Mid Snake River/Succor Creek Subbasin Assessment and Total Maximum Daily Load Addendum – Birch, Hardtrigger, McBride, Pickett Creeks, and Vinson Wash

Draft

Department of Environmental Quality
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Mid Snake River/Succor Creek Subbasin Assessment and Total Maximum Daily Load Addendum – McBride, Hardtrigger, Pickett, and Birch Creeks

ID17050103 TMDL Addendum

April 1, 2013

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Abbreviations, Acronyms, and Symbols

§303(d)	Refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section
µ	micro, one-one thousandth
§	Section (usually a section of federal or state rules or statutes)
ADB	assessment database
AU	assessment unit
AWS	agricultural water supply
BLM	United States Bureau of Land Management
BMP	best management practice
BOR	United States Bureau of Reclamation
BURP	Beneficial Use Reconnaissance Program
C	Celsius
CFR	Code of Federal Regulations (refers to citations in the federal administrative rules)
cfs	cubic feet per second
cfu	colony forming units
cm	centimeters
CWA	Clean Water Act
COLD	cold water aquatic life
DEQ	Idaho Department of Environmental Quality
DO	dissolved oxygen
DOI	U.S. Department of the Interior
DWS	domestic water supply
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
GIS	Geographical Information Systems
HUC	Hydrologic Unit Code
I.C.	Idaho Code
IP	implementation plan
IDAPA	refers to citations of Idaho administrative rules
IDFG	Idaho Department of Fish and Game
IDL	Idaho Department of Lands
IDWR	Idaho Department of Water Resources
km	kilometer
km^2	square kilometer
LA	load allocation

LC	load capacity
m	meter
m^3	cubic meter
mi	mile
mi^2	square miles
MBI	Macroinvertebrate Biotic Index
MGD	million gallons per day
mg/L	milligrams per liter
mm	millimeter
MOS	margin of safety
MWMT	maximum weekly maximum temperature
n.a.	not applicable
NA	not assessed
NB	natural background
nd	no data (data not available)
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NTU	nephelometric turbidity unit
PCR	primary contact recreation
PFC	proper functioning condition
ppm	part(s) per million
QA	quality assurance
QC	quality control
SBA	subbasin assessment
SCR	secondary contact recreation
SFI	DEQ's Stream Fish Index
SHI	DEQ's Stream Habitat Index
SMI	DEQ's Stream Macroinvertebrate Index
SRP	soluble reactive phosphorus
SS	salmonid spawning
SSC	suspended sediment concentration
STATSGO	State Soil Geographic Database
TDS	total dissolved solids
TKN	total Kjeldahl nitrogen
TMDL	total maximum daily load
TP	total phosphorus
TS	total solids
TSS	total suspended solids
t/y	tons per year
U.S.	United States
U.S.C.	United States Code
USDA	United States Department of Agriculture

USFS United States Forest Service

USGS United States Geological Survey

WAG Watershed Advisory Group

WBAG Water Body Assessment Guidance

WBID water body identification number

WLA wasteload allocation

WQLS water quality limited segment

WQMP water quality management plan

WQS water quality standard

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Executive Summary

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 (33 USC § 1251.101). 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 waters whenever possible. Section 303(d) of the CWA 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 of impaired waters, currently every two years. 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. This document addresses the water bodies in the Mid Snake River/Succor Creek Subbasin that have been placed on what is known as the "§303(d) list."

This subbasin assessment (SBA) addendum and total maximum daily loads (TMDL) are developed to address assessment units (AU) in the Mid Snake River/Succor Creek watershed that are on Idaho's current §303(d) list of water quality limited water bodies, or are otherwise impaired by one or more pollutants. The SBA is an important first step in developing the TMDL because it: 1) examines the status of §303(d) listed waters, 2) defines the extent of impairment and causes of water quality limitation, and 3) describes the physical, biological, and cultural setting, water quality status, pollutant sources, and recent pollution control actions in the Mid Snake River/Succor Creek watershed. The TMDL analysis quantifies pollutant sources and allocates responsibility for load reductions needed for Vinson Wash, and McBride, Hardtrigger, Pickett, and Birch Creek AUs in order to meet water quality standards.

The Mid Snake River/Succor Creek Watershed Advisory Group (WAG) and the designated agencies played a significant role in the TMDL development process. The WAG and the designated agencies were involved in developing the allocation processes and their continued participation will be critical while implementing the TMDL.

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Subbasin at a Glance

A summary of facts regarding the Mid Snake River/Succor Creek watershed (Figure A) AUs included in this SBA and TMDL:

Watershed:	Birch Creek (ID17050103SW021_03 & 04) Hardtrigger Creek (ID17050103SW008_02) McBride Creek Creek (ID17050103SW004_02 & 03) Pickett Creek (ID17050103SW016_03) Vinson Wash (ID17050103SW023_03)
Beneficial Uses:	Cold Water Aquatic Life (COLD)
Impaired Uses:	COLD
Pollutants:	Sedimentation/Siltation
Pollutant Sources:	Natural background, livestock grazing, roads, cultivated agriculture, and irrigation projects.

Figure A shows the §303(d) listed water bodies within the basin and the Mid Snake River/Succor Creek watershed boundaries.

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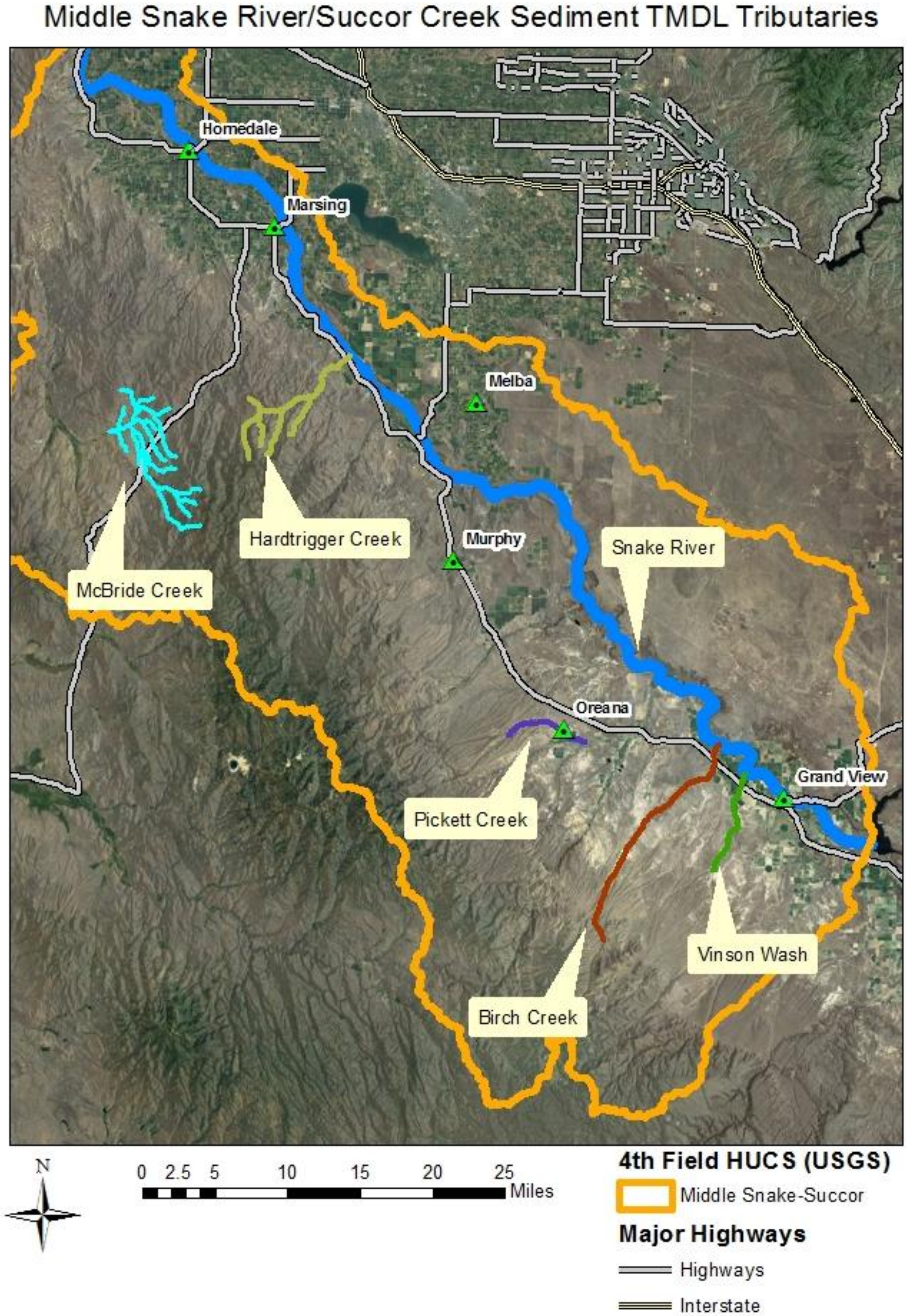

Figure A. Location of Mid Snake River/Succor Creek Subbasin, HUC 17050103 and the tributaries included in this TMDL Addendum.

Key Findings

Data analysis for a five-year review of the Mid Snake River/Succor Creek TMDL was completed in 2011 (DEQ 2011). This document is available at: http://www.deq.idaho.gov/media/699532-snake-river-succor-creek-sba-tmdl-five-year-review-0911.pdf. The identified pollutants in this watershed are exclusively nonpoint source in nature. Tributaries are generally low volume rangeland streams that have a combination of geography, geology, land use, low flow volume, and flow alteration, which can lead to exceeding the Idaho WQS for sediment that are necessary to support COLD. Instream channel erosion is the probable primary source of sediment loading in McBride, Hardtrigger, and Pickett Creeks. As a result, 80% bank stability was selected as a target to fully support COLD beneficial uses these creeks. Conversely, irrigated agriculture is the probable primary source of sediment loading in Birch Creek and Vinson Wash. The target was, therefore, established as 20 mg/L over rolling four-month average throughout the critical irrigation season (April 1 – September 30).

Segments Listed in the 303(d) List:
The Mid Snake River/Succor Creek §303(d) water quality limited segments for sedimentation/siltation are shown in Figure A. Table A displays the listing in the most recent Integrated Report (2010) and the SBA outcomes based on the 2010 Integrated Report, and data collected by DEQ in 2011 and 2012.

This report is available at: http://www.deq.idaho.gov/media/725927-2010-integrated-report.pdf.

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Table A. Summary of 303(d) listed water quality segments and outcomes in this TMDL.

Water Body Name/Assessment Unit	Boundaries	Pollutant	TMDL(s) Completed	Recommended Changes to the next Integrated Report	Justification	TMDL Loads
Birch Creek AU: 021_03, 04	Approximately 7.8 miles upstream above Castle Creek Road to Snake River	Sediment	Sediment	Move to Section 4a	TMDL completed	20 mg/L 4-month average
Hardtrigger Creek AU: 008_02	Headwaters to Snake River	Sediment	Sediment	Move to Section 4a	TMDL Completed	80% Streambank Stability
McBride Creek AU: 004_02, 03	Headwaters to Oregon Line	Sediment	Sediment	Move to Section 4a	TMDL Completed	80% Streambank Stability
Pickett Creek AU: 016_03	Bates Creek Confluence to Browns Creek Confluence	Sediment	Sediment	Move to Section 4a	TMDL Completed	80% Streambank Stability
Vinson Wash AU:23_03	Poison Creek Confluence to Mouth	Sediment	Sediment	Move to Section 4a	TMDL Completed	20 mg/L 4 month average

AU – Assessment Unit; mg – milligrams; L – liters

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1. Subbasin Assessment – Watershed Characterization

This document presents an addendum for the 2003 Mid Snake River/Succor Creek subbasin assessment (SBA) and total maximum daily load (TMDL). This document addresses the water bodies in the watershed that are on Idaho's current §303(d) list for sedimentation/siltation.

1.1. Introduction—Regulatory Requirements

This document is prepared in compliance with both federal and state regulatory requirements, as described in the following.

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 (WQS) necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible.

Section 303(d) of the CWA 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 WQS). 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 WQS.

1.2. Public Participation and Comment Opportunities

The development of the Mid Snake River/Succor Creek Addendum included the following public participation:

- Public meetings with the watershed advisory group (WAG) and others,
    - WAG, October 31, 2012
    - WAG, February 6, 2013
    - Hardtrigger Bank Stability Inventory with WAG Members, March 26 & 27, 2013
    - WAG, April 23, 2013

1.3. Physical, Biological, and Cultural Characteristics

A thorough discussion of the physical, biological, and cultural characteristics of the Mid Snake River/Succor Creek watershed is provided in the Mid Snake River/Succor Creek

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SBA/TMDL approved by EPA in 2003 (DEQ 2003), and the Mid Snake River/Succor Creek *TMDL Five-Year Review HUC 17050103* (DEQ 2011).

1.3.1. Subwatershed Characteristics

Birch Creek (ID17050103SW021_03 & 04)

The Birch Creek subwatershed drains approximately 78 square miles and generally flows in a northeasterly direction. The headwaters of the creek begin near 7,050 feet in elevation and reach the Snake River at around 2,340 feet. The upper mainstem of Birch Creek is an ephemeral, dry, sandy wash (part of which is used as motorized route) as it leaves the Owyhee front range and passes through sagebrush habitat and managed rangelands for approximately 25 miles. It then enters irrigated agricultural land and flows perennially for approximately 1.7 miles before entering the Snake River. The impaired AU_03 has approximately approximately 15 miles, while the lowest impaired segment, AU_04, comprises the final 2.5 miles.

The upper, dry, sandy wash portion exhibits some natural entrenchment and unstable banks, due to episodic rain events and the friable nature of the soils. Other portions result from anthropogenic influences such as use of the wash channel by OHVs and other 4-wheel drive vehicles, and livestock.

Alternatively, the lower, intermittent/perennial segments of the creek exhibit some entrenchment and unstable banks due to natural soil conditions, while the anthropogenic influences on the streambank stability and sediment loading likely result from irrigated agricultural practices. That is, irrigated agriculture appears to be contributing elevated levels of sediment to Birch Creek and then, ultimately, to the Snake River. The primary source of suspended sediment likely comes from these irrigated lands because: a) the upper wash segments typically flow in response to direct precipitation events and rarely reaches the lower segments, and b) sediment delivery in the lower segment appears to correspond with irrigation patterns, and does not correspond well to stream flow throughout the irrigation season.

Stream Status and Land Ownership
Figure 1 shows the stream status and land ownership patterns within the watershed. Approximately 95% of the Birch Creek watershed is rangeland, while the lower segment near the Snake River is primarily irrigated agriculture (< 4%). While some private lands exist in the upper part of the watershed, this land is primarily BLM- and state-owned. Most of the private holdings in the area are irrigated agriculture near the Snake River between the towns of Oreana and Grand View.

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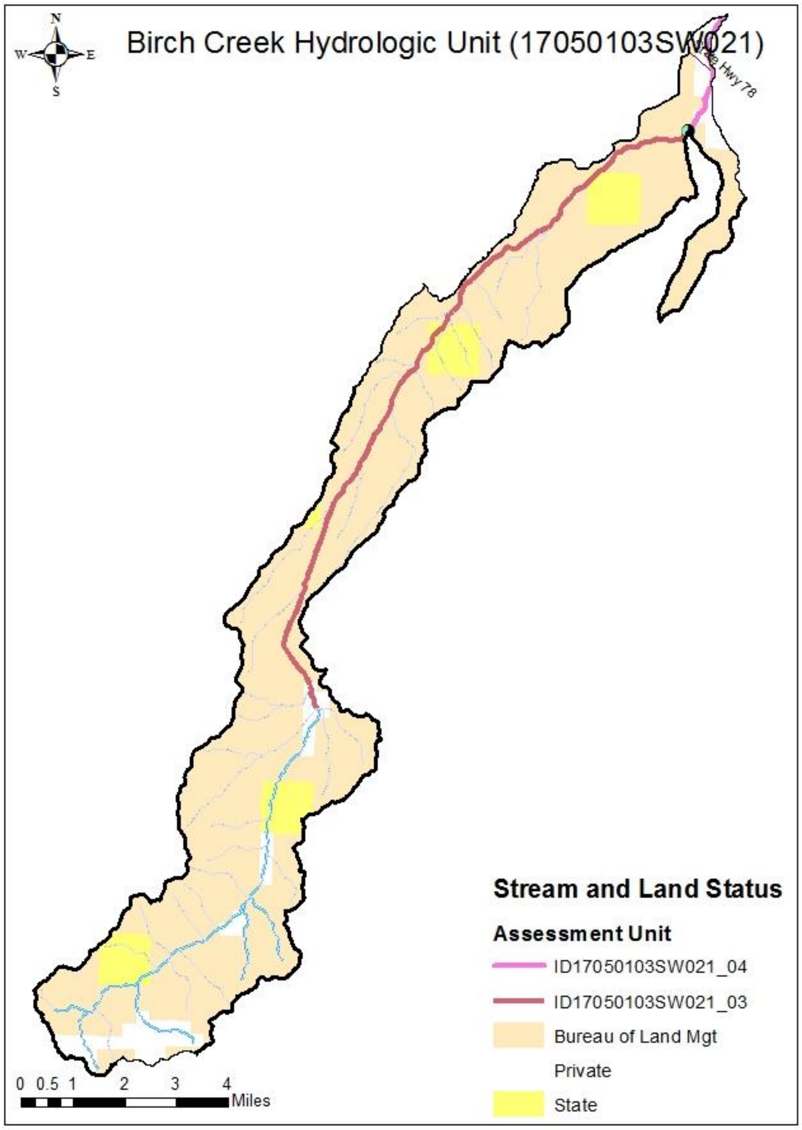

Figure 1. Stream status and land ownership in the Birch Creek watershed.

Hardtrigger Creek (ID17050103SW008_02)

The Hardtrigger Creek subwatershed drains approximately 20 square miles and generally flows in a northeasterly direction. This second order creek begins at approximately 6,010 feet and empties into the Snake River at around 2,230 feet. The mainstem of Hardtrigger Creek comprises approximately 13 linear miles; exiting the Owyhee front to flow through rangeland and then through rural-developed and pastureland areas for the final ¾ miles before its confluence with the Snake River. Hardtrigger Creek has several tributaries that join in the upper rangeland portions, including Middle Fork Hardtrigger and Little Hardtrigger, which contribute approximately 7 miles of additional stream length to the watershed. This creek exhibits some unstable banks throughout various segments of the watershed, likely due in part to the friable nature of some of the soils, but also due to anthropogenic influences such as 4-wheel drive roads adjacent to the creek, BLM wild horse herds, and active livestock

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grazing. However, there is also much well established riparian vegetation throughout much of the channel, consisting of willows, wild roses, and grasses.

Stream Status and Land Ownership

Figure 2 shows the stream status and land ownership patterns within the watershed. Approximately 90% of Hardtrigger Creek watershed is rangeland, while the lower reach near the Snake River is rural development and irrigated pasture (approximately 5%). While private lands exist in the upper part of the watershed, most land in the upper watershed is primarily BLM- and state-owned. Most of the private holdings in the area are closest to the Snake.

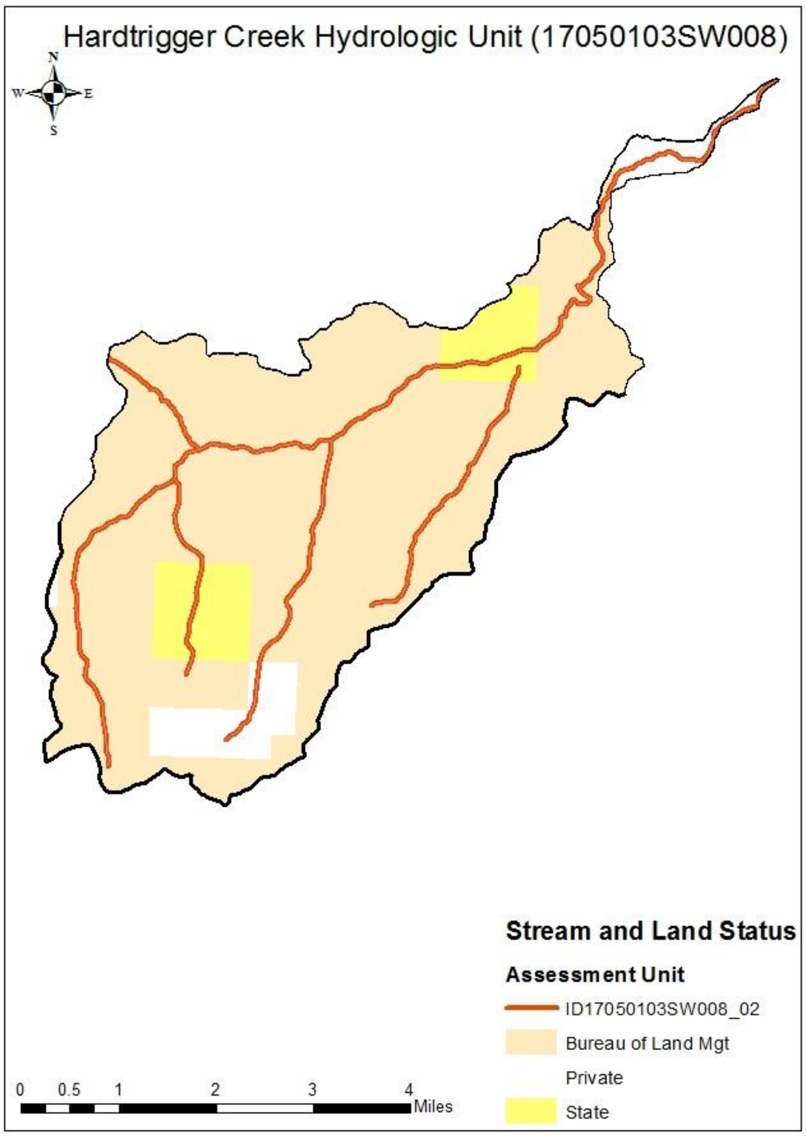

Figure 2. Stream status and land ownership in the Hardtrigger Creek watershed.

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McBride Creek (ID17050103SW004_02 & 03)

The McBride Creek subwatershed drains approximately 38 square miles and generally flows in a northwesterly and westerly direction. These second and third order tributaries begin at approximately 6,740 feet in elevation and cross into Oregon at around 3,850 feet. The mainstem of McBride Creek comprises approximately 11.5 linear miles from the Owyhee front, primarily through rangeland until it then crosses the Oregon border. From there, it continues westward and joins Succor Creek. There are some intermittent/perennial tributaries, including Little McBride Creek and Willow Fork in the upper portion of the watershed, and a numerous intermittent/ephemeral channels, which join the mainstem of McBride Creek throughout the watershed. The lower mainstem, AU_03, includes only approximately 2.5 linear miles, with AU_02 comprising the remainder of the tributary lengths.

The upper portion of the watershed has some well-established riparian vegetation along the channel, but also exhibits signs of bank instability and erosion, likely due, due to anthropogenic influences such as adjacent roads, culverts, and livestock grazing. Conversely, the lower segments of the watershed are more intermittent to ephemeral in nature, and bank instability appears to be more directly related to a combination of the friable nature of some of the soils, episodic high flow events, adjacent roads and culverts. This lower portion also exhibits, in places, signs of current and previous lateral channel movement, and recovery through formation of new channel floodplains and banks.

Stream Status and Land Ownership
Figure 3 shows the stream status and land ownership patterns within the watershed. Approximately 90% or more of McBride Creek watershed is rangeland, while about 6% is forested, less than 2% is in irrigated agriculture. Although considerable private land exists throughout the watershed, the majority is BLM- and state-owned. Most of the private holdings are along the middle to upper segments of McBride Creek and along the Little McBride and Willow Fork segments.

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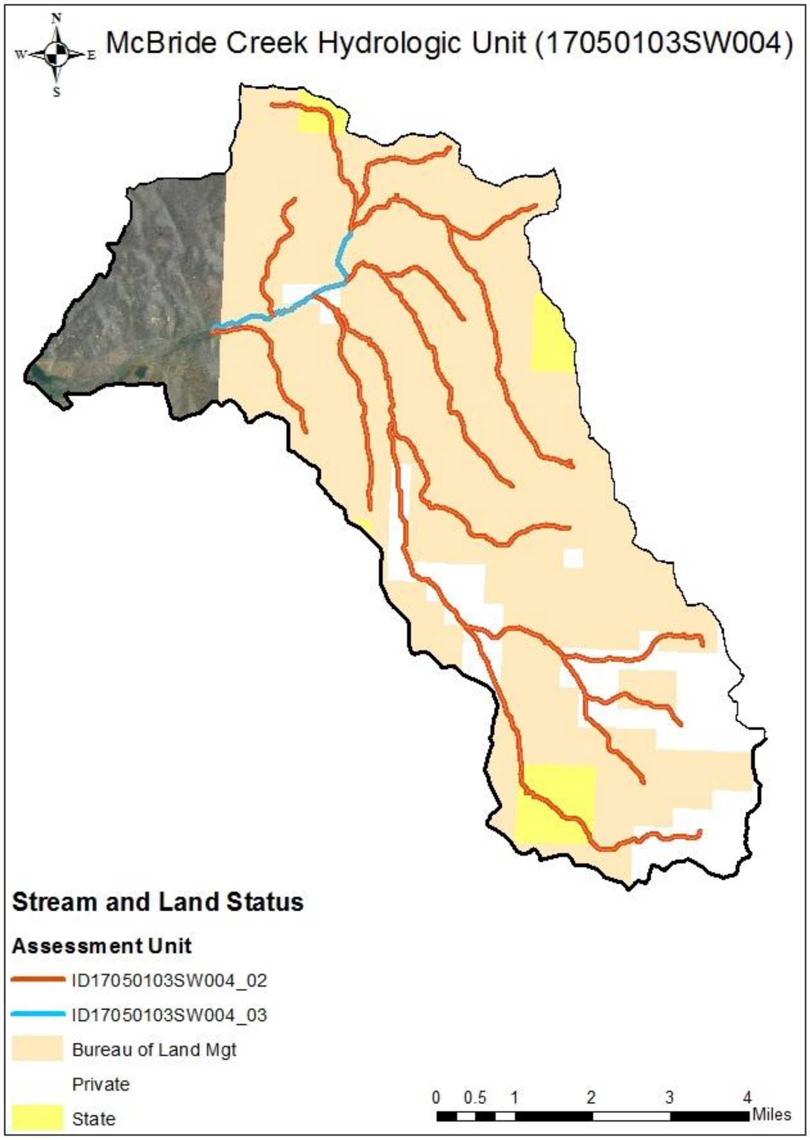

Figure 3. Stream status and land ownership in the McBride Creek watershed.

Pickett Creek (ID17050103SW016_03)

The Pickett Creek subwatershed drains approximately 63 square miles to its confluence with Brown Creek and generally flows in a northeasterly direction. The watershed begin at approximately 8,410 feet elevation and drops down to approximately 2,680 feet where it joins Catherine Creek and then Brown Creek. Beyond the scope of this AU and TMDL, Catherine Creek then continues on to join Castle Creek, which then continues on to join the Snake River.

The segment of Pickett Creek (AU_03) pertaining to this TMDL, however, only contains approximately 6.5 linear miles. It begins upstream at the confluence with Bates Creek, where it flows downstream for approximately 2.6 miles and joins Catherine Creek. It then continues downstream for approximately 3.8 miles where it joins Brown Creek.

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This creek exhibits unstable banks throughout various segments of the watershed, likely due in part to the friable nature of some of the soils, but also due to anthropogenic influences such as irrigated agricultural practices and livestock grazing adjacent to the creek. Where the riparian area has not been disturbed or the channel is not downcut, the riparian area contains cottonwoods, willows, wild roses, and grasses.

Stream Status and Land Ownership

Figure 4 shows the stream status and land ownership patterns within the Pickett Creek watershed. Approximately 85% of the Pickett Creek watershed is rangeland, while about 12% is forested, less than 2% is in irrigated agriculture. Although considerable private land exists throughout the watershed, especially along the lower segments of Pickett and Catherine Creeks, the majority of land is BLM- and state-owned (Figure 6).

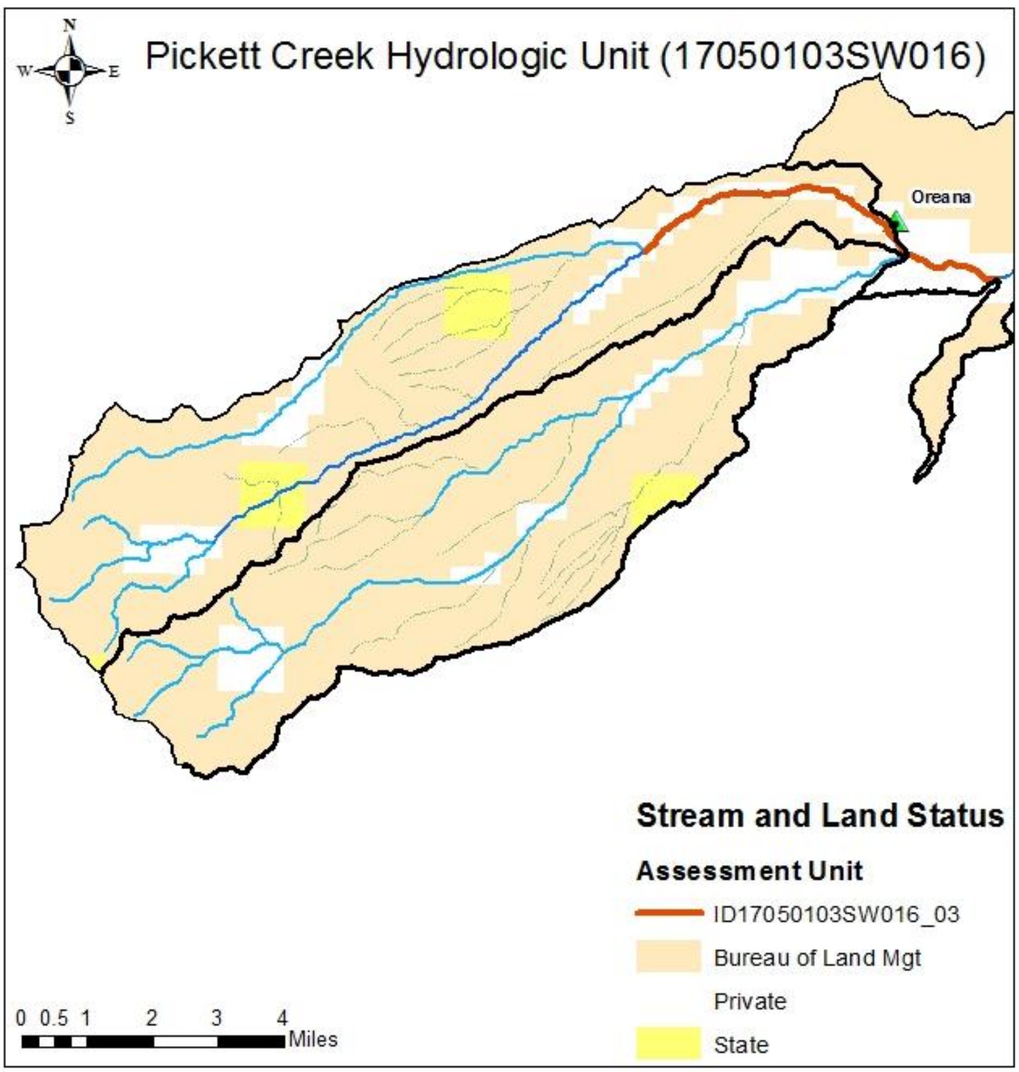

Figure 4. Stream status and land ownership in the Pickett Creek watershed.

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Vinson Wash (ID17050103SW023_03)

VinsonWash drains approximately 48 square miles and generally flows in a northeasterly direction. The subwatershed begins at close to 6,320 feet in elevation and reaches the Snake River at around 2,350 feet. The upper portion of the watershed consists of several unimpaired tributaries, including Poison Creek, which join to form Vinson Wash. From there, the ephemeral, sandy, and dry Vinson Wash leaves the Owyhee front range and passes through sagebrush habitat and managed rangelands for approximately 4.5 miles. It then enters irrigated agricultural land and flows intermittent/perennially for approximately 3.5 miles before entering the Snake River.

Very similar to the conditions on Birch Creek, the upper, ephemeral portion of the wash exhibits some natural entrenchment and unstable banks, due to episodic rain events and the friable nature of the soils. Other portions result from anthropogenic influences such as use of the wash channel by OHVs and other 4-wheel drive vehicles, and livestock grazing.

Alternatively, the lower, perennial segment of the creek exhibits some streambank instability and sediment loading that likely result primarily from irrigated agricultural practices and the friable nature of the soils. That is, flows in the lower segment of Vinson Wash, resulting from irrigated agriculture, are the likely source of elevated sediment levels that reach the Snake River. The primary source of suspended sediment likely comes from these irrigated lands because: a) the ephemeral upper wash segment does not typically flow and rarely reaches the lower perennial segment, and b) judging from data collected in the very similar and nearby Birch Creek, sediment delivery in the lower perennial segment likely corresponds to irrigation patterns, but does not correspond well to stream flow throughout the irrigation season.

Stream Status and Land Ownership

Figure 5 shows stream status and land ownership patterns within the Vinson Wash watershed (the figure only shows the watershed, below the confluence with Poison Creek). Approximately 98% of the entire Vinson Wash watershed is rangeland, while the lower segment near the Snake River is private land, primarily as irrigated agriculture (< 2%). Aside from these private lands near the Snake River, the remaining watershed is virtually all BLM- and state-owned.

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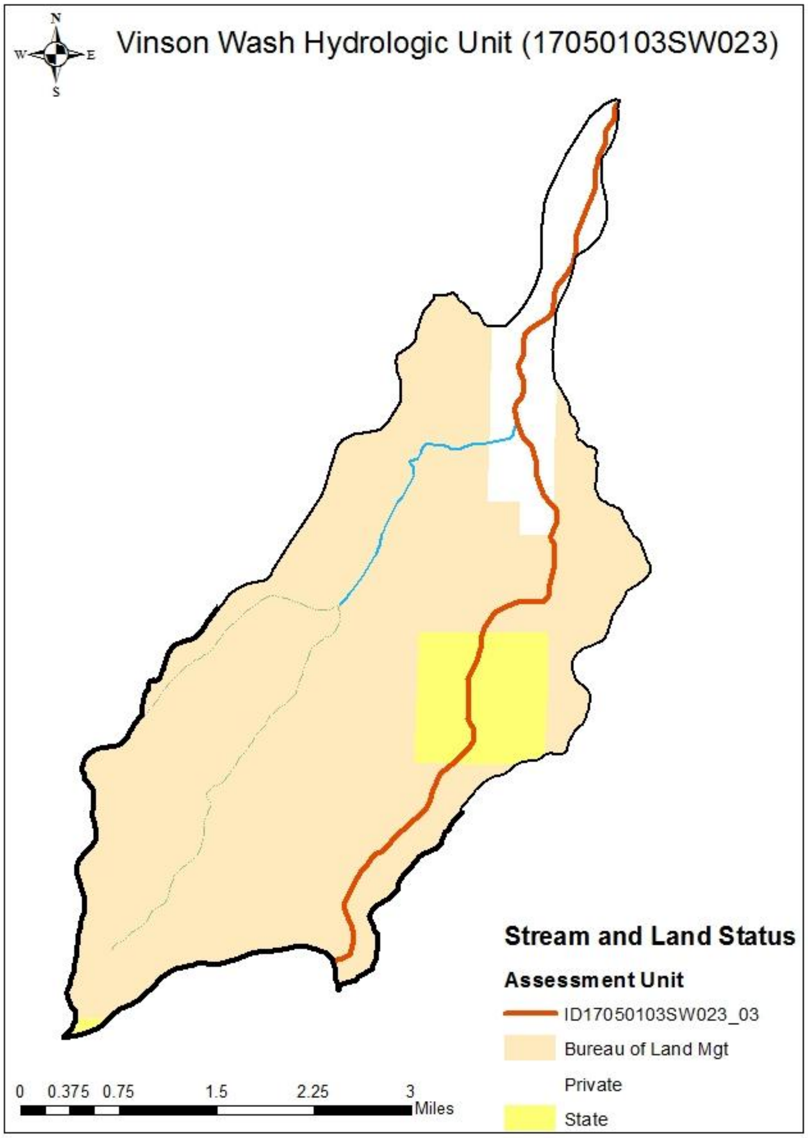

Figure 5. Stream status and land ownership in the Vinson Wash watershed.

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2. Subbasin Assessment – Water Quality Concerns and Status

2.1. Water Quality Limited Assessment Units Occurring in the Subbasin

Section 303(d) of the CWA states that waters that are unable to support their beneficial uses and that do not meet WQS must be listed as water quality limited waters. Subsequently, these waters are required to have TMDLs developed to bring them into compliance with WQS.

2.1.1. Additional Waters Listed Since SBA/TMDL Approval

Table 1 shows the pollutants listed and the basis for listing for each §303(d) listed AU in the Mid Snake River/Succor Creek watershed that has been added since the publication of the lower Middle Snake River/Succor Creek SBA/TMDL approved by EPA in 2003.

Table 1. §303(d) Segments in the Mid Snake River/Succor Creek subbasin.

Water Body Name	Assessment Unit ID Number	2010 §303(d) Boundaries	Pollutants	Listing Basis
Vinson Wash	ID17050103SW023_03	Poison Creek to Snake River	Sedimentation / Siltation	Combined Biota/Habitat Bioassessments

A thorough investigation, using the available data, was performed before determining whether or not a TMDL is necessary.

2.2. Applicable Water Quality Standards and Beneficial Uses

Idaho WQS, defined in IDAPA 58.01.02, designate beneficial uses, and set water quality goals for the waters of the state.

Idaho WQS 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 as briefly described in the following paragraphs. The *Water Body Assessment Guidance*, second edition (WBAG II; Grafe et al. 2002) gives a more detailed description of beneficial use identification for use assessment purposes. This document can be accessed at: http://www.deq.idaho.gov/media/457010-wbag_02_entire.pdf.

2.2.1. Existing Uses

Existing uses under the CWA are "those uses actually attained in the waterbody on or after November 28, 1975, whether or not they are included in the WQS." The existing in-stream water uses and the level of water quality necessary to protect the uses shall be maintained and protected (IDAPA 58.01.02.050.02, .02.051.01, and .02.053). Existing uses include uses actually occurring, whether or not the level of quality to support fully the uses exists. A practical application of this concept would be to apply the existing use of salmonid spawning

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to a water that could support salmonid spawning, but salmonid spawning is not occurring due to other factors, such as dams blocking migration.

2.2.2. Designated Uses

Designated uses under the CWA are "those uses specified in WQS for each water body or segment, whether or not they are being attained." Designated uses are simply uses officially recognized by the state. In Idaho, these designated uses include aquatic life support, recreation in and on the water, domestic water supply, and agricultural uses. Water quality must be sufficiently maintained to meet the most sensitive use.

Designated uses may be added or removed using specific procedures provided for in state law, but the effect must not be to preclude protection of an existing higher quality use such as cold water aquatic life or salmonid spawning.

Designated uses are specifically listed for water bodies in Idaho in tables in the Idaho WQS (see IDAPA 58.01.02.003.27 and .02.109-.02.160, in addition to citations for existing uses).

2.2.3. Presumed Uses

In Idaho, most water bodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations. These 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 "presumed uses," DEQ will apply the numeric cold water aquatic life (COLD) criteria and primary or secondary contact recreation (PCR/SCR) criteria to undesignated waters.

If in addition to these presumed uses, an additional existing use, (e.g., salmonid spawning) exists, because of the requirement to protect levels of water quality for existing uses, then the additional numeric criteria for SS would additionally apply (e.g., intergravel dissolved oxygen, temperature). However, if for example, COLD is not found to be an existing use, a use designation to that effect is needed before some other aquatic life criteria (such as seasonal cold) can be applied in lieu of COLD criteria (IDAPA 58.01.02.101.01).

Table 2. Beneficial uses of Section 303(d) listed streams.

Water Body / Assessment Unit	Beneficial Uses[a]	Type of Use
Birch Creek / AU021 _03 & _04	COLD	Presumed
Hardtrigger Creek / AU008_02	COLD	Presumed
McBride Creek / AU004_02 & _03	COLD	Presumed
Pickett Creek / AU016_03	COLD	Presumed
Vinson Creek / AU023_03	COLD	Presumed

[a] COLD – cold water aquatic life

2.3. Criteria to Support Beneficial Uses

Beneficial uses are protected by 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 3 includes the most common numeric criteria used in TMDLs.

Figure provides an outline of the stream assessment process for determining support status of the beneficial uses of COLD, salmonid spawning, and contact recreation.

Table 3. Selected numeric criteria supportive of designated beneficial uses in Idaho water quality standards.

Designated and Existing Beneficial Uses			
Water Quality Parameter	**Primary Contact Recreation**	**Secondary Contact Recreation**	**Cold Water Aquatic Life**
Water Quality Standards: IDAPA 58.01.02.250			
Bacteria, pH, and Dissolved Oxygen (DO)	Less than 126 *E. coli*/100 mL as a geometric mean of five samples over 30 days; no sample greater than 406 *E. coli*/100 mL	Less than 126 *E. coli*/100 mL as a geometric mean of five samples over 30 days; no sample greater than 576 *E. coli*/100 mL	pH between 6.5 and 9.0 DO exceeds 6.0 mg/L
Temperature			22 °C or less daily maximum; 19 °C or less daily average
Turbidity			Turbidity shall not exceed background by more than 50 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.

- *E. coli – Escherichia coli* ; mL – milliliters; mg/L – milligrams per liter; ˚C – Celsius; NTU – Nephelometric turbidity units
- 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 seven-day average daily maximum air temperature calculated in yearly series over the historic record measured at the nearest weather reporting station.

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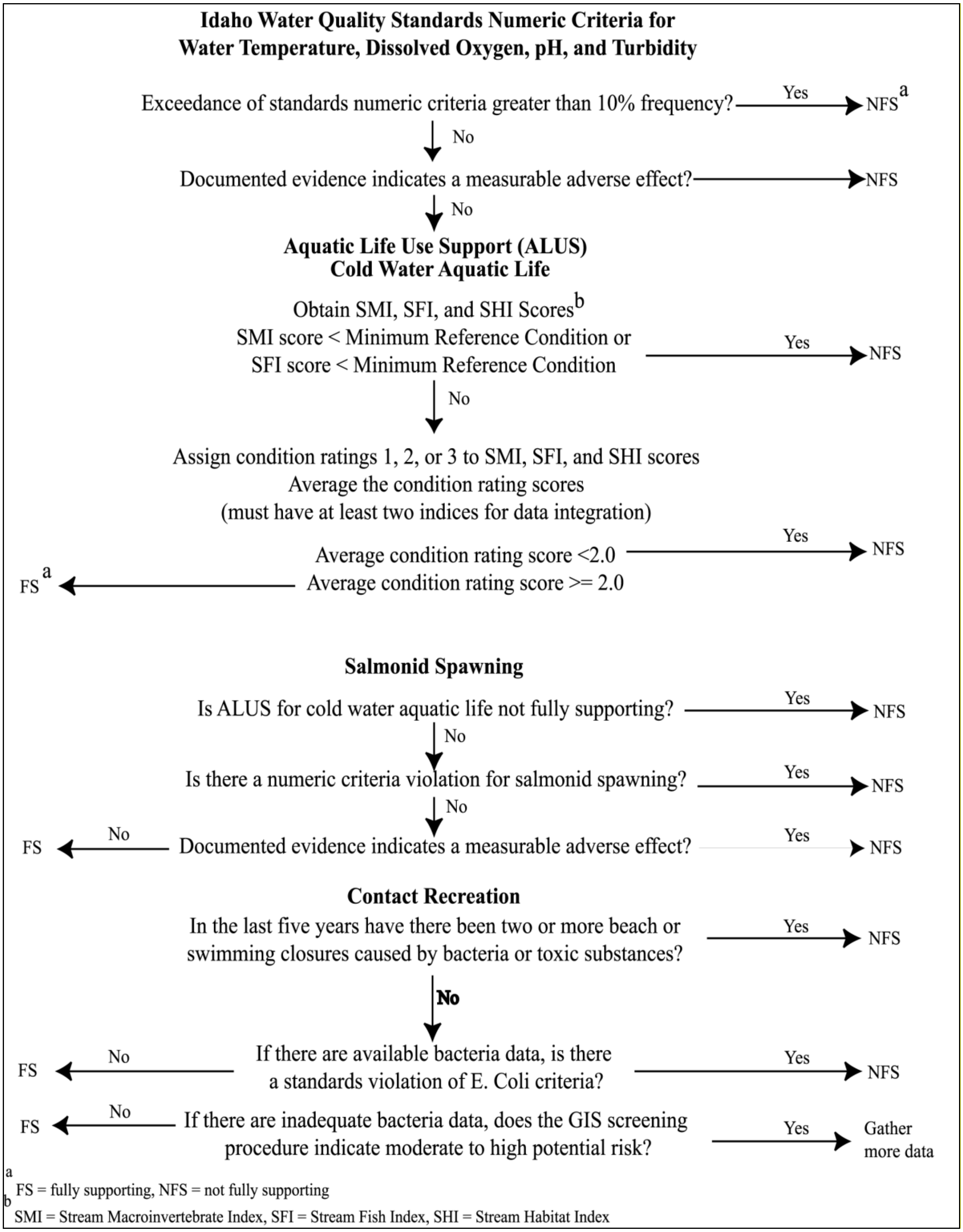

Figure 6. Determination Steps and Criteria for Determining Support Status of Beneficial Uses in Wadeable Streams: *Water Body Assessment Guidance*, Second Edition (Grafe et al. 2002).

2.4. Summary and Analysis of Existing Water Quality Data

A detailed summary and analysis of existing water column data, flow characteristics and biological and habitat assessment data for the Mid Snake River/Succor Creek subbasin is provided in the *Mid Snake River/Succor Creek SBA and TMDL (DEQ 2003)* and *the Mid Snake River/Succor Creek Five-Year Review* (DEQ 2011). These reports are available at: http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/snake-river-middle-succor-creek-subbasin.aspx.

Birch Creek (ID17050103SW021_03, & 04)

Figure 7 shows the location of a BURP site in the lower portion of Birch Creek. Two attempts to collect data were undertaken; in 2001 the channel was dry and in 1995 the channel had a measured flow of 3.8 cfs. The 1995 data estimated that the percentage of fines comprising the channel bottom substrate was only 5%, well within the 28% threshold recognized as supporting COLD. The BURP data for Birch Creek are available at: http://mapcase.deq.idaho.gov/wq2010/js/adb2010.aspx?WBIDSEGID=ID17050103SW021_04.

Idaho Power also collected data at the mouth of Birch Creek as part of their Snake River drain and tributary analysis (Knight and Naymik 2009). The data show that total suspended solids were at 217 mg/L in May, peaked in June at 2720 mg/L and then declined down to 10 mg/L in October. Conversely, flows throughout the sampling period remained between 15.3 and 18.8 cfs for the entire sampling duration. The exception was in October, when flows reached their maximum of 32.3 cfs, which also corresponds to the lowest TSS levels recorded during the analysis. Table 4 is a summary reproduction of the sediment data provided in Idaho Power's 2009 Report (the entire report is available as an appendix to this TMDL), while Figure 8 provides a visual representation of the same data.

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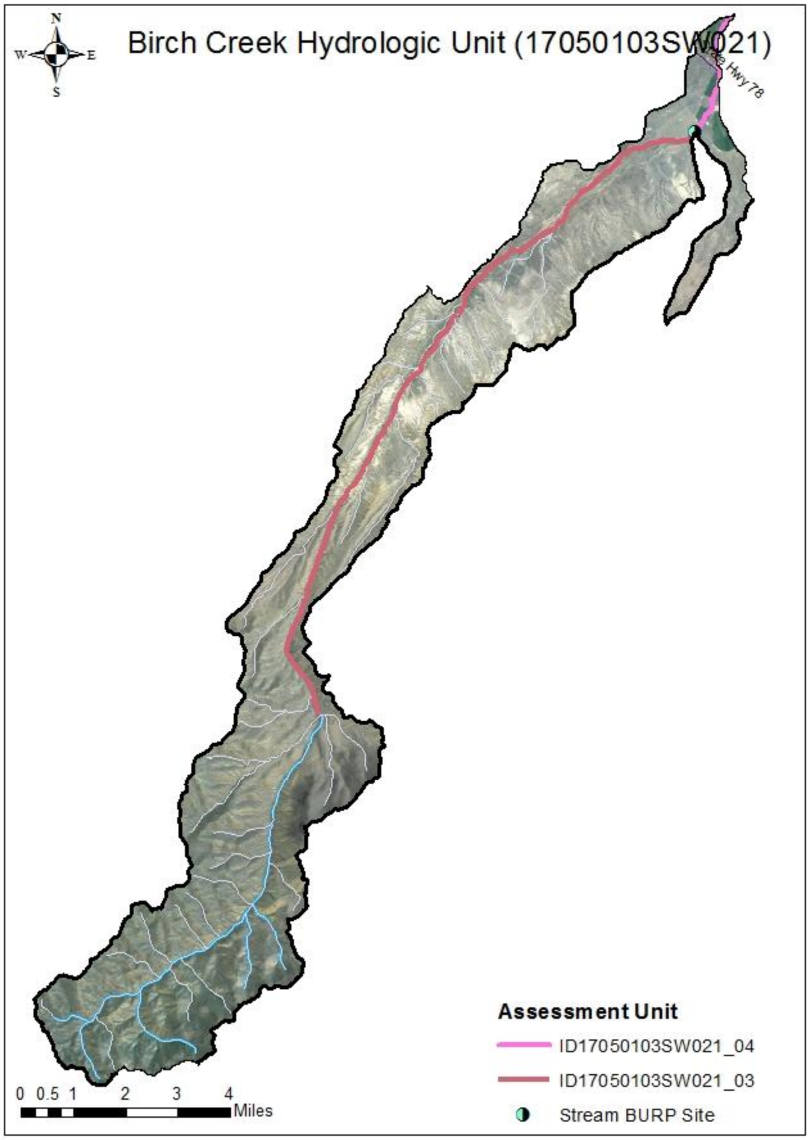

Figure 7. DEQ BURP monitoring location on Birch Creek. Data was collected in 1995; data was not collected in 2001 because the channel was dry.

Table 4. Flow and suspended solid data collected at the mouth of Birch Creek in 2007 by Idaho Power.

Measure Date	Flow (cfs)	Suspended Solids (mg/L)	
		Total	Volatile
5/17/2007	15.4	217	18
6/19/2007	15.3	2720	155
7/31/2007	18.8	742	56
8/29/2007	16.2	531	38
10/8/2007	32.3	10	3

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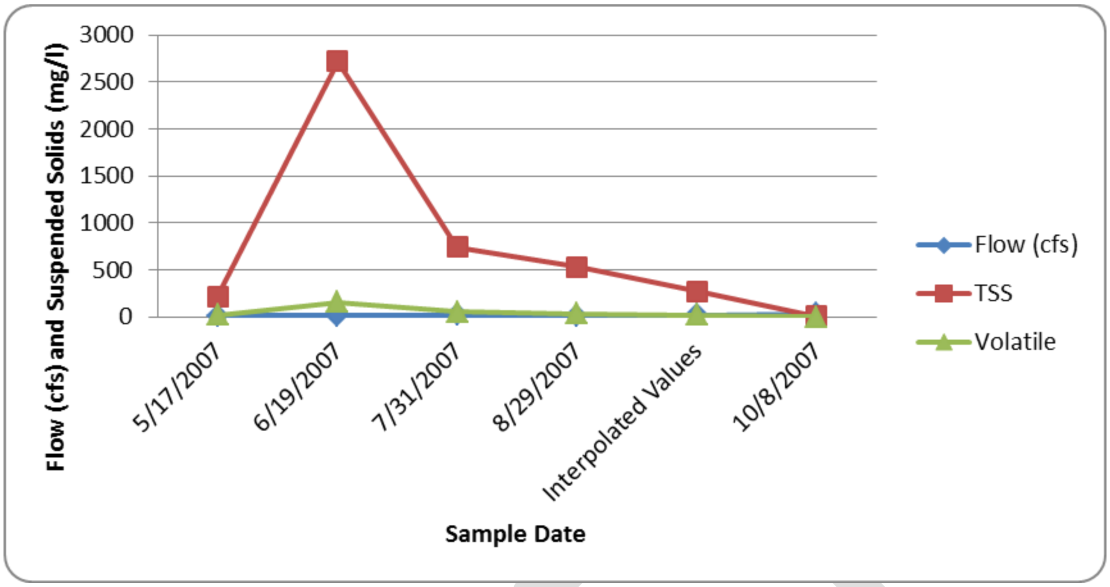

Figure 8. Flow and suspended solid data collected at the mouth of Birch Creek in 2007 by Idaho Power.

<u>Hardtrigger Creek</u> (ID17050103SW008_02)

Figure 9 shows the location of two BURP sites in the Hardtrigger Creek watershed. Attempts were made to collect data in 1995, 1996, and 1998. The channel was dry in 1995 and 1996, but the creek was flowing enough at both sites in 1998 to collect data. The measured flow at each site was 3.9 and 5.1 cfs and total fines for both sites were within the 28% threshold recognized as supporting COLD (19.38 and 23.08%, respectively). The BURP data for Hardtrigger Creek are available at: http://mapcase.deq.idaho.gov/wq2010/js/adb2010.aspx?WBIDSEGID=ID17050103SW008_02.

Additionally, in 2013 DEQ personnel, along with members of the WAG, natural resources agency personnel, and the public conducted streambank stability inventories along sections of the impaired Hardtrigger Creek AU (Figure 9). The data indicate that Hardtrigger Creek has streambank stability levels of approximately 60%, with moderate lateral recession rates (0.12 ft/year) that contribute to sediment loads. It is worth noting that the streambank inventory, which was conducted prior to livestock being released onto the range for the season, indicates that a substantial portion of the actively eroding banks appear to be the result of wild horse and/or wildlife trampling. The field crew noticed a considerable of tracks (most of which appeared to be horse, but some were also deer) along the actively eroding banks. Additionally, a dirt road often parallels the creek at various distances (from 10’s of feet to 10’s of meters), which also contributes to both the actively eroding banks, as well as direct sediment contributions along the multiple road crossings.

Finally, the BLM also has collected streambank stability data on Hardtrigger Creek between 2005 and 2012 (Table 5). During this time, streambank stability measures have varied from as low as 30% up to 94%. During 4 of the 8 years of data collection, streambank stability

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was greater than 80%, the streambank stability threshold widely recognized as supporting COLD. Conversely, streambank stability over the remaining 4 of 8 years was less than 72%, below the 80% threshold. And, in 2012 the BLM also measured in-channel fines as comprising 36% of the total substrate.

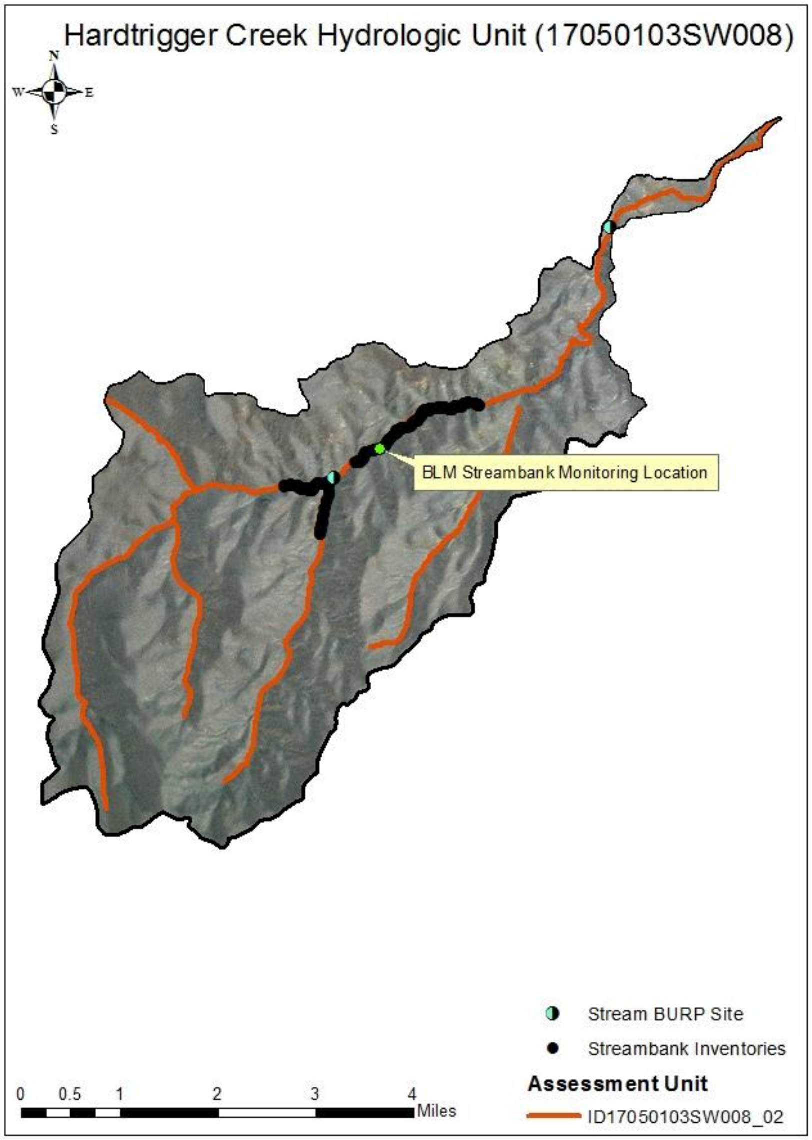

Figure 9. DEQ BURP monitoring locations (1995, 1996, 1998), DEQ streambank stability inventories (2013), and BLM streambank monitoring locations (2005-2012) in the Hardtrigger Creek watershed. BURP data was collected in 1998; data was not collected in 1995 or 1996 because the channel was dry.

Table 5. BLM streambank stability data on Hardtrigger Creek (UTM: 4801645N, 517535E) from 2005 through 2012.

Year	Streambank Stability
2005	68%

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2006	94%
2007	91%
2008	72%
2009	46%
2010	30%
2011	88%
2012	81%

McBride Creek (ID17050103SW004_02 & 03)

Figure 10 shows the location of the BURP site in the McBride Creek watershed. The channel was dry in 2001, but in 1996 the creek flow was estimated at 0.2 cfs and channel-bottom substrate fines were estimated at 13%, within the 28% threshold. The BURP data for McBride Creek are available at: http://mapcase.deq.idaho.gov/wq2010/js/adb2010.aspx?WBIDSEGID=ID17050103SW004_02.

Additionally, in 2011 DEQ personnel conducted streambank stability inventories along two sections of Mcbride Creek (Figure 10): 1) a lower elevation, intermittent section in AU_3, and 2) a higher elevation, intermittent/perennial section in AU_2. The data indicate that lower elevation segments of McBride Creek have streambank stability levels of approximately 61%, but with rather high lateral recession rates (0.135 ft/year) that contribute significantly to sediment loads. Conversely, the data indicate that higher elevation segments of McBride Creek have lower streambank stability rates (approximately 52%), but with considerably lower lateral recession rates (0.04 ft/year), resulting in lower sediment loading.

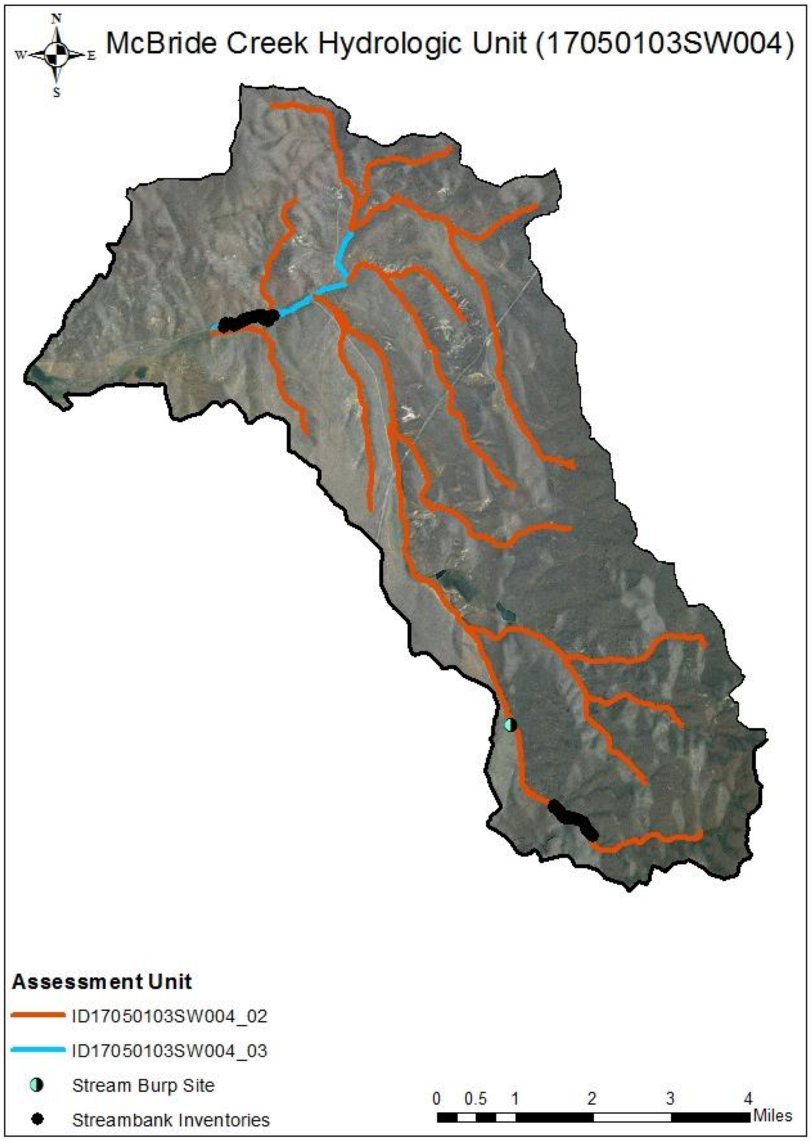

Figure 10. DEQ BURP monitoring location (1996, 2001) and streambank stability inventories (2011) in the McBride Creek watershed. BURP data was collected in 1996; data was not collected in 2001 because the channel was dry.

Pickett Creek (ID17050103SW016_03)

Figure 11 shows the location of BURP sites in the Pickett Creek watershed. The channel was dry in 2001, but in 1996 the creek flow was estimated at 6.1 and 7.4 cfs and channel-bottom substrate fines were estimated at 10% and 7%, well within the 28% threshold for supporting COLD. The BURP data for Pickett Creek are available at: http://mapcase.deq.idaho.gov/wq2010/js/adb2010.aspx?WBIDSEGID=ID17050103SW016_03.

Additionally, in 2012 DEQ personnel conducted streambank stability inventories along a section of Pickett Creek (Figure 11). The data indicate that Pickett Creek have streambank

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stability levels of approximately 80.5%, which is right at the threshold believed to support COLD, but with rather high lateral recession rates (0.15 ft/year) that contribute significantly to sediment loads.

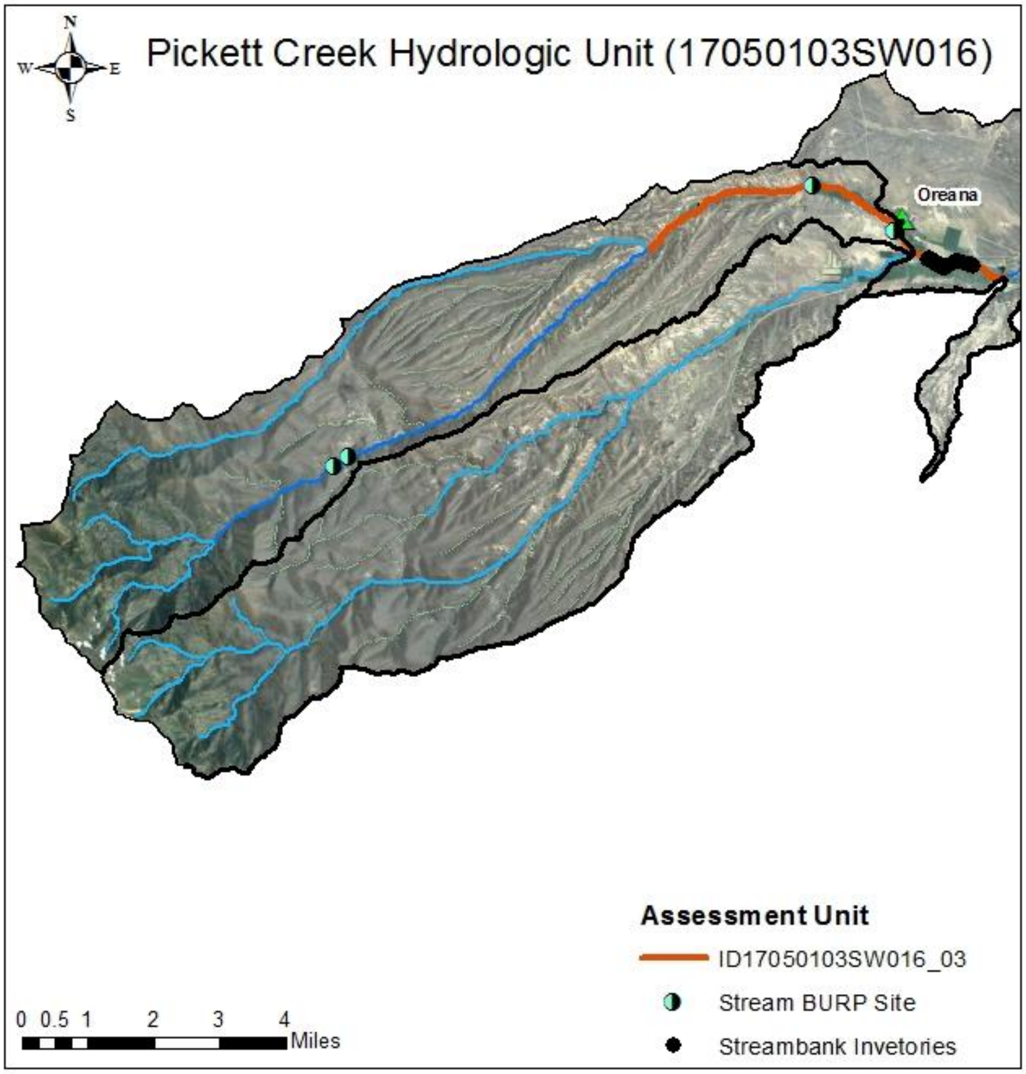

Figure 11. DEQ BURP monitoring locations (1996, 2001) and streambank stability inventories (2012) in the Pickett Creek watershed. BURP data was collected in 1996; data was not collected in 2001 because the channel was dry.

Vinson Wash (ID17050103SW023_03)

Figure 12 shows the BURP site in the impaired AU_03 of Vinson Wash. In 2001 DEQ recorded this segment of the channel having a measured flow of 1.5 cfs. However, the percentage of fines comprising the channel bottom substrate was estimated at over 58%, well outside of the 28% threshold recognized as supporting COLD. The BURP data for Vinson Wash are available at: http://mapcase.deq.idaho.gov/wq2010/js/adb2010.aspx?WBIDSEGID=ID17050103SW023_03.

Idaho Power visually observed what is believed to be the mouth of Vinson Wash as part of their Snake River drain and tributary analysis (identified as River Mile 483.1 in Knight and Naymik 2009). The site was visited on May 17, June 20, July 31, August 29, and October 9, 2007. The site was observed to have water flowing into the river during all site visits, with the exception of the October 9 visit, where no flow was observed October suggesting that it may be primarily comprised of drain returns (A. Knight, pers. comm. 2012).

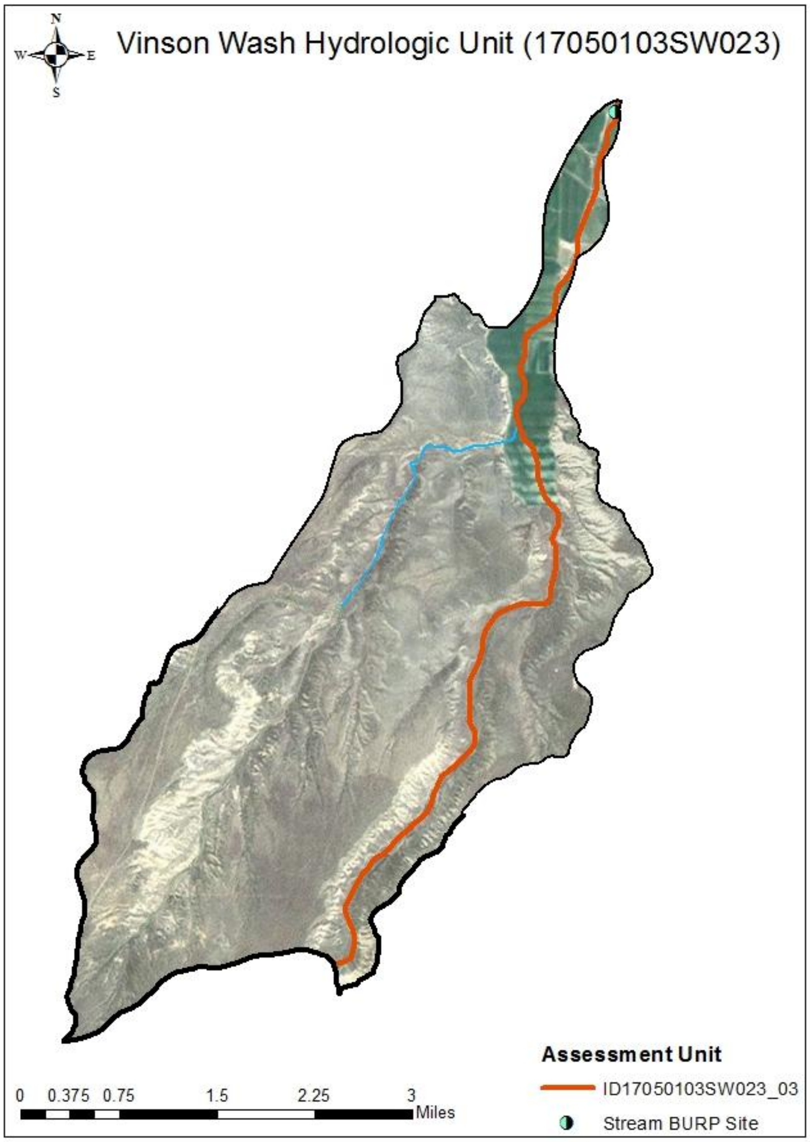

Figure 12. The DEQ BURP monitoring location (2001) on Vinson Wash.

2.5. Data Gaps

A detailed discussion of data gaps for the Mid Snake River/Succor Creek subbasin is provided in the *Mid Snake River/Succor Creek SBA and TMDL (DEQ 2003)* and *the Mid*

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Snake River/Succor Creek Five-Year Review (DEQ 2011). These reports are available at: http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/snake-river-middle-succor-creek-subbasin.aspx.

The intention is to address data gaps as activities to restore beneficial use support are undertaken in the watershed. The details of how this could be accomplished will be included in the implementation plan.

2.6. Conclusions

Based on a thorough analysis of the data collected by DEQ BURP crews, streambank stability data collected by DEQ personnel in 2011-2013 and by the BLM from 2005-2012, and from the data and report produced by Idaho Power in 2009, it is evident that COLD beneficial uses are likely impaired by sediment in the specific AUs addressed for Birch Creek, Hardtrigger Creek, McBride Creek, Pickett Creek, and Vinson Wash. Further, it is evident that due to the absence of point sources, nonpoint sources are the most likely source of these impairments.

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3. Subbasin Assessment–Pollutant Source Inventory

Since the lower *Mid Snake River/Succor Creek TMDL (DEQ 2003)* was approved, DEQ has collected data, requested data from other agencies and organizations, searched external databases, and reviewed university publications and municipal or regional resource management plans for additional and recent water quality data. The results of that effort were compiled in *the Mid Snake River/Succor Creek Five-Year Review* (DEQ 2011) and recommendations for impairment listings and TMDL development for these tributaries have been made. This section will address water quality data (sedimentation/siltation) related to beneficial uses, or impairments in the Mid Snake River/Succor Creek subbasin (specifically, Birch Creek, Hardtrigger Creek, McBride Creek, Pickett Creek, and Vinson Wash).

The pollutant of concern for this review is limited to sedimentation/siltation for which narrative criteria are established in Idaho WQS and have been identified as current or potential limiting factors for attainment of designated, existing, or presumed beneficial uses in the Mid Snake River/Succor Creek subbasin.

3.1. Sources of Pollutants of Concern

A review of identified or observed sources of impairment to surface water in the subbasin, including permitted point sources, nonpoint sources, natural events, and documented or otherwise known accidental releases was completed in the *Mid Snake River/Succor Creek TMDL (DEQ 2003)* and included in *the Mid Snake River/Succor Creek Five-Year Review* (DEQ 2011).

3.1.1. Point Sources

There are no individually-permitted point sources in the Birch Creek, Hardtrigger Creek, McBride Creek, Pickett Creek, or Vinson Creek watersheds.

There are, however, several RCRA and CERCLA sites in the Mid Snake River/Succor Creek subbasin, which are identified in the *Mid Snake River/Succor Creek TMDL (DEQ 2003)* and the *Mid Snake River/Succor Creek Five-Year Review* (DEQ 2011).

3.1.2. Nonpoint Sources

A detailed discussion of nonpoint sources in the subbasin is provided in the *Mid Snake River/Succor Creek TMDL (DEQ 2003)* and the *Mid Snake River/Succor Creek Five-Year Review* (DEQ 2011). While locations of agricultural diversions, dams, and drains in the subbasin can be indicated as specific points on the landscape, the CWA designates these as nonpoint sources due to the impact that widespread land use activities have on the water channeled through agricultural irrigation systems. Septic system leakage, paved and unpaved road surfaces are unquantified sources also likely to contribute sediment to surface waters. Contributions from these orphan sources are acknowledged data gaps and implementation plans could include details regarding future data collection from these sources. Figures 13

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through 17 show the land use and habitat patterns within Birch Creek, Hardtrigger Creek, McBride Creek, Pickett Creek, and Vinson Wash Watersheds.

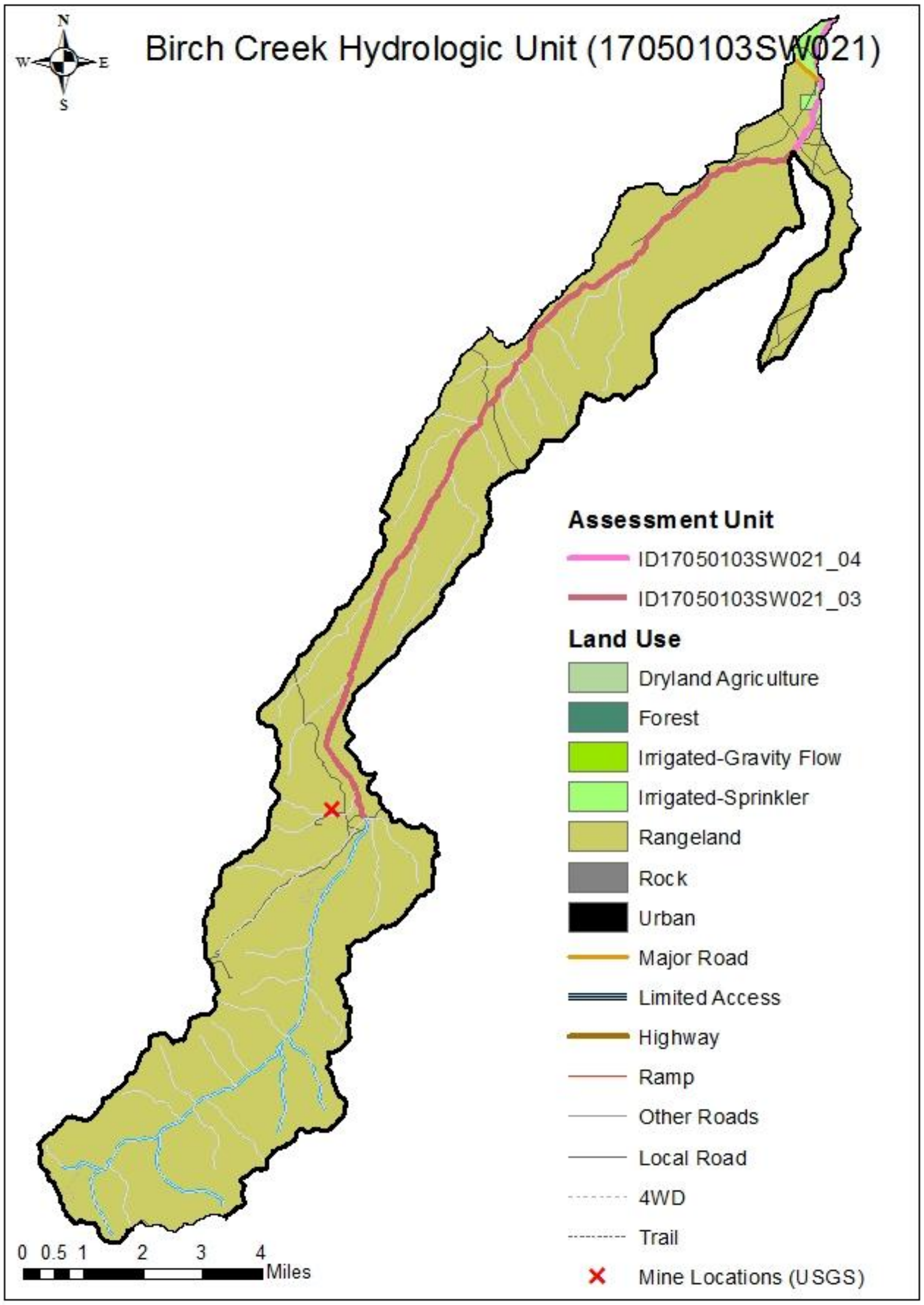

Figure 17. Land use in the Birch Creek watershed.

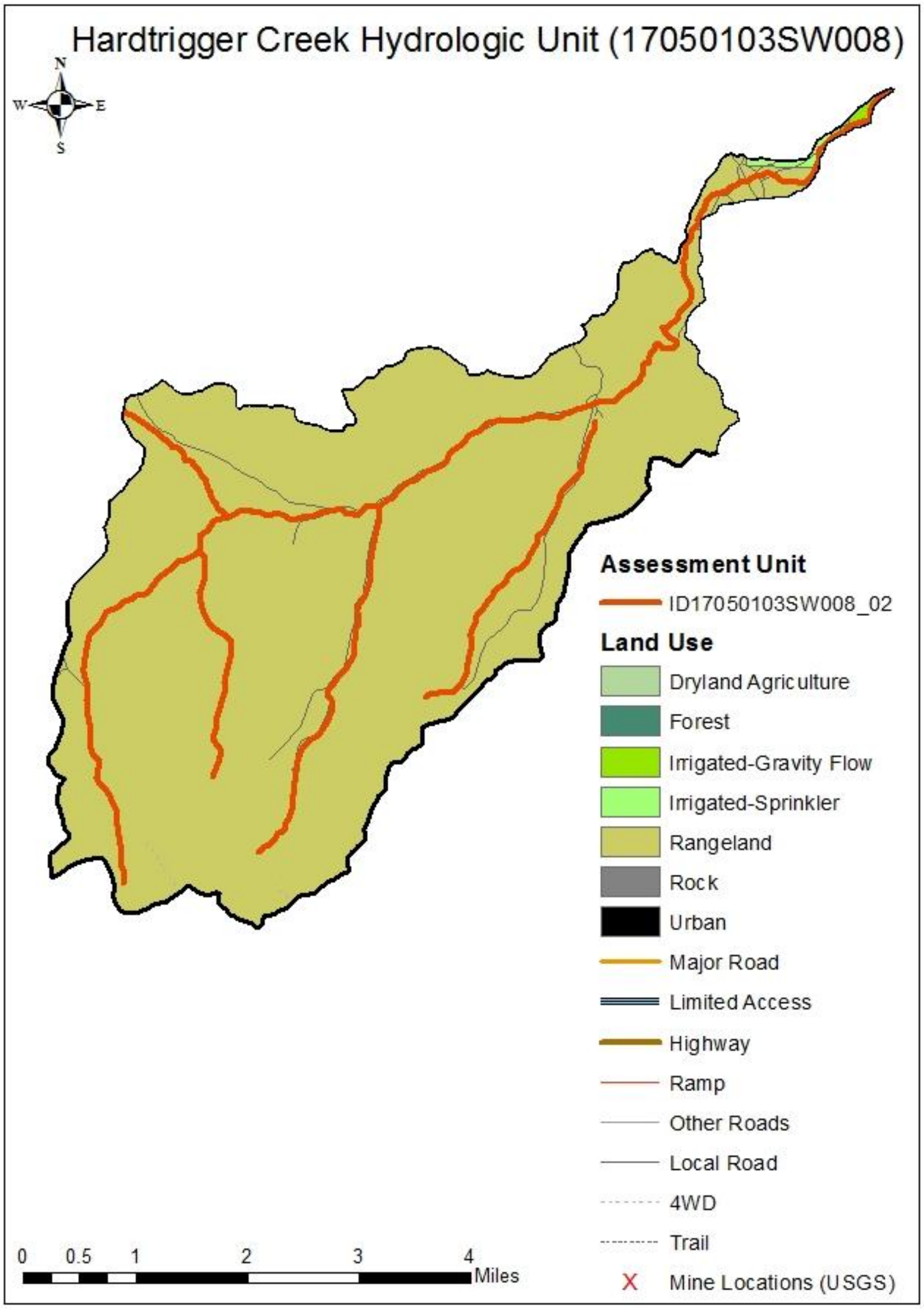

Figure 14. Land use in the Hardtrigger Creek watershed.

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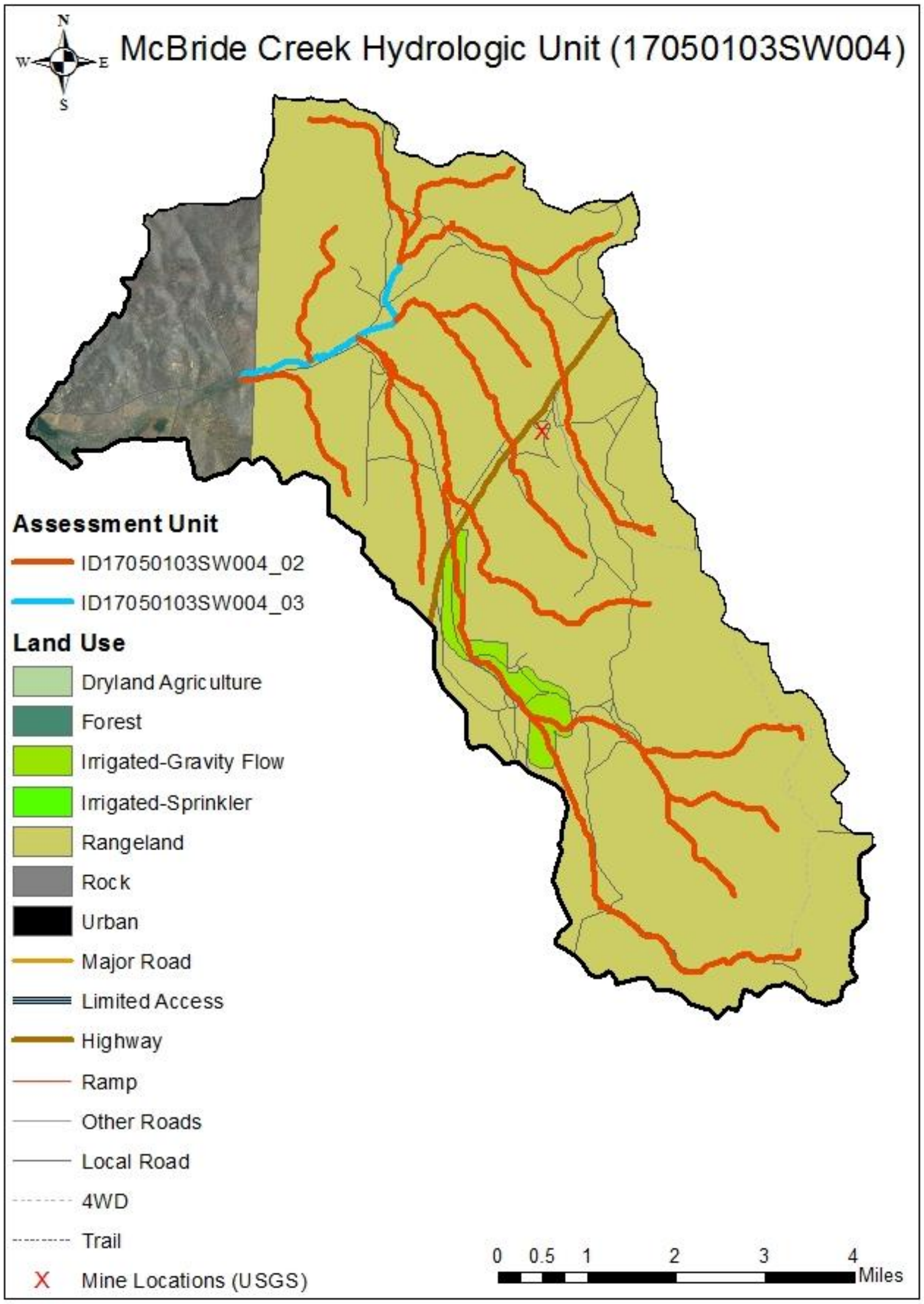

Figure 15. Land use in the McBride Creek watershed.

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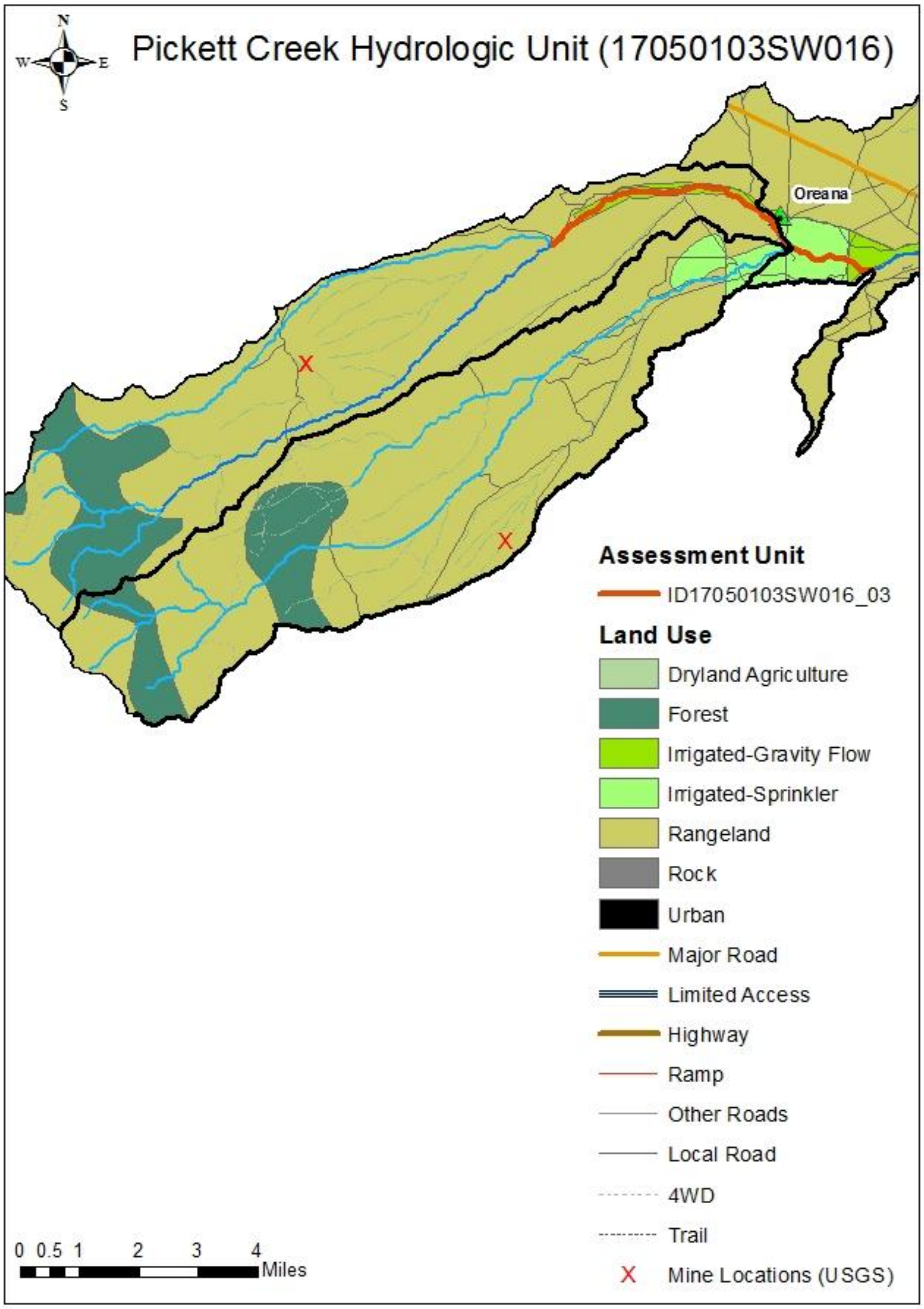

Figure 16. Land use in the Pickett Creek watershed.

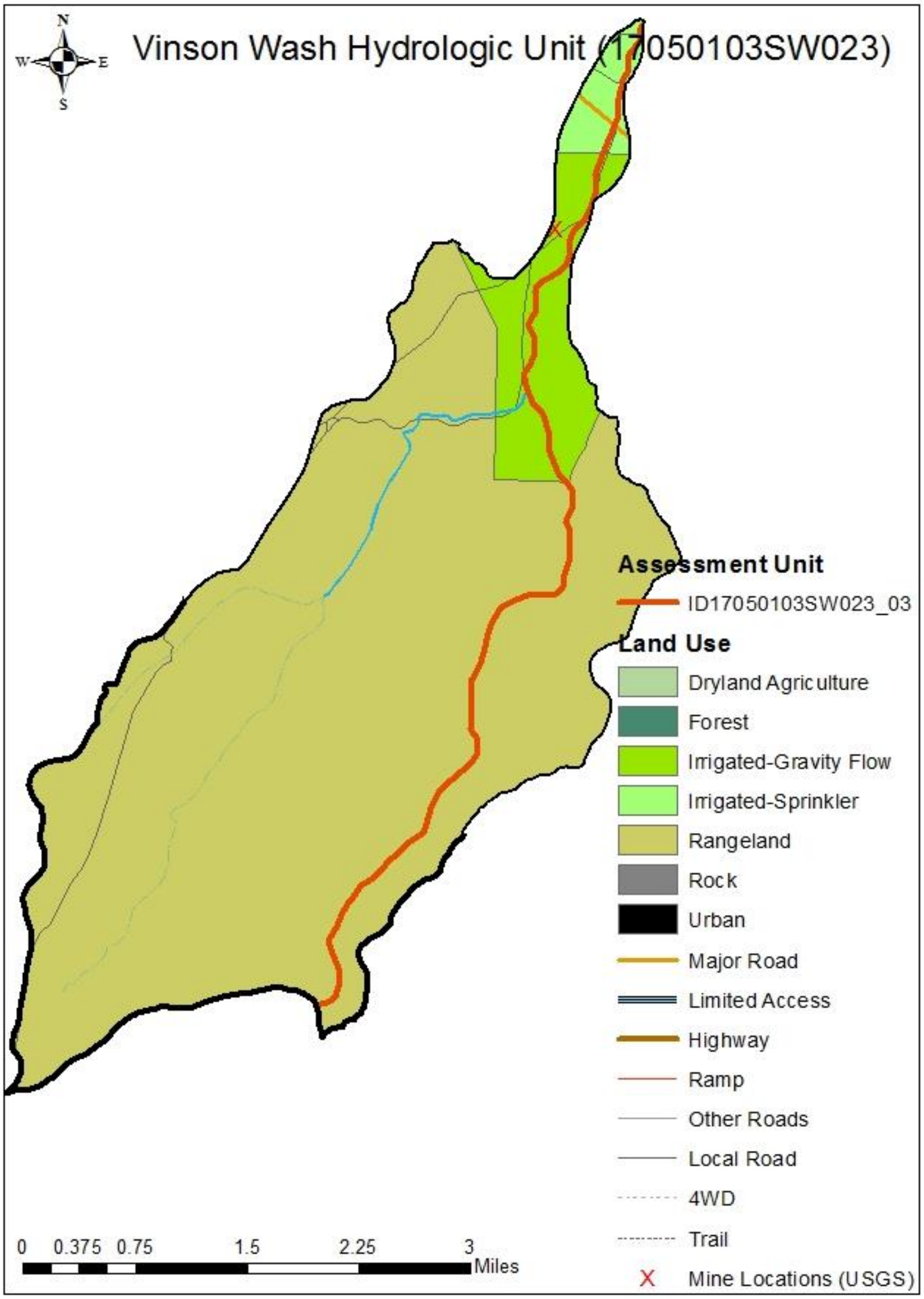

Figure 17. Land use in the Vinson Wash watershed.

3.1.3. Pollutant Transport

A discussion of pollutant transport in the subbasin is provided in the *Mid Snake River/Succor Creek TMDL (DEQ 2003)* and the *Mid Snake River/Succor Creek Five-Year Review* (DEQ 2011).

3.2. Data Gaps

Uncertainty in TMDLs is largely the result of insufficient or limited data. However, while it is easier to develop and refine loading analyses and models with adequate data, there is sufficient data from Birch Creek, Hardtrigger Creek, McBride Creek, and Pickett to identify likely pollution sources and develop reasonable LAs and WLAs to reduce pollutant loads. Vinson Wash is one potential exception in that we have limited streamflow and percent fines data, and we do not have sediment concentration data. However, because much of Vinson Wash is quite similar to Birch Creek (both in the upland, dry sandy wash areas and the lower irrigated agricultural areas, we expect comparable results for both streamflow and sediment concentrations to enable gross estimates of sediment loading.

Additional data gap issues in the Mid Snake River/Succor Creek subbasin include:

- Spatial data sets for land use, hydrology, and channel morphology are sparse.
- Detailed analyses of in-stream flow conditions, water column chemistry, and stream and riparian characteristics in some locations are difficult or not possible.
- Mass-balance and load calculations are based on low-resolution information.
- Statistically valid representations of natural, undisturbed, or background stream conditions are difficult to obtain.
- Dynamic or highly variable conditions are not evaluated.
- Small-scale processes are not evaluated.
- Water returns and withdrawals are not quantified or are over-simplified.

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4. Monitoring and Status of Water Quality Improvements

The goal of the *Mid Snake River/Succor Creek Watershed TMDL Implementation Plan for Agriculture (ISCC 2005)* is to assist and/or compliment other watershed efforts to restore beneficial uses for the 303(d) listed stream segments within the Mid Snake River/Succor Creek Watershed. The agricultural component of the Implementation Plan (IP) includes an adaptive management approach for the implementation of Resource Management Systems (RMSs) and Best Management Practices (BMPs) to meet the requirements for the Mid Snake River/Succor Creek TMDL. Agricultural RMSs and BMPs on privately owned land will be developed and implemented on site with individual agricultural operators as per the 2003 Idaho Agricultural Pollution Abatement Plan (APAP).

The IP can be accessed at http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/snake-river-middle-succor-creek-subbasin.aspx, and includes a watershed implementation priorities, schedules, and milestones for helping meet WQS.

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5. Total Maximum Daily Load(s)

A TMDL prescribes an upper limit (or *load capacity*) on discharge of a pollutant from all sources to assure water quality standards are met. This load capacity (LC) can be represented by an equation:

LC = MOS + NB + LA + WLA

Where:

> Current load = the current concentration of the pollutant in the water body
>
> MOS = margin of safety. Because of uncertainties regarding quantification of loads and the relation of specific loads to attainment of water quality standards, 40 CFR Part 130 requires a margin of safety, which is effectively a reduction in the load capacity available for allocation to pollutant sources.
>
> NB = natural background. When present, NB may be considered part of load allocation (LA), but it is often considered separately because it represents a part of the load not subject to control. NB is also effectively a reduction in the load capacity available for allocation to human-made pollutant sources.
>
> LA = the load allocation for all nonpoint sources
>
> WLA = the wasteload allocation for all point sources

A load is a quantity of a pollutant discharged over some period; numerically, it is the product of concentration and flow. Due to the diverse nature of various pollutants, and the difficulty of strictly dealing with loads, federal rules allow for "other appropriate measures" to be used when necessary. These "other measures" must still be quantifiable, and relate to water quality standards, but they allow flexibility to deal with pollutant loading in more practical and tangible ways. The rules also recognize the particular difficulty of quantifying nonpoint loads and allow "gross allotment" as a load allocation where available data or appropriate predictive techniques limit more accurate estimates. For certain pollutants whose effects are long term, such as sediment and nutrients, EPA allows for seasonal or annual loads.

5.1. In-stream Water Quality Targets

Instream water quality targets are selected for the purpose of restoring beneficial uses to the water body. A detailed discussion of in-stream water quality targets is provided in the *Mid Snake River/Succor Creek TMDL (DEQ 2003)* and the *Mid Snake River/Succor Creek Five-Year Review* (DEQ 2011).

5.1.1. Design Conditions

Design conditions are those methods used to determine LC, existing pollutant loads, WLAs, and LAs. Because these elements are variable for each pollutant and AU combination, design conditions are discussed separately for sediment concentration and bank stability measures. Load capacity is the calculated watershed sediment load that fully supports beneficial uses. The LC for a TMDL designed to address a sediment caused limitation to use

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support is complicated by the fact that the State's water quality standard is narrative rather than numerical.

Within the Mid Snake River/Succor Creek subwatersheds, the sediment interfering with COLD beneficial uses is likely to be primarily fine sediment, < 0.063 mm in size. Adequate quantitative measurements of the effect of excess sediment on the aquatic life uses in the subwatersheds have not been fully developed. Given this reality, a sediment LC for the TMDL can be developed using literature-based values from effects-based studies (empirical). The sediment LC values for these Mid Snake River/Succor Creek subwatersheds are based on the following assertions:

- Natural background concentrations of suspended sediment and bank stability measures in similar watersheds and values identified in scientific literature are fully supportive of COLD beneficial uses.
- The stream system has some finite ability to process (transport) suspended sediment at concentrations greater than background values without impairing beneficial uses.
- The beneficial use will respond positively to a concentration of full support, which can be quantified when the finite, yet unquantified, ability of the stream system to process sediment is met.

5.1.1.1. Sediment Concentration (Birch Creek and Vinson Wash)

Sediment conditions as they relate to WQS are assessed through the interpretation of the narrative criteria based on impacts to aquatic life. Guidelines established by previous and developing TMDLs (for example the Lower Boise River Sediment TMDL 1998, the developing Little Willow Creek TMDL, and Lower Boise River Tributary Sediment TMDL) efforts are based on the work of Newcombe and Jensen (1996). These established sediment concentrations likely to support designated beneficial uses based on a Severity of Ill Effects (SEV) of 8, which Newcombe and Jensen identified as sublethal and identified by DEQ and the EPA (EPA pers. comm. 2012) as protective of aquatic life, water quality, and meeting the requirements of the CWA.

An SEV of 8, or any other SEV for that matter, results from specific combinations of sediment concentration and exposure duration. As identified in Newcombe and Jensen (1996), a constant SEV can be maintained by either increasing or decreasing the level of in stream sediment concentration, while doing the opposite with exposure duration (Figure 18). For example, juvenile salmonids are likely to experience an SEV of 8 under sediment concentrations of 403 mg/L over 2 days (a high dose over a short time period), but also under sediment concentrations of 20 mg/L over 4 months (a low dose over a long time period).

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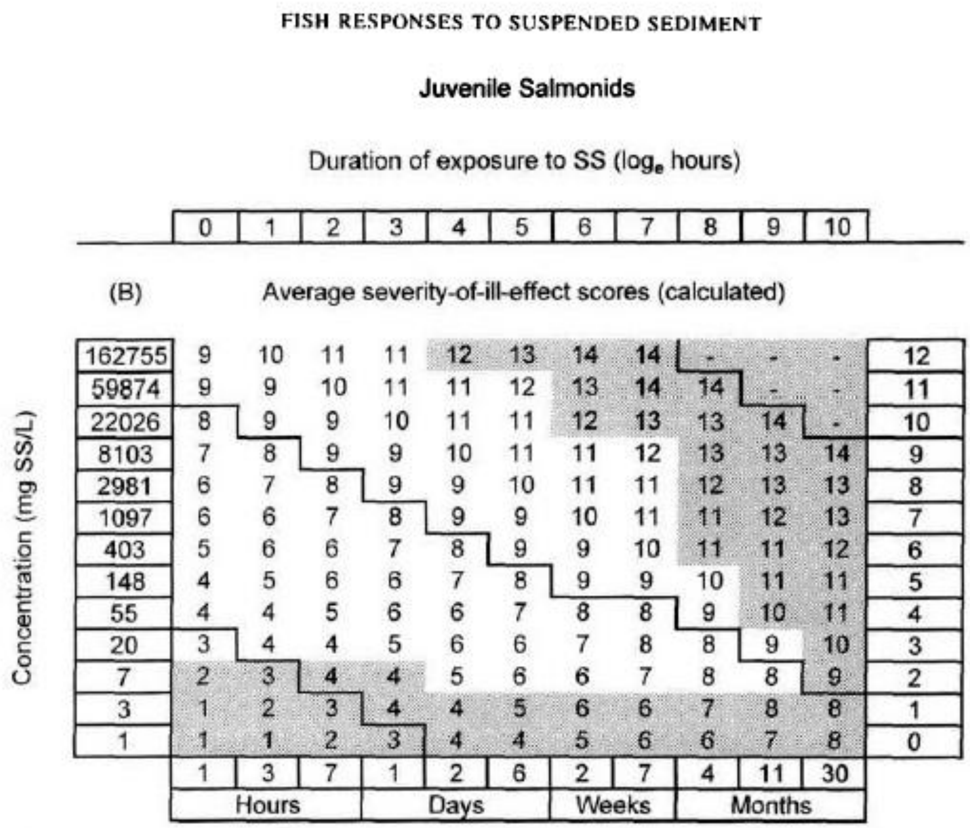

FISH RESPONSES TO SUSPENDED SEDIMENT

Juvenile Salmonids

Duration of exposure to SS (log_e hours)

(B) Average severity-of-ill-effect scores (calculated)

Concentration (mg SS/L)	0	1	2	3	4	5	6	7	8	9	10	(log_e mg SS/L)
162755	9	10	11	11	12	13	14	14	-	-	-	12
59874	9	9	10	11	11	12	13	14	14	-	-	11
22026	8	9	9	10	11	11	12	13	13	14	-	10
8103	7	8	9	9	10	11	11	12	13	13	14	9
2981	6	7	8	9	9	10	11	11	12	13	13	8
1097	6	6	7	8	9	9	10	11	11	12	13	7
403	5	6	6	7	8	9	9	10	11	11	12	6
148	4	5	6	6	7	8	9	9	10	11	11	5
55	4	4	5	6	6	7	8	8	9	10	11	4
20	3	4	4	5	6	6	7	8	8	9	10	3
7	2	3	4	4	5	6	6	7	8	8	9	2
3	1	2	3	4	4	5	6	6	7	8	8	1
1	1	1	2	3	4	4	5	6	6	7	8	0
	1	3	7	1	2	6	2	7	4	11	30	
	Hours			Days			Weeks		Months			

Figure 18. Observed and expected responses of juvenile salmonids under varying sediment concentrations and periods of exposure. This figure was taken from page 703 in Newcombe and Jensen (1996).

Birch Creek and Vinson Wash likely contain elevated suspended solid concentrations as a result of agricultural return water. Using the available site-specific data and scientific literature, a suspended sediment target value of 20 mg/L during any 4 continuous months (an SEV of 8) will be applied throughout the average irrigation season (April 1 through September 30) to ensure water quality standards are met and COLD beneficial uses are fully supported. The target of 20 mg/L average concentration during any 4 continuous months throughout the irrigation season will address TSS conditions in these AUs during the time of year when loads are the highest. Additionally, this value is very similar, yet even more supportive than concentrations allocated to Succor Creek (22 mg/L) and Bissel Creek (22 mg/L) in EPA-approved TMDLs (DEQ 2003, 2003b).

5.1.1.2. Streambank Stability (Hardtrigger, McBride and Pickett Creeks)

The primary source of sediment for the remaining AUs in this addendum is likely instream erosional processes. For these tributaries where the largest amount of sediment is produced from instream erosion, a target of greater than 80% stream bank stability is recommended. This surrogate measure has been used in other EPA-approved TMDLs, including the *Mid Snake River/Succor Creek TMDL (DEQ 2003)*, the Lemhi, Pahsimeroi, and Blackfoot TMDLs (DEQ 1999, 2001a, 2001b), and is based on findings by Overton et al. (1995). Using

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NRCS (1983) derived equations and bank inventory ratings, erosion rates and total tons of eroded sediment/year can be calculated. This 80% bank stability target has been linked to a 28% fines target and has been shown to support salmonids and, thus by corollary, is protective of other aquatic life.

To qualify the seasonal and annual variability and critical timing of sediment loading, climate and hydrology must be considered. The sediment analysis characterizes loads using average annual or seasonal rates determined from empirical characteristics that develop over time within the influence of peak and base flow conditions. While deriving these estimates it is difficult to account for seasonal and annual variation within a particular time frame; however, the seasonal and annual variation is accounted for over the longer time frame under which observed conditions have developed.

The annual average sediment load is not distributed equally throughout the year. Annual erosion and sediment delivery are functions of climate, where wet water years typically produce the highest sediment loads. Additionally, most of the erosion typically occurs during a few critical months. For example, in the Mid Snake River/Succor Creek watershed, most stream bank erosion occurs during spring runoff. The sediment analysis uses empirically derived hydrologic concepts to help account for variation and critical time periods. First, field-based methods consider critical hydrologic mechanisms. For example stream bank erosion inventories account for the fact that most bank recession occurs during peak flow events when banks are saturated. Second, the estimated annual average sediment delivery from a given watershed is a function of bankfull discharge or the average annual peak flow event.

Reduction of stream bank erosion prescribed within this TMDL is directly linked to the improvement of riparian vegetation density and structure to armor stream banks, reduce lateral recession, trap sediment, and reduce the erosive energy of the stream, thus reducing sediment loading. In reaches that are down-cut, or that have vertical erosive banks, continued erosion may be necessary to re-establish a functional floodplain that would subsequently be colonized with stabilizing riparian vegetation, a process that often takes many years.

5.1.2. Target Selection

Targets are selected with the intention to select reasonably achievable values that can be expected to support the beneficial uses in these impaired AUs. The sediment concentration and bank stability targets are based on site-specific empirical data, published scientific literature, and similar watershed analyses.

5.1.2.1. Sediment (Concentration) – Birch Creek and Vinson Wash

A TSS target value of 20 mg/L average concentration during any 4 continuous months, applied continuously throughout the irrigation season (April 1-September 30), has been developed for Birch Creek and Vinson Wash. The target is linked to conditions that will ensure Idaho WQS are met and COLD beneficial uses are returned to full support. The TSS target was derived from similar watersheds (Succor Creek, Bissel Creek, and Lower Boise River Tributaries), and by referencing the extensive metadata analysis conducted by Newcombe and Jensen (1996). Since the irrigation season represents the TSS conditions in

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these waterbodies during a time of year when loading in the stream is highest, the target of 20 mg/L average concentration during any 4 continuous months (April 1 – September 30) will ensure aquatic life beneficial uses will be supported.

This analysis calculates existing loads based on recorded flow and TSS values from data collection efforts in 2007 (Knight and Naymik 2009), providing estimated average monthly rates based on empirical information.

5.1.2.2. Sediment (Streambank Stability) – Hardtrigger, McBride, and Pickett Creeks

An 80% streambank stability target, applied year-round, has been developed for Hardtrigger, McBride, and Pickett Creeks. The target is linked to conditions that will ensure Idaho WQS are met and COLD beneficial uses are returned to full support. The streambank stability target was modeled after similar watersheds and EPA-approved TMDLs (Mid Snake River/Succor Creek TMDL 2003, Pahsimeroi TMDL 2001, and Blackfoot TMDL 2001), and is based on findings by Overton et al. (1995) and NRCS-derived (1983) bank inventory ratings and erosion rate equations.

Background sediment production from stream banks equates to the load at 80% stream bank stability as described in Overton et al. (1995), where stable banks are expressed as a percentage of the total estimated bank length. Natural condition stream bank stability potential is generally at 80% or greater for A, B, and C channel types in plutonic, volcanic, metamorphic, and sedimentary geology types.

The 80% streambank stability target is designed to meet the established instream water quality target of 28% or less fine sediment (less than 6.35 mm in diameter) in riffle areas suitable. Stream bank erosion reductions are quantitatively linked to tons of sediment per year. An inferential link is identified to show how sediment load allocations will reduce subsurface fine sediment to or below target levels. This link assumes that by reducing chronic sources of sediment, there will be a decrease in subsurface fine sediment that will ultimately improve the status of beneficial uses. Stream bank erosion load allocations are based upon the assumption that stream bank erosion is the primary source of sediment.

Site-specific analyses calculate existing loads based on streambank stability data collection efforts by DEQ personnel in 2011-2013.

5.1.3. Monitoring Points

The monitoring locations for BURP, and DEQ and BLM streambank stability data are illustrated in Figures 7, and 9 through 12. The monitoring locations for the Idaho Power collected flow and sediment data are available in their report (Knight and Naymik 2009). Future data collection within these AUs should take place at locations and frequencies consistent with Idaho WQS for determining beneficial use support during the implementation phase of the TMDL.

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5.2. Load Capacity

The LC is the amount of pollutant a water body can receive without violating water quality standards. Seasonal variations and a MOS to account for any uncertainty are calculated within the LC. The MOS accounts for uncertainty about assimilative capacity, the precise relationship between the selected target and beneficial use(s), and variability in target measurement. The LC is based on existing uses within in the watershed. The LC for each water body and specific pollutant are tailored to both the nature of the pollutant and the specific use impairment. A required part of the loading analysis is that the LC be based on critical conditions – the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. Because both LC and pollutant source loads vary, and not necessarily in concert, determination of critical conditions can be more complicated than it may appear on the surface.

5.2.1.1. Sediment (Concentration) – Birch Creek and Vinson Wash

The LC for sediment concentration is based on the instream load that would be present when a concentration of 20 mg/L is met. The LC for Birch Creek and Vinson Wash is based on maintaining 20 mg/L TSS average concentration during any 4 consecutive months during the critical flow, irrigation season, period (April 1 through September).

5.2.1.2. Sediment (Streambank Stability) – Hardtrigger, McBride, and Pickett Creeks

In those instances where the majority of sediment is generated from stream bank erosion, the LC is based on the load generated from banks that are greater than 80% stable. This load defines the LC for the remaining segments of the stream. The 80% streambank stability target is designed to meet the established instream water quality target of 28% or less fine sediment (less than 6.35 mm in diameter) in riffle areas.

5.3. Estimates of Existing Pollutant Loads

Regulations allow that loadings "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading," (Water quality planning and management, 40 CFR § 130.2(I)). An estimate must be made for each point source. Nonpoint sources are typically estimated based on the type of sources (land use) and area (such as a subwatershed), but may be aggregated by type of source or land area. To the extent possible, background loads should be distinguished from human-caused increases in nonpoint loads.

5.3.1.1. Sediment (Concentration and Bank Stability)

In instances where sediment was generated via agricultural or other nonpoint source activities (Birch Creek and Vinson Wash), the existing loads were calculated using measured water column data. In instances where the primary source of sediment is from bank erosion (Hardtrigger, McBride, and Pickett Creeks), existing sediment loads were determined using

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the bank erosion inventory process. This method provided direct measurement of erosion rates within the reach. This erosion rate was then used to calculate the current instream delivery of sediment within the system.

5.4. Load Allocation

Load allocations (LAs) may take the form of required percentage reductions rather than actual loads. Each point source must receive a waste load allocation (WLA). Nonpoint source allocations may be allocated by subwatershed, land use, responsibility for actions, or a combination of sources and activities. It is not necessary to allocate a reduction in load for all nonpoint sources so long as water quality targets can be met with the reductions that are specified. In developing LAs, the total allocations must include a margin of safety (MOS) to take into account seasonal variability and uncertainty. Uncertainty arises in selection of water quality targets, LCs, and estimates of existing loads. The uncertainty is attributable, in part, to incomplete knowledge or understanding of the system, such as unknown assimilation processes, and variable data. The MOS is effectively a reduction in LC that "comes off the top" (i.e., the LC is reduced by the MOS before the remaining LC is allocated to sources). The second factor is the natural background load, a further reduction in LC available for allocations. It is also prudent to allow for growth by reserving a portion of the remaining available load (if any) for future sources.

5.4.1.1. Sediment (Concentration) – Birch Creek and Vinson Wash

The targets for TSS in Birch Creek and Vinson Wash are 20 mg/L average concentration during any 4 continuous months throughout the critical irrigation season period (April 1 through September 30). The 20 mg/L target is intended to provide protection for aquatic life species that may inhabit the stream.

Table 6 shows the LAs for Birch Creek and Vinson Wash. The allocations are designed to meet the TSS goals of 22 mg/L with checkpoints near the end of each stream. The load is calculated using the standard pollutant mixing equation: *mixed conc.* $= (conc_1 * flow_1) + (conc_2 * flow_2) / (flow_1 + flow_2)$ (Hammer 1986). Fixed load targets were selected because management practices that affect sediment loading to the streams are not expected to change on a day-to-day basis. Thus, the management practices should be developed to meet the load goals.

Because the loading capacity for Birch Creek and Vinson Wash is based on maintaining the instream target throughout the critical irrigation period (April 1 through September 30), the actual mass load capacity changes at any given time or location in the stream as flows increase or decrease. As shown in the Table 6, if the load allocations are met, the loading capacity will be met.

Table 6. Gross TSS Load Allocations for of Birch Creek (AU_03 & 04) and Vinson Wash (AU_03). Data does not exist for Vinson Wash, so calculations are derived from Birch Creek due to their watershed similarity, proximity, and sediment sourcing.

Month	Flow (cfs)	TSS (mg/L)	TSS (tons/day)	Avg TSS (tons/day)	Load Capacity @ 20 mg/L (tons/day)	Load Reduction (tons/day | %)		Avg Load Capacity @ 20 mg/L (tons/day)	Avg Load Reduction (tons/day | %)	
April	No Data									
May	15.4	217	9.0	40.0	0.8	8.2	90.8%	1.0	39.0	97.6%
June	15.3	2720	112.4		0.8	111.5	99.3%			
July	18.8	742	37.7		1.0	36.6	97.3%			
August	16.2	531	23.2		0.9	22.4	96.2%			
September[1]	24.3	271	17.8		1.3	16.5	92.6%			
October	32.3	10	0.9	0.9	1.7	0.0	0.0%	1.7	0.0	0

[1]Interpolated flow and sediment concentration values; no data was available to September.
*The existing loads and load allocations are calculated using a portion the standard pollutant mixing equation with a built-in conversion factor: *(conc*flow*5.4)* (Hammer 1986).
*Orange Cells = Reductions are necessary because the existing load is greater than the loading capacity.
*Green Cells = No reduction is necessary because the existing load is equal to or less than the loading capacity. However, no additional sediment should be discharged to the stream.

The analysis for Birch Creek and Vinson Wash shows that TSS loads must be reduced by an average 97.6% in order to maintain 20 mg/L in the stream throughout the irrigation season (April 1 through September 30).

5.4.1.2. Sediment (Streambank Stability) – Hardtrigger, McBride, and Pickett Creeks

The remaining sediment-impaired stream segments in the Mid Snake River/Succor Creek basin are receiving allocations due to excess stream bank erosion. Table 7 shows the load allocations for these segments. The worksheets used to derive these load allocations are located in Appendix X. The current erosion rate is based on the bank geometry and lateral recession rate (as describe in Appendix G) at each measured reach.

The target erosion rate is based on the bank geometry of the measured reach and the lateral recession rate at the reference reach. The reference reach is an area that contains greater than 80% bank stability and less than 28% fine substrate material. The loading capacity is the total load that is present when banks are at least 80% stable with a recession rate of 0.05. As such, the loading capacity and the load allocations are the same. Note that these are the overall decreases necessary in the stream, but only apply to areas where banks are less than 80% stable and/or the lateral recession rate exceeds 0.05. The determination of the reference reach was based on the water quality surrogates (e.g. bank stability, percent fines) at a previously identified reference site in the Mid Snake River/Succor Creek subbasin (DEQ 2003).

Table 7. Streambank erosion load allocations for Hardtrigger, McBride, and Pickett Creeks.

Water Body	Bank Stability (%)	Current Load - Erosion Rate (tons/mile/year)	Current Load - Total Erosion (tons/year)	Load Capacity - Target Erosion Rate (tons/mile/year)	Load Capacity -Target Total Erosion (tons/year)	Load Reduction (tons/year; %)
Hardtrigger Creek (AU 008_02)	60%	33	435	7	91	344 tons/year 79%
McBride - Lower (AU 004_03)	61%	85	239	16	245	193 tons/year 81%
McBride - Upper (AU 004_02)	52%	41	706	21	366	340 tons/year 48%
Pickett Creek (AU 016_03)	80%[1]	34	217	12	74	143 tons/year 66%

[1]The Pickett Creek streambank inventory estimated bank stability right at the 80% threshold. However, due to the estimated later recession rate (8) falling just short of severe (9+), sediment reductions are likely necessary in order to fully support cold water aquatic life.
[*]Orange = Reductions are necessary because the existing load is greater than the loading capacity.
[*]Green = No reduction is necessary because the existing load is equal to or less than the loading capacity. However, no additional sediment should be discharged to the stream.

5.4.2. Margin of Safety

The MOS factored into all load allocations is implicit. The MOS includes the conservative assumptions used to determine existing sediment loads. Conservative assumptions made as part of the loading analysis are discussed below.

5.4.2.1. Sediment (Concentration) – Birch Creek and Vinson Wash

Total suspended solids water column targets are used for lower Birch Creek and Vinson Wash. The TSS target is 20 mg/L over 4 months during the irrigation season (April 1 through September 30). This target is linked by reference, but even more stringent than, segment targets for Succor Creek, Bissel Creek (22 mg/L), and the lower Boise River tributaries (probably 20 mg/L, but still in development). An implicit MOS applies because of the current target is actually lower than Bissel and Succor Creeks, which are believed to be protective of aquatic life.

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Second, the 20 mg/L target over 4 months directly references work by Newcombe and Jensen (1996), which identified this combination as producing an sub-lethal on juvenile salmonids (SEV of 8). Conversely, Newcombe and Jensen also identified that lethal effects (SEV of 9) would occur at sediment concentrations of 55 mg/L over 4 months. That is, during a 4 month exposure period, the resulting impact sediment concentrations exceeding 20 but less than 55 mg/L on juvenile fish are rather uncertain, probably depending on a number of other environmental factors. Therefore, based on their data and the proposed 20 mg/L & 4-month target, reaching an SEV of 9 (lethal and paral-lethal impacts to juvenile salmonids) would either require: 1) increasing sediment concentrations by 2.5 times (55 mg/L) over the same 4 month time period, or 2) increasing the exposure time period by nearly 3 times (11 months) at the same 20 mg/L concentrations. Thus, using 20 mg/L for 4 months is a conservative target for Birch Creek and Vinson Wash.

5.4.2.2. Sediment (Streambank Stability) – Hardtrigger, McBride, and Pickett Creeks

In the case of other Mid Snake River/Succor Creek watersheds, an implicit MOS exists due to a number of reasons: 1) desired bank erosion rates are representative of background conditions; 2) water quality targets for percent fines are consistent with values measured and as set by land management agencies based on stable salmonid production; 3) reference bank conditions in the watershed (Succor, Castle, and Sinker Creeks) used in the 2003 TMDL are based on banks that are ≥ 80% stable with 28% fines target; 4) the load capacity includes a lateral recession rate ≤ 0.05, which means that even streams with ≥ 80% bank stability (for example, Pickett Creek) may need to further reduce erosional processes to meet the corollary sediment load capacity; and 5) the actual sediment loadings are likely conservative (lower) relative to estimates, due in part to these xeric streams being largely intermittent, with flows often being 0 cfs among stream segments and water years due to a combination of low precipitation and subsidence flows, thus reducing the overall movement of sediment throughout the system.

5.4.3. Seasonal Variation and Critical Period

In the Mid Snake/Succor Creek hydrologic unit there are seasonal influences on nearly every pollutant. Based on the data available it is not possible to definitively determine the seasonal variability of sediment in these Mid Snake River/Succor Creek watersheds. However, in general, the spring and summer seasons are when concentrations of sediment and nutrients are the highest. Seasonal variation as it relates to development of this TMDL is addressed simply by ensuring that loads are reduced during the critical period (when beneficial uses are impaired and loads are controllable). Thus, the effects of seasonal variation are built into the load allocations (Table 8).

Table 9. Critical periods for waterbodies receiving TMDLs.

Waterbody	Pollutant	Critical Period (Time of Year Applicable)
Birch Creek (AU021_02, 03, & 04)	Sedimentation/Siltation (Concentration)	April 1 through September 30
Hardtrigger Creek	Sedimentation/Siltation	Year Round

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(AU 008_02)	(Streambank Stability)	
McBride - Lower (AU 004_03)	Sedimentation/Siltation (Streambank Stability)	Year Round
McBride - Upper (AU 004_02)	Sedimentation/Siltation (Streambank Stability)	Year Round
Pickett Creek (AU 016_03)	Sedimentation/Siltation (Streambank Stability)	Year Round
Vinson Wash (AU023_03)	Sedimentation/Siltation (Concentration)	April 1 through September 30

Sediment can be easily transported through the agricultural irrigation system and is easily transported through those systems when irrigation water is flowing across cropland during the growing season and when runoff from any source is delivered into the irrigation system in the dormant season. Because irrigation systems are permanent structures designed to transport water across the landscape, pollutants are easily transmitted through the watershed all year, regardless of crop status. These structures are easily accessible to most community members and border and traverse grazed and cultivated agricultural lands.

5.4.4. Reasonable Assurance

Because land use is documented as almost exclusively as rangeland and agricultural, all reductions are directed at nonpoint sources. Idaho WQS assign specific agencies to be responsible for implementing, evaluating, and modifying BMPs to restore and protect impaired water bodies. The state of Idaho is committed to developing implementation plans within 18 months of EPA approval of TMDLs. DEQ, the WAG, and the designated agencies will develop implementation plans (IPs), and DEQ will incorporate them into the state's water quality management plan. DEQ will periodically reassess the beneficial use support status of water bodies to determine support status. Implementation or revision of BMPs will continue until full beneficial use support status is documented and the TMDL is considered to be achieved.

5.4.5. Background

Background sediment production from stream banks equates to the load at 80% stream bank stability as described in Overton et al. (1995), where stable banks are expressed as a percentage of the total estimated bank length. Natural condition stream bank stability potential is generally at 80% or greater for A, B, and C channel types in plutonic, volcanic, metamorphic, and sedimentary geology types.

The sediment load reductions are designed to meet the established instream water quality target of 28% or less fine sediment (less than 6.35 mm in diameter) in riffle areas. Stream bank erosion reductions are quantitatively linked to tons of sediment per year. An inferential link is identified to show how sediment load allocations will reduce subsurface fine sediment to or below target levels. This link assumes that by reducing chronic sources of sediment, there will be a decrease in subsurface fine sediment that will ultimately improve the status of

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beneficial uses. Stream bank erosion load allocations are based upon the assumption that stream bank erosion is the primary source of sediment.

5.4.6. Reserve

Where applicable, states must include an allowance for future loading in their TMDL that accounts for reasonably foreseeable increases in pollutant loads with careful documentation of the decision-making process. This allowance is based on existing and readily available data at the time the TMDL is established. In the case of the Mid Snake River/Succor Creek TMDL addendum, an allowance for future growth is not recommended until such time as reductions indicate that beneficial uses or state water quality standards have been restored. There are currently no point source discharges to Birch, Hardtrigger, McBride, Pickett, or Vinson Wash. Any additional point sources discharging to these waterbodies would receive a wasteload allocation of zero. Therefore, the allowance for future growth is zero. Growth can occur under the following auspices: 1) pollutant trading, 2) no net increase above the instream target parameters, and 3) no discharge where land application is the preferred option.

5.4.7. Construction Storm Water and TMDL Waste Load Allocations

5.4.7.1. Construction Stormwater

The CWA requires operators of construction sites to obtain permit coverage to discharge storm water to a water body or to a municipal storm sewer. In Idaho, EPA has issued a general permit for storm water discharges from construction sites. In the past storm water was treated as a non-point source of pollutants. However, because storm water can be managed on site through management practices or when discharged through a discrete conveyance such as a storm sewer, it now requires a National Pollution Discharge Elimination System (NPDES) Permit.

5.4.7.2. The Construction General Permit (CGP)

If a construction project disturbs more than one acre of land (or is part of larger common development) that will disturb more than one acre), the operator is required to apply for permit coverage from EPA after developing a site-specific Storm Water Pollution Prevention Plan.

5.4.7.3. Storm Water Pollution Prevention Plan (SWPPP)

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

5.4.7.4. Construction Storm Water Requirements

When a stream is on Idaho's § 303(d) list and has a TMDL developed DEQ may incorporate a gross WLA for anticipated construction storm water activities. TMDLs developed in the past that did not have a WLA for construction storm water activities will also be considered in compliance with provisions of the TMDL if they obtain CGP under the NPDES program and implement the appropriate BMPs.

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

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5.5. Pollution Trading

Pollutant trading (also known as *water quality trading*) is a contractual agreement to exchange pollution reductions between two parties. Pollutant trading is a business-like way of helping to solve water quality problems by focusing on cost effective local solutions to problems caused by pollutant discharges to surface waters.

The appeal of trading emerges when pollutant sources face substantially different pollutant reduction costs. Typically, a party facing relatively high pollutant reduction costs compensates another party to achieve an equivalent, though less costly, pollutant reduction.

Pollutant trading is voluntary. Parties trade only if both are better off because of the trade, and trading allows parties to decide how to best reduce pollutant loadings within the limits of certain requirements.

Pollutant trading is recognized in Idaho's WQS at IDAPA 58.01.02.054.06. Currently, DEQ's policy is to allow for pollutant trading as a means to meet total maximum daily loads (TMDLs), thus restoring water quality limited water bodies to compliance with water quality standards. The *Pollutant Trading Guidance* document sets forth the procedures to be followed for pollutant trading:

http://www.deq.idaho.gov/water/prog_issues/waste_water/pollutant_trading/pollutant_trading_guidance_entire.pdf

5.5.1. Trading Components

The major components of pollutant trading are *trading parties* (buyers and sellers) and *credits* (the commodity being bought and sold). Additionally, *ratios* are used to ensure environmental equivalency of trades on water bodies covered by a TMDL. All trading activity must be recorded in the trading database through the Idaho Clean Water Cooperative, Inc.

Both point and nonpoint sources may create marketable credits, which are a reduction of a pollutant beyond a level set by a TMDL:

- Point sources create credits by reducing pollutant discharges below NPDES effluent limits set initially by the waste load allocation.
- Nonpoint sources create credits by implementing approved best management practices (BMPs) that reduce the amount of pollutant run-off. Nonpoint sources must follow specific design, maintenance, and monitoring requirements for that BMP, apply discounts to credits generated if required, and provide a water quality contribution to ensure a net environmental benefit. The water quality contribution also ensures the reduction (the marketable credit), is surplus to the reductions the TMDL assumes the nonpoint source is achieving to meet the water quality goals of the TMDL.

5.5.2. Watershed-Specific Environmental Protection

Trades must be implemented so that the overall water quality of the water bodies covered by the TMDL are protected. To do this, hydrologically-based ratios are developed to ensure trades between sources distributed throughout TMDL water bodies result in environmentally equivalent or better outcomes at the point of environmental concern. Moreover, localized adverse impacts to water quality are not allowed.

5.5.3. IV. Trading Framework

For pollutant trading to be authorized, it must be specifically mentioned within a TMDL document. After adoption of an EPA approved TMDL, DEQ, in concert with the Watershed Advisory Group (WAG), must develop a pollutant trading framework document as part of an implementation plan for the watershed that is the subject of the TMDL.

The elements of a trading document are described in DEQ's Pollutant Trading Guidance:

http://www.deq.idaho.gov/water/prog_issues/waste_water/pollutant_trading/pollutant_trading_guidance_entire.pdf.

5.6. Public Participation

House Bill 145 (HB145) has brought about changes in how WAGs are involved in TMDL development and review. The basic process for developing TMDLs and implementation plans is as follows:

1. BAG members are appointed by DEQ's director for each of Idaho's basins.
2. An "Integrated Report" is developed by DEQ every two years that highlights which water bodies in Idaho appear to be degraded.
3. DEQ prepares to begin the SBA and TMDL process for individual degraded watersheds.
4. A WAG is formed by DEQ (with help from the BAG) for a specific watershed/TMDL.
5. With the assistance of the WAG, DEQ develops an SBA and any necessary TMDLs for the watershed.
6. The WAG comments on the SBA/TMDL.
7. WAG comments are considered and incorporated, as appropriate, by DEQ into the SBA/TMDL.
8. The public comments on the SBA/TMDL.
9. Public comments are considered and incorporated, as appropriate, by DEQ into the SBA/TMDL.
10. DEQ sends the document to the U.S. Environmental Protection Agency (EPA) for approval.
11. DEQ and the WAG develop, then implement, a plan to reach the goals of the TMDL.

DEQ will provide the WAG with all available information pertinent to the SBA/TMDL, when requested, such as monitoring data, water quality assessments, and relevant reports. The WAG will also have the opportunity to actively participate in preparing the SBA/TMDL documents.

Once a draft SBA/TMDL is complete, it is reviewed first by the WAG, then by the public. If, after WAG comments have been considered and incorporated, a WAG is not in agreement

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with an SBA/TMDL, the WAG's position and the basis for it will be documented in the public notice of public availability of the SBA/TMDL for review. If the WAG still disagrees with the SBA/TMDL after public comments have been considered and incorporated, DEQ must incorporate the WAG's dissenting opinion

5.7. Implementation Strategies

The purpose of this implementation strategy is to outline the pathway by which a larger, more comprehensive, implementation plan will be developed 18 months after TMDL approval. The comprehensive implementation plan will provide details of the actions needed to achieve load reductions (set forth in a TMDL), a schedule of those actions, and specify monitoring needed to document actions and progress toward meeting state water quality standards. These details are typically set forth in the plan that follows approval of the TMDL. In the meantime, a cursory implementation strategy is developed to identify the general issues such as responsible parties, a time line, and a monitoring strategy for determining progress toward meeting the TMDL goals outlined in this document.
The geographic scope of this TMDL addendum effort includes several tributaries to the Snake River, including Birch Creek, Hardtrigger Creek, McBride Creek, Pickett Creek, and Vinson Wash.

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

5.7.1. Time Frame

The implementation plan must demonstrate a strategy for implementing and maintaining the plan and the resulting water quality improvements over the long term. The final timeline should be as specific as possible and should include a schedule for BMP installation and/or evaluation, monitoring schedules, reporting dates, and milestones for evaluating progress. There may be disparity in timelines for different subwatersheds. This is acceptable as long as there is reasonable assurance that milestones will be achieved.

The implementation plan will be designed to reduce pollutant loads from sources to meet TMDLs, their associated loads, and water quality standards. DEQ recognizes that where implementation involves significant restoration, water quality standards may not be met for quite some time. In addition, DEQ recognizes that technology for controlling nonpoint source pollution is, in some cases, in the development stages and will likely take one or more iterations to develop effective techniques.

A definitive timeline for implementing the TMDL and the associated allocations will be developed as part of the implementation plan. This timeline will be developed in consultation with the WAG, the designated agencies, and other interested publics. In the meantime, implementation planning will begin immediately (2013). The goal is to attain the water quality standards and return beneficial uses to full support in the shortest time possible. DEQ expects full implementation of the TMDL and recovery of the beneficial uses to take

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upwards of 20 years. Some subwatersheds may take less time and some may take more, depending on the complexity of the system.

5.7.2. Adaptive Management Approach

The goal of the CWA and its associated administrative rules for Idaho is that water quality standards shall be met or that all feasible steps will be taken towards achieving the highest quality water attainable. This is a long-term goal in this watershed, particularly because nonpoint sources are the primary concern. To achieve this goal, implementation must commence as soon as possible.

The TMDL addendum is a numerical loading that sets pollutant levels such that instream water quality standards are met and designated beneficial uses are supported. DEQ recognizes that the TMDL is calculated from mathematical models and other analytical techniques designed to simulate and/or predict very complex physical, chemical, and biological processes. Models and some other analytical techniques are simplifications of these complex processes and, while they are useful in interpreting data and in predicting trends in water quality, they are unlikely to produce an exact prediction of how streams and other waterbodies will respond to the application of various management measures. It is for this reason that the TMDL has been established with a MOS.

For the purposes of this TMDL addendum, a general implementation strategy is being prepared for EPA as part of the TMDL document. Following this submission, in accordance with approved state schedules and protocols, a detailed implementation plan will be prepared for pollutant sources.

For nonpoint sources, DEQ also expects that implementation plans be implemented as soon as practicable. However, DEQ recognizes that it may take some period of time, from several years to several decades, to fully implement the appropriate management practices. DEQ also recognizes that it may take additional time after implementation has been accomplished before the management practices identified in the implementation plans become fully effective in reducing and controlling pollution. In addition, DEQ recognizes that technology for controlling nonpoint source pollution is, in many cases, in the development stages and will likely take one or more iterations to develop effective techniques. It is possible that after application of all reasonable best management practices, some TMDLs or their associated targets and surrogates cannot be achieved as originally established. Nevertheless, it is DEQ's expectation that nonpoint sources make a good faith effort to achieving their respective load allocations in the shortest practicable time.

DEQ recognizes that expedited implementation of TMDLs will be socially and economically challenging. Further, there is a desire to minimize economic impacts as much as possible when consistent with protecting water quality and beneficial uses. DEQ further recognizes that, despite the best and most sincere efforts, natural events beyond the control of humans may interfere with or delay attainment of the TMDL and/or its associated targets and surrogates. Such events could be, but are not limited to floods, fire, insect infestations, and drought. Should such events occur that negate all BMP activities, the appropriateness of re

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implementing BMPs will be addressed on a case by case basis. In any case, post event conditions should not be exacerbated by management activities that would hinder the natural recovery of the system.

For some pollutants, pollutant surrogates have been defined as targets for meeting the TMDLs. The purpose of the surrogates is not to bar or eliminate human access or activity in the basin or its riparian areas. It is the expectation, however, that the specific implementation plan will address how human activities will be managed to achieve the water quality targets and surrogates. It is also recognized that full attainment of pollutant surrogates (system potential vegetation, for example) at all locations may not be feasible due to physical, legal, or other regulatory constraints. To the extent possible, the implementation plan should identify potential constraints, but should also provide the ability to mitigate those constraints should the opportunity arise. If a nonpoint source that is covered by the TMDL complies with its finalized implementation plan, it will be considered in compliance with the TMDL.

DEQ intends to regularly review progress of the implementation plan. If DEQ determines the implementation plan has been fully implemented, that all feasible management practices have reached maximum expected effectiveness, but a TMDL or its interim targets have not been achieved, DEQ may reopen the TMDL and adjust it or its interim targets.

The implementation of TMDLs and the associated plan is enforceable under the applicable provisions of the water quality standards for point and nonpoint sources by DEQ and other state agencies and local governments in Idaho. However, it is envisioned that sufficient initiative exists on the part of local stakeholders to achieve water quality goals with minimal enforcement. Should the need for additional effort emerge, it is expected that the responsible agency will work with stakeholders to overcome impediments to progress through education, technical support, or enforcement. Enforcement may be necessary in instances of insufficient action towards progress. This could occur first through direct intervention from state or local land management agencies, and secondarily through DEQ. The latter may be based on departmental orders to implement management goals leading to water quality standards.

In employing an adaptive management approach to the TMDL and the implementation plan, DEQ has the following expectations and intentions:

- Subject to available resources, DEQ intends to review the progress of the TMDLs and the implementation plans on a five-year basis.
- DEQ expects that designated agencies will also monitor and document their progress in implementing the provisions of the implementation plans for those pollutant sources for which they are responsible. This information will be provided to DEQ for use in reviewing the TMDL.
- DEQ expects that designated agencies will identify benchmarks for the attainment of TMDL targets and surrogates as part of the specific implementation plans being developed. These benchmarks will be used to measure progress toward the goals outlined in the TMDL.
- DEQ expects designated agencies to revise the components of their implementation plan to address deficiencies where implementation of the specific management techniques are found to be inadequate.

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• If DEQ, in consultation with the designated agencies, concludes that all feasible steps have been taken to meet the TMDL and its associated targets and surrogates, and that the TMDL, or the associated targets and surrogates are not practicable, the TMDL may be reopened and revised as appropriate. DEQ would also consider reopening the TMDL should new information become available indicating that the TMDL or its associated targets and/or surrogates should be modified. This decision will be made based on the availability of resources at DEQ.

5.7.3. Responsible Parties

Development of the final implementation plan for this TMDL addendum will proceed under the existing practice established for the state of Idaho. The plan will be cooperatively developed by DEQ, the Snake River/Succor Creek WAG, the affected private landowners, and other "designated agencies" with input from the established public process. Of the four entities, the WAG will act as the integral part of the implementation planning process to identify appropriate implementation measures. Other individuals may also be identified to assist in the development of the site-specific implementation plans as their areas of expertise are identified as beneficial to the process.

Designated state agencies are responsible for assisting with preparation of specific implementation plans, particularly for those sources for which they have regulatory authority or programmatic responsibilities. Idaho's designated state management agencies are:

• Idaho Department of Lands (IDL): timber harvest, oil and gas exploration and development, mining
• Idaho Soil Conservation Commission (ISCC): grazing and agriculture
• Idaho Department of Transportation (IDT): public roads
• Idaho Department of Agriculture (IDA): aquaculture, AFOs, CAFOs
• Idaho Department of Environmental Quality: all other activities

To the maximum extent possible, the implementation plan will be developed with the participation of federal partners and land management agencies (i.e., NRCS, BLM, U.S. Bureau of Reclamation, etc.). In Idaho, these agencies, and their federal and state partners, are charged by the CWA to lend available technical assistance and other appropriate support to local efforts/projects for water quality improvements.

All stakeholders in the Mid Snake River/Succor Creek subbasin have a responsibility for implementing the TMDL addendum. DEQ and the "designated agencies" in Idaho have primary responsibility for overseeing implementation in cooperation with landowners and managers. Their general responsibilities are outlined below.

• **DEQ** will oversee and track overall progress on the specific implementation plan and monitor the watershed response. DEQ will also work with local governments on urban/suburban issues.
• **IDL** will maintain and update approved BMPs for forest practices and mining. IDL is responsible for ensuring use of appropriate BMPs on state and private lands.

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• **ISCC**, working in cooperation with local Soil and Water Conservation Districts and ISDA, the NRCS will provide technical assistance to agricultural landowners. These agencies will help landowners design BMP systems appropriate for their property, and identify and seek appropriate cost-share funds. They also will provide periodic project reviews to ensure BMPs are working effectively.
• **IDT** will be responsible for ensuring appropriate BMPs are used for construction and maintenance of public roads.
• **IDA** will be responsible for working with aquaculture to install appropriate pollutant control measures. Under a memorandum of understanding with EPA and DEQ, IDA also inspects AFOs, CAFOs and dairies to ensure compliance with NPDES requirements.

The designated agencies, WAG, and other appropriate public process participants are expected to:
• Develop BMPs to achieve LAs
• Give reasonable assurance that management measures will meet LAs through both quantitative and qualitative analysis of management measures
• Adhere to measurable milestones for progress
• Develop a timeline for implementation, with reference to costs and funding
• Develop a monitoring plan to determine if BMPs are being implemented, individual BMPs are effective, LA and WLA are being met, and water quality standards are being met

In addition to the designated agencies, the public, through the WAG and other equivalent processes, will be provided with opportunities to be involved in developing the implementation plan to the maximum extent practical. Public participation will significantly affect public acceptance of the document and the 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 that are developed with substantial public cooperation and involvement.

5.7.4. Monitoring Strategy

The objectives of a monitoring effort are to demonstrate long-term recovery, better understand natural variability, track implementation of projects and BMPs, and track effectiveness of TMDL implementation. This monitoring and feedback mechanism is a major component of the "reasonable assurance of implementation" for the TMDL implementation plan.

The implementation plan will be tracked by accounting for the numbers, types, and locations of projects, BMPs, educational activities, or other actions taken to improve or protect water quality. The mechanism for tracking specific implementation efforts will be annual reports to be submitted to DEQ.

The "monitoring and evaluation" component has two basic categories:
• Tracking the implementation progress of specific implementation plans; and

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• Tracking the progress of improving water quality through monitoring physical, chemical, and biological parameters.

Monitoring plans will provide information on progress being made toward achieving TMDL allocations and achieving water quality standards, and will help in the interim evaluation of progress as described under the adaptive management approach.

Implementation plan monitoring has two major components:
• Watershed monitoring and
• BMP monitoring.

While DEQ has primary responsibility for watershed monitoring, other agencies and entities have shown an interest in such monitoring. In these instances, data sharing is encouraged. The designated agencies have primary responsibility for BMP monitoring.

Watershed Monitoring

Watershed monitoring measures the success of the implementation measures in accomplishing the overall TMDL goals and includes both in-stream and in-river monitoring. Monitoring of BMPs measures the success of individual pollutant reduction projects. Implementation plan monitoring will also supplement the watershed information available during development of associated TMDLs and fill data gaps. In this TMDL addendum, watershed monitoring has the following objectives:

• Evaluate watershed pollutant sources,
• Refine baseline conditions and pollutant loading,
• Evaluate trends in water quality data,
• Evaluate the collective effectiveness of implementation actions in reducing pollutant loading to the mainstem and/or tributaries, and
• Gather information and fill data gaps to more accurately determine pollutant loading.

BMP/Project Effectiveness Monitoring

Site or BMP-specific monitoring may be included as part of specific treatment projects if determined appropriate and justified, and will be the responsibility of the designated project manager or grant recipient. The objective of an individual project monitoring plan is to verify that BMPs are properly installed, maintained, and working as designed. Monitoring for pollutant reductions at individual projects typically consists of spot checks, annual reviews, and evaluation of advancement toward reduction goals. The results of these reviews can be used to recommend or discourage similar projects in the future and to identify specific watersheds or reaches that are particularly ripe for improvement.

5.8. Conclusions

Data analysis for a five-year review of the Mid Snake River/Succor Creek TMDL was completed in 2011 (DEQ 2011). This document is available at: http://www.deq.idaho.gov/media/699532-snake-river-succor-creek-sba-tmdl-five-year-review-0911.pdf. The identified pollutants in this watershed are exclusively nonpoint source in nature. Tributaries are generally low volume rangeland streams that have a combination

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of geography, geology, land use, low flow volume, and flow alteration, which can lead to exceeding the Idaho WQS for sediment that are necessary to support COLD. Instream channel erosion is the probable primary source of sediment loading in McBride, Hardtrigger, and Pickett Creeks. As a result, 80% bank stability was selected as a target to fully support COLD beneficial uses these creeks. Conversely, irrigated agriculture is the probable primary source of sediment loading in Birch Creek and Vinson Wash. The target was, therefore, established as 20 mg/L over rolling four-month average throughout the critical irrigation season (April 1 – September 30).

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Table 10. Summary of assessment outcomes.

Water Body Name/Assessment Unit	Boundaries	Pollutant	TMDL(s) Completed	Recommended Changes to the next Integrated Report	Justification	TMDL Loads
Birch Creek AU: 021_03, 04	Approximately 7.8 miles upstream above Castle Creek Road to Snake River	Sediment	Sediment	Move to Section 4a	TMDL completed	20 mg/L 4-month average
Hardtrigger Creek AU: 008_02	Headwaters to Snake River	Sediment	Sediment	Move to Section 4a	TMDL Completed	80% Streambank Stability
McBride Creek AU: 004_02, 03	Headwaters to Oregon Line	Sediment	Sediment	Move to Section 4a	TMDL Completed	80% Streambank Stability
Pickett Creek AU: 016_03	Bates Creek Confluence to Browns Creek Confluence	Sediment	Sediment	Move to Section 4a	TMDL Completed	80% Streambank Stability
Vinson Wash AU:23_03	Poison Creek Confluence to Mouth	Sediment	Sediment	Move to Section 4a	TMDL Completed	20 mg/L 4 month average

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GIS Coverages

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Glossary

305(b)	Refers to section 305 subsection "b" of the Clean Water Act. The term "305(b)" generally describes a report of each state's water quality and is the principle means by which the U.S. Environmental Protection Agency, Congress, and the public evaluate whether U.S. waters meet water quality standards, the progress made in maintaining and restoring water quality, and the extent of the remaining problems.
§303(d)	Refers to section 303 subsection "d" of the Clean Water Act. 303(d) requires states to develop a list of water bodies that do not meet water quality standards. This section also requires total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and the TMDLs are subject to U.S. Environmental Protection Agency approval.
Acre-foot	A volume of water that would cover an acre to a depth of one foot. Often used to quantify reservoir storage and the annual discharge of large rivers.
Alluvium	Unconsolidated recent stream deposition.
Ambient	General conditions in the environment (Armantrout 1998). In the context of water quality, ambient waters are those representative of general conditions, not associated with episodic perturbations or specific disturbances such as a wastewater outfall (EPA 1996).
Anthropogenic	Relating to, or resulting from, the influence of human beings on nature.
Anti-Degradation	Refers to the U.S. Environmental Protection Agency's interpretation of the Clean Water Act goal that states and tribes maintain, as well as restore, water quality. This applies to waters that meet or are of higher water quality than required by state standards. State rules provide that the quality of those high quality waters may be lowered only to allow important social or economic development and only after adequate public participation (IDAPA 58.01.02.051). In all cases, the existing beneficial uses must be maintained. State rules further define lowered water quality to be 1) a measurable change, 2) a change adverse to a use, and 3) a change in a pollutant relevant to the water's uses (IDAPA 58.01.02.003.61).
Aquatic	Occurring, growing, or living in water.
Aquifer	An underground, water-bearing layer or stratum of permeable rock, sand, or gravel capable of yielding of water to wells or springs.
Assemblage (aquatic)	An association of interacting populations of organisms in a given water body; for example, a fish assemblage or a benthic macroinvertebrate assemblage (also see Community) (EPA 1996).

Assessment Database (ADB)

The ADB is a relational database application designed for the U.S. Environmental Protection Agency for tracking water quality assessment data, such as use attainment and causes and sources of impairment. States need to track this information and many other types of assessment data for thousands of water bodies and integrate it into meaningful reports. The ADB is designed to make this process accurate, straightforward, and user-friendly for participating states, territories, tribes, and basin commissions.

Assessment Unit (AU)

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

Assimilative Capacity

The ability to process or dissipate pollutants without ill effect to beneficial uses.

Batholith

A large body of intrusive igneous rock that has more than 40 square miles of surface exposure and no known floor. A batholith usually consists of coarse-grained rocks such as granite.

Bedload

Material (generally sand-sized or larger sediment) that is carried along the streambed by rolling or bouncing.

Beneficial Use

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

Beneficial Use Reconnaissance Program (BURP)

A program for conducting systematic biological and physical habitat surveys of water bodies in Idaho. BURP protocols address lakes, reservoirs, and wadeable streams and rivers

Benthic

Pertaining to or living on or in the bottom sediments of a water body

Best Management Practices (BMPs)

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

Biochemical Oxygen Demand (BOD)

The amount of dissolved oxygen used by organisms during the decomposition (respiration) of organic matter, expressed as mass of oxygen per volume of water, over some specified period of time.

Biological Integrity

1) The condition of an aquatic community inhabiting unimpaired water bodies of a specified habitat as measured by an evaluation of multiple attributes of the aquatic biota (EPA 1996). 2) The ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to the natural habitats of a region (Karr 1991).

Biota

The animal and plant life of a given region.

Biotic	A term applied to the living components of an area.
Clean Water Act (CWA)	The Federal Water Pollution Control Act (commonly known as the Clean Water Act), as last reauthorized by the Water Quality Act of 1987, establishes a process for states to use to develop information on, and control the quality of, the nation's water resources.
Coliform Bacteria	A group of bacteria predominantly inhabiting the intestines of humans and animals but also found in soil. Coliform bacteria are commonly used as indicators of the possible presence of pathogenic organisms (also see Fecal Coliform Bacteria, *E. Coli*, and Pathogens).
Colluvium	Material transported to a site by gravity.
Community	A group of interacting organisms living together in a given place.
Conductivity	The ability of an aqueous solution to carry electric current, expressed in micro (μ) mhos/centimeter at 25 °C. Conductivity is affected by dissolved solids and is used as an indirect measure of total dissolved solids in a water sample.
Cretaceous	The final period of the Mesozoic era (after the Jurassic and before the Tertiary period of the Cenozoic era), thought to have covered the span of time between 135 and 65 million years ago.
Criteria	In the context of water quality, numeric or descriptive factors taken into account in setting standards for various pollutants. These factors are used to determine limits on allowable concentration levels, and to limit the number of violations per year. The U.S. Environmental Protection Agency develops criteria guidance; states establish criteria.
Cubic Feet per Second	A unit of measure for the rate of flow or discharge of water. One cubic foot per second is the rate of flow of a stream with a cross-section of one square foot flowing at a mean velocity of one foot per second. At a steady rate, once cubic foot per second is equal to 448.8 gallons per minute and 10,984 acre-feet per day.
Depth Fines	Percent by weight of particles of small size within a vertical core of volume of a streambed or lake bottom sediment. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 6.5 millimeters depending on the observer and methodology used. The depth sampled varies but is typically about one foot (30 centimeters).
Designated Uses	Those water uses identified in state water quality standards that must be achieved and maintained as required under the Clean Water Act.
Discharge	The amount of water flowing in the stream channel at the time of measurement. Usually expressed as cubic feet per second (cfs).

Dissolved Oxygen (DO)	The oxygen dissolved in water. Adequate DO is vital to fish and other aquatic life.
Disturbance	Any event or series of events that disrupts ecosystem, community, or population structure and alters the physical environment.
E. coli	Short for *Escherichia coli*, *E. coli* are a group of bacteria that are a subspecies of coliform bacteria. Most *E. coli* are essential to the healthy life of all warm-blooded animals, including humans, but their presence in water is often indicative of fecal contamination. *E. coli* are used by the state of Idaho as the indicator for the presence of pathogenic microorganisms.
Ecology	The scientific study of relationships between organisms and their environment; also defined as the study of the structure and function of nature.
Ecological Indicator	A characteristic of an ecosystem that is related to, or derived from, a measure of a biotic or abiotic variable that can provide quantitative information on ecological structure and function. An indicator can contribute to a measure of integrity and sustainability. Ecological indicators are often used within the multimetric index framework.
Ecological Integrity	The condition of an unimpaired ecosystem as measured by combined chemical, physical (including habitat), and biological attributes (EPA 1996).
Ecosystem	The interacting system of a biological community and its non-living (abiotic) environmental surroundings.
Effluent	A discharge of untreated, partially treated, or treated wastewater into a receiving water body.
Endangered Species	Animals, birds, fish, plants, or other living organisms threatened with imminent extinction. Requirements for declaring a species as endangered are contained in the Endangered Species Act.
Environment	The complete range of external conditions, physical and biological, that affect a particular organism or community.
Eocene	An epoch of the early Tertiary period, after the Paleocene and before the Oligocene.
Eolian	Windblown, referring to the process of erosion, transport, and deposition of material by the wind.
Ephemeral Stream	A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long

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continued supply from melting snow or other sources. Its channel is at all times above the water table (American Geological Institute 1962).

Erosion

The wearing away of areas of the earth's surface by water, wind, ice, and other forces.

Exceedance

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

Existing Beneficial Use or Existing Use

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

Extrapolation

Estimation of unknown values by extending or projecting from known values.

Fauna

Animal life, especially the animals characteristic of a region, period, or special environment.

Flow

See *Discharge*.

Fluvial

In fisheries, this describes fish whose life history takes place entirely in streams but migrate to smaller streams for spawning.

Fully Supporting

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

Fully Supporting Cold Water

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

Geographical Information Systems (GIS)

A georeferenced database.

Geometric Mean

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

Grab Sample

A single sample collected at a particular time and place. It may represent the composition of the water in that water column.

Gradient

The slope of the land, water, or streambed surface.

Ground Water	Water found beneath the soil surface saturating the layer in which it is located. Most ground water originates as rainfall, is free to move under the influence of gravity, and usually emerges again as stream flow.
Growth Rate	A measure of how quickly something living will develop and grow, such as the amount of new plant or animal tissue produced per a given unit of time, or number of individuals added to a population.
Habitat	The living place of an organism or community.
Headwater	The origin or beginning of a stream.
Hydrologic Basin	The area of land drained by a river system, a reach of a river and its tributaries in that reach, a closed basin, or a group of streams forming a drainage area (also see Watershed).
Hydrologic Cycle	The cycling of water from the atmosphere to the earth (precipitation) and back to the atmosphere (evaporation and plant transpiration). Atmospheric moisture, clouds, rainfall, runoff, surface water, ground water, and water infiltrated in soils are all part of the hydrologic cycle.
Hydrologic Unit	One of a nested series of numbered and named watersheds arising from a national standardization of watershed delineation. The initial 1974 effort (USGS 1987) described four levels (region, subregion, accounting unit, cataloging unit) of watersheds throughout the United States. The fourth level is uniquely identified by an eight-digit code built of two-digit fields for each level in the classification. Originally termed a cataloging unit, fourth field hydrologic units have been more commonly called subbasins. Fifth and sixth field hydrologic units have since been delineated for much of the country and are known as watershed and subwatersheds, respectively.
Hydrologic Unit Code (HUC)	The number assigned to a hydrologic unit. Often used to refer to fourth field hydrologic units.
Hydrology	The science dealing with the properties, distribution, and circulation of water.
Impervious	Describes a surface, such as pavement, that water cannot penetrate.
Influent	A tributary stream.
Inorganic	Materials not derived from biological sources.
Instantaneous	A condition or measurement at a moment (instant) in time.

Intergravel Dissolved Oxygen	The concentration of dissolved oxygen within spawning gravel. Consideration for determining spawning gravel includes species, water depth, velocity, and substrate.
Intermittent Stream	1) A stream that flows only part of the year, such as when the ground water table is high or when the stream receives water from springs or from surface sources such as melting snow in mountainous areas. The stream ceases to flow above the streambed when losses from evaporation or seepage exceed the available stream flow. 2) A stream that has a period of zero flow for at least one week during most years.
Interstate Waters	Waters that flow across or form part of state or international boundaries, including boundaries with Native American nations.
Irrigation Return Flow	Surface (and subsurface) water that leaves a field following the application of irrigation water and eventually flows into streams.
Land Application	A process or activity involving application of wastewater, surface water, or semi-liquid material to the land surface for the purpose of treatment, pollutant removal, or ground water recharge.
Limiting Factor	A chemical or physical condition that determines the growth potential of an organism. This can result in a complete inhibition of growth, but typically results in less than maximum growth rates.
Load Allocation (LA)	A portion of a water body's load capacity for a given pollutant that is given to a particular nonpoint source (by class, type, or geographic area).
Load(ing)	The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Loading is the product of flow (discharge) and concentration.
Load(ing) Capacity (LC)	A determination of how much pollutant a water body can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, and a margin of safety, it becomes a total maximum daily load.
Loam	Refers to a soil with a texture resulting from a relative balance of sand, silt, and clay. This balance imparts many desirable characteristics for agricultural use.
Loess	A uniform wind-blown deposit of silty material. Silty soils are among the most highly erodible.
Macroinvertebrate	An invertebrate animal (without a backbone) large enough to be seen without magnification and retained by a 500µm mesh (U.S. #30) screen.

Macrophytes

Rooted and floating vascular aquatic plants, commonly referred to as water weeds. These plants usually flower and bear seeds. Some forms, such as duckweed and coontail (*Ceratophyllum sp.*), are free-floating forms not rooted in sediment.

Margin of Safety (MOS)

An implicit or explicit portion of a water body's loading capacity set aside to allow the uncertainly about the relationship between the pollutant loads and the quality of the receiving water body. This is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The MOS is not allocated to any sources of pollution.

Mass Wasting

A general term for the down slope movement of soil and rock material under the direct influence of gravity.

Mean

Describes the central tendency of a set of numbers. The arithmetic mean (calculated by adding all items in a list, then dividing by the number of items) is the statistic most familiar to most people.

Median

The middle number in a sequence of numbers. If there are an even number of numbers, the median is the average of the two middle numbers. For example, 4 is the median of 1, 2, 4, 14, 16; 6 is the median of 1, 2, 5, 7, 9, 11.

Metric

1) A discrete measure of something, such as an ecological indicator (e.g., number of distinct taxon). 2) The metric system of measurement.

Milligrams per Liter (mg/L)

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

Million Gallons per Day (MGD)

A unit of measure for the rate of discharge of water, often used to measure flow at wastewater treatment plants. One MGD is equal to 1.547 cubic feet per second.

Miocene

Of, relating to, or being an epoch of, the Tertiary between the Pliocene and the Oligocene periods, or the corresponding system of rocks.

Monitoring

A periodic or continuous measurement of the properties or conditions of some medium of interest, such as monitoring a water body.

Mouth

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

National Pollution Discharge Elimination System (NPDES)

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

Natural Condition	The condition that exists with little or no anthropogenic influence.
Nitrogen	An element essential to plant growth, and thus is considered a nutrient.
Nonpoint Source	A dispersed source of pollutants, generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernable point or origin. They include, but are not limited to, irrigated and non-irrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.
Not Assessed (NA)	A concept and an assessment category describing water bodies that have been studied, but are missing critical information needed to complete an assessment.
Not Attainable	A concept and an assessment category describing water bodies that demonstrate characteristics that make it unlikely that a beneficial use can be attained (e.g., a stream that is dry but designated for salmonid spawning).
Not Fully Supporting	Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).
Not Fully Supporting Cold Water	At least one biological assemblage has been significantly modified beyond the natural range of its reference condition.
Nuisance	Anything that is injurious to the public health or an obstruction to the free use, in the customary manner, of any waters of the state.
Nutrient	Any substance required by living things to grow. An element or its chemical forms essential to life, such as carbon, oxygen, nitrogen, and phosphorus. Commonly refers to those elements in short supply, such as nitrogen and phosphorus, which usually limit growth.
Nutrient Cycling	The flow of nutrients from one component of an ecosystem to another, as when macrophytes die and release nutrients that become available to algae (organic to inorganic phase and return).
Organic Matter	Compounds manufactured by plants and animals that contain principally carbon.
Orthophosphate	A form of soluble inorganic phosphorus most readily used for algal growth.
Parameter	A variable, measurable property whose value is a determinant of the characteristics of a system, such as temperature, dissolved oxygen, and fish populations are parameters of a stream or lake.

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Pathogens	A small subset of microorganisms (e.g., certain bacteria, viruses, and protozoa) that can cause sickness or death. Direct measurement of pathogen levels in surface water is difficult. Consequently, indicator bacteria that are often associated with pathogens are assessed. *E. coli*, a type of fecal coliform bacteria, are used by the state of Idaho as the indicator for the presence of pathogenic microorganisms.
Perennial Stream	A stream that flows year-around in most years.
pH	The negative $\log_{10}$ of the concentration of hydrogen ions, a measure which in water ranges from very acid (pH=1) to very alkaline (pH=14). A pH of 7 is neutral. Surface waters usually measure between pH 6 and 9.
Phased TMDL	A total maximum daily load (TMDL) that identifies interim load allocations and details further monitoring to gauge the success of management actions in achieving load reduction goals and the effect of actual load reductions on the water quality of a water body. Under a phased TMDL, a refinement of load allocations, wasteload allocations, and the margin of safety is planned at the outset.
Phosphorus	An element essential to plant growth, often in limited supply, and thus considered a nutrient.
Plankton	Microscopic algae (phytoplankton) and animals (zooplankton) that float freely in open water of lakes and oceans.
Point Source	A source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable "point" of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater.
Pollutant	Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.
Pollution	A very broad concept that encompasses human-caused changes in the environment which alter the functioning of natural processes and produce undesirable environmental and health effects. This includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.
Population	A group of interbreeding organisms occupying a particular space; the number of humans or other living creatures in a designated area.
Pretreatment	The reduction in the amount of pollutants, elimination of certain pollutants, or alteration of the nature of pollutant properties in wastewater prior to, or in lieu of, discharging or otherwise introducing such wastewater into a publicly owned wastewater treatment plant.

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Protocol	A series of formal steps for conducting a test or survey.
Qualitative	Descriptive of kind, type, or direction.
Quality Assurance (QA)	A program organized and designed to provide accurate and precise results. Included are the selection of proper technical methods, tests, or laboratory procedures; sample collection and preservation; the selection of limits; data evaluation; quality control; and personnel qualifications and training (Rand 1995). The goal of QA is to assure the data provided are of the quality needed and claimed (EPA 1996).
Quality Control (QC)	Routine application of specific actions required to provide information for the quality assurance program. Included are standardization, calibration, and replicate samples (Rand 1995). QC is implemented at the field or bench level (EPA 1996).
Quantitative	Descriptive of size, magnitude, or degree.
Reach	A stream section with fairly homogenous physical characteristics.
Reconnaissance	An exploratory or preliminary survey of an area.
Reference	A physical or chemical quantity whose value is known and thus is used to calibrate or standardize instruments.
Reference Condition	1) A condition that fully supports applicable beneficial uses with little affect from human activity and represents the highest level of support attainable. 2) A benchmark for populations of aquatic ecosystems used to describe desired conditions in a biological assessment and acceptable or unacceptable departures from them. The reference condition can be determined through examining regional reference sites, historical conditions, quantitative models, and expert judgment (Hughes 1995).
Reference Site	A specific locality on a water body that is minimally impaired and is representative of reference conditions for similar water bodies.
Representative Sample	A portion of material or water that is as similar in content and consistency as possible to that in the larger body of material or water being sampled.
Resident	A term that describes fish that do not migrate.
Respiration	A process by which organic matter is oxidized by organisms, including plants, animals, and bacteria. The process converts organic matter to energy, carbon dioxide, water, and lesser constituents.

Riffle

A relatively shallow, gravelly area of a streambed with a locally fast current, recognized by surface choppiness. Also an area of higher streambed gradient and roughness.

Riparian

Associated with aquatic (stream, river, lake) habitats. Living or located on the bank of a water body.

Riparian Habitat Conservation Area (RHCA)

A U.S. Forest Service description of land within the following number of feet up-slope of each of the banks of streams:

300 feet from perennial fish-bearing streams
150 feet from perennial non-fish-bearing streams
100 feet from intermittent streams, wetlands, and ponds in priority watersheds.

River

A large, natural, or human-modified stream that flows in a defined course or channel or in a series of diverging and converging channels.

Runoff

The portion of rainfall, melted snow, or irrigation water that flows across the surface, through shallow underground zones (interflow), and through ground water to creates streams.

Sediments

Deposits of fragmented materials from weathered rocks and organic material that were suspended in, transported by, and eventually deposited by water or air.

Settleable Solids

The volume of material that settles out of one liter of water in one hour.

Species

1) A reproductively isolated aggregate of interbreeding organisms having common attributes and usually designated by a common name. 2) An organism belonging to such a category.

Spring

Ground water seeping out of the earth where the water table intersects the ground surface.

Stagnation

The absence of mixing in a water body.

Stream

A natural water course containing flowing water, at least part of the year. Together with dissolved and suspended materials, a stream normally supports communities of plants and animals within the channel and the riparian vegetation zone.

Stream Order

Hierarchical ordering of streams based on the degree of branching. A first-order stream is an unforked or unbranched stream. Under Strahler's (1957) system, higher order streams result from the joining of two streams of the same order.

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Storm Water Runoff	Rainfall that quickly runs off the land after a storm. In developed watersheds the water flows off roofs and pavement into storm drains that may feed quickly and directly into the stream. The water often carries pollutants picked up from these surfaces.
Stressors	Physical, chemical, or biological entities that can induce adverse effects on ecosystems or human health.
Subbasin	A large watershed of several hundred thousand acres. This is the name commonly given to 4th field hydrologic units (also see Hydrologic Unit).
Subbasin Assessment (SBA)	A watershed-based problem assessment that is the first step in developing a total maximum daily load in Idaho.
Subwatershed	A smaller watershed area delineated within a larger watershed, often for purposes of describing and managing localized conditions. Also proposed for adoption as the formal name for 6th field hydrologic units.
Surface Fines	Sediments of small size deposited on the surface of a streambed or lake bottom. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 605 millimeters depending on the observer and methodology used. Results are typically expressed as a percentage of observation points with fine sediment.
Surface Runoff	Precipitation, snow melt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of nonpoint source pollutants in rivers, streams, and lakes. Surface runoff is also called overland flow.
Surface Water	All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors that are directly influenced by surface water.
Suspended Sediments	Fine material (usually sand size or smaller) that remains suspended by turbulence in the water column until deposited in areas of weaker current. These sediments cause turbidity and, when deposited, reduce living space within streambed gravels and can cover fish eggs or alevins.
Taxon	Any formal taxonomic unit or category of organisms (e.g., species, genus, family, order). The plural of taxon is taxa (Armantrout 1998).
Tertiary	An interval of geologic time lasting from 66.4 to 1.6 million years ago. It constitutes the first of two periods of the Cenozoic Era, the second being the Quaternary. The Tertiary has five subdivisions, which from oldest to youngest are the Paleocene, Eocene, Oligocene, Miocene, and Pliocene epochs.

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Threatened Species

Species, determined by the U.S. Fish and Wildlife Service, which are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

Total Maximum Daily Load (TMDL)

A TMDL is a water body’s load capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual bases. A TMDL is equal to the load capacity, such that load capacity = margin of safety + natural background + load allocation + wasteload allocation = TMDL. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.

Total Dissolved Solids

Dry weight of all material in solution in a water sample as determined by evaporating and drying filtrate.

Total Suspended Solids (TSS)

The dry weight of material retained on a filter after filtration. Filter pore size and drying temperature can vary. American Public Health Association Standard Methods (Franson et al. 1998) call for using a filter of 2.0 microns or smaller; a 0.45 micron filter is also often used. This method calls for drying at a temperature of 103-105 °C.

Toxic Pollutants

Materials that cause death, disease, or birth defects in organisms that ingest or absorb them. The quantities and exposures necessary to cause these effects can vary widely.

Tributary

A stream feeding into a larger stream or lake.

Total Dissolved Solids

Dry weight of all material in solution in a water sample as determined by evaporating and drying filtrate.

Total Suspended Solids (TSS)

The dry weight of material retained on a filter after filtration. Filter pore size and drying temperature can vary. American Public Health Association Standard Methods (Franson et al. 1998) call for using a filter of 2.0 micron or smaller; a 0.45 micron filter is also often used. This method calls for drying at a temperature of 103-105 °C.

Toxic Pollutants

Materials that cause death, disease, or birth defects in organisms that ingest or absorb them. The quantities and exposures necessary to cause these effects can vary widely.

Tributary

A stream feeding into a larger stream or lake.

Trophic State

The level of growth or productivity of a lake as measured by phosphorus content, chlorophyll *a* concentrations, amount (biomass) of aquatic vegetation, algal abundance, and water clarity.

Turbidity

A measure of the extent to which light passing through water is scattered by fine suspended materials. The effect of turbidity depends on the size of the particles (the finer the particles, the greater the effect per unit weight) and the color of the particles.

Wasteload Allocation (WLA)

The portion of receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. Wasteload allocations specify how much pollutant each point source may release to a water body.

Water Body

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

Water Column

Water between the interface with the air at the surface and the interface with the sediment layer at the bottom. The idea derives from a vertical series of measurements (oxygen, temperature, phosphorus) used to characterize water.

Water Pollution

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

Water Quality

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

Water Quality Criteria

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

Water Quality Limited

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

Water Quality Limited Segment (WQLS)

Any segment placed on a state's §303(d) list for failure to meet applicable water quality standards, and/or is not expected to meet applicable water quality standards in the period prior to the next list. These segments are also referred to as "§303(d) listed."

Water Quality Management Plan

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

Water Quality Modeling

The prediction of the response of some characteristics of lake or stream water based on mathematical relations of input variables such as climate, stream flow, and inflow water quality.

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Water Quality Standards	State-adopted and U.S. Environmental Protection Agency-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses. **Water Table** The upper surface of ground water; below this point, the soil is saturated with water.
Watershed	1) All the land which contributes runoff to a common point in a drainage network, or to a lake outlet. Watersheds are infinitely nested, and any large watershed is composed of smaller "subwatersheds." 2) The whole geographic region which contributes water to a point of interest in a water body.
Water Body Identification Number (WBID)	A number that uniquely identifies a water body in Idaho and ties in to the Idaho water quality standards and GIS information.
Wetland	An area that is at least some of the time saturated by surface or ground water so as to support with vegetation adapted to saturated soil conditions. Examples include swamps, bogs, fens, and marshes.

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Appendix A. Unit Conversion Chart

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Table A-1. Metric - English unit conversions.

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

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

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

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Appendix B. State and Site-Specific Standards and Criteria

Idaho Water Quality Standards (IDAPA 58.01.02.250.08.)

Sediment. 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 Section 350. (4-5-00)

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Appendix C. Data Sources

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Table C. Major data sources for the Mid Snake River/Succor Creek Subbasin Assessment and TMDL Addendum.

Water Body	Data Source	Type of Data	When Collected
Birch Creek	Idaho Power Company DEQ[1]	Flow, TSS Concentration BURP	2007 1995, 2001
Hardtrigger Creek	BLM[2] DEQ DEQ	Streambank Stability BURP Streambank Stability	2005-2012 1995, 1996, 1998 2013
McBride Creek	DEQ DEQ	BURP Streambank Stability	1996, 2001 2011
Pickett Creek	DEQ DEQ	BURP Streambank Stability	1996, 2001 2012
Vinson Wash	Idaho Power Company DEQ	Visual (flow) BURP	2007 2001

[1]DEQ = Department of Environmental Quality, [2]BLM = Bureau of Land Management

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Appendix D. Distribution List

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Although this list is certainly not fully inclusive, DEQ is grateful for the assistance of the WAG and other individuals who participated in the development of the Mid Snake River/ Succor Creek TMDL addendum:

Mr. Ted Blackstock, Landowner/Rancher
Ms. Connie Brandau, Landowner/Rancher
Mr. Richard Brandau, Landowner/Rancher
Mr. Brian Collett, Landowner/Rancher
Mr. Jerry Hoagland, Landowner/Rancher
Ms. Melissa Jayo, Landowner
Mr. Hans Jensen, Landowner/Rancher
Mr. Bill White, Landowner/Rancher
Mr. Eddie Wisley, Landowner/Rancher

Mr. Rich Jackson, Bureau of Land Management
Mr. Peter Torma, Bureau of Land Management
Mr. Mike Spicer, Bureau of Land Management
Ms. Loretta Chandler, Bureau of Land Management

Mr. Leigh Woodruff, EPA
Ms. Jayne Carlin, EPA

Mr. Chris Witt, USDA Forest Service

Ms. Diane French, Idaho Department of Lands
Ms. Rebeccan Rutan, formerly with Idaho Department of Lands

Mr. Brian Hoelscher, Idaho Power Corporation
Mr. Andy Knight, Idaho Power Corporation

Ms. Gina Millard, Idaho Soil and Water Conservation Commission
Mr. Jason Miller, Idaho Soil and Water Conservation Commission
Ms. Karie Pappani, Idaho Soil and Water Conservation Commission
Mr. Delwyne Trefz, Idaho Soil and Water Conservation Commission

Appendix E. Public Comments/Public Participation

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Appendix F. Streambank Inventory Results

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STREAMBANK EROSION INVENTORY WORKSHEET

Stream (AU):	Hardtrigger Creek	Stream Segment Location (DD)		Elevation (ft)
Section:	Above canyon to above LHT confluence	*Upstream: N*	LHT = 43.354605; HT = 43.361491	3594; 3517
Assessment Unit:	ID17050103SW008_02	*W*	LHT = -116.79497; HT = -116.802522	
	Analysis includes approximately 13 AU miles	*Downstream: N*	43.3748	3088
Date Collected:	March 26 and 27, 2013	*W*	-116.763010	
Field Crew:	Troy Smith & Josh Schultz	Notes: 3 segments were inventoried for approximately 15630 ft along Hardtrigger and Little Hardtrigger Creeks within the AU_03.		
Data Reduced By:	Troy Smith			

Streambank Erosion Calculations		Unit	Area Applied
Bank Length	15630.00	ft	Inventoried Segment
Bank to Bank Length (LBB)	31260.00	ft	"
Erosive Bank Length	6233.81	ft	"
Erosive Bank to Bank Length	12467.62	ft	"
Percent Eroding Bank	39.9	%	"
Bank to Bank Eroding Area (AE)	15024.02	ft^2	"
Lateral Recession Rate (RLR)	0.12		"
Bulk Density (DB)	110	lb/ft^2	"
Total Bank Erosion (E)	99.16	tons/year	"
Bank Erosion Rate (ER)	33.50	tons/mile/year	Reach and Segment
Length of Similar Stream	53010	ft	Total Reach
Total Streambank Erosion	435.46	tons/year	"

Recession Rate Calculation Worksheet		Load Capacity
Slope Factor	Rating	Rating
Bank Stability (0-3)	1.75	1
Bank Erosion (0-3)	1.25	1
Vegetative/cover on Banks (0-3)	1.5	1
Bank/Channel Shape - downcutting (0-3)	0.75	1
Channel Bottom (0-2)	1.75	0
Deposition (0-1)	0	0
Total = Slight (0-4); Moderate (5-8); Severe (9+)	7	4
Recession Rate	0.12	0.05

RLR is average of segments

Streambank Erosion Reduction Calculations		Unit	Area Applied
Bank to Bank Eroding Area With Load Reductions (AE)	7533.93	ft^2	Inventoried Segment
Total Bank Erosion With Load Reductions (E)	20.72	tons/year	"
Bank Erosion Rate With Load Reductions (ER)	7.00	tons/mile/year	Reach and Segment
Total Streambank Erosion With Load Reductions	90.99	tons/year	"

Summary for Load Reductions for Total Reach					
Current Load		Load Capacity			
Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Total Erosion (tons/yr) Reduction	Total Erosion (tons/yr) Reduction
33	435	7	91	79%	344

Stream Name:	Hardtrigger Creek		
Segment:	Above Confluence		
Date:	3/26/2013		
Erosive Bank Height (ft)	Erosive Bank Length (ft)	Eroding Bank Area (ft^2)	Total Bank Length (ft)
0.3	16.4	5.4	
0.0	0.0	0.0	
0.3	6.6	2.2	
1.0	6.6	6.5	
0.3	3.3	1.1	
0.3	3.3	1.1	
0.5	13.1	6.5	
1.0	0.0	0.0	
1.0	8.5	8.4	
1.3	14.8	19.4	
0.3	23.0	7.5	
0.3	29.5	9.7	
1.6	2.6	4.3	
1.0	6.6	6.5	
0.3	10.2	3.3	
0.3	17.1	5.6	
2.0	4.6	9.0	
3.3	4.9	16.1	
0.7	16.1	10.5	
1.0	9.2	9.0	
0.3	7.9	2.6	
0.7	28.9	18.9	
1.0	19.7	19.4	
2.3	5.2	12.1	
0.7	3.9	2.6	
0.7	3.0	1.9	
2.6	6.2	16.4	
0.3	17.4	5.7	
1.0	27.2	26.8	
1.0	5.9	5.8	
1.0	5.2	5.2	
0.7	4.3	2.8	
0.3	13.1	4.3	
0.3	7.9	2.6	
0.3	24.0	7.9	
1.0	15.4	15.2	
1.0	3.6	3.6	
1.6	4.9	8.1	
1.0	5.2	5.2	
1.0	16.4	16.1	
1.0	6.6	6.5	
0.7	11.5	7.5	
0.7	12.5	8.2	
0.7	7.9	5.2	
1.3	4.3	5.6	
0.3	14.8	4.8	
0.7	5.6	3.7	
2.6	19.0	49.9	
1.3	54.1	71.0	
2.0	3.6	7.1	

Stream Name:	Little Hardtrigger Creek		
Segment:	Above Confluence		
Date:	3/26/2013		
Erosive Bank Height (ft)	Erosive Bank Length (ft)	Eroding Bank Area (ft^2)	Total Bank Length (ft)
0.7	12.1	7.9	
0.3	36.4	11.9	
1.0	4.3	4.2	
1.6	17.4	28.5	
0.7	7.9	5.2	
0.7	22	14.4	
1.3	5.9	7.7	
1.3	9.8	12.9	
0.3	16.1	5.3	
0.3	19.7	6.5	
0.7	3.9	2.6	
0.7	5.9	3.9	
0.7	21.7	14.2	
1.3	17.1	22.4	
1.0	19.7	19.4	
0.3	5.6	1.8	
0.7	5.9	3.9	
0.3	12.5	4.1	
2.3	2.3	5.3	
2.0	1.6	3.1	
3.3	13.1	43.0	
0.0	0	0.0	
0.7	15.1	9.9	
0.7	16.7	11.0	
0.7	24.9	16.3	
1.3	2	2.6	
0.3	8.5	2.8	
1.0	10.5	10.3	
0.7	2	1.3	
1.0	3.9	3.8	
1.0	3.3	3.2	
1.0	3	3.0	
0.7	3.9	2.6	
1.3	17.4	22.8	
0.7	5.2	3.4	
0.7	6.2	4.1	
1.0	19.7	19.4	
0.0	0	0.0	
1.3	11.2	14.7	
1.0	11.2	11.0	
1.0	5.6	5.5	
0.7	2	1.3	
0.7	10.8	7.1	
1.3	10.8	14.2	
1.3	4.9	6.4	
1.3	5.2	6.8	
1.3	3.6	4.7	
Total	468.5	416.7	3275.0
			14.31%

1.6	11.8	19.4	
1.0	5.6	5.5	
1.6	5.9	9.7	
1.3	4.9	6.5	
0.7	11.5	7.5	
0.7	20.0	13.1	
0.3	10.8	3.6	
1.3	13.1	17.2	
0.3	11.5	3.8	
0.7	8.5	5.6	
1.0	2.3	2.3	
1.0	2.6	2.6	
1.6	1.6	2.7	
1.0	7.9	7.8	
1.0	5.6	5.5	
1.3	6.2	8.2	
2.0	14.4	28.4	
1.0	7.5	7.4	
4.3	11.8	50.4	
3.0	59.1	174.4	
1.6	9.5	15.6	
1.0	16.7	16.5	
0.3	98.4	32.3	
0.7	5.6	3.7	
0.3	19.7	6.5	
0.3	4.9	1.6	
1.0	32.8	32.3	
0.7	29.2	19.2	
2.0	3.0	5.8	
0.7	12.5	8.2	
1.3	41.7	54.7	
0.3	5.9	1.9	
0.7	4.6	3.0	
2.0	4.3	8.4	
0.7	22.3	14.6	
1.0	7.9	7.8	
1.3	24.0	31.4	
1.0	3.0	2.9	
0.7	3.9	2.6	
1.0	51.5	50.7	
1.0	5.9	5.8	
1.6	14.4	23.7	
Total	1205.7	1215.0	3095.0
			38.96%

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Stream Name: Hardtrigger Creek
Segment: Above Canyon & Below Confluence
Date: 3/27/2013

Erosive Bank Height (ft)	Erosive Bank Length (ft)	Eroding Bank Area (ft^2)	Total Bank Length (ft)
3.9	3.6	14.2	
1.3	21	27.6	
1.6	11.5	18.9	
1.6	11.5	18.9	
1.3	2	2.6	
1.3	3	3.9	
0.7	4.3	2.8	
0.7	3.6	2.4	
1.3	3.3	4.3	
1.6	32.2	52.8	
0.0	0	0.0	
1.0	26.2	25.8	
1.0	6.6	6.5	
1.0	58.1	57.2	
4.3	5.9	25.2	
0.7	2.6	1.7	
0.7	6.2	4.1	
1.0	7.2	7.1	
0.7	7.5	4.9	
1.0	19.7	19.4	
0.3	11.8	3.9	
0.3	6.2	2.0	
0.7	56.1	36.8	
1.0	3.9	3.8	
1.3	2.3	3.0	
1.3	3	3.9	
1.3	3	3.9	
1.0	1.6	1.6	
2.0	4.9	9.6	
1.0	3.9	3.8	
0.7	8.2	5.4	
0.7	4.3	2.8	
4.9	30.8	151.6	
1.6	16.4	26.9	
1.3	3.9	5.1	
1.3	5.6	7.3	
0.7	54.8	36.0	
0.7	7.2	4.7	
0.7	13.1	8.6	
1.0	14.1	13.9	
1.0	6.9	6.8	
1.0	3.9	3.8	
1.3	14.1	18.5	
1.6	5.6	9.2	
0.7	16.1	10.6	
1.6	5.9	9.7	
0.0	0	0.0	
2.0	3.6	7.1	
2.0	3	5.9	
1.3	52.5	68.9	

0.7	18.4	12.1
3.3	4.9	16.1
1.3	4.9	6.4
1.3	2	2.6
1.0	3.9	3.8
1.3	18.4	24.1
1.0	24.6	24.2
0.7	7.2	4.7
1.0	32.8	32.3
4.3	11.8	50.3
1.0	19.7	19.4
0.7	23.3	15.3
0.7	7.5	4.9
0.7	8.9	5.8
0.7	2	1.3
0.7	4.6	3.0
1.0	6.6	6.5
1.0	10.8	10.6
1.0	6.6	6.5
1.6	19.7	32.3
0.7	5.9	3.9
0.7	11.2	7.3
1.0	5.2	5.1
1.0	19.7	19.4
1.6	4.3	7.1
0.7	6.6	4.3
1.0	11.8	11.6
0.7	18	11.8
1.6	3	4.9
1.6	3.3	5.4
1.3	17.4	22.8
1.6	8.9	14.6
1.3	2	2.6
2.0	3.6	7.1
1.6	16.7	27.4
1.0	4.6	4.5
3.6	11.8	42.6
0.3	13.8	4.5
1.0	3.9	3.8
1.3	23.6	31.0
4.6	10.2	46.9
1.6	6.2	10.2
1.3	16.4	21.5
1.3	5.6	7.3
1.6	6.6	10.8
1.6	26.2	43.0
1.3	15.7	20.6
1.3	44.9	58.9
0.3	22.3	7.3
1.3	4.9	6.4
0.3	59.1	19.4
0.7	17.7	11.6
1.6	4.9	8.0
1.6	9.5	15.6
1.3	6.6	8.7
1.0	4.3	4.2
3.3	3	9.8

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1.0	3.6	3.5
1.3	9.5	12.5
1.3	18	23.6
1.3	46.6	61.2
1.3	121.1	158.9
1.3	2	2.6
0.3	17.1	5.6
0.7	16.7	11.0
1.3	10.2	13.4
1.6	16.7	27.4
3.0	10.8	31.9
0.7	9.8	6.4
1.6	24	39.4
1.0	3.6	3.5
1.0	76.1	74.9
1.6	26.9	44.1
1.6	12.1	19.8
1.0	65.6	64.6
1.3	13.1	17.2
2.0	12.1	23.8
1.3	19.4	25.5
0.0	0	0.0
2.3	4.3	9.9
1.3	27.2	35.7
1.6	115.8	190.0
3.0	3.3	9.7
1.0	14.4	14.2
1.0	9.5	9.4
0.7	15.7	10.3
2.3	40.4	92.8
1.0	31.2	30.7
2.0	45.9	90.4
1.0	10.8	10.6
1.6	17.7	29.0
0.3	16.4	5.4
1.3	6.2	8.1
1.3	4.3	5.6
1.3	5.9	7.7
1.6	15.4	25.3
1.0	24.6	24.2
1.3	24.3	31.9
1.0	10.2	10.0
1.0	99.1	97.5
1.0	52.5	51.7
1.0	26.2	25.8
0.7	17.4	11.4
1.6	43.6	71.5
1.0	17.1	16.8
1.6	28.9	47.4
1.0	33.1	32.6
1.3	70.5	92.5
0.7	24.3	15.9
1.3	29.2	38.3
0.7	44.6	29.3
1.0	117.8	115.9
0.7	24	15.7
0.7	32.5	21.3

0.7	102.4	67.2
0.7	24.3	15.9
6.6	14.8	97.1
0.7	33.5	22.0
0.7	40	26.2
1.0	11.5	11.3
0.7	23.3	15.3
0.3	12.1	4.0
1.0	10.2	10.0
1.3	6.6	8.7
0.3	42.7	14.0
1.0	32.5	32.0
0.7	25.3	16.6
1.6	16.7	27.4
1.0	45.3	44.6
1.0	6.2	6.1
2.6	42.7	112.1
1.0	12.1	11.9
1.6	7.2	11.8
1.0	19	18.7
1.3	19.7	25.9
1.0	22	21.7
0.7	21.7	14.2
1.0	28.9	28.4
1.3	4.6	6.0
0.7	14.1	9.3
3.0	45.9	135.5
0.0	0	0.0
2.0	19.4	38.2
1.0	18.7	18.4
1.3	65	85.3
1.3	24	31.5
1.0	17.1	16.8
0.7	11.2	7.3
2.0	23	45.3
1.6	13.1	21.5
0.7	8.9	5.8
1.3	13.5	17.7
1.0	7.2	7.1
1.0	7.2	7.1
1.3	16.4	21.5
0.7	16.1	10.6
1.3	8.5	11.2
0.3	15.1	5.0
0.7	4.9	3.2
1.0	14.8	14.6
1.0	10.5	10.3
1.0	21	20.7
0.7	6.2	4.1
0.3	5.2	1.7
0.7	25.3	16.6
1.0	13.5	13.3
1.0	3.9	3.8
0.3	3.6	1.2
0.7	4.3	2.8
1.3	4.6	6.0
1.3	5.2	6.8

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1.3	8.9	11.7	
1.0	4.6	4.5	
0.7	3.6	2.4	
0.0	0	0.0	
0.3	23.3	7.6	
0.7	7.5	4.9	
1.0	6.6	6.5	
1.0	2	2.0	
1.3	3.6	4.7	
0.7	3.6	2.4	
13.1	45.9	602.4	
1.0	11.8	11.6	
0.7	16.4	10.8	
1.3	32.5	42.7	
0.7	10.8	7.1	
0.7	10.2	6.7	
0.3	17.4	5.7	
1.3	15.7	20.6	
1.0	19.7	19.4	
1.3	12.8	16.8	
1.0	49.9	49.1	
0.7	27.9	18.3	
1.3	6.2	8.1	
0.7	19	12.5	
0.7	16.4	10.8	
0.7	105	68.9	
0.7	18.7	12.3	
0.7	4.6	3.0	
1.0	7.2	7.1	
1.0	15.1	14.9	
Total	4559.6	5880.3	9260.0
			49.24%

STREAMBANK EROSION INVENTORY WORKSHEET

Stream (AU):	McBride Creek	**Stream Segment Location (DD)**		**Elevation (ft)**
Section:	Lower	*Upstream: N*	43.33842	3929
Assessment Unit:	ID17050103SW004_03	*W*	-117.01158	
	Analysis includes approximately 2.8 AU miles.	*Downstream: N*	43.33629	3894
Date Collected:	1-Aug-11	*W*	-117.024940	
Field Crew:	BRO BURP Crew	**Notes:** This segment was inventoried for approximately 3800 ft at the lower end of McBride Creek watershed.		
Data Reduced By:	Troy Smith			

Streambank Erosion Calculations		Unit	Area Applied
Bank Length	3800.00	ft	Inventoried Segment
Bank to Bank Length (LBB)	7600.00	ft	"
Erosive Bank Length	1476.45	ft	"
Erosive Bank to Bank Length	2952.90	ft	"
Percent Eroding Bank	38.9	%	"
Bank to Bank Eroding Area (AE)	8287.33	ft^2	"
Lateral Recession Rate (RLR)	0.135		"
Bulk Density (DB)	110	lb/ft^2	"
Total Bank Erosion (E)	61.53	tons/year	"
Bank Erosion Rate (ER)	85.50	tons/mile/year	Reach and Segment
Length of Similar Stream	10931	ft	Total Reach
Total Streambank Erosion	238.54	tons/year	"

Recession Rate Calculation Worksheet		Load Capacity
Slope Factor	**Rating**	**Rating**
Bank Stability (0-3)	3	1
Bank Erosion (0-3)	2	1
Vegetative/cover on Banks (0-3)	1.5	1
Bank/Channel Shape - downcutting (0-3)	2	1
Channel Bottom (0-2)	0	0
Deposition (0-1)	-1	0
Total = Slight (0-4); Moderate (5-8); Severe (9+)	7.5	4
Recession Rate	0.135	0.05

RLR is average of segments

Streambank Erosion Reduction Calculations		Unit	Area Applied
Bank to Bank Eroding Area With Load Reductions (AE)	4265.89	ft^2	Inventoried Segment
Total Bank Erosion With Load Reductions (E)	11.73	tons/year	"
Bank Erosion Rate With Load Reductions (ER)	16.30	tons/mile/year	Reach and Segment
Total Streambank Erosion With Load Reductions	45.48	tons/year	"

Summary for Load Reductions for Total Reach					
Current Load		Load Capacity			
Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Total Erosion (tons/yr) Reduction (%)	Total Erosion (tons/yr) Reduction
85	239	16	45	81	193

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Stream Name: McBride - Below Highway
Segment: 1 to 44
Date: 8/1/2011

Erosive Bank Height (ft)	Erosive Bank Length (ft)	Eroding Bank Area (ft^2)	Total Bank Length (ft)
1.6	144.4	231.04	
6.6	39.4	260.04	
1	91.9	91.9	
0.7	82	57.4	
0.8	39.4	31.52	
0.8	88.6	70.88	
1.1	72.2	79.42	
4.6	236.2	1086.52	
1	52.5	52.5	
1.3	190.3	247.39	
5.6	157.5	882	
2	111.5	223	
1	39.4	39.4	
2.6	55.8	145.08	
1.6	26.2	41.92	
8.2	131.2	1075.84	
1.6	124.7	199.52	
1.3	45.9	59.67	
1	45.9	45.9	
2	42.7	85.4	
2	105	210	
3.9	203.4	793.26	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
Total	1063.05	3004.80	2736.00
			38.9%

Stream Name: McBride - Below Highway
Segment: 45 to 60
Date: 8/1/2011

Erosive Bank Height (ft)	Erosive Bank Length (ft)	Eroding Bank Area (ft^2)	Total Bank Length (ft)
0.8	59.1	47.28	
3.3	118.1	389.73	
1	45.9	45.9	
6.6	124.7	823.02	
1.3	98.4	127.92	
2.3	137.8	316.94	
2.3	85.3	196.19	
2.1	157.5	330.75	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
Total	413.40	1138.87	1064.00
			38.9%

(Yellow) Values reduced by 1/2 because both sides of bank were sampled.

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STREAMBANK EROSION INVENTORY WORKSHEET

Stream (AU):	McBride Creek	**Stream Segment Location (DD)**		**Elevation (ft)**
Section:	Upper	*Upstream: N*	43.243701	5070
Assessment Unit:	ID17050103SW004_02	*W*	-116.928147	
	Analysis includes approximately 17.4 AU miles.	*Downstream: N*	43.248887	4870
Date Collected:	1-Aug-11	*W*	-116.938253	
Field Crew:	BRO BURP Crew	**Notes: This** segment was inventoried for approximately 3684 ft in the upper watershed of McBride Creek, and includes Little McBride and Willow Fork.		
Data Reduced By:	Troy Smith			

Streambank Erosion Calculations		Unit	Area Applied
Bank Length	3684.00	ft	Inventoried Segment
Bank to Bank Length (LBB)	7368.00	ft	"
Erosive Bank Length	1778.05	ft	"
Erosive Bank to Bank Length	3556.10	ft	"
Percent Eroding Bank	48.3	%	"
Bank to Bank Eroding Area (AE)	12844.64	ft^2	"
Lateral Recession Rate (RLR)	0.04		"
Bulk Density (DB)	110	lb/ft^2	"
Total Bank Erosion (E)	28.26	tons/year	"
Bank Erosion Rate (ER)	40.50	tons/mile/year	Reach and Segment
Length of Similar Stream	88346	ft	Total Reach
Total Streambank Erosion	705.92	tons/year	"

Recession Rate Calculation Worksheet		Load Capacity
Slope Factor	**Rating**	**Rating**
Bank Stability (0-3)	2	1
Bank Erosion (0-3)	1	1
Vegetative/cover on Banks (0-3)	1	1
Bank/Channel Shape - downcutting (0-3)	0	1
Channel Bottom (0-2)	0	0
Deposition (0-1)	-1	0
Total = Slight (0-4); Moderate (5-8); Severe (9+)	3	4
Recession Rate	**0.04**	**0.05**

RLR is average of segments

Streambank Erosion Reduction Calculations		Unit	Area Applied
Bank to Bank Eroding Area With Load Reductions (AE)	5322.65	ft^2	Inventoried Segment
Total Bank Erosion With Load Reductions (E)	14.64	tons/year	"
Bank Erosion Rate With Load Reductions (ER)	20.98	tons/mile/year	Reach and Segment
Total Streambank Erosion With Load Reductions	365.65	tons/year	"

Summary for Load Reductions for Total Reach					
Current Load		Load Capacity		Total Erosion (tons/yr) Reduction (%)	Total Erosion (tons/yr) Reduction
Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)		
41	**706**	**21**	**366**	**48**	**340**

Stream Name: McBride - Upper Watershed
Segment: 61 to 114
Date: 8/1/2011

Erosive Bank Height (ft)	Erosive Bank Length (ft)	Eroding Bank Area (ft^2)	Total Bank Length (ft)
1.6	39.4	63.04	
0.7	19.7	13.79	
0.7	13.1	9.17	
0.8	19.7	15.76	
0.3	13.1	3.93	
2.6	45.9	119.34	
1.6	52.5	84	
3.3	16.4	54.12	
1.6	19.7	31.52	
1	26.2	26.2	
2	134.5	269	
1	49.2	49.2	
2	19.7	39.4	
2	32.8	65.6	
2.3	19.7	45.31	
2	78.7	157.4	
2.6	82	213.2	
1.1	26.2	28.82	
2	39.4	78.8	
1.3	16.4	21.32	
3	147.6	442.8	
1.6	32.8	52.48	
2	26.2	52.4	
2.3	32.8	75.44	
2	32.8	65.6	
2.6	45.9	119.34	
3.6	65.6	236.16	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
		0	
Total	574.00	1216.57	1189.00
			48.3%

Stream Name: McBride - Upper Watershed
Segment: 115 to 186
Date: 8/1/2011

Erosive Bank Height (ft)	Erosive Bank Length (ft)	Eroding Bank Area (ft^2)	Total Bank Length (ft)
3.9	95.1	370.89	
2.6	16.4	42.64	
3.9	32.8	127.92	
2.6	105	273	
7.9	75.5	596.45	
2	78.7	157.4	
3.3	42.7	140.91	
4.3	154.2	663.06	
4.9	32.8	160.72	
4.9	147.6	723.24	
1.3	39.4	51.22	
3.3	26.2	86.46	
3.3	42.7	140.91	
9.8	85.3	835.94	
2.3	85.3	196.19	
3.6	177.2	637.92	
2	26.2	52.4	
3.6	39.4	141.84	
3	19.7	59.1	
4.3	85.3	366.79	
2.6	121.4	315.64	
5.6	36.1	202.16	
4.3	78.7	338.41	
6.6	59.1	390.06	
6.9	42.7	294.63	
6.6	32.8	216.48	
5.9	32.8	193.52	
6.6	114.8	757.68	
2.6	75.5	196.3	
0.8	36.1	28.88	
8.2	42.7	350.14	
4.9	65.6	321.44	
2.3	26.2	60.26	
3	78.7	236.1	
4.9	131.2	642.88	
1.6	26.2	41.92	
Total	1204.05	5205.75	2495.00
			48.3%

Values reduced by 1/2 because both sides of bank were sampled.

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STREAMBANK EROSION INVENTORY WORKSHEET

Stream (AU):	Pickett Creek/Catherine Creek	**Stream Segment Location (DD)**		**Elevation (ft)**
Section:	Bates Creek to Brown Creek	*Upstream: N*	43.044627	2748
Assessment Unit:	ID17050103SW016_03	*W*	-116.387984	
	Analysis includes approximately 6.4 AU miles	*Downstream: N*	43.043582	2718
Date Collected:	12-Oct-12	*W*	-116.376848	
Field Crew:	Darcy Sharp, TGS & ND	**Notes:** 1 segment was inventoried for approximately 5808 ft along Pickett and Catherine Creeks within the AU_03.		
Data Reduced By:	Troy Smith			

Streambank Erosion Calculations		Unit	Area Applied
Bank Length	5808.00	ft	Inventoried Segment
Bank to Bank Length (LBB)	11616.00	ft	"
Erosive Bank Length	1130.20	ft	"
Erosive Bank to Bank Length	2260.40	ft	"
Percent Eroding Bank	19.5	%	"
Bank to Bank Eroding Area (AE)	4507.04	ft^2	"
Lateral Recession Rate (RLR)	0.15		"
Bulk Density (DB)	110	lb/ft^2	"
Total Bank Erosion (E)	37.18	tons/year	"
Bank Erosion Rate (ER)	33.80	tons/mile/year	Reach and Segment
Length of Similar Stream	28142	ft	Total Reach
Total Streambank Erosion	217.35	tons/year	"

Recession Rate Calculation Worksheet		Load Capacity
Slope Factor	**Rating**	**Rating**
Bank Stability (0-3)	2	1
Bank Erosion (0-3)	2	1
Vegetative/cover on Banks (0-3)	2	1
Bank/Channel Shape - downcutting (0-3)	1	1
Channel Bottom (0-2)	1	0
Deposition (0-1)	0	0
Total = Slight (0-4); Moderate (5-8); Severe (9+)	8	4
Recession Rate	**0.15**	**0.05**

Streambank Erosion Reduction Calculations		Unit	Area Applied
Bank to Bank Eroding Area With Load Reductions (AE)	4632.26	ft^2	Inventoried Segment
Total Bank Erosion With Load Reductions (E)	12.74	tons/year	"
Bank Erosion Rate With Load Reductions (ER)	11.58	tons/mile/year	Reach and Segment
Total Streambank Erosion With Load Reductions	74.46	tons/year	"

Summary for Load Reductions for Total Reach					
Current Load		Load Capacity			
Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Erosion Rate (tons/mile/yr)	Total Erosion (tons/yr)	Total Erosion (tons/yr) Reduction	Total Erosion (tons/yr) Reduction
34	217	12	74	**66%**	**143**

Stream Name: Pickett Creek
Segment: 853 to 942
Date: 10/12/2012

Erosive Bank Height (ft)	Erosive Bank Length (ft)	Eroding Bank Area (ft^2)	Total Bank Length (ft)
2	9.8	19.6	
1.3	13.1	17.03	
0.3	29.5	8.85	
0.3	49.2	14.76	
3.3	196.9	649.77	
3.3	9.8	32.34	
2	16.4	32.8	
3.3	26.2	86.46	
2	23	46	
1	19.7	19.7	
1.6	13.1	20.96	
1.6	6.6	10.56	
3.3	6.6	21.78	
1.6	19.7	31.52	
3.3	19.7	65.01	
2.6	29.5	76.7	
0.3	16.4	4.92	
0.3	16.4	4.92	
2.6	3.3	8.58	
0.3	16.4	4.92	
3	23	69	
0.3	16.4	4.92	
2	32.8	65.6	
3.3	16.4	54.12	
1.6	9.8	15.68	
1.3	3.3	4.29	
2.3	9.8	22.54	
3	6.6	19.8	
3.3	52.5	173.25	
0.3	16.4	4.92	
2	32.8	65.6	
1.6	19.7	31.52	
2	9.8	19.6	
1.3	19.7	25.61	
1.3	16.4	21.32	
1.3	16.4	21.32	
3.3	49.2	162.36	
1.3	42.7	55.51	
2.3	32.8	75.44	
3.3	16.4	54.12	
2.6	6.6	17.16	
0.3	9.8	2.94	
1.3	8.2	10.66	
1.6	32.8	52.48	
0.3	88.6	26.58	
		0	
Total	1130.20	2253.52	5808.00
			19.5%

DRAFT April 1, 2013
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