Corporation property, purchased from the United States Forest Service in the mid-1990s had a mass failure on a steep section of road approximately 100 feet wide and 800 feet long reaching to Jim Ford Creek.

The Jim Ford Creek TMDL (DEQ et al. 2000) noted problems with sediment and large cobble filling pools and moving the channel in the lower reach of Jim Ford Creek.

The Green Road Project stabilized and repaired the slope failure using gabion baskets and rock, installed 240 feet of 18-inch steel culverts in key locations for proper drainage, and rocked one-half mile of road down to Jim Ford Creek to prevent further sediment delivery to the lower reach of Jim Ford Creek.

Work completed on that project consisted of the following:

- Installed 240 feet of 18-inch culvert
- Applied 640 cubic yards (yd^3) of crushed aggregate to road surface
- Reshaped portions of problem road area

Monitoring of all the component practices that were installed on both projects was accomplished by Potlatch Corporation staff and the Bennett Creek grazing allotment leaseholder. The leaseholder monitored and maintained the entire riparian fence that had been installed. The riparian plantings were monitored for survival and heartiness by the Potlatch Corporation forestry staff. A private consultant provided photo point documentation. The Potlatch Corporation forestry staff monitored any changes in sediment transport off the Green Road due to adverse overland flow conditions.

Subproject 3 (Clearwater Highway District)

Each year precipitation from winter snowmelt, spring thaws, and localized thunderstorms cause serious runoff problems. The soil type resists water entry, resulting in a flashy, concentrated runoff that causes water over roadways, gully washing, bank erosion, and increased turbidity in the streams.

As a program for runoff control, the CHD has maintained an aggressive process of rock lining most of their drainage ditches (to slow the water down for better water infiltration), replacing outdated and undersized culverts, and seeding steep cut banks. Those BMPs have been very effective in targeting adverse road conditions and water conveyance by reducing flows and sediment transport detrimental to water quality as identified in the Jim Ford Creek TMDL. Most of the BMPs are associated with each of the previously mentioned road projects.

The following BMPs were installed between 2000 and 2002 (Figure 9 and Figure 10):

Wilson Road

- 168 yd^3 of pit run rock (ditch armoring)
- 144 yd^3 of 5/8-inch gravel (road surfacing)
- 45 feet of 4 x 5-foot steel culvert
- 30 feet of 18-inch steel culvert

Chapman Road

- 36 yd^3 of 5/8-inch gravel (road surfacing)
- Two 15-inch x 32-foot culverts replaced
- 12 yd^3 of rock riprap (culvert splash pad)



Figure 9. Newly installed culvert.

The CHD road crews performed regular visual monitoring of the culverts and road system for sustainability and effectiveness. All culverts, road ditches, and sediment traps were monitored for flow characteristics directly proportional to runoff events. Appropriate maintenance was carried out as necessary.



Figure 10. Streambank stabilization (rock riprap).

Subproject 4 (Private Landowners)

In keeping with the aggressive riparian restoration strategies laid out in the Jim Ford Creek TMDL implementation plan, the Clearwater SWCD realized the need to focus on other possible sources of nutrient and bacteria loads in the watershed. The AFO sites were negatively influencing the water quality of various tributaries to Jim Ford Creek. Two of the projects focused on feedlot restoration with the third project focusing on wetland restoration and enhancement.

Feedlot Restoration 1 (AFO)—The first feedlot restoration site was located in the Heywood Creek drainage and supported a 120 cow-calf livestock operation. This operation lacked the infrastructure to properly house and feed the number of animals on the site (Figure 11). The Clearwater SWCD worked with the landowner to design and construct a complete AFO facility that included the following:

- 6,000-square foot (ft^2) covered manure stacking pad and loafing area with a stanchion system for feeding
- 200 feet of pipeline
- 650-feet of corral fence
- 380-feet of gutter system
- 1 water trough system

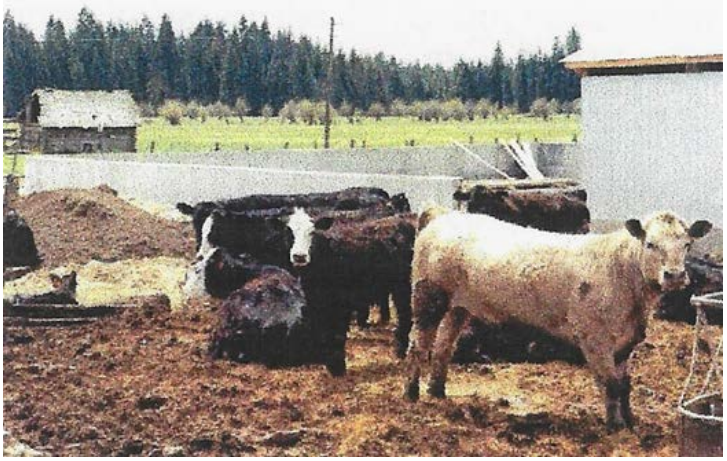


Figure 11. Feedlot condition before project.

For this AFO facility, two buildings were constructed with sidewalls to properly manage the feeding and manure storage for the 120 cow-calf livestock operation (Figure 12). A fence was constructed and a corral system within the feedlot complex was created to effectively manage the rotation and movement of the animals to reduce the impact of soil distribution and potential water quality problems. A pipeline was installed to convey water from the supply source. A roof runoff system was constructed by using a series of bermed and fenced ditches from the buildings to collect and transfer all clean, uncontaminated roof runoff at the feedlot site to a suitable outlet offsite. The ditches consisted of 6-inch perforated drain tile, covered with filter cloth and drain rock. The ditches were also fenced on both sides to exclude livestock access.

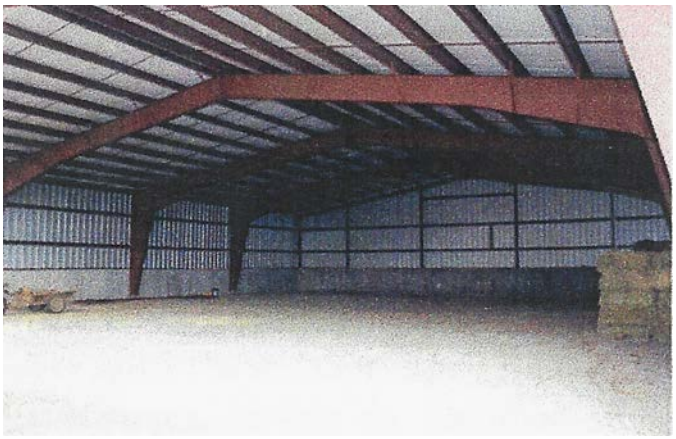


Figure 12. Feedlot project under construction.

Follow-up monitoring was performed at the mouth of Heywood Creek by IASCD and DEQ as part of an overall monitoring plan. This feedlot operation was maintained and managed for the life of the contract to effectively manage feeding and proper disposal of all solid waste. The operation was also managed to ensure that Heywood Creek's water quality will not be compromised from animal waste leaving the site.

Feedlot Restoration 2 (AFO)—The second feedlot restoration site was located in the Grasshopper Creek drainage and supported a 60 cow-calf livestock operation. This project, half the size of restoration 1, mirrored the BMPs that were implemented. The only added practice was

two grade stabilization structures that were installed to capture and divert upland runoff from entering the corral complex.

BMPs installed on this livestock restoration site included a 3,852 ft^2 covered manure stacking pad/loafing area, with a stanchion system for feeding, pipeline for watering livestock, a gutter system and drain for roof runoff water conveyance, and two grade stabilization structures to capture upland runoff and divert it away from the corral system (Figure 13).

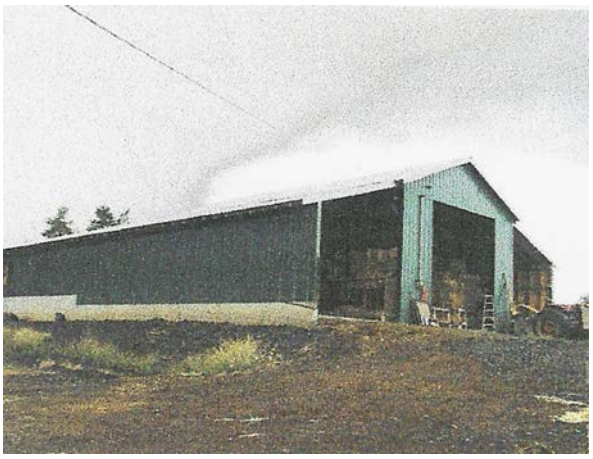


Figure 13. Barn complex after feedlot restoration project.

Chapman Road Wetland Restoration—The Weippe Prairie historically consisted of wetland complexes, serving an important stop for migratory waterfowl and home for numerous wetland associated wildlife species. Over time, agricultural development drained and diminished wetland acres. Due to the elevation and flatness of the prairie today, many areas remain inundated with water most of the spring, which makes it difficult to maintain agricultural practices (Figure 14).

The Chapman Road wetland restoration is the last of the private landowner projects in the Weippe Prairie installed between 2000 and 2002. The 25-acre Chapman Wetland was completed in fall 2002 with help from landowners, IDFG, ISWCC, Clearwater SWCD, and NRCS. A 30-year contract was signed by the landowners and associated agencies to enhance and manage this wetland for years to come.

Construction consisted of numerous deep and shallow water complexes ranging from marshy areas less than 1-foot deep to areas exceeding 8 feet. For the safety of adjacent landowner property and to control the volume of stored water in the complex, open-ended berms, culverts, and a water control structure were incorporated.

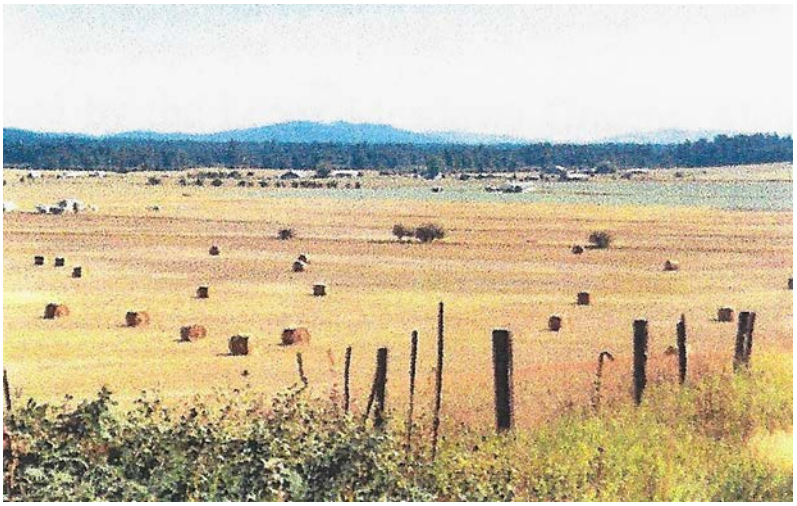


Figure 14. Beginning stage of wetland restoration.

The goal of the wetland project was to enhance, restore, protect, manage, and maintain the functional values of the wetland thereby conserving natural resource values including fish and wildlife habitat, water quality improvement, aesthetic values, and environmental education (Figure 15). IDFG secured additional funding from the United States Fish and Wildlife Service to further develop the wetland. Funding included procuring wetland vegetative plantings of trees, shrubs, sedges, and rushes. The additional funding package included dollars for an interpretive center/viewing station (built in 2003), and a maintenance budget. This 25-acre wetland has been the site for wetland training classes for high school students each year since it was built.

The major landowner, Mr. Chapman, purchased an additional 140-acre parcel of land across the road from this wetland and enrolled 100 acres into an NRCS-sponsored federal Wetland Reserve Program for the life of that property (Clearwater SWCD 2003).



Figure 15. Completed Chapman Road wetland.

4.6 Empire Lumber Company—Enhancements in Stormwater Planning and Management

The Empire Lumber Weippe Operations mill was covered by the EPA National Pollutant Discharge Elimination System Multisector General Permit (MSGP), including all inspection, monitoring, and reporting requirements. The operation is covered under the new MSGP 2015 permit and an updated stormwater pollution prevention plan (SWPPP), and is taking the four consecutive quarters of stormwater samples for the required lab analysis. No MSGP stormwater sample has exceeded the MSGP benchmark standards since Empire Lumber took over facility ownership. EPA inspectors have been onsite, and verified compliance with all applicable permit requirements. The following lists enhancements made since the Jim Ford Creek TMDL was written in 2000—most occurred after Empire Lumber purchased the facility in 2005.

Stormwater management improvement enhancements initiated by Empire Lumber include the following:

- Installed a drain and pipe system (designed by Reidesel Engineering) to drain all facility log yards and much of the rest of the facility. This effort minimized runoff from the disturbed surface areas on the facility, instead routing that potentially sediment-laden runoff, including log irrigation runoff, into a settling pond on the southwest end of the property.
- Extensive rocking and gravelling of the log yards and areas with disturbed surface. This effort made the log yards more accessible year round, minimized track out of sediment by mobile equipment, and cut down on erosion by significantly improving infiltration.
- Established a protocol in the facility SWPPP to monitor water levels in the southwest corner settling pond and used pumps to prevent overflow into the Weippe storm drain system, instead routing any excess water down a south-central draw through 200 yards of healthy vegetation including some riparian vegetation and a settling pond before reaching the lone facility outfall. This effort ensured that potentially sediment-laden water (which also includes contributions from offsite areas to the facility's north and east) overflows would be absorbed in that typically dry draw or filtered by vegetation before reaching the outfall.
- Reclaimed a large percentage of wood and yard debris previously piled on the south side of the property north of the facility outfall. This effort minimized a potential source of leachates above the facility outfall.
- Established a system of culverts, contouring, rock surfacing, and revegetation to minimize impacts of facility activities on waterways through the property to minimize impacts to surface water and outflows.
- Added a 27-acre parcel on the north side, across Pleasant Acres Road. This area drains mostly into itself or the historical mill property and is mostly grass surfaced with limited surface disturbances. It has provided more options for storage or future activities in areas where runoff can be practically managed.
- Rebuilt the large log mill in 2009 to be maximally efficient with near 100% containment of hazardous materials and potential stormwater hazards. At the same time, containment at the historic log mill was significantly enhanced. These efforts minimized exposure of potential pollutants to stormwater, cut down on wood by-product volume, and enhanced handling of those by-products to minimize stormwater exposure.

- The facility is installing an impervious surface pad around the shop and equipment parking area draining into an oil/water separator, with the runoff then routed to the southwest side settling pond. This effort will capture most or all potential pollutants from the shop, equipment maintenance, and equipment storage area, keeping those potential pollutants from reaching storm or ground water.
- Generally, operational facility managers are fully aware of environmental regulations and considerations and have expert help onsite regularly and available for support as needed. This effort has resulted in establishing management and housekeeping policies that ensure compliance with applicable environmental regulations and being ecologically good neighbors.

5 Summary of TMDL Review

Using the pollutant targets established in the Jim Ford Creek TMDL existing pollutant loads in listed streams are generally improving. Bacteria in the lowest AU included in the Jim Ford Creek TMDL (AU ID17060306CL034_04) were listed in error, and the AU has continued to meet the standard for contact recreation beneficial use. Bacteria sampling at eight other monitoring points established in the TMDL showed that one site needs a load reduction of 0% during both spring and fall sampling and seven sites need load reductions ranging from 1% to 68% during the spring or fall sampling periods (Table 2). Nutrient sampling at nine monitoring points established in the TMDL showed eight sites need 0% load reductions while one site needs a 5% reduction (Table 4). Table 15 provides recommended changes to AU listing status in the next Integrated Report.

Table 15. Summary of recommended changes for AUs based on TMDL review.

Assessment Unit Name	Assessment Unit Number	Pollutant	Recommended Changes to Next Integrated Report	Justification
Jim Ford Creek—waterfall (12.5-miles upstream) to mouth	ID17060306CL034_04	Bacteria	Move from Category 4a to 2 for bacteria (*E. coli*)	Listed in error; data show 126 cfu/100 mL geometric mean criterion is being met, AU fully supports contact recreation beneficial use.
Jim Ford Creek—waterfall (12.5-miles upstream) to mouth	ID17060306CL034_04	Coarse sediment	Keep in Category 4a, remove sediment as an impairment	BURP data score of 2, indicating aquatic life beneficial uses are fully supporting; sediment data show no exceedance of the sediment surrogate.
Jim Ford Creek—waterfall (12.5-miles upstream) to mouth	ID17060306CL034_04	Nutrients (total phosphorous)	Keep in Category 4a, remove nutrients as an impairment	BURP data score of 2, indicating aquatic life beneficial uses are fully supporting; nutrient data show no exceedance of the nutrient surrogate.

Assessment Unit Name	Assessment Unit Number	Pollutant	Recommended Changes to Next Integrated Report	Justification
Heywood, Wilson Creeks and tributaries	ID17060306CL035_02	Coarse sediment	Keep in Category 4a, remove sediment as an impairment	AU listed as impaired by sediment in error; see Section 2.2.3 for further explanation.
Jim Ford Creek—source to Jim Ford Creek waterfall (12.5 miles)	ID17060306CL035_03	Coarse sediment	Keep in Category 4a, remove sediment as an impairment	AU listed as impaired by sediment in error; see Section 2.2.3 for further explanation.
Jim Ford Creek—source to Jim Ford Creek waterfall	ID17060306CL035_04	Coarse sediment	Keep in Category 4a, remove sediment as an impairment	AU listed as impaired by sediment in error; see Section 2.2.3 for further explanation.
Winter Creek—Winter Creek waterfall (3.4-miles upstream)	ID17060306CL037_02	Bacteria (*E. coli*), nutrients (total phosphorous), and temperature	Move from Category 3 to 4a for bacteria (*E. coli*), nutrients (total phosphorous), and temperature	AU was assessed under the Jim Ford Creek TMDL but listed as unassessed in error; current data show cold water aquatic life and contact recreation beneficial uses are not being met and AU should be moved to Category 4a.
Winter Creek—waterfall (3.4-miles upstream) to mouth	ID17060306CL037_03	Bacteria (*E. coli*)	Move from Category 4a to 2 for bacteria (*E. coli*)	Data show 126 cfu/100 mL geometric mean criterion is being met, AU fully supports contact recreation beneficial use.

5.1 Water Quality Trend

Overall, while pollutant loads have improved in the watershed, water quality and the current biological condition of AUs as determined by BURP data has not significantly changed in the Jim Ford Creek watershed since the TMDL was approved. In most cases, AUs listed in the Jim Ford Creek TMDL are not supporting beneficial uses (Table 11). Table 15 shows two AUs in the Jim Ford Creek watershed that are supporting recreational beneficial uses and one AU that is supporting aquatic life beneficial uses.

5.2 Review of Pollutant Targets

The Jim Ford Creek TMDL included targets for coarse sediment and nutrients (TP). No changes to the pollutant targets are recommended at this time.

5.3 Review of Beneficial Uses

Six AUs included in this TMDL are designated for cold water aquatic life and contact recreation beneficial uses. One AU has an existing use for salmonid spawning beneficial uses. Three AUs have presumed cold water aquatic life and contact recreation beneficial uses (Table 11). No changes to the beneficial use designations are recommended.

5.4 Watershed Advisory Group Consultation

This review was developed with participation from the Jim Ford Creek WAG. Meeting dates were as follows:

- May 11, 2016—Jim Ford Creek TMDL review status and structuring of the WAG
- June 16, 2016—Jim Ford Creek TMDL review of nutrient and bacteria criteria and data
- July 21, 2016—Jim Ford Creek TMDL review of sediment
- August 18, 2016—Jim Ford Creek TMDL temperature/PNV methodology review

5.5 Recommendations for Further Action

This review complies with Idaho Code §39-3611(7), and DEQ will continue to review and reevaluate the Jim Ford Creek TMDLs and all available data periodically. The Jim Ford Creek WAG recommends that the wasteload allocation for phosphorous and the applicable critical time period for the Weippe WWTP be reevaluated before or during the next scheduled Jim Ford Creek TMDL review. The implementation plan will be updated to reflect the observations and results in this review, and the designated management agencies will continue to work with landowners on riparian restoration.

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Appendix A. Bacteria Data

Grasshopper Creek - ID17060306CL036_02			
Sample Date	**Flow (cfs)**	**E. coli (CFU/100 mL)**	**Geometric Mean**
5/27/2015	3.086	14.5	—
6/2/2015	NA	222.4	—
6/7/2015	NA	55.6	—
6/11/2015	0.136	117.8	—
6/17/2015	0.156	43.2	62
11/2/2015	NA	1732.9	—
11/9/2015	NA	121.1	—
11/12/2015	4.025	79.4	—
11/16/2015	NA	26.2	—
11/19/2015	5.891	90.7	132
Grasshopper Creek -ID17060306CL036_03			
Sample Date	**Flow (cfs)**	**E. coli (CFU/100 mL)**	**Geometric Mean**
5/27/2015	4.842	123.6	—
6/2/2015	NA	547.5	—
6/7/2015	NA	275.5	—
6/11/2015	0.821	40.4	—
6/17/2015	0.405	33.1	120
11/2/2015	NA	547.5	—
11/9/2015	NA	58.6	—
11/12/2015	4.727	88.2	—
11/16/2015	NA	73.8	—
11/19/2015	8.239	344.8	148

Jim Ford Creek - ID17060306CL034_04			
Sample Date	**Flow (cfs)**	**E. coli (CFU/100 mL)**	**Geometric Mean**
5/27/2015	19.58	11.4	—
6/2/2015	NA	151.9	—
6/7/2015	NA	18.5	—
6/11/2015	5.367	178.5	—
6/17/2015	2.282	53.8	50
11/2/2015	NA	21.1	—
11/9/2015	NA	41.05	—
11/12/2015	15.3	21.6	—
11/16/2015	NA	37.3	—
11/19/2015	30.68	22.8	28
Heywood Creek - ID17060306CL035_02			
Sample Date	**Flow (cfs)**	**E. coli (CFU/100 mL)**	**Geometric Mean**
5/27/2015	3.109	53.8	—
6/2/2015	NA	816.4	—
6/7/2015	NA	579.4	—
6/11/2015	0.117	920.8	—
6/17/2015	0.028	275.5	365
11/2/2015	NA	2419.2	—
11/9/2015	NA	344.8	—
11/12/2015	2.164	248.1	—
11/16/2015	NA	93.2	—
11/19/2015	3.462	201.4	330

Jim Ford Creek - ID17060306CL035_03			
Sample Date	**Flow (cfs)**	**E. coli (CFU/100 mL)**	**Geometric Mean**
5/27/2015	3.879	35	—
6/2/2015	NA	38.2	—
6/7/2015	NA	56.3	—
6/11/2015	0.418	235.9	—
6/17/2015	0.002	38.9	59
11/2/2015	NA	2419.2	—
11/9/2015	NA	139.6	—
11/12/2015	2.443	579.4	—
11/16/2015	NA	47.2	—
11/19/2015	6.844	1046.2	395
Jim Ford Creek - ID17060306CL035_04			
Sample Date	**Flow (cfs)**	**E. coli (CFU/100 mL)**	**Geometric Mean**
5/27/2015	14.79	50.4	—
6/2/2015	NA	248.1	—
6/7/2015	NA	43.5	—
6/11/2015	1.127	17.3	—
6/17/2015	0.314	8.6	38
11/2/2015	NA	686.7	—
11/9/2015	NA	35.9	—
11/12/2015	7.991	770.1	—
11/16/2015	NA	248.9	—
11/19/2015	13.49	517.2	300

Winter Creek - ID17060306CL037_02			
Sample Date	**Flow (cfs)**	**E. coli (CFU/100 mL)**	**Geometric Mean**
5/27/2015	0.89	50.4	—
6/2/2015	NA	1299.7	—
6/7/2015	NA	33.2	—
6/11/2015	0.245	31.9	—
6/17/2015	0.016	12.1	61
11/2/2015	NA	980.4	—
11/9/2015	NA	101.4	—
11/12/2015	2.982	218.7	—
11/16/2015	NA	40.45	—
11/19/2015	3.836	141.4	166
Winter Creek - ID17060306CL037_03			
Sample Date	**Flow (cfs)**	**E. coli (CFU/100 mL)**	**Geometric Mean**
5/27/2015	1.323	129.6	—
6/2/2015	NA	613.1	—
6/7/2015	NA	26.2	—
6/11/2015	0.124	16.1	—
6/17/2015	0.05	2	37
11/2/2015	NA	1119.9	—
11/9/2015	NA	42.8	—
11/12/2015	1.914	125.1	—
11/16/2015	NA	42.8	—
11/19/2015	3.183	74.9	114

Winter Creek - ID17060306CL038_02			
Sample Date	**Flow (cfs)**	**E. coli (CFU/100 mL)**	**Geometric Mean**
5/27/2015	0.899	325.5	—
6/2/2015	NA	2419.2	—
6/7/2015	NA	48.7	—
6/11/2015	0.124	41	—
6/17/2015	0.009	20.8	127
11/2/2015	NA	648.4	—
11/9/2015	NA	37.7	—
11/12/2015	1.725	206.3	—
11/16/2015	NA	44.8	—
11/19/2015	2.041	141.3	126

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Appendix B. Phosphorus Data

Grasshopper Creek - ID17060306CL036_02				
Sample Date	**Flow (cfs)**	**TP (mg/mL)**	**TP Load Capacity (lb/day)**	**TP Existing Load (lb/day)**
5/27/2015	3.086	0.0515	1.25	0.86
6/11/2015	0.136	0.0501	0.05	0.04
6/17/2015	0.156	0.0488	0.06	0.04
6/30/2015	0.006	0.0944	0.00	0.00
7/17/2015	0.057	0.0609	0.02	0.02
Grasshopper Creek -ID17060306CL036_03				
Sample Date	**Flow (cfs)**	**TP (mg/mL)**	**TP Load Capacity (lb/day)**	**TP Existing Load (lb/day)**
5/27/2015	4.842	0.0431	1.96	1.12
6/11/2015	0.821	0.0256	0.33	0.11
6/17/2015	0.405	0.0242	0.16	0.05
7/17/2015	0.239	0.0481	0.10	0.06
Jim Ford Creek - ID17060306CL034_04				
Sample Date	**Flow (cfs)**	**TP (mg/mL)**	**TP Load Capacity (lb/day)**	**TP Existing Load (lb/day)**
5/27/2015	19.58	0.0305	7.92	3.22
6/11/2015	5.367	0.0197	2.17	0.57
6/17/2015	2.282	0.0193	0.92	0.24
6/30/2015	1.163	0.0313	0.47	0.20
7/17/2015	1.292	0.0304	0.52	0.21

Heywood Creek - ID17060306CL035_02				
Sample Date	**Flow (cfs)**	**TP (mg/mL)**	**TP Load Capacity (lb/day)**	**TP Existing Load (lb/day)**
5/27/2015	3.109	0.0707	1.26	1.18
6/11/2015	0.117	0.153	0.05	0.10
6/17/2015	0.028	0.0816	0.01	0.01
Jim Ford Creek - ID17060306CL035_03				
Sample Date	**Flow (cfs)**	**TP (mg/mL)**	**TP Load Capacity (lb/day)**	**TP Existing Load (lb/day)**
5/27/2015	3.879	0.08	1.57	1.67
6/11/2015	0.418	0.074	0.17	0.17
6/17/2015	0.002	0.0432	0.00	0.00
Jim Ford Creek - ID17060306CL035_04				
Sample Date	**Flow (cfs)**	**TP (mg/mL)**	**TP Load Capacity (lb/day)**	**TP Existing Load (lb/day)**
5/27/2015	14.79	0.0606	5.98	4.83
6/11/2015	1.127	0.0392	0.46	0.24
6/17/2015	0.314	0.0411	0.13	0.07
6/30/2015	0.008	0.0462	0.00	0.00
7/17/2015	0.01	0.0306	0.00	0.00
Winter Creek - ID17060306CL037_02				
Sample Date	**Flow (cfs)**	**TP (mg/mL)**	**TP Load Capacity (lb/day)**	**TP Existing Load (lb/day)**
5/27/2015	0.89	0.0329	0.36	0.16
6/11/2015	0.245	0.0219	0.10	0.03
6/17/2015	0.016	0.0163	0.01	0.00

Winter Creek - ID17060306CL037_03				
Sample Date	**Flow (cfs)**	**TP (mg/mL)**	**TP Load Capacity (lb/day)**	**TP Existing Load (lb/day)**
5/27/2015	1.323	0.0297	0.53	0.21
6/11/2015	0.124	0.0217	0.05	0.01
6/17/2015	0.05	0.0207	0.02	0.01
Winter Creek - ID17060306CL038_02				
Sample Date	**Flow (cfs)**	**TP (mg/mL)**	**TP Load Capacity (lb/day)**	**TP Existing Load (lb/day)**
5/27/2015	0.899	0.0446	0.36	0.22
6/11/2015	0.124	0.0712	0.05	0.05
6/17/2015	0.009	0.027	0.00	0.00

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Appendix C. Implementation Monitoring in Jim Ford Creek (Idaho Association of Soil Conservation Districts)

The Idaho Association of Soil Conservation Districts (IASCD) collected water quality data from Jim Ford Creek and several of its tributaries from April 2003 through July 2004. The monitoring project was initiated to evaluate water quality in the Jim Ford Creek watershed as a follow-up to the TMDL.

The monitoring data from the 2003–2004 report review the monitoring results utilizing the following parameters:

- Total phosphorus (TP)
- Orthophosphorus (OP)
- Bacteria (Escherichia coli)
- Nitrogen components—NO2, NO3, NH3
- Total suspended solids (TSS)
- Instantaneous Water Temperature
- Turbidity
- Dissolved oxygen (DO)
- Percent (%) saturation
- Total dissolved solids (TDS)

The University of Idaho Analytical Science Laboratory (UIASL) conducted all inorganic parameter testing and Anatek Labs, Inc. performed bacteria analysis.

Some key assumptions of the TMDL were:

- Fine sediment is not degrading water quality in Jim Ford Creek.
- Coarse sediment is impairing salmonid spawning and rearing in lower Jim Ford Creek.
- Temperature exceedances are common throughout the watershed.
- Jim Ford Creek is impaired by excess nutrients, which negatively affect dissolved oxygen levels in the stream.
- *E. coli* bacteria levels exceed water quality standards during summer months.

The Jim Ford Creek Watershed Advisory Group and supporting agencies created a TMDL implementation plan consisting of a Watershed Restoration Strategy (WRS). The WRS provided the framework necessary to implement BMPs aimed at improving water quality through practices such as riparian restoration, bank stabilization, animal waste systems, conservation cropping and tillage practices, and livestock exclusion.

Monitoring Site Descriptions

The seven monitoring sites selected for the Jim Ford Creek Watershed Enhancement Project were sites where data was initially collected for TMDL development in 1998. Below is a general description of site locations; these sites are also illustrated graphically in Figure 1.

JF-1 Jim Ford Creek (mouth)

JF-2 Winter Creek (below agricultural influence)

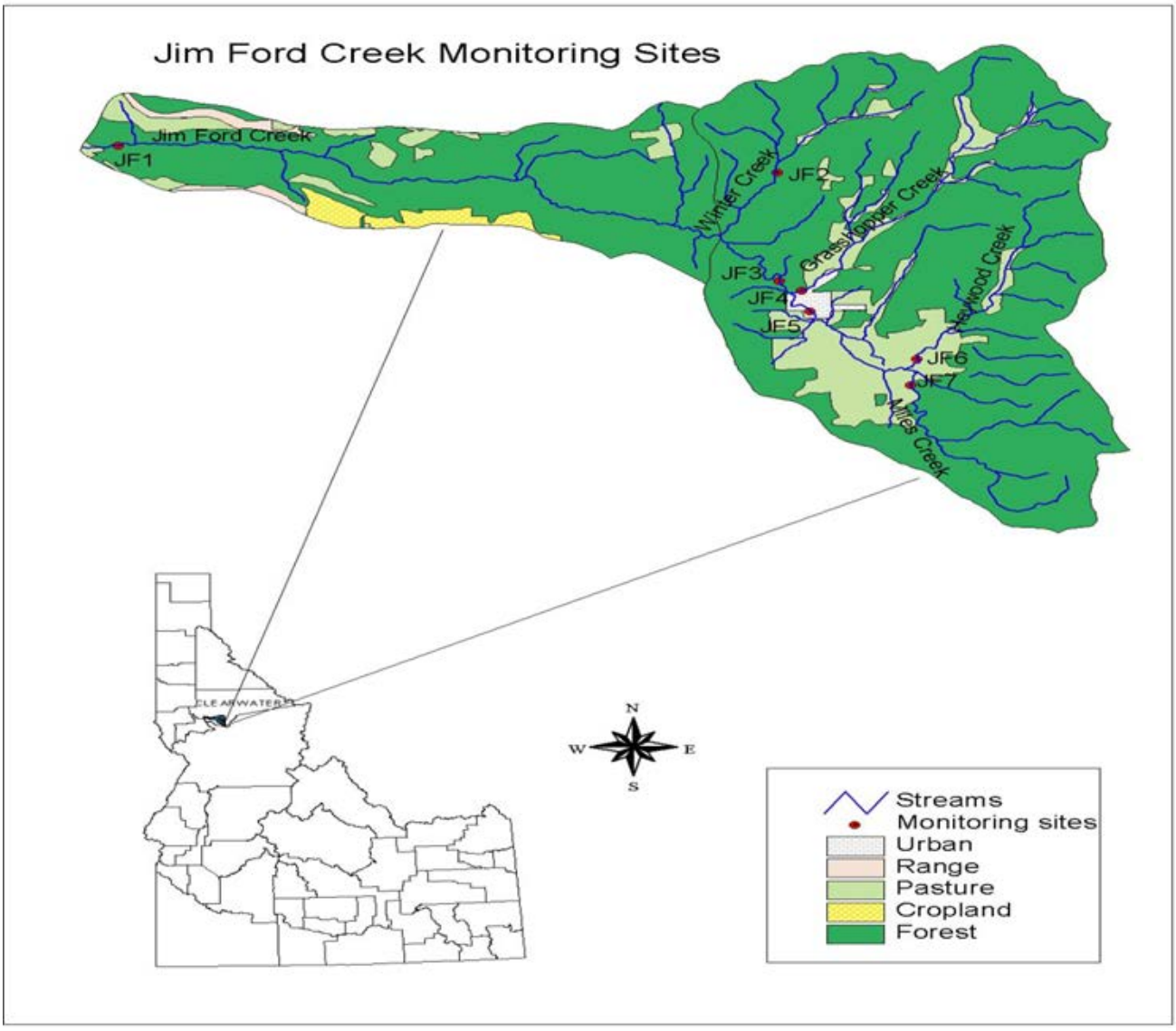
JF-3 Jim Ford Creek (downstream of city of Weippe WWTP)

JF-4 Grasshopper Creek (mouth)

JF-5 Jim Ford Creek (upstream of city of Weippe WWTP)

JF-6 Heywood Creek (mouth)

JF-7 Miles Creek (mouth)



Summary of Water Quality Monitoring (comparison between 1998 and 2003–2004)

Improvements in water quality were noticeable in a number of streams assessed during the monitoring study and water quality generally improved as one moved downstream from the headwaters to the mouth of Jim Ford Creek. It was likely that intensive land use on the Weippe

Prairie accounted for the elevated numbers seen in the data set, while the relatively untouched, rugged canyon lands found in the middle section of Jim Ford Creek may allow pollutants to settle out, assimilate and/or be diluted, thereby accounting for the improved water quality observed at the mouth.

Contrary to the conclusions of the TMDL, fine sediment appeared to be an issue in the headwater tributaries as well as the upper section of Jim Ford Creek itself. While TSS levels never exceeded the instantaneous target of 80 mg/L, it appeared that sediment levels were high enough to partially account for the high levels of phosphorus observed in the upper watershed.

Excessive stream temperature was a major concern throughout the Jim Ford Creek watershed. Aquatic organisms from microbes to fish were dependent on certain temperature ranges for their optimal health. Aquatic insects were sensitive to temperature and would move in a stream to find their optimal temperature. Temperature was also critical for fish spawning and embryo development. If stream temperatures are outside of optimal levels for prolonged periods of time, organisms become stressed and may die or be unable to reproduce. Temperature typically had an inverse relationship with DO. DO levels throughout the system were low during the months when water temperatures were high and flows were minimal.

Total phosphorus loading was more of an issue in the upper watershed, but violations also occurred at the mouth albeit much less frequently.

Bacteria levels in 2004 were noticeably lower than in 1998 throughout the watershed, likely due to the implementation of livestock exclusions, and manure management practices.

An abbreviated summary for each site follows.

Winter Creek

- Several BMPs, aimed primarily at mitigating the impacts of livestock, were implemented in the watershed.
- The 13 °C instantaneous temperature standard was violated seven times (33.3%) during the 2003–2004 sampling period, although it did not cause DO levels to drop below the 6.0 mg/L water quality standard.
- TSS concentrations never exceeded the 80 mg/L target and the 2004 TSS median was 20% lower than the 1998 median.
- OP and TP were in the expected range, with the only reading to exceed the 0.075 mg/L TMDL target occurring during the highest turbidity event on 12/2/03. Overall, there was a 76% reduction in median TP levels from 1998 to 2004.
- The median *E. coli* count was reduced by 80 % from 1998 to 2004.

Grasshopper Creek

A nominal number of BMPs were implemented in this watershed.

Elevated total dissolved solids and conductivity readings were evident at this site.

TP was consistently below the EPA Gold Book criterion of 0.1 mg/L, but exceeded the 0.075 mg/L TMDL target three times during the growing season of April through October.

Miles Creek

BMPs including fencing, revegetation, and livestock management structures were implemented within this watershed.

DO levels fell below numeric water quality standard only when flows fell below one cfs.

Multiple exceedances of the 0.075 mg/L TP standard were observed. Median TP levels have increased by 38% since 1998

Median *E. coli* readings were 75% lower than those observed in 1998.

Temperatures were consistently elevated during the summer months and frequently exceeded the temperature standard.

Heywood Creek

BMPs have been implemented in the watershed, including fencing, forest buffer, revegetation, and livestock management structures.

TP readings were consistently elevated at this site and exceeded the TMDL target 77% of the time.

E. coli levels were relatively low, although they exceeded the water quality standard twice during the study.

Temperatures were high during the summer months and exceeded the water quality standard a number of times.

JF-5 (main stem, above City of Weippe)

BMPs were implemented, including revegetation, grade stabilizations, wetland creation, and livestock management structures.

DO levels fell below numeric water quality standard only when flows fell below one cfs.

TP consistently exceeded the TMDL target at this site, although median levels were 9% lower in 2004 than in 1998.

Temperatures exceeded state criteria throughout the summer months.

Median *E. coli* level was 29% lower than observed in 1998.

JF-3 (main stem, below City of Weippe)

BMPs were implemented, including revegetation, fencing, and an off-site watering facility for livestock.

TP levels exceeded the TMDL target nearly 40% of the time, although median TP levels were 18% lower than in 1998.

Median *E. coli* level was 14% lower than in 1998.

JF-1 (main stem, mouth)

The median turbidity was 62% lower than in 1998.

Median TSS level dropped 50% from the 1998 level.

Water temperatures exceeded the salmonid spawning instantaneous criteria during late April and May and exceeded the cold water aquatic life criteria in July.

Median TP level was 45% lower than in 1998 although levels still exceeded the TMDL target four times during the study.

Recommendations based on the 2003–2004 Monitoring Event

Significant erosion was evident along a number of streams, and treatment should be applied to streams that are already undergoing the most severe erosion. Based on visual assessments, TSS rates, and turbidity levels, the greatest erosion problems seem to be located on the main stem of Jim Ford Creek above Weippe and on Miles and Heywood Creeks. TP levels were also much higher in those streams but would likely be reduced as sediment levels were decreased. DO levels would likely increase as reductions of TP and TSS occurred. The revegetation of stream banks would help reduce sediment transport in problem areas, as healthy riparian vegetation was effective in reducing bank erosion. Riparian vegetation would also filter sediment transported in surface water runoff.

Excessive stream temperatures were a widespread problem within this watershed and would be a difficult problem to overcome. Perhaps the most effective strategy would be to work toward the establishment of natural full potential canopy shade. Reducing sediment loads within critical reaches would assist in reducing stream temperatures as well, since suspended particles tend to absorb more heat.

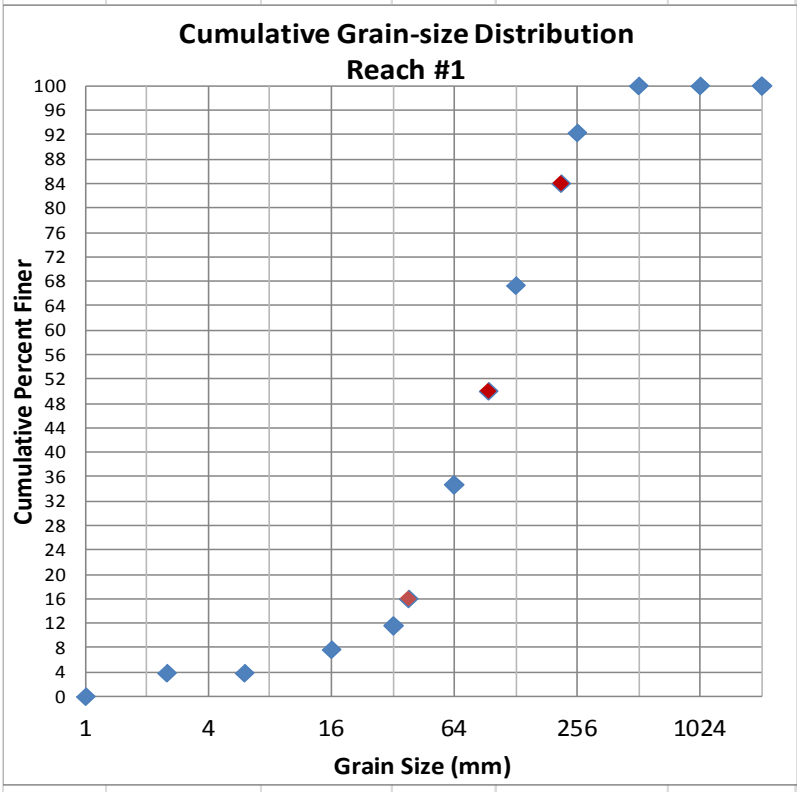
Significant reductions in bacteria levels have already been observed in watersheds where livestock exclusion via fencing has been used. Continuing to fence cattle away from creeks and developing off-stream watering facilities is apt to be the most cost-effective method to reduce bacteria levels and sediment levels in problem areas.

BMP placement in this watershed had improved overall water quality, and continued implementation of targeted stream improvements to reduce sediment loads, lower temperatures, and lower nutrient levels would be important (IASCD Monitoring Report December 2005).

Appendix D. Calculations and Cumulative Grain-Size Distributions for the 2016 Grain-Size Data

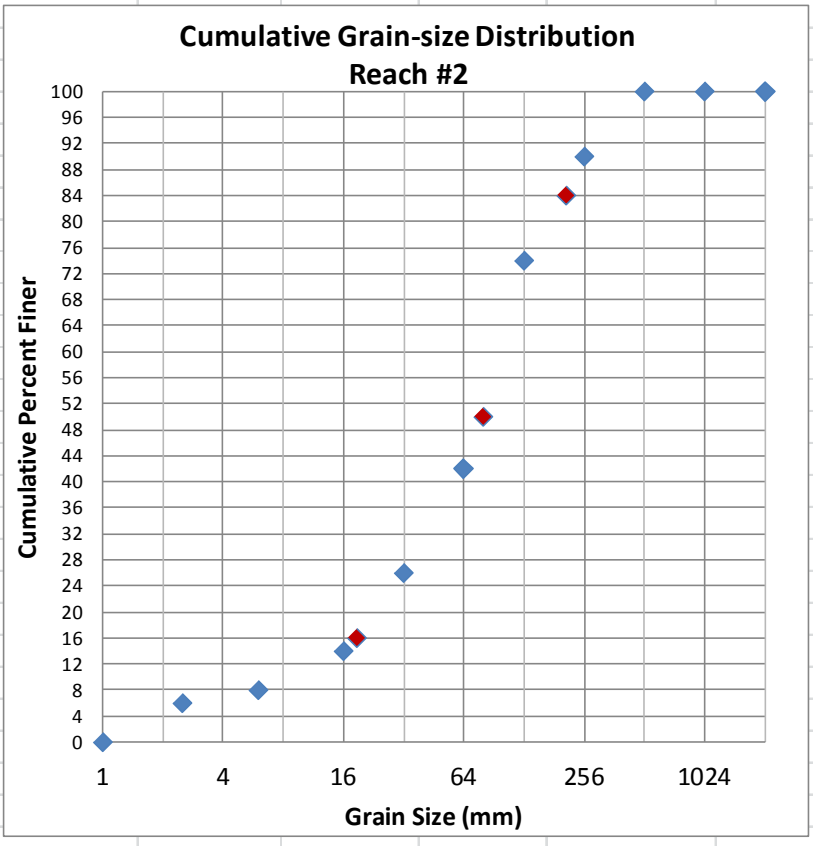
Reach # 1					
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Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size
		0	0.0	0.0	1
2		2	3.8	3.8	2.5
		0	0.0	3.8	6
2		2	3.8	7.7	16
1	1	2	3.8	11.5	32
6	6	12	23.1	34.6	64
5	12	17	32.7	67.3	128
2	11	13	25.0	92.3	256
	4	4	7.7	100.0	512
		0	0.0	100.0	1024
		0	0.0	100.0	2048
	Totals	52	100		

Interpolated		
Cumulative %age		Grain-size
0		1
3.8		2.5
3.8		6
7.7		16
11.5		32
16.0	0.2	38.2
34.6		64
50.0	0.5	94.1
67.3		128
84.0	0.7	213.5
92.3		256
100		512
100		1024
100		2048



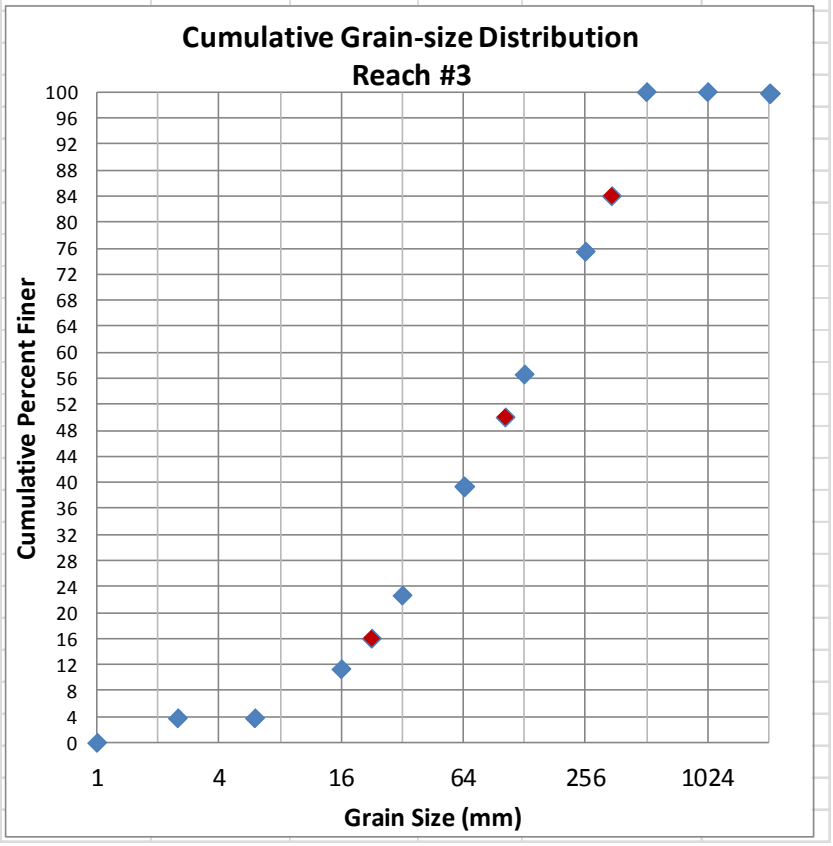
Reach # 2					
Wetted Width					
Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size
		0	0	0	1
2	1	3	6	6	2.5
1		1	2	8	6
3		3	6	14	16
1	5	6	12	26	32
3	5	8	16	42	64
2	14	16	32	74	128
1	7	8	16	90	256
	5	5	10	100	512
		0	0	100	1024
		0	0	100	2048
		50	100		

Interpolated		
Cumulative %age		Grain-size
0		1
6.0		2.5
8.0		6
14.0		16
16.0	0.2	18.7
26.0		32
42.0		64
50.0	0.25	80
74.0		128.00
84.0	0.625	208
90.0		256
100.0		512
100.0		1024
100.0		2048.00



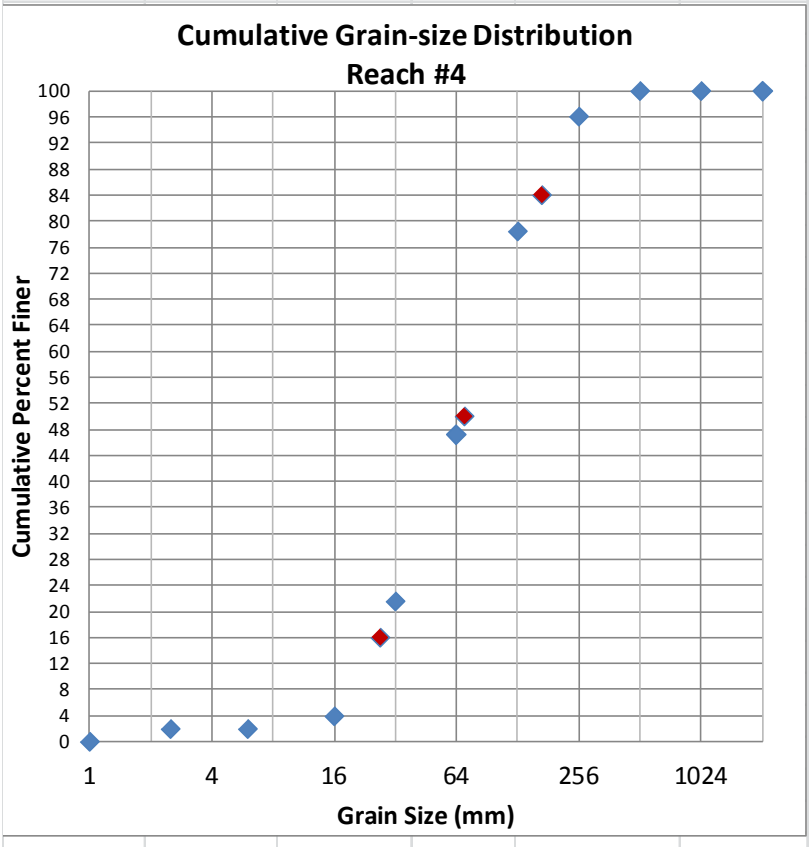
Reach # 3					
Wetted Width					
Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size
		0	0	0	1
1	1	2	3.8	3.8	2.5
		0	0.0	3.8	6
2	2	4	7.5	11.3	16
2	4	6	11.3	22.6	32
	9	9	17.0	39.6	64
	9	9	17.0	56.6	128
	10	10	18.9	75.5	256
1	12	13	24.5	100.0	512
		0	0	100	1024
		0	0	100	2048
		53	100		

Interpolated		
Cumulative %age		Grain-size
0		1
3.8		2.5
3.8		6
11.3		16
16.0	0.4	22.6
22.6		32
39.6		64
50.0	0.6	103.1
56.6		128
75.5		256
84.0	0.3	345.0
100		512
100		1024
100		2048



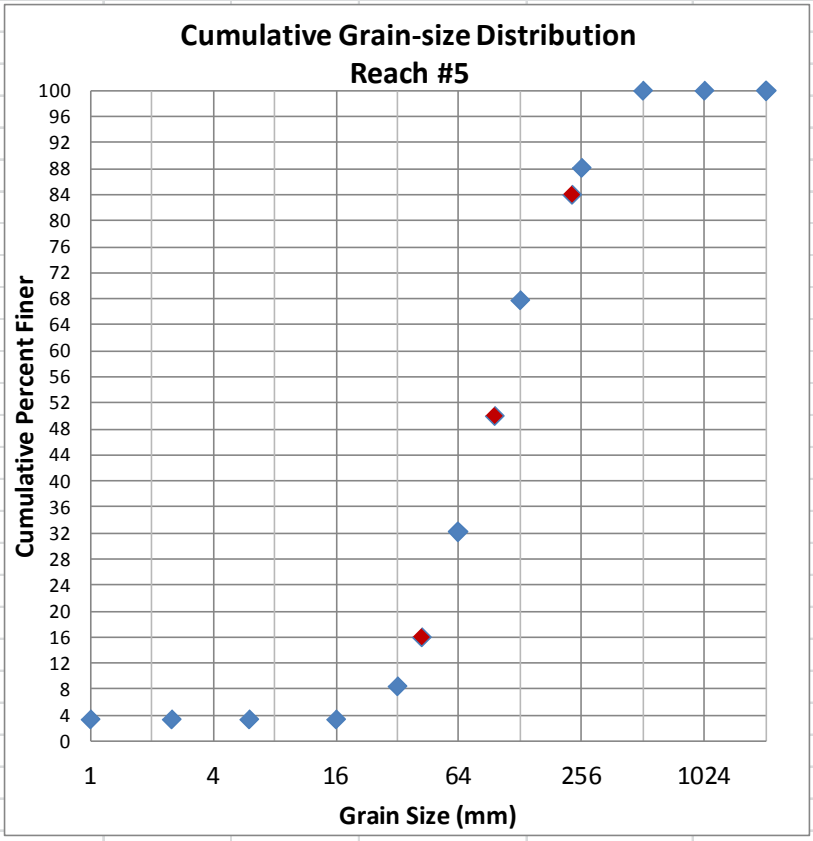
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Wetted Width					
Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size
		0	0	0	1
1		1	2.0	2.0	2.5
		0	0.0	2.0	6
	1	1	2.0	3.9	16
4	5	9	17.6	21.6	32
8	5	13	25.5	47.1	64
2	14	16	31.4	78.4	128
2	7	9	17.6	96.1	256
1	1	2	3.9	100.0	512
		0	0	100	1024
		0	0	100	2048
		51	100		

Interpolated		
Cumulative %age		Grain-size
0		1
2.0		2.5
2.0		6
3.9		16
16.0	0.7	27.0
21.6		32
47.1		64
50.0	0.1	70.0
78.4		128
84.0	0.3	168.4
96.1		256
100		512
100		1024
100		2048



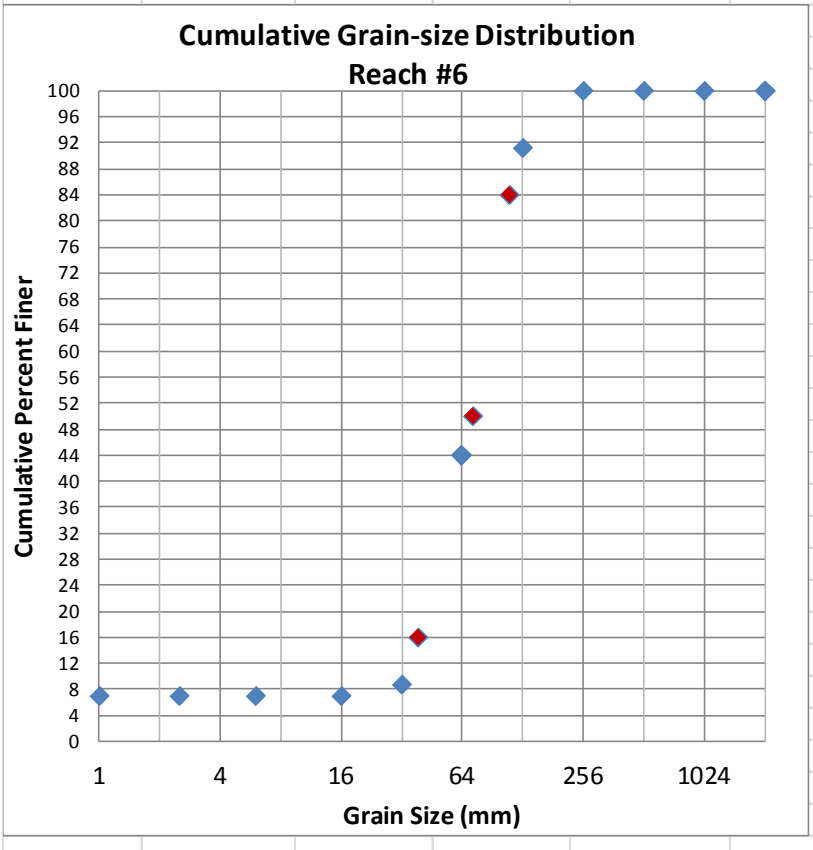
Reach # 5					
Wetted Width					
Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size
2		2	3.4	3.4	1
		0	0.0	3.4	2.5
		0	0.0	3.4	6
		0	0.0	3.4	16
	3	3	5.1	8.5	32
	14	14	23.7	32.2	64
	21	21	35.6	67.8	128
2	10	12	20.3	88.1	256
1	6	7	11.9	100.0	512
		0	0	100	1024
		0	0	100	2048
		59	100		

Interpolated		
Cumulative %age		**Grain-size**
3.4		1
3.4		2.5
3.4		6
3.4		16
8.5		32
16.0	0.3	42.1
32.2		64
50.0	0.5	96.0
67.8		128
84.0	0.8	230.0
88.1		256
100		512
100		1024
100		2048



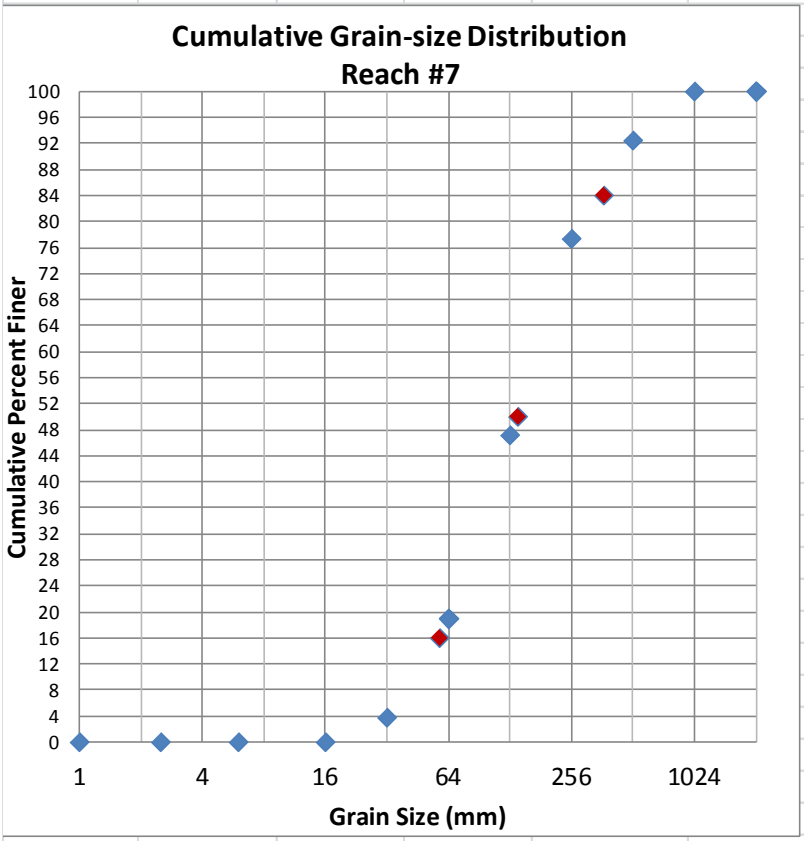
Reach # 6					
Wetted Width					
Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size
3	1	4	7.0	7.0	1
		0	0.0	7.0	2.5
		0	0.0	7.0	6
		0	0.0	7.0	16
	1	1	1.8	8.8	32
5	15	20	35.1	43.9	64
3	24	27	47.4	91.2	128
	5	5	8.8	100.0	256
		0	0.0	100.0	512
		0	0.0	100	1024
		0	0.0	100	2048
		57	100		

Interpolated		
Cumulative %age		Grain-size
7.0		1
7.0		2.5
7.0		6
7.0		16
8.8		32
16.0	0.2	38.6
43.9		64
50.0	0.1	72.3
84.0	0.7	109.9
91.2		128
100		256
100		512
100		1024
100		2048



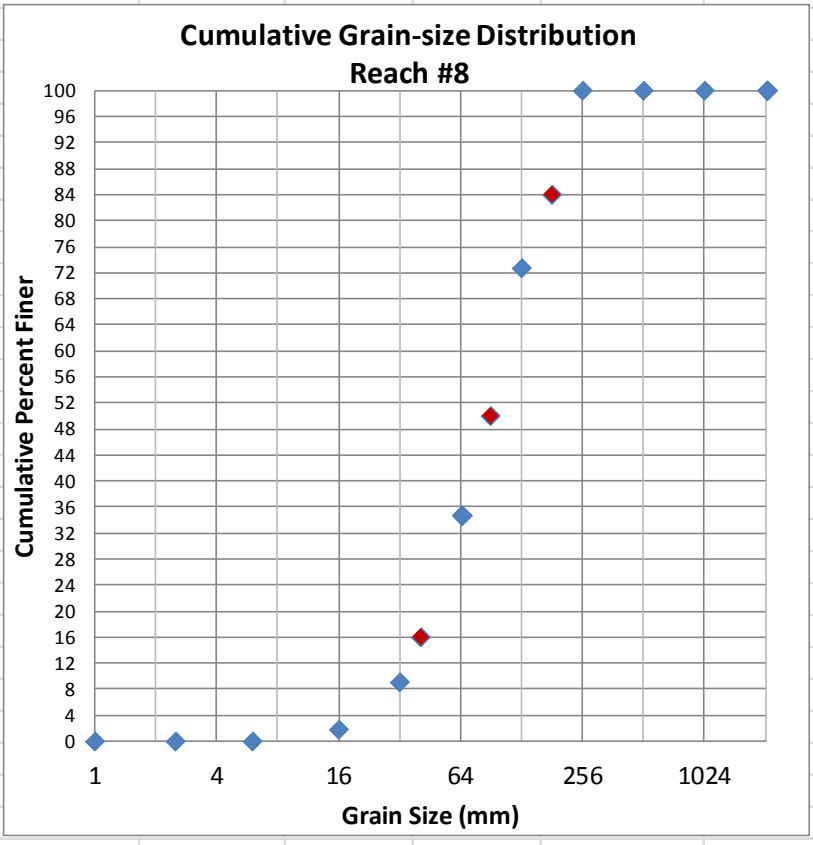
Reach # 7					
Wetted Width					
Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size
		0	0.0	0.0	1
		0	0.0	0.0	2.5
		0	0.0	0.0	6
		0	0.0	0.0	16
1	1	2	3.8	3.8	32
2	6	8	15.1	18.9	64
6	9	15	28.3	47.2	128
5	11	16	30.2	77.4	256
2	6	8	15.1	92.5	512
1	3	4	7.5	100	1024
		0	0.0	100	2048
		53	100		

Interpolated		
Cumulative %age		Grain-size
0		1
0		2.5
0		6
0		16
3.8		32
16.0	0.8	57.9
18.9		64
47.2		128
50.0	0.1	140.0
77.4		256
84.0	0.4	368.6
92.5		512
100		1024
100		2048



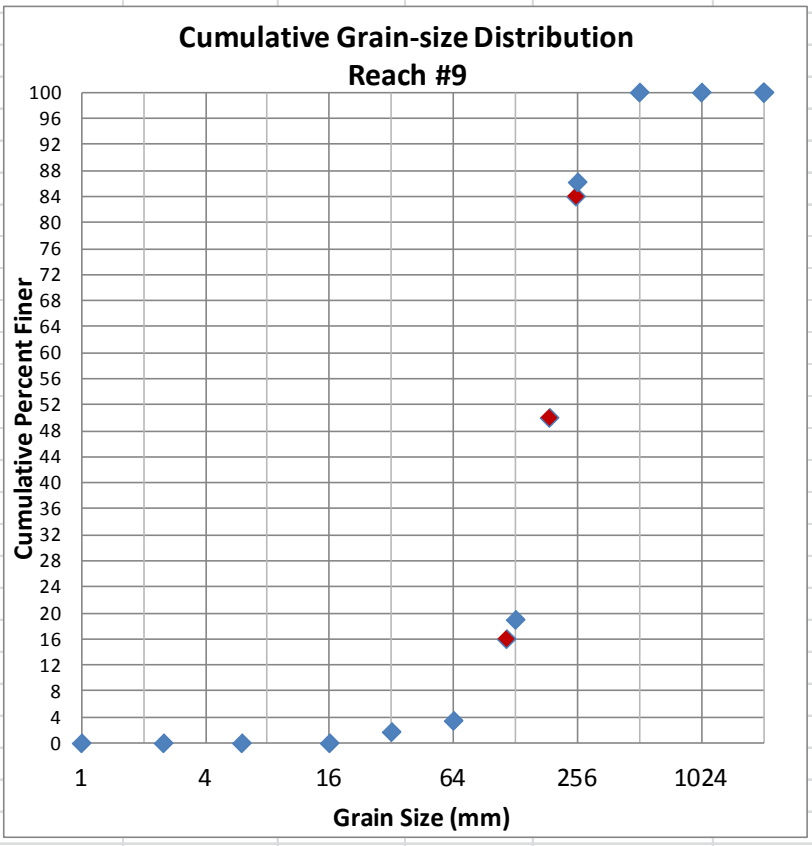
Reach # 8					
Wetted Width					
Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size
		0	0.0	0.0	1
		0	0.0	0.0	2.5
		0	0.0	0.0	6
	1	1	1.8	1.8	16
1	3	4	7.3	9.1	32
6	8	14	25.5	34.5	64
10	11	21	38.2	72.7	128
4	11	15	27.3	100.0	256
		0	0.0	100.0	512
		0	0.0	100	1024
		0	0.0	100	2048
		55	100		

Interpolated		
Cumulative %age		Grain-size
0		1
0		2.5
0		6
1.8		16
9.1		32
16.0	0.3	40.7
34.5		64
50.0	0.4	89.9
72.7		128
84.0	0.4	180.9
100		256
100		512
100		1024
100		2048



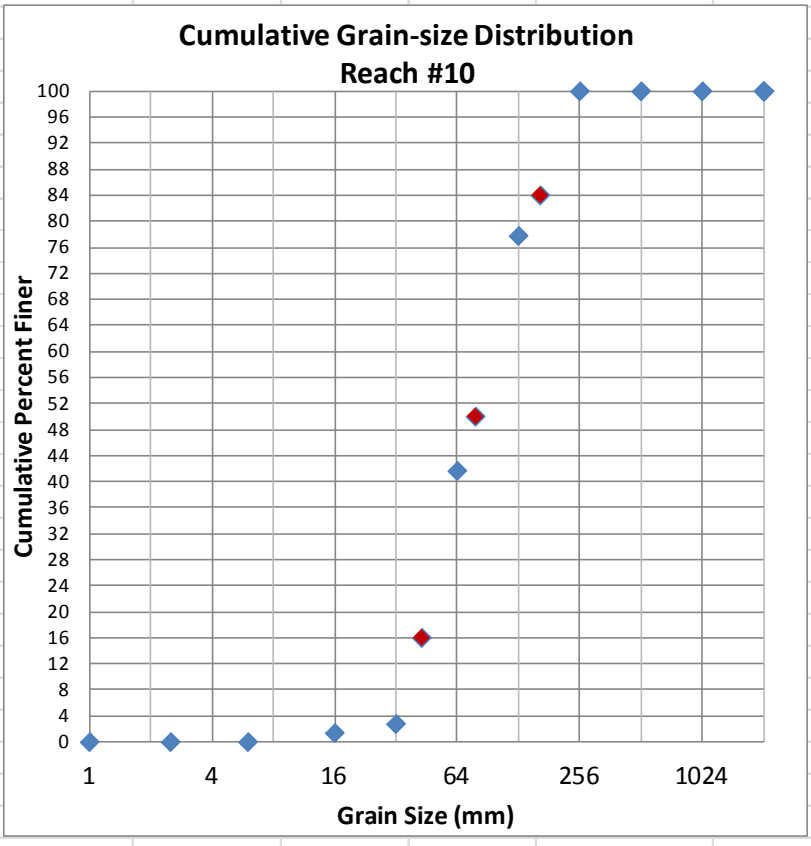
Reach # 9					
Wetted Width					
Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size
		0	0.0	0.0	1
		0	0.0	0.0	2.5
		0	0.0	0.0	6
		0	0.0	0.0	16
1		1	1.7	1.7	32
1		1	1.7	3.4	64
2	7	9	15.5	19.0	128
7	32	39	67.2	86.2	256
2	6	8	13.8	100.0	512
		0	0.0	100	1024
		0	0.0	100	2048
		58	100		

Interpolated		
Cumulative %age		Grain-size
0		1
0		2.5
0		6
0		16
1.7		32
3.4		64
16.0	0.8	115.8
19.0		128
50.0	0.5	187.1
84.0	1.0	251.8
86.2		256
100		512
100		1024
100		2048



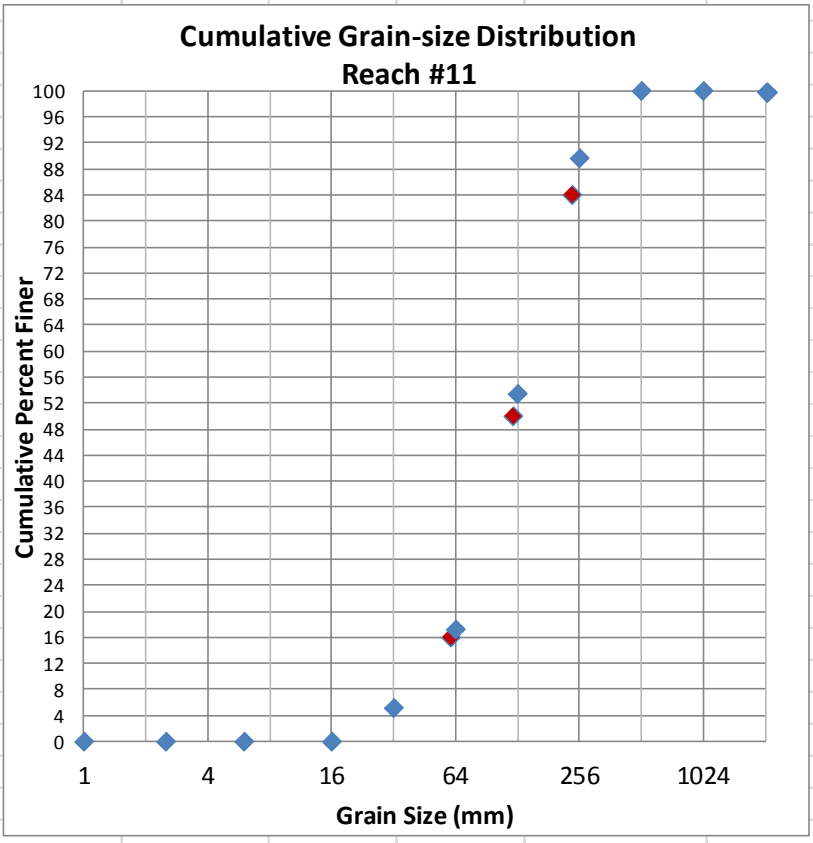
Reach # 10					
Wetted Width					
Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size
		0	0.0	0.0	1
		0	0.0	0.0	2.5
		0	0.0	0.0	6
1		1	1.4	1.4	16
1		1	1.4	2.8	32
20	8	28	38.9	41.7	64
10	16	26	36.1	77.8	128
2	14	16	22.2	100.0	256
		0	0.0	100.0	512
		0	0.0	100	1024
		0	0.0	100	2048
		72	100		

Interpolated		
Cumulative %age		Grain-size
0		1
0		2.5
0		6
1.4		16
2.8		32
16.0	0.3	42.9
41.7		64
50.0	0.2	78.8
77.8		128
84.0	0.3	163.8
100		256
100		512
100		1024
100		2048



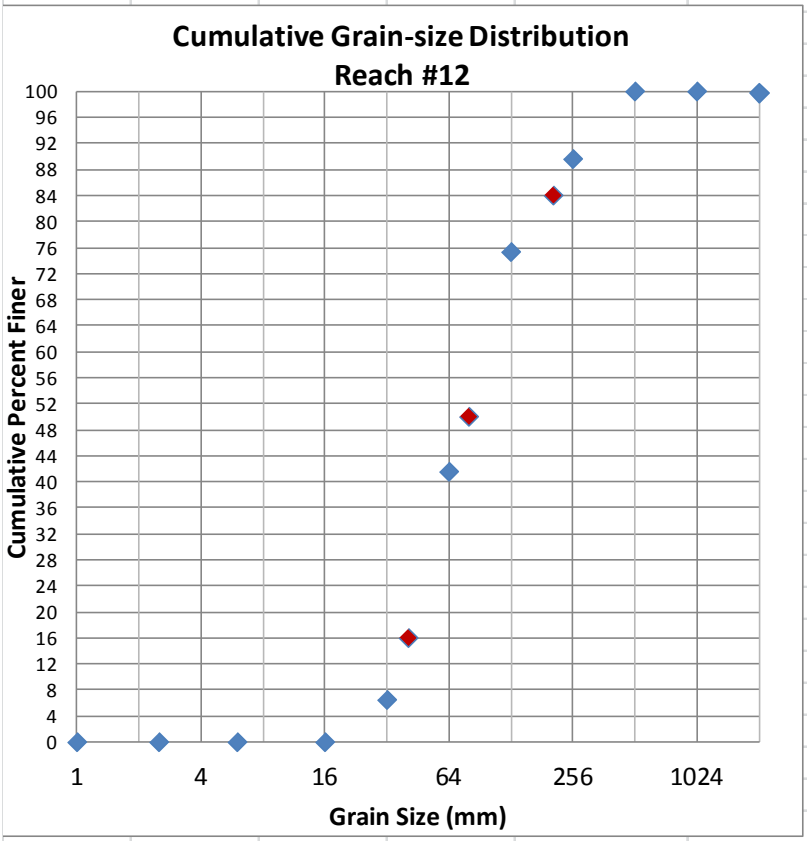
Reach # 11					
Wetted Width					
Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size
		0	0.0	0.0	1
		0	0.0	0.0	2.5
		0	0.0	0.0	6
		0	0.0	0.0	16
2	1	3	5.2	5.2	32
3	4	7	12.1	17.2	64
9	12	21	36.2	53.4	128
6	15	21	36.2	89.7	256
	6	6	10.3	100.0	512
		0	0.0	100	1024
		0	0.0	100	2048
		58	100		

Interpolated		
Cumulative %age		Grain-size
0		1
0		2.5
0		6
0		16
5.2		32
16.0	0.9	60.7
17.2		64
50.0	0.9	121.9
53.4		128
84.0	0.8	236.0
89.7		256
100		512
100		1024
100		2048



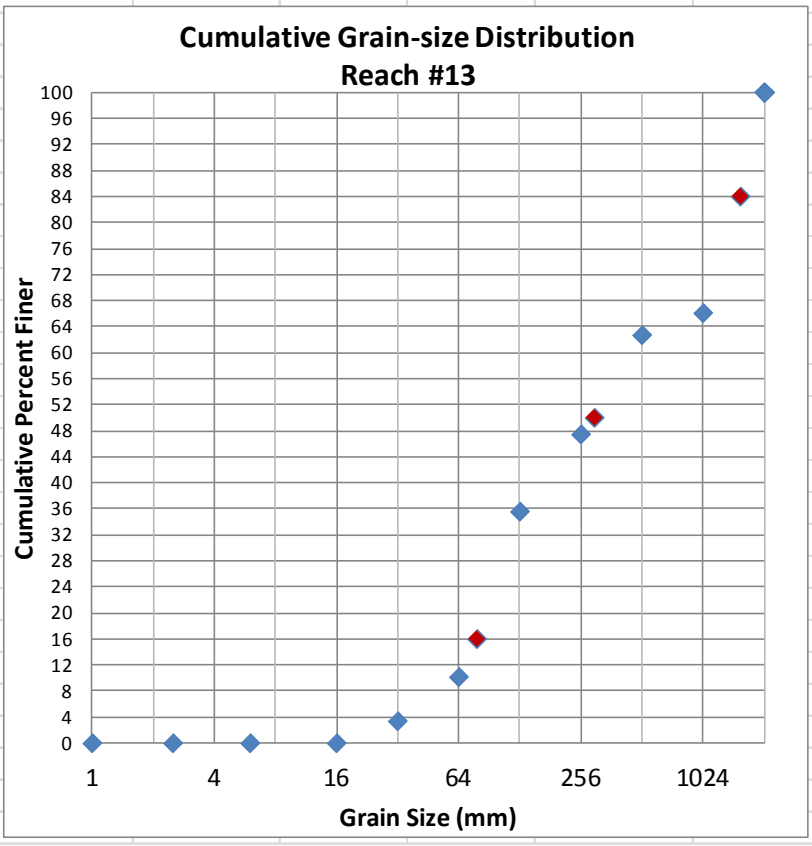
Reach # 12					
Wetted Width					
Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size
		0	0.0	0.0	1
		0	0.0	0.0	2.5
		0	0.0	0.0	6
		0	0.0	0.0	16
	5	5	6.5	6.5	32
2	25	27	35.1	41.6	64
5	21	26	33.8	75.3	128
	11	11	14.3	89.6	256
	8	8	10.4	100.0	512
		0	0.0	100	1024
		0	0.0	100	2048
		77	100		

Interpolated		
Cumulative %age		Grain-size
0		1
0		2.5
0		6
0		16
6.5		32
16.0	0.3	40.7
41.6		64
50.0	0.3	80.0
75.3		128
84.0	0.6	205.7
89.6		256
100		512
100		1024
100		2048



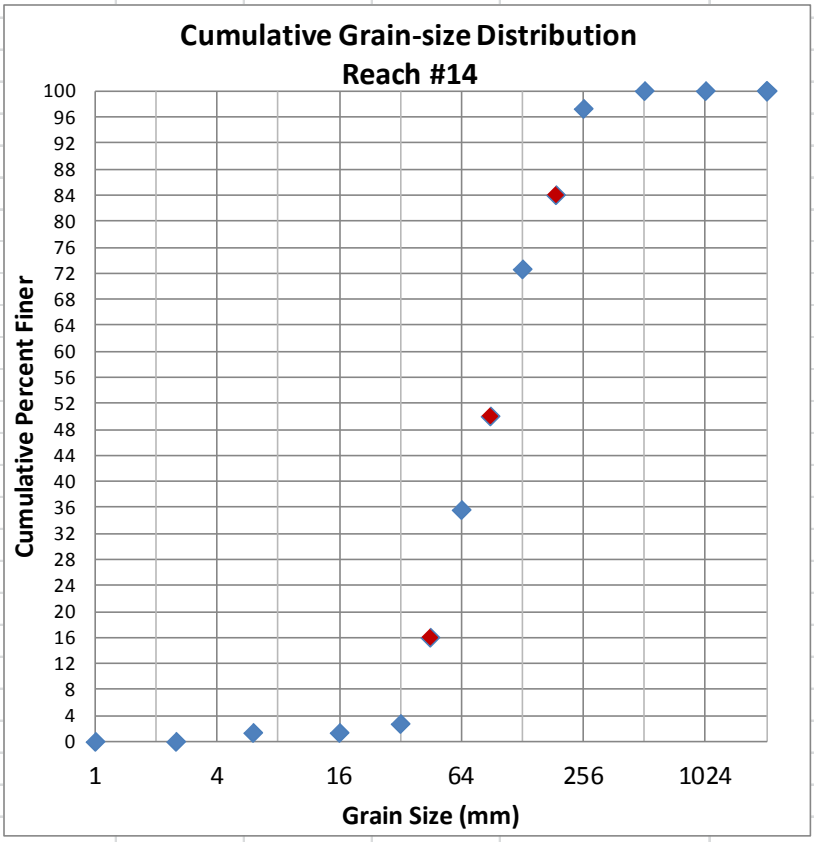
Reach # 13					
Wetted Width					
Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size
		0	0.0	0.0	1
		0	0.0	0.0	2.5
		0	0.0	0.0	6
		0	0.0	0.0	16
1	1	2	3.4	3.4	32
4		4	6.8	10.2	64
10	5	15	25.4	35.6	128
3	4	7	11.9	47.5	256
3	6	9	15.3	62.7	512
	2	2	3.4	66.1	1024
2	18	20	33.9	100	2048
		59	100		

Interpolated		
Cumulative %age		Grain-size
0		1
0		2.5
0		6
0		16
3.4		32
10.2		64
16.0	0.2	78.7
35.6		128
47.5		256
50.0	0.2	298.7
62.7		512
66.1		1024
84.0	0.5	1564.7
100		2048



Reach # 14					
Wetted Width					
Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size
		0	0.0	0.0	1
		0	0.0	0.0	2.5
	1	1	1.4	1.4	6
		0	0.0	1.4	16
	1	1	1.4	2.7	32
4	20	24	32.9	35.6	64
4	23	27	37.0	72.6	128
2	16	18	24.7	97.3	256
	2	2	2.7	100.0	512
		0	0.0	100.0	1024
		0	0.0	100	2048
		73	100		

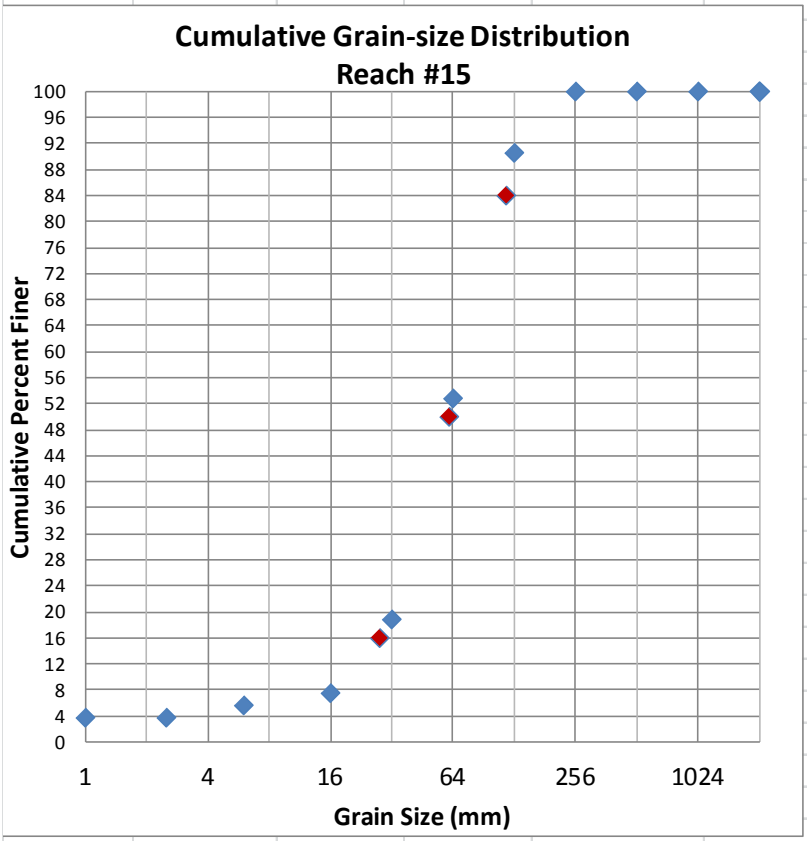
Interpolated		
Cumulative %age		Grain-size
0		1
0		2.5
1.4		6
1.4		16
2.7		32
16.0	0.4	44.9
35.6		64
50.0	0.4	88.9
72.6		128
84.0	0.5	187.2
97.3		256
100		512
100		1024
100		2048



Reach # 15

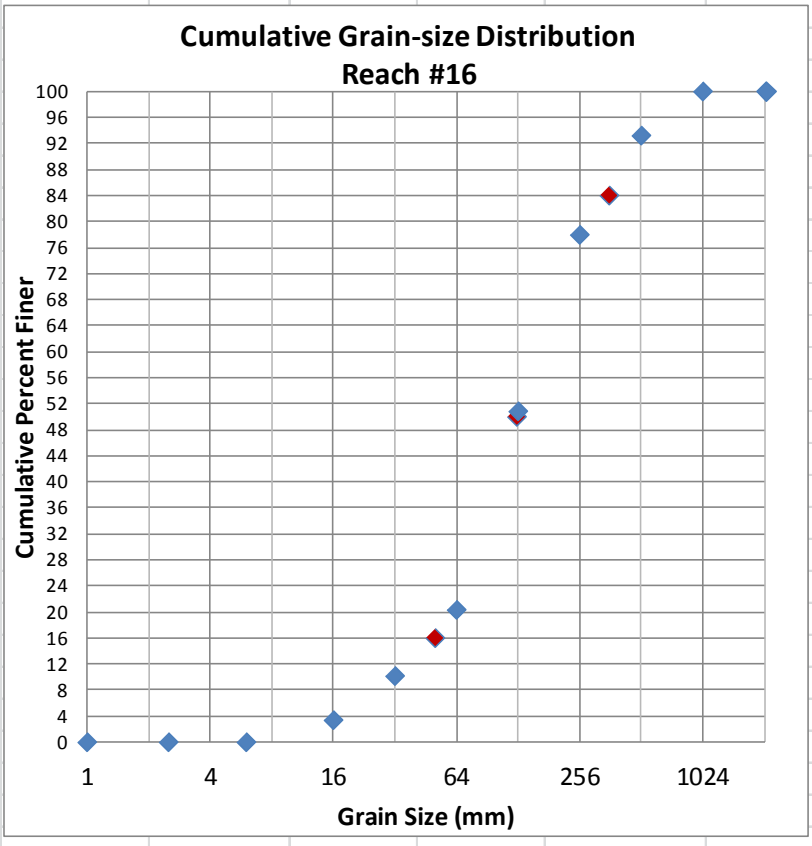
Wetted Width					
Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size
2		2	3.8	3.8	1
		0	0.0	3.8	2.5
	1	1	1.9	5.7	6
	1	1	1.9	7.5	16
5	1	6	11.3	18.9	32
11	7	18	34.0	52.8	64
10	10	20	37.7	90.6	128
2	3	5	9.4	100.0	256
		0	0.0	100.0	512
		0	0.0	100.0	1024
		0	0.0	100	2048
		53	100		

Interpolated		
Cumulative %age		**Grain-size**
3.8		1
3.8		2.5
5.7		6
7.5		16
16.0	0.7	27.9
18.9		32
50.0	0.9	61.3
52.8		64
84.0	0.8	116.9
90.6		128
100		256
100		512
100		1024
100		2048



Reach # 16					
Wetted Width					
Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size
		0	0.0	0.0	1
		0	0.0	0.0	2.5
		0	0.0	0.0	6
	2	2	3.4	3.4	16
2	2	4	6.8	10.2	32
2	4	6	10.2	20.3	64
7	11	18	30.5	50.8	128
4	12	16	27.1	78.0	256
	9	9	15.3	93.2	512
2	2	4	6.8	100.0	1024
		0	0.0	100	2048
		59	100		

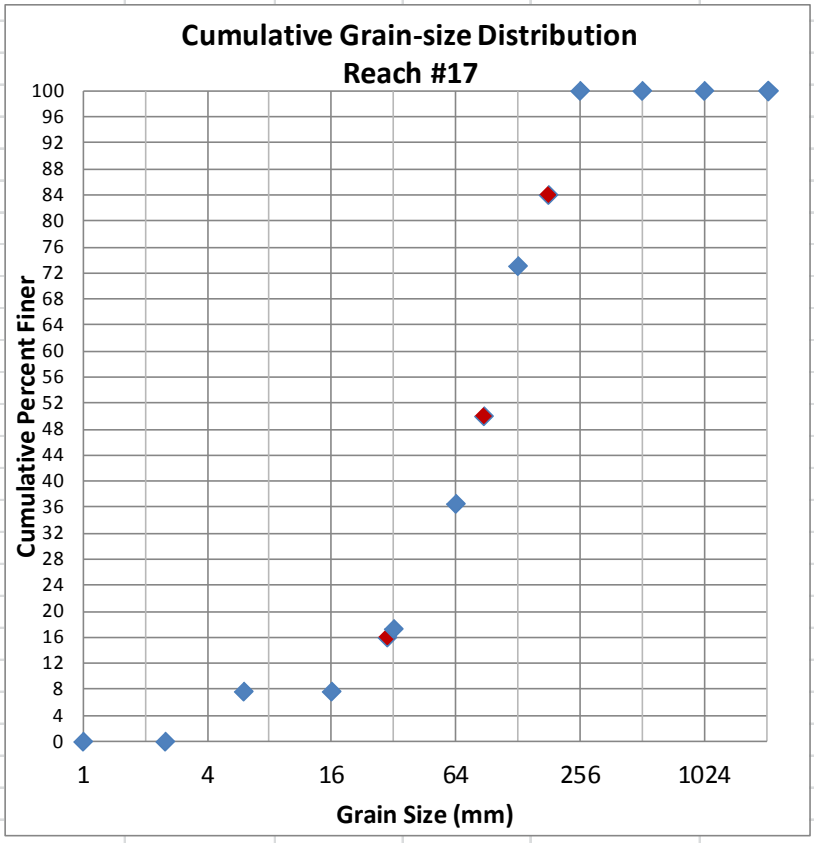
Interpolated		
Cumulative %age		Grain-size
0		1
0		2.5
0		6
3.4		16
10.2		32
16.0	0.6	50.3
20.3		64
50.0	1.0	126.2
50.8		128
78.0		256
84.0	0.4	357.3
93.2		512
100		1024
100		2048



Reach # 17

Wetted Width					
Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size
		0	0.0	0.0	1
		0	0.0	0.0	2.5
4		4	7.7	7.7	6
		0	0.0	7.7	16
1	4	5	9.6	17.3	32
3	7	10	19.2	36.5	64
6	13	19	36.5	73.1	128
6	8	14	26.9	100.0	256
		0	0.0	100.0	512
		0	0.0	100.0	1024
		0	0.0	100	2048
		52	100		

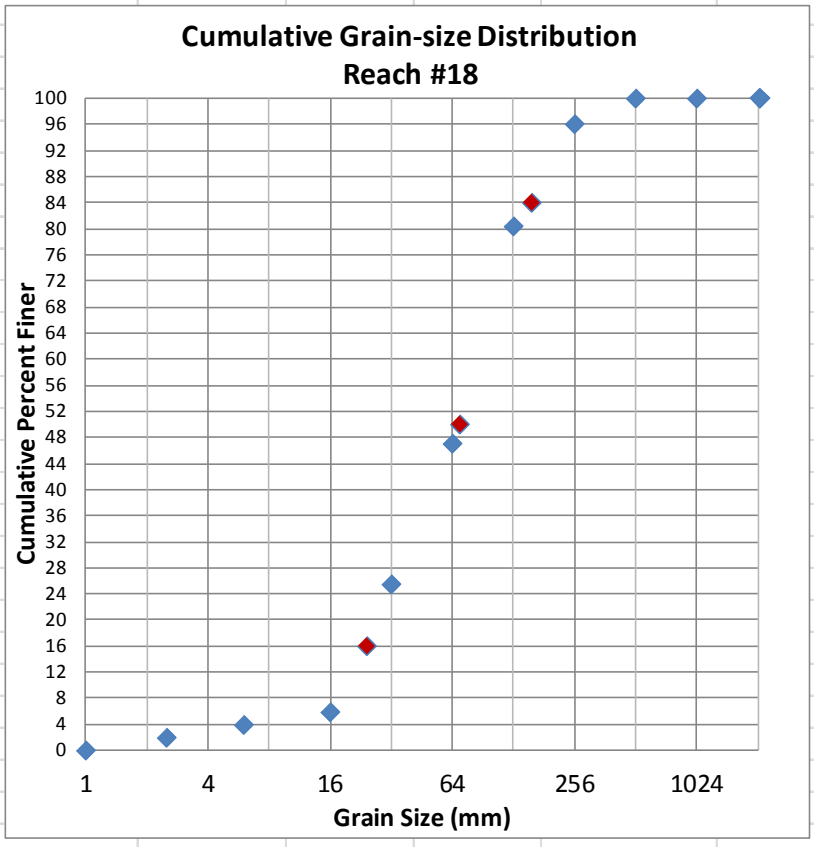
Interpolated		
Cumulative %age		Grain-size
0		1
0		2.5
7.7		6
7.7		16
16.0	0.9	29.8
17.3		32
36.5		64
50.0	0.4	87.6
73.1		128
84.0	0.4	179.9
100		256
100		512
100		1024
100		2048



Reach # 18

Wetted Width					
Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size
		0	0.0	0.0	1
1		1	2.0	2.0	2.5
	1	1	2.0	3.9	6
1		1	2.0	5.9	16
7	3	10	19.6	25.5	32
6	5	11	21.6	47.1	64
9	8	17	33.3	80.4	128
	8	8	15.7	96.1	256
	2	2	3.9	100.0	512
		0	0.0	100.0	1024
		0	0.0	100	2048
		51	100		

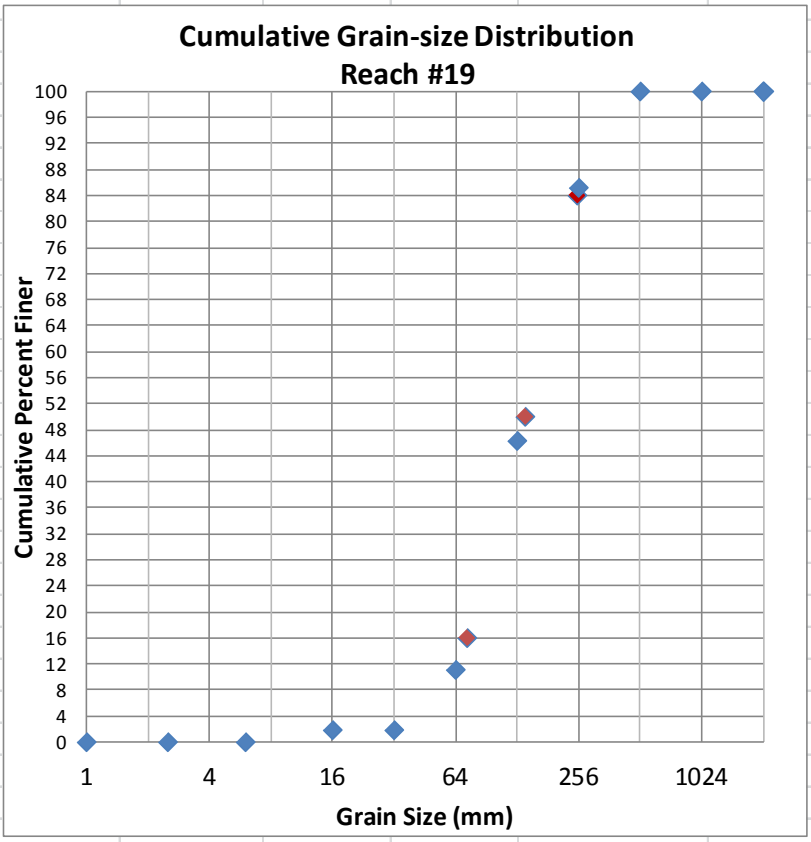
Interpolated		
Cumulative %age		**Grain-size**
0		1
2.0		2.5
3.9		6
5.9		16
16.0	0.5	24.3
25.5		32
47.1		64
50.0	0.1	69.6
80.4		128
84.0	0.2	157.4
96.1		256
100		512
100		1024
100		2048



Reach # 19

Wetted Width					
Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size
		0	0.0	0.0	1
		0	0.0	0.0	2.5
		0	0.0	0.0	6
	1	1	1.9	1.9	16
		0	0.0	1.9	32
4	1	5	9.3	11.1	64
6	13	19	35.2	46.3	128
8	13	21	38.9	85.2	256
6	2	8	14.8	100.0	512
		0	0.0	100.0	1024
		0	0.0	100	2048
		54	100		

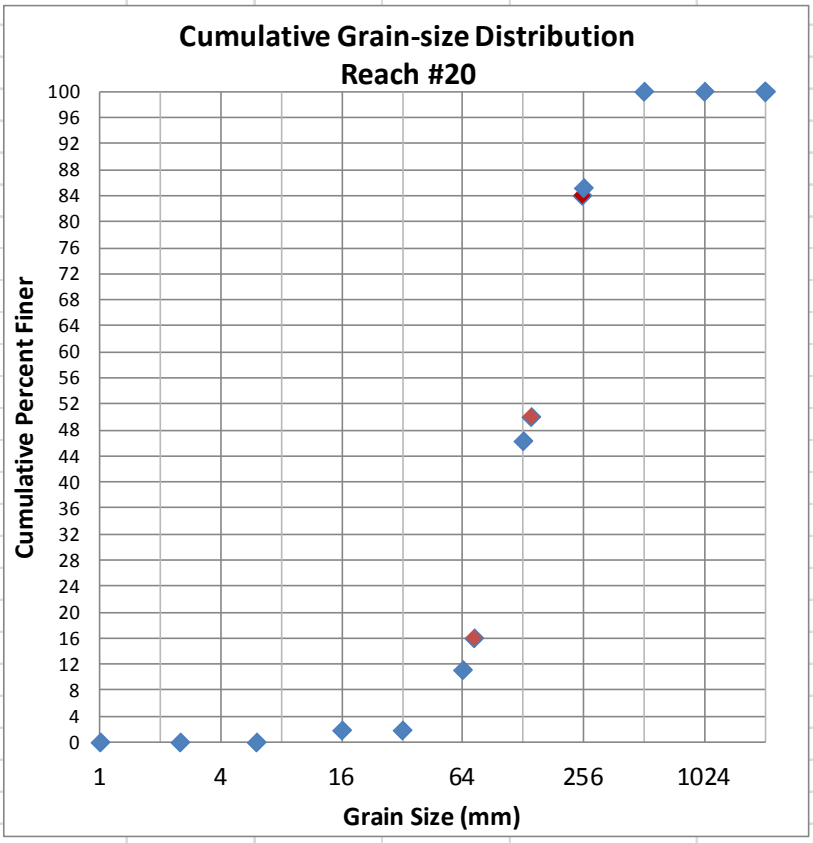
Interpolated		
Cumulative %age		Grain-size
0		1
0		2.5
0		6
1.9		16
1.9		32
11.1		64
16.0	0.1	72.9
46.3		128
50.0	0.1	140.2
84.0	0.97	252.1
85.2		256
100		512
100		1024
100		2048



Reach # 20

Wetted Width					
Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size
		0	0.0	0.0	1
		0	0.0	0.0	2.5
		0	0.0	0.0	6
		0	0.0	0.0	16
	1	1	1.8	1.8	32
1	8	9	16.4	18.2	64
5	9	14	25.5	43.6	128
10	10	20	36.4	80.0	256
1	10	11	20.0	100.0	512
		0	0.0	100.0	1024
		0	0.0	100	2048
		55	100		

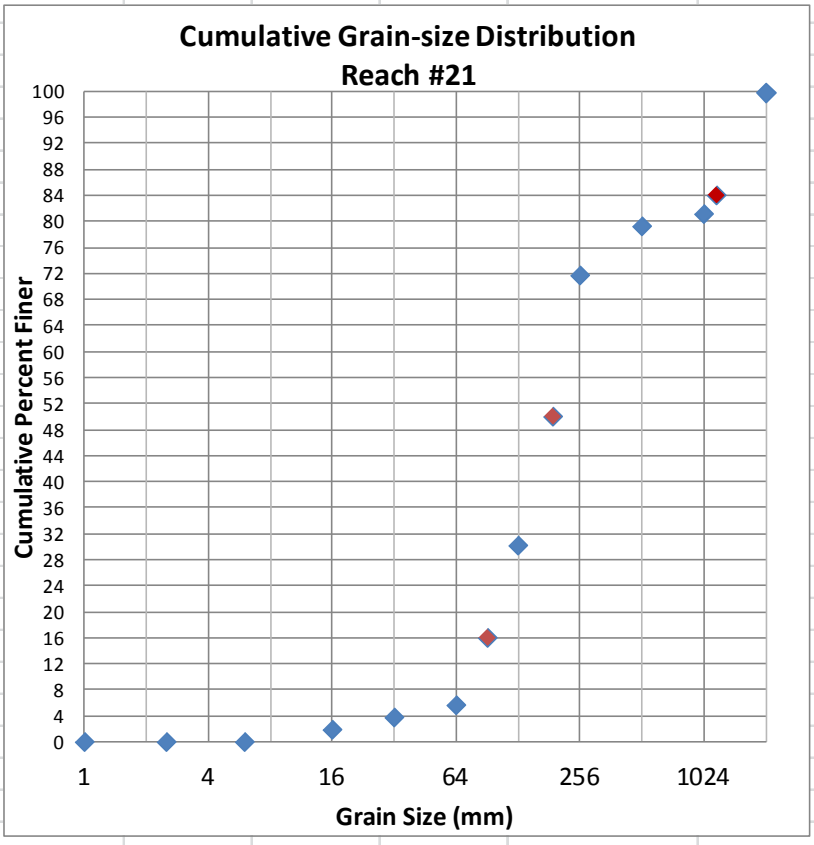
Interpolated		
Cumulative %age		**Grain-size**
0		1
0		2.5
0		6
0		16
1.8		32
16.0	0.9	59.7
18.2		64
43.6		128
50.0	0.2	150.5
80		256
84.0	0.2	307.2
100		512
100		1024
100		2048



Reach # 21

Wetted Width					
Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size
		0	0.0	0.0	1
		0	0.0	0.0	2.5
		0	0.0	0.0	6
	1	1	1.9	1.9	16
	1	1	1.9	3.8	32
	1	1	1.9	5.7	64
4	9	13	24.5	30.2	128
4	18	22	41.5	71.7	256
1	3	4	7.5	79.2	512
	1	1	1.9	81.1	1024
3	7	10	18.9	100	2048
		53	100		

Interpolated		
Cumulative %age		Grain-size
0		1
0		2.5
0		6
1.9		16
3.8		32
5.7		64
16.0	0.4	91.0
30.2		128
50.0	0.5	189.1
71.7		256
79.2		512
81.1		1024
84.0	0.2	1179.6
100		2048



Reach # 22					
Wetted Width					
Outside	Inside	Sum	Percent	Cumulative Percentage	Grain Size
		0	0.0	0.0	1
		0	0.0	0.0	2.5
	1	1	1.9	1.9	6
	1	1	1.9	3.8	16
		0	0.0	3.8	32
5	9	14	26.4	30.2	64
7	10	17	32.1	62.3	128
3	15	18	34.0	96.2	256
	2	2	3.8	100.0	512
		0	0.0	100.0	1024
		0	0.0	100	2048
		53	100		

Interpolated		
Cumulative %age		Grain-size
0		1
0		2.5
1.9		6
3.8		16
3.8		32
16.0	0.5	46.8
30.2		64
50.0	0.6	103.5
62.3		128
84.0	0.6	209.9
96.2		256
100		512
100		1024
100		2048

