Boise-Mores Creek Watershed

TMDL Five-Year Review

Hydrologic Unit Code 17050112

State of Idaho
Department of Environmental Quality
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Acknowledgments

This document is the result of collaboration between Chase Cusack, Stephanie Jenkins, Cory Sandow, Graham Freeman, and Josh Shultz.

Prepared by
Chase Cusack
Idaho Department of Environmental Quality
Boise Regional Office
1445 North Orchard St.
Boise, Idaho, 83706

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Abbreviations, Acronyms, and Symbols

§	section (usually a section of federal or state rules or statutes)
§303(d)	refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section
AU	assessment unit
BAG	basin advisory group
BLM	United States Bureau of Land Management
BURP	Beneficial Use Reconnaissance Program
C	Celsius
CFR	Code of Federal Regulations (refers to citations in the federal administrative rules)
COLD	cold water aquatic life
CWA	Clean Water Act
DEQ	Idaho Department of Environmental Quality
DO	dissolved oxygen
DWS	domestic water supply
E. coli	*Escherichia coli*
EPA	United States Environmental Protection Agency
ft^2	square feet
GIS	geographic information system
IDAPA	Refers to citations of Idaho administrative rules
L	liter
mg	milligram
mL	milliliter
mm	millimeter
MOS	margin of safety
NTU	nephelometric turbidity unit
PCR	primary contact recreation
RCD	resource conservation and development
SEI	Streambank Erosion Inventory
SS	salmonid spawning
TMDL	total maximum daily load
WAG	watershed advisory group
WEPP	Water Erosion Prediction Project

Executive Summary

This 5-year review of the *Boise-Mores Creek Watershed Subbasin Assessment and Total Daily Maximum Loads* (DEQ 2009) addresses water bodies in the subbasin in Category 4a of Idaho's most recent Integrated Report (DEQ 2017). The review complies with Idaho Code §39-3611(7) and describes current water quality status, pollutant sources, and recent pollution control efforts in the subbasin.

Subbasin at a Glance

The Boise-Mores Creek subbasin is located in southwestern Idaho, east of Boise, Idaho. The subbasin includes Mores Creek, Grimes Creek, and all tributaries upstream to the headwaters. It also includes Lucky Peak and Arrowrock Reservoirs, and the Middle Fork Boise River to the confluence of the North Fork Boise River. The subbasin is approximately 397,330 acres, and except for 83,925 acres of private land and 53,039 acres of state land, the subbasin is federally owned and administered. The watershed lies within hydrologic unit code 17050112, and contains 31 assessment units. Predominantly in Boise County, the watershed also extends to Ada and Elmore Counties. Idaho City and Placerville are the only recognized cities in the watershed, but numerous subdivided areas with second, summer, or recreational homes are located throughout. Extensive access is provided by US Forest Service-maintained roads and roads owned or maintained by counties.

Key Findings

The total maximum daily loads (TMDLs) for this subbasin are shown in Table A and address temperature and sediment impairments. In 2016, DEQ revisited shade curves developed for the 2009 TMDL and used the latest PNV-style analysis to update the shade curves. Another TMDL will be prepared to address the updated shade analysis. This review includes only TMDLs impacted by sediment and *Escherichia coli* (*E. coli*).

Changes in Subbasin

No significant changes in the watershed related to land use and development have occurred; however, major fires in 2013 and 2016 could impact stream water quality in the Boise-Mores Creek subbasin. Future 5-year reviews and associated monitoring efforts in the Boise-Mores Creek subbasin will help document the impacts of fires on water quality. Implementation projects occurring throughout the watershed have reduced the amount of sediment reaching listed water bodies. Current data indicate that water quality is largely static in impaired streams.

Table A. Existing TMDLs and general status.

Assessment Unit Name	Assessment Unit Number	Pollutants	TMDL Approval Year	Water Quality Trend
Mores Creek	ID17050112SW009_02 ID17050112SW009_03 ID17050112SW009_04 ID17050112SW009_06	Temperature, sediment	2010	Static
Smith Creek	ID17050112SW010_02	Temperature	2010	Static
Thorn Creek	ID17050112SW011_02 ID17050112SW011_03	Temperature	2010	Static
Elk Creek	ID17050112SW012_02 ID17050112SW012_03	Temperature	2010	Static
Grimes Creek	ID17050112SW013_02 ID17050112SW013_03 ID17050112SW013_04 ID17050112SW013_05	Temperature, sediment	2010	Static
Macks Creek	ID17050112SW015_02	Temperature	2010	Static
Daggett Creek	ID17050112SW016_02 ID17050112SW016_03	Temperature	2010	Static
Robie Creek	ID17050112SW017_02 ID17050112SW017_03	Temperature	2010	Static

TMDL Analysis

The targets for streambank stability and depth fines are largely accepted values used in multiple TMDLs across Idaho (DEQ 2003a). The turbidity targets assigned to suction dredging are based on water quality standards. The *E. coli* load allocation is set by Idaho water quality standards. Data indicate streambank targets are being met and are not a major source of sediment to the subbasin. The largest sediment source is from historic, hydraulically mined areas that continue to erode in mass wasting events. The depth fines target addresses this sediment source but is not being met. The Idaho Department of Environmental Quality (DEQ) will continue to model appropriate sediment sources within the watershed and compare the data to previous Water Erosion Prediction Project (WEPP) modeling results.

Review of Beneficial Uses

Current data do not suggest any changes to either designated or presumed uses, and no changes to listed pollutants or AUs are recommended in the next Integrated Report (Table B). Sediment/siltation, temperature, and bacteria continue to cause impairment to waters in the subbasin.

Data collected through DEQ's Beneficial Use Reconnaissance Program suggests salmonid spawning is an appropriate designated use. In this review, DEQ identifies water bodies in the subbasin that must be protected through appropriate use designations to ensure the availability and suitability of spawning habitat.

Table B. Summary of recommended changes for AUs evaluated.

Assessment Unit Name	Assessment Unit Number	Pollutant	Recommended Changes to Next Integrated Report
Lucky Peak Lake—Robie Creek swim beach area	ID17050112SW001L_0La	*E. coli*	No change
Mores Creek—1st and 2nd order	ID17050112SW009_02	Sedimentation/siltation, temperature	No change
Mores Creek—3rd order (Hayfork Creek to Elk Creek)	ID17050112SW009_03	Sedimentation/siltation, temperature	No change
Mores Creek—4th order (Elk Creek to Grimes Creek)	ID17050112SW009_04	Sedimentation/siltation, temperature	No change
Mores Creek—6th order (Grimes Creek to mouth)	ID17050112SW009_06	Sedimentation/siltation, temperature	No change
Grimes Creek—4th order (Clear Creek to Granite Creek)	ID17050112SW013_04	Sedimentation/siltation, temperature	No change
Grimes Creek—5th order (Granite Creek to mouth)	ID17050112SW013_05	Sedimentation/siltation, temperature	No change

Water Quality Criteria

Beneficial uses are protected by a set of water quality criteria, including *numeric* criteria for pollutants such as bacteria, dissolved oxygen, pH, ammonia, temperature, and turbidity, and *narrative* criteria for pollutants such as sediment and nutrients (IDAPA 58.01.02.250–251) (Table C).

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

Surface Water Quality Criteria[a]				
Beneficial Uses				
	Recreation		**Cold Water Aquatic Life**	**Salmonid Spawning**
	Primary Contact	**Secondary Contact**		
***E. Coli* Bacteria (*Organisms*/100 milliliters)**				
Geometric mean	< 126	< 126	—	—
Single sample	≤ 406	≤ 576	—	—
Public beach single sample	≤ 235	—		
Turbidity (Nephelometric Turbidity Unit [NTU])				
Instantaneous	—	—	≤ 50 NTUs above background	≤ 50 NTUs above background
10-day consecutive	—	—	≤ 25 NTUs above background	≤ 25 NTUs above background

a. Water Quality Standards (IDAPA 58.01.02.250–251)

DEQ's procedure to determine whether a water body fully supports designated and existing beneficial uses is outlined in IDAPA 58.01.02.050.02. The procedure relies on biological parameters and is presented in the *Water Body Assessment Guidance* (DEQ 2016a). This guidance requires DEQ to use the most complete data available to make beneficial use support status determinations.

Implementation Activities

Water quality improvement projects were implemented during and after TMDL development. DEQ funded Clean Water Act §319 grants, managed by Trout Unlimited and West Central Highlands Resource Conservation and Development. Grants awarded in 2007, 2009, and 2011 funded major restoration projects throughout the watershed, including bank stabilization, riparian plantings, sediment retention basins, and stabilization of eroding hillslopes from historic mining activities. DEQ staff conducted field visits to several project locations and reported that the projects appeared to be functioning as intended. The restoration activities removed and reduced sediment loads and increased shade to water bodies in the subbasin.

No formal implementation plan has been drafted by a designated management entity involved in the TMDL, and the lack of a formal implementation plan makes it difficult to assess the success of meeting any prescribed goals. The subbasin and the success of the TMDL would benefit from an implementation plan, but many of the parties involved during TMDL development and initial implementation have dissolved. Any future plan depends on reforming an active watershed advisory group (WAG).

Recommendations for Further Action

DEQ should work with a reestablished WAG and coordinating agencies to develop a formal implementation plan and outline the next steps to improve water quality and meet the TMDL targets. To fill the data gaps and identify and quantify sediment sources, DEQ should monitor turbidity and possibly total suspended sediment around highly erosive, historic hydraulically mined areas known to be significant sources of sediment. DEQ will continue to model appropriate sediment sources within the watershed and compare the data to previous WEPP modeling results. Future sediment monitoring and/or modeling will be incorporated in the next 5-year review.

DEQ may conduct a thorough investigation into the source of *E. coli* contamination at the Robie Creek swim beach area using deployable conductivity meters or another tracking method to isolate the source of bacteria.

1 Introduction

This 5-year review addresses seven assessment units (AUs) in the Boise-Mores Creek subbasin placed in Category 4a of Idaho's most recent federally approved Integrated Report (DEQ 2017), or are informational total maximum daily loads (TMDLs).

For each pollutant of concern in the Boise-Mores Creek subbasin, a TMDL was developed to improve water quality by limiting pollutant loads. TMDLs are water body- and pollutant-specific. Based on the original subbasin assessment and TMDLs from the *Boise-Mores Creek Watershed Subbasin Assessment and Total Maximum Daily Loads* (DEQ 2009), this TMDL 5-year review evaluates current water quality data, the appropriateness of the TMDL to current watershed conditions, and any available implementation plans.

The Boise-Mores Creek subbasin (hydrologic unit code 17050112, 31 AUs) is located in southwestern Idaho, east of Boise, Idaho (Figure 1). The subbasin includes Mores Creek, Grimes Creek, and all tributaries upstream to the headwaters. It also includes Lucky Peak and Arrowrock Reservoirs, and the Middle Fork Boise River to the confluence of the North Fork Boise River. The subbasin is approximately 397,330 acres, and except for 83,925 acres of private land and 53,039 acres of state land, the subbasin is federally owned and administered. Predominantly in Boise County, the watershed also lies in Ada and Elmore Counties. Idaho City and Placerville are the only recognized cities in the watershed, but numerous subdivided areas with second, summer, and recreational homes are located throughout. Extensive access is provided by US Forest Service-maintained roads and roads owned or maintained by counties.

1.1 Public Involvement

The watershed advisory group (WAG) involved in developing the original TMDL and the implementing watershed restoration projects has dissolved. Initial contact using the original WAG email list was made on April 4, 2016. Due to the unsuccessful reformation of the Boise-Mores Creek WAG, the Boise-Mores Creek watershed TMDL and 5-year review were presented to the Southwest Basin Advisory Group (BAG). On October 18, 2017, Mark Shumar and Cory Sandow of the Idaho Department of Environmental Quality (DEQ) presented the updated material to the Southwest BAG.

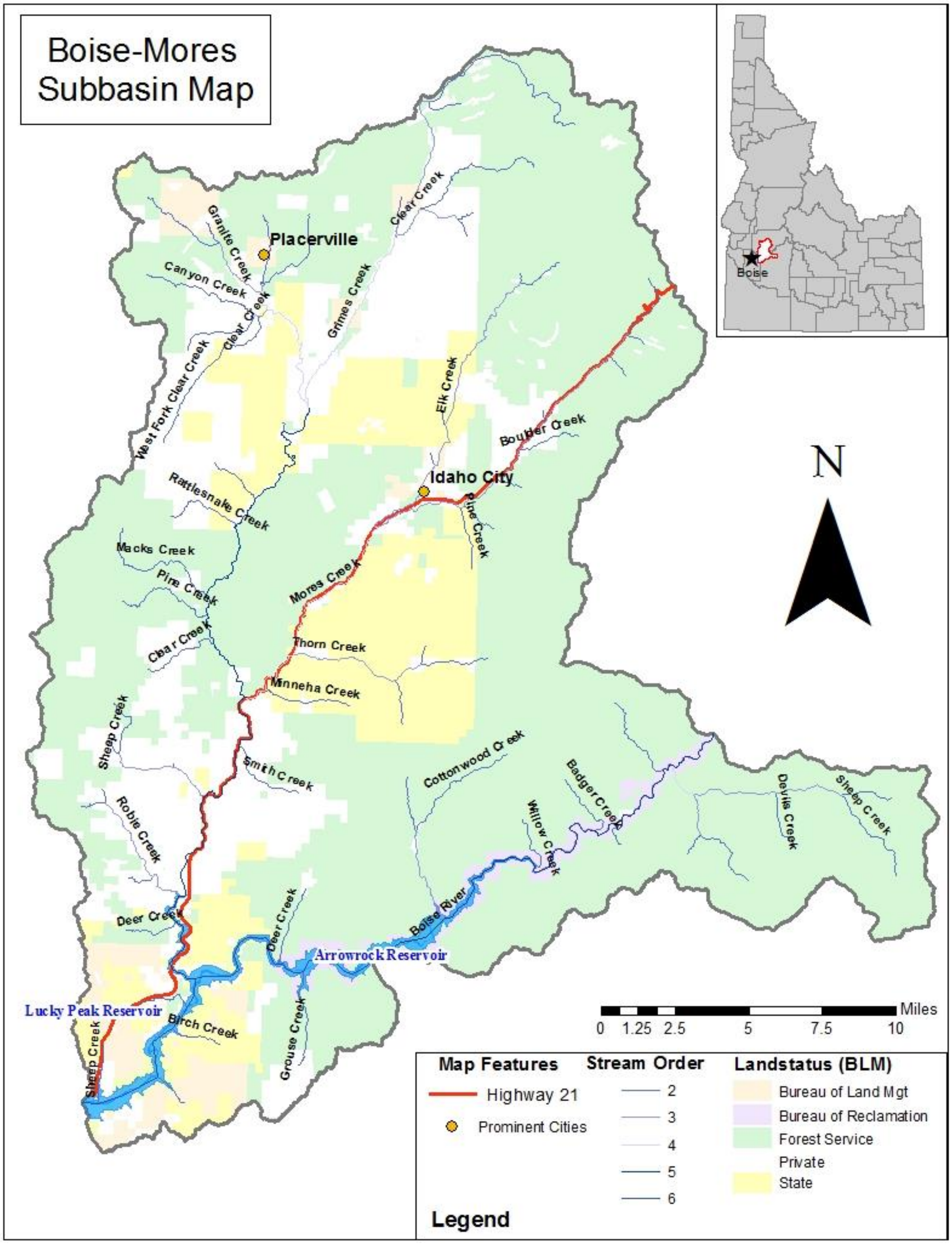

Figure 1. Boise-Mores Creek subbasin map.

1.2 Regulatory Requirements

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 CWA §303, 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 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.

This report documents the review of the *Boise-Mores Creek Watershed Subbasin Assessment and Total Maximum Daily Loads* (DEQ 2009), considers the most current and applicable information in conformance with Idaho Code §39-3607, evaluates the appropriateness of the TMDL to current watershed conditions, and consults with the WAG. An evaluation of the recommendations presented is provided. Final decisions for TMDL modifications are decided by the DEQ director. Approval of TMDL modifications is decided by the US Environmental Protection Agency, with consultation by DEQ.

Water bodies are tracked and assessed by AU. AUs are groups of similar streams that have similar land use practices, ownership, or land management. Stream order, however, is the main basis for determining AUs—even if ownership and land use change significantly, an AU 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

DEQ collected data in 2015 to assess sediment and *Escherichia coli* (*E. coli*) targets in the 2009 TMDL and quantify improvements in water quality. The Boise-Mores Creek watershed subbasin assessment and TMDLs (DEQ 2009) were approved in 2010 and currently serve as the only subbasin assessment and TMDL written for the subbasin. Streams, AUs, pollutants, and targets, included in Table 1, currently have sediment and/or bacteria TMDLs and are in Category 4a of the Integrated Report (DEQ 2017).

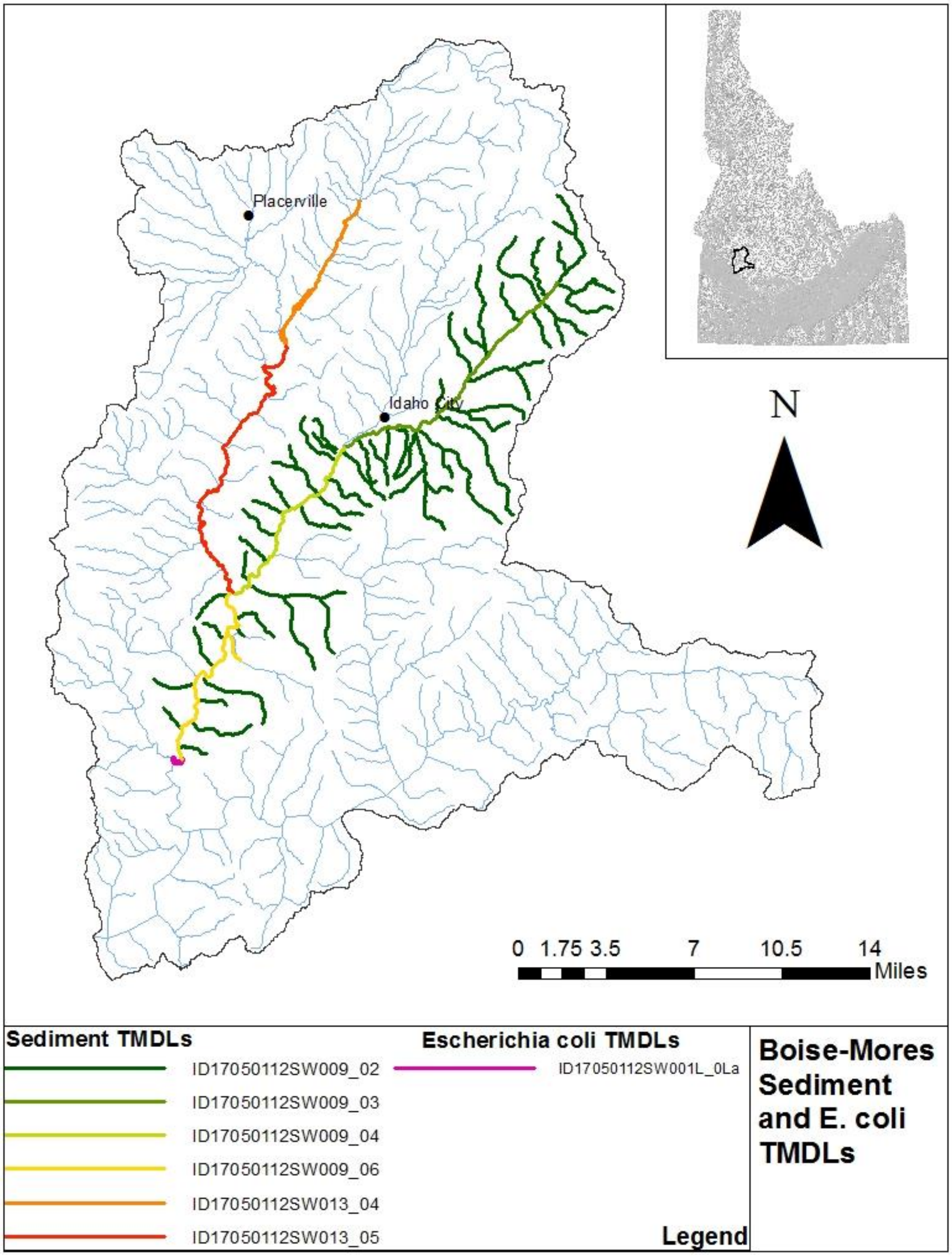

Figure 2. Boise-Mores Creek watershed existing TMDLs for assessed AUs; all AUs shown have sediment TMDLs, except ID1705112SW001L_0La.

Table 1. Applicable TMDL targets.

Assessment Unit Name	Assessment Unit Number	Pollutant	Numeric Target	Narrative Target	Critical Period	Relevant TMDL
Lucky Peak Lake—Robie Creek Swim Beach	ID17050112SW001L_0La	*E. coli*	126 organisms/ 100 mL	—	May–Aug	TMDL ID 38234
Mores Creek	ID17050112SW009_02	Sediment		80% bank stability, 28% fines, NTU[a] dredge days, WEPP models	Year-round	TMDL ID 38234
	ID17050112SW009_03	Sediment		80% bank stability, 28% fines, NTU, dredge days, WEPP models	Year-round	TMDL ID 38234
	ID17050112SW009_04	Sediment		80% bank stability, 28% fines, NTU, dredge days, WEPP models	Year-round	TMDL ID 38234
	ID17050112SW009_06	Sediment		80% bank stability, 28% fines, NTU, dredge days, WEPP models	Year-round	TMDL ID 38234
Grimes Creek	ID17050112SW013_04	Sediment		80% bank stability, 28% fines, NTU, dredge days, WEPP models	Year-round	TMDL ID 38234
	ID17050112SW013_05	Sediment		80% bank stability, 28% fines, NTU, dredge days, WEPP models	Year-round	TMDL ID 38234

a. The target requires turbidity below any mixing zone shall not exceed background turbidity by more than 5 nephelometric turbidity units (NTUs) when background turbidity is below 50 NTUs. Turbidity below any applicable mixing zone shall not exceed background turbidity by more than 10% when background turbidity is more than 50 NTU. Turbidity shall not exceed 25 NTUs above background for more than 10 consecutive days.
Notes: milliliter (mL); Water Erosion Prediction Project (WEPP)

Temperature TMDLs will be revised in a separate TMDL for Mores Creek—all 1st- and 2nd-order tributaries from the source to Lucky Peak Reservoir; one 4th-order tributary of Mores Creek (Thorn Creek); and Grimes Creek—all 1st- and 2nd-order tributaries, including the 3rd-order segment of Smiths Creek and Granite Creek to Lucky Peak Reservoir.

2.1 Pollutant Targets

2.1.1 Sediment

Idaho's water quality standard (IDAPA 58.01.02) for sediment is a narrative, so no specific quantitative value is established for the contaminant in Idaho rules. While nonnumeric standards are challenging to interpret and apply on a case-by-case basis, they allow flexibility and can be adapted to specific water bodies. Water bodies throughout Idaho exhibit a great degree of variability in their ability to assimilate sediment and maintain their beneficial uses. Typically, similar streams within the watershed provide guidelines for setting sediment targets. The Boise-Mores Creek subbasin has been highly altered and disturbed due to extensive mining. Consequently, no reference streams exist within the subbasin in regards to sediment loads and erosion rates. The Boise-Mores Creek sediment TMDL contains three separate TMDL targets intended to address disparate sources of sediment (Table 2). The TMDL contains bank stability, depth fines, and turbidity targets.

One major source of sediment in impaired streams is instream erosion that results from eroding banks caused by a lack of riparian vegetation. Literature values, along with approved sediment TMDLs in Idaho, suggest that bank stability of 80% or greater is considered background and should support beneficial uses (DEQ 2003a). Streams can assimilate sediment and maintain support of beneficial uses when bank stability is between 80% and 100%, while streams with less than 80% bank stability are subject to increased rates of sedimentation. In streams where sources of sediment are not apparent, the source of sediment is typically from bank erosion. The Boise-Mores Creek TMDL assigned an 80% bank stability target to all water bodies listed for sediment impairment.

The Boise-Mores Creek TMDL depth fines target was used to assess and protect salmonid spawning gravels. High proportions of fine sediment are detrimental to spawning gravels and can reduce the quality of the sites by filling in the interstitial spaces or eliminating them altogether. Stream substrate sediment size composition has been shown to directly influence spawning success, egg survival to emergence, rearing habitat, and fish escapement from streambed spawning gravels. The component of subsurface fine sediment (<6.35 millimeters [mm]) must be reduced to a 5-year mean below 28%, with no individual year to exceed 29%, to achieve suitable habitat for salmonid survival (DEQ 2003a). This target is the most critical because it can indicate other sources of sediment in the watershed are not coming from the streambanks.

The sediment TMDL included targets for turbidity related to suspension of introduced sediment and resuspension of bedload due to flow or activities such as suction dredging. The target requires turbidity below any authorized mixing zone shall not exceed background turbidity by more than 5 nephelometric turbidity units (NTUs) when background turbidity is below 50 NTUs. Turbidity below any applicable mixing zone shall not exceed background turbidity by more than 10% when background turbidity is more than 50 NTU. Finally, turbidity shall not exceed 25 NTUs above background for more than 10 consecutive days. This target is very difficult to monitor and assess compliance and requires sampling during high flows or precipitation events.

Table 2. Pollutant targets established for the Boise-Mores Creek subbasin.

Assessment Unit Name	Assessment Unit Number	Pollutant	Parameter	Numeric Target
Lucky Peak Lake—Robie Creek Swim Beach	ID17050112SW001L_0La	*E. coli*	Geometric mean	126 organisms/ 100 mL
Mores Creek	ID17050112SW009_02	Sediment	Turbidity	80% bank stability, 28% fines, NTU, dredge days, WEPP models
	ID17050112SW009_03	Sediment	Turbidity	80% bank stability, 28% fines, NTU, dredge days, WEPP models
	ID17050112SW009_04	Sediment	Turbidity	80% bank stability, 28% fines, NTU, dredge days, WEPP models
	ID17050112SW009_06	Sediment	Turbidity	80% bank stability, 28% fines, NTU, dredge days, WEPP models
Grimes Creek	ID17050112SW013_04	Sediment	Turbidity	80% bank stability, 28% fines, NTU, dredge days, WEPP models
	ID17050112SW013_05	Sediment	Turbidity	80% bank stability, 28% fines, NTU, dredge days, WEPP models

2.1.2 E. coli

The Idaho water quality standard for *E. coli* is 126 organisms per 100 milliliters (organisms/100 mL). Water bodies should not have *E. coli* bacteria concentrations exceeding a geometric mean of 126 organisms/100 mL based on a minimum of 5 samples taken every 3–7 days over a 30-day period.

The standards for primary and secondary contact recreation are the same as is the standard for public swimming beaches; however, each has a different trigger value for follow-up 30-day geometric mean monitoring. When the single sample maximums are exceeded, additional monitoring is required to produce a 30-day geometric mean to assess compliance with the standard.

Water bodies recognized as public swimming beaches, such as the Robie Creek swim beach area, have the most conservative trigger value and require follow-up monitoring when single samples exceed 235 organisms/100 mL. Single sample counts above this value are used when considering beach closures. Water bodies designated for primary contact recreation require follow-up monitoring when single sample results exceed 406 organisms/100 mL. Finally, water bodies with the beneficial use of secondary contact recreation require additional monitoring when single sample results exceed 576 organisms/100 mL.

2.2 Control and Monitoring Points

2.2.1 Sediment

The source of sediment is disparate throughout the watershed and has a varied effect on beneficial uses. For that reason, there are no specified control and monitoring points for bank stability or the depth fines targets. The turbidity target is prescribed as monitored 500 feet downstream of active suction dredging operations, which DEQ believes is an adequate mixing zone for addressing turbidity increases.

The 2009 TMDL recommended performing a Streambank Erosion Inventory (SEI) at the original sites if possible to directly compare improvement rates; however, it is more important to select an appropriate monitoring location. SEIs should be performed on representative stream reaches. A representative reach should have land use, rates of erosion, and geology similar to the water body as a whole. Additionally, an SEI should encompass a minimum of 10% of the entire AU length. For this 5-year review, it was possible to perform SEIs at the original sites from the 2009 TMDL. These locations remain representative of the overall AU and will provide a direct comparison over time to assess changes in stability.

Because streams are dynamic systems and spawning gravels move in response to flow events, there were no prescribed monitoring locations for instream sediment targets. DEQ recommended collecting McNeil core samples at the downstream end of each AU in spawning gravel. McNeil cores quantify the amount of fine sediment found in a 6-inch depth of gravel. Excessive sediment adversely impacts the quality of spawning gravel, so the sites should be located in potential spawning gravel beds to ensure a good measure of the quality and suitability of gravel beds for spawning. Data for this review were collected at the downstream locations of each AU and are assumed to represent the conditions throughout the AU and loads occurring throughout the reach.

Theoretical monitoring points for turbidity are during high flow and precipitation events, or downstream of active suction dredges. The monitoring locations for turbidity are difficult to locate and challenging to assess for attainment. No suction dredging activities have been monitored to assess compliance with the TMDL.

2.2.2 E. coli

Only one AU has a TMDL for *E. coli* impairment. The impairment location and control point is the Robie Creek swim beach area at Lucky Peak Reservoir. The Robie Creek swim beach is popular area and should be monitored on a regular basis during the recreation season. It is critical that sampling occur within the public swimming area and not outside of it to accurately define the *E. coli* load in that area. This location is appropriate for *E. coli* monitoring as the beach experiences high recreation use and has annual *E. coli* exceedances and beach closures.

DEQ and the US Army Corps of Engineers monitor this area annually for *E. coli* exceedances. Monitoring typically begins at the beginning of the recreation season (May/June) and occurs throughout the summer. Monitoring revealed routine exceedances of the public swimming beach criteria, resulting in *E. coli* public health advisories posted on an annual basis.

2.3 Load Capacity

The load capacity is "the greatest load a water body can receive without violating water quality standards" (40 CFR 130.2). Seasonal variations and a margin of safety (MOS) to account for uncertainty are considered within the load capacity. Likely sources of uncertainty include lack of knowledge of assimilative capacity, uncertain relationship of selected targets to beneficial uses, and variability in target measurement.

The load capacity estimates the quantity of pollutant a water body is believed to be able to receive and still support beneficial uses and meet water quality standards. Load capacities for specific pollutants and water bodies are covered in the following sections.

2.3.1 Sediment

The total sediment load capacity for the Boise-Mores Creek subbasin was estimated to be 6,958 tons/year. Table 3 outlines the sediment load capacity for the Boise-Mores Creek subbasin that was developed during the original TMDL using the WEPP model and 80% streambank stability and suction dredging estimates. Within the sediment load allocation, there is likely uncertainty in the calculation related to suction dredging. During TMDL development, the extent of suction dredging was unknown and the load allocation was patterned after the South Fork Clearwater River TMDL (DEQ 2003b). At this time, no additional information has been obtained to further clarify the load allocation that should be assigned to suction dredging.

The WEPP model was used to calculate sediment load allocations in the original TMDL, in addition to literature related to bank stability and erosion rates and approved sediment TMDLs in Idaho. Sources of sediment in a watershed are varied and depend on land use.

DEQ employed the US Forest Service WEPP model to determine the load capacity estimate for forested land, urban land, and paved and unpaved roads in the watershed (Table 3). This model uses total land area multiplied by an erosion coefficient to estimate the total amount of sediment eroded by the specific land type. Sediment erosion for land types using this model are some of the most accurate sediment estimates of the TMDL and remain valid to date. The total load capacity for surface erosion in the watershed is 6,958 tons of sediment per year.

The load capacity for sediment from streambank erosion in the Boise-Mores Creek TMDL is based on the assumption that the natural background stability of streambanks is 80%, and 20% of the bank may be contributing sediment to the stream. It was assumed that beneficial uses will be supported at this level. A key component of the bank stability calculation is the erosion and recession rates, which determine the total erosion rate for the entire AU. In estimating load capacity, it was assumed that all upstream tributaries that were supporting their beneficial uses were also meeting the 80% bank stability. The 80% bank stability and the amount of sediment generated from 20% eroding banks serves both as the streambank load capacity and the TMDL target. Reference streams in the subbasin are absent as a result of historic mining.

Suction dredging occurs throughout the watershed and requires a permit, but the permit does not require the user to report location or number of hours. No site-specific determination of the assimilative capacity for sediment-impaired streams in the Boise-Mores Creek subbasin has been made. Suction dredging is very difficult to evaluate from a load perspective. It does not introduce new sediment into the stream but re-suspends existing bedload. The key is to not cause high turbidity, so turbidity targets use NTU measurements or NTU/total suspended sediment relationships. Turbidity measures should be used as targets for 5-year reviews and compliance with TMDLs.

If the streambank stability targets are later met and a sufficient amount of time and high flow events have failed to remove and flush the existing instream sediment from the system, the overall load capacity for sediment may need to revisited. At this time, the load capacity estimates remain valid and do not need revision.

Table 3. Load capacity estimates from WEPP model used in the 2009 TMDL.

Source	Load Capacity Estimate (tons/year)
Forest	2,154
Urban	7
Unpaved roads	129
Paved roads	10
Streambank erosion	2,152
Historic hydraulically mined areas	187
Additional assimilated load (allocations for suction dredge industry and margin of safety)	2,319
Watershed Total	**6,958**

2.3.2 E. coli

The load capacity for *E. coli* bacteria in a water body is based on the Idaho water quality standard of 126 organisms/100 mL. The load capacity is expressed as a concentration (organisms/100 mL) because it is difficult to calculate a mass load due to several variables (i.e., temperature and water volume) that influence growth and die-off rate of *E. coli* in the environment. It is more meaningful and tangible to consider bacteria load capacity in terms of a concentration.

The Robie Creek swim beach is subject to sudden and significant changes in water levels as reservoir levels change throughout the irrigation season. Changes in water levels can increase *E. coli* levels by concentrating bacterial sources near shorelines. No changes are recommended to the *E. coli* load capacity.

2.4 Load Allocations

An allocation is the portion of a water body’s load capacity for a given pollutant that is allocated to a particular nonpoint source (load allocation) or existing or future point source (wasteload allocation).

2.4.1 Sediment

Sediment load and wasteload allocations were developed for nonpoint and point sources using the WEPP model and other load criteria. Table 4 details the existing sediment load estimates and subdivides the point and nonpoint sources to specific sources. Table 4 provides the 2009 TMDL allocations and the associated necessary percent reduction. The WEPP model and TMDL did not assign sediment load allocations to specific water bodies but rather assigned a load allocation for sediment to the watershed as a whole.

The largest nonpoint sources of sediment come from forested land and historic, hydraulically mined areas. Little sediment is coming from the streambanks, suggesting efforts should be focused on restoring historically mined areas and minimizing erosion of forested areas. SEIs performed in 2009 and 2015 confirm that streambanks contribute minimal sediment loads. Once the largest sources of sediment are addressed, the areas are restored, and sediment erosion is minimized, other sediment sources (suction dredging) should be looked at more carefully if beneficial uses are not supported.

A sediment wasteload allocation was reserved for a future wastewater treatment facility in Idaho City. At this time, the reserve wasteload allocation is unneeded and is included in the overall sediment wasteload allocation. Suction dredging occurs throughout the watershed and is unique in that it does not contribute new sediment to the stream from outside the stream channel. However, the re-suspended sediment mobilizes previously deposited material and sends it downstream where it may settle in spawning gravels. The overall percent reduction for suction dredging throughout the watershed is estimated at 26%. Overtime, this estimate may need to be revised as other reductions have been met.

Table 4. Boise-Mores Creek subbasin load allocations.

Source	Existing Load (2009) (tons/year)	Load/Wasteload Allocation (tons/year)	Percent Reduction
Nonpoint Sources			
Forest	3,231	2,154	33
Urban	24	7	71
Unpaved roads	627	129	79
Paved roads	47	10	79
Streambank erosion	868	2,152	0
Historic hydraulic mining	1,301	187	85.7
Point Sources			
Wastewater treatment discharge	0	8	0
Grimes Creek (suction dredge)	1,568	878	—
Mores Creek (suction dredge)	157	626	—
Elk Creek (suction dredge)	471	111	—
Suction dredge total	2,196	1,615	26
Margin of safety	—	696	—
Watershed Total	**8,300**	**6,958**	**25**

2.4.2 E. coli

The Robie Creek swim beach area at Lucky Peak Reservoir is the only AU impacted by bacteria. No point sources of bacteria exist within the watershed. Several potential nonpoint sources of bacteria exist including on-site restroom facilities, geese and other wildlife, septic systems, and domestic animals. To date, no definitive source of bacteria has been identified. Table 5 details the load capacity, load allocation, existing *E. coli* load identified in the 2009 TMDL and *E. coli* levels identified in the most recent year of data collection (2015). Current loads were compromised by sample timing issues. It is unclear if levels would be below the load capacity.

Table 5. Bacteria loads at Robie Creek swim beach area.

Location (Control Point)	Load Capacity (organisms/100 mL)	Load Allocation	Existing Load (2009 TMDL) (organisms/100 mL)	Current Load (2015)
Luck Peak Reservoir at Robie Creek swim beach area	126	0	543	83–93

2.5 Margin of Safety

Because TMDLs have an inherent amount of uncertainty, a MOS is included. A MOS may be expressed as an implicit or explicit portion of a water body's load capacity that is reserved to account for the uncertainty about the relationship between the pollutant loads and the quality of the receiving water body. A MOS is not allocated to any particular source but to the pollutant itself.

2.5.1 Sediment

The sediment load capacity contains both an explicit and implicit MOS. An explicit 10% MOS (696 tons/year) is included in the sediment load capacity to account for model uncertainty and data gaps in the sediment load. In addition, an implicit MOS for the Boise-Mores Creek sediment TMDL is built in due to several conservative factors used in determining existing sediment loads. The WEPP-modeled reaches incorporated a MOS into the target by using conservative sediment delivery targets. Additionally, the sediment yield coefficients were selected based on the most erosive soil types in the watershed.

At this time, DEQ does not see a justification for adjusting the MOS for the sediment targets. However, the MOS may require adjustment in the future to accommodate more accurate sediment loads if load reductions are met and beneficial uses are not improving.

2.5.2 E. coli

The MOS applied to the bacteria TMDL is built into the load allocation through the 90th-percentile *E. coli* data as a conservative assumption when calculating the existing load. No other MOS was applied to the bacteria TMDL load calculation. No changes are recommended.

2.6 Seasonal Variation

2.6.1 Sediment

Sediment load to lotic systems is variable and seasonal by nature, especially in watersheds lacking point sources where loads highly depend on seasonal events. The majority of bank erosion and sediment delivery occurs during high runoff associated with snowmelt and spring rains. It is often difficult to monitor these events, so the sediment load analysis is based on sediment delivery from streambanks and upland sources over an entire year. Seasonal erosion and sediment load to listed water bodies is largely related to flow, spring runoff, and storm events, but bank stability, depth fines, and turbidity sediment targets do not consider seasonal variation. The use of these targets captures the overall seasonality of erosion and sedimentation occurring in the system.

2.6.2 E. coli

No seasonal variation is included in the *E. coli* TMDL. The risk of exposure to high *E. coli* levels peaks during the summer months when people are recreating on the water, and changes in water levels increase *E. coli* levels by concentrating bacterial sources near shorelines.

2.7 Reserve

The original TMDL included a sediment reserve for growth: "A reserve for growth wasteload allocation is included in this TMDL for future wastewater treatment facilities. Idaho City and several large subdivisions along Mores and Grimes Creeks are currently operating with rapid infiltration basins. Their capacity is expected to be exceeded in the near future based on current population growth estimates" (DEQ 2009).

Currently, the reserve for growth remains unused. No new treatment facilities have been or are planned in Idaho City, and the city still operates rapid infiltration basins. The reserve for growth will be retained until Idaho City uses it in a future wastewater facility upgrade.

No other reserve for growth was allocated for any other pollutant or source.

2.8 Changes to Subbasin Characteristics

No new point sources or Idaho Pollutant Discharge Elimination System permits have been approved, and no significant changes in the watershed related to land use and development have occurred that would result in a significant change in sediment or *E. coli* loads to listed streams with TMDLs.

However, major fires occurred in the subbasin in 2013 and 2016 that may impact water quality for years to come. Future 5-year reviews and associated monitoring efforts in the Boise-Mores Creek subbasin will help document the impacts of fires on water quality. Current data indicate water quality is largely static in the impaired streams, but implementation projects that occurred throughout the watershed have reduced the amount of sediment reaching listed water bodies.

3 Beneficial Use Status

Idaho water quality standards (IDAPA 58.01.02) list beneficial uses and set water quality goals for waters of the state. 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 uses, designated uses, and presumed uses and are described in more detail at *www.deq.idaho.gov/water-quality/surface-water/beneficial-uses*. The *Water Body*

Assessment Guidance (DEQ 2016a) provides a more detailed description of beneficial use identification for use assessment purposes.

Beneficial uses include the following:

- Aquatic life support—cold water, seasonal cold water, warm water, salmonid spawning, and modified
- Contact recreation—primary (e.g., swimming) or secondary (e.g., boating)
- Water supply—domestic, agricultural, and industrial
- Wildlife habitats
- Aesthetics

Water bodies in the Boise-Mores Creek subbasin are designated for salmonid spawning, cold water aquatic life, primary contact recreation, and drinking water; the remaining undesignated water bodies in the watershed are protected by the presumed beneficial uses of cold water aquatic life and primary or secondary contact recreation. At this time, all beneficial uses appear to be appropriate.

Streams for which TMDLs were developed in 2009 remain impaired for the original pollutants. While improvements within the watershed have resulted from implementing water quality improvement projects, opportunity remains to restore and remediate old, eroding, hydraulically mined areas where the majority of sediment originates. Remediation projects have not resulted in improvement to the subbasin or support of impaired beneficial uses.

The Robie Creek swim beach area remains impaired, with consistent closures during the summer. A permanent advisory sign is posted due to the frequency of maximum single sample *E. coli* standard violations for swimming beaches (section 3.2, Table 10). A site-specific study should be conducted to determine the source of *E. coli*. The beneficial uses at the beach will not be met until the source is determined.

Not enough improvement in water quality has resulted in the subbasin to positively affect the status of beneficial uses. Future attainment of beneficial uses depends on aggressive remediation of the eroding, historic hydraulically mined areas that contribute the majority of sediment to the watershed. The *E. coli* target cannot be met until the source of bacteria is identified and controlled.

3.1 Beneficial Uses

Beneficial uses of the water bodies included in this 5-year review are provided in Table 6. Mores Creek and tributaries are designated for salmonid spawning and cold water aquatic life along with primary contact recreation and drinking water supply. Thorn and Grimes Creeks do not have any use designations and are protected for the presumed uses of cold water aquatic life and primary or secondary contact recreation. Mack Creek is designated for salmonid spawning, cold water aquatic life, and primary contact recreation.

Table 6. Boise-Mores Creek subbasin beneficial uses of §303(d)-listed streams.

Assessment Unit Name	Assessment Unit Number	Beneficial Uses[a]	Type of Use
Mores Creek	ID17050112SW009_02	SS, COLD, PCR, DWS	Designated
Mores Creek	ID17050112SW009_03	SS, COLD, PCR, DWS	Designated
Mores Creek	ID17050112SW009_04	SS, COLD, PCR, DWS	Designated
Mores Creek	ID17050112SW009_06	SS, COLD, PCR, DWS	Designated
Grimes Creek	ID17050112SW013_04[b]	COLD, PCR	Presumed
Grimes Creek	ID17050112SW013_05[b]	COLD, PCR	Presumed

a. Cold water (COLD), salmonid spawning (SS), primary contact recreation (PCR), secondary contact recreation (SCR), domestic water supply (DWS)
b. The 2014 and 2016 Integrated Reports list SS as a presumed use for Grimes Creek 4th- and 5th-order streams. Those uses are not included in this table because they are incorrect and will be addressed in the next Integrated Report.

Beneficial uses are protected by a set of water quality criteria, which include *numeric* criteria for pollutants such as bacteria, dissolved oxygen, pH, ammonia, temperature, and turbidity (Appendix A), and *narrative* criteria for pollutants such as sediment and nutrients (IDAPA 58.01.02.250–251).

Narrative criteria for excess sediment are described in the water quality standards:

> Sediment shall not exceed quantities specified in Sections 250 and 252, or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determinations of impairment shall be based on water quality monitoring and surveillance and the information utilized as described in Subsection 350. (IDAPA 58.01.02.200.08)

3.2 Summary and Analysis of Current Water Quality Data

For this 5-year review, DEQ collected *E. coli* and sediment data (SEIs and McNeil cores) during 2015. No other recent water quality data were available. DEQ collected streambank erosion data at the same locations used in the original TMDL. Depth fines using McNeil cores were collected at the most downstream portion of an AU in spawning gravel. Bacteria data were collected at the Robie Creek swim beach area and at various locations upstream.

SEIs were done on water bodies listed for sediment in Category 4a of the Integrated Report. In an effort to fully quantify changes and improvements in bank stability on the listed AUs, DEQ returned to the survey locations used in the original 2009 TMDL. Seven AUs were surveyed on Grimes and Mores Creeks (Table 7). Original SEIs indicated the streambanks met the 80% target; a 2015 follow-up indicated that streambanks further stabilized, far surpassing the 80% target outlined in the TMDL. Erosive lengths of the AUs ranged from 0.3% to 5.9%. Conversely, all surveyed streambanks ranged from 94.1% to 99.7% stable.

Table 7. SEI results for 2015.

Water Body	Assessment Unit Number	Date	Reach Length (feet)	% Erosive Bank	Lateral Recession Rate (feet/year)	Total Bank Erosion Rate (tons/mile/year)
Mores Creek	ID17050112SW009_02	9/10/2015	2,050	0.3	0.0175	0.10
	ID17050112SW009_03	9/10/2015	2,461	0.7	0.01	0.02
	ID17050112SW009_04	9/10/2015	1,969	1.2	0.02	0.05
	ID17050112SW009_06	9/10/2015	911	0.9	0.0125	0.07
Grimes Creek	ID17050112SW013_03	9/11/2015	1,050	5.9	0.06	1.16
	ID17050112SW013_04	9/11/2015	1,312	5.9	0.0425	6.62
	ID17050112SW013_05	9/11/2015	1,854	2.9	0.015	1.96

DEQ examined depth fines in potential spawning gravels on four AUs on Grimes and Mores Creeks (Table 8). Each monitoring location consisted of three sample cores that were averaged for that location. The depth fines target identified in the TMDL is less than or equal to 28%. Depth fines are particles of 6.00 mm or less. None of the sites met the target of less than or equal to 28% depth fines.

These results can be expected in a watershed with sediment impairments, and this target is likely to be the last achieved. As sediment sources are reduced and eliminated, high flows will eventually flush remaining instream sediment through the system, improving spawning gravel habitat. While the TMDL was written with a target for streambank erosions and corresponding stability, the source of sediment impairing the streams in the Boise-Mores Creek subbasin does not come from the streambanks but from highly erosive, historic hydraulically mined areas. Some of the hydraulically mined areas have been addressed, but the remaining areas are likely the largest source of sediment to these streams. Further investigations to quantify sediment load in formerly hydraulically mined areas are warranted and should be investigated during the next review cycle.

Table 8. McNeil core results (2015–2016).

Assessment Unit Name	Assessment Unit Number	Date	Sample Size	% Fines <6.00 mm	Standard Deviation
Mores Creek, Elk Creek, Grimes Creek	ID17050112SW009_04	8/27/2015	3	36	0.02
Mores and Grimes Creeks to mouth	ID17050112SW009_06	7/15/2016	3	50	0.09
Grimes Creek to Granite Creek	ID17050112SW013_04	7/16/2015	3	31	0.02
Grimes Creek and Granite Creek to mouth	ID17050112SW013_05	7/15/2016	3	45	0.06

Additional data have been collected by DEQ’s Beneficial Use Reconnaissance Program (BURP) throughout the watershed dating back to 1993. Table 9 describes the BURP assessments performed since 2013 with assessment status.

Table 9. BURP assessments performed in Boise-Mores Creek subbasin since 2013.

BURP ID	Assessment Unit Name	Assessment Unit Number	Assessment Status
2013SBOIA003	Grimes Creek	ID17050112SW013_05	Sampled
2013SBOIA006	Granite Creek	ID17050112SW014_04	Sampled
2013SBOIA007	Elk Creek	ID17050112SW012_02	Sampled
2014SBOIA020	Elk Creek	ID17050112SW012_03	Sampled
2015SDEQA080	Daggett Creek	ID17050112SW016_03	Sampled
2015SBOIA012	Cottonwood Creek	ID17050112SW007_02	Sampled
2016SBOIA007	Mores Creek	ID17050112SW009_06	Sampled
2016SBOIA008	Granite Creek	ID17050112SW014_04	Sampled
2016SBOIA009	Ophir Creek	ID17050112SW014_02	Marshland
2018SBOIA005	Grimes Creek 2	ID17050112SW013_02	Sampled
2018SBOIA006	Grimes Creek 3	ID17050112SW013_03	Sampled
2018SBOIA007	South Fork Sheep Creek	ID17050112SW005_03	Sampled
2018SBOIA008	Browns Creek	ID17050112SW006_02	Sampled
2018SBOIA013	Grouse Creek	ID17050112SW003_02	Sampled
2018SBOIA014	Deep Creek	ID17050112SW002_02	Dry
2018SBOIA015	South Fork Gulch	ID17050112SW001_02	Dry
2018SBOIA016	Nibbler Creek	ID17050112SW002_02	Dry
2018SBOIA017	Nevins Creek	ID17050112SW002_02	Dry
2018SBOIA018	Trail Creek	ID17050112SW002_02	Dry
2018SBOIA019	Deer Creek	ID17050112SW008_02	Sampled
2018SBOIA038	Bannock Creek	ID17050112SW009_02	Sampled

Note: Assessment status: Sampled = data collected; Dry = no data collected, no water observed; Marshland = no data collected.

E. coli monitoring was performed during summer 2015 for this review and annually since 2009 at the Robie Creek swim beach and surrounding areas (Table 10). The Robie Creek swim beach suffers annual closures due to high levels of bacteria, but the specific source of bacteria has not been identified. Additional sites were monitored during 2015 to isolate the source of *E. coli* to the beach area. Samples were taken at Barclay Bay on Lucky Peak Reservoir, Mack's Creek on Lucky Peak Reservoir, Mores Park, Robie Creek boat launch, Robie Creek upstream of the park, and Robie Creek swim beach area.

Bacteria concentrations were fairly low at most locations with the exception of the Robie Creek boat launch, Robie Creek, and Robie Creek swim beach. Some sampling locations had insufficient data to calculate the 30-day geometric means for comparison to the water quality standards; however, the high counts would have likely violated standards if more sampling or correct sampling had been done. At this time, the water quality trend is static, with continued exceedances. Regular health advisories and a permanent sign at the swim beach informs the public about the water quality and hazards of *E. coli* bacteria.

Table 10. *E. coli* monitoring results for 2015.

Monitoring Location	Date	*E. coli* Concentration (organisms/100 mL)			
		Result	Duplicate	Blank	Geometric Mean
Barclay Bay Lucky Peak	06/03/15	4.1	—	—	—
Barclay Bay Lucky Peak	06/08/15	18.5	—	—	—
Barclay Bay Lucky Peak	06/22/15	1.0	—	—	—
Barclay Bay Lucky Peak	06/29/15	<1.0	—	—	—
Macks Creek Lucky Peak	06/03/15	7.5	—	—	—
Macks Creek Lucky Peak	06/08/15	13.5	—	—	—
Macks Creek Lucky Peak	06/22/15	6.3	—	—	—
Macks Creek Lucky Peak	06/29/15	14.6	—	—	—
Mores Park	06/02/15	26.2	25.3	—	—
Mores Park	06/08/15	45.7	63.1	—	—
Mores Park	06/11/15	28.5	—	<1.0	—
Mores Park	06/17/15	47.1	39.5	—	—
Mores Park	06/22/15	69.7	—	—	—
Mores Park	06/23/15	37.9	—	<1.0	40.2
Robie Boat Launch	06/23/15	39.7	—	—	—
Robie Boat Launch	06/29/15	1,986.3	—	—	—
Robie Boat Launch	07/02/15	67.6	—	—	—
Robie Boat Launch	07/07/15	59.8	—	—	—
Robie Boat Launch	07/13/15	55.7	—	—	112.2
Robie Creek	06/23/15	93.3	—	—	—
Robie Creek	06/29/15	81.6	158	—	—
Robie Creek	07/02/15	1,986.3	—	—	—
Robie Creek	07/07/15	410.6	—	—	—
Robie Creek	07/13/15	4,105.8	—	<1.0	—
Robie Creek	07/20/15	224.7	—	—	423
Robie Creek Beach	06/03/15	235.9	—	—	—
Robie Creek Beach	06/08/15	344.8	—	—	—
Robie Creek Beach	06/22/15	51.2	—	—	—
Robie Creek Beach	06/29/15	117.8	—	—	—
Robie Creek Beach	07/06/15	122.3	—	—	143 (34 days)
Robie Creek Beach	07/13/15	325.5	—	—	161 (36 days)
Robie Creek Beach	07/20/15	29.5	—	—	93.33
Robie Creek Beach	07/27/15	27.9	—	—	82.66
Individual Samples					
Robie Creek Larkspur	07/20/15	145.0	—	—	—
Robie Creek Mile Marker 4	07/20/15	23.3	—	—	—
Robie Creek Rock Canyon	07/20/15	36.4	—	—	—
Robie Creek Tallgate	07/20/15	140.1	—	—	—

Note: Some geometric means at the Robie Creek swim beach did not meet the 30-day time limit. The number of actual days is listed in parentheses.

To date, *E. coli* monitoring has been inconclusive, and the source of *E. coli* remains unknown. Potential sources are geese, on-site restroom facilities, pets, upstream septic systems, or domestic animals and other wildlife upstream on Robie Creek. The Lucky Peak State Park has a similar beach area with a similar amount of geese and consistently meets the *E. coli* criteria. Deployable conductivity meters or other source tracking methods could help identify leaking septic tanks and potential illicit sewer discharges along with nonpoint source pollution coming from domestic animals on the upstream portion of Robie Creek. Additionally, source tracking could be used to identify *E. coli* genetic markers at various locations on Robie Creek swim beach, Lucky Peak, and Robie Creek. This pollutant is the most challenging in the watershed as the exact source of the contamination is unknown. Health advisories occur annually at the Robie Creek swim beach, with closures occurring in 2006, 2012, 2013, 2014, and 2016.

3.3 Assessment Unit Summary

This section summarizes the data analysis, literature review, and field investigations and provides a list of conclusions for AUs in Category 4a of the 2014 Integrated Report (DEQ 2017). No change in the subbasin has occurred to support beneficial uses, and no changes to the Integrated Report are recommended as a result of the data collected in this 5-year review. Table 11 documents changes to the next Integrated Report once the TMDLs in this document have been approved by EPA.

Table 11. Summary of recommended changes for AUs evaluated.

Assessment Unit Name	Assessment Unit Number	Pollutant	Recommended Changes to Next Integrated Report
Lucky Peak Lake—Robie Creek swim beach area	ID17050112SW001L_0La	*E. coli*	No change
Mores Creek—1st and 2nd order	ID17050112SW009_02	Sedimentation/siltation, temperature	No change
Mores Creek—3rd order (Hayfork Creek to Elk Creek)	ID17050112SW009_03	Sedimentation/siltation, temperature	No change
Mores Creek—4th order (Elk Creek to Grimes Creek)	ID17050112SW009_04	Sedimentation/siltation, temperature	No change
Mores Creek—6th order (Grimes Creek to mouth)	ID17050112SW009_06	Sedimentation/siltation, temperature	No change
Thorn Creek—3rd order (North Fork Thorn Creek to mouth)	ID17050112SW011_03	Temperature	No change
Grimes Creek—1st and 2nd order	ID17050112SW013_02	Temperature	No change
Grimes, Clear and Smith Creeks—3rd-order	ID17050112SW013_03	Temperature	No change
Grimes Creek—4th order (Clear Creek to Granite Creek)	ID17050112SW013_04	Sedimentation/siltation, temperature	No change
Grimes Creek—5th order (Granite Creek to mouth)	ID17050112SW013_05	Sedimentation/siltation, temperature	No change
Macks Creek—1st and 2nd order	ID17050112SW015_02	Temperature	No change

3.3.1 Assessment Units in TMDLs—Still Impaired

ID17050112SW001L_0La, Lucky Peak Lake—Robie Creek Swim Beach Area

- Listed for *E. coli*.
- A bacteria TMDL was completed for nearshore areas of Robie Creek swim beach in Lucky Peak Reservoir and shows frequent exceedance of the single sample trigger value for public swimming beaches (235 organisms/100mL).

ID17050112SW009_02, Mores Creek—1st and 2nd order

- Listed for sedimentation/siltation.
- Data indicate streambank targets are being met and are not a major source of sediment to the subbasin. The largest source of sediment may be from historic hydraulically mined areas that continue to erode in mass wasting events.

ID17050112SW009_03, Mores Creek—3rd order (Hayfork Creek to Elk Creek)

- Listed for sedimentation/siltation.
- Data indicate streambank targets are being met and are not a major source of sediment to the subbasin. The largest source of sediment may be from historic hydraulically mined areas that continue to erode in mass wasting events.

ID17050112SW009_04, Mores Creek—4th order (Elk Creek to Grimes Creek)

- Listed for Sedimentation/siltation.
- Data indicate that streambank targets are being met and are not a major source of sediment to the subbasin. The largest source of sediment may be from historic hydraulically mined areas that continue to erode in mass wasting events.

ID17050112SW009_06, Mores Creek—6th order (Grimes Creek to mouth)

- Listed for sedimentation/siltation.
- Data indicate streambank targets are being met and are not a major source of sediment to the subbasin. The largest source of sediment may be from historic hydraulically mined areas that continue to erode in mass wasting events.

ID17050112SW013_04, Grimes Creek—4th order (Clear Creek to Granite Creek)

- Listed for sedimentation/siltation.
- Data indicate streambank targets are being met and are not a major source of sediment to the subbasin. The largest source of sediment may be from historic hydraulically mined areas that continue to erode in mass wasting events.

ID17050112SW013_05, Grimes Creek—5th order (Granite Creek to mouth)

- Listed for sedimentation/siltation.
- Data indicate that streambank targets are being met and are not a major source of sediment to the subbasin. The largest source of sediment may be from historic hydraulically mined areas that continue to erode in mass wasting events.

3.3.2 Assessment Units in TMDLs—Proposed for Delisting

In the Integrated Report, DEQ refers to a delisting as any AU-cause combination that is removed from Category 4 or Category 5. Delisting must be supported by a detailed rationale. No AUs are proposed for delisting in the next Integrated Report because they are not meeting their beneficial uses.

3.4 Beneficial Use Recommendations

Water bodies in the Boise-Mores Creek subbasin are designated for salmonid spawning, cold water aquatic life, primary contact recreation, secondary contact recreation, wildlife habitat, domestic water supply, agricultural water supply, industrial water supply, and aesthetics; the remaining undesignated water bodies in the watershed are protected by the presumed beneficial uses of cold water aquatic life and secondary contact recreation. At this time, all beneficial uses appear to be appropriate, and data do not suggest any changes to either designated or presumed uses.

4 Review of Implementation Plan and Activities

The 2009 Boise-Mores Creek watershed subbasin assessment and TMDL recommended developing an implementation plan within 18 months of approval of the TMDL. During TMDL development and following its approval in 2010, significant implementation occurred throughout the watershed under Trout Unlimited, US Forest Service, West Central Highlands Resource Conservation and Development (RCD), Boise County, and DEQ. Implementation projects were primarily funded through the §319 grant program. Consequently, no formal implementation plan was drafted by any party involved in the TMDL.

The lack of a formal implementation plan makes it difficult to assess the success of meeting any prescribed goals. The subbasin and the success of the TMDL would benefit greatly from an implementation plan; however, many of the parties involved during original TMDL development and initial project implementation have dissolved. A future implementation plan depends on the WAG reforming.

Two parties—Trout Unlimited and the West Central Highlands RCD—obtained funding through the §319 grant program and other non-DEQ programs to implement projects that improved water quality.

4.1 Responsible Parties

The Boise-Mores Creek subbasin TMDL implementation is designated to multiple management agencies contingent on the resources involved (Table 12). Implementation plan development for the Boise-Mores Creek subbasin TMDL will proceed under the existing practice established for Idaho. DEQ, Boise-Mores Creek subbasin WAG, federal land management agencies, affected private landowners, and other watershed stakeholders will cooperatively develop and implement the plan. Other individuals may be identified to assist in developing site-specific implementation plans if their areas of expertise are identified as beneficial to the process.

In addition to the designated agencies, the public, through the WAG process and equivalent processes, is provided with opportunities to be involved in developing the implementation plan to the maximum extent practical. Public participation significantly affects public acceptance of the document and proposed control actions. Stakeholders (landowners, local governing authorities, taxpayers, industries, and land managers) are the most educated regarding the pollutant sources and will be called upon to help identify the most appropriate control actions for each area. Experience has shown that the best and most effective implementation plans are those developed with substantial public cooperation and involvement.

Table 12. Designated management agencies and their responsibility for implementing the Boise-Mores Creek subbasin TMDLs.

Designated Management Agency	Resource Responsibility
Bureau of Land Management	BLM Land
US National Forest	USFS Land
Idaho Department of Lands	State endowment lands, timber harvest, and mining
Idaho Department of Transportation	Roads

4.2 Activities Planned and Implemented

No projects are planned at this time that would improve water quality in the subbasin. As the WAG is reestablished, DEQ hopes to have a formal implementation plan developed. The plan should build on the past restoration projects in the subbasin with a focus on heavily eroded, historic hydraulically mined areas that contribute the bulk of the sediment to the listed streams. The WAG should identify a party responsible for developing the implementation plan.

Water quality improvement project implementation occurred during and following TMDL development. DEQ funded a number of §319 grants, managed by Trout Unlimited and the West Central Highlands RCD. Three grants in 2007, 2009, and 2011 implemented major restoration projects throughout the watershed (Table 13), including bank stabilization, riparian plantings, sediment retention basins, and stabilizing eroding hillslopes due to historic mining activities. DEQ conducted field visits to the locations where project implementation occurred, and the projects were functioning as intended. Restoration activities removed and reduced approximately 100 tons of sediment per year and increased shading to water bodies in the subbasin. An estimated 170 pounds of nitrogen and 90 pounds of phosphorus have been removed and reduced per year.

Table 13. Completed implementation activities in the Boise-Mores Creek subbasin.

Project	Assessment Unit	Best Management Practice	Responsible Party	Date
Elk and Mores Creek sediment reduction and floodplain restoration	ID17050112SW009_04	Streambank restoration	WCHRCD	2007
Mores Creek floodplain restoration	ID17050112SW009_04	Streambank restoration	WCHRCD	2009
Grimes Creek restoration cooling waters	ID17050112SW013_02	Streambank restoration	Trout Unlimited	2011

Note: WCHRCD = West Central Highland Resource Conservation and Development

In 2007, the sediment reduction project on Elk and Mores Creeks began. This three-phase floodplain restoration project in the Mores Creek watershed was funded with $100,000 in §319 grant money. Numerous project partners developed a 5-year plan to systematically restore natural processes within the Mores Creek watershed, primarily by restoring floodplain and riparian function. The entire project restored approximately 9 miles of Mores Creek, 17 miles of Grimes Creek, and 3 miles of Elk Creek.

In Phase 1, restoration work included constructing a chain of sediment basins at the base of Gold Hill. The basins were intended to capture sediment-laden runoff from the Gold Hill watershed and were estimated to remove 83% of fine sediment. The constructed basins flow into two natural basins where rock weirs were created to allow more settlement and infiltration. As the first basin fills with flow, it overflows to the second, then overflows to the third before reaching Mores Creek. This project is located nearly 1 mile upstream of the Idaho City drinking water intake. The area was heavily seeded and planted, and travel has been restricted. A site visit was conducted in October 2016, and the infiltration basins were in functioning condition and retained a sizable amount of sediment. At this time, the basins appear to have significant use remaining before cleaning is needed. Hillside stabilization structures consisting of rocks and logs were built into the hillside and most were intact and functioning, although a few were eroding.

In Phase 2, the Elk Creek streambank erosion control project included installing a log coir, rock barbs, and hardened inflow areas to allow runoff entry and bank stabilization. Riparian plantings of willow, cottonwood, and other woody species were completed along Elk Creek. The Elk Creek pump plant site allowed Idaho City to install a new infiltration gallery to provide water to the high school athletic field. Using §319 grant funds, the bank stabilization project installed rip-rap and stream barbs.

Phase 3 occurred in Noble Gulch, a highly modified area that supplied runoff directly into Mores Creek. To prevent runoff, a series of dykes and berms were constructed to direct water into a wetland area to assimilate sediment and reduce turbidity before reaching Mores Creek. A motorcycle stream crossing was altered to offer a more direct crossing route rather than the previous run up the creek. The area was heavily seeded with grasses and planted with willows and cottonwoods.

Started in 2009, the Mores Creek floodplain restoration project was finalized in 2014 with $96,000 plus an additional $69,982 in matching funds. The project targeted 10 sites on Mores and Elk Creeks using stream barbs or J-hooks for a total of 32 structures. Approximately 510 linear feet of rip-rap was installed in selected areas, primarily to secure the tow slopes in critical areas. Over 1,900 feet of streambank were restored using riparian plantings, and 1.5 acres of riparian buffer were created in addition to approximately 5 acres of floodplain restoration.

This project directly reduced runoff from 1,000 feet of road, 230 feet of which was diverted into two separate upland sites rather than slowing and diverting into Mores Creek. An additional 10 acres of hillslope improvement and road closures also reduced sediment load.

The 2011 Grimes Creek restoration cooling waters project addressed Grimes and Granite Creeks, where access was easier and depth of mine tailings was not cost prohibitive. Historic tailings were pulled back from the creek to create a floodplain, and additional instream structures were positioned to create habitat complexity. Nearly 7,000 riparian plants were planted to provide shade and serve as a sediment filter. Bioengineering methods were used where streambank stabilization was needed. The project involved approximately 5,805 volunteer hours.

Nearing the end of this project, Trout Unlimited performed monitoring. In the treatment area, shade was documented with photo points. The project increased surface area and water volume by 7,023 square feet (ft^2) and 123,305 ft^3, respectively. Pools per mile increased from 15 to 41 after treatment. Percent pool and riffle habitat increased, changing from a ratio of 1:3 to 2:1. Habitat for aquatic organisms has improved with over 2,000 linear feet of edge cover and over 580 ft^2 of turbulence downstream from full-span structures. Habitat conditions improved using large boulders, large woody debris, and root wads. Based on a site visit in fall 2016, DEQ concluded the floodplain development was a success and riparian plants had colonized the area. Beaver had moved into the area in recent years, and the area behind the beaver dam was filled with water.

4.3 Future Strategy

Monitoring sediment in the Boise-Mores Creek subbasin has been limited mostly to SEIs and McNeil Core samples to target instream sources. Data have shown that potential sources within the channel are not contributing significant sediment loads, and sediment may be derived from other sources within the watershed. Monitoring efforts should focus on other known sources of sediment in the watershed. Historic hydraulically mined areas should be identified and monitored, especially during high precipitation and flow events. Turbidity could be used as a proxy below targeted areas to establish a more continuous data set for sediment contributions, along with suspended sediment concentration samples.

DEQ and the US Army Corps of Engineers have been monitoring the Robie Creek swim beach area annually for *E. coli* exceedances. Monitoring typically begins in May/June and occurs throughout the summer. Monitoring has revealed routine *E. coli* exceedances, and public health advisory are posted on an annual basis. Monitoring will continue at the swim beach area. A more continuous targeted study at Robie Creek would help isolate the sources of bacteria, and further deoxyribonucleic acid (DNA) analysis of the samples could further point towards a specific source.

4.4 Planned Time Frame

DEQ and the designated WAG will continue to reevaluate TMDLs on a 5-year cycle. During the 5-year review, implementation actions completed, in progress, and planned will be reviewed, and pollutant load allocations will be reassessed accordingly.

5 Conclusion

The focus on streambank stability targets may be misplaced. Data indicate streambank targets are being met and are not a major source of sediment to the subbasin. The largest source of sediment is from historic hydraulically mined areas that continue to erode in mass wasting events. The only target that addresses this source of sediment is the depth fines target, which is not being met. DEQ should work with the WAG and coordinating agencies to develop a formal implementation plan outlining the next steps to improve water quality and meet the TMDL targets. To fill the data gaps and identify and quantify sediment sources, DEQ should monitor turbidity and possibly total suspended sediment around the highly eroded, historic hydraulically mined areas known to be significant sources of sediment.

Additionally, DEQ needs to conduct a thorough investigation into the source of *E. coli* contamination at the Robie Creek swim beach area using deployable conductivity meters to isolate the source of bacteria.

This document was prepared with input from the public (Appendix B).

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GIS Coverages

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Appendix A. Water Quality Criteria

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	—	—
• Public Beach Single Sample	≤ 235 *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 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.

Appendix B. Public Participation

This TMDL review was developed with participation from the Southwest Basin Advisory Group (BAG), and the updated material was presented to the BAG on October 18, 2017.