Upper Salmon River Subbasin Assessment and TMDL

2016 Addendum and Five-Year Review

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September 2016

Prepared by
Idaho Department of Environmental Quality
Idaho Falls Regional Office
900 Skyline Dr., Suite B
Idaho Falls, Idaho 83402

And

Technical Services, State Office
1410 N. Hilton
Boise, Idaho 83706

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Cover photo: Sawtooth Range from the Park Creek Overlook.

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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
BAER	Burned Area Emergency Response
BAG	basin advisory group
BLM	United States Bureau of Land Management
BMP	best management practice
BURP	Beneficial Use Reconnaissance Program
C	Celsius
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations (refers to citations in the federal administrative rules)
cfu	colony-forming units
CGP	Construction General Permit
cfs	cubic feet per second
cm	centimeters
CW	cold water (aquatic life)
DEQ	Idaho Department of Environmental Quality
DMA	Designated Monitoring Area
DO	dissolved oxygen
DWS	domestic water supply
EPA	United States Environmental Protection Agency
E. coli	*Escherichia coli*
F	Fahrenheit
GIS	geographic information system
HUC	hydrologic unit code
IDAPA	Refers to citations of Idaho administrative rules
IDFG	Idaho Department of Fish and Game
IDPR	Idaho Department of Parks and Recreation
IFRO	DEQ's Idaho Falls Regional Office
ISDA	Idaho State Department of Agriculture
kWh	kilowatt hour
LA	load allocation
LC	load capacity
m	meter
MDAT	maximum daily average temperature

MDMT	maximum daily maximum temperature
mg/L	milligrams per liter
MIM	Multiple Indicator Monitoring
mL	milliliter
MOS	margin of safety
MS4	municipal separate storm sewer systems
MSGP	Multi-Sector General Permit
MWAT	maximum weekly average temperature
MWMT	maximum weekly maximum temperature
n/a	not applicable
NB	natural background
NPDES	National Pollutant Discharge Elimination System
NREL	National Renewable Energy Laboratory
NRCS	Natural Resources Conservation Service
NTU	nephelometric turbidity unit
PNV	potential natural vegetation
PCR	primary contact recreation
SCR	secondary contact recreation
SCS	Soil Conservation Service—now called the Natural Resources Conservation Service (NRCS)
SEI	streambank erosion inventory
SFI	DEQ's Stream Fish Index
SHI	DEQ's Stream Habitat Index
SMI	DEQ's Stream Macroinvertebrate Index
SNRA	Sawtooth National Recreation Area
SS	salmonid spawning
SWPPP	stormwater pollution prevention plan
TCM	Thompson Creek Mining Co.
TMDL	total maximum daily load
US	United States
USBR	United States Bureau of Reclamation
USC	United States Code
USFS	United States Forest Service
USGS	United States Geological Survey
WAG	watershed advisory group
WBAG	*Water Body Assessment Guidance*
WLA	wasteload allocation

Executive Summary

The federal Clean Water Act 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 Clean Water Act, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. Section 303(d) of the Clean Water Act establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards).

States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently, this list is published every two (2) years as the list of Category 5 water bodies in Idaho's Integrated Report. 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 thirty (30) assessment units (AUs) in the Upper Salmon River subbasin that have been placed in Category 5 of Idaho's federally approved 2012 Integrated Report (DEQ 2014) and other locations and AUs integral to the subbasin assessment process.

This addendum describes the key physical and biological characteristics of the subbasin; water quality concerns and status; pollutant sources; and recent pollution control actions in the Upper Salmon River subbasin, located in east-central Idaho. For more detailed information about the subbasin and previous TMDLs, see the *Upper Salmon River Subbasin Assessment and TMDL* (DEQ 2003).

The TMDL analysis establishes water quality targets and load capacities, estimates existing pollutant loads, and allocates responsibility for load reductions needed to return listed waters to a condition meeting water quality standards. It also identifies implementation strategies—including reasonable time frames, approach, responsible parties, and monitoring strategies—necessary to achieve load reductions and meet water quality standards.

Subbasin at a Glance

The Upper Salmon River subbasin is located in the central Idaho mountains (Figure A). Water quality, native fish populations, and riparian habitat conditions continue to be issues of concern in the subbasin. Historic concerns in the subbasin have included the effects of mining, warm-season grazing, grazing in riparian areas, timber harvest and associated roads, introduction of exotic fish and plant species, residential and recreational development, and human-caused stream alteration and diversion of surface waters as potential factors leading to limited production and survival of native resident and anadromous fishes throughout the subbasin. Numerous restoration projects have been completed, are under construction, or are planned in the Upper Salmon River subbasin. These projects have resulted in improvements in water quality and fisheries of many miles of streams in the subbasin. The waters of the upper Salmon River have been identified as an essential component of anadromous fish and Bull Trout restoration in Idaho. This subbasin assessment and TMDL is intended to identify where improvements in water quality are needed and to support the intent of the Clean Water Act that waters of the United States be fishable and swimmable.

This document addresses the water bodies in the Upper Salmon River subbasin that have been placed in Category 5 of Idaho's 2012 federally approved Integrated Report (see Figure A). In this document, each listed AU is examined. For more information about these specific watersheds or the subbasin as a whole, see the *Upper Salmon River Subbasin Assessment and TMDL* (DEQ 2003).

This TMDL analysis has been developed to comply with Idaho's TMDL requirements for the listed AUs and unlisted AUs determined to be exceeding Idaho's water quality standards. A TMDL analysis determines instream water quality targets, calculates load capacities, estimates existing pollutant sources, and allocates load reductions needed to return listed waters to a condition meeting the water quality standards associated with beneficial uses.

The Upper Salmon River subbasin (hydrologic unit code [HUC] 17060201) is located in central Idaho from the Sawtooth Mountains to Ellis, Idaho. Temperature was determined to be impairing water quality in sixteen (16) AUs requiring temperature TMDLs: 8 listed in Category 5 of the 2012 Integrated Report and eight (8) unlisted but identified as having exceedances of the temperature standard for salmonid spawning. Temperature load allocations are provided in this document using the current Idaho Department of Environmental Quality (DEQ) methods for estimating shade. Sediment was found to be impairing beneficial uses in 4 AUs, and allocations for sediment load reductions are provided in this document. In 1 AU, *Escherichia coli* (*E. coli*) was determined to be impairing water quality; a bacteria TMDL is provided for restoring the secondary contact recreation beneficial use to this AU. In total, 21 AUs received TMDLs (Table A).

The subbasin assessment portion of this document (Sections 1–4) examines water quality and use status for these AUs and summarizes completed or ongoing watershed improvement projects in the subbasin. The TMDL analyses (Section 5) quantify pollutant loads and allocate load reductions needed to return impaired waters to a condition meeting water quality standards. There are two individual NPDES permits for mine discharges (Hecla – Grouse Creek Unit and Thompson Creek Mine). These mines also have industrial stormwater general permits. There are potentially two aquaculture permits, a general permit for the state's Sawtooth Fish Hatchery and a terminated individual permit for Epicenter Aquaculture. It is anticipated that the Epicenter facility will start up under new ownership and apply for an aquaculture general permit. There were no municipal separate storm sewer systems (MS4s), one industrial stormwater permit (Challis Mine) covered under the Multi-Sector General Permit (MSGP). There may be construction general permits in the subbasin that come and go based on projects, most tend to be temporary road construction projects.

Most of the permitted facilities discharge to waters not in TMDL development and no wasteload allocations have been developed at this time. Permitted projects that are near TMDL waters are considered in compliance with the intent of the TMDL so long as they follow their permit. The exception is the potential new permit for the previously identified Epicenter facility. This facility will discharge to a canal tributary to sediment TMDL waters and is receiving a wasteload allocation for its TSS load.

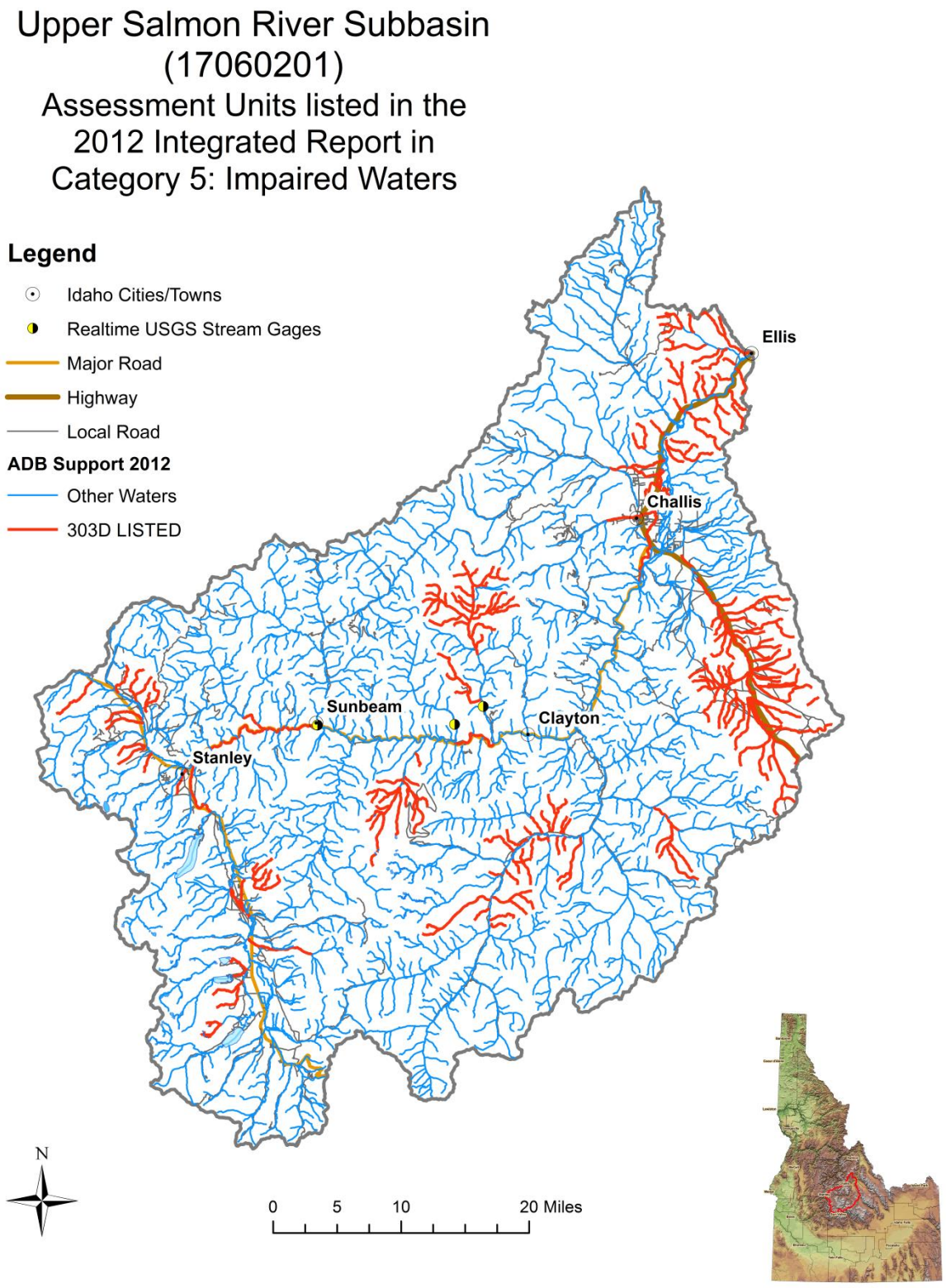


Figure A. Upper Salmon River subbasin.

Table A. Water bodies and pollutants for which TMDLs were developed.

Water Body	Assessment Unit Number	Pollutants
Salmon River – Pennal Gulch to Pahsimeroi River	ID17060201SL001_06	Temperature
Challis Creek – Darling Creek to mouth	ID17060201SL007_04	Temperature
Challis Creek – Bear Creek to Darling Creek	ID17060201SL009_03	Temperature
Challis Creek – Bear Creek to Darling Creek	ID17060201SL009_04	Temperature
Salmon River – Birch Creek (formerly Garden Creek/Gini Canal) to Pennal Gulch	ID17060201SL014_06	Temperature
Salmon River – East Fork Salmon River to Birch Creek (formerly Garden Creek/Gini Canal)	ID17060201SL016_06	Temperature
Salmon River – Squaw Creek to East Fork Salmon River	ID17060201SL019_05	Temperature
Squaw Creek – Cash Creek to mouth	ID17060201SL021_04	Temperature
Squaw Creek tributaries	ID17060201SL023_02	Temperature
Squaw Creek – Willow Creek to Martin Creek	ID17060201SL023_03	Temperature
Squaw Creek – Martin Creek to Cash Creek	ID17060201SL023_04	Temperature
Aspen Creek – Martin Creek to Cash Creek	ID17060201SL024_02	Temperature
Salmon River – Thompson Creek to Squaw Creek	ID17060201SL027_05	Temperature
Salmon River – Yankee Fork Creek to Thompson Creek	ID17060201SL031_05	Temperature
Salmon River – Valley Creek to Yankee Fork Creek	ID17060201SL047_05	Temperature
Salmon River – Redfish Lake Creek to Valley Creek	ID17060201SL063_05	Temperature
Herd Creek – source to mouth	ID17060201SL118_04	*Escherichia coli*
Warm Spring Creek – Hole-in-Rock Creek to mouth	ID17060201SL131_04	Sedimentation/siltation
Warm Spring Creek – source to Hole-in-Rock Creek	ID17060201SL132_02	Sedimentation/siltation
Warm Spring Creek – source to Hole-in-Rock Creek	ID17060201SL132_03	Sedimentation/siltation
Warm Spring Creek – source to Hole-in-Rock Creek	ID17060201SL132_04	Sedimentation/siltation

Key Findings

The Upper Salmon River subbasin has several AUs that are impaired by various pollutants. The primary pollutant is temperature, but sediment and *E. coli* impairments also exist. Since the 2003 TMDL, there have been improvements in the land uses and updated management plans, which are discussed in section 4. Despite land use changes and restoration projects in the subbasin, some AUs do have impairments and more active measures are required to mitigate for those pollutants; therefore, TMDLs are required. TMDLs have been developed identifying the impairments and needed reductions to meet Idaho water quality standards. Since most pollutants are from nonpoint sources, the use of best management practices (BMPs) is essential. Temperature and sediment impairments are expected to persist a decade after mitigation BMPs are applied so that natural stream processes and vegetation can recover. Whereas *E. coli* impairments are extremely variable by season and mitigation options; for example, exclosure fencing can cause nearly instant decreases in loading within areas where livestock grazing is the primary *E. coli* source.

Idaho's 2012 Integrated Report lists AUs in Category 5 for suspected water quality impairments (DEQ 2014). This document presents a determination of the status of these AUs as an addendum

to the *Upper Salmon River Subbasin Assessment and TMDL* (DEQ 2003). In addition, the results of ongoing monitoring and watershed improvement projects are reported in this document and serve as a five-year review of the original TMDL.

A summary of assessment outcomes for AUs listed in Category 5 of the 2012 Integrated Report is given in Table B; AUs that are not listed in Category 5 but are impaired are given in Table C, along with their assessment outcomes.

Table B. Summary of assessment outcomes for §303(d)-listed assessment units.

Assessment Unit	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
ID17060201SL001_02, Salmon River tributaries – Pennal Gulch to Pahsimeroi River	Combined biota/habitat bioassessments	No	Place in Category 4c for low flow alterations. Delist for combined biota/habitat bioassessments.	Low flow alterations are the sole impairment cause.
ID17060201SL007_04, Challis Creek – Darling Creek to mouth	Temperature	Yes	Move to Category 4a for temperature.	Temperature TMDL developed using potential natural vegetation (PNV); excess solar load from a lack of existing shade. Temperature explains impairments along with existing sediment TMDL.
ID17060201SL009_04, Challis Creek – Bear Creek to Darling Creek	Temperature, cause unknown (nutrients suspected)	Yes	Move to Category 4a for temperature; delist for cause unknown.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade. Temperature explains impairments along with existing sediment TMDL.
ID17060201SL015_03, Garden Creek	Sedimentation/ siltation, cause unknown (nutrients suspected)	No	Delist for sedimentation/siltation and cause unknown; retain in Category 4c.	Current 4c listing for other flow regime alterations and physical substrate habitat alterations identifies the impairment causes.
ID17060201SL015_04, Garden Creek (aka Gini Canal)	Sedimentation/ siltation, cause unknown (nutrients suspected)	No	Delist for sedimentation/siltation and cause unknown; move to Category 3.	Listing erroneously replicated from nearby streams. Agricultural beneficial uses of the canal are unassessed.
ID17060201SL023_02, Squaw Creek tributaries	Temperature	Yes	Move to Category 4a for temperature.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade. Temperature explains impairments.
ID17060201SL023_03, Squaw Creek – Willow Creek to Martin Creek	Temperature	Yes	Move to Category 4a for temperature.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade. Temperature explains impairments.
ID17060201SL023_04, Squaw Creek – Martin Creek to Cash Creek	Temperature	Yes	Move to Category 4a for temperature.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade. Temperature explains impairments.
ID17060201SL026_02, Bruno Creek	Combined biota/habitat bioassessments	No	Place in Category 4c for other flow regime alterations and physical substrate habitat alterations. Delist for combined biota/habitat bioassessments.	Other flow regime alterations and physical substrate habitat alterations are the sole impairment causes; stream is piped around disturbed mine lands.
ID17060201SL027_05, Salmon River – Thompson Creek to Squaw Creek	Sedimentation/ siltation, temperature	Yes	Move to Category 4a for temperature; delist for sedimentation/siltation.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade. Temperature explains impairments.
ID17060201SL047_05, Salmon River – Valley Creek to Yankee Fork Creek	Sedimentation/ siltation, temperature	Yes	Move to Category 4a for temperature; delist for sedimentation/siltation.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade. Temperature explains impairments.

Assessment Unit	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
ID17060201SL048_03, Basin Creek – East Basin Creek to mouth	Sedimentation/ siltation	No	Retain in Category 5 for sedimentation/ siltation.	Effects of the 2012 Halstead Fire require recovery before impairments can be assessed.
ID17060201SL051_02, Valley Creek tributaries – Trap Creek to mouth	Combined biota/habitat bioassessments	No	Delist combined biota/habitat bioassessments; move to Category 3.	These streams were improperly assessed using BURP data. Channels flow through high-elevation wet meadows wetlands and are outside BURP protocols. Channel function and habitat quality appear to be high, but assessment metrics are not available.
ID17060201SL056_02, Meadow Creek	Combined biota/habitat bioassessments	No	Delist combined biota/habitat bioassessments; move to Category 2.	No documentation supports the listing of this AU. Assessment based only on BURP scores, which indicate stream is meeting macroinvertebrate and habitat metrics.
ID17060201SL063_05, Salmon River – Redfish Lake Creek to Valley Creek	Sedimentation/ siltation, temperature	Yes	Move to Category 4a for temperature; delist for sediment/siltation.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade. Temperature explains impairments.
ID17060201SL072_05, Salmon River – Fisher Creek to Decker Creek	Sedimentation/ siltation	No	Delist for sediment/siltation; move to Category 2.	There is sufficient stream power to mobilize sediment inputs; listing based on erroneous application of upland land use.
ID17060201SL075_02, Alturas Lake Creek	Combined biota/habitat bioassessments	No	Delist combined biota/habitat bioassessments; move to Category 3.	Stream function is altered from reference conditions by lake effects and beaver dams and was assessed using stream metrics.
ID17060201SL086_03, Champion Creek	Combined biota/habitat bioassessments	No	Delist combined biota/habitat bioassessments; move to Category 2.	This AU was impaired and impacted by a forest fire and land use/water withdrawals. The channel has improved, and 2011 BURP monitoring found good scores indicating high macroinvertebrate and fish scores. On a site visit, many Sculpin were identified on the cobble substrate with limited fines remaining in channel.
ID17060201SL089_02, Williams Creek	Combined biota/habitat bioassessments	No	Retain in Category 5 for combined biota/habitat bioassessments.	There has been a change in grazing allotments and use in 2010; recovery is still required. BURP monitoring is also required for assessment.
ID17060201SL099_02, Slate Creek	Combined biota/habitat bioassessments	No	Delist combined biota/habitat bioassessments; place in Category 4c for physical substrate habitat alterations.	This AU was devastated by a microburst that removed the channel and all associated habitat in 1994. Recovery is proceeding, but the AU does not have a functional habitat and will not for decades.
ID17060201SL103_02, East Fork Salmon River – tributaries between Germania Creek and Herd Creek	Combined biota/habitat bioassessments	No	Delist combined biota/habitat bioassessments; move to Category 2.	Listing based on low BURP fish scores; macroinvertebrate and habitat scores passing.
ID17060201SL104_03, Big Lake Creek	Combined biota/habitat bioassessments	No	Delist combined biota/habitat bioassessments; move to Category 3.	Stream function is altered from reference conditions by lake effects and was assessed using reference stream metrics.
ID17060201SL125_03, Road Creek – source to Corral Basin Creek	Combined biota/habitat bioassessments	No	Delist combined biota/habitat bioassessments; move to Category 2.	Listing based on limited fish age classes; fish habitat limited by stream size. Macroinvertebrate and habitat scores passing.
ID17060201SL126_02, Mosquito Creek	Combined biota/habitat bioassessments	No	Delist combined biota/habitat bioassessments; move to Category 3.	Naturally intermittent stream channel; lack of water explains deviation from reference streams.

Assessment Unit	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
ID17060201SL131_04, Warm Spring Creek – Hole-in-Rock Creek to mouth	Sedimentation/ siltation	Yes	Move to Category 4a for sediment.	Sediment TMDL completed based on streambank stability.
ID17060201SL132_02, Warm Spring Creek – source to Hole-in-Rock Creek	Sedimentation/ siltation	Yes	Move to Category 4a for sediment.	Sediment TMDL completed based on streambank stability.
ID17060201SL132_03, Warm Spring Creek – source to Hole-in-Rock Creek	Sedimentation/ siltation	Yes	Move to Category 4a for sediment.	Although the AU is not specifically impacted by loss of streambank stability, the unit carries excess load from units above.
ID17060201SL132_04, Warm Spring Creek – source to Hole-in-Rock Creek	Sedimentation/ siltation	Yes	Move to Category 4a for sediment.	Sediment TMDL completed based on streambank stability.
ID17060201SL133_02, Broken Wagon Creek	Sedimentation/ siltation	No	Delist for sediment/siltation; retain in Category 4c.	Ephemeral channel; current Category 4c designation explains impairment.
ID17060201SL133_03, Broken Wagon Creek	Sedimentation/ siltation	No	Delist for sediment/siltation; retain in Category 4c.	Ephemeral channel; current Category 4c designation explains impairment.

Note: BURP = Beneficial Use Reconnaissance Program

Table C. Summary of assessment outcomes for unlisted but impaired assessment units.

Assessment Unit	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
ID17060201SL001_06, Salmon River – Pennal Gulch to Pahsimeroi River	No 2012 impaired listing	Yes	Move to Category 4a for temperature TMDL.	Temperature TMDL developed using potential natural vegetation (PNV); excess solar load from a lack of existing shade.
ID17060201SL009_03, Challis Creek – Bear Creek to Darling Creek	No 2012 impaired listing	Yes	Move to Category 4a for temperature TMDL.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade.
ID17060201SL014_06, Salmon River – Birch Creek (formerly Garden Creek/Gini Canal) to Pennal Gulch	No 2012 impaired listing	Yes	Move to Category 4a for temperature TMDL.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade.
ID17060201SL016_06, Salmon River – East Fork Salmon River to Birch Creek (formerly Garden Creek/Gini Canal)	No 2012 impaired listing	Yes	Move to Category 4a for temperature TMDL.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade.
ID17060201SL019 _05, Salmon River – Squaw Creek to East Fork Salmon River	No 2012 impaired listing	Yes	Move to Category 4a for temperature TMDL.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade.
ID17060201SL021_04, Squaw Creek – Cash Creek to mouth	No 2012 impaired listing	Yes	Move to Category 4a for temperature TMDL.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade.
ID17060201SL024_02, Aspen Creek – Martin Creek to Cash Creek	No 2012 impaired listing	Yes	Move to Category 4a for temperature TMDL.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade.
ID17060201SL031_05, Salmon River – Yankee Fork Creek to Thompson Creek	No 2012 impaired listing	Yes	Move to Category 4a for temperature TMDL.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade.
ID17060201SL118_04, Herd Creek – source to mouth	No 2012 impaired listing	Yes	Move to Category 4a for *E. coli* TMDL.	*E. coli* TMDL based on geometric mean.

Temperature

Listed in Category 5 of the 2012 Integrated Report for temperature were eight (8) AUs that included portions of Challis Creek, Squaw Creek, and the Salmon River (Figure B). DEQ has developed temperature TMDLs for these waters.

Effective target shade levels were established for sixteen (16) AUs (eight (8) listed and eight (8) unlisted) based on the concept of maximum shading under potential natural vegetation resulting in natural temperature levels. Shade targets were derived from effective shade curves developed for similar vegetation types in Idaho. Existing shade was determined from aerial photo interpretation or using the Oregon Department of Environmental Quality's Heat Source modeling (shade-alator portion only). Estimates of existing shade were partially field verified with Solar Pathfinder data. Target and existing shade levels were compared to determine the amount of shade needed to bring water bodies into compliance with temperature criteria in Idaho's water quality standards (IDAPA 58.01.02). A summary of assessment outcomes, including recommended changes to listing status in the next Integrated Report, is presented in Table B.

Most AUs are in reasonably good condition with respect to shade and thermal loads. The majority of AUs have average lack of shade values at or fewer than 10% and necessary load reductions less than 20%.

Two (2) of the listed Category 5 AUs included most of lower Challis Creek (AUs ID17060201SL007_04 and SL009_04). We also included the 3rd-order segment (ID10760201SL009_03) to provide a more complete analysis of lower Challis Creek. The three (3) AUs examined in Challis Creek appeared to have the most impacts, with necessary load reductions between 25% and 43%. Average lack of shade along Challis Creek was also greater than in other AUs in the analysis. Lower Challis Creek has considerably more land use activities than other streams examined.

The unlisted 4th-order segment of Squaw Creek (ID17060201SL021_04), closest to the Salmon River, did have some shade loss likely due to land use activities in the area. Numeric temperature data from 2011 indicate this AU has exceedances of the temperature standard. The temperature listed segment of Squaw Creek (ID17060201SL023_04) just upstream was in better condition. There were three (3) AUs listed in Category 5 as impaired by temperature in the 2012 Integrated Report (AUs ID17060201SL023_02, SL023_03, and SL023_04) that had temperature TMDLs developed. To maintain continuity in the examination, we included Aspen Creek (ID17060201SL024_02), which is within the Squaw Creek watershed but is not listed as impaired in the 2012 Integrated Report.

Of the eight (8) temperature-listed AUs, three (3) were part of the Salmon River: from Redfish Lake outlet to Valley Creek (ID17060201SL063_05), from Valley Creek to Yankee Fork (ID17060201SL047_05), and from Thompson Creek to Squaw Creek (ID17060201SL027_05). While not listed in the 2012 Integrated Report, 4 Salmon River AUs downstream of the Squaw Creek confluence exceeded the temperature standard for salmonid spawning based on temperature monitoring. These AUs are included in the analysis from Squaw Creek to Pahsimeroi River (AUs ID17060201SL019_05, SL016_06, SL014_06, and SL001_06). We also found temperature exceedances in the portion of the Salmon River from Yankee Fork to

Thompson Creek (ID17060201SL031_05). TMDLs were developed for these five (5) unlisted AUs.

The Salmon River (ID17060201SL047_05) had the largest excess load and requires an 8% reduction to meet its target load. This temperature-impaired reach includes the river from Valley Creek to Yankee Fork. The lack of shade in this region results primarily from the proximity of Hwy 75 to the river and associated rock piles preventing vegetation development. Although shade deficits periodically exceed 15%, the river is unlikely to attain sufficient shade to reduce deficits due to the highway. Squaw Creek also had low excess loads, with the 3rd-order segment having no excess loads and very little shade deficit.

The Salmon River downstream of the Squaw Creek confluence lacked shade, especially in the cottonwood dominated valleys. However, due to the river's large width, excess load only amounted to 3% of the total solar load.

All streams require some rehabilitation to achieve shade targets. Target shade levels for individual stream segments should be the goal managers strive for with future implementation plans. Managers should focus on the largest differences between existing and target shade as locations to prioritize implementation efforts. Load analysis tables and figures showing lack of shade can be used to prioritize implementation efforts in key areas.

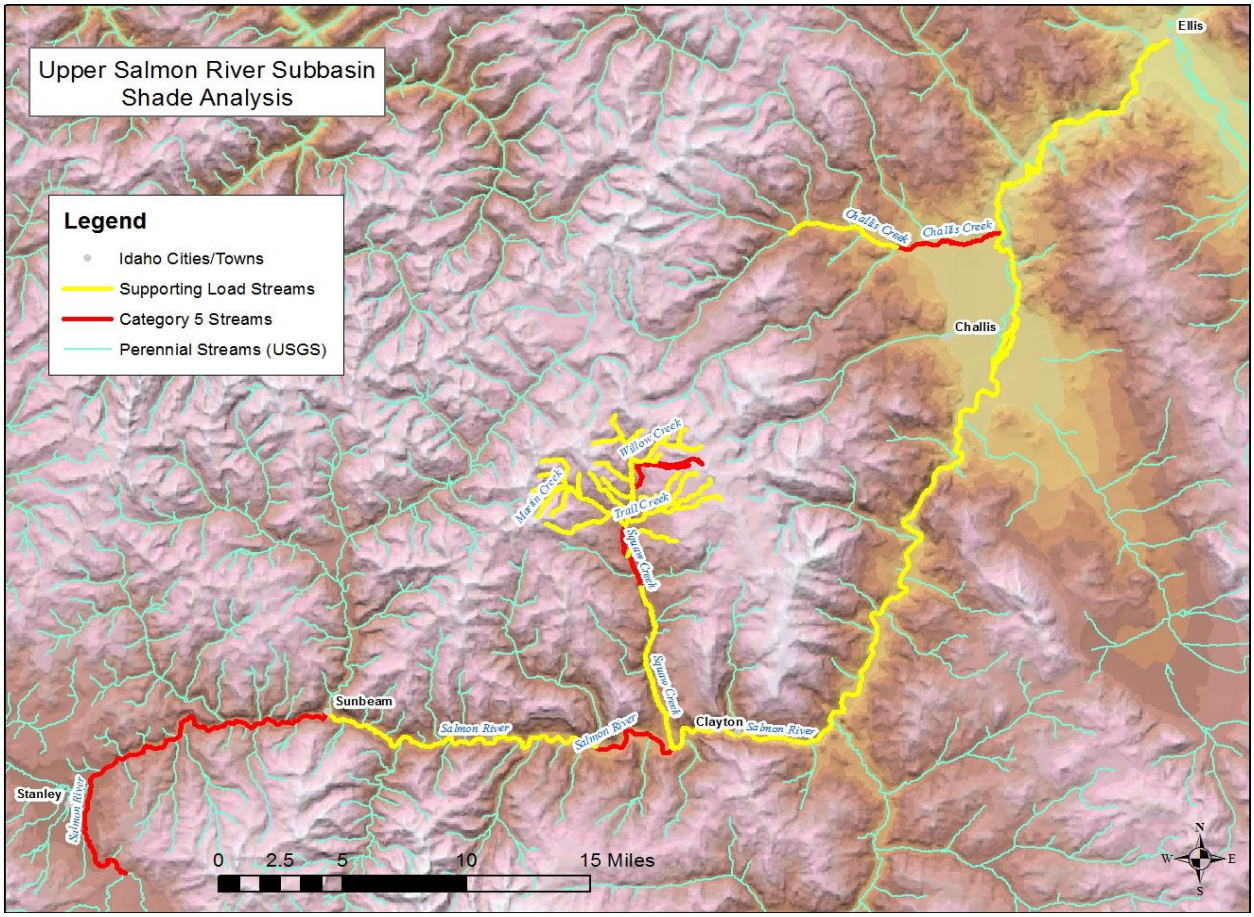


Figure B. Upper Salmon River subbasin shade analysis based on the 2012 Integrated Report.

Sedimentation/Siltation

Idaho's 2012 Integrated Report lists twelve (12) AUs for sediment-related impairments. Of these, eight (8) were found to be impaired for other causes (i.e., temperature or water withdrawals [Category 4c]) or were erroneously listed as impaired. The four (4) impaired AUs (all within the Warm Spring Creek watershed [5th field HUC—1706020115]) have TMDLs for sediment with allocations and reductions developed in this document (ID17060201SL131_04, SL132_02, SL132_03, and SL132_04).

Additional sediment examination occurred in the Salmon River to examine if sediment was a potential pollutant. The Salmon River was determined to have sufficient stream power to transport the sediment reaching the channel. All the Salmon River sediment-listed AUs had temperature TMDLs developed, except for Salmon River – Fisher Creek to Decker Creek (ID17060201SL072_05), which had McNeil core sample data at less than 28% fines.

Bacteria

No AUs were listed for bacteria impairment in the 2012 Integrated Report, either as fecal coliform or as *E. coli*. One unlisted AU required a bacteria TMDL for impairment to the recreation beneficial uses by *E. coli*. Herd Creek – source to mouth (ID17060201SL118_04) had a TMDL developed, along with load allocations and reductions.

Other Listings

Two AUs shall remain in Category 5 since mitigating factors must be accounted for before a determination of any impairment to beneficial uses can be made. Basin Creek (ID17060201SL048_03) was severely burnt in the 2012 Halstead Fire, which has naturally altered the landscape and any potential anthropogenically imposed impairment. Baseline data have been collected in the Basin Creek watershed to monitor recovery. Williams Creek (ID17060201SL089_02) shall remain in Category 5 as on-going grazing management changes in the subwatershed have not yet had time to alter the stream condition. It is expected that concerns of sediment-caused impairments will be mitigated by this land use alteration, but confirmation by DEQ water quality metrics is required. It is recommended that Beneficial Use Reconnaissance Program (BURP) monitoring occur before the next five-year review for this AU.

Two (2) AUs have impairments from pollution and not by a pollutant; therefore, these AUs should be re-categorized into Category 4c. Bruno Creek (ID17060201SL026_02) should be relisted in Category 4c for "other flow regime alterations." Slate Creek (ID17060201SL099_02) should be relisted in Category 4c for "physical substrate habitat alterations." None of the three AUs listed for cause unknown (nutrients suspected) had any identifiable impairments that could be related to nutrient impairment causing nuisance growth in the stream channel. All had other impairments, either with TMDLs developed (Category 4a) or classification into Category 4c for other impairments.

Three AUs are solely impaired by pollution and not by a pollutant; therefore, these AUs retain their Category 4c listing. Garden Creek's (ID17060201SL015_03) current Category 4c listing for "other flow regime alterations" and "physical substrate habitat alterations" identifies the sole

impairment causes. Broken Wagon Creek's (ID17060201SL133_ 02 and SL133_03) current Category 4c listing for "low flow alterations" identifies the sole impairment cause.

Four AUs were listed using BURP metrics that were applied to hydrologic systems outside of the BURP protocol. These AUs should be listed as unassessed (Category 3). Tributaries to Valley Creek (ID17060201SL051_02) are streams flowing through a peat wetland, whereas Mosquito Creek (ID174060201SL126_02) is an intermittent stream. Both of these AUs were assessed using metrics designed for streams, not wetlands or intermittent streams; therefore, assessment based on BURP data was inappropriately applied and these AUs should be relisted into Category 3 until accurate assessments can be made using applicable metrics. Alturas Lake Creek (ID17060201SL075_02) should be relisted in Category 3, as BURP monitoring locations and metrics should not have been applied to the locations that had lake effects altering the water column or those locations monitored within a beaver complex. Big Lake Creek (ID17060201SL104_03) should be relisted into Category 3 since the lake affects the water column quality in the outflow channel, which is outside of the reference condition metrics used to assess natural stream channels in Idaho.

Gini Canal (Garden Creek ID17060201SL015_04) is solely an irrigation canal containing water for only a portion of the year. DEQ does not have metrics to determine beneficial use support in this agricultural water type. Additionally, nonsupport determinations were replicated from Garden Creek and not on data from Gini Canal itself. Therefore, this AU should be relisted to Category 3 as unassessed for its actual beneficial use.

Assessment Units Determined as Unimpaired

AUs were determined not to be impaired and should be removed from Category 5 and relisted into Category 2 for full support. Champion Creek (ID17060201SL086_03) was impacted by land use and a fire. Since the fire, land uses have changed and the stream channel has recovered from the fire effects. Monitoring in 2011 found full support for macroinvertebrates, habitat, and fish. Two AUs were listed based on low fish populations, but the macroinvertebrate and habitat scores were passing. It was determined that both AUs (East Fork Salmon River tributaries [ID17060201SL103_02] and Road Creek [ID17060201SL125_03]) were fully supporting all beneficial uses and concerns of fish populations and size classes were related to stream size and rearing habitat refugia, not to impairments. Meadow Creek (ID17060201SL056_02) was erroneously listed based solely on BURP monitoring metric scores (passing for the two collected parameters of macroinvertebrates and habitat), and no identifiable reason, justification, or cause could be identified for the impaired listing. Therefore, it was deemed a mistaken listing. Salmon River – Fisher Creek to Decker Creek (ID17060201SL072_05), which had McNeil core sample data at less than 28% fines, was not found to have sediment inputs or deposition in the channel to support the listing as sediment impaired. It appears this listing was based on concerns of potential impairment and not on any measurable parameters.

Previous TMDL Status

Sediment TMDLs were developed in the *Upper Salmon River Subbasin Assessment and TMDL* (DEQ 2003) for three AUs in Challis Creek. In 2013, it appeared that stream conditions had improved, as fine sediment particles were limited and the banks appeared stable. However, the Lodgepole Fire burned great portions of the watershed in late 2013. In August 2014, monsoon

rains on burned areas led to flooding, debris flows, and washouts in Challis Creek (William MacFarlane, USFS, personal communication, August 2014). Therefore, no updates on improvements are available for these AUs. However, regular observations in 2013 and early 2014 identified no indication of excessive nuisance growth in the channel indicating a nutrient impairment as suggested in the cause unknown listing for AU ID17060201SL009_04. These AUs have impairments by sediment and temperature, which are the only identifiable causes.

Public Participation

Because there is no established WAG for this HUC, the Salmon Basin Advisory Group (BAG) reviewed and provided input and supported the start of the public comment period.

Contacts have been made and developed throughout the process of developing this TMDL; regular contact was attempted with the primary land agencies and users. Many of those contacts are referenced in this document as personal contacts when applicable. Other contacts and conversations may not have been referenced within the text and many of those are listed below. There were multiple USFS contacts with Bill MacFarlane and Mark Moulton (primarily in 2014). Contact with the US BLM (Challis Office) via numerous emails and conversations in person (i.e., July 16, 2013, April 9, 2014, and August 4, 2014). Communication and status was also conveyed to Karma Bragg with the Custer Soil and Water Conservation District primarily through email with updates to TMDL progress.

Introduction

This document addresses the water bodies in the Upper Salmon River subbasin that have been placed in Category 5 of Idaho's 2012 federally approved Integrated Report (DEQ 2014) or have subsequently been identified as impaired. The purpose of this total maximum daily load (TMDL) addendum is to characterize and document pollutant loads within the Upper Salmon River subbasin. This document is an addendum to the *Upper Salmon River Subbasin Assessment and TMDL* (DEQ 2003). The first portion of this document presents key characteristics or updated information for the subbasin assessment, which is divided into four major sections: subbasin characterization (Section 1), water quality concerns and status (Section 2), pollutant source inventory (Section 3), and a summary of past and present pollution control efforts (Section 4). While the subbasin assessment is not a requirement of the TMDL, the Idaho Department of Environmental Quality (DEQ) performs the assessment to ensure impairment listings are up-to-date and accurate.

The subbasin assessment is used to develop a TMDL for each pollutant of concern for the Upper Salmon River subbasin. The TMDL (Section 5) is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimate of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (40 CFR Part 130). Consequently, a TMDL is water body- and pollutant-specific. The TMDL also allocates allowable discharges of individual pollutants among the various sources discharging the pollutant.

This document addresses the thirty (30) assessment units (AUs) in the Upper Salmon River subbasin that have been placed in Category 5 of Idaho's federally approved 2012 Integrated Report (DEQ 2014) and other locations and AUs integral to the subbasin assessment process. TMDLs were developed for temperature-, sediment-, and bacteria-impaired waters.

This addendum also serves as a five-year review of the original TMDLs in accordance with Idaho Code 39-3611(7).

Regulatory Requirements

This document was prepared in compliance with both federal and state regulatory requirements. The federal government, through the United States Environmental Protection Agency (EPA), assumed the dominant role in defining and directing water pollution control programs across the country. DEQ implements the Clean Water Act in Idaho, while EPA oversees Idaho and certifies the fulfillment of Clean Water Act requirements and responsibilities.

Congress passed the Federal Water Pollution Control Act, more commonly called the Clean Water Act, in 1972. The goal of this act was to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (33 USC §1251). The act and the programs it has generated have changed over the years as experience and perceptions of water quality have changed. The Clean Water Act has been amended fifteen (15) times, most significantly in 1977, 1981, and 1987. One of the goals of the 1977 amendment was protecting and managing waters to ensure "swimmable and fishable" conditions. These goals relate water quality to more than just chemistry.

The Clean Water Act requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to §303 of the Clean Water Act, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. DEQ must review those standards every three (3) years, and EPA must approve Idaho's water quality standards. Idaho adopts water quality standards to protect public health and welfare, enhance water quality, and protect biological integrity. A water quality standard defines the goals of a water body by designating the use or uses for the water, setting criteria necessary to protect those uses, and preventing degradation of water quality through antidegradation provisions.

Section 303(d) of the Clean Water Act establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently, this list is published every two (2) years as the list of Category 5 waters in Idaho's Integrated Report. For waters identified on this list, states and tribes must develop a TMDL for the pollutants, set at a level to achieve water quality standards.

DEQ monitors waters, and for those not meeting water quality standards, DEQ must establish a TMDL for each pollutant impairing the waters. However, some conditions that impair water quality do not require TMDLs. EPA considers certain unnatural conditions—such as flow alteration, human-caused lack of flow, or habitat alteration—that are not the result of discharging a specific pollutant as "pollution." TMDLs are not required for water bodies impaired by pollution, rather than a specific pollutant. A TMDL is only required when a pollutant can be identified and in some way quantified.

1 Subbasin Assessment—Subbasin Characterization

Features of the Upper Salmon River subbasin, the tributary watersheds, and individual streams are detailed in the 2003 TMDL. Comprehensive biological and instream water quality data were also presented and analyzed in the original subbasin assessment and TMDL (DEQ 2003). This TMDL addendum summarizes pertinent subbasin characteristics and any additional data that pertain to water quality and beneficial uses in the Upper Salmon River subbasin.

1.1 Subbasin Characteristics

The Upper Salmon River subbasin (hydrologic unit code [HUC] 17060201) is located in central Idaho (Figure 1). The northern boundary of the subbasin is bordered by the Frank Church-River of No Return Wilderness. The western extent is bordered by the Sawtooth Mountains, and to the south are the Boulder Mountains and Galena Summit, where the headwaters of the Salmon River originate. The eastern boundary follows the Pahsimeroi Mountains of the Lost River Range. Through the center of the subbasin run the Boulder-White Cloud Mountains. This mountainous terrain has produced many steep valley stream systems, glacial lakes, and troughs that feed the headwaters of the Salmon River.

Stream discharges in the Upper Salmon River subbasin are generally a function of snowmelt runoff. Snowmelt in the lower reaches of the subbasin begins in early spring, while snowmelt in

the higher elevations occurs in late spring to mid-summer. The deeper snowpack in the higher elevations results in larger streamflow discharge in mid- to late-summer. Rain-on-snow events that occur in the spring season also contribute to increased streamflows. Late spring and summer thunderstorms may also vary runoff patterns throughout the subbasin. In some instances, precipitation from the high-intensity storms can cause flash flooding and subsequent erosion damage within a stream system. High-intensity precipitation has led to severe floods, washouts, and stream channel morphology being completely rearranged or demolished.

Irrigation withdrawals for cropland and stock watering have been extensive throughout the Upper Salmon River subbasin. DEQ has no jurisdiction over water rights and does not provide load allocations for flow alteration.

Detailed information on the climate, geology, topography, and hydrology are available in the 2003 TMDL (DEQ 2003).

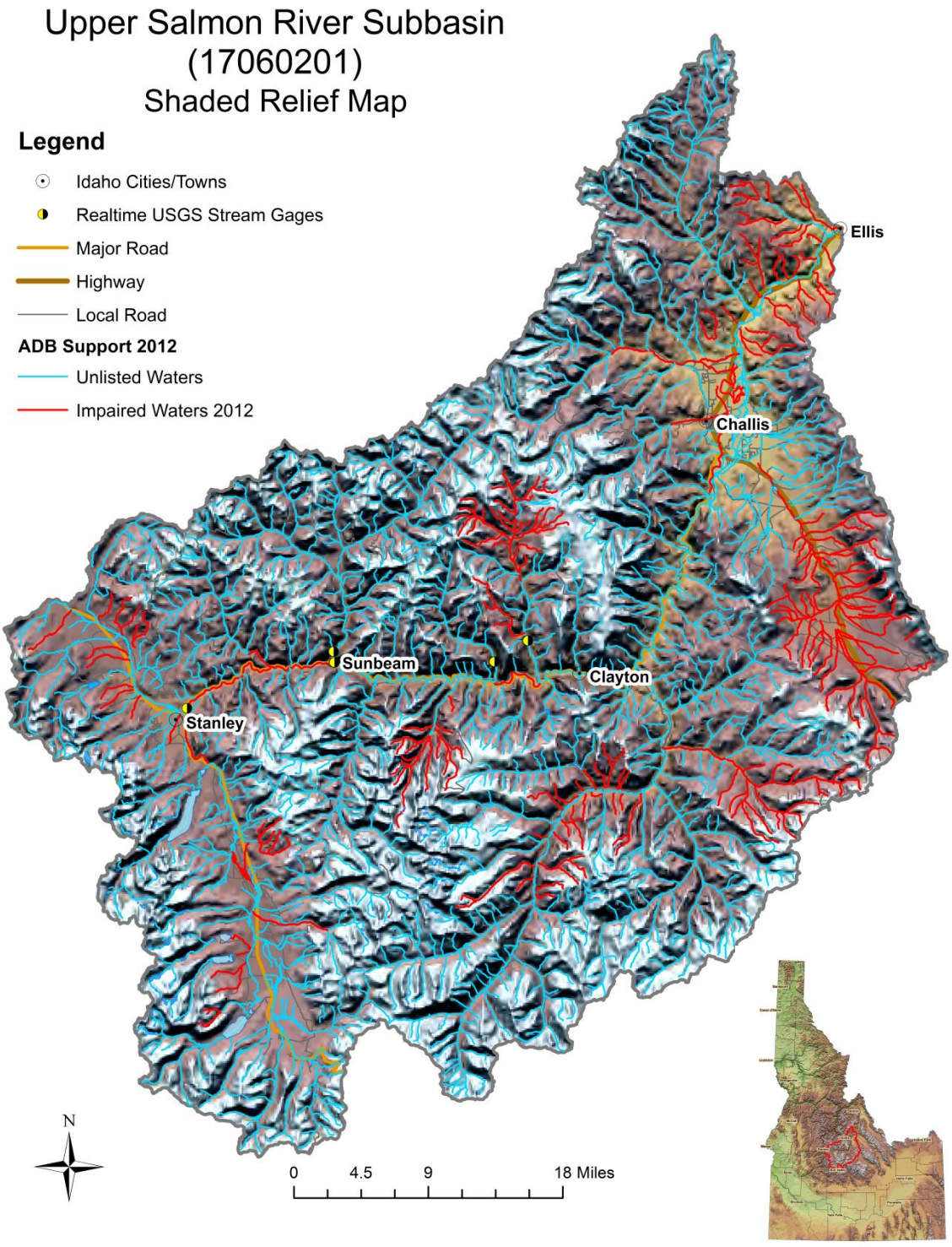


Figure 1. Shaded relief map of the Upper Salmon River subbasin.

1.2 Climate and Hydrology

At least five (5) climate stations have been active in or near the subbasin. The period of record extends from January 1, 1895, through September 30, 2012. Western Regional Climate Center weather station data are presented in Table 1 (WRCC 2013).

Table 1. Weather station data for the Upper Salmon River subbasin.

Weather Station	Date Range	Average Maximum Temperature (°F)	Average Minimum Temperature (°F)	Average Total Precipitation (inches)	Average Total Snowfall (inches)
Stanley, Idaho (108676)	June 25, 1916–September 30, 2012	52.0	18.1	13.62	74.8
Challis, Idaho (101663)	January 1, 1895–June 30, 1996	58.1	30.1	7.38	17.1
Galena, Idaho	September 1, 1963–March 31, 1996	51.3	18.6	24.74	182.8
Average		**53.8**	**22.3**	**15.25**	**91.6**

Agriculture has long been established in the Upper Salmon River valley. Since much of the agricultural region is semiarid, surface water is extensively diverted for agricultural irrigation. In progressively higher elevations up the slopes of the subbasin, precipitation increases, as evidenced by the precipitation as snowfall at Galena (Table 1).

The US Geological Survey (USGS) operates five (5) stream gaging stations on the Salmon River and its tributaries in the Upper Salmon River subbasin. The period of record at each stream gage is listed in Table 2. Data are available from the USGS National Water Information System website (*http://waterdata.usgs.gov/usa/nwis*).

Table 2. Summary of discharge data at historic US Geological Survey stream gaging stations.

Gaging Station		Period of Record[a]
13295000	Valley Creek at Stanley ID	1911–2014
13296000	Yankee Fork Salmon River nr Clayton ID	1921–2014
13296500	Salmon River bl Yankee Fork nr Clayton ID	1921–2014
13297330	Thompson Creek nr Clayton ID	1972–2014
13297355	Squaw Creek bl Bruno Creek nr Clayton ID	1972–2014

[a] Dates are for the data available at time of developing this TMDL.

The Upper Salmon River subbasin is within the Columbia River basin hydrologic region. The principle drainage of the subbasin is the Salmon River from its headwaters to the confluence with the Pahsimeroi River. Stream flow regimes are typical of central Idaho mountain streams with seasonal peak flows in late spring to early summer from snowmelt runoff. Summer thunderstorms can increase daily peak flows. Low flow occurs in late summer through the winter. Substantial variability exists from year to year due to fluctuating precipitation and temperatures. The Upper Salmon River subbasin is primarily composed of steep, narrow drainages with V-shaped valleys. The floodplain of the Upper Salmon River, in the Stanley area, is fairly broad compared to floodplain in the canyon reach of the Salmon River further

downstream. Irrigated agriculture exists on the river's floodplain throughout the lower reaches of the subbasin below the canyon.

The East Fork Salmon River is the largest tributary to the Salmon River within the subbasin. The lower portions of the East Fork Salmon River have gradients less than 1% with an average channel width between 40 and 60 feet. Many tributaries to the Salmon River in the subbasin are relatively small with steep gradients.

1.3 Landownership and Population

Since the original TMDL (DEQ 2003), the delineation of many watersheds has been altered by a cooperative effort among the Idaho Department of Water Resources, the Natural Resources Conservation Service (NRCS), and various state and local agencies. The Idaho Watershed Boundary 5th and 6th Field Delineation Project (IDWR 2008) implemented changes in many Idaho watershed boundaries to coordinate with surrounding states and more accurately reflect drainage patterns. Consequently, for the Upper Salmon River subbasin, the total acreage, proportions in landownership distribution and other land area characteristics may differ from the original TMDL analysis and implementation plan. Table 3 and Figure 2 detail the current distribution of landownership for this subbasin.

Table 3. Current landownership in the Upper Salmon River subbasin.

Owner/Land Manager	Acreage	Percent of Basin
Bureau of Land Management	379,495	24.48%
Private	69,902	4.51%
State	22,743	1.47%
Surveyed water	6,377	0.41%
US Forest Service	1,072,013	69.14%
Total	**1,550,530**	**100.00%**

This subbasin is approximately 5% private lands, most of which is agricultural. The Salmon-Challis National Forest and Sawtooth National Recreation Area (SNRA) manages the upland regions and forested slopes. The US Bureau of Land Management (BLM) presence is centered round the city of Challis, primarily in the lower elevations. The Challis and Stanley areas are the predominant privately owned locations, along with other valley locations. The subbasin spans several counties, with the greatest portion in Custer County and minor portions of the headwaters (Galena Summit–Alturas Lake area) in Blaine County.

The land area in this subbasin is almost all rural. The 2010 population of 4,368 residents in Custer County increased from 4,140 in 2014. Custer County is sparsely populated, with less than 1 resident per square mile (US Census Bureau 2016). Challis, the largest town (approximately 20 miles upstream of the Salmon River–Pahsimeroi River confluence), had 1,081 residents in 2010, up from 909 in 2000 (US Census Bureau 2012).

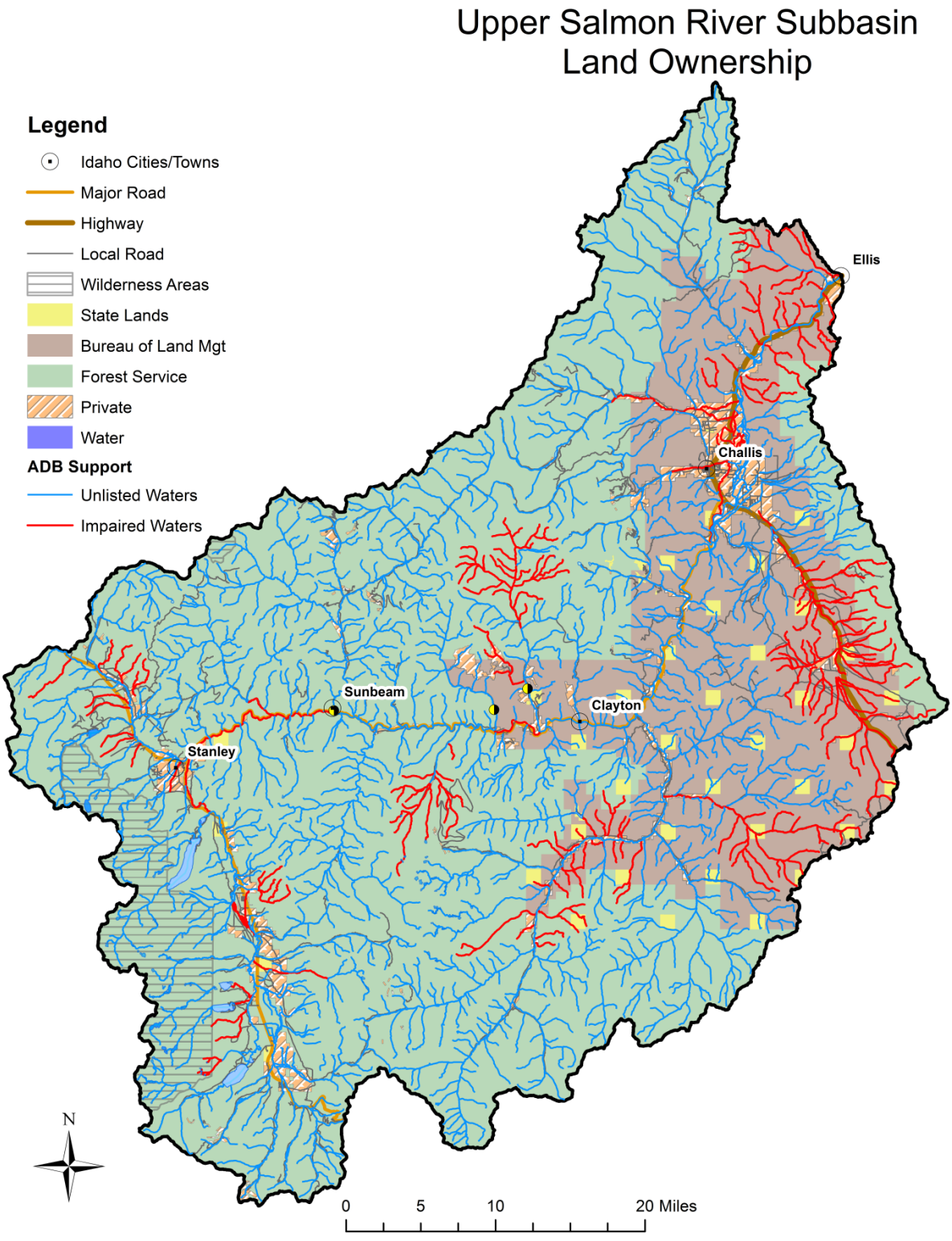


Figure 2. Landowner distribution (BLM 2010).

1.4 Economics

Employment in Custer County is predominantly in the government and natural resources sectors, providing over 50% of the nonfarm payroll jobs in the county (Idaho Department of Labor 2014). Custer County has had significant increases in unemployment since 2006, but with a slight decrease since the high in 2010. Historically, mining supported a thriving economy in this area, but mine closures have reduced the number of highly paid workers (Idaho Department of Labor 2012), and mine closures are of ongoing concern. Mining positions boost the per capita wage in Custer County to above the state average (Idaho Department of Labor 2014).

1.5 Fishes

The Upper Salmon River subbasin is generally characterized by its clear, cool mountain streams. Most streams historically contained a number of native salmonids, including Bull Trout, Westslope Cutthroat Trout, resident Rainbow Trout, Mountain Whitefish, Chinook Salmon, and steelhead trout. The subbasin contains spawning and rearing waters for anadromous fish, including steelhead trout, Chinook Salmon, and Sockeye Salmon. More detailed information on the fishes found in the Upper Salmon River subbasin are found in section 4, which summarizes efforts to improve habitat in the subbasin, and in the original TMDL (DEQ 2003).

Fishery management is determined by the Idaho Department of Fish and Game (IDFG), whose *Fisheries Management Plan 2013–2018* (IDFG 2013) details the expected uses, fish species, hydrology, and objectives and programs for the State of Idaho, with a section specific to the Salmon River between the North Fork and the headwaters. Of specific mention in the document for the Salmon River are the cold-water fisheries and the anadromous fisheries, the primary tributaries to the Salmon River, and numerous lakes and reservoirs. The management direction varies between closed to harvest (catch and release only) to stocking with hatchery fish for a put-and-take fishery (IDFG 2013).

2 Subbasin Assessment—Water Quality Concerns and Status

2.1 Water Quality Limited Assessment Units Occurring in the Subbasin

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

2.1.1 Assessment Units

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

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

2.1.2 Listed Waters

Table 4 details the pollutants and the basis for listing for each §303(d)-listed AU in the subbasin (i.e., AUs in Category 5 of the Integrated Report).

Table 4. Upper Salmon River subbasin 2012 §303(d)-listed assessment units in the subbasin.

Assessment Unit Name	Assessment Unit Number	Listed Pollutants	Listing Basis
Salmon River - Pennal Gulch to Pahsimeroi River	ID17060201SL001_02	Combined biota/habitat bioassessments	2002 §303(d) list
Challis Creek - Darling Creek to mouth	ID17060201SL007_04	Temperature	1998 §303(d) list
Challis Creek - Bear Creek to Darling Creek	ID17060201SL009_04	Temperature, cause unknown	1998 §303(d) list
Garden Creek - source to mouth	ID17060201SL015_03	Cause unknown, sedimentation/siltation	1998 §303(d) list
	ID17060201SL015_04	Cause unknown, sedimentation/siltation	1998 §303(d) list
Squaw Creek tributaries	ID17060201SL023_02	Temperature	1998 §303(d) list—EPA addition
Squaw Creek- Willow Creek to Martin Creek	ID17060201SL023_03	Temperature	1998 §303(d) list—EPA addition
Squaw Creek - Martin Creek to Cash Creek	ID17060201SL023_04	Temperature	1998 §303(d) list—EPA addition
Bruno Creek - source to mouth	ID17060201SL026_02	Combined biota/habitat bioassessments	2002 §303(d) list
Salmon River - Thompson Creek to Squaw Creek	ID17060201SL027_05	Sedimentation/siltation; temperature, water	2002 §303(d) list
Salmon River - Valley Creek to Yankee Fork Creek	ID17060201SL047_05	Sedimentation/siltation, temperature	2002 §303(d) list
Basin Creek - East Basin Creek to mouth	ID17060201SL048_03	Combined biota/habitat bioassessments	2008 §303(d) list
Valley Creek - Trap Creek to mouth	ID17060201SL051_02	Combined biota/habitat bioassessments	2002 §303(d) list
Meadow Creek - source to mouth	ID17060201SL056_02	Combined biota/habitat bioassessments	2002 §303(d) list
Salmon River - Redfish Lake Creek to Valley Creek	ID17060201SL063_05	Sedimentation/siltation, temperature	1998 §303(d) list
Salmon River - Fisher Creek to Decker Creek	ID17060201SL072_05	Sedimentation/siltation	1998 §303(d) list
Alturas Lake Creek - Alturas Lake to mouth	ID17060201SL075_02	Combined biota/habitat bioassessments	2010 §303(d) list
Champion Creek - source to mouth	ID17060201SL086_03	Combined biota/habitat bioassessments	2010 §303(d) list
Williams Creek - source to mouth	ID17060201SL089_02	Combined biota/habitat bioassessments	2010 §303(d) list

Assessment Unit Name	Assessment Unit Number	Listed Pollutants	Listing Basis
Slate Creek - source to mouth	ID17060201SL099_02	Combined biota/habitat bioassessments	2002 §303(d) list
East Fork Salmon River - Germania Creek to Herd Creek	ID17060201SL103_02	Combined biota/habitat bioassessments	2002 §303(d) list
Big Lake Creek - source to mouth	ID17060201SL104_03	Combined biota/habitat bioassessments	2002 §303(d) list
Road Creek - source to Corral Basin Creek	ID17060201SL125_03	Combined biota/habitat bioassessments	1998 §303(d) list
Mosquito Creek - source to mouth	ID17060201SL126_02	Combined biota/habitat bioassessments	2002 §303(d) list
Warm Spring Creek - Hole-in-Rock Creek to mouth	ID17060201SL131_04	Sedimentation/siltation	1998 §303(d) list
Warm Spring Creek - source to Hole-in-Rock Creek	ID17060201SL132_02	Sedimentation/siltation	1998 §303(d) list
	ID17060201SL132_03	Sedimentation/siltation	1998 §303(d) list
	ID17060201SL132_04	Sedimentation/siltation	1998 §303(d) list
Broken Wagon Creek - source to mouth	ID17060201SL133_02	Sedimentation/siltation	2002 §303(d) list
	ID17060201SL133_03	Sedimentation/siltation	2002 §303(d) list

Within the subbasin, 13 AUs are impaired by non-pollutants in Category 4c of the 2012 Integrated Report. No TMDL will be developed for the AUs in Category 4c (Table 5), unless they also have impairments meeting narrative standards (i.e., sediment and nutrients).

Table 5. Assessment units reported in Category 4c, "Waters Impaired by Pollution," of the 2012 Integrated Report.

Assessment Unit Name	Assessment Unit Number	Impaired Stream Miles	Pollution
Challis Creek - Darling Creek to mouth	ID17060201SL007_04	3.42	Low flow alterations
Challis Creek - Bear Creek to Darling Creek	ID17060201SL009_03	4.94	Low flow alterations, other flow regime alterations, high flow regime
Challis Creek - Bear Creek to Darling Creek	ID17060201SL009_04	1.5	Other flow regime alterations, physical substrate habitat alterations
Garden Creek - source to mouth	ID17060201SL015_03	3.92	Low flow alterations, physical substrate habitat alterations
Basin Creek - East Basin Creek to mouth	ID17060201SL048_03	2.36	Physical substrate habitat alterations
Road Creek - source to Corral Basin Creek to mouth	ID17060201SL124_04	4.79	Low flow alterations
Road Creek - source to Corral Basin Creek to mouth	ID17060201SL125_02	31.93	Other flow regime alterations
Warm Spring Creek - Hole-in-Rock Creek to mouth	ID17060201SL131_04	4.29	Low flow alterations
Warm Spring Creek - source to Hole-in-Rock Creek	ID17060201SL132_02	104.67	Low flow alterations
Warm Spring Creek - source to Hole-in-Rock Creek	ID17060201SL132_03	5.08	Low flow alterations
Warm Spring Creek - source to Hole-in-Rock Creek	ID17060201SL132_04	6.71	Low flow alterations
Broken Wagon Creek - source to mouth	ID17060201SL133_02	44.76	Low flow alterations
Broken Wagon Creek - source to mouth	ID17060201SL133_03	3.18	Low flow alterations

2.1.3 Unlisted Waters

Nine AUs had TMDLs developed but were not listed in Category 5 of the 2012 Integrated Report. These waters were found to have impairments during monitoring and development of this document (Table 6).

Table 6. Upper Salmon River subbasin assessment units with TMDLs developed but not listed in Category 5 of the 2012 Integrated Report.

Assessment Unit Name	Assessment Unit Number	Pollutants
Salmon River – Pennal Gulch to Pahsimeroi River	ID17060201SL001_06	Temperature
Challis Creek – Bear Creek to Darling Creek	ID17060201SL009_03	Temperature
Salmon River – Birch Creek to Pennal Gulch	ID17060201SL014_06	Temperature
Salmon River – East Fork Salmon River to Birch Creek	ID17060201SL016_06	Temperature
Salmon River – Squaw Creek to East Fork Salmon River	ID17060201SL019_05	Temperature
Squaw Creek – Cash Creek to mouth	ID17060201SL021_04	Temperature
Aspen Creek – Martin Creek to Cash Creek	ID17060201SL024_02	Temperature
Salmon River – Yankee Fork Creek to Thompson Creek	ID17060201SL031_05	Temperature
Herd Creek – source to mouth	ID17060201SL118_04	*E. coli*

2.2 Applicable Water Quality Standards and Beneficial Uses

Idaho water quality standards (IDAPA 58.01.02) list beneficial uses and set water quality goals for waters of the state. Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and presumed uses as described briefly in the following paragraphs. The *Water Body Assessment Guidance* (Grafe et al. 2002) provides a more detailed description of beneficial use identification for use assessment purposes. Appendix A provides additional information about water quality standards.

Beneficial uses include the following:

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

2.2.1 Existing Uses

Existing uses under the Clean Water Act are "those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards" (40 CFR 131.3). The existing instream water uses and the level of water quality necessary to protect the uses shall be maintained and protected (IDAPA 58.01.02.051.01). Existing uses need to be protected, whether or not the level of water quality to fully support the uses currently exists. A practical application of this concept would be to apply the existing use of salmonid

spawning to a water that supported salmonid spawning since November 28, 1975, but does not now due to other factors, such as blockage of migration, channelization, sedimentation, or excess heat.

2.2.2 Designated Uses

Designated uses under the Clean Water Act are "those uses specified in water quality standards for each water body or segment, whether or not they are being attained" (40 CFR 131.3). Designated uses are simply uses officially recognized by the state. In Idaho, these include uses such as aquatic life support, recreation in and on the water, domestic water supply, and agricultural uses. Multiple uses often apply to the same water; in this case, water quality must be sufficiently maintained to meet the most sensitive use (designated or existing). 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 described in the Idaho water quality standards (IDAPA 58.01.02.100) and specifically listed by water body in sections 110–160.

2.2.3 Undesignated Surface Waters

In Idaho, due to a change in scale of cataloging waters in 2000, most water bodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations (IDAPA 58.01.02.110–160). These undesignated surface waters ultimately need to be designated for appropriate uses. In the interim, and absent information on existing uses, DEQ presumes most of these waters will support cold water aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01). To protect these so-called *presumed uses*, DEQ applies the cold water aquatic life and recreation use criteria to undesignated waters. If in addition to *presumed uses*, an additional existing use (e.g., salmonid spawning) exists, then the additional numeric criteria for salmonid spawning would also apply (e.g., intergravel dissolved oxygen, temperature) because of the requirement to protect water quality for that existing use. However, if some other use that requires less stringent criteria for protection (such as seasonal cold water aquatic life) is found to be an existing use, then a use designation (rulemaking) is needed before that use can be applied in lieu of cold water criteria.

2.2.4 Beneficial Uses in the Subbasin

Beneficial uses of AUs addressed by this addendum are listed in Table 7 and Table 8.

Table 7. Upper Salmon River subbasin beneficial uses for §303(d)-listed streams.

Assessment Unit Name	Assessment Unit Number	Designated, Existing, or Presumed Beneficial Uses[a]
Salmon River - Pennal Gulch to Pahsimeroi River	ID17060201SL001_02	CW, SS, PCR, DWS
Challis Creek - Darling Creek to mouth	ID17060201SL007_04	CW, SCR
Challis Creek - Bear Creek to Darling Creek	ID17060201SL009_04	CW, SCR
Garden Creek - source to mouth	ID17060201SL015_03	CW, SCR
Garden Creek - source to mouth	ID17060201SL015_04	CW, SCR
Squaw Creek tributaries	ID17060201SL023_02	CW, SS, SCR
Squaw Creek- Willow Creek to Martin Creek	ID17060201SL023_03	CW, SS, SCR
Squaw Creek - Martin Creek to Cash Creek	ID17060201SL023_04	CW, SS, SCR
Bruno Creek - source to mouth	ID17060201SL026_02	CW, SCR
Salmon River - Thompson Creek to Squaw Creek	ID17060201SL027_05	CW, SS, PCR, DWS
Salmon River - Valley Creek to Yankee Fork Creek	ID17060201SL047_05	CW, SS, PCR, DWS
Basin Creek - East Basin Creek to mouth	ID17060201SL048_03	CW, SCR
Valley Creek - Trap Creek to mouth	ID17060201SL051_02	CW, SCR
Meadow Creek - source to mouth	ID17060201SL056_02	CW, SCR
Salmon River - Redfish Lake Creek to Valley Creek	ID17060201SL063_05	CW, SS, PCR, DWS
Salmon River - Fisher Creek to Decker Creek	ID17060201SL072_05	CW, SS, PCR, DWS
Alturas Lake Creek - Alturas Lake to mouth	ID17060201SL075_02	CW, SCR
Champion Creek - source to mouth	ID17060201SL086_03	CW, SCR
Williams Creek - source to mouth	ID17060201SL089_02	CW, SCR
Slate Creek - source to mouth	ID17060201SL099_02	CW, SCR
East Fork Salmon River - Germania Creek to Herd Creek	ID17060201SL103_02	CW, SS, PCR, DWS
Big Lake Creek - source to mouth	ID17060201SL104_03	CW, SCR
Road Creek - source to Corral Basin Creek	ID17060201SL125_03	CW, SCR
Mosquito Creek - source to mouth	ID17060201SL126_02	CW, SCR
Warm Spring Creek - Hole-in-Rock Creek to mouth	ID17060201SL131_04	CW, SCR
Warm Spring Creek - source to Hole-in-Rock Creek	ID17060201SL132_02	CW, SCR
Warm Spring Creek - source to Hole-in-Rock Creek	ID17060201SL132_03	CW, SCR
Warm Spring Creek - source to Hole-in-Rock Creek	ID17060201SL132_04	CW, SCR
Broken Wagon Creek - source to mouth	ID17060201SL133_02	CW, SCR
Broken Wagon Creek - source to mouth	ID17060201SL133_03	CW, SCR

[a] Cold water (CW), salmonid spawning (SS), primary contact recreation (PCR), secondary contact recreation (SCR), domestic water supply (DWS)

Table 8. Upper Salmon River subbasin beneficial uses of unlisted streams that had TMDLs developed.

Assessment Unit Name	Assessment Unit Number	Designated, Existing, or Presumed Beneficial Uses[a]
Salmon River – Pennal Gulch to Pahsimeroi River	ID17060201SL001_06	CW, SS, PCR, DWS
Challis Creek - Bear Creek to Darling Creek	ID17060201SL009_03	CW, SCR
Salmon River – Birch Creek to Pennal Gulch	ID17060201SL014_06	CW, SS, PCR, DWS
Salmon River – East Fork Salmon River to Birch Creek	ID17060201SL016_06	CW, SS, PCR, DWS
Salmon River – Squaw Creek to East Fork Salmon River	ID17060201SL019_05	CW, SS, PCR, DWS
Squaw Creek – Cash Creek to mouth	ID17060201SL021_04	CW, SS, SCR
Aspen Creek - Martin Creek to Cash Creek	ID17060201SL024_02	CW, SCR
Salmon River – Thompson Creek to Squaw Creek	ID17060201SL027_05	CW, SS, PCR, DWS
Salmon River – Yankee Fork Creek to Thompson Creek	ID17060201SL031_05	CW, SS, PCR, DWS
Herd Creek – source to mouth	ID17060201SL118_04	CW, SCR

[a] Cold water (CW), salmonid spawning (SS), primary contact recreation (PCR), secondary contact recreation (SCR), domestic water supply (DWS)

2.2.5 Water Quality Criteria to Support Beneficial Uses

Beneficial uses are protected by a set of water quality criteria, which include *numeric* criteria for pollutants such as bacteria, dissolved oxygen, pH, ammonia, temperature, and turbidity, and *narrative* criteria for pollutants such as sediment and nutrients (IDAPA 58.01.02.250–251) (Table 9).

Table 9. Selected numeric criteria supportive of beneficial uses in Idaho water quality standards.

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

[a] During spawning and incubation periods for inhabiting species
[b] *Escherichia coli* per 100 milliliters
[c] Temperature exemption: Exceeding the temperature criteria will not be considered a water quality standard violation when the air temperature exceeds the 90th percentile of the 7-day average daily maximum air temperature calculated in yearly series over the historic record measured at the nearest weather reporting station.

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

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

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

> Surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses. (IDAPA 58.01.02.200.06)

Narrative criteria for floating, suspended, or submerged matter are described in the water quality standards:

> Surface waters of the state shall be free from floating, suspended, or submerged matter of any kind in concentrations causing nuisance or objectionable conditions or that may impair designated beneficial uses. This matter does not include suspended sediment produced as a result of nonpoint source activities. (IDAPA 58.01.02.200.05)

DEQ's procedure to determine whether a water body fully supports designated and existing beneficial uses is outlined in IDAPA 58.01.02.050.02. The procedure relies heavily on biological parameters and is presented in detail in the *Water Body Assessment Guidance* (Grafe et al. 2002). This guidance requires DEQ to use the most complete data available to make beneficial use support status determinations (Figure 3).

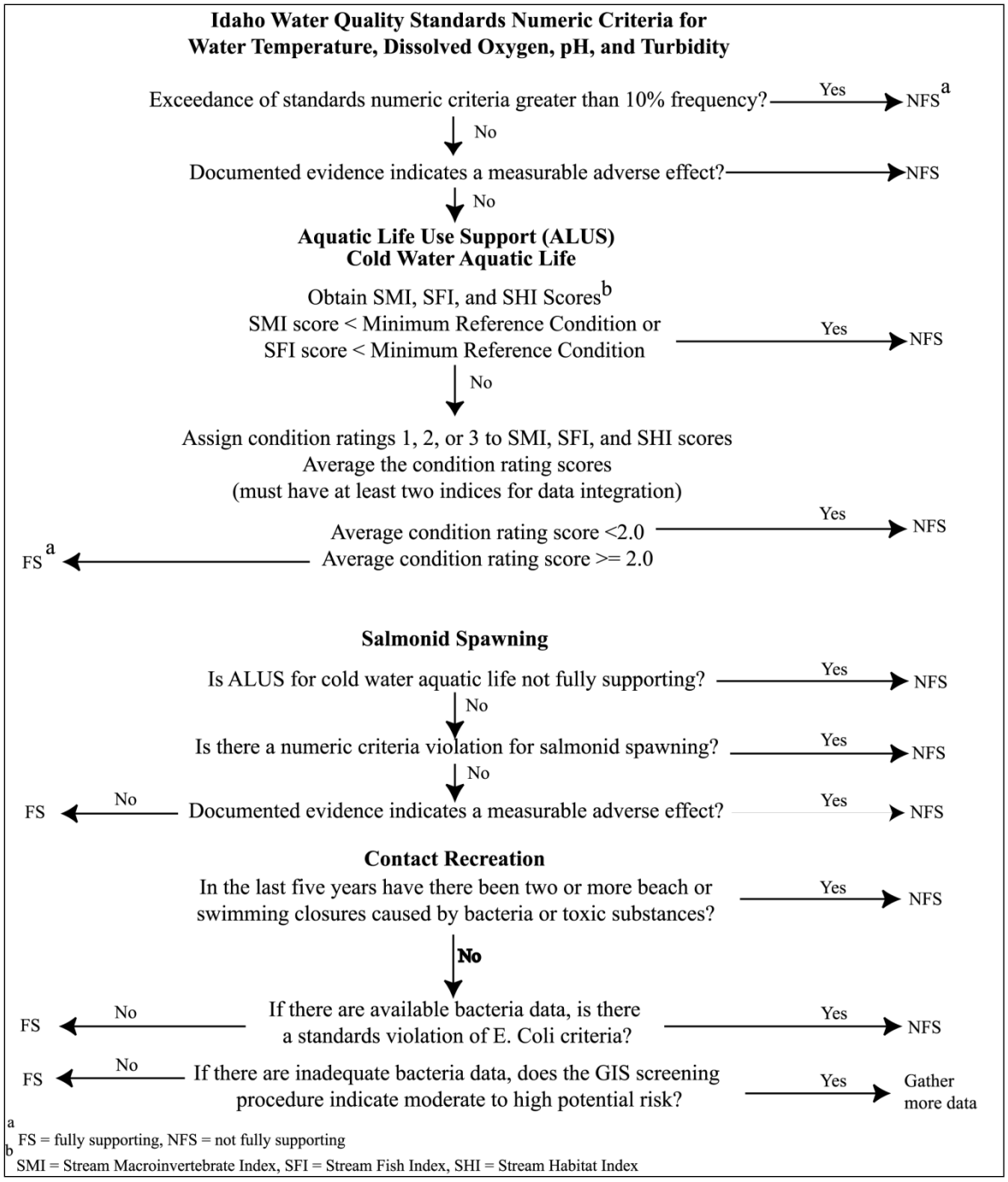


Figure 3. Steps and criteria for determining support status of beneficial uses in wadeable streams (Grafe et al. 2002).

2.3 Status of Beneficial Uses

Three primary pollutants are diminishing beneficial uses in the Upper Salmon River subbasin. The primary pollutant is temperature, the second is sediment, and the third is *Escherichia coli* (*E. coli*). Mitigating sediment inputs should have positive effects on any of the cause unknown (nutrients suspected) listings in the 2012 Integrated Report.

2.4 Assessment Unit Summary

A summary of the data analysis, literature review, and field investigations and a list of conclusions for AUs included in this analysis follows. This section includes changes that will be documented in the next Integrated Report once the TMDLs in this document have been approved by EPA.

ID17060201SL001_02, **Salmon River Tributaries – Pennal Gulch to Pahsimeroi River**

- Listed for combined biota/habitat bioassessments.
- These tributaries are intermittent/ephemeral and what water might exist is allocated to meet water rights. Beneficial Use Reconnaissance Program (BURP) monitoring in 1998 occurred in Shep Creek with a discharge of 0.10 cubic feet per second (cfs). In Shep Creek, this water is allocated and removed from the channel via a pipe (see Appendix B for details). Biota and habitat are functioning at expected levels for the multiple types of water limitation.
- Place into Category 4c for low flow alterations. Delist from Category 5 for combined biota/habitat bioassessments.

ID17060201SL001_06, **Salmon River – Pennal Gulch to Pahsimeroi River**

- An unlisted AU found to be impaired by temperature based on 2011 US Forest Service (USFS) monitoring data.
- TMDL created with 3% load reductions required to meet the temperature standard (see section 5.1 for details). This AU is shade limited, and the temperature exceedances of the standard are the sole cause of impairments.
- Place in Category 4a for completed temperature TMDL.

ID17060201SL007_04, **Challis Creek – Darling Creek to Mouth**

- Listed for temperature.
- Temperature TMDL created with 25% load reductions required to meet the temperature standard (see section 5.1 for details). This AU is shade limited.
- Move to Category 4a for completed temperature TMDL. Retain in Category 4c for and Category 4a for sedimentation/siltation.

ID17060201SL009_03, **Challis Creek – Bear Creek to Darling Creek**

- Currently in Category 4a for sedimentation/siltation.
- AU was unlisted for temperature but found to be shade deficient (see section 5.1 for details), justifying TMDL development for temperature impairments.
- Move to Category 4a for temperature; retain in Category 4a for sedimentation/siltation and Category 4c.

ID17060201SL009_04, **Challis Creek – Bear Creek to Darling Creek**

- Listed for temperature and cause unknown.
- Listed in Category 4a for sedimentation/siltation.
- Temperature TMDL created with 29% load reductions required to meet the temperature standard (see section 5.1 for details). This AU is shade limited.

- There are no cause unknown impairments. The sole cause leading to impairment status is sediment, lack of shade and subsequent temperature exceedances, and habitat limitations associated with low flow alterations. There is an approved TMDL for sediment.
- Move to Category 4a for completed temperature TMDL. Delist from Category 5 for both temperature and cause unknown. Retain in Category 4c for low flow alterations and 4a for sediment.

ID17060201SL014_06, Salmon River – Birch Creek (formerly Garden Creek/Gini Canal) to Pennal Gulch

- An unlisted AU found to be impaired by temperature based on 2014 DEQ monitoring data.
- Temperature TMDL created with 3% load reductions required to meet the temperature standard (see section 5.1 for details). This AU is shade limited, and the temperature exceedances of the standard are the sole cause of impairments.
- Place in Category 4a for completed temperature TMDL.

ID17060201SL015_03, Garden Creek

- Listed for sedimentation/siltation and cause unknown.
- There are no sediment impairments in the channel, nor is there any cause unknown impairment. The sole cause leading to impairment status is alterations in the hydrology (see Appendix B).
- Retain Category 4c listing for low flow alterations. Delist from Category 5 for sedimentation/siltation and cause unknown.

ID17060201SL015_04, Garden Creek (aka Gini Canal)

- Listed for sedimentation/siltation and cause unknown.
- Listings erroneously replicated from ID17060201SL015_03 due to digitizing and/or labelling errors during development of the AU system. This entire AU is an irrigation canal. This canal only has beneficial uses for agriculture (see Appendix B).
- Connection to Garden Creek was remedied in 2007 by the US Bureau of Reclamation (USBR) (*www.usbr.gov/pn/programs/fcrps/thp/srao/uppersalmon/completion/ginicanal/gini-garden.pdf*), which may have contributed to replication of Garden Creek listings (USBR 2007).
- Move to Category 3 as not assessed for the beneficial uses associated with an agricultural canal. Delist from Category 5 for sedimentation/siltation and cause unknown.

ID17060201SL016_06, Salmon River – East Fork Salmon River to Birch Creek (formerly Garden Creek/Gini Canal)

- An unlisted AU found to be impaired by temperature based on 2011, 2012, and 2013 USFS monitoring data.
- Temperature TMDL created with 3% load reductions required to meet the temperature standard (see section 5.1 for details). This AU is shade limited, and the temperature exceedances of the standard are the sole cause of impairments.
- Place in Category 4a for completed temperature TMDL.

ID17060201SL019_05, **Salmon River – Squaw Creek to East Fork Salmon River**

- An unlisted AU found to be impaired by temperature based on 2013 USFS monitoring data.
- TMDL created with 3% load reductions required to meet the temperature standard (see section 5.1 for details). This AU is shade limited, and the temperature exceedances of the standard are the sole cause of impairments.
- Place in Category 4a for completed temperature TMDL.

ID17060201SL021_04, **Squaw Creek - Cash Creek to mouth**

- An unlisted AU found to be impaired by temperature based on 2011 DEQ monitoring data.
- Temperature TMDL created with 16% load reductions required to meet the temperature standard (see section 5.1 for details). This AU is shade limited.
- Place in Category 4a for completed temperature TMDL.

ID17060201SL023_02, **Squaw Creek Tributaries**

- Listed for temperature.
- TMDL created with 17% load reductions required to meet the temperature standard (see section 5.1 for details). This AU is shade limited.
- Move to Category 4a for completed temperature TMDL. Delist from Category 5.

ID17060201SL023_03, **Squaw Creek – Willow Creek to Martin Creek**

- Listed for temperature.
- Temperature TMDL created with 0% load reductions required to meet the temperature standard (see section 5.1 for details). Upstream temperature sources are not mitigated in this AU; therefore, this AU is not meeting the Idaho salmonid spawning criterion. Rounding errors contributed to the calculation of a 0% load reduction determination; average lack of shade was calculated at 2% below expected natural conditions.
- Move to Category 4a for completed temperature TMDL. Delist from Category 5 for temperature.

ID17060201SL023_04, **Squaw Creek –Martin Creek to Cash Creek**

- Listed for temperature.
- TMDL created with 11% load reductions required to meet the temperature standard (see section 5.1 for details). This AU is shade limited.
- Move to Category 4a for completed temperature TMDL. Delist from Category 5.

ID17060201SL024_02, **Aspen Creek –Martin Creek to Cash Creek**

- AU previously not assessed.
- AU was unlisted for temperature but found to be shade deficient (see section 5.1 for details), justifying TMDL development for temperature impairments.

ID17060201SL026_02, **Bruno Creek**

- Listed for combined biota/habitat bioassessments.

- This stream flows through the Thompson Creek Mine, and water not being used per water rights appropriation is piped and transferred around the mine. Downstream of the pipe, the channel is modified by sediment ponds and other control structures. The channel has no impairments other than those associated with necessary modifications to prevent downstream impairments (see Appendix B for details).
- Place into Category 4c for other flow regime alterations and physical substrate habitat alterations. Delist from Category 5 for combined biota/habitat bioassessments.

ID17060201SL027_05, Salmon River – Thompson Creek to Squaw Creek

- Listed for sedimentation/siltation and temperature.
- There are no sediment impairments in this AU. There is sufficient stream power to mobilize sediment inputs (see Appendix C for details).
- Temperature TMDL created with 0% load reductions required to meet the temperature standard (see section 5.1 for details). The temperature exceedances of the standard are the sole cause of impairments. Upstream temperature sources are not mitigated in this AU; therefore, this AU is not meeting the Idaho salmonid spawning standard. Rounding errors contributed to the calculation of a 0% load reduction determination; average lack of shade was calculated at 2% below expected natural conditions.
- Move to Category 4a for completed temperature TMDL. Delist from Category 5 for sedimentation/siltation and temperature.

ID17060201SL031_05, Salmon River – Yankee Fork Creek to Thompson Creek

- An unlisted AU found to be impaired by temperature.
- Temperature TMDL created with 4% load reductions required to meet the temperature standard (see section 5.1 for details). This AU is shade limited, and the temperature exceedances of the standard are the sole cause of impairments.
- Place in Category 4a for completed temperature TMDL.

ID17060201SL047_05, Salmon River – Valley Creek to Yankee Fork Creek

- Listed for sedimentation/siltation and temperature.
- There are no sediment impairments in this AU. There is sufficient stream power to mobilize sediment inputs (see Appendix C for details).
- TMDL created with 8% load reductions required to meet the temperature standard (see section 5.1 for details). This AU is shade limited, and the temperature exceedances of the standard are the sole cause of impairments.
- Move to Category 4a for completed temperature TMDL. Delist from Category 5 for sedimentation/siltation and temperature.

ID17060201SL048_03, Basin Creek – East Basin Creek to mouth

- Listed for combined biota/habitat bioassessments.
- The Halstead Fire of 2012 destroyed most of the forest in this watershed (see Appendix B for details).
- Examine monitoring transects and determine if/when BURP monitoring is justified. Baseline BURP scores were collected in 2014.
- Retain in Category 5 for combined biota/habitat bioassessments until stream and watershed recover from the fire effects. Retain in Category 4c.

ID17060201SL051_02, Valley Creek Tributaries – Trap Creek to mouth

- Listed for combined biota/habitat bioassessments.
- These streams were improperly assessed using BURP data. Channels flow through high elevation peat bogs/wetlands and are outside of BURP protocols. Channel function and habitat for these peat bogs. Fish and frogs were spotted in the channel and wetlands (see Appendix B for details), but assessment metrics are not available.
- Move to Category 3 as not assessed. Delist from Category 5 for combined biota/habitat bioassessments.

ID17060201SL056_02, Meadow Creek

- Listed for combined biota/habitat bioassessments.
- Channel function and habitat are deemed meeting beneficial uses for these peat bogs. Fish and frogs were spotted in the channel and wetlands (see Appendix B for details).
- There is no documented reason indicating why this AU was listed as impaired when BURP data indicate passing stream macroinvertebrate and stream habitat index scores with no data for the stream fish index.
- Move to Category 2 as fully supporting beneficial uses. Delist from Category 5 for combined biota/habitat bioassessments.

ID17060201SL063_05, Salmon River – Redfish Lake Creek to Valley Creek

- Listed for sedimentation/siltation and temperature.
- There are no sediment impairments in this AU. There is sufficient stream power to mobilize sediment inputs (see Appendix C for details).
- Temperature TMDL created with 2% load reductions required to meet the temperature standard (see section 5.1 for details). This AU is shade limited, and the temperature exceedances of the standard are the sole cause of impairments.
- Move to Category 4a for completed temperature TMDL. Delist from Category 5 for sedimentation/siltation and temperature.

ID17060201SL072_05, Salmon River – Fisher Creek to Decker Creek

- Listed for sedimentation/siltation.
- There are no sediment impairments in this AU; in-channel fine particles were found to be less than 28% at salmonid spawning depths. There is sufficient stream power to mobilize sediment inputs (see McNeil core sample data in Appendix C and Appendix B for details). Stream channel is anastomosed because of geologic features and has several beaver dams and irrigation canal withdrawals that alter channel shape and function. There are no impairments. Listing was based on erroneous application of upland land use when transferring from water body ID usage.
- Move to Category 2. Delist from Category 5 for sedimentation/siltation.

ID17060201SL075_02, Alturas Lake Creek

- Listed for combined biota/habitat bioassessments.
- Streams below Alturas Lake were found by BURP monitoring to lack the appropriate macroinvertebrate composition. However, the streams are either impacted by natural features such as the lake effects of the surface release from Alturas Lake or from beaver

dam created wetlands. Neither scenario is compatible for using the BURP stream protocols to effectively examine for habitat (see Appendix B for details).
- Move to Category 3 as unassessed for the specific water body type. Delist from Category 5 for combined biota/habitat bioassessments.

ID17060201SL086_03, **Champion Creek**

- Listed for combined biota/habitat bioassessments.
- This AU was impaired and impacted by a forest fire and land use/water withdrawals. The channel has improved, and 2011 BURP monitoring found good scores indicating high macroinvertebrate and fish communities. On a site visit, many Sculpin were identified on the cobble substrate, with limited fines remaining in channel (see Appendix B for details).
- Multiple withdrawals exist in the AU that could limit full recovery and alter biology.
- Move to Category 2 for full support of all designated and presumed beneficial uses. Delist from Category 5 for combined biota/habitat bioassessments.

ID17060201SL089_02, **Williams Creek**

- Listed for combined biota/habitat bioassessments.
- A change in grazing allotments and use occurred in 2010. However, more recovery time was required as of 2013. Recommend BURP monitoring prior to next subbasin assessment/TMDL cycle (see Appendix B for details).
- Remain in Category 5 for combined biota/habitat bioassessments.

ID17060201SL099_02, **Slate Creek**

- Listed for combined biota/habitat bioassessments.
- This AU was devastated by a microburst that removed the channel and all associated habitat in 1994. Recovery is proceeding, but the AU does not have a functional habitat and will not for decades to come. Monitoring should occur periodically over the next several decades to assess recovery (see Appendix B for details).
- Place into Category 4c for physical substrate habitat alterations. Delist from Category 5 for combined biota/habitat bioassessments.

ID17060201SL103_02, **East Fork Salmon River – Tributaries between Germania Creek and Herd Creek**

- Listed for combined biota/habitat bioassessments.
- BURP monitoring in 1997 found passing scores for macroinvertebrates and habitat; however, the AU was improperly assessed as impaired because of assumptions about ideal fish populations. The limited size classes are of Rainbow Trout (most likely ocean-going steelhead), which are not expected to reside and grow in this stream. There is no impairment (see Appendix B for details).
- Move to Category 2. Delist from Category 5 for combined biota/habitat bioassessments.

ID17060201SL104_03, **Big Lake Creek**

- Listed for combined biota/habitat bioassessments.
- The stream below Big Lake was found by BURP monitoring to have a functional habitat composition. However, this stream is impacted by natural features such as the lake effects

of the surface release from this landslide-formed lake. Lake-affected streams are not compatible stream types for using the BURP protocols (see Appendix B for details).
- Move to Category 3 as unassessed for the specific water body type. Delist from Category 5 for combined biota/habitat bioassessments.

ID17060201SL118_04, **Herd Creek – Source to Mouth**

- An unlisted AU found to be impaired by *E. coli* based on 2011 DEQ monitoring data.
- A 55% load reduction required to meet the 126 colony-forming units per 100 milliliter (cfu/100 mL) standard (see section 5.3 for details). The secondary contact recreation beneficial use is impaired; all other available data indicate full support for other uses.
- Place in Category 4a for *E. coli* with completed TMDL.

ID17060201SL125_03, **Road Creek – Source to Corral Basin Creek**

- Listed for combined biota/habitat bioassessments.
- BURP monitoring during several field seasons found passing scores for macroinvertebrates and habitat; however, the AU was improperly assessed as impaired because of assumptions about ideal fish sizes/age classifications. This is a small stream in an arid volcanic valley and larger fish most likely travel downstream to larger streams or become stunted because of habitat limitations (pool size/water volume). Stream is a good rearing habitat for small fish; numerous trout were seen in every pool. There is no impairment (see Appendix B for details).
- Move to Category 2. Delist from Category 5 for combined biota/habitat bioassessments.

ID17060201SL126_02, **Mosquito Creek**

- Listed for combined biota/habitat bioassessments.
- BURP monitoring resulted in scores of 1 for macroinvertebrates, habitat, and fish; however, the AU was improperly assessed as it is an intermittent stream, low-flow system. This is a small stream in an arid geologically controlled volcanic valley that does not have a continuous surface water connection with Road Creek. The stream is a water source for wild horses when and where water is present (see Appendix B for details).
- Move to Category 3 as not assessed as an intermittent stream. Delist from Category 5 for combined biota/habitat bioassessments.

ID17060201SL131_04, **Warm Spring Creek – Hole-in-Rock Creek to Mouth**

- Listed for sedimentation/siltation.
- TMDL created for excessive sediment load requiring a load reduction of 4,107 tons/year (see section 5.2 for details).
- Move to Category 4a for sedimentation/siltation TMDL completed. Retain in Category 4c.

ID17060201SL132_02, **Warm Spring Creek – Source to Hole-in-Rock Creek**

- Listed for sedimentation/siltation.
- TMDL created for excessive sediment load requiring a load reduction of 9,793 tons/year (see section 5.2 for details).
- Move to Category 4a for sediment/siltation TMDL completed. Retain in Category 4c.

ID17060201SL132_03, **Warm Spring Creek – Source to Hole-in-Rock Creek**

- Listed for sedimentation/siltation.
- This AU is not a producer of sediment in the same manner that the AUs listed above and below are; however, the upstream production impairs the beneficial uses in this AU. A TMDL was created for this excessive sediment deposition requiring a load reduction of 2,450 tons/year, which is a quarter of the input from the upstream AU composed of multiple 1st- and 2nd-order tributaries (see section 5.2 for details).
- Move to Category 4a for sedimentation/siltation. Retain in Category 4c.

ID17060201SL132_04, **Warm Spring Creek – Source to Hole-in-Rock Creek**

- Listed for sedimentation/siltation.
- TMDL created for excessive sediment load requiring a load reduction of 1,265 tons/year (see section 5.2 for details).
- Move to Category 4a for sedimentation/siltation. Retain in Category 4c.

ID17060201SL133_02, **Broken Wagon Creek**

- Listed for sedimentation/siltation.
- This is an ephemeral wash that was incorrectly classified as a stream. There are indications of rare surface flows in the sagebrush flats, but no indications of any recent surface water flows. Springs and other water sources all have applied water rights There is no impairment from sediment, nor is it a source to downgradient streams except during exceptional events (estimated at 25–50 year recurrence intervals). There is no impairment; there is neither source nor pathway (see Appendix B for details).
- Retain in Category 4c. Delist from Category 5 for sedimentation/siltation.

ID17060201SL133_03, **Broken Wagon Creek**

- Listed for sedimentation/siltation.
- This is an ephemeral wash that was incorrectly classified as a stream. There are indications of rare surface flows in the sagebrush flats, but no indications of any recent surface water flows. Springs and other water sources all have applied water rights. DISCUSS WATER RIGHTS There is no impairment from sediment, nor is it a source to downgradient streams except during exceptional events (estimated at 25–50 year recurrence intervals). There is no impairment; there is neither source nor pathway (see Appendix B for details).
- Retain in Category 4c. Delist from Category 5 for sedimentation/siltation.

3 Subbasin Assessment—Pollutant Source Inventory

Pollutants within the Upper Salmon River subbasin are primarily temperature, sediment, and bacteria. Load allocations for various pollutants were established in the *Upper Salmon River Subbasin Assessment and TMDL* approved by EPA in March 2003 (DEQ 2003).

3.1 Point Sources

There are several National Pollutant Discharge Elimination System (NPDES) permits in the Upper Salmon River subbasin, three of which are active dischargers or have active discharge permits (Figure 4). None of these point source dischargers are out of compliance nor do they discharge pollutants of concern for the TMDLs being developed. None discharge warm water that might affect temperature TMDLs along the Salmon River. No recommendations or requirements in this TMDL suggest or indicate necessary changes to the NPDES permit levels previously established.

The Thompson Creek Mine has an NPDES permit (ID-002540-2), but it does not discharge any of its waters. Instead, it recycles them back into the processing methods on Bruno Creek. Only waters that are not used to fulfill their water rights and/or processing needs (which are consumed in the process) are piped around the mine tailing pond and returned to the creek. The tailing pond becomes the source for water consumed in processing. This creek is highly modified by sediment detention ponds and a dirt road built to withstand heavy-duty traffic. The stream is repeatedly adapted to ensure that none of the mine's byproducts exit the mine property boundaries. The mine has the right to divert all the water in the watershed. See Appendix B (Bruno Creek notes) for complete details of operations and management actions. Other permitted locations associated with the mine are not considered an impairment factor or risk as long as they remain in compliance with NPDES permits.

The Sawtooth Fish Hatchery (Aquaculture General Permit, IDG-131000) near Stanley, Idaho, is within its permitted discharge limits and does not impact the water quality of the Salmon River receiving waters (ID17060201SL068_05). This facility is currently operating under an administrative exception while the permit is being updated. It is not expected that significant changes will be made during the current update (D. Helder, personal communication, May 2014) that affect downstream beneficial uses or water quality.

The remaining facility is Grouse Creek Mine, operated by Hecla Mining Company. This location is not active except for contaminant cleanup and management. Discharges from this location are managed under NPDES Permit number ID-0026468. This permit is revised and EPA put it out for public comment from March 17 to April 18, 2016. This permit authorizes treated discharge into Jordan Creek and the Yankee Fork.

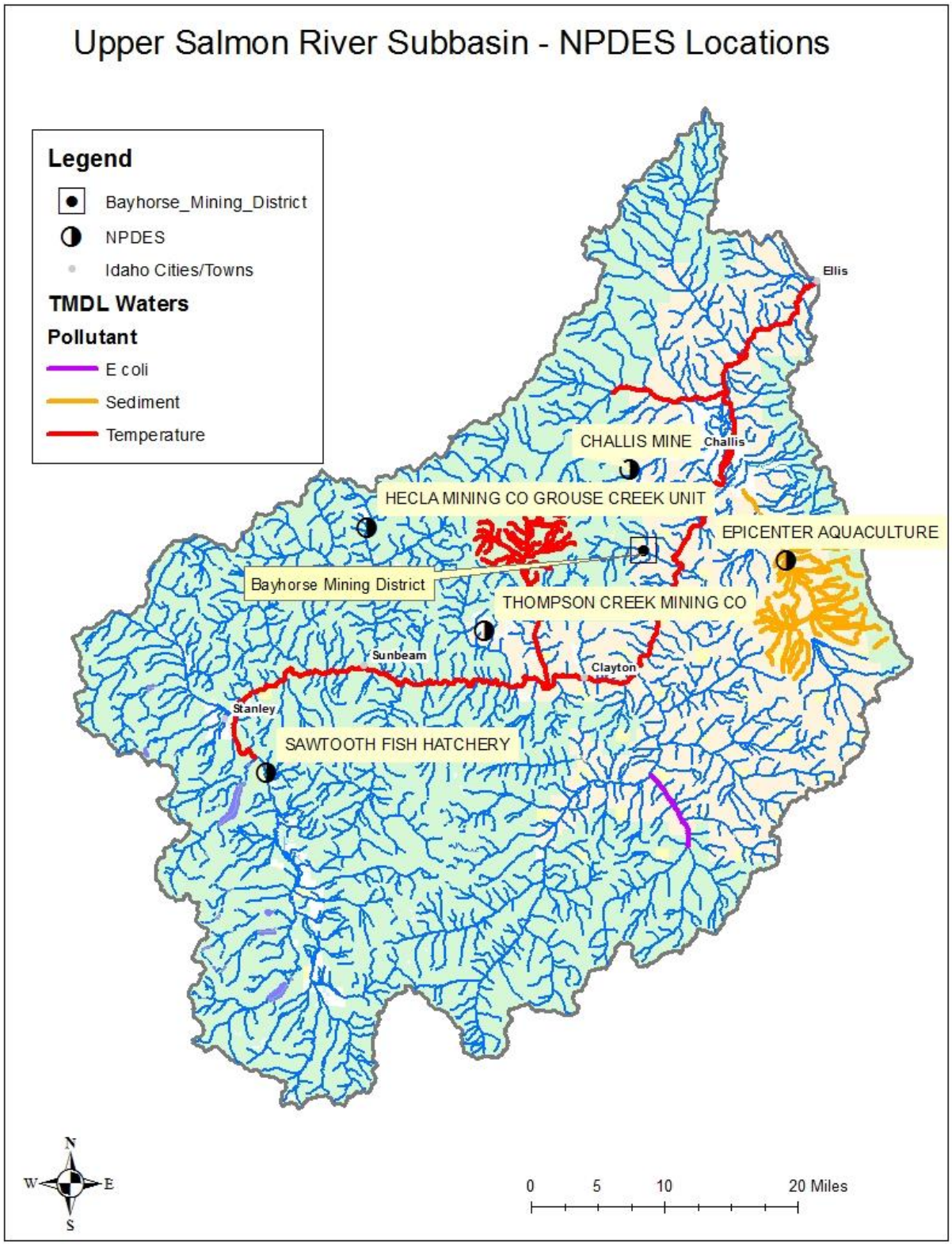


Figure 4. Active NPDES-permitted discharger locations in the Upper Salmon River subbasin.

3.2 Nonpoint Sources

The following are the primary nonpoint sources of pollution in the subbasin:

- Sediment—streambanks and uplands contribute the most significant proportion of sediment to the streams and rivers within the subbasin.
- Heat loads—lack of shade on many portions of streams and rivers contribute to impairments to beneficial uses.
- Bacteria—domestic and wild animals (deer, moose, waterfowl) can be significant sources.

Multiple springs and wetlands are located within the basin. It is unknown if these are sources of pollutants (in particular heat additions), but based on observation of several springs, the comparative discharge from the springs versus the Salmon River indicates a minimal input.

3.3 Pollutant Transport

Pollutant transport refers to the pathway by which pollutants move from the pollutant source to cause an identifiable problem or water quality violation in the receiving water body. Two primary types of pollutant transport occur in the Upper Salmon River subbasin: direct and indirect inputs. The direct inputs include NPDES and Multi-Sector General Permit (MSGP) inputs from permitted discharges (based on loads and impairments, neither of these direct sources are updated or modified based on this TMDL), solar radiation, streambank erosion, and bacteria. The indirect pollutant transport is from locations not adjacent to the stream channel as pollutants are transported by water as surface flows (typically ephemeral or storm driven) or via wind and other natural phenomena.

4 Subbasin Assessment—Summary of Past and Present Pollution Control Efforts and Water Quality Monitoring

A number of restoration/remediation/rehabilitation projects have taken place in the Upper Salmon River subbasin since the last subbasin assessment and TMDL. Regular monitoring of the stream water and habitat quality has also occurred. This section briefly discusses some of the restoration and water quality monitoring efforts along with the changing practices that have had positive effects on the water quality in the subbasin. All information contained in this section is summarized from larger datasets and documentation. Duplication may have occurred as projects are often a cross-agency/group action. Additionally, not all groups and agencies may be listed as participants in all projects, as this document is not intended to be the definitive work on projects but serve as a summary source. Further details and information can be acquired from the managing agency or responsible group.

Multiple sources of water quality data were made available for the development of this TMDL. Data sources are presented in Appendix D. The primary external sources were from the USFS and BLM, which complement the data from the DEQ Idaho Falls Regional Office (IFRO). Additional data are available from USFS offices (Sawtooth NRA or Salmon–Challis National Forest) and the BLM (Challis office). The USFS provided temperature data that were processed

by DEQ IFRO staff and are presented in Appendix E. The DEQ temperature data collected in 2013 were processed by the IFRO staff and are also presented in Appendix E. Water quality data and improvement projects are summarized below.

The Assessment Database (ADB) used by DEQ contains a compilation of bioassessment data that have been collected statewide from 1994 through 2013. Analyzing the habitat condition and populations of macroinvertebrates and fish is the most efficient and cost-effective means of determining long-term water quality in streams. Diversity of species, existence of species with a low tolerance to water quality impairments, and size of populations are just a few of the measures that demonstrate support status of beneficial uses. See Barbour et al. (1999) for more information about bioassessment protocols that identify water quality characteristics. The Upper Salmon River subbasin has been extensively monitored for beneficial use support status through these bioassessment protocols (i.e., BURP monitoring) (Figure 5).

BURP monitoring data collected between 1998 and 2013 for the Upper Salmon River subbasin (Appendix F) were used to identify support status for the cold water aquatic life beneficial use. See section 4.2.4 for details.

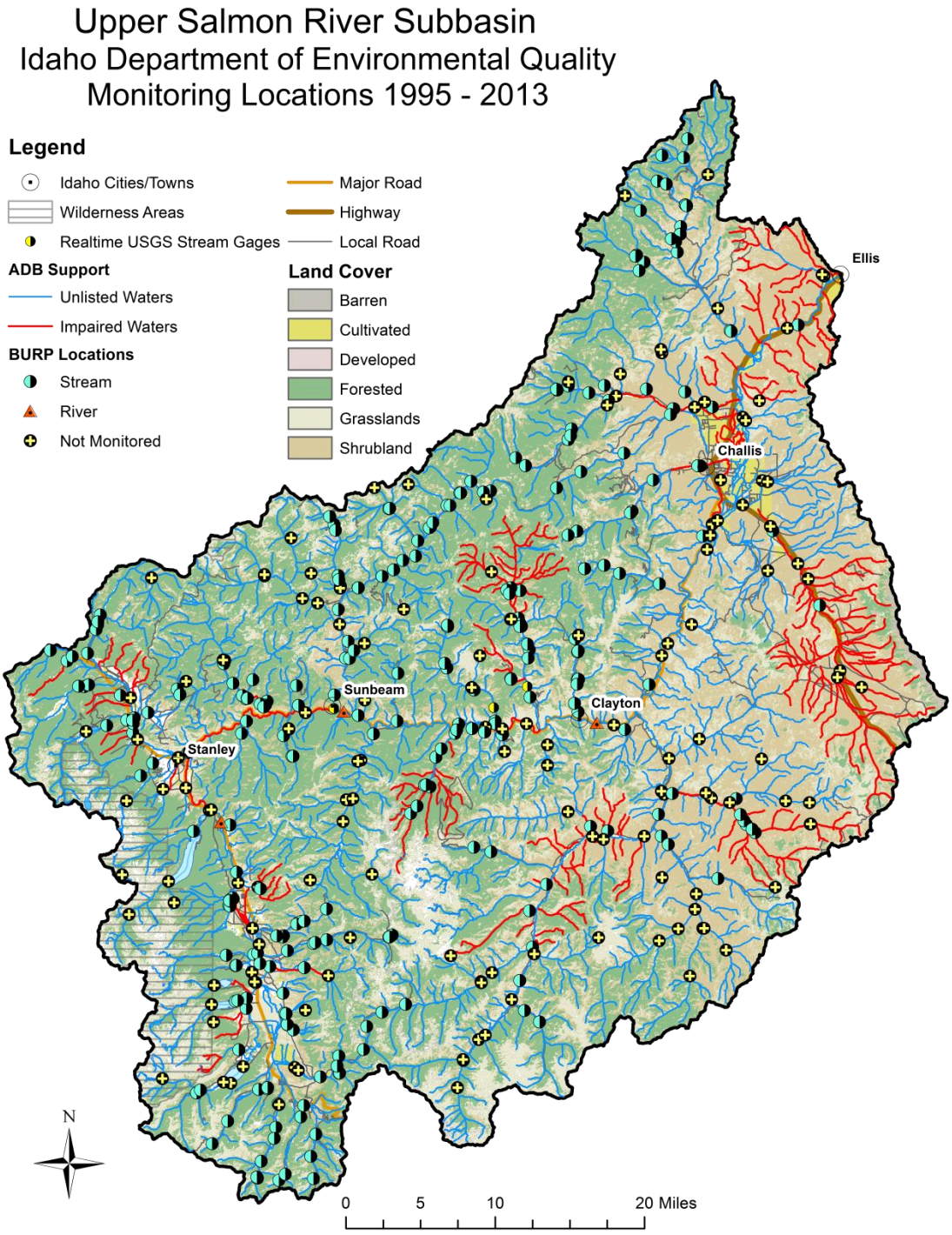


Figure 5. BURP monitoring sites in the Upper Salmon River subbasin.

4.1 Water Quality Pollution Control Projects

4.1.1 Bayhorse Mine Townsite

The concerted effort to remediate mining activities in the Bayhorse Mine townsite (see Figure 4) began in 2003 with a reconnaissance of the area and discussions between multiple agencies, including Idaho Department of Parks and Recreation (IDPR), DEQ, USFS, US Fish and Wildlife Service, and BLM, along with input requested from Custer County commissioners. Mine tailings were a risk to the stream water quality and the cultural legacy of the site was also at risk. However, the unknown determinations of environmental liability were a concern. Approximately 500 acres of disturbed lands are spread over several square miles. In 2004, DEQ examined the site and performed a risk assessment. In 2006, IDPR purchased the property and five associated mines with the final goal to develop a state park. This area was then identified as a brownfield site and nearly $800,000 in grant monies were received to begin cleanup. The primary concerns were for the arsenic, lead, and other metals in the Bayhorse Creek stream channel. These metals impair water quality and are also a human health concern as access to upstream locations was through the mine tailings.

In addition to the Bayhorse townsite remediation, cleanup was needed for the five mine sites (Beardsley-Excelsior Mine, Pacific Mine, Skylark Mine, Ramshorn Mine, and an unnamed site). Cleanup began in 2008 and included developing clean areas for visitors, limiting access to open mines and buildings, and developing fencing and signage to warn visitors of potential hazards. Water and soil samples were collected and results directed remediation cleanup. Exposed and recovered soils and stream channel/riparian zones were revegetated. In October 2009–2011, the USFS and EPA re-aligned Bayhorse Creek away from the mine tailings, regraded the tailings, and covered the tailings with uncontaminated rock, thereby limiting the mobility of the tailings and dust. The park opened in 2010 and expanded to include access into the Skylark and Ramshorn Mines in summer 2012. The Bayhorse area was incorporated in the Land of the Yankee Fork management unit, which includes several ghost towns and the Yankee Fork Gold Dredge.

Long-term maintenance and monitoring began after the initial remediation was complete. Since the initial completion, routine monitoring and maintenance of the Bayhorse State Park site ensures that remediation activities have prevented exposure to hazardous constituents found at the site and maintained and improved the developments to prevent tailings and dust. This effort includes monitoring stream water quality, particularly for metal concentrations, and the soil quality. There is insufficient data to determine what effect the remediation actions will have on long-term stream water quality; however, the soil and tailings stabilization appears to have limited these source areas from being mobilized.

Additional information is available from the following sources:

- DEQ website—*www.deq.idaho.gov/waste-mgmt-remediation/brownfields/success-stories/former-bayhorse-mining-district-custer-county*
- EPA website—*http://cfpub.epa.gov/bf_factsheets/gfs/index.cfm?event=factsheet.display&display_type=PDF&xpg_id=6802*
- USFS—*www.fs.usda.gov/detail/scnf/news-events/?cid=STELPRDB5310739*

- IDPR— *http://parksandrecreation.idaho.gov/sites/default/files/uploads/documents/LOYF%20Master%20Plan/LAN%20MasterPlan%20Final.pdf*

Photos from the preliminary site assessment of the Bayhorse mining area are included below as Figure 6 through Figure 8 (Maxim Technologies 2004).



Figure 6. Ramshorn Mine ore loading shed on upper adit level.



Figure 7. Ramshorn Mine, view of tram from upper adit level.



Figure 8. View of Bayhorse townsite from the west.

4.1.2 Yankee Fork Salmon River

Numerous projects (and associated monitoring) have been completed in the Yankee Fork drainage of the Upper Salmon River subbasin. Additional projects are either in progress or in the planning stages. The Yankee Fork was dredge mined for gold in the mid-twentieth century. The dredge remains intact in the watershed and is open for tours; combined with the mining dredge piles, this area contains important vestiges of Idaho's history. However, mining impacted fish spawning and rearing habitat in the subbasin; rehabilitation efforts have improved this habitat for Chinook Salmon, steelhead, Cutthroat Trout, and resident populations of Bull Trout. A USBR website details the monitoring and rehabilitation efforts within the Yankee Fork watershed (*www.usbr.gov/pn/fcrps/habitat/projects/uppersalmon/reports/uppersalmon/yfta/index*).

Several projects were recently completed, including the pond series (2 and 3) projects, where a series of ponds created by dredge piles was reconnected and developed into side channels of the Yankee Fork, creating new fish habitat. Natural meanders and vegetation were restored to the reconstructed reaches with an end result of steelhead spawning in those reaches within 6 months of completion.

The Preacher's Cove area was scheduled for log placement (large woody debris) to help develop habitat in fall 2014. These logs and root-balls were to be placed in the stream in a manner to allow natural processes and discharges sit and shift the logs as if they naturally fell into the channel. These placements will develop habitat (i.e., pools) for fish, and are also expected to have secondary benefits such as long-term stream channel development and stabilization. Helicopters and other heavy machinery will be required to place the logs. It is expected that over 300 logs will be placed within the channel.

A project in the West Fork Yankee Fork is being developed for 2015/2016. This project alters the course of the West Fork Yankee Fork back to its historic location, creating historic connections and improving fish habitat. There is also remediation plans in the conceptual phase for the Pole Flat area that is estimated to begin in the 2017/2018 time frame.

These projects are supported in part by the USFS, Trout Unlimited, USBR, Bonneville Power, the Shoshone-Bannock Tribes, and Simplot.

For project photos, see Figure 9 through Figure 12. For more information and publications, see *www.usbr.gov/pn/fcrps/habitat/projects/uppersalmon/reports/uppersalmon/yfta/index*.



Figure 9. Rehabilitated stream from old dredge pile ponds with willow cuttings.



Figure 10. Pond to stream rehabilitation.





Figure 11. Dredge and dredge piles.





Figure 12. Shoshone-Bannock Tribes Chinook spawning research weir.

4.1.3 Bureau of Land Management

Since approval of the Upper Salmon River subbasin TMDL in 2003, the BLM has altered livestock grazing within the subbasin through adaptive management techniques. Grazing management modifications range from physical alteration of allotments through fencing of riparian areas and off-channel water developments to more subtle changes in timing, duration, and intensity of use.

The BLM has also shifted the way it monitors riparian areas that are subject to livestock grazing. Multiple Indicator Monitoring (MIM) is based on several objectives, including the following: collecting multiple short- and long-term indicators, measuring the most important indicators relative to detecting change, determining statistically acceptable results within realistic time constraints, and performing data analysis to inform management decisions (Burton et al. 2011). The MIM method has provided a defined monitoring process for BLM lands with both short- and long-term monitoring indicators and is more appropriate for determining trend over time than past monitoring methods. In addition to more robust and defensible monitoring methods, the BLM has also provided greater emphasis on grazing management within riparian areas and has modified grazing practices to limit the timing and intensity of livestock use within these areas. The improved monitoring efforts combined with management changes have allowed streams to improve in most reaches and ultimately have resulted in better quality habitat for aquatic resources than what was observed during development of the 2001 TMDL.

4.1.4 Bureau of Reclamation

The Bureau of Reclamation has also been active in projects outside the Yankee Fork watershed. Many of the projects have improved existing diversion structures. Several of the projects listed below may correspond or be related to work done by other agencies and groups described in this document. In addition to the site-specific projects listed below, nearly all of the major diversion structures in the upper Salmon River region have been installed with improved measurement

devices (2005–2008). These measurement devices will improve the accuracy of water right allocations, ensuring that water rights are fulfilled at the designated levels.

Upper Salmon River Region

- *2006: S-40 location (Near Fisher Creek upstream of Stanley)*—An earthen water level ramp, which required regular maintenance, was replaced with a rock ramp that better stabilizes water levels at the diversion structure. This ramp decreases in-channel manipulations to rebuild the earthen ramp, thereby decreasing sediment loads and substrate alterations. Additionally, a rock ramp also provides more consistent water levels leading to more accurate measures and deliveries of water to meet water right allocations.
- *2009–2010: Elk Creek 2*—An in-channel diversion structure was removed and a well was installed to provide water to meet water right allocations, thereby leaving more water in-channel.
- *2014: Ongoing work in the Pole Creek watershed*—A culvert was removed and replaced with a more fish-friendly bridge, and riparian fencing was installed. There are plans to alter the center pivots to limit the number of stream crossings.

East Fork Salmon River region

- *2003: EF-10/11 diversions*—These diversion structures were consolidated to a single structure with steel and rock instead of the annually maintained earthen ramps, thus limiting substrate alterations from ramp maintenance. The structure also included improved fish screens, which limit access to the canals by migrating fish.
- *2005 and 2006: EF-17 and EF-15*—The diversion structures were rebuilt with steel and rock instead of the annually maintained earthen ramp, thereby limiting substrate alterations from ramp maintenance. The structures also included improved fish screens, which limit access to the canal by migrating fish.
- *2011: EF-13*—A fish screen was installed.

4.1.5 Sawtooth National Recreation Area

Multiple rehabilitation/restoration and monitoring projects have occurred within the SNRA since the 2003 TMDL. Table 10 is a general listing of projects and monitoring that occurred within the SNRA.

Table 11 is a selected table that details many of the projects between 2004 and 2007, while Table 12 details projects between 2009 and 2012. This is not meant to be a comprehensive listing but an overview of projects that have implications for improving water quality within the forest.

For more information, contact Mark Moulton, SNRA, (208) 727-5000.

Table 10. Sawtooth National Recreation Area project and monitoring—Upper Salmon River subbasin.

Sawtooth National Recreation Area Project and Monitoring Track	Implementation Date
Williams Creek riparian fence and fish screens: WC2,3	2001
Trap Creek puncheon replacement	2003
Nip and Tuck Road reconstruction	2003
Champion Creek CHC4/CHC7 consolidation	2003
Stanley Creek Road 653 realignment	2004
Casino Creek Campground reconstruction	2004
Basin Creek Campground closure/restoration	2005
Upper Alturas and Eureka Gulch conversion to trails	2005
Woolley Salmon River fences	2005
Fisher Creek primula exclosure	2005
Stanley Lake inlet recreation fence	2005
Cabin Creek drainage ditch fill and restore	2006
Cabin Creek non-system road obliteration and reconnect	2006
Cabin Creek diversion plug	2006
Alpine Creek new bridge and ford closure	2006
Vat Creek non-system road closures/restoration	2006
Pole Creek aspen	2006
Champion Creek CHC6 fish screen	2007
Iron Creek IC6 screen	2007
Canyon Highway shoulder stabilizations	2007
Warm Springs Meadow trail realignment	2007
Slate Creek fish habitat improvements	2007
Alturas unauthorized road obliteration	2007
Job Creek road realignment/restoration	2007
Williams Creek (WC0) pipe-end screen intake	2007
Walker Lake Trail turnpike	2007–2008
Woolley willow cuttings	2008
Smiley Creek SMC2 screen	2008
Hell Roaring Trail (097) reroute	2009
Redfish Northshore log placement	2009
Goat Creek GC8 and 9 consolidation and screen	2009
Redfish waste site rehabilitation	2009
Lower Elk Creek dispersed campsite reconfiguration	2009
Valley Creek campsites closure	2009
Stanley Lake outlet shoreline fence and plantings	2009
Elk Creek EC2 diversion closure	2009
Valley Road fire white bark reestablishment	2009
Big Casino Creek Trail reroute	2010
Alturas ski bridge replacement	2010

Sawtooth National Recreation Area Project and Monitoring Track	Implementation Date
Elk Creek ramp reconstruction	2010
Iron Creek Road flood repair	2010
Valley Creek conifer encroachment treatments	2010
Pole Creek travel management changes	2010–13
Alturas A shoreline rehab and viewing platform	2010
Upper valley powerline ATV closures	2011
West Fork Big Smokey Trail reroute	2011
Rough Creek Trail puncheon	2011
Williams Creek Trail bridges and puncheons	2011
Iron and Goat Creek Hwy culvert replacements	2011
Hell Roaring/Mays Creek Road oblit and TH relocate	2011
Iron Creek Subdivision Rd realignment	2012
Obsidian Allotment closed and fences removed	2013
Stanley Lake Trail reroute (7640) at inlet	2012–2013
Valley Road culvert to bridge at Pole Creek	2013
Pole Creek corrals ATV bridge/culvert removal	2013
Cabin Creek Road 207 removal	2013

Table 11. Sawtooth National Recreation Area select project details (fiscal years 2004–2007).

Project Name	Summary of Work Accomplished	Target
Fiscal Year 2004		
Stanley Creek Road realignment and crossing rehabilitation	Wetland restoration and road realignment in Stanley Creek. Project was designed to reduce annual road damage from high flows; reduce sedimentation; and restore 1 acre of wetland/floodplain in Stanley Creek.	1 mile of stream and 1 acre of wetland
Casino Creek Campground	Casino Creek Campground restoration was designed to reduce foot traffic and camp sites along the Salmon River.	1 mile of stream
Recreation fences	Lakeshore restoration and fencing. Project was designed to limit recreational impacts on lakeshore banks, soils, and riparian vegetation in the Pettit Lake Campground and boat launch. Constructed approximately 580 feet of rustic wood fence to protect and restore damaged and threatened lakeshore areas.	5 acres of lake
Fiscal Year 2005		
Basin Creek Campground closure and rehabilitation	Basin Creek Campground was removed to restore wetlands and floodplain habitat. This project addressed the fundamental design error in locating Basin Creek Campground in a consistently wet and active floodplain adjacent to Basin Creek and the Salmon River. The project is expected to restore wetland and floodplain function and habitats to the important 1-mile segment of Basin Creek.	1 mile
Stanley Lake inlet recreation fence	A rustic log-worm fence was constructed to protect streamside threatened and endangered species habitat from recreation pressure adjacent to the Stanley Inlet Campground and Bridalveil Falls Trail. Openings in the fence were built to allow visitor access to the creek, but only in select locations rather than along the entire stream. Streambanks, riparian vegetation, and soils are expected to recover on a half mile of stream.	0.5 miles

Project Name	Summary of Work Accomplished	Target
Casino Creek Campground fence	A rustic log-worm fence was constructed to protect streamside threatened and endangered species habitat from recreation pressure along a 0.25-mile segment of the Salmon River adjacent to the newly reconstructed Casino Creek Campground and Trailhead. Openings in the fence were built to allow visitor access to the creek, but only in select locations rather than along the entire river. Streambanks, riparian vegetation, and soils are expected to recover on 0.5 miles of stream.	0.25 miles
Woolley Ranch riverside fence	Approximately 3 miles of rustic logworm fence was constructed on a private ranch on either side of the Salmon River protecting approximately 2 miles of bank. The Sawtooth NRA owns a partial interest in the form of a conservation easement and work was facilitated by the USFS. Streambanks, riparian vegetation, and soils are expected to recover within the fenced section.	2 miles
Fiscal Year 2006		
Corral Creek large woody debris	Twenty one logs were placed in lower Corral Creek to create pool habitat and overhead cover for fish and provide structures to catch additional wood debris moving down the channel.	2.2 miles
Valley Road Fire—aerial straw mulch	The Valley Road Fire burned approximately 40,838 acres between September 3 and September 15, 2005, in the White Cloud Mountains on the east side of Sawtooth Valley. In October 2005, approximately 1,400 acres of straw mulch were treated via aerial application in Fisher, Champion, Warm Springs, and Fourth of July subwatersheds. In addition, 500 acres in the Fourth of July drainage were treated by hand, for a total mulch treatment of 1,900 acres. Treatment objectives were to (1) provide protective organic mulch to help stabilize hillslopes by reducing soil erosion and subsequent sediment delivery to streams; (2) reduce peak flows by absorbing and slowly releasing accelerated overland runoff due to bare soil and hydrophobic soils; and (3) secure on-site seeds and maintain a favorable moisture regime for seed germination and growth.	1,900 acres
Valley Road Fire—road drainage improvements	Treatments increased culvert capacities to accommodate increased water flows and associated bedload and debris and restore road template drainage. Six drivable dips were constructed, six culverts were replaced, and one new culvert was installed. Other work included maintenance on existing drainage structures to bring them to current standards in response to the burned conditions.	5 acres
Valley Road Fire—trail drainage maintenance	Thirty six miles of trail in high or moderate burn severity areas had water bars cleaned to route water and sediment from the trails, preventing trail erosion and minimizing impacts to habitat for federally listed aquatic species.	100 acres
Valley Road Fire—trail drainage maintenance	Project was implemented to ensure drainage structures sufficiently divert water away from trails given expected increased runoff/overland flow. Erosion control was needed to protect trails and high-value watersheds, including spawning and rearing habitat for federally listed aquatic species. Water bars were repaired or replaced along 33 miles of trails along Garland, South Fork, Champion, Casino/Martin, Martin, Williams, Pigtail, and Warm Springs Creeks.	100 acres
Vat Creek meadow road obliteration	The user-created roads in Vat Creek were not engineered, designed, nor constructed for forest access, resource protection, or visitor safety. A roads analysis of the area identified these roads as contributing to resource damage while providing few benefits to forest visitors. In addition, some routes occur within the Smoky Mountain Inventoried Roadless Area. The purpose of the project is to obliterate numerous roads from the seasonal wetland and associated uplands to restore vegetation and drainage in the area. An excavator and back-hoe were used for road obliteration to break soil compaction, re-establish natural drainage, and accelerate restoration. Four miles of road was removed in the vicinity of Vat Creek Meadow. Due to the seasonally wet conditions in much of the area, vegetation is expected to quickly recolonize the former roadbed. Soil, water, and wildlife will benefit when vehicular traffic is removed, erosion is reduced, and the meadow returns to a more natural state.	0.1 miles; 4 miles of road decom-missioned
Valley Creek 6 diversion restoration	The purpose of the project was to restore natural processes to Valley Creek and its floodplain in the vicinity of the former Valley Creek 6 diversion intake. The project replaced the plug of boulders within the former Valley Creek 6 diversion intake with a plug constructed with natural materials. The plug is designed to re-establish deep-rooted willow and sedge bank vegetation, common at the site, while using conifer revetment to provide resilience in the near-term. The project removed another 120 large boulders from the floodplain associated with the former wasteway. Bank locations where boulder treatments are removed were rehabilitated with similar natural methods. Fish and fish habitats are expected to benefit from the project by facilitating long-term habitat processes.	1 mile and 15 acres

Project Name	Summary of Work Accomplished	Target
Upper Alturas transportation modifications	The purpose of the project was to halt deteriorating conditions of Road 205 and Alpine Creek occurring at the Alpine Creek ford. During the previous decade, deteriorating conditions upstream of the ford resulted in the capture of Alturas Lake Creek within a 0.25-mile segment of Road 205, immediately above the ford. This situation was addressed in 2000 with the return of flows to the natural channel. However, it was also recognized that a similar scenario was soon to occur at the Alpine ford without intervention. As a result, the initial planning effort was expanded to include the comprehensive changes needed to maintain healthy landscape functions and sustainable road and trail infrastructure in the upper Alturas Lake Creek drainage. The result of this planning effort was a revised transportation system in Upper Alturas Creek. In fiscal year 2006, the Mattingly and Alpine Creek Trailheads were consolidated and relocated to a new location below Alpine Creek; a new trail bridge was constructed; 0.5 miles of former trail no longer needed was obliterated and rehabilitated; and the former vehicle ford through Alpine Creek, including a 0.5-mile approach on either side, of the ford was closed and rehabilitated.	1 mile; 2 acres
Fiscal Year 2007		
Alturas unauthorized road obliteration	Project obliterated unauthorized roads in the Alturas Lake Creek watershed. An excavator and backhoe were used for road and campsite obliteration, to break soil compaction, to install barrier rock, to re-establish vegetation, and to accelerate restoration. In all, 3.7 miles of road and numerous campsites were obliterated.	22 acres
Slate Creek	The SNRA improved habitat conditions for Chinook, steelhead, Bull Trout, and Westslope Cutthroat Trout in the lower portions of the Slate Creek drainage by adding large wood (root-wads with 10–20 foot boles attached) and boulders to the stream channel. Debris flows and extensive flooding in Slate Creek in 1998 created a uniform channel lacking fundamental fish habitat structure and complexity such as wood jams and pools. The project helped to increase rearing habitat for salmonids and resting habitats for spawning adults. Wood was installed in a manner that would allow for future high flows to scour deep water habitats in the vicinity of the “structures.” In all, 32 tree boles and dozens of boulders were placed in Slate Creek to enhance fish habitats.	3 miles
Job Creek Road	Project relocated the Job Creek Road to an upland location and removed approximately 0.2 miles of the former alignment fill from a wetland near Stanley Lake Creek. Heavy equipment (excavator, dump trucks, etc.) were used to remove 235 truckloads of fill associated with the former alignment and return it to the original upland source. A short reroute was constructed in uplands to replace this alignment. Wetland functionality is expected to return over 80 years.	12 acres
Vat Creek unauthorized road	Project obliterated approximately 1 mile of unauthorized road in the Vat Creek drainage. Roads analysis and National Environmental Policy Act analysis have been completed for this project and funds were used solely for implementation.	5 acres
Salmon River willow/alder restoration	Project incorporated willow and alder transplants and cuttings at locations where they are currently absent but historically provided the core structure within riparian communities of the upper Salmon River drainage. Locations included reaches impacted by historic grazing, dewatering, or development. Planting also occurred at earlier restoration sites where experience now suggests much greater use of woody vegetation could have been incorporated. Challis High School "Envirothon" club assisted in planting willow cuttings along the Salmon River. A mini-excavator was used to supplement willow transplants at the 2000 Frenchman Ford Restoration site.	5 acres
Valley Road Fire road work (NFN3)	Ten miles of road prism were reconditioned in Fisher and Fourth of July Creeks.	30 acres
Valley Road Fire road work (BAER)	Additional rehabilitation work on the Fisher Creek and 4th of July Roads inside the Valley Road Fire perimeter was completed in fall 2006. Several drive-through dips were improved and culverts repaired.	2 acres
Valley Road Fire trail work (NFN3)	Thirty-six miles of trails lie within the burn perimeter of the Valley Road Fire. Most were in high-intensity burn areas. Burned Area Emergency Response funds were used to install 300 additional water bars to control runoff and preserve the trails. Thorough maintenance of trail drainage structures will be necessary to ensure continued proper function of the drainage structures, which fill quickly during spring runoff. Some trail tread repair will likely be necessary. Thick stands of burned timber over the entire area will require extensive logging-out. Trees in the burned area will continue to fall onto the trail for many years.	109 acres

Table 12. Sawtooth National Recreation Area select project details (fiscal years 2009–2012).

Project Name	Subwatershed(s)	Summary of Work Accomplished	Target Accomplished
Fiscal Year 2009			
Elk Creek Campsite reconstruction/ restoration	Elk Creek	Relocated an extensive camping area adjacent to Elk Creek.	10 acres and 0.5 miles of stream
Programmatic conifer encroachment treatment	Boulder Creek-Big Wood River, Frenchman-Salmon River, Beaver Creek, Lower Valley Creek	This project treated conifer encroachment in aspen, meadows, and sagebrush in the SNRA. Projects that occurred in meadows are designed to decrease evapotranspiration and increase base flows to streams. This project treated at least 200 acres of conifer encroachment in aspen, meadows, and 400 acres of sagebrush on the SNRA.	20 acres
Stanley Lake outlet beach rehabilitation	Stanley Lake Creek	Funds were used to plan and implement restoration treatments on a segment of the Stanley Lake shoreline adjacent to the outlet, where former dispersed camping altered lakeshore habitats.	8 acres, 3 acres of lake, 0.5 miles of stream
Travel plan maintenance	Elk Creek	Implemented vehicle control and site rehabilitation measures where expanding recreation use is not appropriate or desired.	10 acres and 0.3 miles of road decom-missioning
Trailhead Fire water bars (WFW3)	Stanley Lake Creek	Installed and repaired water bars on nine miles of trail	5 acres
Beaver Creek unauthorized road obliteration	Beaver Creek	Obliterated unauthorized roads (and associated dispersed recreation sites) in the Beaver Creek area as authorized in the Beaver Creek Fuels Reduction project. Coordinated with landowners in nearby community.	15 acres, 0.5 miles of stream, 1.5 miles road decom-missioned
Wilderness campsite and lakeshore restoration	Lower Valley Creek	Collected Grouse Whortleberry seed for seedling production. Seedlings will be used to restore campsites and lakeshore habitat in the Sawtooth Wilderness.	2 acres of lakes
Iron Creek Trail relocation	Lower Valley Creek	Project relocated 0.2 miles of trail out of wetlands onto higher ground. The third generation of native log puncheons over the seasonally flooded section of trail had rotted out. Foot and horse traffic through the area continually disturbs the soils and vegetation in this wet fragile area near Iron Creek.	1 acre
Aquatic invasive education program and management strategy	Lower Redfish Lake Creek	Initiated boater surveys. Developed early detection/rapid response plan for most probable aquatic invasives.	1 acre of lake
Fiscal Year 2010			
Alturas Lake Picnic B shoreline rehabilitation	Upper Alturas Lake Creek	Funds were used to design and implement reconstruction and rehabilitation treatments on a short segment of the Alturas Lake shoreline within the Picnic B recreation site. Near-term shoreline resilience was established with an integrated front of conifer rootballs. Soil was added behind this foundation and transplants and seed of native vegetation incorporated into the site. A viewing platform was constructed to continue to provide the scenic vista valued at the site. Finally, forest debris was added for surface protection and a rustic fence constructed to limit foot traffic to the restoration area.	3 acres of lake and 2 miles of stream
Programmatic conifer encroachment treatment	Middle Valley Creek, Elk Creek	This project treated conifer encroachment in aspen, meadows, and sagebrush in the SNRA. Conifer encroachment has resulted in a loss of aspen forest and important wildlife habitat; reduced open meadow habitat; negatively impacted watershed conditions by reducing available streamflows; and increased fuel density and continuity in forested and meadow communities, which may lead to increased fire behavior and uncharacteristic fire effects in the event of a wildfire. Treatment areas included both wet and dry meadows and riparian areas.	50 acres: 10 acres Elk Creek, 20 acres Meadow/Trap, 20 acres Dry/Park Creek
Non system road/trail obliteration	Beaver Creek, Frenchman Creek-Salmon River	Project obliterated unauthorized roads (and associated dispersed recreation sites) in the Beaver Creek area as authorized in the Beaver Creek Fuels Reduction project. Includes coordination with landowners in nearby community.	27.3 acres, 9.02 miles road decom-missioned

Project Name	Subwatershed(s)	Summary of Work Accomplished	Target Accomplished
Wilderness campsite and lakeshore restoration	Lower Valley Creek	Collected Grouse Whortleberry seed for seedling production. Seedlings will be used to restore campsites and lakeshore habitat in the Sawtooth Wilderness.	5 acres and 2 acres of lakes
Carbonate mine reclamation	Slate Creek	The Carbonate Mine and Mill Site Remediation and Reclamation Project was implemented according to the Forest Service's Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) authorities. Project included cleaning up mine waste, decommissioning roads, removing culverts, etc.	21 acres
Aquatic invasive education program and management strategy	Lower Redfish Lake Creek, Upper Alturas Lake Creek, Stanley Lake Creek	Initiated boater surveys. Developed early detection/rapid response plan for most probable aquatic invasives.	4 acres of lake (2 acres Redfish, 1 acre each Alturas and Stanley Lakes)
Fiscal Year 2011			
Pole Creek travel management implementation	Pole Creek	As a result of community collaboration facilitated by the Sawtooth Society, appropriate travel objectives were identified within the Pole Creek drainage. Closure of the inappropriate and unauthorized routes was initiated in 2011 for approximately 2 miles of road. Heavy equipment was used to close and encumber areas to travel while breaking compaction, re-establishing natural drainage, incorporating organic material, and accelerating restoration of damaged areas.	0.5 miles of stream, 10 acres, and 2 miles of road decom-missioned
Non system road/trail obliteration	Middle Valley Creek	Project curtailed inappropriate and unauthorized motorized use along upper Valley Creek that occurs associated with the electric powerline and exacerbated by recent right-of-way clearing. Heavy equipment was used to close and encumber areas to travel while breaking compaction, re-establishing natural drainage, incorporating organic material, and accelerating restoration of damaged areas. Authorized travelways and parking areas were defined and drainage conditions improved.	0.5 miles of stream and 10 acres
Hell Roaring Trailhead relocation	Hell Roaring Creek-Salmon River	Project relocated and re-established the Upper Hell Roaring Trailhead outside of the designated Sawtooth Wilderness. Includes closure and rehabilitation of the former streamside trailhead, and 1 mile of road converted to trail. Similar objectives on 0.25 miles of road within the adjacent Mays Creek drainage. Heavy equipment was used to break compaction, re-establish natural drainage, incorporate organic material, and accelerate restoration of the former road and parking areas.	2 miles of stream and 3 acres
Aquatic invasive education program and management strategy	Lower Redfish Lake Cr.	The SNRA has several lakes that are popular boating destinations and are vulnerable to aquatic invasive species (e.g., mud snails, mussels, etc.). To help protect aquatic resources within these lakes, the USFS partnered with the Idaho State Department of Agriculture (ISDA) to establish a boat inspection station on Redfish Lake and complete monitoring in several large glacial lakes. The USFS helped ISDA with public outreach, boat washing, and equipment.	8 acres of lake
Fiscal Year 2012			
Iron Creek Road realignment	Lower Valley Creek	Project closed and rehabilitated former Road 70692 alignment, including the culvert crossing of Iron Creek. The project also closed and rehabilitated the unauthorized routes branching from the former route. CMLG funding completed the other project objectives including construction of the new bridge and road alignment and paving. Other work included reconditioning a section of Iron Creek Road in the narrows area.	3 miles of stream, 5 acres
Pole Creek travel management implementation	Pole Creek	As a result of community collaboration facilitated by the Sawtooth Society, appropriate travel objectives were identified within the Pole Creek drainage. Closure of the inappropriate and unauthorized routes was initiated in 2011 for approximately 2 miles of road. Heavy equipment was used to close and encumber areas to travel while breaking compaction, re-establishing natural drainage, incorporating organic material, and accelerating restoration of damaged areas.	0.5 miles of stream, 5 acres, and 3 miles of road decom-missioned

Project Name	Subwatershed(s)	Summary of Work Accomplished	Target Accomplished
Non system road/trail obliteration	Stanley Lake Creek, Lower Valley Creek, Stanley Creek	Implemented vehicle control and site and route rehabilitation measures within the SNRA where actively expanding recreation use or travel was not appropriate or desired. Benefits will be decreased bank erosion and sediment input from stream crossings, increased riparian vegetation and habitat, and reduced road and trail surface erosion/sediment delivery.	0.5 miles of stream, 5 acres, 1 acre lake, and 0.5 miles of road decom-missioned
Aquatic invasive education program and management strategy	Lower Redfish Lake Creek, Upper Alturas Lake, Stanley Lake Creek, Lower Alturas Lake	The SNRA has several lakes that are popular boating destinations and are vulnerable to aquatic invasive species. To help protect aquatic resources within these lakes, the USFS partnered with ISDA to establish a boat inspection station on Redfish Lake and monitoring in several large glacial lakes. The USFS also completed spot boat inspections on Pettit, Alturas, and Stanley Lakes in 2012.	1,530 acres lake 837 acres lake 398 acres lake 180 acres lake

4.1.6 Salmon-Challis National Forest

The following summary of Salmon-Challis National Forest restoration and improvement projects in the Upper Salmon River subbasin was compiled by Bill MacFarlane, forest hydrologist Salmon-Challis National Forest, in October 2014. The projects specific to the Upper Salmon River subbasin are listed in Table 13. Projects and planning that can be applied forest-wide are listed in Table 14.

Table 13. Upper Salmon River subbasin restoration and improvement projects in the Salmon-Challis National Forest.

Project	Year(s)	Location	Description
Upper Yankee Fork large wood restoration project	2014–2016 (in progress)	Yankee Fork between Jordan Creek and Eightmile Creek (23 miles southwest of Challis)	Restoration of a 7-mile section of the Yankee Fork, restoring large wood to natural levels to improve instream habitat and channel condition.
Lodgepole Fire Burned Area Emergency Response (BAER) / storm inspection and response, road maintenance	2014	Bear Creek and White Valley Creek (northwest of Challis)	Opened blocked culverts and re-established proper road drainage on roads affected by post-fire flooding in August 2014.
Halstead Fire BAER / trail stabilization	2013	Numerous trail segments adjacent to high severity burned areas in the Halstead burned area (north of Stanley)	Constructed drainage features and stabilization measures on trails that pass through extensive moderate and high burn severity areas to reduce damage to trail infrastructure and impacts to downstream values at risk from erosion and sedimentation.
Halstead Fire BAER / culvert replacement	2012–2013	Vanity Summit area, headwaters of Beaver Creek	Replaced several culverts in the Vanity Summit/Seafoam area to provide increased capacity for post-fire floods, protect road infrastructure, and minimize erosion (only one of these culverts is located in the Upper Salmon River subbasin).
Yankee Fork habitat improvement project	2012–present	Yankee Fork at mine dredge tailings	Restoration of placer mine tailings ponds to improve fish habitat and create stream channels and floodplains in a more natural condition (large, multiphase project with numerous partners).
Greylock Bridge bank stabilization	2010	Custer Motorway (Yankee Fork Road)	Repaired eroded embankment and installed stream control structures to prevent future erosion of the affected banks and minimize threats to bridge stability.
Potato Fire BAER / mulching	2006	West Fork Yankee Fork watershed	Aerial straw mulching of 346 acres of high severity burned area to reduce the potential for impacts associated with post-fire flood events.
West Fork Twin Creek road project	2005	Headwaters of Bear Creek (northwest of Challis)	Project included decommissioning of 1 mile of unnecessary road segments to re-establish drainage and surface conditions.

Table 14. Forest-wide restoration and improvement projects in the Salmon-Challis National Forest.

Project	Year(s)	Location	Description
Travel plan	2012–present	Forest-wide	Implementation of Salmon-Challis National Forest Travel Plan to restrict motorized use to designated routes and eliminate off-road motorized travel.
Road maintenance	Ongoing	Forest-wide	Maintenance of high-use road segments to improve road drainage and reduce erosion of road surface.
Weed treatments	Ongoing	Forest-wide	Mechanical and chemical weed treatments to prevent establishment and spread of invasive plants and reduce impacts to soils and runoff. Includes additional treatments funded through BAER for treatments in burned areas of the Lodgepole, Mustang Complex, Halstead, and Salt Fires.

Sediment TMDLs were developed in the 2003 TMDL (DEQ 2003) for three AUs of Challis Creek. In 2013, it appeared that stream conditions had improved, as there were limited fine sediment particles and the banks appeared stable. However, the Lodgepole Fire burned large portions of the watershed in late summer 2013. In August 2014, heavy monsoon rains fell in the watershed and burned areas, which led to flooding, debris flows, and washouts in Challis Creek (William MacFarlane, USFS, personal communication, August 2014; Figure 13). Therefore, no updates on improvements are available for these AUs. However, regular observations in 2013 and early 2014 identified no indication of excessive nuisance growth in the channel supporting a nutrient impairment as suggested in the cause unknown listing for AU ID17060201SL009_04. These AUs are impaired by sediment and temperature, and these are the only identifiable causes.

Debris Flow on Unnamed Tributary of Challis Creek – August 12, 2014
Observations from August 15, 2014 site visit
Bill MacFarlane, Salmon-Challis National Forest

Location: NE Sec7 T14N R18E, approximately 8 miles NW of Challis, Idaho



Debris fan created by the tributary, which dammed Challis Creek and pushed the channel to the north against the side of the valley and onto the Challis Creek Road (FR#40080).



Challis Creek was pushed to the north side of the valley, and the channel was routed onto about 550 feet of the Challis Creek Road.



Debris from the blowout caused considerable aggradation over the entire valley width (150-300 feet) along a distance of about 1000 feet. The road was along the left side of the valley.



The debris fan dammed Challis Creek, inundating about 200 feet of road and several hundred feet of channel/floodplain.

Figure 13. Challis Creek update from the Salmon–Challis National Forest.

4.1.7 Discharge/Flow Additions and Diversion Improvements

A number of projects have added water or shifted the point of diversion to maintain streamflow in the Upper Salmon River subbasin (Morgan Case, IDWR, personal communication, July 2014).

- Morgan Creek (2006–2014)—2 cfs minimum flow in lower Morgan Creek
- Bayhorse Creek (2012–2031)—source switch adding 2.2 cfs to lower Bayhorse Creek
- Fourth of July Creek (2004–2028)—lease of 2.97 cfs in lower Fourth of July Creek

- Pole Creek (2005–2010)—5 cfs minimum flow between diversion and hydropower return
- Pole Creek (2011–2014)—6 cfs minimum flow between diversion and hydropower return
- Alturas Lake Creek (2006–2007)—lease of 5.86 cfs in Alturas Lake Creek
- Alturas Lake Creek (2006–2011)—lease of 2.66 cfs in Alturas Lake Creek
- Beaver Creek (2005–2014)—lease of 9.38 cfs in Beaver Creek

Garden Creek has had several structural improvements since the 2003 TMDL. In addition to the Gini Canal diversion improvement (discussed in Appendix B and USBR 2007), other diversion structure improvements have been made, such as the improvement to the Challis water supply diversion and the Garden Creek irrigation diversion. Older structures were removed and replaced with fish-friendly diversion structures and improved berm and stream channels (Figure 14). The City of Challis is also working toward shifting back to well water, rather than surface water from Garden Creek, as its drinking water source (K. Bragg, Custer Soil and Water Conservation District, personal communication, November 2014).



Figure 14. Improved Garden Creek diversion structure and rehabilitated stream substrate.

The Gini Canal and the Challis irrigation canal are the result of several canals being combined at the Salmon River diversion for alternate sides of the river. Earthen berms have been removed and fish-friendly (i.e., screened) and automated diversion structures have been installed that block fish from being caught in irrigation canals. Fencing projects have also been active in the Challis area to protect streambanks and areas of high priority for fish habitat (K. Bragg, Custer Soil and Water Conservation District, personal communication, November 2014).

4.2 Water Quality Monitoring

All information contained in this section is summarized from larger datasets and documentation. Further details and information can be acquired from the managing agency or responsible group.

4.2.1 Temperature

Temperature logger data were collected by DEQ and USFS and used in determining if temperature exceedances occurred in the AUs of concern and developing TMDLs (Figure 15). Temperature data collected by the USFS (Appendix E) were essential to determining the extent of temperature impairments in the Salmon River, both spatially and temporally. These data add to data collected by the IFRO in 2011, 2013, and 2014 (Appendix E). Together, both data sets helped determine that temperature exceedances of the salmonid spawning standard were persistent through time and space and therefore warranted TMDL development. Temperature exceedances were identified in all 4 years of data (2011–2014). Thermographs and a table listing the number of dates with exceedances of either the daily average temperature, daily maximum temperature, or both are provided with the thermographs in Appendix E.

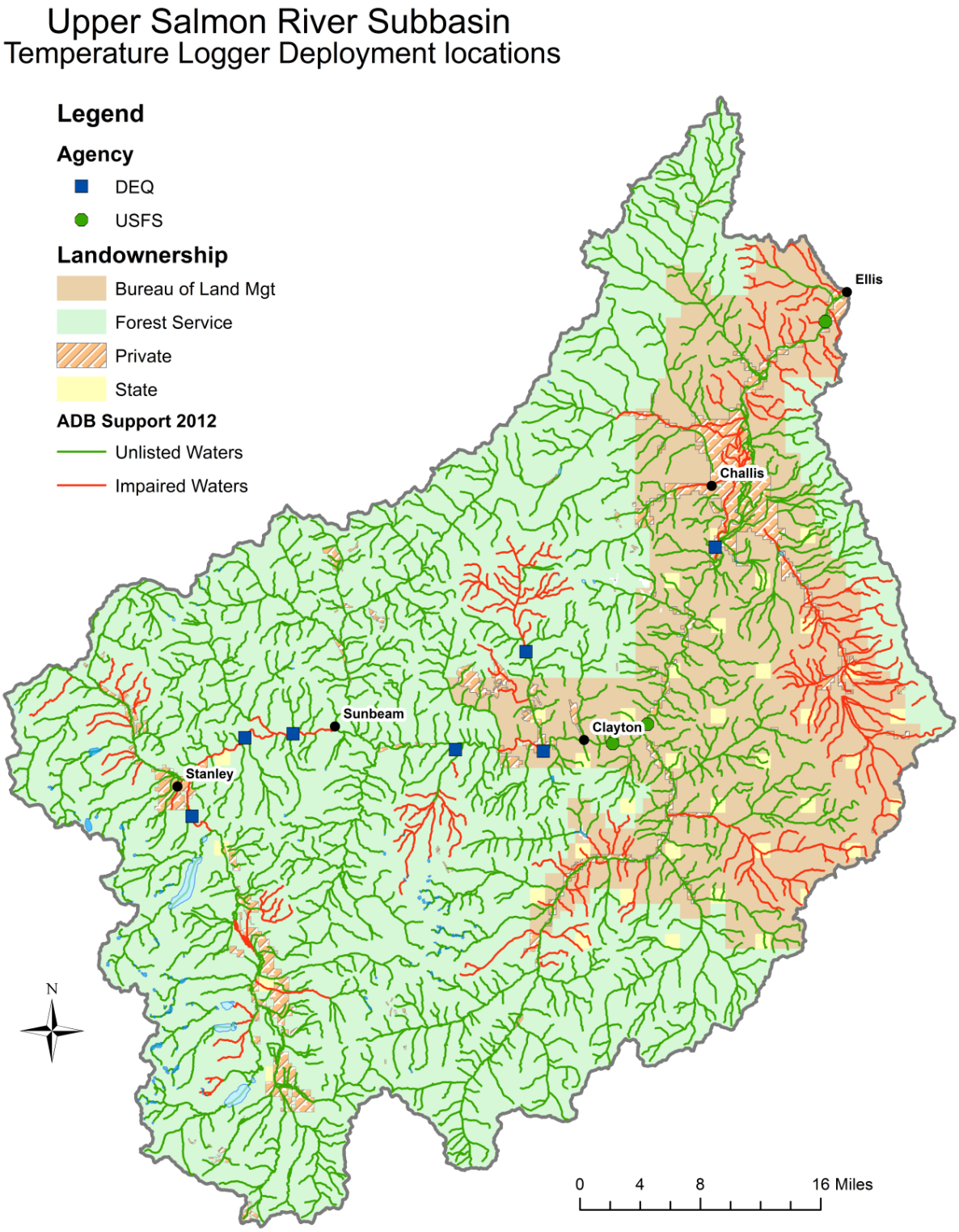


Figure 15. Temperature data logger deployment locations.

4.2.2 Sediment, Riparian Areas, and Streambanks

DEQ sediment monitoring is detailed in Appendix C. This monitoring included streambank erosion inventories, McNeil core samples, and observation of sediment pulses from event-based erosion (i.e., storm events). Overall, the Salmon River is not impaired by the sediment that does reach the main channel. There are tributary streams that are sediment impaired, but also many that are not exhibiting the sediment that was of concern in the 1980s. Many miles of exclosure fences and changes in grazing management have countered the concerns of sediment issues in the basin. Additionally, many locations that had concerns for sediment were never fully documented as to the extent, only that a land use was known or suspected to have the potential for causing erosion and sediment impairments. Basin Creek and Slate Creek are known sediment sources, but both have mitigating factors that are not anthropogenically related (i.e., forest fire and microburst storm event) and neither can be correlated to sediment deposition in the Salmon River that would impair the beneficial uses. These locations are isolated in their impairments and are expected to naturally recover in time.

The Salmon-Challis National Forest provided data for bank stability (Table 15) and fine sediment (Table 16). These data are indicative of mountainous terrain, much of which has been altered by recent forest fires. Many locations in the past decade have bank stability scores that are below the 80% stability used by DEQ; however, many of those locations are in areas with improved stability scores, which indicates there are mitigating factors that need to be accounted for before determinations of potential impairment. Additionally, data collected in the past 5 years are more relevant to any assessments and determinations; data older than 5 years require supplemental information. Several streams have a high percentage of fine particles in the substrate; however, many of those locations were impacted by recent fires and run-off events. These data are examined with the short-term impacts of fires as a mitigating circumstance but should be examined in 5–7 years to determine if fire effects are persisting longer than expected, or if there are anthropogenic-related impairments.

BLM has provided data derived from the MIM protocols; the basic site information descriptions are located in Table 17. Bank stability and substrate fine particles are included in Table 18. Several AUs have streambank stability levels below the 80% threshold used by DEQ; however, most are in AUs listed for sedimentation/siltation or have other pollution-related impairments (e.g., low flow alterations). BLM data support decisions and interpretations of impairment in many of these waters and imply that streambank stability in some areas has not reached the level necessary for delisting. Some streams have a significant proportion of the sediment as fine particles. Many of these are also exhibiting fire effects, but others are small, intermittent channels that lack sufficient stream power to scour fines on an annual basis. These intermittent channels with a high percentage of fine particles should have site visits by DEQ personnel before the next TMDL cycle to determine if these locations are sources to sediment-impaired AUs.

Table 15. Percent stable banks—summary streambank stability measurements recorded on the Salmon-Challis National Forest from 1993 through 2014.

Station	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Count	Average	St Dev
Basin Creek 1A				94.0	87.5	100.0	71.0	90.0	87.5	95.5	100.0	98.0		92.5	98.5						98.5	100.0	13	93.3	8.1
Basin Creek 1A (re-sample)																					98.5		1	98.5	N/A
Block Creek 1R					71.5		89.5	86.0															3	82.3	9.5
Challis Creek 1A			81.0	53.0	59.0	75.0	43.0	69.0	55.5	70.0	54.5	90.0	90.5		77.0	93.5	95.0	97.0				93.0	16	74.8	17.7
Challis Creek 2A					56.5		41.0	52.0	74.0	71.5	84.5	95.0								94.0		95.5	9	73.8	20.3
Challis Creek 3A										79.0		94.0	94.5	89.0	95.0	74.0	96.5	97.5					8	89.9	8.8
Challis Creek 4A												99.0	74.0										2	86.5	17.7
East Pass Creek 1A			76.0	84.0	92.5	90.0	86.0	85.5	89.0	89.5													8	86.6	5.1
Eight Mile Creek 1A														57.5	54.5	27.5					89.3		4	57.2	25.3
Fivemile Creek 1A			86.0		71.0	98.0	83.0	76.0	62.0	77.0	86.5	88.0								66.5			10	79.4	11.0
Garden Creek USR 1A			90.0		93.0	98.0	96.0	97.0	100.0	100.0	97.5	99.0		93.5	100.0	98.5	98.0	98.0			100.0		15	97.2	3.0
Herd Creek 1A			75.0	90.0	73.5	84.0	83.0	91.5	88.0	72.5	75.5		98.0				90.0				92.6		12	84.5	8.6
Herd Creek 2A											91.5		99.0				95.5	97.5					4	95.9	3.3
Jordan Creek 0A			91.0	87.5	89.0	83.0	70.5	81.0	70.5	92.0	90.0	100.0	100.0							100.0	100.0		13	88.8	10.3
Jordan Creek 1A															100.0								1	100.0	N/A
Jordan Creek 2A			91.0	77.5	62.5	96.0	80.5	85.5	89.5	76.0	97.5	94.0											10	85.0	10.9
Jordan Creek 3A			83.0	82.5	68.0	94.0	78.0	71.0	73.5	76.0	78.5	94.5											10	79.9	8.9
Jordan Creek 4A																							0	N/A	N/A
Mackay Creek 1A			73.0		89.0	86.5	92.0	86.0	91.5	97.5	95.5	96.0								98.5	95.1		11	91.0	7.3
Morgan Creek 1A			88.0	91.5	68.5	99.0	81.0	73.0	94.0	81.0	81.5	87.5	90.0		95.0	79.0	86.5	88.5		99.5	92.7	81.0	18	86.5	8.5
Morgan Creek 2A			50.0	64.0	62.0	74.0	63.5	69.0	70.0	69.0	72.0	67.0	71.0							90.0	92.0	85.9	14	71.4	11.4
Morgan Creek 3A			86.0	86.0	78.0	84.0	81.5	67.0	86.0	88.0	87.5	82.0	90.0	90.0	86.0	94.5	93.5	83.5	83.0	92.5	85.3	75.4	20	85.0	6.4
NF Rankin Creek 1R											94.5									95.5	96.0		3	95.3	0.8
Rankin Creek 1R											85.5										96.0		2	90.8	7.4
Squaw Creek USR 1A			85.5	87.0	84.0	97.0	93.5	93.5	92.0	97.5	97.0	100.0			100.0	89.5					98.1		13	93.4	5.5
Tenmile Creek 1A			91.5		90.5	88.0	69.0	72.0	87.0	82.5	82.0	88.5									95.5		10	84.7	8.5
Thompson Creek 1A			93.5	91.5	83.0	91.0	94.0	99.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0								13	96.3	5.4
Trail Creek USR 1R				91.5																	82.8		2	87.2	6.2
Valley Creek 1A			94.5				82.0	81.5	87.0	83.0	91.5				98.5	93.0	99.0	97.0	88.5		96.0	94.5	13	91.2	6.2
WF Herd Creek 1A			70.0	88.5	74.0	88.0	85.5														95.5		6	83.6	9.7
WF Morgan Creek 1A			81.0	91.5	85.0	90.0	87.5	75.0	82.0	97.0	82.0	87.0			90.5	93.0	89.5	97.5	85.5	99.5	82.9	90.0	18	88.1	6.4
WF Yankee Fk 1A			92.5		79.5	84.0	73.0	79.0	84.5	76.5	79.5	85.0			100.0	81.5					100.0		12	84.6	8.7
Yankee Fk 1A			92.5	89.5	85.5	99.0	95.5	96.0	95.0	100.0	98.5	100.0	100.0	98.5	100.0	98.0		100.0					15	96.5	4.4
Yankee Fk 2A			92.0	86.0	72.5	77.0	82.5	64.0	90.0	76.5	79.0	97.0				88.5		92.5				87.5	13	83.5	9.3
Yankee Fk 3A			84.5	71.5	81.0	59.0	54.0	83.0	66.5	79.0	88.0	89.5	85.5						89.0			87.0	13	78.3	11.8
Yankee Fk 4A			87.0	94.0	77.5	90.0	75.5	79.0	91.0	77.0	76.5	92.5							89.0		88.8		12	84.8	7.1
Yankee Fk 5A			80.0	83.5	60.0	71.0	69.0	72.0	95.0	83.5	84.5	80.5									91.6		11	79.1	10.3

Table 16. Mean percent fines (less than 0.25 inch) at depth—summary streambank stability measurements recorded on the Salmon-Challis National Forest from 1993 through 2014.

Station	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Count	Average	St Dev
Basin Creek 1A			33.3	28.5	22.3	13.5	32.4	28.1	30.0	32.3	31.8	30.3		22.7	10.7						27.0	32.4	14	26.8	7.1
Basin Creek 1A (repeat sample)																					21.0		1	21.0	N/A
Block Creek 1R					33.7		31.0	38.5															3	34.4	3.8
Challis Creek 1A			44.1	41.1	17.4	13.0	21.3	24.3	26.5	22.4	21.0	23.4	20.3	18.6	9.0	23.0	20.9	19.6				20.0	17	22.7	8.6
Challis Creek 1A (repeat sample)																						48.5	1	48.5	N/A
Challis Creek 2A					29.2		22.0	25.7	29.8	29.8	33.4	25.7								16.1		30.8	9	26.9	5.3
Challis Creek 3A										24.2		20.1	13.6	21.3	10.8	14.5	29.6	22.6					8	19.6	6.2
Challis Creek 4A												18.2	27.0										2	22.6	6.2
East Pass Creek 1A			27.1	31.9	31.2	37.9	38.8	37.3	36.3	42.0								9.8					9	32.5	9.6
Eightmile Creek 1A														32.5	21.8	28.3					32.2		4	28.7	5.0
Fivemile Creek 1A			14.3		20.8	28.8	11.7	18.2	23.4	27.5	28.3	20.8								23.7			10	21.8	5.8
Garden Creek USR 1A			22.4		19.0	12.3	18.0	19.2	19.7	19.4	19.5	16.7		13.1	3.0	20.6	29.2	20.2			22.5		15	18.3	5.8
Herd Creek 1A			30.1	31.0	32.5	28.4	30.7	32.5	43.2	36.0	26.4		23.4				26.7				22.4		12	30.3	5.7
Herd Creek 2A											23.7		16.7				33.7	32.7					4	26.7	8.0
Jordan Creek 0A			26.2	32.1	18.4	13.9	15.3	16.5	17.9	18.2	17.5	24.3	12.9							16.0	8.5		13	18.3	6.1
Jordan Creek 1A			17.6												11.9								2	14.8	4.0
Jordan Creek 2A			16.0	22.5	18.0	17.5	21.1	17.7	16.1	22.5	16.9	13.7											10	18.2	2.9
Jordan Creek 3A			14.3	23.5	16.7	10.9	23.1	18.1	11.1	25.5	11.8	14.4											10	16.9	5.4
Jordan Creek 4A			13.5																				1	13.5	N/A
Mackay Creek 1A			19.0		29.3	33.2	30.1	38.9	29.4	31.3	24.8	33.7								27.1	34.3		11	30.1	5.3
Morgan Creek 1A			38.5	34.3	29.3	22.8	24.8	25.5	21.8	25.2	26.7	30.1	18.4		16.8	29.5	34.4	23.9		23.6	30.7	31.2	18	27.1	5.7
Morgan Creek 2A			34.4	34.5	31.7	22.0	23.8	32.0	28.5	31.4	35.8	32.9	20.0							25.1	23.8	48.4	14	30.3	7.3
Morgan Creek 3A			42.3	27.7	41.3	31.4	39.4	40.7	34.6	41.2	61.4	52.1	38.8	32.5	28.2	24.9	34.6	22.7	23.7	15.9	39.9	30.9	20	35.2	10.5
NF Rankin Creek 1R									28.1		42.9									6.7	18.2		4	24.0	15.4
Rankin Creek 1R									24.8		25.6										21.5		3	24.0	2.2
Squaw Creek USR 1A			25.9	24.2	27.4	23.5	30.5	34.0	23.5	33.9	31.5	33.9			16.4	29.0					25.3		13	27.6	5.2
Tenmile Creek 1A			32.3		36.9	28.5	33.7	34.3	35.3	45.0	35.6	39.5									35.5		10	35.7	4.4
Thompson Creek 1A			25.1	20.2	25.4	16.5	21.2	24.7	22.9	26.5	25.4	21.1	13.4	22.1	18.6	13.4							14	21.2	4.4
Trail Creek USR 1R		40.2		27.0																	48.3		3	38.5	10.8
Valley Creek 1A			41.4				26.4	33.8	35.0	38.5	37.8					28.9	29.8	31.7	29.9		39.0	35.7	12	34.0	4.7
WF Herd Creek 1A			20.4	27.2	27.2	27.2	25.2														16.6		6	24.0	4.5
WF Morgan Creek 1A			36.2	33.0	23.4	11.4	25.6	24.5	21.1	26.1	25.5	23.6			22.6	17.2	33.2	23.3	20.2	28.8	25.5	19.3	18	24.5	5.9
WF Yankee Fk 1A			21.9		27.5	18.1	25.1	27.8	26.1	25.6	25.4	25.2			10.6	30.5					25.4		12	24.1	5.2
Yankee Fk 1A			27.1	20.5	19.6	27.8	24.1	21.8	17.8	26.8	20.5	23.3	18.8	19.4	11.1	33.4		24.8					15	22.5	5.3
Yankee Fk 2A			15.6	29.5	14.9	22.6	27.5	25.6	31.4	29.7	21.8	31.3				36.5		36.7				22.2	13	26.6	7.0
Yankee Fk 3A			13.3	29.1	5.3	14.7	24.2	27.8	34.0	24.7	29.5	20.1	9.7						32.9			19.9	13	21.9	9.1
Yankee Fk 4A			40.1	36.1	27.4	25.2	32.7	28.9	20.8	29.4	32.3	27.0							26.5		24.4		12	29.2	5.3
Yankee Fk 5A			31.5	29.7	23.6	21.0	15.7	27.6	33.8	29.5	22.5	19.0									24.8		11	25.3	5.6

Table 17. BLM site information for Designated Monitoring Area (DMA) examinations using MIM protocols.

DMA Location and Date	Number of Plots	DMA Length (meters)	Streambank Alteration (%)	Woody Use (%)
BBC-KA-02 Big Boulder Big Boulder 6/21/2012	80	326.4	2.3%	14.9%
BBC-KA-02 BIG BOULDER BIG BOULDER 21/9/2012	80	358.4	1.8%	14.9%
BBC-KA-02 Big Boulder Big Boulder Creek 5/11/2013	96	261.1	3.8%	19.6%
BC-KA-01 Bayhorse Creek 25/8/1993	79	214.9		
BC-KA-01 Bayhorse Creek 17/9/2008	97	252.2	2.1%	5.0%
BC-KA-01 Wood Creek Bayhorse Creek 25/10/2011	80	108.8	0.5%	12.2%
BC-KA-01 Woods Basin Bayhorse Creek 15/6/2011	40	108.8	3.0%	10.2%
BEAR-KA-01 Bear Creek 18/7/2013	80	217.6	11.8%	11.1%
BEAR-KA-01 Unit 1 Bear Creek 24/10/2011	85	231.2	22.6%	19.2%
BEAR-KA-01 Unit 1 BEAR CREEK 28/10/2013	80	217.6	10.8%	23.3%
Bear-KA-01 Unit 1 Bear Creek 6/10/2010	80	217.6	24.8%	36.2%
BIRCH KA 01 BIRCH 10/22/2012	82	223.0	0.7%	10.0%
BIRCH-KA- 01 Birch Creek Birch Creek 10/18/2012	80	217.6	0.3%	10.0%
Birch-KA-01 Birch Creek 5/23/2012	95	258.4	9.7%	10.0%
BIRCH-KA-01B Birch Creek 10/6/2013	81	217.6	5.1%	10.0%
BIRCH-KA-01B Birch Creek 27/6/2008	60	156.0	20.0%	0.0%
BIRCH-KA-01B Birch Creek 12/8/2010	80	217.6	3.3%	
BIRCH-KA-01B BIRCH CREEK 6/20/2012	83	225.8	1.9%	10.8%
BIRCH-KA-01B Birch Creek 7/6/2011	76	217.6	0.5%	10.0%
BIRCH-KA-01B Birch Creek 9/9/2013	81	220.3	0.0%	10.3%
BIRCH-KA-01B Birch Creek Birch Creek 2/8/2011	80	220.3	0.8%	11.3%
BIRCH-KA-01B BIRCH CREEK Birch Creek 11/8/2009	80	217.6	0.2%	
BIRCH-KA-01B BIRCH CRK Birch Creek 31/5/2011	86	231.2	1.6%	10.4%
Birch-KA-01G birch creek 12/10/2011	85	236.6	14.6%	21.7%
BIRCH-KA-01G birch birch creek 5/11/2013	84	228.5	4.0%	10.6%
BIRCH-KA-01G Birch Birch Creek 21/5/2013	79	223.0	2.3%	10.4%
BIRCH-KA-01G Birch Ck Birch Ck 26/5/2011	100	257.4	8.9%	15.0%
BIRCH-KA-01G Birch Creek Birch Creek 4/6/2013	80	217.6	5.0%	14.1%

DMA Location and Date	Number of Plots	DMA Length (meters)	Streambank Alteration (%)	Woody Use (%)
BIRCH-KA-1 Birch Creek Birch Creek 27/6/2008	62	166.4	20.0%	0.0%
BLC-KA-01 Corral Big Lake Creek 26/8/2013	80	217.6	0.0%	9.9%
BLC-KA-01 corral big lake 6/5/2012	87	236.6	0.0%	10.0%
BLC-KA-01 corral big lake creek 5/10/2011	84	228.5	0.0%	10.0%
BLC-KA-01 Corral Creek Big Lake Creek 15/6/2011	80	217.6	0.3%	10.6%
blc-ka-01 corral creek big lake creek 30/5/2013	80	217.6	0.0%	10.0%
BLUE -KA-02 Unit 1 Blue Creek 11/6/2013	80	217.6	38.0%	16.3%
BLUE-KA-02 Unit 1 Blue Creek 24/9/2013	83	225.8	27.5%	16.2%
brc-ka1 bear/mosquito bear creek 7/19/2012	80	217.6	18.2%	13.6%
CORR-KA-01 Corral Creek 11/9/2013	80	217.6	14.5%	
CORR-KA-01 Corral Creek Corral Creek 5/6/2013	80	217.6	22.5%	
CORR-KA-01 Corral Creek Corral Creek 16/6/2011	80	217.6	26.3%	10.0%
CORR-KA-01 Corral Creek Corral Creek 18/10/2011	82	223.0	36.1%	30.0%
DARL-KA-01 Unit 1 Darling Creek 17/10/2007	81	182.3	16.1%	17.2%
DARL-KA-01 Unit 1 Darling Creek 4/6/2013	80	217.6	2.0%	10.0%
darl-ka-01 unit 1 darling creek 11/14/2012	80	217.6	0.0%	30.0%
DARL-KA-01 Unit 1 Darling Creek 24/10/2013	81	220.3	0.7%	10.3%
darl-ka-01 unit 1 darling creek 4/10/2011	81	220.3	0.2%	10.0%
ELLI-KA-01 Ellis Creek 13/10/2010	81	220.3	17.8%	55.4%
ELLI-KA-04 3/10/2011	82	111.5	20.5%	32.1%
ELLI-KA-04 unit 3 Ellis creek 13/11/2013	82	223.0	1.5%	15.3%
ELLI-KA-04 Unit 3 Ellis Creek 8/6/2011	79	163.2	5.1%	16.6%
HBC-KA-01 Horse Basin Creek 25/10/2013	80	217.6	7.8%	18.0%
HBC-KA-01 Anderson Ranch Horse Basin 25/8/2011	98	272.0	13.5%	10.0%
HBC-KA-01 Anderson Ranch horse basin ck 7/12/2012	80	326.4	9.0%	10.0%
HBC-KA-01 ANDERSON RANCH Horse Basin Creek 1/11/2011	93	253.0	12.3%	30.0%
hbc-ka-02 horse basin horse basin creek 8/10/2012	93	505.9	21.9%	15.5%
HBC-KA-02 Horse Basin Horse Basin 25/8/2011	105	360.4	25.7%	31.7%
HBC-KA-02 Horse Basin Horse Basin 29/6/2011	126	345.4	28.9%	11.3%

DMA Location and Date	Number of Plots	DMA Length (meters)	Streambank Alteration (%)	Woody Use (%)
hbcka02 horse basin horse basin ck 7/12/2012	82		20.7%	21.1%
HBC-KA-02 HORSE BASIN HORSE BASIN CREEK 1/11/2011	102	554.9	25.3%	31.8%
HBC-KA-02 horse basin horse basin creek 31/7/2013	86	233.9	27.2%	20.6%
HBC-KA-02 Upper Horse Horse Basin Creek 24/9/2013	83	225.8	18.2%	23.7%
HC-KA-01 herd creek 10/7/2013	80	380.8	0.3%	16.7%
HC-KA-01 Herd Creek 16/9/2013	83	225.8	1.7%	11.6%
HC-KA-01 Herd Creek 3/9/2013	94	258.4	1.9%	11.7%
HC-KA-01 spring gulch herd creek 5/10/2010	103	396.6	1.4%	13.3%
HC-KA-01 Taylor McDonald Herd Creek 22/10/2013	79	217.6	1.5%	12.6%
HC-KA-01 TAYLOR-MCDONALD HERD CREEK 13/9/2011	100	272.0	0.4%	27.9%
HC-KA-01 Unit 2 Herd Creek 14/8/1996	79	214.9		
HC-KA-02	88	475.2	4.8%	17.4%
KINN_KA_01 KINNIKINIC 10/19/2012	84	228.5	11.2%	
KINN-KA-01 Kinnikinic Creek 27/9/2013	84	228.5	6.9%	22.1%
KINN-KA-01 Kinnikinic Creek Kinnickinic Creek 15/7/2011	81	220.3	10.1%	12.5%
KINN-KA-01 Kinnikinic Creek Kinnikinic Creek 10/11/2009	81	210.6	14.7%	
KINN-KA-01 Kinnikinic Creek Kinnikinic Creek 6/7/2011	80	217.6	8.3%	10.7%
KINN-KA-01 Kinnikinic Kinnikinic 30/9/2008	83	730.4	28.2%	
KINN-KA-01 KINNIKINIC KINNIKINIC 6/20/2012	86	233.9	19.8%	
KINN-KA-01 Kinnikinnic Kinnikinnic Creek 17/10/2011	83	225.8	31.8%	34.4%
KINN-KA-01 Kinnikinnic Kinnikinnic Creek 5/8/2010	81	208.0	22.9%	4.8%
KINN-KA-1 Kinnikinic Creek Kinnikinic Creek 21/10/2010	80	217.6	18.0%	
LC-KA-01 Lake creek 13/7/2012	80	217.6	0.8%	11.9%
LC-KA-01 Lake Creek 16/9/2013	82	223.0	1.7%	13.2%
LC-KA-01 Herd Lake Lake Creek 15/10/2008	81	210.6	4.2%	39.0%
LC-KA-01 Herd Lake Lake Creek 6/10/2011	81	220.3	11.4%	20.8%
LC-KA-01 HERD LAKE LAKE CRK 12/7/2013	80	217.6	0.0%	12.1%
LC-KA-02 HERD LAKE LAKE CREEK 12/7/2013	82	223.0	2.9%	33.2%
LC-KA-02 HERD LAKE LAKE CREEK 26/7/2013	80	217.6	4.5%	17.2%

DMA Location and Date	Number of Plots	DMA Length (meters)	Streambank Alteration (%)	Woody Use (%)
LC-KA-02 Lake Creek Lake Creek 23/9/2008	82	213.2	1.5%	43.4%
LHB-KA-01 Lower Horse Basin Horse Basin Creek 25/10/2013	80	217.6	12.5%	12.0%
LHB-KA-01 lower horse basin lower horse basin 1/8/2013	88	478.7	23.0%	10.1%
LHC-KA-01 dry gulch little hat cr. 6/11/2013	85	228.5	6.0%	10.0%
LYON-KA-02 lyon creek 25/10/2011	80	217.6	3.8%	10.0%
LYON-KA-02 Lyon Creek 9/9/2013	82	223.0	3.2%	12.0%
LYON-KA-02 Lyon Creek Lyon Creek 13/7/2011	80	217.6	1.8%	10.0%
LYON-KA-02 lyon creek lyon creek 18/6/2013	80	217.6	10.5%	10.0%
MC-KA-01 Morgan Creek Morgan Creek 15/8/2006	97	266.8	7.4%	0.2%
MC-KA-01 UNIT 1 MORGAN CR 20/10/2011	86	233.9	1.9%	12.8%
MC-KA-01 UNIT 1 MORGAN CREEK 10/10/2012	80	217.6	4.3%	15.0%
MC-KA-01 Unit 1 Morgan Creek 14/7/2009	82	213.2	0.7%	14.9%
MC-KA-01 Unit 1 Morgan Creek 27/6/2013	83	225.8	6.1%	9.9%
MC-KA-01 Unt 1 Morgan Creek 18/9/2013	81	220.3	4.2%	13.6%
MILL-KA-01 Mill Creek Mill Creek 4/9/2008	104		0.2%	10.6%
MILL-KA-01 MILL CREEK MILL CREEK 6/21/2012	87	233.9	3.3%	10.3%
MILL-KA-01 South Mill Creek 24/9/2013	87	236.6	0.7%	10.7%
MILL-KA-01 South Pasture Mill Creek 11/9/2012	88	239.4	2.7%	13.7%
MILL-KA-02 Mill Creek 13/10/2010	80	217.6	12.8%	38.0%
MILL-KA-02 Klug Gulch Mill Creek 22/8/2013	81	220.3	2.2%	10.6%
MLC-KA-01 Mill Creek 12/10/2010	80	214.9	0.0%	12.1%
MLC-KA-01 Mill Creek 22/5/2013	80	217.6	0.3%	14.8%
MLC-KA-01 Mill Creek 27/8/2013	81	220.3	1.5%	12.7%
MLC-KA-01 Milll Mill Creek 3/6/2013	82	223.0	2.2%	10.3%
RC-KA-01 chicken creek road Creek 8/23/2012	82	223.0	0.7%	17.2%
RC-KA-01 Chicken Creek Road Creek 1/10/2010	83	223.0	0.0%	10.7%
RC-KA-01 Chicken Creek Road Creek 20/7/1999	79	214.9		
RC-KA-01 chicken creek road creek 25/6/2013	81	220.3	0.5%	10.7%
RC-KA-01 Chicken Creek Road Creek 7/30/2012	79	217.6	0.0%	11.7%

DMA Location and Date	Number of Plots	DMA Length (meters)	Streambank Alteration (%)	Woody Use (%)
rc-ka-02 bear/mosquito road creek 7/20/2012	88	709.9	14.8%	21.8%
RC-KA-02 BEAR/MOSQUITO ROAD CRK 6/13/2012	100	408.0	2.6%	10.0%
RC-KA-03 Road/NFS Road Creek 1/10/2010	88	239.4	4.3%	30.0%
RC-KA-04 Spring Basin Road Creek 22/10/2013	82	225.8	9.5%	12.2%
RC-KA-04 Spring Basin Road Creek 7/25/2012	80	220.3	8.5%	17.4%
RC-KA-04 Spring Gulch Road Creek 27/8/2013	88	239.4	11.4%	13.4%
RC-KA-05 Dry Hollow Road Creek 16/9/2013	80	217.6	3.2%	12.2%
RC-KA-05 dry hollow road creek 25/6/2013	80	217.6	0.3%	12.7%
RC-KA-05 DRY HOLLOW ROAD CREEK 3/7/2012	80	217.6	1.5%	11.3%
SHPC-KA-01 Baker Basin Sheep Creek 20/8/2013	81	217.6	3.5%	12.9%
SHPC-KA-O1 BAKER BASIN SHEEP CREEK 18/9/2012	80	217.6	19.8%	18.1%
SINK-KA-01 Lyon Creek Sink Creek 7/8/2008	172	172.0	2.8%	1.8%
SINK-KA-02 sink creek 4/8/2011	86	233.9	0.2%	10.0%
SINK-KA-02 lyon creek sink creek 18/6/2013	80	217.6	7.8%	10.0%
SQC-KA-01 Squaw Creek 27/9/2013	80	217.6	0.8%	10.8%
SQC-KA-01 Redbird Squaw Creek 24/10/2005	104	270.4	0.0%	0.0%
SQC-KA-01 Redbird Squaw Creek 27/7/2011	80	217.6	0.5%	10.0%
TC-KA-01 Lower Thompson 26/8/1993	80	217.6		
TC-KA-01 Lower Thompson Creek 30/7/1996	79	214.9		
TC-KA-02 Middle Thompson Creek 26/8/1993	80	217.6		
TC-KA-02 Middle Thompson Creek 30/7/1996	79	214.9		
WFMC-KA-01 West Fork Morgan 26/9/2013	81	220.3	2.0%	12.7%
WFMC-KA-01 WF Morgan Creek 27/6/2013	81	220.3	4.8%	9.9%
WFMC-KA-01 Unit 1 west fork morgan creek 3/10/2011	77	209.4	0.5%	11.9%

Table 18. BLM bank and greenline information for Designated Monitoring Area (DMA) examinations using MIM protocols.

DMA Location and Date	Bank Stability (%)	Bank Coverage (%)	Woody Species (%)	Hydric Herbaceous (%)	Greenline-Greenline Width (Meters)	Fine Sediment (%)
BBC-KA-02 BIG BOULDER BIG BOULDER 21/9/2012	90.0%	93.8%	42.3%	25.4%	7.76	12.5%
BC-KA-01 Bayhorse Creek 25/8/1993			90.1%	2.1%		
BC-KA-01 Bayhorse Crk 17/9/2008	68.4%	74.7%	54.4%	4.9%	6.56	8.8%
Bear-KA-01 Unit 1 Bear Creek 6/10/2010	81.3%	91.3%	62.6%	17.9%	1.39	90.5%
BIRCH-KA-01B Birch Creek 27/6/2008	78.3%	91.7%	13.4%	5.2%		
BIRCH-KA-01B Birch Creek Birch Creek 2/8/2011	96.3%	93.8%	27.7%	27.3%	1.64	36.0%
BIRCH-KA-01G Birch Creek Birch Creek 4/6/2013	91.3%	91.3%	36.0%	25.4%	1.59	46.5%
BIRCH-KA-1 Birch Creek Birch Creek 27/6/2008	78.3%	91.7%	14.2%	6.7%		
BLC-KA-01 corral big lake creek 5/10/2011	88.1%	86.9%	72.7%	3.9%	2.59	18.5%
DARL-KA-01 Unit 1 Darling Creek 17/10/2007	51.9%	58.4%	35.8%	34.5%		
darl-ka-01 unit 1 darling creek 4/10/2011	86.4%	85.2%	60.0%	16.1%	2.92	44.0%
ELLI-KA-01 Ellis Creek 13/10/2010	22.2%	16.0%	69.8%	6.0%	3.82	66.0%
ELLI-KA-04 3/10/2011	70.7%	57.3%	67.7%		1.28	69.5%
HC-KA-01 herd creek 10/7/2013	82.5%	83.8%	26.4%	41.8%	8.20	5.1%
HC-KA-01 spring gulch herd creek 5/10/2010	86.4%	91.3%	30.9%	33.6%	8.32	8.5%
HC-KA-01 Unit 2 Herd Creek 14/8/1996			32.9%	19.0%		
HC-KA-02	79.5%	81.8%	27.2%	35.7%	6.64	15.0%
KINN-KA-01 Kinnikinic Creek Kinnickinic Creek 15/7/2011	84.0%	80.2%	21.9%	38.9%	4.82	21.0%
KINN-KA-01 Kinnikinic Kinnikinic 30/9/2008	54.8%	82.1%	27.2%	22.1%		
KINN-KA-1 Kinnikinic Creek Kinnikinic Creek 21/10/2010	73.4%	81.0%				
LC-KA-01 Lake creek 13/7/2012	93.7%	91.1%	33.2%	45.1%	1.99	28.0%
LC-KA-01 Herd Lake Lake Creek 15/10/2008	73.8%	76.3%	29.0%	50.3%	2.17	22.6%
LC-KA-02 Lake Creek Lake Creek 23/9/2008	81.5%	87.7%	25.1%	40.6%	2.21	20.0%
LYON-KA-02 Lyon Creek Lyon Creek 13/7/2011	97.5%	97.5%	35.4%	26.9%	3.65	13.5%
MC-KA-01 Morgan Creek Morgan Creek 15/8/2006	88.2%	87.1%	60.0%	9.4%	13.70	
MC-KA-01 Unit 1 Morgan Creek 14/7/2009	86.6%	78.0%	57.1%	12.6%	8.29	24.5%
MILL-KA-01 Mill Creek Mill Creek 4/9/2008	62.0%	76.1%	42.5%	15.4%	4.26	24.9%
MILL-KA-01 South Pasture Mill Creek 11/9/2012	78.4%	68.2%	53.2%	14.4%	4.25	26.5%

DMA Location and Date	Bank Stability (%)	Bank Coverage (%)	Woody Species (%)	Hydric Herbaceous (%)	Greenline-Greenline Width (Meters)	Fine Sediment (%)
MILL-KA-02 Mill Creek 13/10/2010	48.8%	50.0%	16.3%	40.4%	5.55	20.6%
MILL-KA-02 Klug Gulch Mill Creek 22/8/2013	85.0%	83.8%	28.7%	20.9%	4.90	27.0%
MLC-KA-01 Mill Creek 12/10/2010	83.5%	78.5%	64.6%	17.7%	2.25	36.5%
MLC-KA-01 Mill Creek 27/8/2013	90.1%	86.4%	55.2%	11.5%	1.88	46.0%
RC-KA-01 Chicken Creek Road Creek 1/10/2010	94.0%	96.4%	42.5%	47.3%	2.14	49.0%
RC-KA-01 Chicken Creek Road Creek 20/7/1999			34.2%	30.4%		
RC-KA-03 Road/NFS Road Creek 1/10/2010	78.4%	86.4%	39.5%	16.8%	1.51	88.9%
RC-KA-05 DRY HOLLOW ROAD CREEK 3/7/2012	98.8%	95.0%	40.9%	27.0%	2.01	39.0%
SHPC-KA-O1 BAKER BASIN SHEEP CREEK 18/9/2012	100.0%	85.0%	40.6%	13.3%	3.01	85.0%
SINK-KA-01 Lyon Creek Sink Creek 7/8/2008	80.0%	92.2%	33.9%	2.7%		
SINK-KA-02 sink creek 4/8/2011	100.0%	100.0%	27.3%	14.3%	1.62	18.0%
SQC-KA-01 Redbird Squaw Creek 24/10/2005	83.5%	84.5%	24.7%	29.7%		
SQC-KA-01 Redbird Squaw Creek 27/7/2011	61.3%	53.8%	31.8%	36.8%	9.27	1.5%
TC-KA-01 Lower Thompson 26/8/1993			41.2%	22.4%		
TC-KA-01 Lower Thompson Creek 30/7/1996			33.3%	3.0%		
TC-KA-02 Middle Thompson Creek 26/8/1993			26.5%	48.2%		
TC-KA-02 Middle Thompson Creek 30/7/1996			36.0%	10.0%		
WFMC-KA-01 Unit 1 west fork morgan creek 3/10/2011	67.1%	64.5%	28.5%	33.6%	5.09	6.0%

4.2.3 Bacteria (*Escherichia coli*)

DEQ has regularly monitored for *E. coli* in the Upper Salmon River subbasin. Only Herd Creek was identified as exceeding the bacteria criterion. Details of the recent *E. coli* monitoring are contained in section 5.3, with recent data sheets included in Appendix G.

4.2.4 Beneficial Use Reconnaissance Program Monitoring

BURP data for the Upper Salmon River subbasin (Figure 5) collected between 1998 and 2013 were used to identify support status for the cold water aquatic life beneficial use for wadeable waters (data prior to 1998 are not included within this document.) There were 327 locations identified for beneficial use measurements, but many sites were either inaccessible or dry; therefore, only 161 sites have data (Appendix F). Of 158 locations monitored, ninety-eight (98) AUs have data and associated assessments. Of the sampled sites, 138 supported the monitored uses, twenty (20) sites had low condition scores, and six (6) locations had recent data (2013 and 2014) but incomplete analyses. Location information for 2013 sites is included in Appendix F. Of those locations with low condition scores, most had mitigating factors, such as lake effects, beaver dams, or water right withdrawals, all of which influence the condition away from reference. There were sixty (60) sites that were dry or with no flow and were not monitored and fifteen (15) sites that were either nonwadeable or had discharges too high for the monitoring methods (i.e., monitoring personnel could be at risk or equipment would be over topped). The remaining locations were either inaccessible or were outside the BURP protocols (e.g., wetlands).

Pertinent BURP data are presented in Appendix F. Where the stream fish index (SFI) is blank, a fishing effort was not made and only the stream macroinvertebrate index (SMI) and stream habitat index (SHI) scores are available. If the average score of the indices is greater than or equal to two (2), the AU is fully supporting cold water aquatic uses; if the average score is less than two (2), the AU is not fully supporting. However, mitigating factors are also accounted for during the assessment process (e.g., non-representative BURP site location).

Specific to the use of the BURP data is the assessment of previously identified impaired streams. BURP data from 2011 were examined for Champion Creek (ID17060201SL086_03), which was listed based on data from 1996 and 1998. The 2011 BURP SMI and SFI metrics were each calculated at three (3) and SHI at one (1), which is not surprising given that BURP monitoring occurred 6 years after the Valley Creek Fire and many of the stressors have dissipated. Additionally, the monitoring occurred in a location that was more representative of the AU; this site was in the sagebrush flats on the alluvium/alluvial fan that compose over two-thirds of the AU. Habitat (SHI) scores in 2011 represent the limited cover by sagebrush and other in-channel factors that were altered by the 2005 Valley Creek Fire. Recovery from the fire and its impacts is apparent, but full recovery will require more time. Water right withdrawals from the system may limit the overall recovery from reaching a reference/pristine condition. The nature of the alluvium also precludes full vegetation cover as the cobble-dominated alluvium is expected to have high transmissivity (vertical, not horizontal) to the groundwater and/or surface water / groundwater interactions. Nothing indicates that willows or other riparian woody plants ever dominated the vegetation composition along this stream channel. Additional descriptions and details are included in Appendix B and Appendix F.

4.2.5 Idaho Major Rivers Survey

Three (3) locations in the Upper Salmon River subbasin were included in the Idaho Major Rivers Survey. DEQ monitored several large rivers in 2006 and 2008; only the data specific to the Upper Salmon River subbasin are included in this document (Figure 16; Appendix F). Complete results and data are located in *Extent and Condition of Idaho's Major Rivers* (Pappani 2010). River monitoring protocols are similar to the stream monitoring BURP protocols but adapted to nonwadeable waters using the *Beneficial Use Reconnaissance Program Field Manual for Rivers (Draft)* (DEQ 2006). Macroinvertebrate and fish scores were in the good category at all three (3) locations monitored; the biologic condition also was given a good rating.

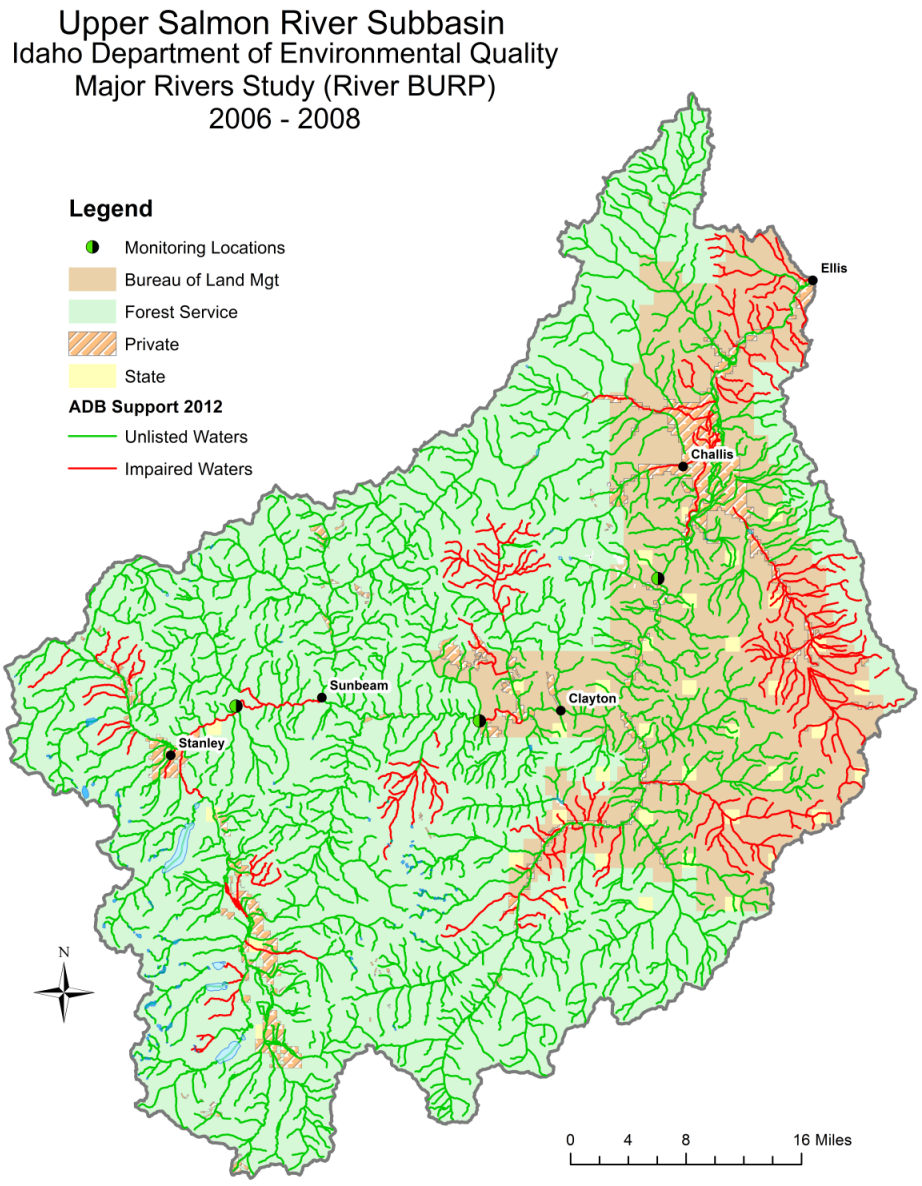


Figure 16. Idaho Major Rivers Survey sampling locations.

4.2.6 Previous TMDL Status

Sediment TMDLs were developed in the *Upper Salmon River Subbasin Assessment and TMDL* (DEQ 2003) for three AUs in Challis Creek. In 2013, stream conditions had seemed to improve, as there were limited fine sediment particles and the banks appeared stable. However, the Lodgepole Fire burned great portions of the watershed in late 2013. In August 2014, heavy monsoon rains in the watershed and burned areas led to flooding, debris flows, and washouts in Challis Creek (William MacFarlane, USFS, personal communication, August 2014). Therefore, no updated data are available for these AUs. However, regular observations in 2013 and early 2014 identified no indication of excessive nuisance growth in the channel indicating a nutrient impairment as suggested in the cause unknown listing for AU ID17060201SL009_04. These Challis Creek AUs have impairments by sediment and/or temperature, and these are the only identifiable causes.

5 Total Maximum Daily Loads

A TMDL prescribes an upper limit (i.e., load capacity) on discharge of a pollutant from all sources to ensure water quality standards are met. It further allocates this load capacity among the various sources of the pollutant. Pollutant sources fall into two broad classes: point sources, each of which receives a wasteload allocation, and nonpoint sources, each of which receives a load allocation. Natural background contributions, when present, are considered part of the load allocation but are often treated separately because they represent a part of the load not subject to control. Because of uncertainties about quantifying loads and the relation of specific loads to attaining water quality standards, the rules regarding TMDLs (40 CFR Part 130) require a margin of safety be included in the TMDL. Practically, the margin of safety and natural background are both reductions in the load capacity available for allocation to pollutant sources.

Load capacity can be summarized by the following equation:

$$LC = MOS + NB + LA + WLA = TMDL$$

Where:

LC = load capacity
MOS = margin of safety
NB = natural background
LA = load allocation
WLA = wasteload allocation

The equation is written in this order because it represents the logical order in which a load analysis is conducted. First, the load capacity is determined. Then the load capacity is broken down into its components. After the necessary margin of safety and natural background, if relevant, are quantified, the remainder is allocated among pollutant sources (i.e., the load allocation and wasteload allocation). When the breakdown and allocation are complete, the result is a TMDL, which must equal the load capacity.

The load capacity must 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 load capacity and pollutant source loads vary, and not necessarily in concert, determining critical conditions can be more complicated than it may initially appear.

Another step in a load analysis is quantifying current pollutant loads by source. This step allows for the specification of load reductions as percentages from current conditions, considers equities in load reduction responsibility, and is necessary for pollutant trading to occur. A load is fundamentally a quantity of pollutant discharged over some period of time and is the product of concentration and flow. Due to the diverse nature of various pollutants, and the difficulty of strictly dealing with loads, the federal rules allow for "other appropriate measures" to be used when necessary (40 CFR 130.2). 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 Temperature TMDL

Temperature was determined to be impairing water quality in 14 AUs requiring temperature TMDLs: 8 listed in Category 5 of the 2012 Integrated Report and eight (8) unlisted but identified as having exceedances of the temperature standard for salmonid spawning.

5.1.1 Instream Water Quality Targets

Effective target shade levels were established for sixteen (16) AUs (eight (8) listed and eight (8) unlisted) based on the concept of maximum shading under potential natural vegetation (PNV) resulting in natural temperature levels. The Idaho water quality standards include a provision (IDAPA 58.01.02.200.09) that if natural conditions exceed numeric water quality criteria, exceedance of the criteria is not considered a violation of water quality standards. In these situations, natural conditions essentially become the water quality standard, and for temperature TMDLs, the natural level of shade and channel width become the TMDL target. The instream temperature that results from attaining these conditions is consistent with the water quality standards, even if it exceeds numeric temperature criteria. See Appendix A for further discussion of water quality standards and natural background provisions.

The PNV approach is described briefly below. The procedures and methodologies to develop PNV target shade levels and to estimate existing shade levels are described in detail in *The Potential Natural Vegetation (PNV) Temperature Total Maximum Daily Load (TMDL) Procedures Manual* (Shumar and De Varona 2009). The manual also provides a more complete discussion of shade and its effects on stream water temperature.

5.1.1.1 Design Conditions

Factors Controlling Water Temperature in Streams

There are several important contributors of heat to a stream, including groundwater temperature, air temperature, and direct solar radiation (Poole and Berman 2001). Of these, direct solar

radiation is the source of heat that is most controllable. The parameters that affect the amount of solar radiation hitting a stream throughout its length are shade and stream morphology. Shade is provided by the surrounding vegetation and other physical features such as hillsides, canyon walls, terraces, and high banks. Stream morphology (i.e., structure) affects riparian vegetation density and water storage in the alluvial aquifer. Riparian vegetation and channel morphology are the factors influencing shade that are most likely to have been influenced by anthropogenic activities and can be most readily corrected and addressed by a TMDL.

Riparian vegetation provides a substantial amount of shade on a stream by virtue of its proximity. However, depending on how much vertical elevation surrounds the stream, vegetation further away from the riparian corridor can also provide shade. We can measure the amount of shade that a stream receives in a number of ways. Effective shade (i.e., that shade provided by all objects that intercept the sun as it makes its way across the sky) can be measured in a given location with a Solar Pathfinder or with other optical equipment similar to a fish-eye lens on a camera. Effective shade can also be modeled using detailed information about riparian plants and their communities, topography, and stream aspect.

In addition to shade, canopy cover is a similar parameter that affects solar radiation. Canopy cover is the vegetation that hangs directly over the stream and can be measured using a densiometer or estimated visually either on-site or using aerial photography. All of these methods provide information about how much of the stream is covered and how much is exposed to direct solar radiation.

Potential Natural Vegetation for Temperature TMDLs

PNV along a stream is that riparian plant community that could grow to an overall mature state, although some level of natural disturbance is usually included in the development and use of shade targets. Vegetation can be removed by disturbance either naturally (e.g., wildfire, disease/old age, wind damage, wildlife grazing) or anthropogenically (e.g., domestic livestock grazing, vegetation removal, erosion). The idea behind PNV as targets for temperature TMDLs is that PNV provides a natural level of solar loading to the stream without any anthropogenic removal of shade-producing vegetation. Vegetation levels less than PNV (with the exception of natural levels of disturbance and age distribution) result in the stream heating up from anthropogenically created additional solar inputs.

We can estimate PNV (and therefore target shade) from models of plant community structure (shade curves for specific riparian plant communities), and we can measure or estimate existing canopy cover or shade. Comparing the two (target and existing shade) tells us how much excess solar load the stream is receiving and what potential exists to decrease solar gain. Streams disturbed by wildfire, flood, or some other natural disturbance will be at less than PNV and require time to recover. Streams that have been disturbed by human activity may require additional restoration above and beyond natural recovery.

Existing and PNV shade was converted to solar loads from data collected on flat-plate collectors at the nearest National Renewable Energy Laboratory (NREL) weather stations collecting these data. In this case, we used the Boise, Idaho, station. The difference between existing and target solar loads, assuming existing load is higher, is the load reduction necessary to bring the stream back into compliance with water quality standards (see Appendix A).

PNV shade and the associated solar loads are assumed to be the natural condition; thus, stream temperatures under PNV conditions are assumed to be natural (so long as no point sources or other anthropogenic sources of heat exist in the watershed) and are considered to be consistent with the Idaho water quality standards, even if they exceed numeric criteria by more than 0.3 °C.

Existing Shade Estimates

Existing shade was estimated for eight (8) AUs from visual interpretation of aerial photos (not including the Salmon River AUs). Estimates of existing shade based on plant type and density were marked out as stream segments on a 1:100,000 or 1:250,000 hydrography, taking into account natural breaks in vegetation density. Stream segment length for each estimate of existing shade varies depending on the land use or landscape that has affected that shade level. Each segment was assigned a single value representing the bottom of a 10% shade class (adapted from the cumulative watershed effects process, IDL 2000). For example, if shade for a particular stream segment was estimated somewhere between 50% and 59%, we assigned a 50% shade class to that segment. The estimate is based on a general intuitive observation about the kind of vegetation present, its density, and stream width. Streams where the banks and water are clearly visible are usually in low shade classes (10%, 20%, or 30%). Streams with dense forest or heavy brush where no portion of the stream is visible are usually in high shade classes (70%, 80%, or 90%). More open canopies where portions of the stream may be visible usually fall into moderate shade classes (40%, 50%, or 60%).

Visual estimates made from aerial photos are strongly influenced by canopy cover and do not always take into account topography or any shading that may occur from physical features other than vegetation. It is not always possible to visualize or anticipate shade characteristics resulting from topography and landform. However, research has shown that shade and canopy cover measurements are remarkably similar (OWEB 2001), reinforcing the idea that riparian vegetation and objects proximal to the stream provide the most shade. The visual estimates of shade in this TMDL were partially field verified with a Solar Pathfinder, which measures effective shade and takes into consideration other physical features that block the sun from hitting the stream surface (e.g., hillsides, canyon walls, terraces, and man-made structures).

Existing shade levels for the eight (8) AUs of the Salmon River were determined through modeling of near-shore canopy density, height, and branch overhang using the Oregon Department of Environmental Quality's Heat Source model (shade-alator portion only) was used to calculate existing shade for the Salmon River based on visual estimates of near shore canopy density and canopy height.

Solar Pathfinder Field Verification

The accuracy of the aerial photo interpretations was field verified with a Solar Pathfinder at eight-teen (18) unique sites. The Solar Pathfinder is a device that allows one to trace the outline of shade-producing objects on monthly solar path charts. The percentage of the sun's path covered by these objects is the effective shade on the stream at the location where the tracing is made. To adequately characterize the effective shade on a stream segment, ten traces are taken at systematic or random intervals along the length of the stream in question.

At each sampling location, the Solar Pathfinder was placed in the middle of the stream at about the bankfull water level. Ten (10) traces were taken following the manufacturer's instructions (i.e., orient to south and level). Systematic sampling was used because it is easiest to accomplish

without biasing the sampling location. For each sampled segment, the sampler started at a unique location, such as 50 to 100 meters from a bridge or fence line, and proceeded upstream or downstream taking additional traces at fixed intervals (e.g., every 50 meters, 50 paces, etc.). Alternatively, one can randomly locate points of measurement by generating random numbers to be used as interval distances.

When possible, the sampler also measured bankfull widths, took notes, and photographed the landscape of the stream at several unique locations while taking traces. Special attention was given to changes in riparian plant communities and what kinds of plant species (the large, dominant, shade-producing ones) were present. One can also take densiometer readings at the same location as Solar Pathfinder traces. These readings provide the potential to develop relationships between canopy cover and effective shade for a given stream.

The results of the Solar Pathfinder fieldwork showed that our original aerial interpretation of existing shade was correct 42% of the time (8 of 18 unique sites), was within one (1) shade class interval 47% of the time (9 of 18 unique sites), and off by two (2) or three (3) shade classes only twice. The average difference between interpreted and measured classes was only 0 classes ± 0.50 (mean ± 95% confidence interval). The original aerial interpretation of existing shade was corrected for these site locations and the results were used to "calibrate the eye" in examining the remaining stream segments that did not receive field verification.

Solar Pathfinder results from the six sites in the upper portion of the Salmon River were used to verify the Heat Source (shade-alator) output of existing shade. Model results were generally within 10% of Solar Pathfinder results (Table 19).

Table 19. Solar Pathfinder results for sites in the Upper Salmon River Subbasin.

Aerial Class	Pathfinder Actual	Pathfinder Class	Class Delta		Site Name
20	15.6	10	1		Salmon 1
10	5.2	0	1		Salmon 2
10	22.3	20	-1		Salmon 3
10	6	0	1		Salmon 4
0	7.6	0	0		Salmon 5
0	3.9	0	0		Salmon 6
40	38.3	30	1		Challis 1
40	27.8	20	2		Challis 2
50	51.7	50	0		Squaw 1a
30	36.2	30	0		Squaw 1b
30	39.6	30	0		Squaw 2
30	38.8	30	0		Squaw 3
30	23.6	20	1		Squaw 4
20	32.3	30	-1		Squaw 5
20	36.7	30	-1		Squaw 6
20	30.7	30	-1		Squaw 7
10	16.9	10	0		Squaw 8
70	48.6	40	3		Trealor 1
80	80.2	80	0		Trealor 2
			0	Average	
			1.11	Std Dev	
			0.50	95% CI	

Target Shade Determination

PNV targets were determined from an analysis of probable vegetation at the streams and comparing that to shade curves developed for similar vegetation communities in Idaho (see Shumar and De Varona 2009). A shade curve shows the relationship between effective shade and stream width. As a stream gets wider, shade decreases as vegetation has less ability to shade the center of wide streams. As the vegetation gets taller, the more shade the plant community is able to provide at any given channel width.

Natural Bankfull Widths

Stream width must be known to calculate target shade since the width of a stream affects the amount of shade the stream receives. Bankfull width is used because it best approximates the width between the points on either side of the stream where riparian vegetation starts. Measures of current bankfull width may not reflect widths present under PNV (i.e., natural widths). As impacts to streams and riparian areas occur, width-to-depth ratios tend to increase such that streams become wider and shallower. Shade produced by vegetation covers a lower percentage of the water surface in wider streams, and widened streams can also have less vegetative cover if shoreline vegetation has eroded away.

Since existing bankfull width may not be discernible from aerial photo interpretation and may not reflect natural bankfull widths, this parameter must be estimated from available information. We used regional curves for the major basins in Idaho—developed from data compiled by Diane Hopster of the Idaho Department of Lands—to estimate natural bankfull width (Figure 17).

For each stream evaluated in the load analysis, natural bankfull width was estimated based on the drainage area of the Salmon Basin curve from Figure 17. For streams in the analysis, existing width data should also be evaluated and compared to these curve estimates if such data are available. However, for the Challis Creek and Squaw Creek watersheds, only a few BURP sites exist, and bankfull width data from those sites represent only spot data (e.g., only three (3) measured widths in a reach just several hundred meters long) that are not always representative of the stream as a whole. We chose to use the Salmon Basin estimates of channel width for the majority of small streams in the upper Squaw Creek watershed. No BURP data exist for this region; thus we chose to use the basin of origin for these higher elevation streams.

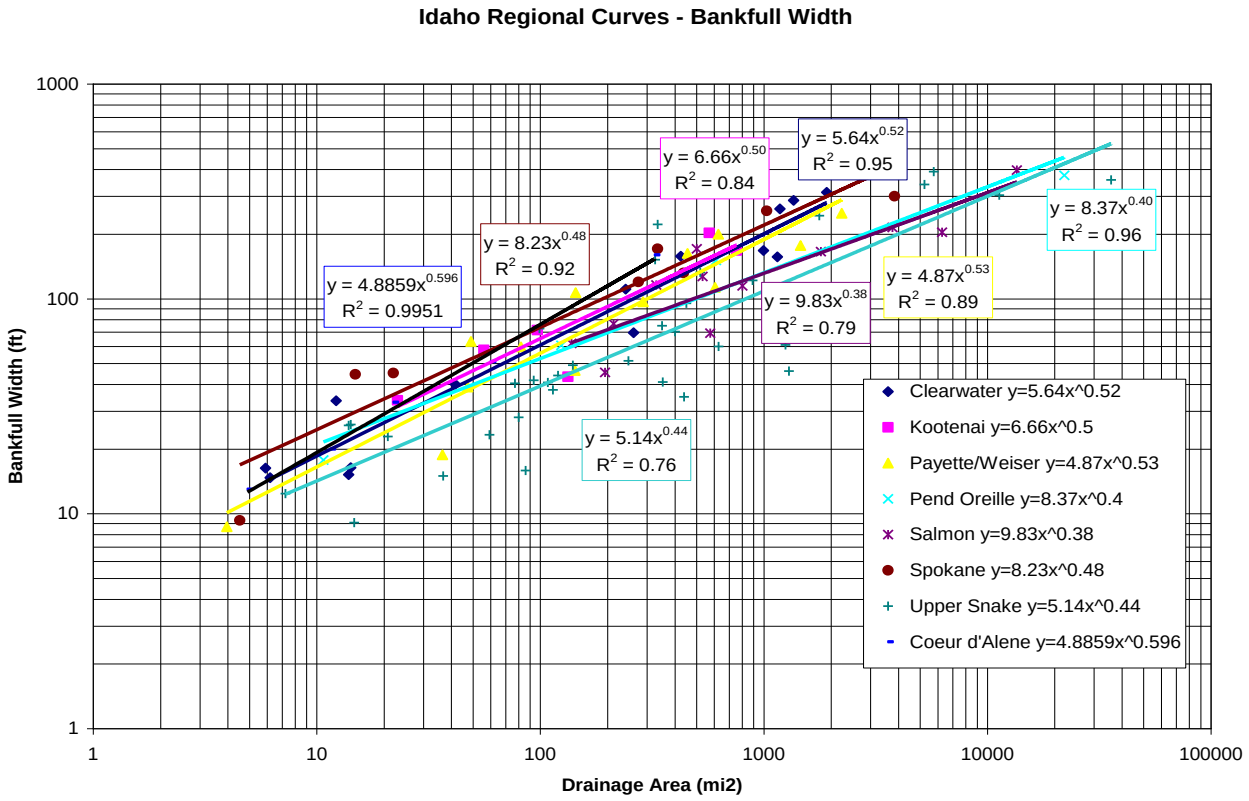


Figure 17. Bankfull width as a function of drainage area.

In general, for lower Challis Creek and lower Squaw Creek, we found BURP bankfull width data to disagree with natural bankfull width estimates from the Salmon Basin curve and chose not to make natural widths any different than these existing measurements. It is possible that natural channel widths for lower Challis Creek and lower Squaw Creek could have been larger if there were no divisions of water for irrigation purposes; however, these existing conditions are unlikely to change. Table 20 contains natural bankfull width estimates for each stream in this analysis. The load analysis tables (Appendix H) contain a natural bankfull width and an existing bankfull width for every stream segment in the analysis based on the bankfull width results

presented in Table 20. Existing widths and natural widths are the same in load tables when no data support making them differ.

Table 20. Bankfull width estimates for various locations on streams in the Upper Salmon River subbasin.

Location	area (sq mi)	Salmon (m)	existing (m)
Challis Creek bl Bear Creek	47.38	13	5.9 (1 of 2 channels)
Challis Creek @ 5200ft	91.59	17	11.2
Challis Creek @ mouth	147.82	20	
Pack Creek @ mouth	1.06	3	
Rough Creek @ mouth	0.69	3	
Willow Creek @ mouth	3.17	5	
Willow Creek ab 2nd tributary	1.38	3	
1st tributary to Willow Creek	0.59	2	
2nd tributary to Willow Creek	0.37	2	
3rd tributary to Willow Creek	0.26	2	
Sheep Creek @ mouth	1.39	3	
Un-named tributary @ mouth	0.51	2	
Lavine Creek @ mouth	0.81	3	
Leg Creek @ mouth	0.59	2	
Trail Creek @ mouth	5.66	6	
Trail Creek ab 1st tributary	0.97	3	
Trail Creek ab 3rd tributary	4.24	5	
1st tributary to Trail Creek	0.77	3	
2nd tributary to Trail Creek	2.37	4	
3rd tributary to Trail Creek	0.82	3	
Martin Creek ab 2nd tributary	1.78	4	
Martin Creek bl 2nd tributary	4.28	5	
Martin Creek @ mouth	9.6	7	
1st tributary to Martin Creek	0.67	3	
2nd tributary to Martin Creek	2.5	4	
tributary to 2nd tributary	0.7	3	
3rd tributary to Martin Creek	0.72	3	
4th tributary to Martin Creek	0.55	2	
5th tributary to Martin Creek	2.03	4	
Trealor Creek @ mouth	2.6	4	
Squaw Creek ab Pack Creek	1.34	3	
Squaw Creek ab Willow Creek	4.17	5	
Squaw Creek bl Willow Creek	7.35	6	
Squaw Creek ab Martin Creek	20.27	9	
Squaw Creek bl Martin Creek	29.91	11	7.6
Squaw Creek bl Cinnabar Creek	43.39	13	8.03
Squaw Creek bl Cash Creek	52.87	14	
Squaw Creek @ mouth	78.23	16	8
Aspen Creek ab tributary	0.59	2	
Aspen Creek @ mouth	2.62	4	
tributary to Aspen Creek	0.59	2	

Channel widths for the Salmon River were estimated from a digitized right bank and left bank using an aerial photo and Oregon DEQ's Tools ArcGIS extension. Those results are presented in

Figure 18, and Figure 19, and are used for channel widths in the Salmon River load analysis. The Salmon River was divided and modeled as two separate sections. The first section, from Redfish Lake outlet to Squaw Creek, is approximately 59 kilometer long and can be described as the conifer-influenced section. The second section of the modeled Salmon River is 80.8 kilometers long and extends from Squaw Creek to the confluence with the Pahsimeroi River. Section two can be described as the cottonwood-influenced section.

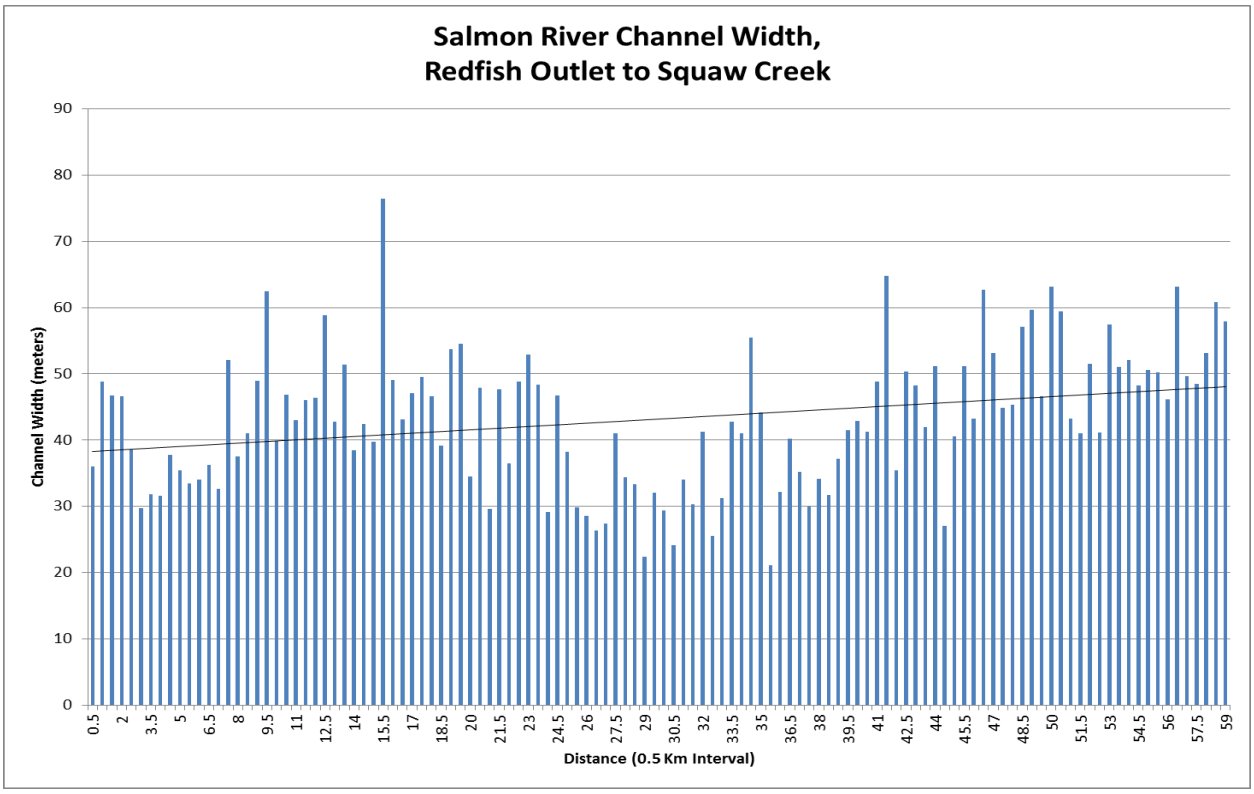


Figure 18. Channel widths estimated by TTools for the Salmon River, Redfish Lake outlet to Squaw Creek.

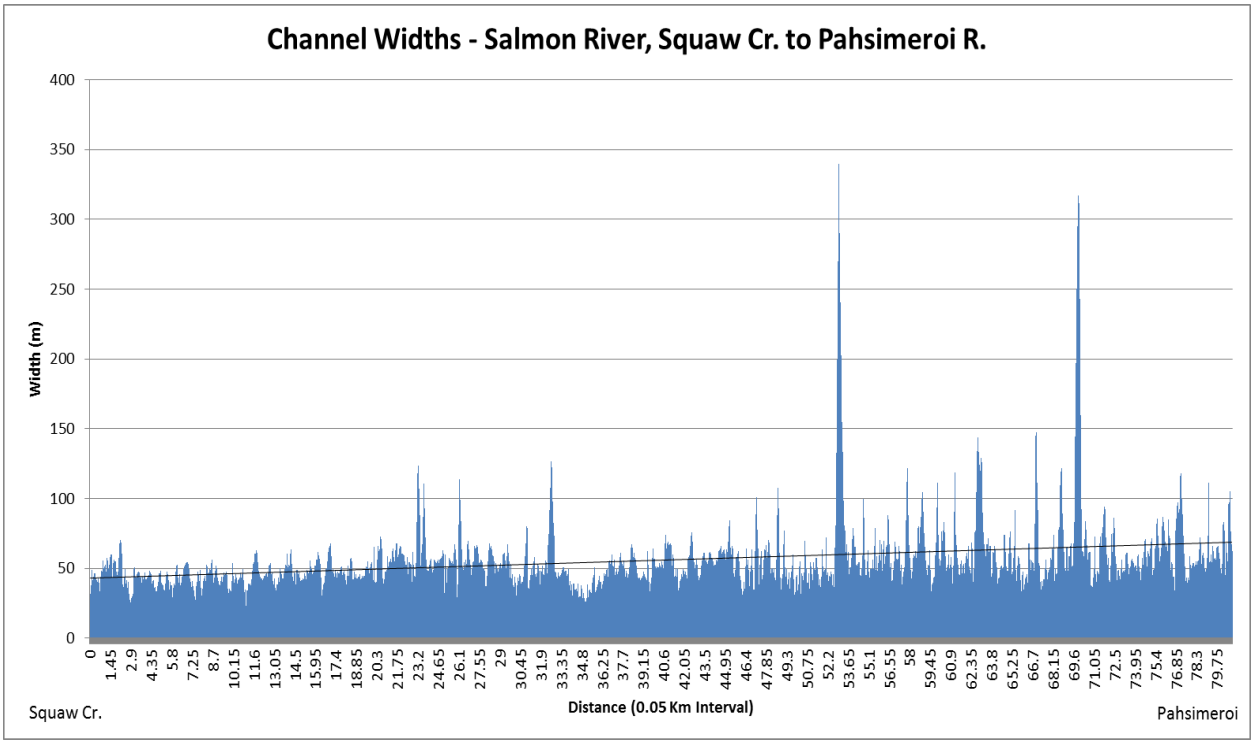


Figure 19. Channel widths estimated by TTools for the Salmon River, Squaw Creek to Pahsimeroi River.

5.1.1.2 Target Selection

The Upper Salmon River subbasin is located in the Idaho Batholith Level 3 Ecoregion of McGrath et al. (2001), an area of glacially influenced granitic soils that are droughty and easily eroded. Winters are cold and can have deep snow packs with substantial spring runoff. The region along the Salmon River above the town of Stanley, Idaho, is in the High Glacial Drift-Filled Valleys Level 4 Ecoregion. This subecoregion is known for terraces, outwash plains, moraines, wetlands, and hills that are less rugged and less forested than the surrounding mountains. This subecoregion has sagebrush/bunchgrass communities on drier soils, usually southern exposed slopes, and lodgepole pine on valley floors. Winters are cold and snowy producing large amounts of spring runoff. Wetland soils are predominantly graminoid (grasses and sedges) dominated. Livestock grazing and recreational/residential development are the principle land uses.

Downstream from Stanley, the Salmon River enters the surrounding Southern Forested Mountains and the Dry, Partly Wooded Mountains Level 4 Ecoregions. These subecoregions of the Idaho Batholith contains droughty soils derived from granitic rock only marginally affected by maritime influences. Forest diversity is low with open Douglas-fir and grand fir/subalpine fir at higher elevations. Ponderosa pine can occur in canyons. The Salmon River upstream of the city of Stanley can have open Douglas-fir forests or dry sagebrush slopes in canyons or pasture-dominated reaches that may have had marginal willow communities along river edges. Below Stanley, the river becomes dominated by Douglas-fir forests on more northerly exposed slopes and sagebrush/bunchgrass communities on drier southerly exposures. The drier side of the Salmon River canyon below Stanley was affected by the construction of Highway 75 along the

river. Most of the shade along this section of the river comes from the forested opposite shoreline.

The Salmon River near Clayton leaves the Idaho Batholith and enters the Middle Rockies Level 3 Ecoregion. While still in narrow canyon, the hillsides become completely dominated by sagebrush grass and lack a conifer component. The river is in the Dry, Gneissic-Schistose Volcanic Hills Level 4 Ecoregion nearly until Challis, at which point it enters the Dry Intermontane Sagebrush Valleys Level 4 Ecoregion. The Salmon River from about Thompson Creek to the mouth of the subbasin (at the Pahsimeroi River) is largely dominated by thin willow communities and sagebrush in narrow canyons or black cottonwood gallery forest in the open valleys. The Squaw Creek watershed is within the Southern Forested Mountains subecoregion, and its upper tributaries are largely dominated by open Douglas-fir or subalpine fir forests. Lower reaches of Squaw Creek are alder or willow dominated. Lower Challis Creek is also dominated by black cottonwood as it traverses the broader floodplain where Challis Creek and the Salmon River meet.

Shade Curve Selection

To determine PNV shade targets for the Salmon River, Squaw Creek, and Challis Creek, effective shade curves from the Salmon-Challis National Forest and southern Idaho non-forest sections of the DEQ PNV manual were examined (Table 21) (Shumar and De Varona 2009). These curves were produced using vegetation modeling of Idaho plant communities. Effective shade curves include percent shade on the vertical axis and stream width on the horizontal axis. For the Salmon River, Squaw Creek, and Challis Creek, curves for the most similar vegetation type were selected for shade target determinations. Shade curves produced for forest types found in the Salmon-Challis National Forest were used in forested regions of the upper Squaw Creek watershed and along the Salmon River. Shade curves produced for the non-forest vegetation types found in southern Idaho were applied to non-forested portions of streams examined.

Because the upper portion of the Salmon River generally has forest types on its right, north-facing shore and shrub communities on its left, south-facing shore, special shade curves were developed using applicable Salmon-Challis forest types: Douglas-fir/lodgepole, steep or dry Douglas-fir without Ponderosa pine on right bank and Geyer willow/reedgrass on the left bank.

Additionally, open sage/conifer country where conifer density is very low and sagebrush/grass communities dominate were targeted via a mixture of sagebrush/grass attributes and dry Douglas-fir (without Ponderosa pine) attributes. Targets from these curves are only used in the analysis of the Salmon River, not other streams. These curves are not found in Shumar and De Varona (2009) but are presented in Appendix H.

The Salmon River emerges from the conifer-dominated zone around Thompson Creek, and the Geyer willow/reedgrass shade curve is used to reflect the narrow willow plant community seen along the river. The Salmon River valley begins to open up below the confluence with the East Fork Salmon River and the black cottonwood type becomes dominant, although Geyer willow type is used in narrow canyon locations throughout this reach.

Table 21. Shade curves used in the Upper Salmon River subbasin PNV temperature TMDL.

Salmon-Challis National Forest Shade Curves	Southern Idaho Non-Forest Shade Curves
Douglas-fir/lodgepole, steep	Alder
Douglas-fir/lodgepole, gentle	Geyer willow/sedge (tributaries)
Dry Douglas-fir/without ponderosa pine	Geyer willow/reedgrass (Salmon River)
Subalpine fir/dry, steep	Meadow (graminoid)
Subalpine fir/dry, gentle	Rangeland (sagebrush/graminoid)
Subalpine fir/whitebark pine	Black cottonwood

5.1.1.3 Water Quality Monitoring Points

Numeric monitoring in any of the temperature-impaired or shade-deficient AUs should be based on the statewide protocols. Care should be taken to ensure the locations have sufficient depth to fully cover the monitoring equipment throughout the sampling period and are well-mixed. PNV-style shade curves are based on the entire AU and location information is described separately.

5.1.2 Load Capacity

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" (40 CFR 130.2(g)).

The load capacity for a stream under PNV is essentially the solar loading allowed under the shade targets specified for the segments within that stream. These loads are determined by multiplying the solar load measured by a flat-plate collector (under full sun) for a given period of time by the fraction of the solar radiation that is not blocked by shade (i.e., the percent open or 100% minus percent shade). In other words, if a shade target is 60% (or 0.6), the solar load hitting the stream under that target is 40% of the load hitting the flat-plate collector under full sun.

We obtained solar load data from flat-plate collectors at the NREL weather station in Boise, Idaho. The solar load data used in this TMDL analysis are spring/summer averages (i.e., an average load for the 6-month period from April through September). As such, load capacity calculations are also based on this 6-month period, which coincides with the time of year when stream temperatures are increasing, deciduous vegetation is in leaf, and fall spawning is occurring. During this period, temperatures may affect beneficial uses such as spring and fall salmonid spawning, and cold water aquatic life criteria may be exceeded during summer months. Late July and early August typically represent the period of highest stream temperatures. However, solar gains can begin early in the spring and affect not only the highest temperatures reached later in the summer but also salmonid spawning temperatures in spring and fall (Appendix H).

Tables H1–H12 and Figures H2, H5, and H8) detail the PNV shade targets. The tables also list corresponding target summer loads (in kilowatt-hours per square meter per day [$kWh/m^2/day$] and kWh/day) that serve as the load capacities for the streams. Existing and target loads in

kWh/day can be summed for the entire stream or portion of stream examined in a single load analysis table. These total loads are shown at the bottom of their respective columns in each table. Because load calculations involve stream segment area calculations, the segment channel width, which typically only has one or two significant figures, dictates the level of significance of the corresponding loads. One significant figure in the resulting load can create rounding errors when existing and target loads are subtracted. The totals row of each load table represents total loads with two significant figures in an attempt to reduce apparent rounding errors.

The AU with the largest target load (i.e., load capacity) was Salmon River (ID17060201SL031_05) with 5.4 million kWh/day (Table H7). The smallest target load was in the Aspen Creek AU (ID17060201SL024_02) with 12,000 kWh/day (Table H1).

5.1.3 Estimates of Existing Pollutant Loads

A load 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 area. To the extent possible, background loads should be distinguished from human-caused increases in nonpoint loads.

Existing loads in this temperature TMDL come from estimates of existing shade as determined from aerial photo interpretations and Heat Source modeling. No permitted point sources exist in the affected AUs. Like target shade, existing shade was converted to a solar load by multiplying the fraction of open stream by the solar radiation measured on a flat-plate collector at the NREL weather station. Existing shade data are presented in Appendix H (Tables H1–H12 and Figures H1, H4, and H7). Like load capacities (target loads), existing loads are presented on an area basis (kWh/m^2/day) and as a total load (kWh/day). Existing loads in kWh/day are also summed for the entire stream or portion of stream examined in a single load analysis table. The difference between target and existing load is also summed for the entire table. Should existing load exceed target load, this difference becomes the excess load (i.e., lack of shade) to be discussed next in the load allocation section and as depicted in the lack-of-shade figures (Appendix H, Figures H3, H6, and H9).

The AU with the largest existing load was Salmon River (ID17060201SL031_05) with over 5.6 million kWh/day (Table H7). The smallest existing load was in the Aspen Creek AU (ID17060201SL024_02) with 22,000 kWh/day (Table H1).

Existing or current shade, as modeled by Heat Source, and target shade for the lower four AUs of the Salmon River (Squaw Creek to Pahsimeroi River) are shown in Appendix H (Figure H10). The difference between these two shade types (also known as shade deficit/surplus or lack-of-shade) is presented in Appendix H (Figure H11). Large spikes (exceeding 60%) in existing (or current) shade occur on vegetated islands within the Salmon River.

5.1.4 Load Allocation

Because this TMDL is based on PNV, which is equivalent to background loading, the load allocation is essentially the desire to achieve background conditions. However, in order to reach that objective, load allocations are assigned to nonpoint source activities that have affected or may affect riparian vegetation and shade as a whole. Therefore, load allocations are stream

segment specific and dependent on the target load for a given segment. Load analysis tables (Appendix H) list the target shade and corresponding target summer load. This target load (i.e., load capacity) is necessary to achieve background conditions. There is no opportunity to further remove shade from the stream by any activity without exceeding its load capacity. Additionally, because this TMDL is dependent on background conditions for achieving water quality standards, all tributaries to the waters examined here need to be in natural conditions to prevent excess heat loads to the system.

Table 22 lists the total existing, target, and excess loads and the average lack of shade for each water body examined. The size of a stream influences the size of the excess load. Large streams have higher existing and target loads by virtue of their larger channel widths.

Although this TMDL analysis focuses on total solar loads, it is important to note that differences between existing and target shade, as depicted in the lack-of-shade figures (Appendix H, Figures H3, H6, and H9), are the key to successfully restoring these waters to achieving water quality standards. Target shade levels for individual reaches should be the goal managers strive for with future implementation plans. Managers should focus on the largest differences between existing and target shade as locations to prioritize implementation efforts. Each load analysis table contains a column that lists the lack of shade on the stream segment. This value is derived by subtracting target shade from existing shade for each segment. Thus, stream segments with the largest lack of shade are in the worst shape. The average lack of shade derived from the last column in each load analysis table is also listed in Table 22 and provides a general level of comparison among streams.

Because of similarity in vegetation and bankfull width, the Salmon River below Squaw Creek (AUs ID17060201SL019_05, 016_06, 014_06, and 001_06) had load reductions and allocations developed as a contiguous group.

Shade-deficient AUs without temperature data do not require the development of a TMDL (Table 22). These AUs are lacking determination of exceedances of Idaho’s water quality standard for either salmonid spawning or cold water aquatic life. Exceedances and thermographs are located in Appendix E for all of the Salmon River AUs examined. Most of the AUs in Challis and Squaw Creeks were previously determined to exceed their applicable water quality temperature standard.

Table 22. Total solar loads and average lack of shade for examined waters.

Water Body/ Assessment Unit	Total Existing Load	Total Target Load	Excess Load/ (Reduction)	Average Lack of Shade (%)	TMDL Completed
	(kWh/day)				
Salmon River (ID17060201SL001_06, ID17060201SL014_06, ID17060201SL016_06, ID17060201SL019_05)	25,030,000	24,350,000	680,000/ (3%)	-3	Yes
Challis Creek (ID17060201SL007_04)	340,000	260,000	84,000/ (25%)	-18	Yes
Challis Creek (ID17060201SL009_03)	490,000	280,000	210,000/ (43%)	-31	Yes
Challis Creek (ID17060201SL009_04)	130,000	92,000	38,000/ (29%)	-22	Yes
Squaw Creek (ID17060201SL021_04)	530,000	450,000	84,000/ (16%)	-18	Yes
Squaw Creek (ID17060201SL023_02)	290,000	240,000	48,000/ (17%)	-8	Yes
Squaw Creek (ID17060201SL023_03)	160,000	160,000	0/ (0%)	-2	Yes
Squaw Creek (ID17060201SL023_04)	170,000	150,000	19,000/ (11%)	-5	Yes
Aspen Creek (ID17060201SL024_02)	22,000	12,000	11,000/ (50%)	-5	Yes
Salmon River (ID17060201SL027_05)	2,100,000	2,300,000	0/ (0%)	-2	Yes
Salmon River (ID17060201SL031_05)	5,600,000	5,400,000	230,000/ (4%)	-5	Yes
Salmon River (ID17060201SL047_05)	5,200,000	4,800,000	420,000/ (8%)	-9	Yes
Salmon River (ID17060201SL063_05)	2,000,000	1,900,000	45,000/ (2%)	-4	Yes

Note: Load data are rounded to two significant figures, which may present rounding errors.

Many AUs are in reasonably good condition (as defined by excess loads less than 20%) with respect to shade and thermal loads (Table 22). The majority of AUs have average lack of shade values at or fewer than 10% and necessary load reductions less than 20%. The Salmon River AU ID17060201SL047_05 had the largest excess load, requiring an 8% reduction. This temperature-impaired reach includes the river from Valley Creek to Yankee Fork. The lack of shade in this region results primarily from the proximity of Hwy 75 to the river and the lack of vegetation on the north shore from rock piles under-pinning the road structure. Although shade deficits periodically exceed 15%, it is unlikely that the river could attain sufficient shade to reduce deficits due to the presence of the highway.

A single excess load was calculated for the four AUs of the Salmon River from Squaw Creek to the Pahsimeroi River. No load tables were presented for these AUs because of their considerable size. Several large islands have high shade levels (spikes in Figure H10) that could affect the outcome of the river load analysis. The shade on these islands does not necessarily directly cover the river itself; therefore, they were removed from the load analysis presented in Table 22. The

excess load to the river (not including shade from these islands) was only about 3% of the total existing load. Although the cottonwood-dominated valleys do lack shade because of agricultural activities and other effects to these plant communities, that loss of shade has only a minor effect on the river's heat budget due to large channel widths.

Squaw Creek also had low excess loads, with the 3rd-order segment having no excess loads and very little shade deficit. The 4th-order segment of Squaw Creek closest to the Salmon River (ID17060201SL021_04) did have some shade loss, likely due to land use activities in the area. The temperature-listed segment of Squaw Creek (ID17060201SL023_04) just upstream was in better condition. The 3rd-order reach further upstream had no identified excess loads. The 2nd-order AU of Squaw Creek includes a number of small tributaries that have some periodic shade deficits (see Table H9).

The three (3) AUs examined in Challis Creek appear to have the most impacts, with necessary load reductions between 25% and 43%. Average lack of shade along Challis Creek was also greater than in other AUs in the analysis. Lower Challis Creek has considerably more land use activities than other streams examined.

Aspen Creek (ID17060201SL024_02) requires a large load reduction (50%) despite having one of the smallest excess loads and shade deficits that rarely exceed 10% (Appendix H, Figure H7). This large load reduction results from its small size and the fact that a certain amount of excess load is potentially created by the existing shade/target shade difference inherent in the loading analysis. Because existing shade is reported as a 10% shade class and target shade a unique integer between 0 and 100%, there is usually a difference between the two. For example, say a particular stream segment has a target shade of 86% based on its vegetation type and natural bankfull width. If existing shade on that segment were at target level, it would be recorded as 80% in the loading analysis because it falls into the 80% existing shade class. There is an automatic difference of 6%, which could be attributed to the margin of safety. Aspen Creek rarely had shade deficits greater than this margin of safety and is likely to be in good condition overall. This AU is shade deficient and does not require the development of temperature TMDL. Further monitoring and development of a thermograph and temperature exceedances are required to determine impairment.

5.1.4.1 Wasteload Allocation

There are two known active NPDES-permitted point sources in watersheds adjacent to temperature TMDL waters (see Figure 4). The IDFG Sawtooth Fish Hatchery (Aquaculture General Permit, IDG-131010) is located on the Salmon River upstream from the first listed reach at Redfish Lake outlet. In the Squaw Creek area, Thompson Creek Mining Co. (TCM) (ID-002540-2) has five discharge outfalls listed in its NPDES permit, two of which (003 and 004) are to Squaw Creek and one (005) is in the Salmon River above Squaw Creek. The two Squaw Creek discharge outfalls include one for stormwater and the other for emergencies related to excess water at other outfalls. The Salmon River outfall is also for emergency discharge from other outfalls. TCM's primary outfalls (001 and 002) are in Thompson Creek tributaries. The TCM permit and Aquaculture General Permit require temperature monitoring as periodic grab samples, not continuous monitoring. Neither facility has temperature effluent limits. Neither facility discharges to a temperature-impaired AU nor is expected to contribute thermal loading to temperature-listed segments involved in this TMDL due to the nature of each discharge. No

temperature wasteload allocations are provided. Should a point source be proposed that would have thermal consequences on these waters, background provisions in Idaho water quality standards addressing such discharges (IDAPA 58.01.02.200.09; IDAPA 58.01.02.401.01) should be involved (see section 3.1 and Appendix A).

5.1.4.2 Margin of Safety

The margin of safety in this TMDL is considered implicit in the design. Because the target is essentially background conditions, loads (shade levels) are allocated to lands adjacent to these streams at natural background levels. Because shade levels are established at natural background or system potential levels, it is unrealistic to set shade targets at higher, or more conservative, levels. Additionally, existing shade levels are reduced to the next lower 10% shade class, which likely underestimates actual shade in the loading analysis. Although the loading analysis used in this TMDL involves gross estimations that are likely to have large variances, load allocations are applied to the stream and its riparian vegetation rather than specific nonpoint source activities and can be adjusted as more information is gathered from the stream environment.

5.1.4.3 Seasonal Variation

This TMDL is based on average summer loads. All loads have been calculated to be inclusive of the six-month period from April through September. This time period is when the combination of increasing air and water temperatures coincides with increasing solar inputs and vegetative shade. The critical time periods are April through June when spring salmonid spawning occurs, July and August when maximum temperatures may exceed cold water aquatic life criteria, and September when fall salmonid spawning is most likely to be affected by higher temperatures. Water temperature is not likely to be a problem for beneficial uses outside of this time period because of cooler weather and lower sun angle.

5.1.4.4 Natural Background

For PNV temperature TMDLs, it is assumed that natural temperatures may exceed these criteria during certain time periods. If PNV targets are achieved yet stream temperatures are warmer than these criteria, it is assumed that the stream's temperature is natural (provided there are no point sources or human-induced groundwater sources of heat) and natural background provisions of Idaho water quality standards apply:

> When natural background conditions exceed any applicable water quality criteria set forth in Sections 210, 250, 251, 252, or 253, the applicable water quality criteria shall not apply; instead, there shall be no lowering of water quality from natural background conditions. Provided, however, that temperature may be increased above natural background conditions when allowed under Section 401. (IDAPA 58.01.02.200.09)

Section 401 relates to point source wastewater treatment requirements. In this case, if temperature criteria for any aquatic life use are exceeded due to natural conditions, then a point source discharge cannot raise the water temperature by more than 0.3 °C (IDAPA 58.01.02.401.01.c).

5.2 Sediment TMDL

Idaho's 2012 Integrated Report lists twelve (12) AUs for sediment-related impairments. Of these listed AUs, eight (8) were found to be impaired for other causes (i.e., temperature, water

withdrawals [Category 4c]) or listed in error. The four (4) sediment impaired AUs (all within the Warm Spring Creek watershed) had sediment TMDLs developed in this document.

Additional sediment analysis occurred in the Salmon River to examine if sediment was a potential pollutant. The Salmon River was determined to have sufficient stream power to carry the sediment reaching the channel. Appendix C details the sediment examination in the Salmon River and other locations within the subbasin.

5.2.1 Instream Water Quality Targets

To restore full support of beneficial uses that have been impaired by excess sediment, TMDL load allocations were determined using the best available data and field verification. DEQ collected subsurface fine sediment and streambank stability data and measurements in 2013. Calculations, maps, photographs, and field notes documenting this work and interpretations are provided in Appendix C.

5.2.1.1 Design Conditions

The 2003 TMDL contains a detailed discussion of subbasin conditions (DEQ 2003). In summary, excess streambank erosion generally occurs during spring runoff when bankfull discharge occurs. Therefore, the stability characteristics of streambanks are measured at bankfull widths to determine the rate of excess erosion above natural background during peak flows.

5.2.1.2 Target Selection

In the original Upper Salmon River TMDL, instream sediment targets were established at 80% streambank stability and less than 28% of the total streambed particle volume for subsurface fine sediment (particles <6.35 millimeters) (DEQ 2003). These targets were retained for the sediment TMDLs developed in this addendum. Subsurface fines are an indicator of spawning bed quality. Streambank erosion is the sediment load generator. Methods for determining streambank stability from field observations are based on modified NRCS methods, Rosgen stream classification systems, and other applicable literature (Pfankuch 1975; Lohrey 1989; Rosgen 1996). The 28% subsurface fine sediment target is based on research of salmonid spawning success as it relates to particle size of spawning bed materials (Hall 1986; McNeil and Ahnell 1964; Reiser and White 1988). The methods DEQ uses for determining bank stability are summarized in Appendix C.

5.2.1.3 Water Quality Monitoring Points

DEQ monitors streambank stability by conducting streambank erosion inventories. When bioassessments indicate impairment and sediment is suspected as a pollutant, DEQ staff identify homogenous reaches of AUs to monitor for streambank stability by examining existing data and aerial photos. In the field, DEQ staff estimates the length of the streambanks that are completely stable by measuring the length, bank height, and condition of streambanks that are eroding. Recession rates (feet per year) of the eroding streambanks are determined in the field according to their condition rating. The percentage of stable and eroding streambanks are extrapolated to similar stream types in the AU.

This calculation for both the eroding and stable streambanks determines the relationship between load capacity at 80% streambank stability and the current load of the eroding areas. The load capacity is the natural, minimally erosive state (20%) one would expect of a primarily covered, stable streambank. The current load is the tons of sediment per year calculated for the eroding streambanks at their current condition. The difference between the current load and the load capacity (minus a margin of safety) is the necessary load reduction. Since the sediment-impaired streams in the Upper Salmon River subbasin are impaired from nonpoint sources (i.e., streambank erosion), wasteload allocations are of limited assistance in improving stream quality to the natural background load capacity. Therefore, this TMDL allocates sediment load reductions that are necessary to meet the load capacities on a seasonal basis. Allocating load reductions is useful in identifying the erosion magnitude and timing needed to improve land management and the application of BMPs.

DEQ conducted streambank erosion inventories at the eleven (11) locations indicated in Table 23. Four (4) AUs in the Upper Salmon River subbasin (Warm Spring Creek) exhibited impairment from sediment according to calculations from the field measurements and have received TMDLs and load allocations. Another two (2) AUs (Road and Mosquito Creeks)were examined to determine if sediment could be limiting beneficial uses, but these AUs did not have streambank erosion measurements indicative of a sediment impairment, nor were significant sources of sediment or hillslope erosion processes identified that would lead to impairments. In the two (2) Broken Wagon Creek AUs, the Salmon River tributaries, and Garden Creek, water limitations were identified as the only impairment (these AUs currently are, or are recommended to be, listed in Category 4c). Two (2) AUs received a modified streambank erosion inventory (SEI) to monitor recovery status (Basin and Slate Creeks); Slate Creek also received a traditional examination (see Appendix B for details).

The AUs exhibiting sediment impairment should be monitored as watershed improvement projects proceed to confirm that streambanks are becoming more stable and salmonid spawning habitat is improving. The SEI and sediment data are located in Appendix C. Despite historic concern that the main stem Salmon River AUs were sediment impaired, none were found to have any sediment impairments.

Table 23. Locations to monitor for sediment trends in the Upper Salmon River subbasin.

Water Body	Assessment Unit Number	Monitoring Location
Salmon River tributaries – Pennal Gulch to Pahsimeroi River	ID17060201SL001_02	N 44.64297 W 114.10712
Garden Creek	ID17060201SL015_03	Entire AU
Slate Creek	ID17060201SL099_02	N 44.1843250 W 114.613916
Road Creek	ID17060201SL125_03	N44.170888 W114.194462
Mosquito Creek	ID17060201SL126_02	N 44.152122 W114-175243
Warm Spring Creek	ID17060201SL131_04	N 44.446658 W 114.143501
Warm Spring Creek	ID17060201SL132_02	N 44.397217 W 114.090676
Warm Spring Creek	ID17060201SL132_03	Entire AU
Warm Spring Creek	ID17060201SL132_04	Entire AU
Broken Wagon Creek	ID17060201SL133_02	N 44.29913 W 114.03023
Broken Wagon Creek	ID17060201SL133_03	N 44.294760 W 114.055022

5.2.2 Load Capacity

The sediment load capacity is the sediment loading rate at which beneficial uses are supported, and reductions will be determined to meet those loads. The assumption is that this rate will be achieved at 80% streambank stability and possibly in combination with decreasing the streambank erosion rate. Monitoring helps determine the individual load capacity for each impaired reach. Progress toward the load capacity will be made through near-stream trail and road maintenance, land management, and improvement of riparian vegetative cover and stream channel condition.

Although the load capacity is calculated in this TMDL in terms of the surrogate sediment target of 80% streambank stability, the proportion of subsurface fine sediment is another indicator of meeting the sediment load capacity. Appendix C provides specific literature references for the subsurface fine sediment target of 28% for supporting salmonid spawning.

5.2.3 Estimates of Existing Pollutant Loads

To the extent possible, background loads should be distinguished from human-caused increases in nonpoint loads. Federal 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" (40 CFR §130.2(g)). The volume of eroding streambank at bankfull condition was calculated by measuring eroding bank height and length and evaluating the bank condition to estimate lateral recession rate during periods of high discharge, taking erodibility of

the soil type into consideration. Detailed results are in Appendix C. As a result of these survey results and calculations, the current loads estimated for the Upper Salmon River subbasin are in Table 24. Appendix B includes AU-specific notes detailing observations and interpretations.

Table 24. Current sediment loads from nonpoint sources within the Upper Salmon River subbasin.

Load Type	Assessment Unit	Current Load (tons/year)	Estimation Method	TMDL Required?
Annual sediment	ID17060201SL001_02 Salmon River tributaries – Pennal Gulch to Pahsimeroi River	57	Observed erosion rate calculated on target of 80% streambank stability	No
	ID17060201SL015_03 Garden Creek	1.1		No
	ID17060201SL099_02 Slate Creek	2,244[a]		Yes
	ID17060201SL125_03 Road Creek	10		No
	ID17060201SL126_02 Mosquito Creek	16		No
	ID17060201SL131_04 Warm Spring Creek	3,958		Yes
	ID17060201SL132_02 Warm Spring Creek	11,378		Yes
	ID17060201SL132_03 Warm Spring Creek	25 (2,450)[b]		Yes
	ID17060201SL132_04 Warm Spring Creek	1,406		Yes
	ID17060201SL133_02 Broken Wagon Creek	0		No
	ID17060201SL133_03 Broken Wagon Creek	2.7		No

[a] Slate Creek was impacted from a natural microburst-induced flood leading to destruction of the channel bed and vegetation in the upper portions of the creek.
[b] ID17060201SL132_03 Warm Spring Creek is not impaired from sources internal to the AU but from upstream sources. Therefore, number in parentheses is approximately a quarter of upstream AU (ID17060201SL132_02 Warm Spring Creek) load.

5.2.4 Load and Wasteload Allocation

Sediment load allocations are estimated targets to improve water quality so beneficial uses of cold water aquatic life and/or salmonid spawning are fully supported. Table 25 lists the difference between the current sediment load and the load capacity (minus a 10% margin of safety) of the impaired AUs. This difference equals the necessary load reduction.

The load allocation is the amount of sediment that can be discharged to the stream and still meet the water quality standards (load capacity), inclusive of a 10% margin of safety. However, as sediment in these AUs is solely from streambank sources, the allocation required to meet load capacity will be partitioned among different flow regimes likely to be encountered throughout the year. This method better directs implementation to times of greatest loads. Table 25 lists the sediment reductions necessary to achieve the load capacity of the AU.

Table 25. Sediment loads from nonpoint sources in Upper Salmon River subbasin.

AU (ID17060201)	Segment	Current Load (tons/ year)	Load Capacity (tons/year)	Margin of safety (tons/ year)	Load Allocation (tons/year)	Necessary Load Reduction (tons/year)	Necessary Percent Reduction
SL001_02	Salmon River tributaries – Pennal Gulch to Pahsimeroi River (Shep Creek)	57	94	9	85	n/a	n/a
SL015_03	Garden Creek	1	7	1	6	n/a	n/a
SL099_02	Slate Creek[a]	2,244	202	20	182	2062	91
SL125_03	Road Creek	10	42	4	38	n/a	n/a
SL126_02	Mosquito Creek	16	32	3	29	n/a	n/a
SL131_04	Warm Spring Creek	3,958	247	25	222	3,736	94
SL132_02	Warm Spring Creek	11,378	2,722	272	2,450	8,928	77
SL132_03	Warm Spring Creek	25[b]	163	16	147	n/a	n/a
SL132_04	Warm Spring Creek	1,406	281	28	253	1,153	80
SL133_02	Broken Wagon Creek	0	4.4	0.4	4.0	n/a	n/a
SL133_03	Broken Wagon Creek	3	4.4	0.4	4.0	n/a	n/a

[a] This AU has a sediment load from a natural microburst-induced flood leading to destruction of the channel bed and vegetation in the upper portions of the creek. Recommendation is to relist into Category 4c (see Appendix B).
[b] This AU is not impaired from sources internal to the AU (as reflected in low streambank erosion) but from upstream sources.

Four AUs require load reductions that are being developed in this TMDL (Table 25; Figure 20). There is an automatic assumption that measured/observed streambank erosion was based on a single year of erosion (tons/year). This assumption most likely overstates the loads as the combination of water withdrawals and naturally intermittent reaches diminishes the stream power, and observed erosion/sediment build-up is most likely occurring over multiple years. This assumption is deemed appropriate as the streams do transport sediment when water is flowing and at rates that cause impairments to the beneficial uses; any additional mass of sediment is considered as additive to the overall margin of safety. According to the 2003 TMDL, the perennial portion of Warm Spring Creek flows approximately one hundred (100) yards in its natural channel before it is diverted in its entirety into a constructed channel for agriculture and hydroelectric purposes, leaving no water in the original natural stream course. The lowest AU (ID17060201SL131_04) is specific to the Warm Spring Creek main stem, but the contributing area is highlighted for discharge estimation purposes (Figure 20).

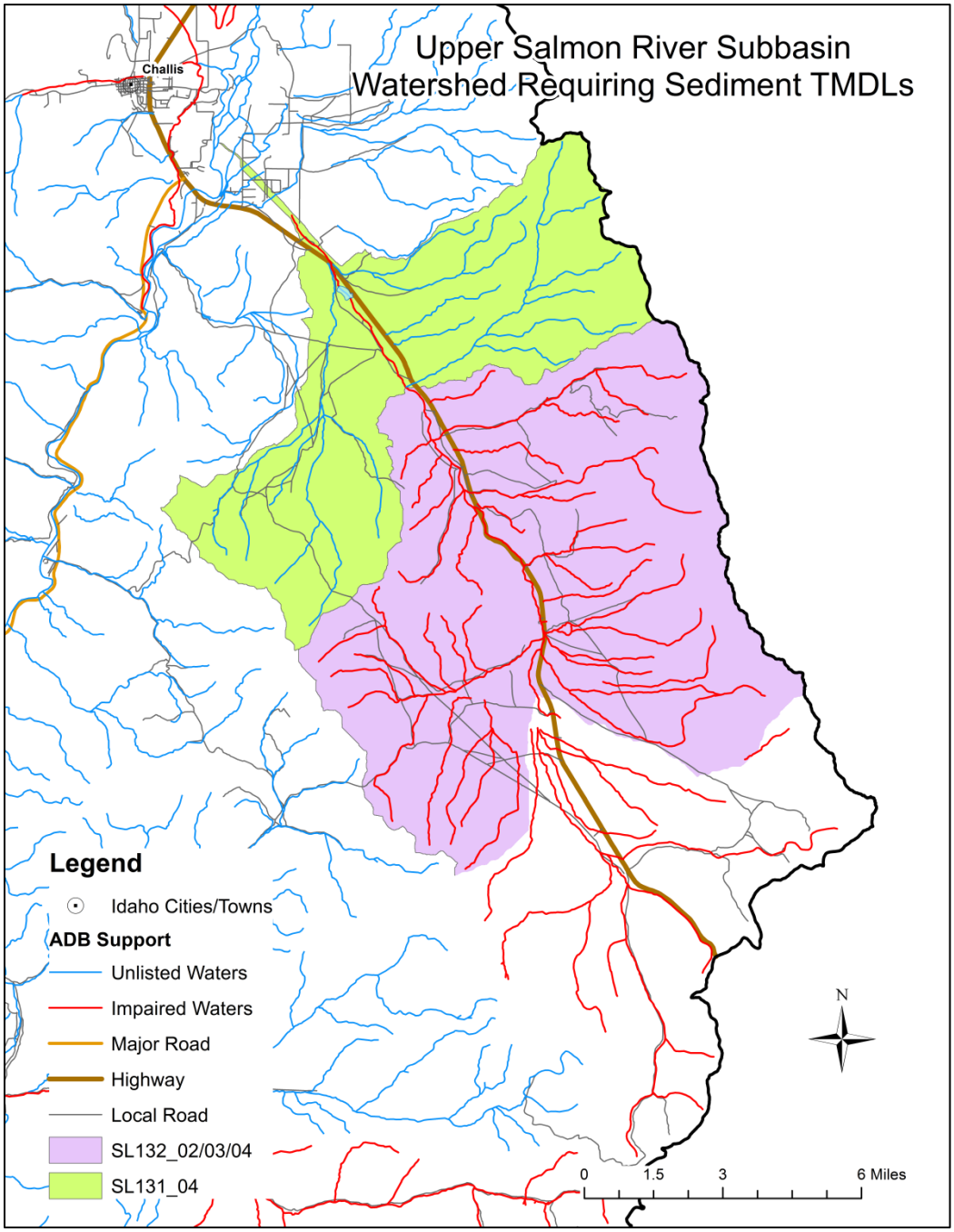


Figure 20. Assessment unit segments and subwatersheds requiring sediment reductions in the Upper Salmon River subbasin.

Peak discharges in these sediment-impaired streams occur during spring snowmelt. The largest proportion of sediment is eroded from the streambanks during spring discharge, except for the main stem reaches of the upper Salmon River (Appendix C). The daily sediment load is allocated based on discharge. Flow duration intervals summarize the cumulative frequency of historic discharge data over the period of record for which discharge data have been recorded. No gages are located in the AUs of concern; therefore, USGS StreamStats was used to estimate monthly discharges (*http://water.usgs.gov/osw/streamstats/idaho.html*).

EPA describes an approach for using load duration curves in developing TMDLs and specifies calculating the cumulative frequency distribution using discharge records (EPA 2007). Extrapolations from this EPA guidance were used to adapt the data from the USGS StreamStats discharge estimations. The 0–20th percentile discharges are designated as high discharges, 20th–50th percentiles as midrange discharges, 50th–80th as dry conditions, and 80th–100th as low flow conditions. However, in the Warm Spring Creek watershed, the streams will likely have minimal or no flow during the majority of the year due to natural precipitation limitations onto a porous volcanic soil and water rights allocations. It is also expected that the baseline assumptions in StreamStats of precipitation minimums are too high and that those assumptions will be adapted using BURP data (when available), observations, or other data/information sources.

AU# ID17060201SL131_04

Results of the flow duration intervals allocating sediment load reductions are summarized in Table 26. In AU ID17060201SL131_04 (Warm Spring Creek—Hole-in-Rock Creek to mouth), load allocations were developed using the StreamStats modified flow duration curve. StreamStats output was modified to account for the water withdrawals and precipitation below the range of the predictive equations. Flow duration intervals of the monthly discharge estimations were developed for this AU (Figure 21).

- High discharges (0–20th percentile time interval) occur between 0.8 and 1.8 cfs (mid-point = 1.3 cfs).
- Middle-range discharges (20th–50th percentile time interval) occur between 0 and 0.8 cfs (mid-point = 0.4 cfs).
- Dry conditions and low flow (50th–100th percentile time interval) occur at 0 cfs.

High flow period lasts seventy-three (73) days (20% of 365 days) where 76% of the annual flow occurs (based on ratio of mid points or 1.3/1.3+0.4). Mid-range flow lasts 110 days (30% of 365 days) where 24% of the annual flow occurs (based on 0.4/1.3+0.4). Prorating the load allocation over these time periods and flow volumes results in 2.3 tons per day during the high flow and 0.48 tons per day during the mid-range flow (see LA in Table 26). The low flow period receives no load allocation because of the lack of flow.

Table 26. Allocations for sediment load reductions.

Assessment Unit	Load Capacity (tons/year)	Load Allocation (tons/year)	Load Allocation (tons/day)	Wasteload Allocation
ID17060201SL131_04 Warm Spring Creek—Hole-in-Rock Creek to mouth	247	222	High flow (73 days): 2.3 tons/day Mid flow (110 days): 0.48 tons/day Low flow (182 days): 0 tons/day	
ID17060201SL132_02/03/04 Warm Spring Creek—source to Hole-in-Rock Creek	3,167	2,850	High flow (73 days): 30.8 tons/day Mid flow (110 days): 5.4 tons/day Low flow (182 days): 0 lbs/day	471 lbs/day (86 tons/year)

Note: Three AU load allocations (2nd 3rd & 4th orders) are combined for ID17060201SL132. See Table 27. The wasteload allocation is for the ID17060201SL132_04 AU only.

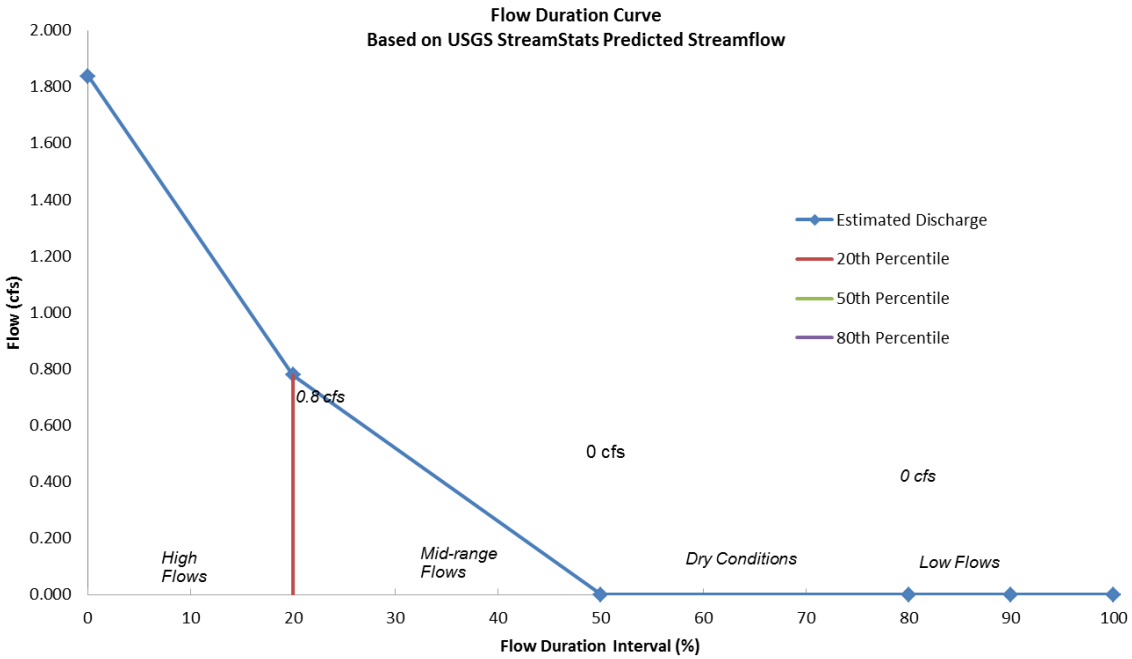


Figure 21. Flow duration curve for the ungaged stream segment in Warm Spring Creek (ID17060201SL131_04).

AU# ID17060201SL132_02 & _03 & _04

In AUs ID17060201SL132_02/03/04 Warm Spring Creek (source to Hole-in-Rock Creek), load reductions (Table 27) were developed using the StreamStats modified flow duration curve (Figure 22). All the AUs were combined as the intermittent nature of the multiple streams precludes individual flow curves. Therefore, the point of TMDL concern is at the confluence with Hole-in-Rock Creek for this grouping. However, basic assumptions of streambank stability must also be met. StreamStats output was modified to account for the water withdrawals and precipitation below the range of the predictive equations. The Warm Spring Creek (ID17060201SL132_04) BURP site (1995SIDFA033) had a measured discharge of 1.6 cfs and was used as the metric to calibrate the StreamStats output. The stream is intermittent and often dry, both from natural causes and water withdrawals, but sediment and erosion do cause impairments to the stream system. Precipitation in the valley is typically in the 8–12 inches per year range.

Table 27. Sediment loads from combined waters of Warm Spring Creek (ID17060201SL132_02/03/04) in Upper Salmon River subbasin.

AU (ID17060201)	Segment	Current Load (tons/year)	Load Capacity (tons/year)	Margin of safety (tons/year)	Load Allocation (tons/year)	Load Reduction (tons/year)	Percent Reduction
SL132_02	Warm Spring Creek	11,378	2,722	272	2,450	8,928	77
SL132_03	Warm Spring Creek	25[a]	164	16	147	n/a	n/a
SL132_04	Warm Spring Creek	1,406	281	28	253	1,153	80
SL132_All		**12,809**	**3,167**	**316**	**2,850**	**10,080**	**79**

[a] This AU is not impaired from sources internal to the AU but from upstream sources. For load allocation purposes (as compared to impairment designation), the measured load will be used in allocating reductions.

[b] The load allocation for SL132_04 has had the wasteload allocation of 471 lbs/day or 86 tons/year removed from it for the aquaculture facility.

This AU combination was estimated to have a load capacity of 3,167 tons/year and a load allocation of 2,850 tons/year. Flow duration intervals of the monthly discharge estimations were developed for this AU (Figure 22).

- High discharges (0–20th percentile time interval) occur between 0.6 and 1.6 cfs (mid-point = 1.1 cfs).
- Middle-range discharges (20th–50th percentile time interval) occur between 0 and 0.6 cfs (mid-point = 0.3 cfs).
- Dry conditions and low flow (50th–100th percentile time interval) occur at 0 cfs.

High flow period lasts 73 days (20% of year) where 79% of the annual flow occurs (based on ratio of midpoints or 1.1/1.1+0.3). Mid-range flow lasts 110 days (30% of year) where 21% of the annual flow occurs (based on 0.3/1.1+0.3). Prorating the load allocation over these time periods and flow volumes results in 30.8 tons per day during the high flow and 5.4 tons per day during the mid-range flow, however, it is recognized that the wasteload allocation will exist during the low flow period (see LA in Table 26).

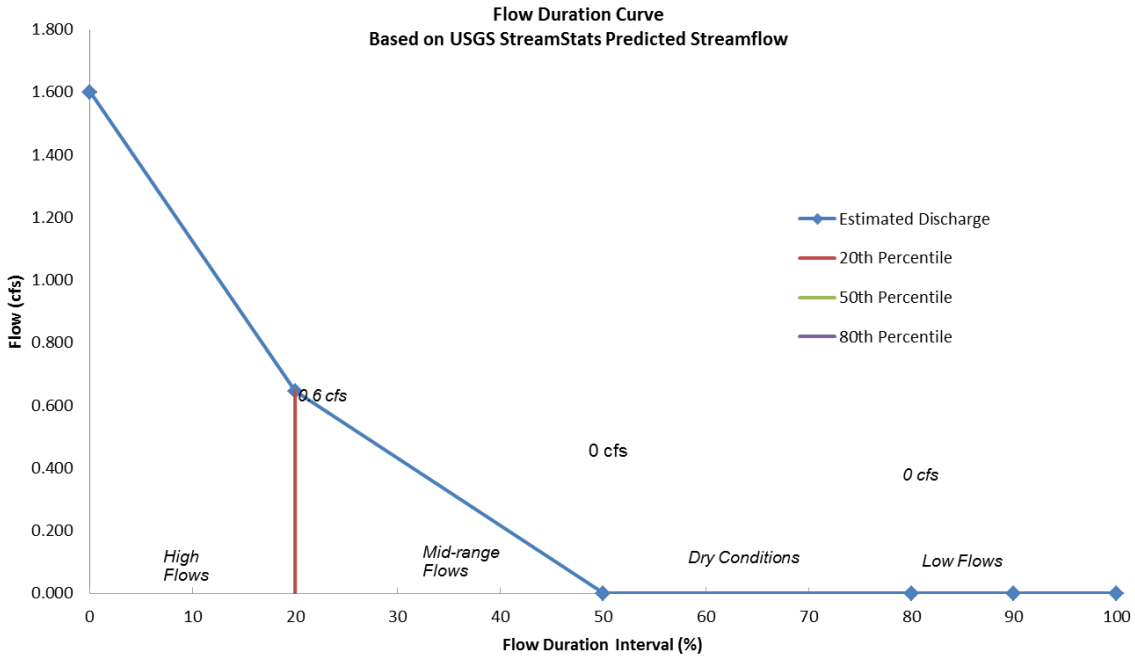


Figure 22. Flow duration curve for the ungaged stream segment in Warm Spring Creek (ID17060201SL132_02/03/04).

5.2.4.1 Wasteload Allocation

There is one wasteload allocation (see Table 26) for a potential future permitted facility (formerly Epicenter Aquaculture) within the Warm Springs Creek watershed (see Figure 4). Section 5.4 discusses the possible future use of the Epicenter Aquaculture facility. The facility is located in AU# ID17060201SL132_04 of Warm Springs Creek. The sediment wasteload

allocation for the facility is based on previous facility flow and TSS effluent limits established in the individual permit for Epicenter Aquaculture. The effluent limit and flow used in the wasteload allocation are 12.7 mg/L (monthly average limit) and 6.9 cfs facility flow (see link for previous permit: *https://yosemite.epa.gov/r10/water.nsf/95537302e2c56cea8825688200708c9a/2978a2d617a53f36882568790059bd3c/$FILE/ID0028266%20FP.pdf*).

The wasteload allocation of 471 pounds per day has been calculated as follows:

12.7 mg/L x 28.3 L/cu. ft. x 6.9 cfs x 86400 s/day x 2.2 lbs/1,000,000 mg = 471 lbs/day.

5.2.4.2 Margin of Safety

An explicit 10% margin of safety is added to the load allocations to ensure the assimilative capacity is met and allowances account for variability. The following assumptions in methodology also build in an additional implicit margin of safety:

- The SEI is a conservative method using assumptions of bankfull discharges that mobilize the banks and substrate. Since bankfull discharges are typically considered to have a 1.5-year recurrence interval, assumptions of bankfull discharges on an annual basis and associated erosion add to the conservative nature during the allocation process.
- These AUs are flow-limited and are often dry; therefore, assumptions of annual loads and processes overestimate the actual load, which is based on an annual erosion rate.
- The wasteload allocation has an implicit margin of safety as the load is based on the TSS effluent limit which is likely to contain organic sediment in addition to mineral sediment. The allocation assumes that it is entirely mineral sediment.

5.2.4.3 Seasonal Variation

Peak discharges in these sediment-impaired streams occur during spring snowmelt. The largest proportion of sediment is eroded from the streambanks during spring discharge. The daily sediment load is allocated based on this discharge dominated curve.

5.2.4.4 Natural Background

Sediment load allocations are estimated targets to improve water quality to support beneficial uses of cold water aquatic life and/or salmonid spawning. The load capacity is the natural, minimally erosive state in a vegetated and stable streambank. The load capacity is the natural background condition, currently targeted to be 80% stable streambanks. Sediment may be the causal factor for impairment, but until the stream meets the designated beneficial uses, typically determined by passing BURP scores, any implementation and load reduction cannot be deemed successful.

5.3 Bacteria TMDL

E. coli was determined to be impairing water quality in one unlisted AU (Herd Creek).

5.3.1 Instream Water Quality Targets

Instream water quality targets for the bacteria-impaired waters in the Upper Salmon River subbasin were set from the Idaho water quality standards. The water quality standards relate beneficial use impairment to a numeric standard. The State of Idaho water quality standards prescribe *E. coli* criteria for both primary and secondary contact recreation. To support the recreation beneficial uses, the number of *E. coli* colonies may not exceed a geometric mean of 126 organisms/100 milliliters (mL) for five (5) samples collected every three (3) to seven (7) days within a thirty (30) day period (IDAPA 58.01.02.251.01). For secondary contact recreation, which is applicable to Herd Creek, an instantaneous sample of 576 organisms/100 mL triggers the need for additional sampling to calculate the geometric mean for comparison to the criterion.

5.3.1.1 Design Conditions

Bacteria affect streams throughout the summer months and into the fall during baseflow conditions. The critical period for recreational beneficial use is from May through October. With no known sources of human-caused bacteria loading, it is assumed that the observed *E. coli* levels are caused by a combination of wildlife, waterfowl, and livestock. To protect the beneficial use, the design conditions include the critical period when the bacteria contamination is most likely to occur.

5.3.1.2 Target Selection

The number of *E. coli* colonies may not exceed a geometric mean of 126 organisms/100 mL for five (5) samples collected every three (3) to seven (7) days within a thirty (30) day period.

5.3.1.3 Water Quality Monitoring Points

The Upper Salmon River impaired by bacteria were monitored for compliance with the *E. coli* bacteria secondary contact recreation criteria at the locations where exceedances were last identified and where future monitoring should occur (as necessary):

- Herd Creek at 2011SIDFA016—N 44.13843° W -114.28108°

5.3.2 Load Capacity

In bacteria TMDLs, the water quality standard is the load capacity of a system. Because the bacteria target is in colony forming units (cfu) per 100mL, we have converted it to a daily load by using the average monthly flow for the month of sampling and a conversion factor that converts mL per second to cubic feet per day:

> LC (cfu/day) = WQS (cfu/100 mL) * flow (cfs) * unit conversion factor where,
> unit conversion factor = 24,465,525 ml*s / ft3*day.

5.3.3 Estimates of Existing Pollutant Loads

Herd Creek (ID17060201SL118_04) monitoring was associated with the 2011 BURP monitoring of site 2011SIDFA016. The initial sample exceeded the instantaneous threshold for secondary contact recreational beneficial uses and required additional monitoring. A 5-sample geometric mean analysis was initiated. The geometric mean of 282 organisms/100 mL for 5 samples

requires TMDL development (Table 28). Additional recent monitoring for bacteria has also occurred in the subbasin (Table 28).

Table 28. Bacteria monitoring results in the Upper Salmon River subbasin.

AU	Stream	Site ID	Date	*E. coli* (organisms/100 mL)
ID17060201SL118_04	Herd Creek	2011SIDFA016	Aug/Sep 2011	282 geomean[a]
ID17060201SL086_03	Champion Creek	2011SIDFA020	Aug 2011	2 single sample
ID17060201SL001_02	Shep Creek	1998SIDFA133	June 2010	13 single sample
			April 2012	3 geomean[a]
ID17060201SL002_03	Morgan Creek	2011SIDFA015	Aug 2011	48 single sample
ID17060201SL020_02	Kinnikinic Creek	2013SIDFA020	Aug 2013	19 single sample
ID17060201SL023_04	Squaw Creek	2013SIDFA022	Aug 2013	167 single sample
ID17060201SL034_03	Yankee Fork 2	2011SIDFA030	Aug 2011	31 single sample
	Yankee Fork 1	2011SIDFA029	Aug 2011	70 single sample
ID17060201SL083_03	Smiley Creek	2011SIDFA019	Aug 2011	13 single sample
ID17060201SL087_02	Fourth of July Creek	2011SIDFA028	Aug 2011	2 single sample
ID17060201SL088_02	Fisher Creek	2011SIDFA021	Aug 2011	31 single sample
ID17060201SL099_03	Slate Creek	2011SIDFA018	Aug 2011	2 single sample
		2013SIDFA019	Aug 2013	38 single sample
ID17060201SL100_02	Holman Creek	2011SIDFA017	Aug 2011	25 single sample

[a] The "geomean" is the geometric mean calculated from 5 samples collected in a 30-day period every 3–7 days.

5.3.4 Load Allocation

No AUs were listed for *E. coli* bacteria (or fecal coliform) in the 2012 Integrated Report, but as part of BURP monitoring data, one AU (Herd Creek) had a 5-sample geometric mean calculated from 2011 monitoring data (Table 28). Herd Creek was found to be exceeding the water quality standard for bacteria. Historically, Idaho monitored for fecal coliform, but the standard changed in 2006 to *E. coli*, common intestinal bacteria found in warm-blooded animals and therefore considered more directly pathogenic to humans. The load and allocation for the AU requiring a TMDL is in Table 29. Since the bacteria target level is the WQS or 126 cfu/100mL, we convert that target to a load capacity on a daily basis. The August average monthly flow for Herd Creek (43 cfs) was used in this calculation. We then determined the load allocation by subtracting a 10% MOS from the load capacity as follows:

> LA = 126 cfu/100mL x 43cfs x 24,465,525 mL*s/cu. ft.*day = 132,554,214,450 cfu/day x 90% (MOS removal) = 119,298,793,005 cfu/day

The current load in August in Herd Creek was based on a sampled geomean of 282 cfu/100mL and is shown calculated below. Thus, the excess load is the current load minus the load allocation, resulting in a needed 60% reduction in order to achieve the load allocation:

> 282 cfu/100mL x 43cfs x 24,465,525 mL*s/cu. ft.*day = 296,668,956,150 cfu/day

Table 29. Nonpoint source bacteria load allocation for the Upper Salmon River subbasin.

Assessment Unit	Load Allocation (cfu/day)	Current Load (cfu/day)	Excess Load (cfu/day)	Percent Reduction
ID17060201SL118_04 Herd Creek	119,298,793,005	296,668,956,150	177,370,163,145	60%

Herd Creek is believed to be affected primarily by grazing in the late summer months when range is accessible, but this bacteria source is compounded by the general habitat being suitable for elk, deer, and pronghorn antelope. Additional inputs are expected to come from the herds of wild horses that roam in this portion of the subbasin. The WQS level is set to account for these sources (Table 29). The BURP scores for the stream were excellent and electrofishing collected both Rainbow Trout (presumably steelhead) and Chinook Salmon (see Appendix F). Based on the time of year of the 2011 *E. coli* monitoring, it is suspected that the grazing management plans dictate removal of stock at approximately the time of monitoring. These are likely the expected highest *E. coli* measurements as livestock are atypically congregated.

Future bacteria sampling, as monthly geomeans, may occur in any month of the year. Load allocations are determined based on the average monthly flow for Herd Creek (Table 30). Monthly geomean sampling can be converted to a current load using the unit conversion and compared to the appropriate LA for that month.

Table 30. Monthly Flow Averaged Load Allocations, Herd Creek, Upper Salmon River subbasin.

Month	Ave Monthly Flow (cfs)	Target E coli (cfu/100mL)	Unit conversion (mL s/cu.ft. day)	LA (w/10% MOS)
Jan	20	126	24,465,525	55,487,810,700
Feb	18	126	24,465,525	49,939,029,630
Mar	17	126	24,465,525	47,164,639,095
Apr	26	126	24,465,525	72,134,153,910
May	106	126	24,465,525	294,085,396,710
Jun	205	126	24,465,525	568,750,059,675
Jul	97	126	24,465,525	269,115,881,895
Aug	43	126	24,465,525	119,298,793,005
Sep	31	126	24,465,525	86,006,106,585
Oct	24	126	24,465,525	66,585,372,840
Nov	23	126	24,465,525	63,810,982,305
Dec	21	126	24,465,525	58,262,201,235

Note: Flows are from USGS Gage # 13297597 Herd Creek bl Trail Gulch nr Clayton, ID. 10/1/79 to 9/30/84

Margin of Safety

The bacteria TMDL has an explicit margin of safety set at 10% (Table 29 & 30). In addition, any conservative approaches used in the various calculations required by a TMDL serve as an implicit component of the margin of safety.

5.3.4.1 Seasonal Variation

For the Upper Salmon River subbasin AUs, the summer growing season is when concentrations of bacteria are the highest. This season is also when water flow is lowest. With lower water flow,

bacteria increase due to a combination of agricultural diversion, cattle grazing, and limited water sources for wildlife. Seasonal variation as it relates to development of this TMDL is addressed 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. However, the 126 organisms/100 mL calculated from a 5-sample geometric mean criterion is expected to be met year-round.

5.3.4.2 Natural Background

A geometric mean of 126 organisms/100 mL for 5 samples collected within thirty (30) days is deemed as being protective of beneficial uses and meeting water quality standards. This determination is dependent on identifying changes in the source load and pathways that have led to exceedances of the standard. Natural sources are accounted for in the load allocations (Table 29 & 30).

5.4 Construction Stormwater and TMDL Wasteload Allocations

Stormwater runoff is water from rain or snowmelt that does not immediately infiltrate into the ground and flows over or through natural or man-made storage or conveyance systems. When undeveloped areas are converted to land uses with impervious surfaces—such as buildings, parking lots, and roads—the natural hydrology of the land is altered and can result in increased surface runoff rates, volumes, and pollutant loads. Certain types of stormwater runoff are considered point source discharges for Clean Water Act purposes, including stormwater that is associated with municipal separate storm sewer systems (MS4s), industrial stormwater covered under the MSGP, and construction stormwater covered under the Construction General Permit (CGP).

There are five facilities within the subbasin with various NPDES permits (Table 31 and Figure 4). Most discharge to waters that are of full support status or are un-assessed and are not involved in TMDLs developed in this document. The Thompson Creek mine is adjacent to the Squaw Creek watershed that has a temperature TMDL developed in Section 5.1. The Sawtooth Fish Hatchery is also upstream of the Salmon River temperature TMDL. The nature of the discharges in relation to potential wasteload allocations is discussed in Section 5.1.4.1. The facilities are not anticipated to affect stream temperatures within Squaw Creek or the Salmon River.

Epicenter Aquaculture is a terminated individual NPDES permit for aquaculture. It is our understanding that the facility maybe starting up again under new ownership, however, a discharge permit has not been issued at this time. The previous discharge point was to a canal adjacent to Warm Springs Creek, which is subject to a sediment TMDL in Section 5.2. Sediment loads are generated from streambank erosion inventories. This facility is not anticipated to discharge sediment directly to Warm Springs Creek, however, because of its proximity and potential for discharge under a new permit, the effluent limits for TSS within the permit shall be the sediment wasteload allocation for this discharge (see Section 5.2.4.1).

Table 31. NPDES Permits within the Upper Salmon River subbasin.

Permit #	Facility	Type	Water Body (AU)	Water Status
IDG131010	IDFG – Sawtooth Fish Hatchery	Aquaculture General	Salmon River (ID17060201SL068_05)	Full Support
ID0026468	Hecla Mining Co. GCU	Individual	Jordan Creek (ID17060201SL042_03) Yankee Fork (ID17060201SL034_04)	Full Support Full Support
IDR053105	Hecla Mining Co. GCU	Stormwater GP	Jordan Creek watershed	Full Support
ID0025402	Thompson Creek Mining Co.	Individual	Pat Hughes Creek (ID17060201SL029_02)	Not Assessed
IDR10BZ56 IDR10BY67	Thompson Creek Mining Co.	Stormwater GP	Thompson Creek, Squaw Creek watersheds	Temperature TMDL nearby
IDR053102	Challis Mine	Stormwater GP	Garden Creek (ID17060201SL015_02)	Full Support
ID0028266	Epicenter Aquaculture	Individual (terminated)	Canal adjacent to Warm Springs Creek (ID17060201SL132_04)	Sediment TMDL nearby

5.4.1 Municipal Separate Storm Sewer Systems

Polluted stormwater runoff is commonly transported through MS4s, from which it is often discharged untreated into local water bodies. An MS4, according to 40 CFR 122.26(b)(8), is a conveyance or system of conveyances that meets the following criteria:

- Owned by a state, city, town, village, or other public entity that discharges to waters of the United States
- Designed or used to collect or convey stormwater (including storm drains, pipes, ditches, etc.)
- Not a combined sewer
- Not part of a publicly owned treatment works (sewage treatment plant)

To prevent harmful pollutants from being washed or dumped into an MS4, operators must obtain an NPDES permit from EPA, implement a comprehensive municipal stormwater management program, and use best management practices (BMPs) to control pollutants in stormwater discharges to the maximum extent practicable.

There are no MS4 permits in the HUC. With a total population in the county of 4, 140 none of the municipalities meet the population threshold requiring the MS4 permit.

5.4.2 Industrial Stormwater Requirements

Stormwater runoff picks up industrial pollutants and typically discharges them into nearby water bodies directly or indirectly via storm sewer systems. When facility practices allow exposure of industrial materials to stormwater, runoff from industrial areas can contain toxic pollutants (e.g., heavy metals and organic chemicals) and other pollutants such as trash, debris, and oil and grease. This increased flow and pollutant load can impair water bodies, degrade biological habitats, pollute drinking water sources, and cause flooding and hydrologic changes, such as channel erosion, to the receiving water body.

Multi-Sector General Permit and Stormwater Pollution Prevention Plans

In Idaho, if an industrial facility discharges industrial stormwater into waters of the US, the facility must be permitted under EPA's most recent MSGP. To obtain an MSGP, the facility must prepare a stormwater pollution prevention plan (SWPPP) before submitting a notice of intent for permit coverage. The SWPPP must document the site description, design, and installation of control measures; describe monitoring procedures; and summarize potential pollutant sources. A copy of the SWPPP must be kept on site in a format that is accessible to workers and inspectors and be updated to reflect changes in site conditions, personnel, and stormwater infrastructure.

Industrial Facilities Discharging to Impaired Water Bodies

Any facility that discharges to an impaired water body must monitor all pollutants for which the water body is impaired and for which a standard analytical method exists (see 40 CFR Part 136).

Also, because different industrial activities have sector-specific types of material that may be exposed to stormwater, EPA grouped the different regulated industries into twenty-nine (29) sectors, based on their typical activities. Part 8 of EPA's MSGP details the stormwater management practices and monitoring that are required for the different industrial sectors. DEQ anticipates including specific requirements for impaired waters as a condition of the 401 certification. Any new MSGP will detail the specific monitoring requirements.

TMDL Industrial Stormwater Requirements

When a stream is on Idaho's §303(d) list and has a TMDL developed, DEQ may incorporate a wasteload allocation for industrial stormwater activities under the MSGP. However, most load analyses developed in the past have not identified sector-specific numeric wasteload allocations for industrial stormwater activities. Industrial stormwater activities are considered in compliance with provisions of the TMDL if operators obtain an MSGP under the NPDES program and implement the appropriate BMPs. Typically, operators must also follow specific requirements to be consistent with any local pollutant allocations. The next MSGP will have specific monitoring requirements that must be followed. One MSGP is active in the HUC, at the Grouse Creek Mine (Permit#IDR05C429).

5.4.3 Construction Stormwater

The Clean Water Act requires operators of construction sites to obtain permit coverage to discharge stormwater to a water body or municipal storm sewer. In Idaho, EPA has issued a general permit for stormwater discharges from construction sites.

Construction General Permit and Stormwater Pollution Prevention Plans

If a construction project disturbs more than one (1) acre of land (or is part of a larger common development that will disturb more than one (1) acre), the operator is required to apply for a CGP from EPA after developing a site-specific SWPPP. The SWPPP must provide for the erosion, sediment, and pollution controls they intend to use; inspection of the controls periodically; and maintenance of BMPs throughout the life of the project. Operators are required to keep a current

copy of their SWPPP on site or at an easily accessible location. There are currently five (5) active permits in the HUC.

TMDL Construction Stormwater Requirements

When a stream is on Idaho's §303(d) list and has a TMDL developed, DEQ may incorporate a gross wasteload allocation for anticipated construction stormwater activities. Most loads developed in the past did not have a numeric wasteload allocation for construction stormwater activities. Construction stormwater activities are considered in compliance with provisions of the TMDL if operators obtain a CGP under the NPDES program and implement the appropriate BMPs. Typically, operators must also follow specific requirements to be consistent with any local pollutant allocations. The CGP has monitoring requirements that must be followed.

Postconstruction Stormwater Management

Many communities throughout Idaho are currently developing rules for postconstruction stormwater management. Sediment is usually the main pollutant of concern in construction site stormwater. DEQ's *Catalog of Stormwater Best Management Practices for Idaho Cities and Counties* (DEQ 2005) should be used to select the proper suite of BMPs for the specific site, soils, climate, and project phasing in order to sufficiently meet the standards and requirements of the CGP to protect water quality. Where local ordinances have more stringent and site-specific standards, those are applicable.

5.4.4 Water Diversion

Stream temperature may be affected by diversions of water for water rights purposes. Diversion of flow reduces the amount of water exposed to a given level of solar radiation in the stream channel, which can result in increased water temperature in that channel. Loss of flow in the channel also affects the ability of the near-stream environment to support shade-producing vegetation, resulting in an increase in solar load to the channel.

Although these water temperature effects may occur, nothing in this TMDL supersedes any water appropriation in the affected watershed. Section 101(g), the Wallop Amendment, was added to the CWA as part of the 1977 amendments to address water rights. It reads as follows:

> It is the policy of Congress that the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by this chapter. It is the further policy of Congress that nothing in this chapter shall be construed to supersede or abrogate rights to quantities of water which have been established by any State. Federal agencies shall co-operate with State and local agencies to develop comprehensive solutions to prevent, reduce and eliminate pollution in concert with programs for managing water resources.

Additionally, Idaho water quality standards indicate the following:

> The adoption of water quality standards and the enforcement of such standards is not intended to…interfere with the rights of Idaho appropriators, either now or in the future, in the utilization of the water appropriations which have been granted to them under the statutory procedure… (IDAPA 58.01.02.050.01)

In this TMDL, we have not quantified what impact, if any, diversions are having on stream temperature. Water diversions are allowed for in state statute, and it is possible for a water body to be 100% allocated. Diversions notwithstanding, reaching shade targets as discussed in the

TMDL will protect what water remains in the channel and allow the stream to meet water quality standards for temperature. This TMDL will lead to cooler water by achieving shade that would be expected under natural conditions and water temperatures resulting from that shade. DEQ encourages local landowners and holders of water rights to voluntarily do whatever they can to help instream flow for the purpose of keeping channel water cooler for aquatic life.

The Upper Salmon HUC contains 1000 surface water rights, with decreed, licensed or statutory claimed dates ranging from 1877 through 2000 for a total of 1066.08 cubic feet per second annually. Additionally, there are 33 permitted or applications for 324.32 cubic feet per second dated from 1975 through 2015. This information, provided and maintained by the Idaho Department of Water Resources (IDWR) through their website water rights search tool, is subject to change. IDWR should be contacted for questions about updated water rights activities and appropriations. See: *https://www.idwr.idaho.gov/*

5.5 Reasonable Assurance

Under Section 319 of the Clean Water Act, each state is required to develop and submit a nonpoint source management plan. Idaho's most recent *Nonpoint Source Management Plan* (DEQ 2015) was approved in March 2015. The plan was submitted to and approved by the EPA. Among other things, the plan identifies programs to achieve implementation of nonpoint source BMPs, includes a schedule for program milestones, outlines key agencies and agency roles, is certified by the state attorney general to ensure that adequate authorities exist to implement the plan, and identifies available funding sources.

Idaho's nonpoint source management program describes many of the voluntary and regulatory approaches the state will take to abate nonpoint pollution sources. One of the prominent programs described in the plan is the provision for public involvement, such as the formation of basin advisory groups and WAGs. The Salmon Basin Advisory Group (BAG) is the designated WAG for the Upper Salmon subbasin.

The Idaho water quality standards refer to existing authorities to control nonpoint pollution sources in Idaho. Some of these authorities and responsible agencies are listed in Table 31.

Table 32. State of Idaho's regulatory authority for nonpoint pollution sources.

Authority	WQS Citation	Responsible Agency
Rules Pertaining to the Idaho Forest Practices Act (IDAPA 20.02.01)	58.01.02.350.03(a)	Idaho Department of Lands
Solid Waste Management Rules and Standards (IDAPA 58.01.06)	58.01.02.350.03(b)	Idaho Department of Environmental Quality
Individual/Subsurface Sewage Disposal Rules (IDAPA 58.01.03)	58.01.02.350.03(c)	Idaho Department of Environmental Quality
Stream channel Alteration Rules (IDAPA 37.03.07)	58.01.02.350.03(d)	Idaho Department of Water Resources
Rathdrum Prairie Sewage Disposal	58.01.02.350.03(e)	Idaho Department of Environmental

Regulations (Panhandle District Health Department)		Quality/ Panhandle District Health Department
Rules Governing Exploration, Surface Mining and Closure of Cyanidation Facilities (IDAPA 20.03.02)	58.01.02.350.03(f)	Idaho Department of Lands
Dredge and Placer Mining Operations in Idaho (IDAPA 20.03.01)	58.01.02.350.03(g)	Idaho Department of Lands
Rules Governing Dairy Waste (IDAPA 02.04.14)	58.01.02.350.03(h)	Idaho State Department of Agriculture

The State of Idaho uses a voluntary approach to address agricultural nonpoint sources. However, regulatory authority can be found in the water quality standards (IDAPA 58.01.02.350.01–03). IDAPA 58.01.02.055.07 refers to the *Idaho Agricultural Pollution Abatement Plan* (APAP) (ISWCC 2015), which provides direction to the agricultural community regarding approved BMPs. A portion of the Ag Plan outlines responsible agencies or elected groups (soil conservation districts) that will take the lead if nonpoint source pollution problems need to be addressed. For agricultural activity, the Ag Plan assigns the local soil conservation districts to assist the landowner/operator with developing and implementing BMPs to abate nonpoint source pollution associated with the land use. If a voluntary approach does not succeed in abating the pollutant problem, the state may seek injunctive relief for those situations determined to be an imminent and substantial danger to public health or the environment (IDAPA 58.01.02.350.02(a)).

The Idaho water quality standards and wastewater treatment requirements specify that if water quality monitoring indicates that water quality standards are not being met, even with the use of BMPs or knowledgeable and reasonable practices, the state may request that the designated agency evaluate and/or modify the BMPs to protect beneficial uses. If necessary, the state may seek injunctive or other judicial relief against the operator of a nonpoint source activity in accordance with the DEQ director's authority provided in Idaho Code §39-108 (IDAPA 58.01.02.350). The water quality standards list designated agencies responsible for reviewing and revising nonpoint source BMPs: the Idaho Department of Lands for timber harvest activities, oil and gas exploration and development, and mining activities; the Idaho Soil and Water Conservation Commission for grazing and agricultural activities, the Idaho Transportation Department for public road construction, the Idaho State Department of Agriculture for aquaculture, and DEQ for all other activities (IDAPA 58.01.02.010.24).

After TMDL acceptance by DEQ, EPA, and stakeholders, the next step of the Idaho water body management process is implementation. Idaho's water quality standards identify designated agencies that are responsible for evaluating and modifying BMPs to protect impaired water bodies. DEQ is committed to developing implementation plans within eight-teen (18) months of EPA approval of a TMDL document. The watershed advisory group (WAG), DEQ, and other agencies will develop implementation plans, and DEQ will incorporate them into the state's water quality management plan.

Ongoing assessment of the support status of the water bodies with TMDLs will be reported in a five-year review of the TMDL. If full support status has not been achieved, further

implementation will be necessary and further assessment performed until full support status is reached. Monitoring will be done at least every five (5) years. If full support status is reached, the requirements of the TMDL will be considered complete.

5.6 Implementation Strategies

Implementation strategies for TMDLs produced using PNV-based shade and solar loads should incorporate the load analysis tables presented in this TMDL. These tables need to be updated, first to field verify the remaining existing shade levels and second to monitor progress toward achieving reductions and TMDL goals. Using the Solar Pathfinder to measure existing shade levels in the field is important to achieving both objectives. Further field verification will likely find discrepancies with reported existing shade levels in the load analysis tables. Due to the inexact nature of the aerial photo interpretation technique, these tables should not be viewed as complete until verified. Implementation strategies should include Solar Pathfinder monitoring to simultaneously field verify the TMDL and mark progress toward achieving desired load reductions.

There may be a variety of reasons that individual stream segments do not meet shade targets, including natural phenomena (e.g., beaver ponds, springs, wet meadows, and past natural disturbances) and/or historic land use activities (e.g., logging, grazing, and mining). It is important that existing shade for each stream segment be field verified to determine if shade differences are real and result from activities that are controllable. Information within this TMDL (maps and load analysis tables) should be used to guide and prioritize implementation investigations. The information in this TMDL may need further adjustment to reflect new information and conditions in the future.

Similar requirements necessary for temperature TMDL implementation are also needed to implement sediment and bacteria TMDLs. Improvements in riparian communities will both help stabilize the streambank and limit bacteria pathways into the stream channel. Successful implementation presumes that the Upper Salmon River and tributaries will receive changes in land management that may be coupled with additional exclosure fencing that are proven effective at improving riparian density.

Implementation of the bacteria TMDL is already in effect with the current management of grazing allotments limiting cattle residence in riparian habitat. For example, grazing management will continue to improve the condition of the Williams Creek AU (ID17060201SL089_02).

DEQ recognizes that implementation strategies for TMDLs may need to be modified if monitoring shows that TMDL goals are not being met or significant progress is not being made toward achieving the goals. Reasonable assurance (addressed in section 5.5) for the TMDL to meet water quality standards is based on the implementation strategy.

5.6.1 Time Frame

Implementation of the temperature TMDL relies on riparian area management practices that will provide a mature canopy cover to shade the stream and prevent excess solar loading. Because implementation is dependent on mature riparian communities to substantially improve stream

temperatures, DEQ believes 10–20 years may be a reasonable amount time for achieving water quality standards. Shade targets will not be achieved all at once. Given their smaller bankfull widths, smaller streams may reach targets sooner than larger streams

Implementation of the sediment TMDL relies on multiple factors, includes stabilizing streambanks, improving agricultural practices, and removing fines in the substrate. Given their smaller bankfull widths, smaller streams may reach targets more rapidly than larger streams. It is estimated that without new sediment inputs, the removal of the fines on the substrate and redevelopment of the thalweg will take approximately five (5) years. The streams with sediment TMDLs are also flow-limited AUs, which may not have the water available for full recovery due to withdrawals. Streams with limited stream power, especially in the semi-arid portions of the subbasin, may require longer periods to recover than in moister environments. Whereas *E. coli* impairments are extremely variable by season and mitigation options, such as exclosure fencing can cause nearly instant improvements, if the primary source for the *E. coli* is from domesticated animal sources (i.e., cattle).

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

5.6.2 Approach and Responsible Parties

Lead agencies and landowners of key riparian habitat are working cooperatively to increase streambank stability and vegetative cover and improve grazing practices. Practices dictated by the latest scientific knowledge and technology are being implemented that will lead to a reduction in solar loading that may currently be impairing beneficial uses such as salmonid spawning. Federal, state, and local funding sources have provided the means to implement targeted BMPs. Specifically, the Shoshone-Bannock Tribes, Idaho's Office of Species Conservation, the US Forest Service and the Bureau of Reclamation implement BMPs and restoration activities in the watershed. See Chapter 4 for details.

Effective shade monitoring can take place on any segment throughout the AU and be compared to existing shade estimates. Those areas with the largest disparity between existing and target shade should be monitored with Solar Pathfinders to verify existing shade levels and determine progress toward meeting shade targets. Since many existing shade estimates have not been field verified, they may require adjustment during the implementation process. Stream segment length for each estimate of existing shade varies depending on the land use or landscape that has affected that shade level. It is appropriate to monitor within a given existing shade segment to see if that segment has increased its existing shade toward target levels. Ten (10)equally spaced Solar Pathfinder measurements averaged together within that segment should suffice to determine new shade levels in the future.

Monitoring locations for sediment are included in Table 23 and should be used for the next review unless land use changes occur and these locations are determined not to be representative. Use of the SEI method is recommended to maintain consistency and comparability in the results.

Bacteria monitoring should remain consistent and a 5-sample geometric mean should be calculated.

6 Conclusions

Overall, the waters in the Upper Salmon River subbasin (HUC 17060201) are meeting their beneficial uses, as evidenced by the spawning grounds for salmon and steelhead trout that migrate into this area. However, there are locations with diminished water quality that is impairing beneficial uses. This TMDL addendum and five-year review was developed to examine the known water quality issues reported in the 2012 Integrated Report or identified by monitoring efforts. Where limitations to beneficial uses were found, the cause was identified and a TMDL was developed. Three identifiable pollutants were found in the subbasin (temperature, sediment, and bacteria) and TMDLs developed.

Effective shade targets were established for four stream systems based on the concept of maximum shading under PNV resulting in natural background temperature levels. Shade targets were derived from effective shade curves developed for similar vegetation types in Idaho. Existing shade was determined from aerial photo interpretation or modeling and partially field verified with Solar Pathfinder data. Target and existing shade levels were compared to determine the amount of shade needed to bring water bodies into compliance with temperature criteria in Idaho's water quality standards (IDAPA 58.01.02). A summary of assessment outcomes, including recommended changes to listing status for Category 5 waters in the next Integrated Report, is presented in Table 30. Unlisted waters with TMDLs developed and recommended changes to listing status are included in Table 31.

Most assessment units are in reasonably good condition with respect to shade and thermal loads. The majority of AUs have average lack of shade values at or under -10% and load reductions are less than 20%. The Salmon River AU ID17060201SL047_05 had the largest excess load, requiring an 8% reduction. This temperature-impaired reach includes the river from Valley Creek to Yankee Fork. The lack of shade in this region results primarily from the proximity of Hwy 75 to the river and associated rock piles on the north shore. Although shade deficits periodically exceed 15%, it is unlikely that the river could attain sufficient shade to reduce deficits because of the highway. Squaw Creek had low excess loads, with the 3rd-order segment having no excess loads and very little shade deficit. The 4th-order segment of Squaw Creek (ID17060201SL021_04), closest to the Salmon River, did have some shade loss likely due to land use activities in the area. The temperature-listed segment of Squaw Creek (ID17060201SL023_04) just upstream was in better condition.

The three (3) AUs examined in Challis Creek appeared to have the most impacts, with necessary load reductions between 25% and 43%. Average lack of shade along Challis Creek was also greater than in other AUs in the analysis. Lower Challis Creek has considerably more land use activities than other streams examined.

Aspen Creek (ID17060201SL024_02) has an estimated necessary load reduction of 50% despite having one of the smallest excess loads and shade deficits that rarely exceed 10%. This required load reduction results from its small size and the fact that a certain amount of excess load is potentially created by the existing shade/target shade difference inherent in the loading analysis. Unlisted shade-deficient AUs are listed in Table 32.

Table 30. Summary of assessment outcomes for Category 5-listed assessment units.

Assessment Unit	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
ID17060201SL001_02, Salmon River tributaries – Pennal Gulch to Pahsimeroi River	Combined biota/habitat bioassessments	No	Place in Category 4c for low flow alterations. Delist for combined biota/habitat bioassessments.	Low flow alterations are the sole impairment cause.
ID17060201SL007_04, Challis Creek – Darling Creek to mouth	Temperature	Yes	Move to Category 4a for temperature.	Temperature TMDL developed using potential natural vegetation (PNV); excess solar load from a lack of existing shade. Temperature explains impairments along with existing sediment TMDL.
ID17060201SL009_04, Challis Creek – Bear Creek to Darling Creek	Temperature, cause unknown	Yes	Move to Category 4a for temperature; delist for cause unknown.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade. Temperature explains impairments along with existing sediment TMDL.
ID17060201SL015_03, Garden Creek	Sedimentation/ siltation, cause unknown	No	Delist for sedimentation/siltation and cause unknown; retain in Category 4c.	Current 4c listing for other flow regime alterations and physical substrate habitat alterations identifies the impairment causes.
ID17060201SL015_04, Garden Creek (aka Gini Canal)	Sedimentation/ siltation, cause unknown	No	Delist for sedimentation/siltation and cause unknown; move to Category 3.	Listing erroneously replicated from nearby streams. Agricultural beneficial uses of the canal are unassessed.
ID17060201SL023_02, Squaw Creek tributaries	Temperature	Yes	Move to Category 4a for temperature.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade. Temperature explains impairments.
ID17060201SL023_03, Squaw Creek – Willow Creek to Martin Creek	Temperature	Yes	Move to Category 4a for temperature.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade. Temperature explains impairments.
ID17060201SL023_04, Squaw Creek – Martin Creek to Cash Creek	Temperature	Yes	Move to Category 4a for temperature.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade. Temperature explains impairments.
ID17060201SL026_02, Bruno Creek	Combined biota/habitat bioassessments	No	Place in Category 4c for other flow regime alterations and physical substrate habitat alterations. Delist for combined biota/habitat bioassessments.	Other flow regime alterations and physical substrate habitat alterations are the sole impairment causes; stream is piped around disturbed mine lands.
ID17060201SL027_05, Salmon River – Thompson Creek to Squaw Creek	Sedimentation/ siltation, temperature	Yes	Move to Category 4a for temperature; delist for sedimentation/siltation.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade. Temperature explains impairments.
ID17060201SL047_05, Salmon River – Valley Creek to Yankee Fork Creek	Sedimentation/ siltation, temperature	Yes	Move to Category 4a for temperature; delist for sedimentation/siltation.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade. Temperature explains impairments.
ID17060201SL048_03, Basin Creek – East Basin Creek to mouth	Sedimentation/siltation	No	Retain in Category 5 for combined sedimentation/siltation.	Effects of the 2012 Halstead Fire require recovery before impairments can be assessed.
ID17060201SL051_02, Valley Creek tributaries – Trap Creek to mouth	Combined biota/habitat bioassessments	No	Delist combined biota/habitat bioassessments; move to Category 3.	These streams were improperly assessed using BURP data. Channels flow through high-elevation wet meadows wetlands and are outside BURP protocols. Channel function and habitat quality appear to be high, but assessment metrics are not available.

Assessment Unit	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
ID17060201SL056_02, Meadow Creek	Combined biota/habitat bioassessments	No	Delist combined biota/habitat bioassessments; move to Category 2.	No documentation supports the listing of this AU. Assessment based only on BURP scores, which indicate stream is meeting macroinvertebrate and habitat metrics.
ID17060201SL063_05, Salmon River – Redfish Lake Creek to Valley Creek	Sedimentation/ siltation, temperature	Yes	Move to Category 4a for temperature; delist for sediment/siltation.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade. Temperature explains impairments.
ID17060201SL072_05, Salmon River – Fisher Creek to Decker Creek	Sedimentation/ siltation	No	Delist for sediment/siltation; move to Category 2.	There is sufficient stream power to mobilize sediment inputs; listing based on erroneous application of upland land use.
ID17060201SL075_02, Alturas Lake Creek	Combined biota/habitat bioassessments	No	Delist combined biota/habitat bioassessments; move to Category 3.	Stream function is altered from reference conditions by lake effects and beaver dams and were assessed using stream metrics.
ID17060201SL086_03, Champion Creek	Combined biota/habitat bioassessments	No	Delist combined biota/habitat bioassessments; move to Category 2.	This AU was impaired and impacted by a forest fire and land use/water withdrawals. The channel has improved, and 2011 BURP monitoring found good scores indicating high macroinvertebrate and fish scores. On a site visit, many Sculpin were identified on the cobble substrate with limited fines remaining in channel.
ID17060201SL089_02, Williams Creek	Combined biota/habitat bioassessments	No	Retain in Category 5 for combined biota/habitat bioassessments.	There has been a change in grazing allotments and use in 2010; recovery is still required. BURP monitoring is also required for assessment.
ID17060201SL099_02, Slate Creek	Combined biota/habitat bioassessments	No	Delist combined biota/habitat bioassessments; place in Category 4c for physical substrate habitat alterations.	This AU was devastated by a microburst that removed the channel and all associated habitat in 1994. Recovery is proceeding, but the AU does not have a functional habitat and will not for decades.
ID17060201SL103_02, East Fork Salmon River – tributaries between Germania Creek and Herd Creek	Combined biota/habitat bioassessments	No	Delist combined biota/habitat bioassessments; move to Category 2.	Listing based on low BURP fish scores; macroinvertebrate and habitat scores passing.
ID17060201SL104_03, Big Lake Creek	Combined biota/habitat bioassessments	No	Delist combined biota/habitat bioassessments; move to Category 3.	Stream function is altered from reference conditions by lake effects and was assessed using reference stream metrics.
ID17060201SL125_03, Road Creek – source to Corral Basin Creek	Combined biota/habitat bioassessments	No	Delist combined biota/habitat bioassessments; move to Category 2.	Listing based on limited fish age classes; fish habitat limited by stream size. Macroinvertebrate and habitat scores passing.
ID17060201SL126_02, Mosquito Creek	Combined biota/habitat bioassessments	No	Delist combined biota/habitat bioassessments; move to Category 3.	Naturally intermittent stream channel; lack of water explains deviation from reference streams.
ID17060201SL131_04, Warm Spring Creek – Hole-in-Rock Creek to mouth	Sedimentation/ siltation	Yes	Move to Category 4a for sediment.	Sediment TMDL completed based on streambank stability.
ID17060201SL132_02, Warm Spring Creek – source to Hole-in-Rock Creek	Sedimentation/ siltation	Yes	Move to Category 4a for sediment.	Sediment TMDL completed based on streambank stability.

Assessment Unit	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
ID17060201SL132_03, Warm Spring Creek – source to Hole-in-Rock Creek	Sedimentation/ siltation	Yes	Move to Category 4a for sediment.	Although the AU is not specifically impacted by loss of streambank stability, the unit carries excess load from units above.
ID17060201SL132_04, Warm Spring Creek – source to Hole-in-Rock Creek	Sedimentation/ siltation	Yes	Move to Category 4a for sediment.	Sediment TMDL completed based on streambank stability.
ID17060201SL133_02, Broken Wagon Creek	Sedimentation/ siltation	No	Delist for sediment/siltation; retain in Category 4c.	Ephemeral channel; current Category 4c designation explains impairment.
ID17060201SL133_03, Broken Wagon Creek	Sedimentation/ siltation	No	Delist for sediment/siltation; retain in Category 4c.	Ephemeral channel; current Category 4c designation explains impairment.

Note: BURP = Beneficial Use Reconnaissance Program

Table 31. Summary of assessment outcomes for unlisted but impaired assessment units.

Assessment Unit	Pollutant	TMDL(s) Completed	Recommended Changes to Next Integrated Report	Justification
ID17060201SL001_06, Salmon River – Pennal Gulch to Pahsimeroi River	No 2012 impaired listing	Yes	Move to Category 4a for temperature TMDL.	Temperature TMDL developed using potential natural vegetation (PNV); excess solar load from a lack of existing shade.
ID17060201SL009_03, Challis Creek – Bear Creek to Darling Creek	No 2012 impaired listing	Yes	Move to Category 4a for temperature TMDL.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade.
ID17060201SL014_06, Salmon River – Birch Creek (formerly Garden Creek/Gini Canal) to Pennal Gulch	No 2012 impaired listing	Yes	Move to Category 4a for temperature TMDL.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade.
ID17060201SL016_06, Salmon River – East Fork Salmon River to Birch Creek (formerly Garden Creek/Gini Canal)	No 2012 impaired listing	Yes	Move to Category 4a for temperature TMDL.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade.
ID17060201SL019 _05, Salmon River – Squaw Creek to East Fork Salmon River	No 2012 impaired listing	Yes	Move to Category 4a for temperature TMDL.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade.
ID17060201SL021_04, Squaw Creek – Cash Creek to mouth	No 2012 impaired listing	Yes	Move to Category 4a for temperature TMDL.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade.
ID17060201SL024_02, Aspen Creek – Martin Creek to Cash Creek	No 2012 impaired listing	Yes	Move to Category 4a for temperature TMDL.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade.
ID17060201SL031_05, Salmon River – Yankee Fork Creek to Thompson Creek	No 2012 impaired listing	Yes	Move to Category 4a for temperature TMDL.	Temperature TMDL developed using PNV; excess solar load from a lack of existing shade.
ID17060201SL118_04, Herd Creek – source to mouth	No 2012 impaired listing	Yes	Move to Category 4a for *E. coli* TMDL.	*E. coli* TMDL based on geometric mean.

Target shade levels for individual stream segments should be the goal managers strive for with future implementation plans. Managers should focus on the largest differences between existing and target shade as locations to prioritize implementation efforts.

Idaho's 2012 Integrated Report lists twelve (12) AUs for sediment-related impairments. Of these listed AUs, 8 were found to be impaired for other causes (i.e., temperature, water withdrawals [Category 4c]) or listed in error. The four (4) impaired AUs (all within the Warm Spring Creek watershed) had sediment TMDLs developed in this document.

Additional sediment analysis occurred in the Salmon River to examine if sediment was a potential pollutant. The Salmon River was determined to have sufficient stream power to carry the sediment reaching the channel. All Salmon River sediment-listed AUs had a temperature TMDL developed, except for Salmon River – Fisher Creek to Decker Creek (ID17060201SL072_05). Appendix C details the sediment examination in the Salmon River and other locations within the subbasin.

Idaho's 2012 Integrated Report had no AUs listed for bacteria impairment. However, BURP monitoring determined that one (1) AU required a bacteria TMDL for impairment to the secondary contact recreation beneficial uses by *E. coli*. A TMDL was developed for Herd Creek (ID17060201SL118_04).

The *Upper Salmon River Subbasin Assessment and TMDL* (DEQ 2003) established sediment TMDLs for three AUs in Challis Creek. In 2013, stream conditions had seemed to improve, as there were limited fine sediment particles and the banks appeared stable. However, the Lodgepole Fire burned great portions of the watershed in late 2013. In August 2014, heavy rains led to flooding, debris flows, and washouts in Challis Creek (William MacFarlane, USFS, personal communication, August 2014). Therefore, no updates on improvements are available for these AUs. However, regular observations in 2013 and early 2014 identified no indication of excessive nuisance growth in the channel indicating a nutrient impairment as suggested in the cause unknown listing for AU ID17060201SL009_04. The three (3) Challis Creek AUs have impairments by sediment and temperature, and these are the only identifiable causes.

Five AUs should be slated for a more comprehensive examination for the next TMDL 5-year review. The recommended future monitoring listed in Table 32 includes the AUs that are exhibiting improvements or alterations that may lead to delisting or a better understanding of what the actual (if any) stressor might be. Since streams and rivers are dynamic, the period between identification as impaired and development of this TMDL may have been sufficient to allow for some degree of natural recovery. Additionally, land use changes (such as in Williams Creek) could promote natural recovery. In the Challis, Aspen, and Squaw Creek watersheds, habitat and shading are of concern; therefore, numeric data should be collected before the next review to determine if the shade deficits are reflected in stream temperatures in these three (3) AUs.

Table 32. Recommended future monitoring.

Assessment Unit	Listed Pollutant(s)/ Pollution	Idaho's 2012 Integrated Report Status	Status	Recommended Action
ID17060201SL009_03, Challis Creek – Bear Creek to Darling Creek	No 2012 Category 5 listing	Category 4a for sediment and 4c	Identified as shade deficient while calculating adjacent AU temperature/heat loads using PNV method	Deploy temperature data logger
ID17060201SL024_02, Aspen Creek – source to mouth	No 2012 impaired listing	Category 3	Identified as shade deficient while calculating adjacent AU temperature/heat loads using PNV method	Deploy temperature data logger
ID17060201SL048_03, Basin Creek – East Basin Creek to mouth	Sedimentation/siltation	Category 5, 4c	Insufficient data to identify causal pollutant or stressor	Examine for causes once recovered from Halstead Fire effects
ID17060201SL089_02, Williams Creek	Combined biota/habitat bioassessments	Category 5	Insufficient data to identify causal pollutant or stressor	Monitor with BURP protocols once changes in land use produce expected recovery

This document was prepared with input from the public, as described in Appendix I. Following the public comment period, comments and DEQ responses will also be included in this appendix, and a distribution list will be included in Appendix J.

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Geographic Information System (GIS) Coverages

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Glossary

§303(d)

Refers to Section 303 subsection "d" of the Clean Water Act. Section 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 United States Environmental Protection Agency approval.

Assessment Unit (AU)

A group of similar streams that have similar land use practices, ownership, or land management. However, stream order is the main basis for determining AUs. All the waters of the state are defined using AUs, and because AUs are a subset of water body identification numbers, they tie directly to the water quality standards so that beneficial uses defined in the water quality standards are clearly tied to streams on the landscape.

Beneficial Use

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

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.

Exceedance

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

Fully Supporting

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

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 Capacity (LC)	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, a margin of safety, and natural background contributions, it becomes a total maximum daily load.
Margin of Safety (MOS)	An implicit or explicit portion of a water body's load capacity set aside to allow for uncertainly about the relationship between the pollutant loads and the quality of the receiving water body. The margin of safety 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 margin of safety is not allocated to any sources of pollution.
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 nonirrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.
Not Assessed (NA)	A concept and an assessment category describing water bodies that have been studied but are missing critical information needed to complete an assessment.
Not Fully Supporting	Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).
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 plants.
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 that alter the functioning of natural processes and

	produce undesirable environmental and health effects. Pollution includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.
Stream Order	Hierarchical ordering of streams based on the degree of branching. A 1st-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.
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 basis. 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.
Wasteload Allocation (WLA)	The portion of receiving water's load 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 Quality Criteria	Levels of water quality expected to render a body of water suitable for its beneficial uses. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, aquatic habitat, or industrial processes.
Water Quality Standards	State-adopted and United States 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.

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Appendix A. State and Site-Specific Water Quality Standards and Criteria

Water Quality Standards Applicable to Salmonid Spawning Temperature

Water quality standards for temperature are specific numeric values not to be exceeded during the salmonid spawning and egg incubation period, which varies by species. For spring-spawning salmonids, the default spawning and incubation period recognized by the Idaho Department of Environmental Quality (DEQ) is generally March 15 to July 15 (Grafe et al. 2002). Fall spawning can occur as early as September 1 and continue with incubation into the following spring up to June 1. As per IDAPA 58.01.02.250.02.f.ii., the following water quality criteria need to be met during that time period:

- 13 °C as a daily maximum water temperature
- 9 °C as a daily average water temperature

For the purposes of a temperature TMDL, the highest recorded water temperature in a recorded data set (excluding any high water temperatures that may occur on days when air temperatures exceed the 90th percentile of the highest annual maximum weekly maximum air temperatures) is compared to the daily maximum criterion of 13 °C. The difference between the two water temperatures represents the temperature reduction necessary to achieve compliance with temperature standards.

Natural Background Provisions

For potential natural vegetation temperature TMDLs, it is assumed that natural temperatures may exceed these criteria during certain time periods. If potential natural vegetation targets are achieved yet stream temperatures are warmer than these criteria, it is assumed that the stream's temperature is natural (provided there are no point sources or human-induced groundwater sources of heat) and natural background provisions of Idaho water quality standards apply:

> When natural background conditions exceed any applicable water quality criteria set forth in Sections 210, 250, 251, 252, or 253, the applicable water quality criteria shall not apply; instead, there shall be no lowering of water quality from natural background conditions. Provided, however, that temperature may be increased above natural background conditions when allowed under Section 401. (IDAPA 58.01.02.200.09)

Section 401 relates to point source wastewater treatment requirements. In this case, if temperature criteria for any aquatic life use are exceeded due to natural conditions, then a point source discharge cannot raise the water temperature by more than 0.3 °C (IDAPA 58.01.02.401.01.c).

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Appendix B. Assessment Unit Notes and Observations

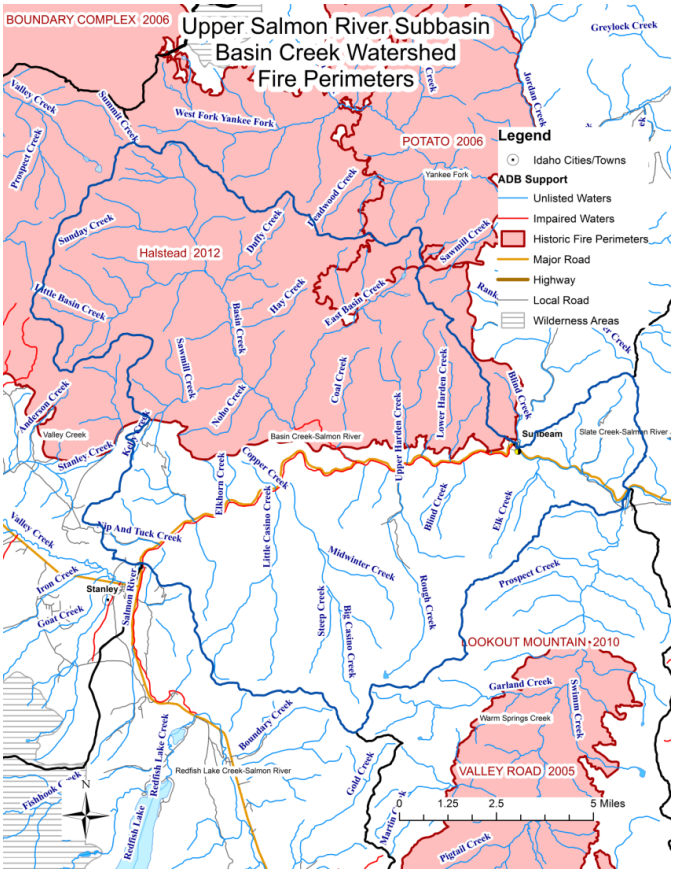
Assessment Units Remaining in Category 5

Basin Creek
(ID17060201SL048_03)

Site visits on September 11 and October 17, 2013, and August 6, 2014, confirmed the Halstead Fire impacts to the channel. Any anthropogenic impairment causes and/or sources have been lost in the impacts from the fire. Based on USFS comments, these fire impacts and sediment loads will likely decrease in 5–7 years and are storm driven and/or seasonal. Certain signs indicate that storm events lead to pulses of sediment and organic matter. The sediment is nearly black in locations and incongruous with the soils of surrounding areas. Vegetation on the banks is beginning to recover, but hillslope erosion and rilling is apparent. This AU should remain in Category 5 until the fire effects have diminished within this watershed.

A modified SEI protocol was used to estimate sediment deposition, identify areas of concern, and develop a baseline in AU ID17060201SL048_02 to monitor the recovery process. The developed transects are upstream of East Basin Creek and outside of the Category 5 listed AU, but this monitoring was done as the listed AU was completely burned and recovery in this contributing reach should also signify recovery in the AU in question. Significant deposition gravel bars are found in the upstream AU that must be stabilized before deposition and streambank erosion can be examined downstream. Some reaches in this baseline transect have channel bottoms that have been completely lost. The channel has evenly aggraded so that at baseflow the water level is at the pre-fire bankfull level, with indications that thunderstorm-driven water levels were 1.5 feet above the water level during transect monitoring in August 2014.

Recommendation: This AU should remain in Category 5 for sedimentation/siltation as the Halstead fire has made any examination of the habitat illogical. It is recommended that in approximately 2018 this AU be monitored using BURP protocols (or equivalent) to confirm complete recovery and a full-assessment process.



Halstead Fire perimeter overlay of Basin Creek



Bare soil lacking duff layer within Basin Creek



Fine soil particles and soot washed deposited in Basin Creek



East Basin Creek



Fine soil particles and soot washed deposited in Basin Creek



Basin Creek at confluence with the Salmon River





Deposited gravel bars upstream of East Basin Creek. Deposition and erosion are forest fire and thunderstorm induced geomorphological features (August 2014).

Williams Creek
ID17060201SL089_02

Per ADB:

> Assessment based upon one BURP score (2008SIDFA178). Habitat score was low, and limited fish were present when electro-fished. Listing was based upon limited fish caught and for impairments to the salmonid spawning and cold water aquatic life because of the high siltation and embeddedness identified in the 2008 monitoring. Heavy grazing and excessive sediment were listed as the cause.

A site visits to the lower portion of the creek (089_03) in 2011 and 2013 found good vegetation and a cobble bed with willow dominating the vegetation. Access to the 2nd-order portion of the AU requires hiking, but excessive sediment loads were expected to be seen in the lower 3rd-order location if the upper section was producing sediment. This was not an identified source. Removal from Category 5 requires BURP monitoring; however, USFS documents indicate a June 2010 management plan update was sent out for review and that monitoring and management changes are required. A 2013 operating instructions report indicates that only thirty-five (35) cow/calf pairs were to be allowed in the allotment, rather than the sixty-five (65) permitted.

Recommend waiting for next five-year cycle to re-assess and re-BURP the location after the management changes have had time to affect the stream habitat and other conditions. BURP monitoring should occur 2–3 years prior to next TMDL cycle to examine recovery.

Assessment Units Requiring Category 4c Designation

Bruno Creek – Source to Mouth

ID17060201SL026_02

Per ADB:

> This AU is listed for Combined Biota/Habitat Bioassessments and is based upon assessments based upon BURP scores. There were low SMI and SHI scores in 1997 and 1996, respectively.

The vast majority of this creek is within the Thompson Creek Mine property or in a pipe bypassing the active mine areas. Only limited portions of this creek are above the active mining area. Most branches are intermittent and the others only have a trickle of baseflow. All stream channels and tributaries appear to have headgates that allow the mine personnel to divert water into the twenty-four (24)-inch pipe. Above these headgates, baseflow was less than one (1) cfs, but case-building caddis fly larvae were identified on the submerged rocks surrounded by thick moss covering the banks.

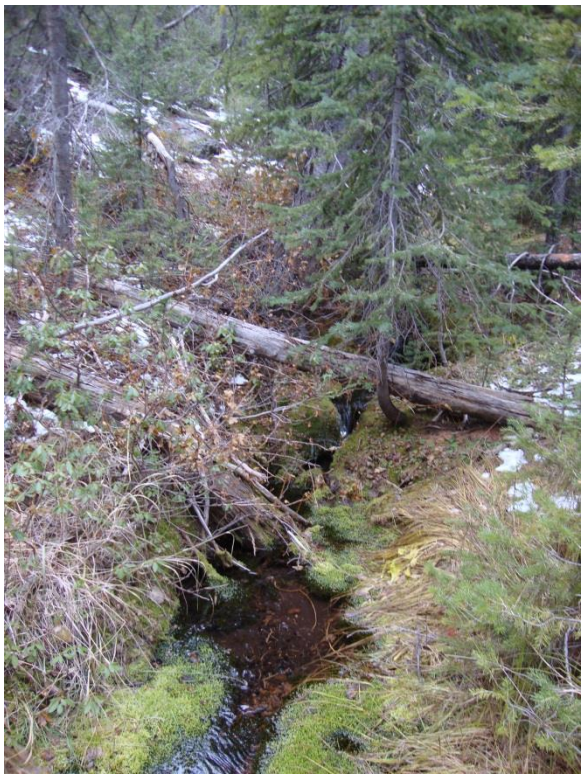
The Thompson Creek Mine has an NPDES permit (ID-002540-2) but does not discharge any of its waters; it recycles them back into the processing methods. Only waters that are not used to fulfill their water rights (72-7193, 72-7257, 72-7414, and 72-7573) and/or processing needs (which are consumed in the process) are piped around the mine tailing pond and returned to the creek. The tailing pond becomes the source for water consumed in processing. This creek is highly modified by sediment detention ponds and a dirt road built to withstand heavy-duty traffic. The stream is repeatedly adapted to ensure that none of the mine activities flow off the mine property boundaries. In effect, the entire stream should be in Category 4c for "physical habitat substrate modifications" and "low flow alterations" as the mine has the rights to divert all the water in the watershed.

The roadways, especially along the stream, are equipped with a three-part sediment BMP method. First, the road has a berm in place and straw waddles to capture sediment; these are regularly replaced. Second, road windows allow water to bypass the berms into regularly dredged catch pools and silt fencing. Third, sediment detention ponds capture sediment in the main channel of Bruno Creek.

Recommendation: There is no impairment in Bruno Creek that is not related to "physical habitat substrate modifications" and "low flow alterations," both reasons for a Category 4c listing. The piping and habitat alterations are essential to mine operation and water right allocation and preventing downstream effects.







Bruno Creek above Thompson Creek Mine and inflow to pipe



Caddis on rock above Thompson Creek Mine







Bruno Creek within pipes and connections with other headwater channels



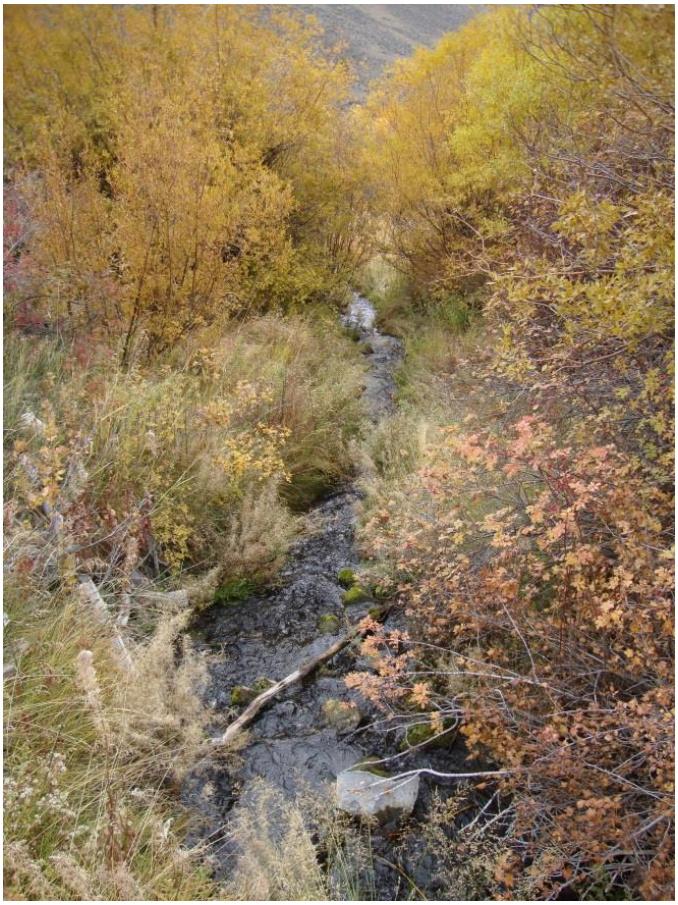


Sediment traps along Bruno Creek and roadway





Sediment control along Bruno Creek and roadway





Bruno Creek above confluence with Squaw Creek

Slate Creek – Source to Livingston Creek and tributaries

ID17060201SL099_02

Per ADB:

> Assessment based upon BURP scores prior to 1998 flood. Habitat score was low in some locations and SMI in others.

USFS worked in 2004 to restore the stream channel after the 1998 flood event, mostly by adding rootballs and other habitat improvements. In the channel, cobbles are embedded with slatey soil deposits in and on the banks/back water deposits. These soils in the channel are likely to be mobilized during storm events and discharges that reach the undeveloped floodplains. Most of the "banks" are potentially erodible, but limited defined banks exist in this reach. The microburst scoured the common indicators and it looks more like a glacial outwash plain than a mountain stream channel. There is limited difference between the flood plain and the channel, except that one is dry. Some locations show initial signs of returning vegetation, but the habitat is essentially nonexistent. The air smells of sulfur and water from the nearby sulfur springs. This sulfur source may be a factor in the low macroinvertebrate scores from the 1998 BURP sampling.

Multiple reaches were examined to find similar features of cut banks and unconsolidated material in banks and the "floodplain" and channel bottom.

At the upper road end was a very strong sulfur smell, and it appears there are multiple springs along the channel. The trail was washed out at some unknown time. This wash-out is a potential source of sediment from recent storms. However, the entire hillslope is a combination of cobble and slatey soil, like a talus slope, most likely at the angle of repose, meaning that this location is readily destabilized and small landslides may enter the channel/floodplain for the short distance they intersect. It appears that this is a natural hillslope, but we could not determine if there was mining above the talus-like hillslope. Slate Creek was not dredged, and mine tailings have roughly five (5) ft of "freeboard" above the channel proper. Therefore, the mine tailings are not a concern in this area or as a source of material to the stream.

The microburst in 1998 decimated the system and only rudimentary restoration was done in the upper section. The mine is closed, will mostly likely be left alone for the foreseeable future, and does not appear to be an impairment cause/source. The cause of the channel scour and the subsequent impairment appear to be from natural processes. Based on the site visit and history, the most accurate option is to list Slate Creek in Category 4c for physical substrate habitat alterations, as was done in Dump Creek in the Middle Salmon – Panther AU (ID17060203SL038_03). The microburst occurred approximately fifteen (15) years ago and the channel is only just beginning to recover from the heavy scouring. It is presumed that every large precipitation event will create some sediment pulses; however, all indications are that the Salmon River is sediment starved with more than ample capacity to accept these pulses.

A modified SEI approach was used to identify potential in-channel contributing areas for sediment. As there is limited channel development, washout and deposition zones (e.g., gravel bars) are included in the examination of the baseline transect. While there may not be sufficient stream power to mobilize cobbles, the washout zones contain ample gravels and fines that are readily mobilized during storm events and snowmelt.

Recommendation: Relisting in Category 4c, physical substrate habitat alterations, as the impairment is due to the 1998 microburst storm event. The upper AU was monitored to develop a baseline measure and should be followed by monitoring in 5–10 years to examine for recovery. Floodplain/riparian habitat is required to develop, along with a defined thalweg, before the sediment sources are completely removed.





Slate Creek within microburst washout



Slate Creek within microburst washout, note lack of channel structure



Initial development of channel structure within Slate Creek microburst washout



Readily mobilized sediment within the Slate Creek microburst washout

Assessment Units with Category 4c Designation as Sole Impairment

Garden Creek

ID17060201SL015_03

Garden Creek was listed as impaired from cause unknown (nutrients suspected) and sediment. However no evidence justified these listings. Therefore the stream channel was examined in 2013 and 2014 to confirm if the narrative standards had been exceeded. Multiple visits to the AU found no evidence of nuisance growths in the channel, no build-up of fine particle sediments, and minimal evidence of bank erosion. There was no evidence of any of the listed impairments. However, this AU is listed in Category 4c for both low flow alterations and physical substrate habitat alterations, both of which remain relevant as there are multiple irrigation water withdrawals throughout the AU and the stream flows through the city of Challis and is channelized. There are limited identifiable pathways into the stream from the roads and land use activities within the AU as the riparian habitat appears to be an effective BMP. Those areas with road crossings have well placed culverts and bridges with adequate BMPs to limit pathways into the stream. A Streambank Erosion Inventory did not identify in-channel sources.

The Category 4c designations have been determined to be the sole causes of the impairment listing and the early 1990s BURP score. Any future BURP monitoring and assessment should account for the urban conditions and the water withdrawals imposed on the functioning condition of the stream channel.

Recommendation: Remove from Category 5 for cause unknown (nutrients suspected) and sedimentation. The Category 4c designations are the sole causes of impairments. Retain in Category 4c for both listed causes.



July 15, 2013



July 22, 2014



Note moss growth (not nuisance growth) on rocks during July 22, 2014, site visit.

Broken Wagon Creek – Source to Mouth

ID17060201SL133_02 and ID17060201SL133_03

Per ADB:

> 6/29/2011 (NED) - Broken Wagon Creek along with Lone Pine Creek are sub-watersheds of Warm Spring Creek, together these two sub-watersheds make up the Warm Spring Creek drainage. Sediment and nutrients carried forward from the 1992 305(b) Report, Appendix D (first added to the 1994 §303(d) list which was promulgated by EPA). Broken Wagon Creek was originally captured in the same water quality limited segment as Warm Springs Creek (WQLS 3019) which explains why it is listed for sediment and nutrients. The 1994 listing was solely based on an evaluation and not on any actual water quality monitoring data. Suspected sediment and nutrient impairments were a case of best professional judgment. Low flow alterations identified and proposed for listing in the Upper Salmon TMDL approved January 2003. Low flow first added to the 2010 Report and nutrients delisted due to a listing error.
>
> Sediment shall remain in Category 5 until additional water quality monitoring data can be collected to conclusively demonstrate that the aquatic life beneficial use is not impaired by sediment.

A full reconnaissance site visit in June 2013 found no water, no indications of water, and no riparian/wetland obligate vegetation (multiple follow-up visits in the spring 2014 found similar results). The "stream channel" was indistinguishable from a deer trail through sagebrush and likely had more pronghorn using the channel than water. This is an ephemeral drainage that might have surface water with sufficient energy to transport sediment once every 25–50 years. This area is semi-arid in the rainshadow of multiple ranges (including the Sawtooth and the White Mountain ranges). The soils are poorly developed with no organic matter (O-Horizon) and minimal soil structure. The primary vegetation is sagebrush. There is no aquatic life, vegetation, or water. No residual streams, pools, seeps, or any other hydrology indicate a stream channel, unless examined only from topographic maps and assumptions of contributing area and topographic features leading to stream channel development.

The only indication of water in the channel was at a culvert where runoff from the road pooled. There was no indication of water flowing through the culvert. Other indications of water are from the soil surface, where dry-cracking was observed, mostly like from winter precipitation that infiltrated into the soil without measureable/identifiable runoff. However, there are over fifty (50) water right decrees within this township and range within this watershed primarily for the springs. There is at least one annual decree in the named portion Broken Wagon Creek with a priority dating to 1934 (Water Right No. 72-15972).

A site visit on August 12, 2014, (during a rainstorm) found no surface ponding, no overland flow, and the rusty can was not moved from its location below the only culvert (see pictures below).

Recommendation: Remove from Category 5. Current Category 4c listing is sufficient. AU is an ephemeral system.

June 2013 Site Visit Photos











Panorama of the lower Broken Wagon Creek watershed

April 2014 Site Visit Photos







May 2014 Site Visit Photos







August 2014 Site Visit Photos (during rainstorm)





Assessment Units Requiring Relist Designation to Category 3

Garden Creek – Source to Mouth (Gini Canal)

ID17060201SL015_04

This canal initiates at the Salmon River, flows through the Yankee Fork Museum property, and then progresses north along the contour lines (versus downgradient). This AU is more correctly known as Gini Canal. This AU is specific to the canal but is listed as being impaired for cause unknown and sediment/siltation. Water quality listings of impairment appear to have been replicated onto the Gini Canal accidentally during the process of incorporating listings from the WBID system to the current AU format from the main stem Garden Creek AU (ID17060201SL015_03). This replication error should be rectified and ADB and the 2014 Integrated Report be updated to account for the error.

This canal is solely used for agricultural purposes, and when water is in the Gini Canal, it is meeting its beneficial uses. Other than agriculture, there are no additional beneficial uses associated with this canal. It was noted twice in the BURP records that this is a canal and is not monitored. Outside of the irrigation season, the canal is dry (see photograph).

Any other potential uses that may have accidentally encroached into the canal (fish habitat) have been limited by fish screens and/or flumes to limit mixing with Garden Creek, downgradient of Challis, Idaho.

Per a conversation with Custer SWCD personnel (Karma Bragg, January 8, 2013), better information is available to delist AU ID17060201SL015_04 (Gini Canal). It appears that years ago where the canal met Garden Creek they were mixed (bringing Garden Creek water into the canal – and all the garbage), but there was a flume installed to pass over the creek so they no longer mix. Apparently the upper headgate for the canal had a fish screen, but Garden Creek did not, so there were additional problems with fish by-passing and entering the Gini Canal. In approximately 2005, the flume, with screening, was installed and now there is no longer any unintended mixing of the Gini Canal with Garden Creek.

The USBR developed a document *Completion Report Garden Creek and Gini Canal Crossing Project Upper Salmon Subbasin Salmon, Idaho* in 2007 (*www.usbr.gov/pn/programs/fcrps/thp/srao/uppersalmon/completion/ginicanal/gini-garden.pdf*) that describes in the detail the disconnection of the Gini Canal from Garden Creek.

Recommendation: Category 5 listings should be removed from this canal and the AU moved to Category 3 as unassessed for agricultural beneficial uses.



Gini Canal Photo (December 2012)

Valley Creek Tributaries – Source to Mouth

ID17060201SL051_02

Per ADB:

> This AU was listed based upon BURP monitoring finding low habitat and macroinvertebrate scores.

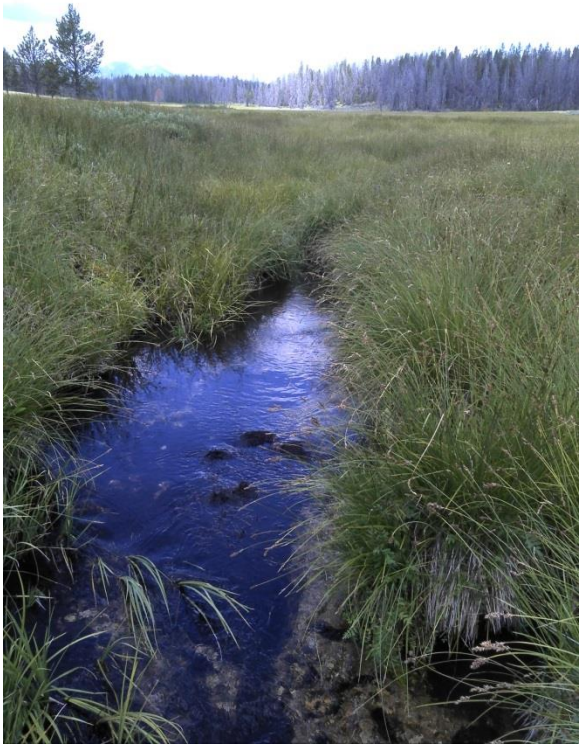
The tributaries to Valley Creek that have 1998 BURP scores are low-gradient, highly sinuous streams flowing through a wet meadow. This AU was listed as impaired for not supporting cold water aquatic life based solely on BURP scores (Job Creek, 1998SIDFA067, and Park Creek, 1998SIDFA066). Fish scores for both tributaries were good with SFIs of 2 and 3 for Job Creek and Park Creek, respectively. Brook and Rainbow Trout are present in these streams. Macroinvertebrate and habitat scores are within the expected variation in a wet meadow environment with locally unchannelized flow.

A site visit on July 17, 2013, found numerous fish and frogs in the stream along with a small elk herd, composed of cow-calf pairs. There were significant numbers of sedges but limited willow vegetation along the channels. These channels are in a wet meadow and have limited woody plant development within the saturated area. The site visit found the soils to be anoxic, releasing sulfur-gases (rotten egg smell) when disturbed. Trout and frogs were observed in the stream and swampy areas. There were no indications of pollution or pollutants. Some logging occurs on nearby hills, and a small subdivision is nearby, but both land uses are distant from the actual channel. Logging will not occur in the channel as the bog limits tree growth. The subdivision is downgradient of most, if not all, of the stream channels. Beetle kill was evident on the trees on the hillsides above both creeks. Channel banks are stable and substrate is consistent with a wet meadow environment but does have locally unchannelized flow (silts with high organic matter); however, the higher-gradient locations have decomposed granite as the substrate.

Recommendation: Move to Category 3, as these channels are in wet meadow environment that are outside of the BURP monitoring protocols. Additionally, habitat is more than sufficient for rearing locations for the small trout found in the channels. Assessments using BURP data and associated metrics are not directly applicable to a wetland environment.



Park Creek



Park Creek



Job Creek



Park Creek, looking downstream, Highway 21 in the distance

Alturas Lake Creek – Petit and Vat Creeks
(ID17060201SL075_02)

Alturas Lake Creek tributaries were found to have macroinvertebrate species that were not indicative of cold water aquatic life beneficial use. This is an expected finding for the BURP scores since water quality in these tributaries is influenced by a natural lake with a surface water release and beaver dams. The BURP score for habitat is fully supportive of beneficial uses outside of the wetland areas. The BURP metrics used to determine if beneficial uses are being met do not apply to systems such as these where the lake and beaver dam effects on the downstream habitat are natural processes.

Recommendation: Move to Category 3 (unassessed). BURP monitoring locations and metrics should not have been applied to the locations that had lake effects altering the water column or those locations monitored within a beaver complex.





Petit Lake Outfall (looking toward lake)





Vat Creek Beaver dam wetlands

Big Lake Creek
(ID17060201SL104_03)

Big Lake Creek, below the Jimmy Smith Lake, was found to have macroinvertebrate BURP scores indicating the cold water aquatic life use is not supported. This is an expected finding for the BURP score from 1997 (1997SIDFL050) since this stream is below a natural lake with a surface water release. Big Lake Creek below Jimmy Smith Lake was found to have an excessive number of warmwater macroinvertebrates, but this warm water is directly related to the outfall from the landslide-formed lake. Warm water releases from the lake surface are typical from these types of lakes. The BURP score indicates a high habitat function, but the lake effects do not readily support the expected macroinvertebrate populations for free-flowing streams. The BURP metrics used to determine if beneficial uses are being met do not apply to systems such as these where the lake effects on the downstream habitat are natural processes and are outside of DEQ's established metrics.

A site visits on July 16, 2013, and July 9, 2014, found the habitat in good condition but showing moderate signs of recreation usage. However, significant numbers of mayflies and stoneflies along with caddisfly cases were found on the bottom of rocks. While these macroinvertebrates are in the stream ecosystem, the number Simulidae species that were found in the 1997 monitoring and high population levels indicate a warmer water species than is preferred for natural streams in Idaho. There were limited indications of streambank stability issues, except in areas with high recreation activities which were limited stream stretches and estimated at less than 3% of the AU. Nor were excessive amounts of fine sediment particles found instream. The channel substrate was composed primarily of cobbles and gravels of the expected size and variety for the parent geology. The road was well maintained with buffer strips of thick vegetation between the creek and road for the vast majority of its length. There were no identifiable impairments and the low SMI BURP score in 1997 was determined to be directly related to the lake outfall. Future assessments should account for these lake effects.

Recommendation: Change the listing to Category 3 as unassessed for the specific water body type. Remove from Category 5.



Big Lake Creek



Big Lake Creek Substrate



Dispersed campsite along Big Lake Creek



Channel directly adjacent to campsite

Mosquito Creek – Source to Mouth

ID17060201SL126_02

Per ADB:

> Listing based upon one BURP monitoring data only.

While the BURP data indicate poor ratings, Mosquito Creek is a narrow and shallow stream that is intermittent with low base flow discharges. In July 2013, the discharge was less than one (1) cfs and its surface water did not reach the confluence of Road Creek. We spotted one fish in a pool area, but we did not expect it to survive the summer as it could no longer swim downstream into Road Creek. There were some signs of cattle grazing; however, there was significantly more sign of horse scat than cattle. This area is known for wild horses. Their populations are larger than many in the area would like, and they are damaging some streams and riparian vegetation.

The habitat scores (SHI) are low, but considering the arid and steep hillslopes composed of decomposing Challis volcanics with sagebrush, this stream is essentially an oasis. The green line/riparian habitat is limited by the groundwater-surface water interactions and capillary front, which may not extend much beyond the channel banks due to the combination of soils types and topography. Therefore, habitat measures and metric application are questionable as the reference values may not directly apply. This bioregion is listed as Northern Mountains, but it is a deep valley more similar to the PPBV bioregion surrounded by mountains.

Recommendation: This AU should be moved into Category 3, as the BURP monitoring protocols are not developed for intermittent streams. All indications are that this stream is highly functional within the natural waters limitations.



Aerial view of stream.



Mosquito Creek, overgrown by sedges, no distinct channel.



Stream size and vegetation. Note channel development, tracks are mostly from wild horses in the vicinity.

Assessment Units Requiring Relist Designation to Category 2

Salmon River Tributaries – Pennal Gulch to Pahsimeroi River (1st- and 2nd-Order Tributaries)

ID17060201SL001_02

Per ADB:

> This AU was listed based on an assessment of "Combined Biota/Habitat Bioassessment" impairment.

This intermittent stream actually functions better than expected considering it has multiple water rights withdrawals and point of decrees on it for stock watering. During the 1998 BURP monitoring (site 1998SIDFA133), there was 0.10 cfs measured in the Shep Creek channel. However, its proximity to the Salmon River (<100 m) does provide insect (macroinvertebrate) source colonizers to the channel.The measured discharge of 0.10 cfs is presumed to be the limiting factor for the habitat, thus the SHI score of one (1) supports the interpretation that water is the primary limiting factor in riparian vegetation development. It is assumed that the proximity to the Salmon River was integral to the passing SMI score of three (3) in the 1998 BURP monitoring. The average of the measured SMI and SHI scores are a passing score, therefore the inclusion into Category 5 for impairments for combined biota/habitat bioassessment is deemed an error and most likely due to the *E. coli* exceedances. These *E. coli* exceedance causes/sources have been rectified and the impaired listed removed in the 2012 integrated report.

The channel is stable at bankfull discharges. Water and wind are the dominant geomorphological forces to alter the channel and develop the topography; channel-altering flows are associated with low recurrence interval flooding and storm events. However, the receiving water in the Salmon River has ample capacity to handle the potential sediment loads from this AU from these natural occurrences. The rocks in the channel are still jagged, suggesting that the edges have not been worn down to the rounded shape typical of water-dominated regimes. Nor were the twigs and leaves from the previous fall removed from the channel, suggesting that spring snowmelt peak discharges are not integral to the system and channel development.

The BLM has the majority of water rights in this area and most are directly related to the beneficial use of stock watering (e.g., water right nos. 72-15999, 72-15998, 72-4173). Management practices and the identification of pipes to transfer water to less sensitive locations (identified in Shep Creek) indicate that current approaches are striving to limit grazing and cattle loitering in sensitive areas.

This AU was revisited May 29, 2014, at the highway crossing. No water was in the channel or culvert at that time. Shep Creek was found to be representative of the AU, as most streams in the AU are 1st-order channels with similar geology and land uses.

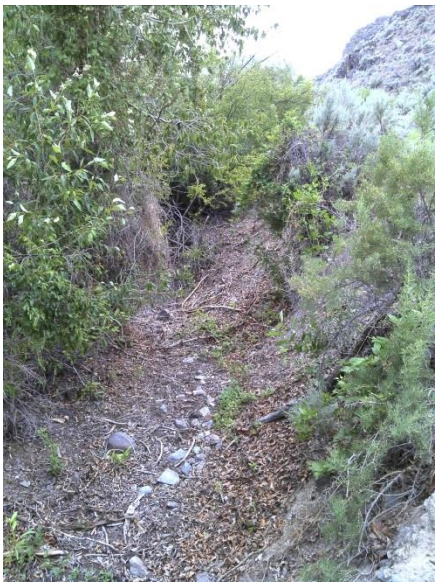
Recommendation: The beneficial uses should be re-examined for this AU (SL001_02) to ensure that the grouping with the Salmon River AU (SL001_06) does not lead to beneficial use designations being misapplied. The impairment cause of "Grazing in Riparian or Shoreline Zones" should be removed as *E. coli* concentrations are meeting standards, and the "Combined Biota/Habitat Bioassessment" should be removed. This AU should be relisted into Category 2 for "full support."



Stock watering withdrawal pipe, initiates at pool (next photo).



Water pooling at the point of diversion for off-site stock watering. Note the channel (lower center) where excess water can move around the diversion. This channel portion is full of readily mobilized detritus (sticks) that were not moved recently. Photo was taken July 8, 2013, indicating that even snowmelt discharges and stream power are typically insufficient to mobilize small woody material or sediment. Dead leaves in the channel appear to have been deposited the previous fall.



Near the 1998 BURP location, currently dry from water withdrawals.



Dry channel and riparian vegetation co-existing with sagebrush.

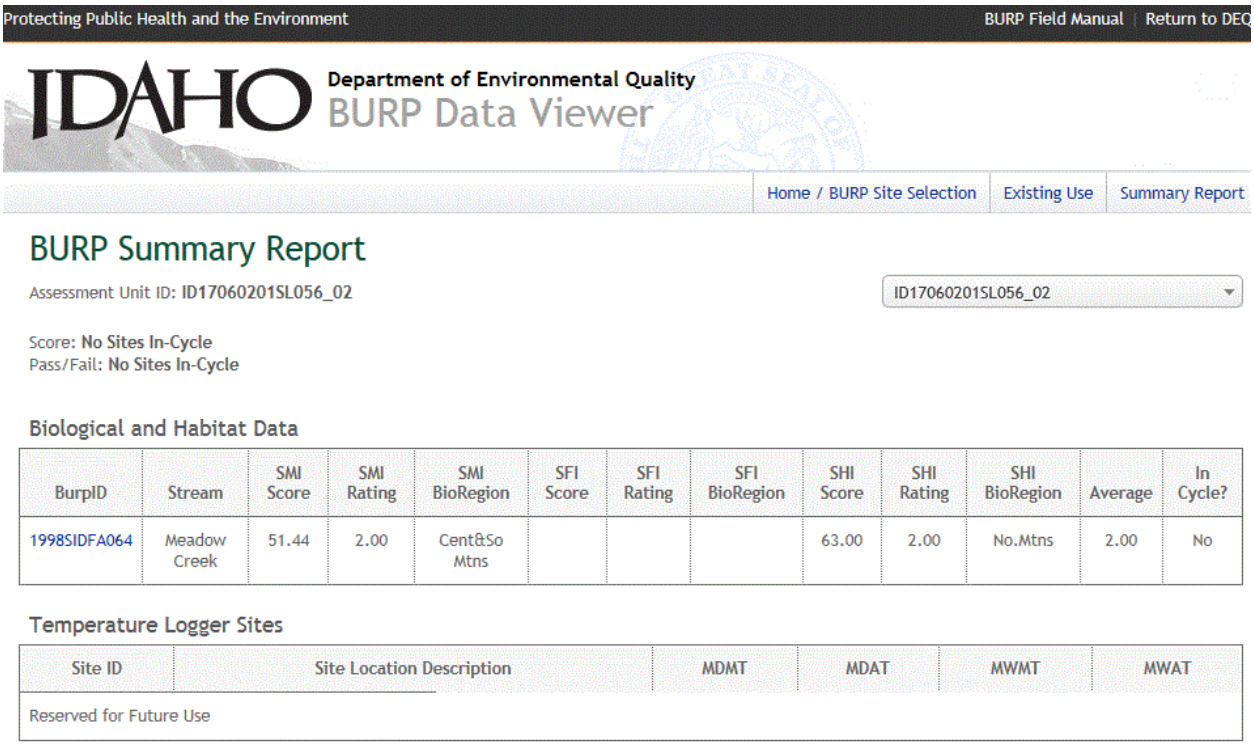


Shep Creek (bottom center) and Salmon River (center left) in the semi-arid Challis Volcanics.

Meadow Creek – Source to Mouth

ID17060201SL056_02

Meadow Creek is a low-gradient, highly sinuous stream flowing through a wet meadow at approximately 6,680 feet elevation near Highway 21. By all appearances, this is a region with deep and heavy snowpack and winter grazing for moose and elk. This AU was listed as impaired for not supporting cold water aquatic life; however, the 1998 SMI and SHI BURP scores (site 1998SIDFA064) passed (SMI and SHI of two (2)). The ADB indicates that the listing was based on the WBAG 2002 manual; however, no other supporting documentation or impairment information was attached. According to DEQ's *Water Body Assessment Guidance* (Grafe et al. 2002), an average score of greater than or equal to two (2) is considered fully supporting. This AU and BURP scores meet that criterion.



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BURP Data Viewer

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BURP Summary Report

Assessment Unit ID: ID17060201SL056_02

ID17060201SL056_02

Score: No Sites In-Cycle
Pass/Fail: No Sites In-Cycle

Biological and Habitat Data

BurpID	Stream	SMI Score	SMI Rating	SMI BioRegion	SFI Score	SFI Rating	SFI BioRegion	SHI Score	SHI Rating	SHI BioRegion	Average	In Cycle?
1998SIDFA064	Meadow Creek	51.44	2.00	Cent&So Mtns				63.00	2.00	No.Mtns	2.00	No

Temperature Logger Sites

Site ID	Site Location Description	MDMT	MDAT	MWMT	MWAT
Reserved for Future Use					

A site visit on July 17, 2013, found numerous fish and frogs in the stream, a mayfly hatch and caddis nests on the rocks, and frog spawn. At least one fish was seen in every pool, and pools existed on nearly every bend (see aerial photo). The majority of the stream was glides and runs with pools at the bends and limited riffles. Portions of the riparia were composed of thick peat/organic soils. No pollution sources were identified, nor were there any identified roads in the subwatershed. The valley had moose and elk scat and prints. Sandhill cranes were seen in the watershed. Sedges, rushes, and willows dominated the vegetation along the banks. Streambanks were as stable as is possible for a stream with this high of sinuosity and is typical for a high–elevation, low-gradient stream. Undercut banks were not fractured but were stable and provided cover and habitat to the fishes. In every way, the channel exceeded expectations for what is typical for a high-elevation, low-gradient stream.

By all determinations and observations, this stream was listed as impaired for unknown and undefined reasons. No impairments were identifiable in this stream. It can only be assumed that this stream was listed in error. The 2002 Integrated Report lists this AU as initially being listed for an unknown (UKN) impairment, which is not represented in the BURP/biologic data.

According to the *Upper Salmon River Subbasin Assessment and TMDL* (DEQ 2003), this subwatershed had historic livestock grazing, which was discontinued in 1993. No anthropogenic sources were identified in the record, nor were any recent sources found.

Recommendation: Category 5 listings should be removed and the AU relisted to Category 2 as meeting its beneficial uses, including cold water aquatic life.







Meadow Creek flowing through wet meadow



Meadow Creek flowing through wet meadow



Unidentified eggs on a rock in Meadow Creek, presumed to be frog spawn

Salmon River – Fisher Creek to Decker Creek

ID17060201SL072_05

Per ADB:

> This AU was listed based upon the Idaho Water Quality Status Report and Nonpoint Source Assessment 1988 which listed the Salmon River between Hellroaring Creek and Redfish Creek as impacted from rangeland with a High rating for sediment. There was also concern in 1988 of impacts from the highway, but this was deemed a Low sediment source. This PNRS#1010 segment is also inclusive of all the drainages and streams into the Salmon River along that designated reach.

Since 1988, the biennial Integrated Report has been developed, along with a more refined stream system designation using AUs. These AUs are smaller than the previous designations and are expected to be more representative since headwater tributaries should not examined in the same manner as the Salmon River main stem. These AUs are examined individually for their impacts, impairments, and source zones. For example, portions of Williams Creek (ID17060201SL089_02) have recently undergone a change in grazing rights and management.

This AU is not wadeable; therefore, BURP monitoring is not recommended. This section of the Salmon River is an anastomosed channel due to the change in stream channel gradient as the valley widens and is upstream of the confining canyon. The river expends excess energy through developing meanders and multiple channels, which are natural, based on the aerial photos that depict the old oxbows and bends in that area, and are now either terraces or still within the active floodplain. The channel may be more meandering in its classification than anastomosing, but headgate placement and withdrawals are expected to add specific area confinement, thereby controlling downstream reaches.

The apparent issue with sediment in this area is from the naturally occurring sinuosity/meanders but also with at least three canals removing water from this reach or just above it. Any sediment problems may be related to the change in hydrology that occurs when those canals are removing water at their full capacity. Additional factors that alter river channel development are the numerous beaver dams in the area, which have dammed side channels and altered erosion and meandering by altering the stream's power to erode and develop meanders as a single channel.

Sediment control measures along this river stretch include exclosure fencing, as seen in the photographs below. The cobbles in the area are clear of fine particles. There is some sand between the cobbles and boulders, but this sediment size is not detrimental to salmonid egg incubation development. Sculpin were identified in the side channels and trout were seen in the deeper pools. The water was clear and the submerged substrate had significant populations of caddis and mayflies. Willows and grasses dominated the banks, but the snowmelt hydrograph and beaver dam/food harvesting has impacted the stand density. Side channels were refugia for small fish.

McNeil sediment core sampling measured 25% fines in this location, from three replicate pits. Additionally, the pits were skewed to the finer particles to allow for digging due to the large cobbles impeding collection of the channel substrate. In streams with salmonid spawning habitat, a sediment core of the substrate is gathered and separated into ten (10) size classes. The volume displaced for each size class is measured. Fine sediments that impair salmonid spawning are those particles with a grain size less than 6.3 millimeters. Three samples are collected at each site

for an average percentage of fine sediment particles. The measured value of 25% is below the 28% fines described by McNeil and Ahnell (1964) and is deemed supportive of spawning conditions.

Recommendation: This AU is not impaired by sediment. By all appearances, the channel geomorphology and meanders are influenced by the geology, channel gradient, headgates, and beaver dams. No data supported the impaired listing, only the concern of potential source loads. There may have been significant inputs of sediment in the past, but this was not identified in the field in 2013 and 2014. Additionally, improved management activities—including changing grazing habits and exclosure fencing—are most likely responsible for improvements in this channel and the tributaries.

Move this AU into Category 2 for meeting beneficial uses. Impacts leading to impairment designation were most likely related to upgradient concerns that are not causing impairments in-channel.

McNeil Sediment Core Sampling Form						
Stream	Salmon River (ID17060201SL072_05)					
Date	8/2/2011					
Location:	Braided Channel - near BURP 2008SIDFA081					
Lat/Lon:	N: 44.05375					
	W: 114.83975					
Site Desc:	Vegetated banks, stable deep gravels Note: Bias towards fines to allow digging					
Personnel:	A.S. & T.H.					
Rosgen Channel:	D					
Reach Gradient:						
Geology: (Q G V S)						
Target Species						
Sample Number	**1**	**2**	**3**			
Seive Size (inches)	ML	ML	ML			
2.5	520	475	190			
1	2700	2410	3200			
0.5	1000	700	980			
0.25	670	580	650			
1.0 - 0.25" Subtotal	4370	3690	4830			
#4	230	130	780			
#8	500	380	725			
#20	475	260	440			
#70	250	100	410			
#270	100	20	200			
<0.25" Subtotal	1555	890	2555			
Sample Total W/O 2.5"	5925	4580	7385	Mean	Std. Dev.	
% Fines W/O 2.5"	**0.262447**	**0.194323**	**0.345972**	**0.267581**	**0.075954**	
Sample Total W 2.5"	6445	5055	7575	Mean	Std. Dev.	
% Fines W 2.5"	0.241272	0.176063	0.337294	0.251543	0.081104	





Note exclosure fencing along terrace



Note exclosure fencing inundated by beaver dam pond



One beaver dam in Salmon River side channel



Note bankfull and cobble size



Substrate composition within Salmon River – Fisher Creek to Decker Creek



Main stem substrate and vegetation



Side channel, small fish refugia

Champion Creek – Source to Mouth (3rd-order segment)

ID17060201SL086_03

Three BURP sites are located within the Champion Creek AU. Two of those locations were sampled in the 1990s and the third in 2011. BURP monitoring in 1996 (1996SIDFY100) and in 1998 (1998SIDFA135) produced mixed data: habitat, fish, and macroinvertebrate scores all at 1 for the 1996 data, whereas the 1998 scores were 3 for macroinvertebrates, 2 for habitat, and 0 for fish (see below). In 1998, four Brook Trout were caught. The 2011 (2011SIDFA020) BURP fish score of 3 was based on several species and size classes: eight (8) Sculpin (35–105 mm) and eleven (11) Rainbow Trout (35–260 mm).

A potential issue outside of anthropogenic effects was a fire in 2005 (Valley Creek Fire), which burned 40,838 acres across both the Champion Creek and 4th of July Creek watersheds. Rehabilitation efforts were made that year to limit potential problems.

The 1998 BURP location appears to be directly below beaver dams (best seen in the 2009 postburn photo below); those dams are suspected of influencing the in-channel metrics for the 1998 data and assessment for fish, as only Brook Trout were caught at that location. Based on aerial photos, multiple canals remove water from Champion Creek to be transferred to areas above the Salmon River and outside of the expected watershed boundaries. These areas are suspected of having a role in altering the fish migration patterns in the channel and affecting the 1990s BURP scores. Fish screens were installed in Champion Creek in 2007 (see SNRA notes in Section 4).

Biological and Habitat Data

BurpID	Stream	SMI Score	SMI Rating	SMI BioRegion	SFI Score	SFI Rating	SFI BioRegion	SHI Score	SHI Rating	SHI BioRegion	Average	In Cycle?
1996SIDFY100	Champion Creek	48.29	1.00	Cent&So Mtns	42.52	1.00	Forested	45.00	1.00	No.Mtns	1.00	No
1998SIDFA135	Champion Creek	67.48	3.00	Cent&So Mtns	33.21	0.00	Forested	65.00	2.00	No.Mtns	0.00	No
2011SIDFA020	Champion Creek	59.12	3.00	Cent&So Mtns	97.55	3.00	Forested	56.00	1.00	No.Mtns	2.33	No

The 2011 BURP SMI and SFI metrics were each calculated at 3 and SHI at 1. This result is not surprising since BURP monitoring occurred six (6) years after the Valley Creek Fire, many of the stressors have dissipated, and fish screens were installed. Additionally, the monitoring occurred in a location that was more representative of the AU, meaning this site was in the sagebrush flats on the alluvium/alluvial fan that composes over two-thirds of the AU. Habitat (SHI) scores in 2011 represent the limited cover by sagebrush and other in-channel factors that were altered by the 2005 Valley Creek Fire. Recovery from the fire and its impacts is apparent; however, full recovery will require more time. The nature of the alluvium also precludes full vegetation cover as the cobble-dominated alluvium is expected to have high vertical transmissivity (not horizontal) to the groundwater and/or surface water/groundwater interactions. There are no indicators that willows or other riparian woody plants ever dominated the vegetation composition along this stream channel. Since 1996 there have been changes in the irrigation management, including installation of fish screens at headgates as well as grazing

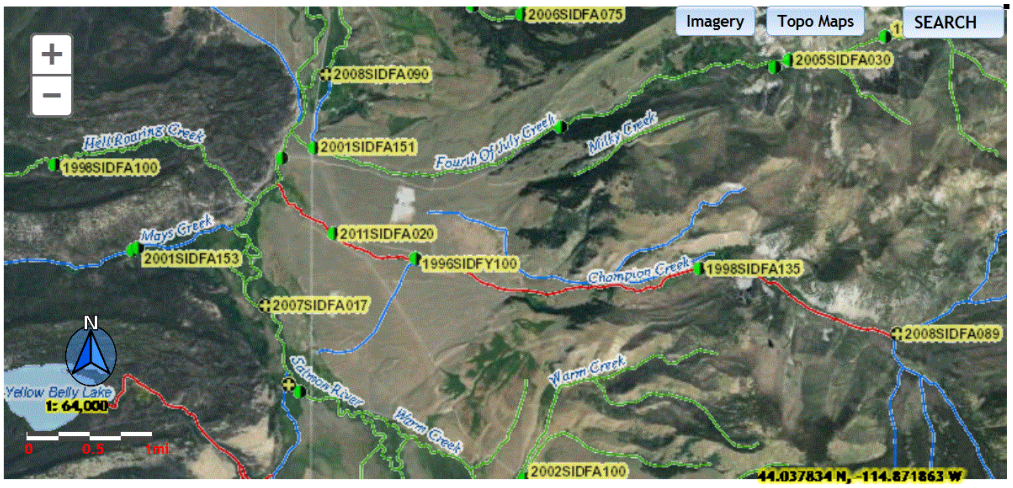
management as evident of the changing SNRA grazing management plans discussed for the nearby Williams Creek (ID17060201SL089_02) and the BLM using the MIM/greenline measures in determining grazing status.

Site visits in 2013 and 2014 found the stream had a well-defined bankfull and BLM greenline (grasses/sedges). There were signs of grazing, most likely sheep, but the greenline was in good shape and a good height, indicating current BLM management practices are in place. Some embeddedness was visible, likely due to the 2005 fire. Cobble-sized particles dominated the substrate. Caddis flies were identified on rocks pulled from the water and more than ten (10) Sculpin/trout were seen darting in the waters.

Recommendation: Based on an examination of the aerial photos pre- and post-fire, several washouts appear to have occurred on the north-facing slopes; however, by 2013 there was increased vegetation stabilizing those slopes. Multiple canals remove water from this creek, so while Champion Creek currently has passing BURP scores, dry year water withdrawals could affect the biota (both fish and riparian vegetation) and may lead (and has led) to substandard scores. This creek should be delisted from Category 5 and moved to Category 2. Future assessments should account for potential indications of impairments due to the altered flow regime through the application of water rights.



Location of BURP monitoring within Champion Creek, note beaver dams upstream of the site





Canal headgate/fish screen with fire scar in distance.



Flume example—downstream from headgate.



Champion Creek "oasis" in sagebrush flat (terraces).



Cobble nature of substrate—limited fines, but some embeddedness left from the fire.

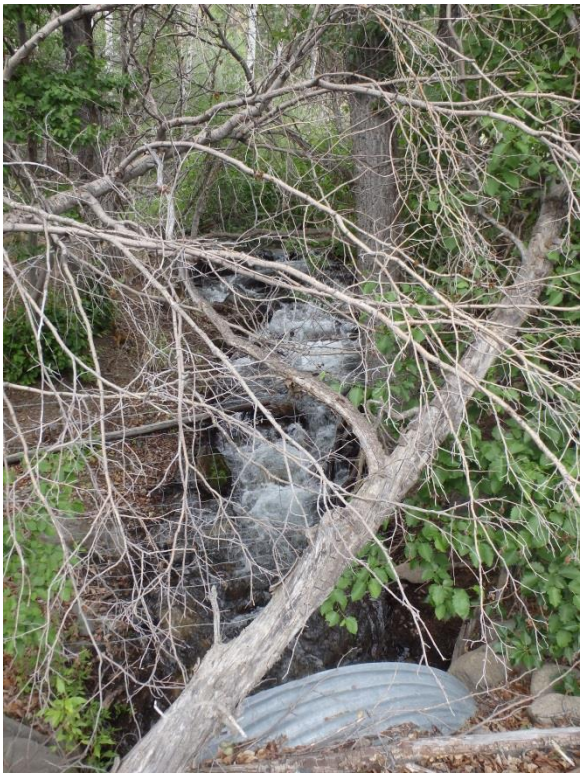
East Fork Salmon River – Tributaries between Germania Creek and Herd Creek
ID17060201SL103_02

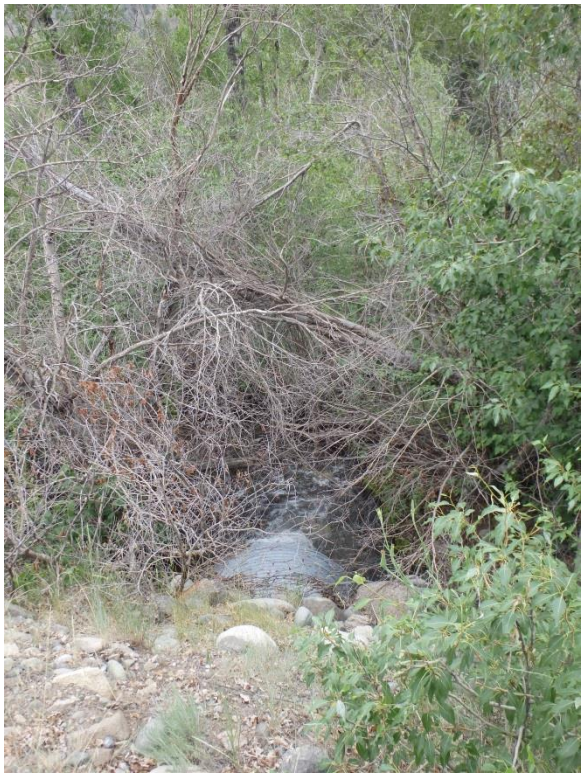
This AU was listed based on a 1997 BURP score (site 1997SIDFL049) in Wickiup Creek. This creek had an SMI and SHI of three (3), but only three (3) Rainbow Trout were caught in the 80–89 centimeter size class; therefore, the AU was deemed impaired for salmonid spawning. It was noted in ADB that this was an over-ride determination of salmonid spawning impairment as there were limited size classes. According to DEQ's *Water Body Assessment Guidance* (Grafe et al. 2002), an average score of greater than or equal to two (2) is considered fully supporting.

Wickiup Creek is a high-gradient channel flowing into the East Fork Salmon River. Near the confluence, Wickiup flows through an elliptical culvert before descending to the East Fork Salmon River that may act as a barrier to upstream migration of spawning trout. It is believed that the electrofishing limitations and geologic controls of this high-gradient channel, combined with the culvert, may contribute to a low fish count rather than an anthropogenic impairment. The substrate is composed of gravel and is stable. Access to the hiking trail along the creek has been blocked at the trailhead, which begins at a private property boundary with "No Trespassing" signs curtailing access.

It appears that this listing was based on an overly proactive assumption of required size classes representing salmonid spawning. However, an alternate examination of the data suggests that salmonid spawning is occurring in Wickiup Creek, as the Rainbow Trout are of a young-of-the-year size class and are most likely steelhead. These migratory fish most likely do not reside and grow in a stream less than 150 meters above the confluence with a larger river (East Fork Salmon River). It should be noted that Wickiup Creek was selected as a potential location for the *Steelhead Supplementation Studies in Idaho Rivers (Part II of Idaho Supplementation Studies) Experimental Design* (1992) by Alan Byrne, Fishery Research Biologist with the Idaho Department of Fish and Game, but was not included due to funding limitations (A. Byrne, personal communication, June 2014) and not because of habitat concerns. The limited numbers and size classes are most likely related to the difficulty in electrofishing the Rosgen Aa^+ overgrown stream channel with a gradient of approximately 11% (per BURP 1997SIDFL049 notes).

Recommendation: The original assessment is not supported by the other metrics and was re-examined based on contributing factors that limit fish capture, instead of assumptions of expected populations. Since the habitat and macroinvertebrate scores were within the highest categories, this AU should never have been listed and should be placed in Category 2 for meeting all beneficial uses.





Looking upstream and downstream from Wickiup Creek road crossing.



Wickiup Creek substrate.



Downstream culvert.





Upstream culvert.

NOTE: Photos above are from 2013 and 2014 but remain representative of the slide photographs available at the Idaho Falls Regional Office and the current vegetative cover and density.

CHECK BURP FISH DATA Marco Creek BURP data (1997SIDFL049) was not used in the assessment as the location was found not be in a representative location during the assessment process.

Road Creek – Source to Corral Basin Creek

ID17060201SL125_03

Per ADB:

> E coli concentrations were below threshold. Override due to lack of age class diversity (fish). Assessment and listing based upon BURP data only.

While the BURP data do indicate poor fish ratings and a lack of diversity of the age/size classes, it is an incorrect assessment based on the physical characteristics of the stream. Road Creek is a narrow, shallow stream that is ideal for fish growth during developing stages but is not likely to be capable of supporting larger fish due to the amount of water in the channel, especially during the baseflow periods, such as when BURP monitoring occurs. Corral Creek is a larger stream (which connects to the East Fork Salmon River); therefore, it is expected that larger fish migrate downstream from Road Creek to areas where conditions are better suited to growth and survival. There is a distinct advantage to the smaller fish to reside in the relative safety of the smaller portions of Road Creek until they are larger. Some stream reaches are marginally affected by the road that parallels the stream, but for the most part, those sections are isolated with minimal impacts. There appears to be sufficient buffer between the road and Road Creek, with road cuts and drainage features typically placed in locations that cannot directly impact the stream. There were some signs of cattle grazing; however, there was significantly more sign of elk scat than cattle.

Electrofishing efforts during BURP monitoring captured both Sculpins and Rainbow Trout, indicating sufficient cold water and habitat for some fishes, a finding supported by the macroinvertebrate (SMI) scores. The habitat scores (SHI) are more variable, but considering the arid and steep hillslopes composed of decomposing Challis volcanics with sagebrush, this stream is essentially an oasis. The green line/riparian habitat is limited by the groundwater/surface water interactions and capillary front, which may not extend much beyond the channel banks due to the combination of soil types and topography. Therefore, habitat is expected to be limited in comparison to the reference streams. This AU is listed as being in the Northern Mountains bioregion, but its deep semiarid valley is more similar to the Basin and Range bioregion surrounded by mountain ranges.

A portion of the stream appears to have developed a new channel. The channel is developing in a meadow and has high sinuosity. This channel was likely caused by the development of an old road crossing (approximately fifty (50) years ago) that altered the course of the stream. However, indications are that the stream has periodically moved through this isolated low-gradient valley portion in the past. Vegetation is developing and the sinuosity and bends have a significant fish population for its size.

The channel (in multiple locations) is in good condition. There are some limited indications of grazing. The riparian habitat is less than preferred, but in good condition. During the site visit, DEQ identified three snakes, three Sculpin, and eight trout (none were longer than approximately five (5) inches). Nearly every bend (pool) contained a fish, especially if there were overhanging banks or vegetation to provide cover.

Below is the adjusted scores which remove the fish scores as the assumption of size classes is not appropriate in this small stream channel indicates that the calculated two-score average meets or

exceeds the 2.0 score indicating full support for all the BURP sites. This adjusted average more appropriate represents a stream with characteristics supporting refugia for smaller fish as opposed to containing the SFI expected size classes.

BURP ID	Stream	SMIScore	SFI Score	SHIScore	AVGScore	AVG Score Adjusted
2006SIDFA072	Road Creek	3	1	1	1.67	2.00
1998SIDFA106	Bear Creek	3	1	2	2.00	2.50
1997SIDFL106	Road Creek	3		2	2.50	2.50
1997SIDFL046	Road Creek	3	1	1	1.67	2.00

Recommendation: This AU was listed based on assumptions of habitat and capacity for fish to develop; therefore, this AU should be moved to Category 2, as the BURP metrics indicated passing scores.



Detail of Road Creek—note the dry talus slopes.





Stream size and vegetation—note the proximity of the hillslope in the lower photo that limits vegetation.





Meadow area with altered channel—note road crossing in upper photo and surrounding hills.

Appendix C. Sediment

The Idaho Department of Environmental Quality (DEQ) collected sediment data from 2011 to 2013 to evaluate progress toward the surrogate sediment targets for instream erosion of at least 80% bank stability and no more than 28% subsurface fine sediment. The literature supporting these surrogate sediment targets, the streambank erosion inventory methods of determining bank stability, and the McNeil sediment core method of determining percent subsurface fine sediment (McNeil and Ahnell 1964) are presented in detail in the *Upper Salmon River Subbasin Assessment and TMDL* (DEQ 2003), approved by the US Environmental Protection Agency (EPA) in 2003.

In summary, the streambank erosion inventories are used to estimate background and existing streambank erosion derived from the Soil Conservation Service (SCS)/Natural Resources Conservation Service (NRCS) methods (a summary of the methods are included in this appendix). DEQ measures the extent of eroding streambanks in key reaches of listed assessment units (AUs). Direct volume calculations of the excess sedimentation delivered by the eroding streambank area and lateral recession rate of the streambanks result in a measure of streambank stability. These calculations provide the current sediment load based on existing conditions and the natural background erosion rate, which is assumed to occur at 80% bank stability. The natural background erosion rate is considered the assimilative capacity, or load capacity, of the stream. The difference between the current load and the load capacity is the load reduction necessary for meeting the sediment TMDL.

Data summarizing the findings of the DEQ streambank erosion inventories and copies of the completed worksheets follow.

McNeil Core Sample Data

McNeil sediment core samples measure percent subsurface fine sediment, which is a direct measure of conditions supportive of salmonid spawning and egg survival within the substrate. The McNeil sediment core results summary, with the sediment core sampling form, follows. These data are also included in Appendix B in the section detailing the Salmon River – Fisher Creek to Decker Creek AU (ID17060201SL072_05).

McNeil Sediment Core Sampling Form						
Stream	Salmon River (ID17060201SL072_05)					
Date	8/2/2011					
Location:	Braided Channel - near BURP 2008SIDFA081					
Lat/Lon:	N: 44.05375					
	W: 114.83975					
Site Desc:	Vegetated banks, stable deep gravels Note: Bias towards fines to allow digging					
Personnel:	A.S. & T.H.					
Rosgen Channel:		D				
Reach Gradient:						
Geology: (Q G V S)						
Target Species						
Sample Number		**1**	**2**	**3**		
Seive Size (inches)		ML	ML	ML		
2.5		520	475	190		
1		2700	2410	3200		
0.5		1000	700	980		
0.25		670	580	650		
1.0 - 0.25" Subtotal		4370	3690	4830		
#4		230	130	780		
#8		500	380	725		
#20		475	260	440		
#70		250	100	410		
#270		100	20	200		
<0.25" Subtotal		1555	890	2555		
Sample Total W/O 2.5"		5925	4580	7385	Mean	Std. Dev.
% Fines W/O 2.5"		**0.262447**	**0.194323**	**0.345972**	**0.267581**	**0.075954**
Sample Total W 2.5"		6445	5055	7575	Mean	Std. Dev.
% Fines W 2.5"		0.241272	0.176063	0.337294	0.251543	0.081104

Streambank Erosion Inventory Method

The streambank erosion inventory (SEI) calculations are adapted and developed from a variety of sources and have been modified to better acquire the data needed by the Idaho Department of Environmental Quality (DEQ). The SEI method is used to determine bank stability and erosion levels with an end goal of determining if channel stability supports beneficial uses. The following material is included to illustrate where the methods were developed and to supply additional information to support the DEQ decision-making processes.

The SEI follows methods outlined in the proceedings from the Soil Conservation Service—now called the Natural Resources Conservation Service—Channel Evaluation Workshop (SCS 1983). The SEI method is a field-based methodology that measures streambank/channel stability, length of active eroding banks, and bank geometry (Stevenson 1994).

Streambank Stability—Lateral Recession Rate

The SEI method is used to estimate the long-term lateral recession rate. The recession rate is determined from field evaluation of six streambank characteristics that are assigned a categorical rating from -1 to 3 in 0.25 increments. The six scores are then summed for a total field stability score and corresponding lateral recession rate. The categories and rating scores are as follows:

Bank Erosion Evidence:

- Do not appear to be eroding—0
- Erosion evident—1
- Surface of bank is eroding and top of bank has cracking present—2
- Slumps and clumps sloughing off into stream (note size of clumps)—3

Bank Stability Condition:

- Very little unprotected bank, no undercut vegetation; **or** bank materials nonerosive—0
- Predominantly bare and unprotected, some rills, moderate undercut vegetation—1
- Almost bare, unprotected bank, rills, severely undercut vegetation, exposed roots—2
- Bare, numerous rills/gullies, severely undercut vegetation, trees or fences falling—3

Bank Cover/Vegetation:

- Predominantly covered with perennials **and/or** stable rock/bedrock—0
- 40% or less bare/erodible **and/or** cover is annual and perennials mixed—1
- 40% to 70% bare/erodible **and/or** cover is mostly annual vegetation—2
- Predominantly bare and erodible/no cover—3

Lateral Channel Stability:

- No evidence of significant lateral movement of channel—0
- Minimal/slight active lateral movement of channel—1
- Older channel shift, developing riparian vegetation on one or both banks—2
- Recent channel shift, no riparian vegetation present (oxbows, braided/anastomosed)—3

Channel Bottom Stability:

- Channel in bedrock/noneroding—0
- Soil bottom, gravels or cobbles, minor erosion—1
- Silt bottom, evidence of active downcutting—2

In-Channel Deposition:

- Deposition is stable and/or vegetated (more than this growing season), channel is aggrading— -1
- No evidence of recent deposition (includes all sizes of bedload-type materials)—0
- Mobile material in recent deposition, deposits will probably move down channel in next high flow—1

Score Summation

Erosion	Lateral Recession Rate
Slight (0–4)	0.01–0.05 feet per year
Moderate (4.25–8)	0.06–0.15 feet per year
Severe (8.25–11.75)	0.16–0.3 feet per year
Very Severe (12+)	0.31–0.5+ feet per year

The original method uses a "Score Summation" in broad categories as shown above as a descriptive estimation of lateral recession rate. Other streambank stability estimation methods exist, such as the simplified modification of Platts et al. (1983, p. 13) as stated in *Monitoring Protocols to Evaluate Water Quality Effects of Grazing Management on Western Rangeland Streams* (Bauer and Burton 1993). This method uses more descriptive terms of bank condition as an effort to make the assignment of lateral recession rate more objective.

However, DEQ prefers to calculate lateral recession rate directly from the stability scores identified in the field for more accurate results. Each total field score from 0 through 15 in 0.25 increments corresponds with a specific lateral recession rate ranging from 0.01 through 0.84 feet per year. The full recession rate table is included in the streambank erosion inventory spreadsheet, but a summary is given here:

Recession Rate Field Score	Lateral Recession Rate	Recession Rate Field Score	Lateral Recession Rate
0	0.01	8	0.15
1	0.02	9	0.16
2	0.03	10	0.27
3	0.04	11	0.38
4	0.05	12	0.5
5	0.06	13	0.61
6	0.09	14	0.73
7	0.12	15	0.84

The calculation process is the preferred choice by DEQ, as it is better suited to determine loading and reduction allocations necessary for total maximum daily load development.

Target stability scores, as opposed to field stability scores, are based on the need for additional erosion reductions beyond the overall 80% streambank stability. This additional parameter is to be used when there are excessive erosion rate indications, such as when the streambanks are prone to very severe erosion rates and need to be less erosive or the channel may anastomose or shift channels outside the current riparian corridor. The goal of this target stability score is to further promote options to meet an in-channel substrate of less than 28% fine sediments.

SEI—Total Bank Erosion Calculations

The direct volume method is used to calculate average annual erosion rates for a given stream segment based on the lateral recession rate determined in the survey (SCS 1983). The erosion rate (tons/mile/year) is used to estimate the total bank erosion of the selected stream corridor.

The direct volume method is summarized in the following equations:

$$E = [A_E \times R_{LR} \times {}_{BD}]/2{,}000 \text{ (pounds/ton)}$$

where:

E = bank erosion over sampled stream reach (tons/year/sample reach)

A_E = eroding area (square feet)

R_{LR} = lateral recession rate (feet/year)

${}_{BD}$ = bulk density of bank material (pounds per cubic feet)

The bank erosion rate (E_R) is calculated by dividing the sampled bank erosion (E) by the total stream length sampled:

$$E_R = E/L_{BB}$$

where:

E_R = bank erosion rate (tons/mile/year)

E = bank erosion over sampled stream reach (tons/year/sample reach)

L_{BB} = inventory/thalweg length

Total bank erosion is expressed as an annual average. However, the frequency and magnitude of bank erosion events are greatly a function of soil moisture and stream discharge (Leopold et al. 1964). Because channel erosion events typically result from above-average flow events, the annual average bank erosion value should be considered a long-term average. For example, a fifty (50) year flood event might cause 5 feet of bank erosion in 1 year, and over a ten (10) year period, this event accounts for the majority of bank erosion. These factors have less of an influence where bank trampling is the major cause of channel instability.

The *eroding area* (A_E) is the product of linear horizontal bank distance and average bank slope height. Bank length and slope heights are measured while walking along the stream channel. Laser distance rangefinders, paces, tape measures, or other tools are used to measure horizontal distance. Bank slope heights are continually measured and recorded over a given reach or site. The horizontal length is the length of the right or left bank or thalweg. Typically, one bank along the stream channel is actively eroding (e.g., the bank on the outside of a meander). However, both banks of channels with severe head cuts (i.e., nickpoints) or gullies will be eroding and are

to be measured separately and will be eventually summed. The spreadsheet automatically accounts for sediment contributions based on inventoried segment inputs.

Soil *bulk density* (*BD*) is the weight of material divided by its volume, including the volume of its pore spaces. The bulk density of bank material can be measured visually in the field or estimated using methods similar to a Wolman pebble count to determine average particle size. Alternatively, a table of typical soil bulk densities can be used (see below), or soil samples can be collected and soil bulk density measured in the laboratory.

Soil Bulk Density Estimation Table

Soil Texture	Bulk Density (lb/ft^3)
Sands, loamy sands	110
Sandy loam	105
Fine sandy loam	100
Loams, sandy clay loams, sandy clay	90
Silt loam	85
Silty clay loam, silty clay	80
Clay loam	75
Clay	70
Organic	22

Note: Adapted from MDEQ (1999)

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Streambank Erosion Inventory Data Sheets

STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Salmon River Tributaries - Penal to Pahsimeroi	**Stream Segment Location (DD)**	
Assessment Unit:	ID17060201SL001_02	***Upstream N***	44.63715
Segment Inventoried:	Shep Creek	***W***	114.10544
Total Reach:	2300 ft	***Downstream N***	44.64294
Date Collected:	8-Jul-13	***W***	114.107120
Field Crew:	C Cooper	**Notes:**	Less than 1cfs. Dry below diversion. Actual erosion is limited to times when stream power is sufficient. Spring only.
Data Reduced By:	C Cooper		

Current Load Streambank Erosion Calculations		Unit	Area Applied
Right, left or both bank measurements	1	Single Bank	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flowpath distance)	2300.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	110	lb/ft^3	Total Reach
Length of Similar Stream	26400	ft	Total Reach
Estimated Distance inventoried	2300.00	ft	"
Total Erosive Bank Length	280.00	ft	"
Percent Erosive Bank	12.2	%	"
Eroding Area (AE)	1640.00	ft^2	"
Lateral Recession Rate (RLR)	0.055		"
Bank Erosion (E)	4.96	tons/year	"
Total Bank Erosion Rate (ER)	11.39	tons/mile/year	Reach and Segment
Total Bank Erosion	56.94	tons/year	"

Recession Rate Calculations		
Factor	**Field Stability Score**	**Erosion Severity Reduction**
Bank Erosion Evidence (0 to 3)	1.5	1.5
Bank Stability Condition (0 to 3)	1	1
Bank Cover/Vegetation(0 to 3)	2	2
Lateral Channel Stability (0 to 3)	0	0
Channel Bottom Stability (0 to 2)	1	1
In-Channel Deposition (-1 to 1)	-1	-1
Total = Slight (0-4); Moderate (4-8); Severe (>8)	4.5	4.5
Lateral Recession Rate (RLR) (ft/yr)	**0.055**	**0.055**

Load Capacity Streambank Erosion Calculations for Total Reach		Unit	Area Applied
Eroding Area at Load Capacity (AE)	2694.29	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	8.15	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	18.71	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	93.55	tons/year	Total Reach

Summary of Loads

Current Load		Load Capacity			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
11.4	**56.9**	**18.7**	**93.6**	**No**	**9**

Percent Erosion Reduction (%)	**0**
Total Erosion Reduction (tons/yr)	**0**

STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Garden Creek	**Stream Segment Location (DD)**	
Assessment Unit:	ID17060201SL015_03	***Upstream N***	ENTIRE AU
Segment Inventoried:	abv Challis	***W***	
Total Reach:	1500 ft	***Downstream N***	
Date Collected:	6-Jun-13	***W***	
Field Crew:	JHeaton - CCooper	**Notes:**	Limited Access...Stability Scores from bridges, etc.
Data Reduced By:	C Cooper		

Current Load Streambank Erosion Calculations		Unit	Area Applied
Right, left or both bank measurements	2	Both Banks	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flowpath distance)	1500.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	110	lb/ft^3	Total Reach
Length of Similar Stream	20000	ft	Total Reach
Estimated Distance inventoried	3000.00	ft	"
Total Erosive Bank Length	100.00	ft	"
Percent Erosive Bank	3.3	%	"
Eroding Area (AE)	100.00	ft^2	"
Lateral Recession Rate (RLR)	0.015		"
Bank Erosion (E)	0.08	tons/year	"
Total Bank Erosion Rate (ER)	0.29	tons/mile/year	Reach and Segment
Total Bank Erosion	1.10	tons/year	"

Recession Rate Calculations		
Factor	**Field Stability Score**	**Erosion Severity Reduction**
Bank Erosion Evidence (0 to 3)	0	0
Bank Stability Condition (0 to 3)	0.5	0.5
Bank Cover/Vegetation(0 to 3)	0	0
Lateral Channel Stability (0 to 3)	0	0
Channel Bottom Stability (0 to 2)	0	0
In-Channel Deposition (-1 to 1)	0	0
Total = Slight (0-4); Moderate (4-8); Severe (>8)	0.5	0.5
Lateral Recession Rate (RLR) (ft/yr)	**0.015**	**0.015**

Load Capacity Streambank Erosion Calculations for Total Reach		Unit	Area Applied
Eroding Area at Load Capacity (AE)	600.00	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	0.50	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	1.74	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	6.60	tons/year	Total Reach

Summary of Loads					
Current Load		**Load Capacity**			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
0.3	**1.1**	**1.7**	**6.6**	**No**	**1**

Percent Erosion Reduction (%)	**0**
Total Erosion Reduction (tons/yr)	**0**

STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Slate Creek	**Stream Segment Location (DD)**	
Assessment Unit:	ID17060201SL099_02	***Upstream N***	44.184199
Segment Inventoried:	Abv Livingstone Creek	***W***	-114.613739
Total Reach:	5280 ft	***Downstream N***	44.172932
Date Collected:	11-Sep-13	***W***	-114.623092
Field Crew:	J Fales - C Cooper	**Notes:**	Abv Livingstone Creek - multiple stops along main channel. Observations to assess recovery from 1998 microburst flood
Data Reduced By:	C Cooper		

Current Load Streambank Erosion Calculations		Unit	Area Applied
Right, left or both bank measurements	1	Single Bank	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flowpath distance)	5280.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	85	lb/ft^3	Total Reach
Length of Similar Stream	52800	ft	Total Reach
Estimated Distance inventoried	5280.00	ft	"
Total Erosive Bank Length	4000.00	ft	"
Percent Erosive Bank	75.8	%	"
Eroding Area (AE)	12000.00	ft^2	"
Lateral Recession Rate (RLR)	0.44		"
Bank Erosion (E)	224.40	tons/year	"
Total Bank Erosion Rate (ER)	224.40	tons/mile/year	Reach and Segment
Total Bank Erosion	2244.00	tons/year	"

Recession Rate Calculations		
Factor	**Field Stability Score**	**Erosion Severity Reduction**
Bank Erosion Evidence (0 to 3)	3	1.5
Bank Stability Condition (0 to 3)	1.5	1.5
Bank Cover/Vegetation(0 to 3)	1.5	1.5
Lateral Channel Stability (0 to 3)	3	1.5
Channel Bottom Stability (0 to 2)	1.5	1
In-Channel Deposition (-1 to 1)	1	1
Total = Slight (0-4); Moderate (4-8); Severe (>8)	11.5	8
Lateral Recession Rate (RLR) (ft/yr)	**0.44**	**0.15**

Load Capacity Streambank Erosion Calculations for Total Reach		Unit	Area Applied
Eroding Area at Load Capacity (AE)	3168.00	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	20.20	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	20.20	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	201.96	tons/year	Total Reach

Summary of Loads					
Current Load		**Load Capacity**			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
224.4	**2244.0**	**20.2**	**202.0**	**YES**	**20**

Percent Erosion Reduction (%)	**91**
Total Erosion Reduction (tons/yr)	**2062**

STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Road Creek	**Stream Segment Location (DD)**	
Assessment Unit:	ID17060201SL125_03	***Upstream N***	44.170888
Segment Inventoried:	Near 2006 BURP location	***W***	114.194462
Total Reach:	2250 ft	***Downstream N***	44.174725
Date Collected:	16-Jul-13	***W***	114.194462
Field Crew:	J Fales - C Cooper	**Notes:**	Both canyon and meadow captured
Data Reduced By:	C Cooper		

Current Load Streambank Erosion Calculations		Unit	Area Applied
Right, left or both bank measurements	2	Both Banks	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flowpath distance)	2250.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	90	lb/ft^3	Total Reach
Length of Similar Stream	15312	ft	Total Reach
Estimated Distance inventoried	4500.00	ft	"
Total Erosive Bank Length	225.00	ft	"
Percent Erosive Bank	5.0	%	"
Eroding Area (AE)	797.00	ft^2	"
Lateral Recession Rate (RLR)	0.0425		"
Bank Erosion (E)	1.52	tons/year	"
Total Bank Erosion Rate (ER)	3.58	tons/mile/year	Reach and Segment
Total Bank Erosion	10.37	tons/year	"

Recession Rate Calculations		
Factor	**Field Stability Score**	**Erosion Severity Reduction**
Bank Erosion Evidence (0 to 3)	1	1
Bank Stability Condition (0 to 3)	0.25	0.25
Bank Cover/Vegetation(0 to 3)	0.5	0.5
Lateral Channel Stability (0 to 3)	1	1
Channel Bottom Stability (0 to 2)	0.5	0.5
In-Channel Deposition (-1 to 1)	0	0
Total = Slight (0-4); Moderate (4-8); Severe (>8)	3.25	3.25
Lateral Recession Rate (RLR) (ft/yr)	**0.0425**	**0.0425**

Load Capacity Streambank Erosion Calculations for Total Reach		Unit	Area Applied
Eroding Area at Load Capacity (AE)	3188.00	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	6.10	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	14.31	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	41.49	tons/year	Total Reach

Summary of Loads					
Current Load		**Load Capacity**			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
3.6	**10.4**	**14.3**	**41.5**	**No**	**4**

Percent Erosion Reduction (%)	**0**
Total Erosion Reduction (tons/yr)	**0**

STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Mosquito Creek	**Stream Segment Location (DD)**	
Assessment Unit:	ID17060201SL126_02	***Upstream N***	44.152122
Segment Inventoried:	Above Road Creek	***W***	114.175243
Total Reach:	2500 feet	***Downstream N***	44.158151
Date Collected:	16-Jul-13	***W***	114.175885
Field Crew:	J Fales - C Cooper	**Notes:**	Cattle, Elk and Horse sign. Lots of Horse sign (scat), wild horses known to be in area.
Data Reduced By:	C Cooper		

Current Load Streambank Erosion Calculations		Unit	Area Applied
Right, left or both bank measurements	1	Single Bank	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flowpath distance)	2500.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	100	lb/ft^3	Total Reach
Length of Similar Stream	39346	ft	Total Reach
Estimated Distance inventoried	2500.00	ft	"
Total Erosive Bank Length	250.00	ft	"
Percent Erosive Bank	10.0	%	"
Eroding Area (AE)	500.00	ft^2	"
Lateral Recession Rate (RLR)	0.04		"
Bank Erosion (E)	1.00	tons/year	"
Total Bank Erosion Rate (ER)	2.11	tons/mile/year	Reach and Segment
Total Bank Erosion	15.74	tons/year	"

Recession Rate Calculations

Factor	Field Stability Score	Erosion Severity Reduction
Bank Erosion Evidence (0 to 3)	1.5	1.5
Bank Stability Condition (0 to 3)	0	0
Bank Cover/Vegetation(0 to 3)	0	0
Lateral Channel Stability (0 to 3)	1.25	1.25
Channel Bottom Stability (0 to 2)	0.25	0.25
In-Channel Deposition (-1 to 1)	0	0
Total = Slight (0-4); Moderate (4-8); Severe (>8)	3	3
Lateral Recession Rate (RLR) (ft/yr)	**0.04**	**0.04**

Load Capacity Streambank Erosion Calculations for Total Reach		Unit	Area Applied
Eroding Area at Load Capacity (AE)	1000.00	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	2.00	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	4.22	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	31.48	tons/year	Total Reach

Summary of Loads

Current Load		Load Capacity			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
2.1	**15.7**	**4.2**	**31.5**	**No**	**3**

Percent Erosion Reduction (%)	**0**
Total Erosion Reduction (tons/yr)	**0**

STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Warm Springs Creek	**Stream Segment Location (DD)**	
Assessment Unit:	ID17060201SL131_04	***Upstream N***	44.445094
Segment Inventoried:	Lower section - BLM	***W***	114.142443
Total Reach:	1000 ft	***Downstream N***	44.446658
Date Collected:	6-Jun-13	***W***	114.143501
Field Crew:	JHeaton - Ccooper	**Notes:**	upper segements were visually confirmed to match lower section
Data Reduced By:	CCooper		

Current Load Streambank Erosion Calculations		Unit	Area Applied
Right, left or both bank measurements	1	Single Bank	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flowpath distance)	750.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	110	lb/ft^3	Total Reach
Length of Similar Stream	24500	ft	Total Reach
Estimated Distance inventoried	750.00	ft	"
Total Erosive Bank Length	684.00	ft	"
Percent Erosive Bank	91.2	%	"
Eroding Area (AE)	4176.00	ft^2	"
Lateral Recession Rate (RLR)	0.5275		"
Bank Erosion (E)	121.16	tons/year	"
Total Bank Erosion Rate (ER)	852.94	tons/mile/year	Reach and Segment
Total Bank Erosion	3957.77	tons/year	"

Recession Rate Calculations

Factor	Field Stability Score	Erosion Severity Reduction
Bank Erosion Evidence (0 to 3)	3	1.5
Bank Stability Condition (0 to 3)	3	1.5
Bank Cover/Vegetation(0 to 3)	2	2
Lateral Channel Stability (0 to 3)	2.5	2
Channel Bottom Stability (0 to 2)	1.75	1
In-Channel Deposition (-1 to 1)	0	0
Total = Slight (0-4); Moderate (4-8); Severe (>8)	12.25	8
Lateral Recession Rate (RLR) (ft/yr)	**0.5275**	**0.15**

Load Capacity Streambank Erosion Calculations for Total Reach		Unit	Area Applied
Eroding Area at Load Capacity (AE)	915.79	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	7.56	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	53.19	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	246.81	tons/year	Total Reach

Summary of Loads

Current Load		Load Capacity			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
852.9	**3957.8**	**53.2**	**246.8**	**YES**	**25**

Percent Erosion Reduction (%)	**94**
Total Erosion Reduction (tons/yr)	**3736**

STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Warm Springs Creek	**Stream Segment Location (DD)**	
Assessment Unit:	ID17060201SL132_02	***Upstream N***	44.397009
Segment Inventoried:	Lime Creek	***W***	114.085250
Total Reach:	Representative of entire AU	***Downstream N***	44.397214
Date Collected:	6-Jun-13	***W***	114.090676
Field Crew:		**Notes:**	Stream was dry. No indications of flow in recent months. Erodible when water flows, therefore estimates high.
Data Reduced By:			

Current Load Streambank Erosion Calculations		Unit	Area Applied
Right, left or both bank measurements	1	Single Bank	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flowpath distance)	1530.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	110	lb/ft^3	Total Reach
Length of Similar Stream	250000	ft	Total Reach
Estimated Distance inventoried	1530.00	ft	"
Total Erosive Bank Length	1279.00	ft	"
Percent Erosive Bank	83.6	%	"
Eroding Area (AE)	8440.00	ft^2	"
Lateral Recession Rate (RLR)	0.15		"
Bank Erosion (E)	69.63	tons/year	"
Total Bank Erosion Rate (ER)	240.29	tons/mile/year	Reach and Segment
Total Bank Erosion	11377.45	tons/year	"

Recession Rate Calculations

Factor	Field Stability Score	Erosion Severity Reduction
Bank Erosion Evidence (0 to 3)	2	2
Bank Stability Condition (0 to 3)	2	2
Bank Cover/Vegetation(0 to 3)	3	3
Lateral Channel Stability (0 to 3)	0.5	0.5
Channel Bottom Stability (0 to 2)	0.5	0.5
In-Channel Deposition (-1 to 1)	0	0
Total = Slight (0-4); Moderate (4-8); Severe (>8)	8	8
Lateral Recession Rate (RLR) (ft/yr)	**0.15**	**0.15**

Load Capacity Streambank Erosion Calculations for Total Reach		Unit	Area Applied
Eroding Area at Load Capacity (AE)	2019.27	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	16.66	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	57.49	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	2722.05	tons/year	Total Reach

Summary of Loads

Current Load		Load Capacity			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
240.3	**11377.5**	**57.5**	**2722.0**	**YES**	**272**

Percent Erosion Reduction (%)	**77**
Total Erosion Reduction (tons/yr)	**8928**

STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Warm Springs Creek	**Stream Segment Location (DD)**	
Assessment Unit:	ID17060201SL132_03	***Upstream N***	44.316300
Segment Inventoried:	Warm Springs Creek	***W***	114.051960
Total Reach:	Representative of entire AU	***Downstream N***	
Date Collected:	6-Jun-13	***W***	
Field Crew:	JHeaton - CCooper	**Notes:**	AU is not eroding, however loads from upstream are impairing beneficial use
Data Reduced By:	CCooper		

Current Load Streambank Erosion Calculations		Unit	Area Applied
Right, left or both bank measurements	1	Single Bank	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flowpath distance)	1000.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	110	lb/ft^3	Total Reach
Length of Similar Stream	99000	ft	Total Reach
Estimated Distance inventoried	1000.00	ft	"
Total Erosive Bank Length	150.00	ft	"
Percent Erosive Bank	15.0	%	"
Eroding Area (AE)	150.00	ft^2	"
Lateral Recession Rate (RLR)	0.03		"
Bank Erosion (E)	0.25	tons/year	"
Total Bank Erosion Rate (ER)	1.31	tons/mile/year	Reach and Segment
Total Bank Erosion	24.50	tons/year	"

Recession Rate Calculations

Factor	Field Stability Score	Erosion Severity Reduction
Bank Erosion Evidence (0 to 3)	0	1.5
Bank Stability Condition (0 to 3)	0	1.5
Bank Cover/Vegetation(0 to 3)	0	1.5
Lateral Channel Stability (0 to 3)	1	1.5
Channel Bottom Stability (0 to 2)	1	1
In-Channel Deposition (-1 to 1)	0	1
Total = Slight (0-4); Moderate (4-8); Severe (>8)	2	8
Lateral Recession Rate (RLR) (ft/yr)	**0.03**	**0.15**

Load Capacity Streambank Erosion Calculations for Total Reach		Unit	Area Applied
Eroding Area at Load Capacity (AE)	200.00	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	1.65	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	8.71	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	163.35	tons/year	Total Reach

Summary of Loads

Current Load		Load Capacity			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
1.3	**24.5**	**8.7**	**163.4**	**No**	**16**

Percent Erosion Reduction (%)	**0**
Total Erosion Reduction (tons/yr)	**0**

STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Warm Springs Creek	**Stream Segment Location (DD)**	
Assessment Unit:	ID17060201SL132_04	***Upstream N***	44.368730
Segment Inventoried:	Warm Springs Creek	***W***	114.077620
Total Reach:	Representative of entire AU	***Downstream N***	
Date Collected:	6-Jun-13	***W***	
Field Crew:	JHeaton - CCooper	**Notes:**	
Data Reduced By:	C Cooper		

Current Load Streambank Erosion Calculations		Unit	Area Applied
Right, left or both bank measurements	1	Single Bank	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flowpath distance)	1000.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	110	lb/ft^3	Total Reach
Length of Similar Stream	31560	ft	Total Reach
Estimated Distance inventoried	1000.00	ft	"
Total Erosive Bank Length	1000.00	ft	"
Percent Erosive Bank	100.0	%	"
Eroding Area (AE)	6000.00	ft^2	"
Lateral Recession Rate (RLR)	0.135		"
Bank Erosion (E)	44.55	tons/year	"
Total Bank Erosion Rate (ER)	235.22	tons/mile/year	Reach and Segment
Total Bank Erosion	1406.00	tons/year	"

Recession Rate Calculations		
Factor	**Field Stability Score**	**Erosion Severity Reduction**
Bank Erosion Evidence (0 to 3)	1	1
Bank Stability Condition (0 to 3)	1	1
Bank Cover/Vegetation(0 to 3)	2	2
Lateral Channel Stability (0 to 3)	1.5	1.5
Channel Bottom Stability (0 to 2)	1	1
In-Channel Deposition (-1 to 1)	1	1
Total = Slight (0-4); Moderate (4-8); Severe (>8)	7.5	7.5
Lateral Recession Rate (RLR) (ft/yr)	**0.135**	**0.135**

Load Capacity Streambank Erosion Calculations for Total Reach		Unit	Area Applied
Eroding Area at Load Capacity (AE)	1200.00	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	8.91	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	47.04	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	281.20	tons/year	Total Reach

Summary of Loads					
Current Load		**Load Capacity**			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
235.2	**1406.0**	**47.0**	**281.2**	**YES**	**28**

Percent Erosion Reduction (%)	**80**
Total Erosion Reduction (tons/yr)	**1153**

STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Broken Wagon Creek	**Stream Segment Location (DD)**	
Assessment Unit:	ID17060201SL133_02	***Upstream N***	44.297190
Segment Inventoried:	Trib near borrow pit	***W***	114.030230
Total Reach:	Representative of entire AU	***Downstream N***	
Date Collected:	6-Jun-13	***W***	
Field Crew:	J Heaton - C Cooper	**Notes:**	not a channel, dip in topography. No indications of recent surface water discharges/pooling, etc. EPHEMERAL
Data Reduced By:	C Cooper		

Current Load Streambank Erosion Calculations		Unit	Area Applied
Right, left or both bank measurements	2	Both Banks	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flowpath distance)	4000.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	110	lb/ft^3	Total Reach
Length of Similar Stream	99000	ft	Total Reach
Estimated Distance inventoried	8000.00	ft	"
Total Erosive Bank Length	10.00	ft	"
Percent Erosive Bank	0.1	%	"
Eroding Area (AE)	1.00	ft^2	"
Lateral Recession Rate (RLR)	0.02		"
Bank Erosion (E)	0.00	tons/year	"
Total Bank Erosion Rate (ER)	0.00	tons/mile/year	Reach and Segment
Total Bank Erosion	0.03	tons/year	"

Recession Rate Calculations		
Factor	**Field Stability Score**	**Erosion Severity Reduction**
Bank Erosion Evidence (0 to 3)	0	0
Bank Stability Condition (0 to 3)	0.5	0.5
Bank Cover/Vegetation(0 to 3)	0.5	0.5
Lateral Channel Stability (0 to 3)	0	0
Channel Bottom Stability (0 to 2)	0	0
In-Channel Deposition (-1 to 1)	0	0
Total = Slight (0-4); Moderate (4-8); Severe (>8)	1	1
Lateral Recession Rate (RLR) (ft/yr)	**0.02**	**0.02**

Load Capacity Streambank Erosion Calculations for Total Reach		Unit	Area Applied
Eroding Area at Load Capacity (AE)	160.00	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	0.18	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	0.23	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	4.36	tons/year	Total Reach

Summary of Loads					
Current Load		**Load Capacity**			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
0.0	**0.0**	**0.2**	**4.4**	**No**	**0.4**

Percent Erosion Reduction (%)	**0**
Total Erosion Reduction (tons/yr)	**0**

STREAMBANK EROSION INVENTORY CALCULATION WORKSHEET

Stream:	Broken Wagon Creek	**Stream Segment Location (DD)**	
Assessment Unit:	ID17060201SL133_03	***Upstream N***	44.294760
Segment Inventoried:	Main Stem - Broken Wagon Creek	***W***	114.055022
Total Reach:	Representative of entire AU	***Downstream N***	44.295892
Date Collected:	6-Jun-13	***W***	114.054892
Field Crew:	J Heaton - C Cooper	**Notes:**	multiple channels, several examined and walked to confirm representative of "main channel" EPHEMERAL
Data Reduced By:	C Cooper		

Current Load Streambank Erosion Calculations		Unit	Area Applied
Right, left or both bank measurements	2	Both Banks	Inventoried Segment
Inventory/Thalweg Length (LBB) (stream flowpath distance)	500.00	ft	Inventoried Segment
TMDL Margin of Safety	10	%	Total Reach
Bulk Density (BD)	110	lb/ft^3	Total Reach
Length of Similar Stream	99000	ft	Total Reach
Estimated Distance inventoried	1000.00	ft	"
Total Erosive Bank Length	100.00	ft	"
Percent Erosive Bank	10.0	%	"
Eroding Area (AE)	10.00	ft^2	"
Lateral Recession Rate (RLR)	0.025		"
Bank Erosion (E)	0.01	tons/year	"
Total Bank Erosion Rate (ER)	0.15	tons/mile/year	Reach and Segment
Total Bank Erosion	2.72	tons/year	"

Recession Rate Calculations		
Factor	**Field Stability Score**	**Erosion Severity Reduction**
Bank Erosion Evidence (0 to 3)	0.5	0
Bank Stability Condition (0 to 3)	0.5	0.5
Bank Cover/Vegetation(0 to 3)	0.5	0.5
Lateral Channel Stability (0 to 3)	0	0
Channel Bottom Stability (0 to 2)	0	0
In-Channel Deposition (-1 to 1)	0	0
Total = Slight (0-4); Moderate (4-8); Severe (>8)	1.5	1
Lateral Recession Rate (RLR) (ft/yr)	**0.025**	**0.02**

Load Capacity Streambank Erosion Calculations for Total Reach		Unit	Area Applied
Eroding Area at Load Capacity (AE)	20.00	ft^2	Inventoried Segment
Bank Erosion at Load Capacity (E)	0.02	tons/year	"
Total Bank Erosion Rate at Load Capacity (ER)	0.23	tons/mile/year	Reach and Segment
Total Bank Erosion at Load Capacity for Reach	4.36	tons/year	Total Reach

Summary of Loads					
Current Load		**Load Capacity**			
Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Total Bank Erosion Rate (tons/mile/yr)	Total Bank Erosion (tons/yr)	Load Reduction Required?	Margin of Safety (tons/yr)
0.1	**2.7**	**0.2**	**4.4**	**No**	**0.4**

Percent Erosion Reduction (%)	**0**
Total Erosion Reduction (tons/yr)	**0**

Sediment Pulses in the Upper Salmon River Subbasin—Summary

This region was listed as sediment impaired based on the *Idaho Water Quality Status Report and Nonpoint Source Assessment: 1988* (DEQ 1989), which classified the Salmon River between Redfish Creek and East Fork Salmon River as having sediment impairing at least one beneficial use. At the time, the stream segments (PNRS# from the Pacific Northwest Rivers Study stream and lake inventory database) were inclusive of all the tributaries into that length of stream (unless specifically excluded with their own group number). The USFS reported that the greatest sediment source was from rangeland. This means that the data reported in 1988 most likely refers more to the tributaries rather than the main stem of the Salmon River since grazing along the canyon portions of the main stem Salmon River was minimal. Comparatively more grazing occurred in the more accessible tributary valleys. The determined pollutant magnitude was listed as high; additional stressors with low magnitude included riparian/stream habitat modifications.

Since 1998, four (4) Integrated Reports have been published and a more refined stream system designation using assessment units (AUs) has been developed. These AUs are smaller and are expected to be more representative since headwater tributaries should not be examined in the same manner as the Salmon River main stem. These AUs are examined individually for their impacts, impairments, and source zones. Additionally, since 1998 there has been a more coordinated approach to managing sediment and habitat in the State of Idaho, especially on public lands, which comprise more than 95% of the land-area above the East Fork Salmon River.

There were no identified sediment impairments in the main stem Salmon River, including the three (3) AUs that are currently listed for sediment impairments (ID17060201SL027_05, ID17060201SL047_05, and ID17060201SL063_05) below the Redfish Lake Creek confluence. These AUs are exceeding the temperature criteria and PNV TMDLs were developed. The fourth AU (ID17060201SL072_05) is listed in the 2012 Integrated Report for sediment impairment but is an anastomosed portion of the river and not impaired by sediment. (See Appendix B for details.) There were several tributaries of concern that provide a sediment load to the Salmon River and those have descriptions/TMDL determinations listed separately. Event-based sediment pulses are described in this appendix and are not subject to TMDL development.

During the summer and fall 2013, four sediment pulses/sources were identified in the main stem Salmon River. Two of these pulses were associated with high-intensity, brief storm events that caused road cut failures and gully erosion in the steep hill slopes, while the third was primarily caused by the Halstead Fire of 2012, with Basin Creek (ID17060201SL048_03) identified as the primary source of high organic matter/soot and soil from the affected area. The fourth source (Slate Creek – ID17060201SL99_02) is a stream in recovery from a 1998 microburst-induced flood that scoured the channel of vegetation and now discharges sediment during storm events.

The first identified pulse was from a storm event during the night of July 16, 2013, that led to the road cut above Highway 75 failing and producing mudslides that subsequently covered the roadway and then entered the river. The sediment pulse diminished by mid-day and was transported down river. As the day progressed, water clarity increased in the lower reaches, as the majority of the load was suspended sediment. Clarity improved more rapidly in the upper reaches of the canyon. The river above the road cut mudslide was not affected by the storm and/or sediment. An additional source was Slate Creek, which was discharging a high sediment load that persisted longer into the day than the mudslide upstream (Slate Creek is discussed later

and in Appendix B). The storm was localized with its highest intensity in the upper-central portions of the watershed surrounding the Salmon River between Challis and Stanley, Idaho. Road crews were on site and removed most of the detritus before noon. During the rest of the summer (and during summer 2014), the road-cut/cliffs above the highway near mile marker 207 were cleaned of loose debris and stabilized.

The second identified pulse was from the East Fork Salmon River where a large thunderstorm with rain and hail caused hillslope erosion and road bank failure. This event occurred on September 3, 2013, with nearby locations reporting flash floods. Based on climate data and communications with locals, a conservative estimate is that this was a 25–50 year storm event and is outside of the typical range of storms for this area. Storm evidence and cleanup were still occurring on September 11, 2013. A follow-up visit in October 2013 found the vast majority of the sediment that entered both the East Fork and the Salmon River main stem was removed. Locations along the bank, above the current water level, still retained some deposition. Hillslopes that eroded are in a semi-arid environment and susceptible to high intensity thunderstorms. Long-term debris in either the East Fork Salmon River or the Salmon River main stem was mostly removed by mid-October and was completely removed in the 2014 spring snowmelt. There was no evidence of the in-channel sediment deposits in July 2014.

The third identified source is from the Halstead Fire of 2012. Site visits on September 11, 2013, and August 6, 2014, confirmed Halstead Fire impacts to the Basin Creek subwatershed (to the confluence to the Salmon River). Based on USFS comments, these fire impacts and sediment loads are expected to decrease in 5–7 years and are storm driven and/or seasonal. There are signs that storm events led to pulses of sediment and organic matter. The sediment is nearly black in locations and incongruous with the soils of surrounding areas. Vegetation on banks is beginning to recover, but hillslope erosion and rilling is apparent. More information on Basin Creek is in Appendix B.

Slate Creek had a microburst storm event in 1998. The storm scoured and removed the existing channel and a new channel is slowly forming along with associated riparian habitat in the upper portion (AU ID17060201SL099_02) of the subwatershed. These developing floodplains have limited, if any, vegetation and are more similar in appearance to a dredged stream than a functioning stream with healthy riparian ecology. Sediment from Slate Creek has a distinctive slate-grey color as was identified in limited slack water locations immediately downstream of its confluence with the Salmon River. Slate Creek was grey with sediment from the July 16–17, 2013, storm, but by July 29, 2013, the water was observed to be clear and by October the water was less turbid appearing than the Salmon River. Slate Creek is turbid when a storm event has caused excess streamflow, and the location will likely be a sediment source for decades to come after high-intensity precipitation events until the channel and habitat recovery is complete. This is a minor source of sediment to the Salmon River and from a natural source/cause. More information on Slate Creek is in Appendix B.

Despite these four identified sediment sources of significant magnitude, the main stem of the Salmon River does not exhibit any sediment impairment. The substrate is composed of boulders, cobbles, gravels, and sand, but there are no persisting fine particles in the channel, nor are the pools choked with sediment. Fish refugia and pools exist without loss of depth, as do macroinvertebrate populations as apparent by stoneflies and caddis flies on temperature logger equipment.

Follow-up for impacts in the Salmon River continued throughout 2013, and at baseflow conditions (2013 had discharges at about 25% of the median based on records at USGS Stream Gage 13296500 [Salmon River below Yankee Fork near Clayton ID]) there was sufficient stream power to mobilize and remove the sediment in the majority of the wetted portions of the channel. Some locations had deposits in the slack water and near shore that are expected to be mobilized and removed from the Upper Salmon River subbasin with the next spring high flows. While the upper Salmon River is currently sediment-limited, significantly larger and more persistent sources would be required to lead to sediment impairment.

Work by Goode et al. (2012) indicate that Salmon River Basin channels are typically supply limited. These channels have the ability to transport the sediment reaching the waters; in other words, the sediment load is typically below the load capacity and can be considered natural for these types of riverine systems.

Goode, Jaime R., Charles H. Luce, and John M. Buffington. Enhanced Sediment Delivery in a Changing Climate in Semi-Arid Mountain Basins: Implications for Water Resource Management and Aquatic Habitat in the Northern Rocky Mountains. *Geomorphology* 139 (2012):1–15.

The images below show the four sediment pulses.

Main Stem Salmon River Sediment Pulse—July 2013

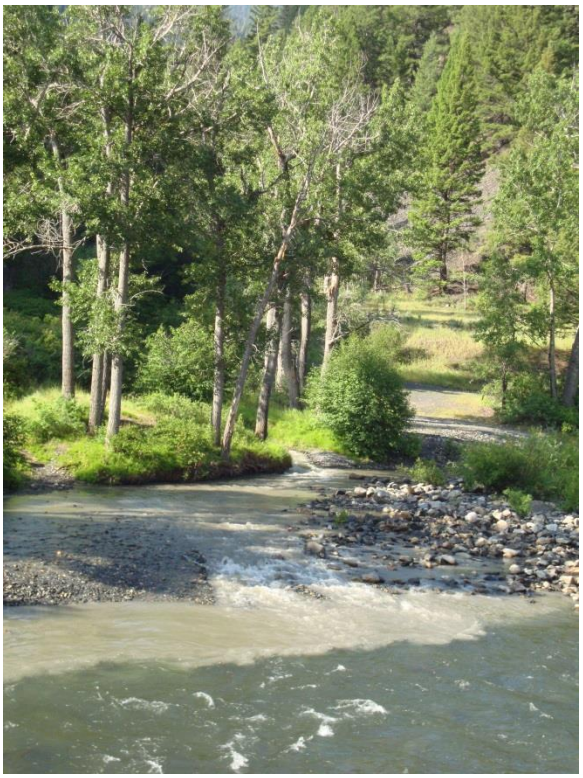




Road cut failure and mudslide, location currently under repair and improvement



Salmon River near Bayhorse, morning of road cut failure, July 2013



Slate Creek inputs, July 2013—post roadway clearing

East Fork Salmon River Sediment Pulse—September 2013



September 2013, East Fork Salmon River at the Salmon River Confluence

Note: In 2014, ongoing bridge work near this location has curtailed access.

East Fork Salmon River (Near Highway 75)



September 11, 2013



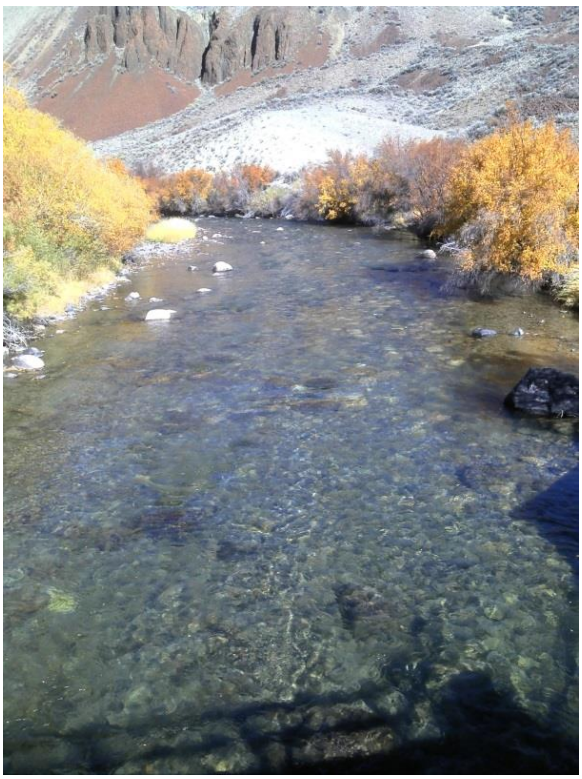
October 17, 2013

Note: In 2014, ongoing bridge work near this location has curtailed access.

East Fork Salmon River (at East Fork Road)



September 11, 2013



October 17, 2013



May 29, 2014



August 12, 2014

Basin Creek Sediment Pulses



Basin Creek (at confluence with Salmon River), October 2013



Fine sediment deposits from Basin Creek watershed

Slate Creek Sediment Pulses



During July 2013 Sediment pulse



Looking downstream Slate Creek at Salmon River confluence, October 2013

Salmon River Sediment Investigations

Salmon River – Thompson Creek to Squaw Creek (ID17060201SL027_05)

This is a talus slope dominated portion of the river, with more Challis Volcanic soils and geology than the upstream portions. There is also more of a valley formation, with the associated land uses, than the canyon areas upstream. Exclosure fences are installed in many locations. In some locations, the terraces are experiencing some erosion, but this is a natural part of the river morphology and not anthropogenically induced erosion or meandering. The large boulder- and cobble-bed, combined with the shallow soils and bedrock, limit sediment sources in this area and to the stream power that continually flushes fine- to medium-sized sediment from the substrate. There are no identifiable impairments due to sediment. The AU is impaired for temperature.



Salmon River – Valley Creek to Yankee Fork (ID17060201SL047_05)

Most of this AU has a channel that is geologically controlled by the bedrock. There is very little space for lateral erosion, and the bedrock limits incision. Much of the AU is composed of granite, and erosion and sediment sources are typically decomposed granite with limited fine particles, as the soils are only minimally developed through much of this area. Basin Creek has its confluence with the Salmon River in this AU. There were minimal indications that the forest fire–mobilized soils/organic matter are being deposited in this AU. The deposited sediment is primarily on the banks, well below bankfull stage, and expected to be removed during the next snowmelt discharges. Some locations behind large boulders have microdeposits of sandy material. There are no identifiable impairments due to sediment. The AU is impaired for temperature.



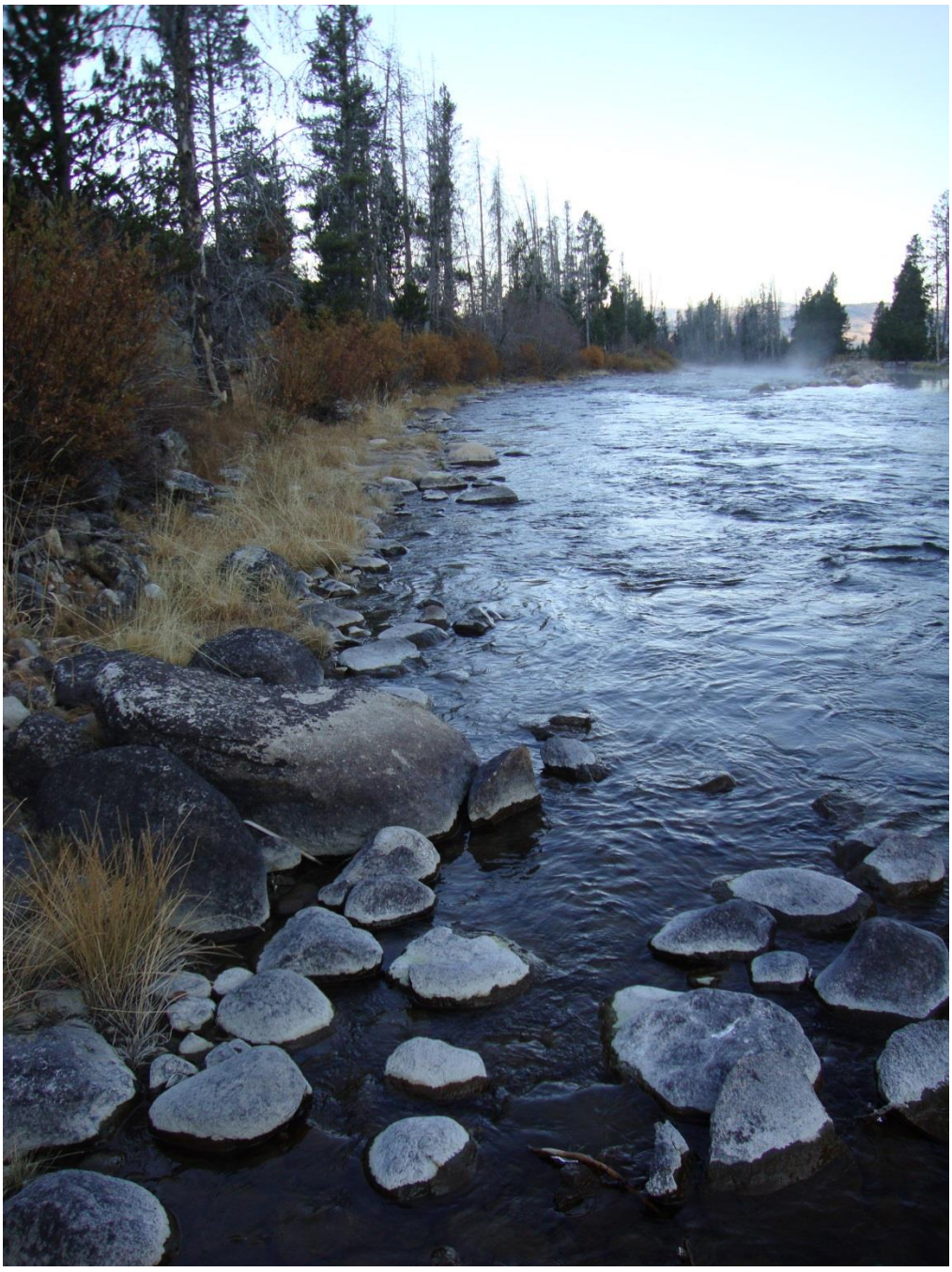


Isolated sand (fines) deposition in Salmon River

Salmon River – Redfish Lake Creek to Valley Creek (ID17060201SL063_05)

Most of this AU has a channel that is geologically controlled by the bedrock. There is very little space for lateral erosion as the terraces are composed of cobbles and boulders, and the bedrock limits incision. Much of the AU is composed of granite, and erosion and sediment sources are typically composed of decomposed granite and are not composed of fine particles as the soils are only minimally developed through much of this area. There are no identifiable impairments due to sediment. The AU is impaired for temperature.





Cobbles and bank within Salmon River – Redfish Lake Creek to Valley Creek

Macroinvertebrates



Stonefly (note scale on wrench)



Caddis larvae on a temperature logger cable

Appendix D. Data Sources

Table D1. Data sources for the Upper Salmon River subbasin assessment and TMDL.

Water Body/Location	Data Source	Type of Data	Collection Date
Sawtooth National Recreation Area region	Sawtooth National Recreation Area	Restoration projects	Variable
Salmon-Challis National Forest	Salmon-Challis National Forest	Restoration, bank stability, percent fines	Variable
Bureau of Land Management – Challis Region	Bureau of Land Management	Multiple Indicator Monitoring, temperature	Variable
Yankee Fork	Bureau of Reclamation	Restoration projects	Variable
Variable	Bureau of Reclamation	Diversion structure improvements, fish screens, riparian fencing	Variable
Bayhorse Mine Sites	DEQ, Idaho Department of Parks and Recreation	Restoration projects	Variable
Variable	Idaho Department of Water Resources	Discharge, flow additions, water exchanges	Variable

Table D2. Data sources for Upper Salmon River subbasin temperature-listed creeks.

Water Body	Data Source	Type of Data	Collection Date
Squaw Creek and tributaries, Challis Creek, Salmon River	DEQ Idaho Falls Regional Office and DEQ State Technical Services Office	Solar Pathfinder effective shade and stream width	September 2012
Squaw Creek and tributaries, Challis Creek, Salmon River	DEQ State Technical Services Office	Aerial photo interpretation of existing shade and stream width estimation	August–October 2012
Squaw Creek and tributaries, Challis Creek, Salmon River	DEQ IDASA Database	Temperature	Variable
Salmon River	US Forest Service	Temperature	Variable
Salmon River	DEQ Idaho Falls Regional Office	Temperature	June–October 2013 April–October 2014

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Appendix E. Temperature Data

Thermograph Abbreviations

MDMT maximum daily maximum temperature

MWMT maximum weekly maximum temperature

MDAT maximum daily average temperature

USFS-Collected Temperature Data

Table E1. Temperature monitoring locations by USFS in the Upper Salmon River subbasin.

Location	Assessment Unit Number	Monitoring Location
Salmon River above the Pahsimeroi River (Site 141)	ID17060201SL001_06	N 44.662934 W 114.078616
Salmon River below the East Fork Salmon River (Site 181)	ID17060201SL016_06	N 44.274763 W 114.31661
Salmon River above the East Fork Salmon River (Site 140)	ID17060201SL019_05	N 44.255927 W 114.363253

USFS 2011 thermograph and exceedance table for the Salmon River above the Pahsimeroi River (Site 141) (AU ID17060201SL001_06)

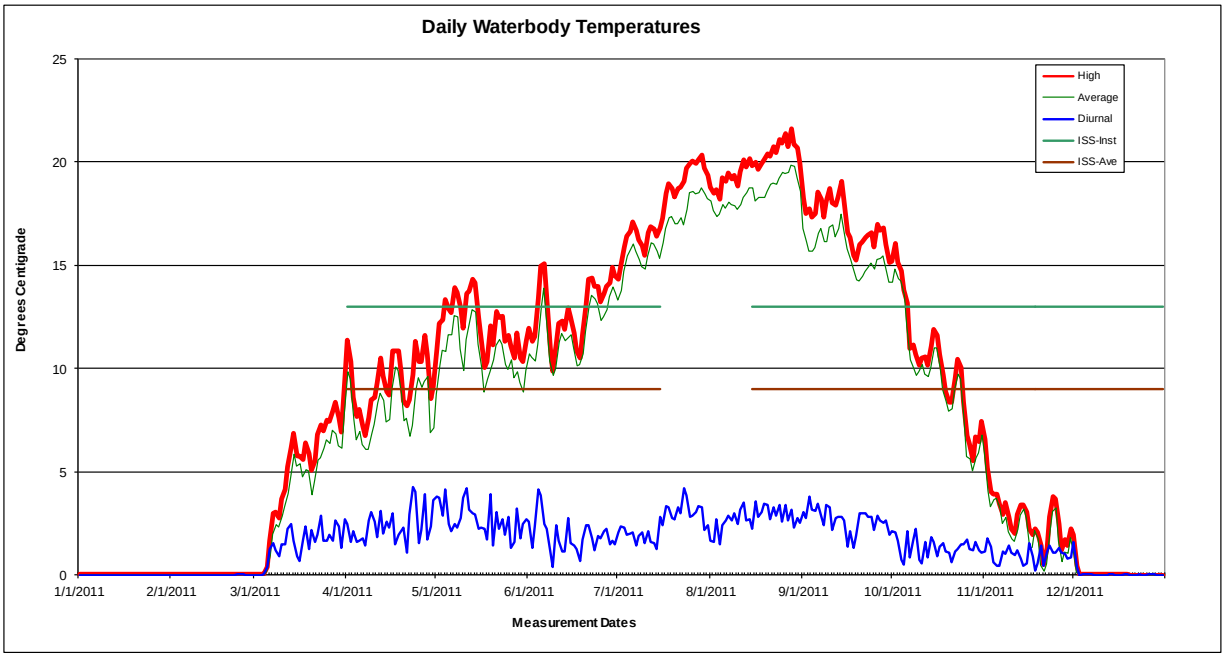
DEQ Summary of Temperature Data

Data Source: USFS
Water Body: Salmon River
Data Collection Site: USFS 141 - Above Pahsimeroi
Data Period: 1/1/2011 - 12/31/2011

MDMT = 21.6, 28 Aug
MWMT = 21.1, 30 Aug

HUC4 Number: 17060201
HUC4 Name: Upper Salmon

Waterbody ID Number: SL001_06



Idaho Salmonid Spawning
Criteria Exceedance Summary

Criteria	Exceedance Counts Nmbr	Prcnt	
13 °C Instantaneous Spring	37	35%	
9 °C Average Spring	82	77%	
Spring Days Eval'd w/in Dates	106	1-Apr	15-Jul
13 °C Instantaneous Fall	53	38%	
9 °C Average Fall	66	47%	
Fall Days Eval'd w/in Dates	139	15-Aug	31-Dec
13 °C Instantaneous Total *	90	37%	
9 °C Average Total *	148	60%	
Tot Days Eval'd w/in Both Dates *	245		

* If spring & fall dates overlap double counting may occur.

USFS 2011 thermograph and exceedance table for the Salmon River below the East Fork Salmon River (Site 181) (AU ID17060201SL016_06)

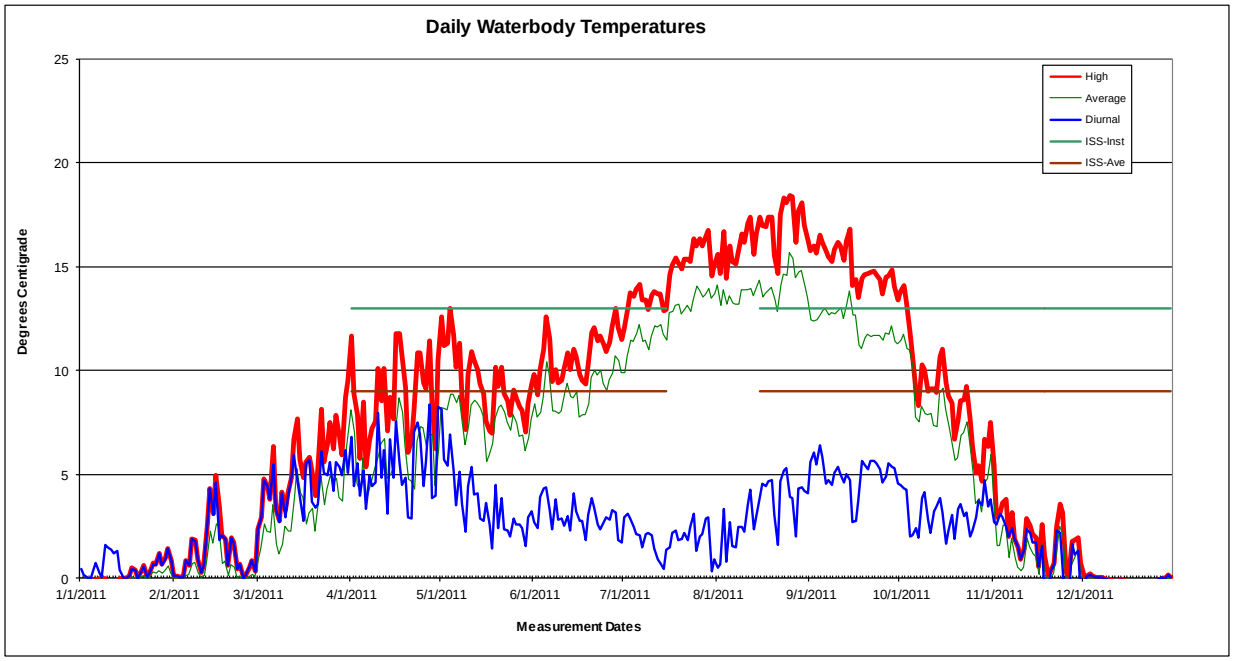
DEQ Summary of Temperature Data

Data Source: USFS
Water Body: Salmon River
Data Collection Site: USFS 181 - Below EF Salmon
Data Period: 1/1/2011 - 12/30/2011

MDMT = 18.4, 25 Aug
MWMT = 17.9, 29 Aug

HUC4 Number: 17060201
HUC4 Name: Upper Salmon

Waterbody ID Number: SL016_06



Idaho Salmonid Spawning
Criteria Exceedance Summary

Criteria	Exceedance Counts Nmbr	Prcnt	
13 °C Instantaneous Spring	11	10%	
9 °C Average Spring	29	27%	
Spring Days Eval'd w/in Dates	106	1-Apr	15-Jul
13 °C Instantaneous Fall	50	36%	
9 °C Average Fall	53	38%	
Fall Days Eval'd w/in Dates	138	15-Aug	31-Dec
13 °C Instantaneous Total *	61	25%	
9 °C Average Total *	82	34%	
Tot Days Eval'd w/in Both Dates *	244		

* If spring & fall dates overlap double counting may occur.

USFS 2012 thermograph and exceedance table for the Salmon River below the East Fork Salmon River (Site 181) (AU ID17060201SL016_06)

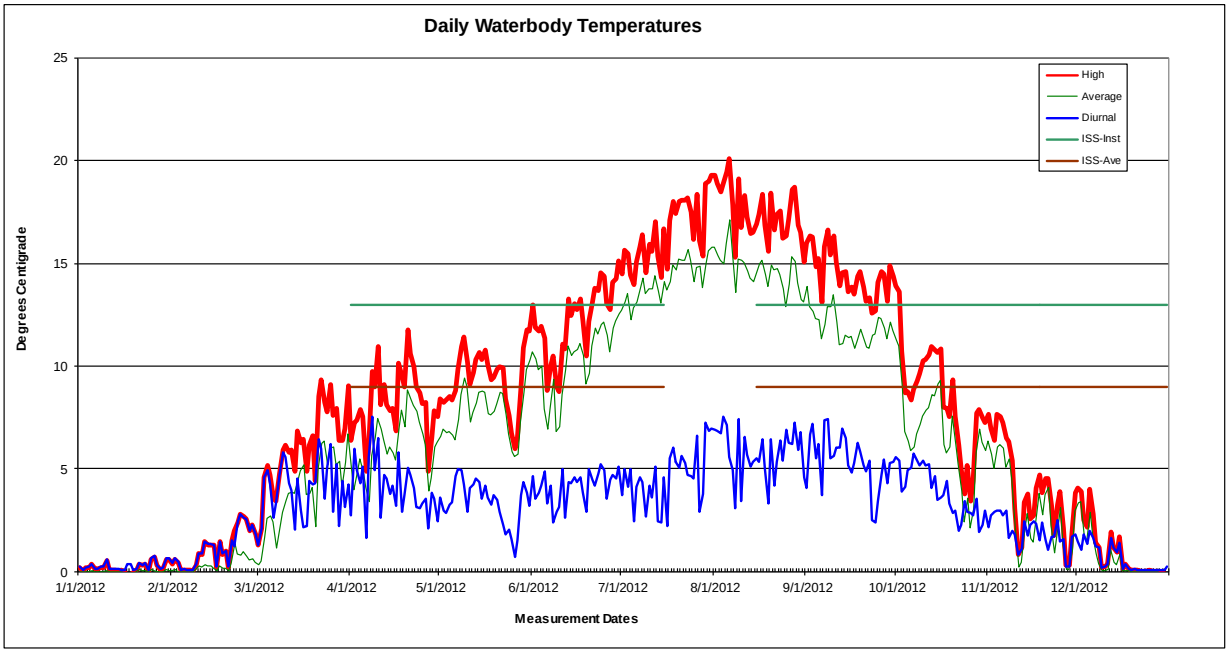
DEQ Summary of Temperature Data

Data Source: USFS
Water Body: Salmon River
Data Collection Site: USFS 181 - Below EF Salmon
Data Period: 1/1/2012 - 12/31/2012

MDMT = 20.1, 06 Aug
MWMT = 19.2, 06 Aug

HUC4 Number: 17060201
HUC4 Name: Upper Salmon

Waterbody ID Number: SL016_06



Idaho Salmonid Spawning
Criteria Exceedance Summary

Criteria	Exceedance Counts Nmbr	Prcnt	
13 °C Instantaneous Spring	27	25%	
9 °C Average Spring	43	41%	
Spring Days Eval'd w/in Dates	106	1-Apr	15-Jul
13 °C Instantaneous Fall	47	34%	
9 °C Average Fall	51	37%	
Fall Days Eval'd w/in Dates	139	15-Aug	31-Dec
13 °C Instantaneous Total *	74	30%	
9 °C Average Total *	94	38%	
Tot Days Eval'd w/in Both Dates *	245		

* If spring & fall dates overlap double counting may occur.

USFS 2013 thermograph and exceedance table for the Salmon River below the East Fork Salmon River (Site 181) (AU ID17060201SL016_06)

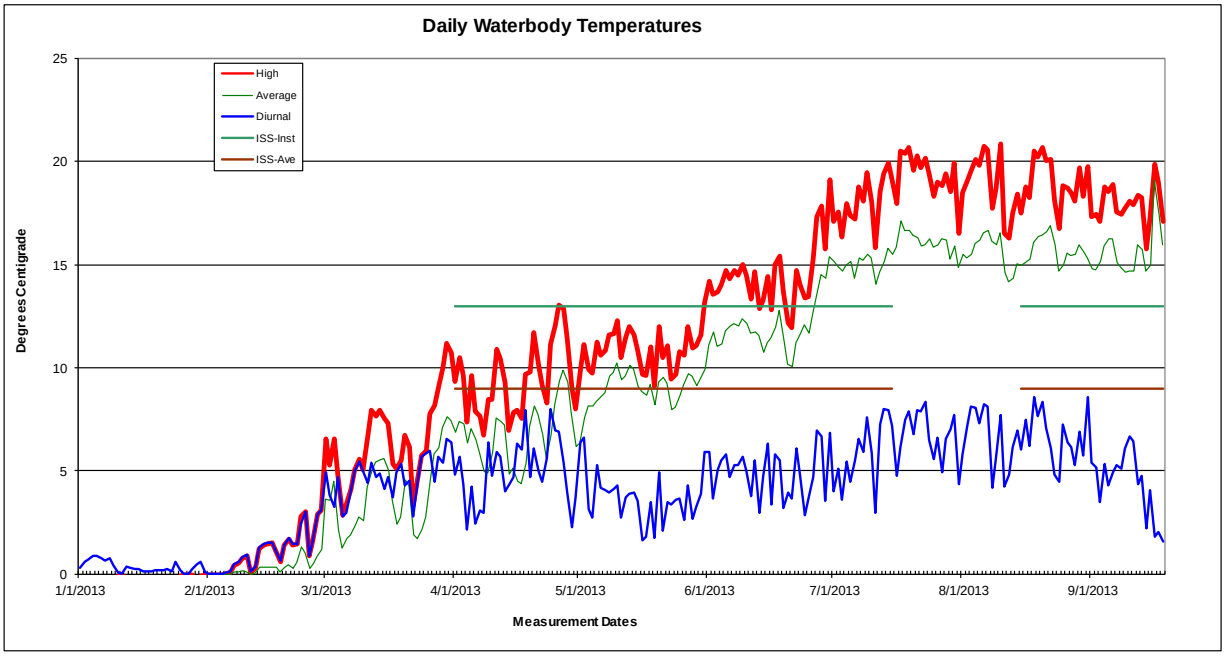
DEQ Summary of Temperature Data

Data Source: USFS
Water Body: Salmon River
Data Collection Site: USFS 181 - Below EF Salmon
Data Period: 1/1/2013 - 9/18/2013

MDMT = 20.8, 10 Aug
MWMT = 20.2, 23 Jul

HUC4 Number: 17060201
HUC4 Name: Upper Salmon

Waterbody ID Number: SL016_06



Idaho Salmonid Spawning
Criteria Exceedance Summary

Criteria	Exceedance Counts Nmbr	Prcnt	
13 °C Instantaneous Spring	43	41%	
9 °C Average Spring	66	62%	
Spring Days Eval'd w/in Dates	106	1-Apr	15-Jul
13 °C Instantaneous Fall	35	100%	
9 °C Average Fall	35	100%	
Fall Days Eval'd w/in Dates	35	15-Aug	31-Dec
13 °C Instantaneous Total *	78	55%	
9 °C Average Total *	101	72%	
Tot Days Eval'd w/in Both Dates *	141		

* If spring & fall dates overlap double counting may occur.

USFS 2011 thermograph and exceedance table for the Salmon River above the East Fork Salmon River (Site 140) (AU ID17060201SL019_05)

DEQ Summary of Temperature Data

Data Source: USFS
Water Body: Salmon River

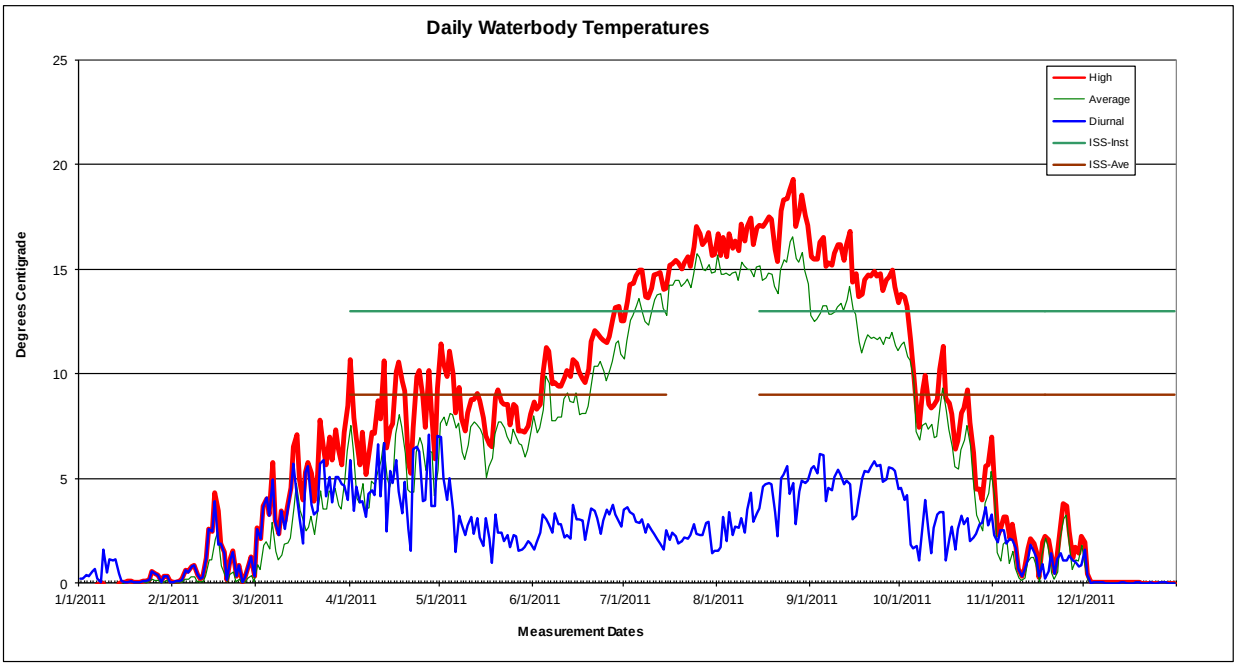
Data Collection Site: USFS 140 - Above EF Salmon
Data Period: 1/1/2011 - 12/31/2011

MDMT = 19.3, 26 Aug

MWMT = 18.3, 29 Aug

HUC4 Number: 17060201
HUC4 Name: Upper Salmon

Waterbody ID Number: SL019_05



Idaho Salmonid Spawning
Criteria Exceedance Summary

Criteria	Exceedance Counts Nmbr	Prcnt	
13 °C Instantaneous Spring	16	15%	
9 °C Average Spring	30	28%	
Spring Days Eval'd w/in Dates	106	1-Apr	15-Jul
13 °C Instantaneous Fall	50	36%	
9 °C Average Fall	53	38%	
Fall Days Eval'd w/in Dates	139	15-Aug	31-Dec
13 °C Instantaneous Total *	66	27%	
9 °C Average Total *	83	34%	
Tot Days Eval'd w/in Both Dates *	245		

* If spring & fall dates overlap double counting may occur.

DEQ-Collected Temperature Data

Table E2. Temperature monitoring locations by DEQ in the Upper Salmon River subbasin.

Water Body	Assessment Unit Number	IDASA Number	Monitoring Location
Salmon River – Birch Creek to Pennal Gulch	ID17060201SL014_06	2014SIDFTL0000	N 44.44558 W 114.22648
Squaw Creek – Cash Creek to mouth	ID17060201SL021_04	2011SIDFTL0016	N 44.344045 W 114.480002
Salmon River – Thompson Creek to Squaw Creek	ID17060201SL027_05	2013SIDFTL0006	N 44.24829 W 114.45599
Salmon River – Yankee Fork Creek to Thompson Creek	ID17060201SL031_05	2013SIDFTL0005	N 44.24930 W 114.57375
Salmon River – Valley Creek to Yankee Fork Creek	ID17060201SL047_05	2013SIDFTL0009	N 44.25886 W 114.85606 (Casino Creek Bridge)
		2013SIDFTL0007	N 44.26319 W 114.79160 (Rough Creek Bridge)
Salmon River – Redfish Lake Creek to Valley Creek	ID17060201SL063_05	2013SIDFTL0002	N 44.18269 W 114.92568

DEQ 2014 thermograph and exceedance table for the Salmon River below Birch Creek (AU ID17060201SL014_06)

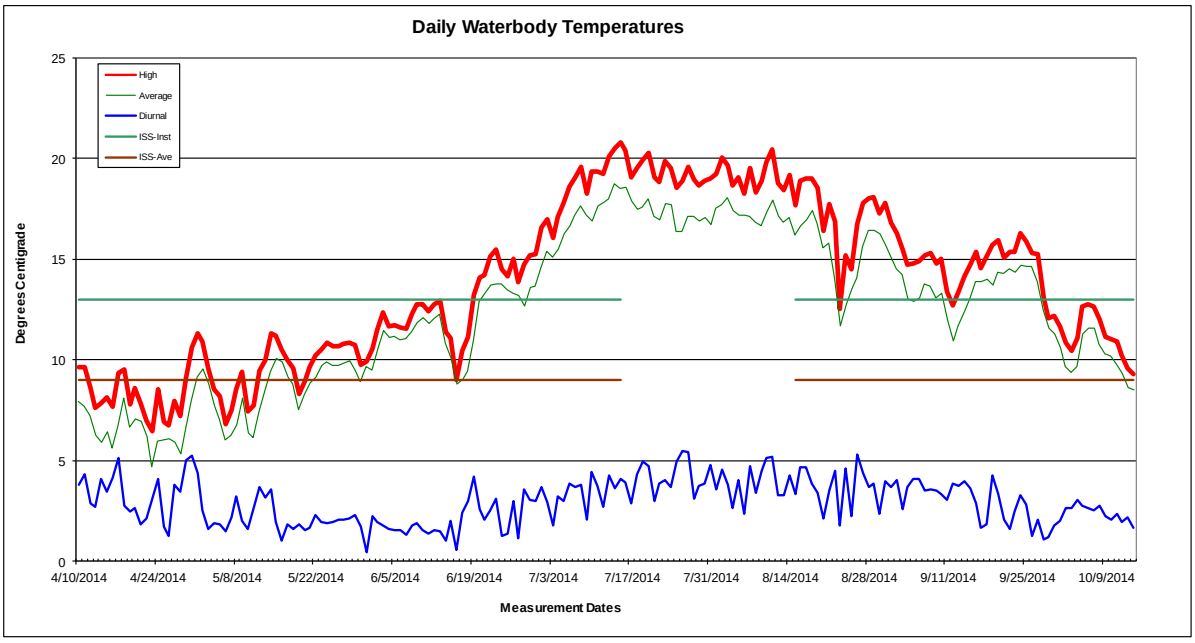
DEQ Summary of Temperature Data

Data Source: DEQ Idaho Falls Office
Water Body: Salmon River
Data Collection Site: Below Birch Creek
Data Period: 4/10/2014 - 10/14/2014

MDMT = 20.8, 15 Jul
MWMT = 20.1, 20 Jul
MDAT = 18.7, 14 Jul
MWAT = 18.2, 17 Jul

HUC4 Number: 17060201
HUC4 Name: Upper Salmon

Waterbody ID Number: SL014_06



Idaho Salmonid Spawning
Criteria Exceedance Summary

Criteria	Exceedance Counts Nmbr	Prcnt	
13 °C Instantaneous Spring	27	29%	
9 °C Average Spring	59	64%	
Spring Days Eval'd w/in Dates	92	15-Apr	15-Jul
13 °C Instantaneous Fall	43	70%	
9 °C Average Fall	59	97%	
Fall Days Eval'd w/in Dates	61	15-Aug	15-Nov
13 °C Instantaneous Total *	70	46%	
9 °C Average Total *	118	77%	
Tot Days Eval'd w/in Both Dates *	153		

DEQ 2011 thermograph and exceedance table for Squaw Creek (AU ID17060201SL021_04)

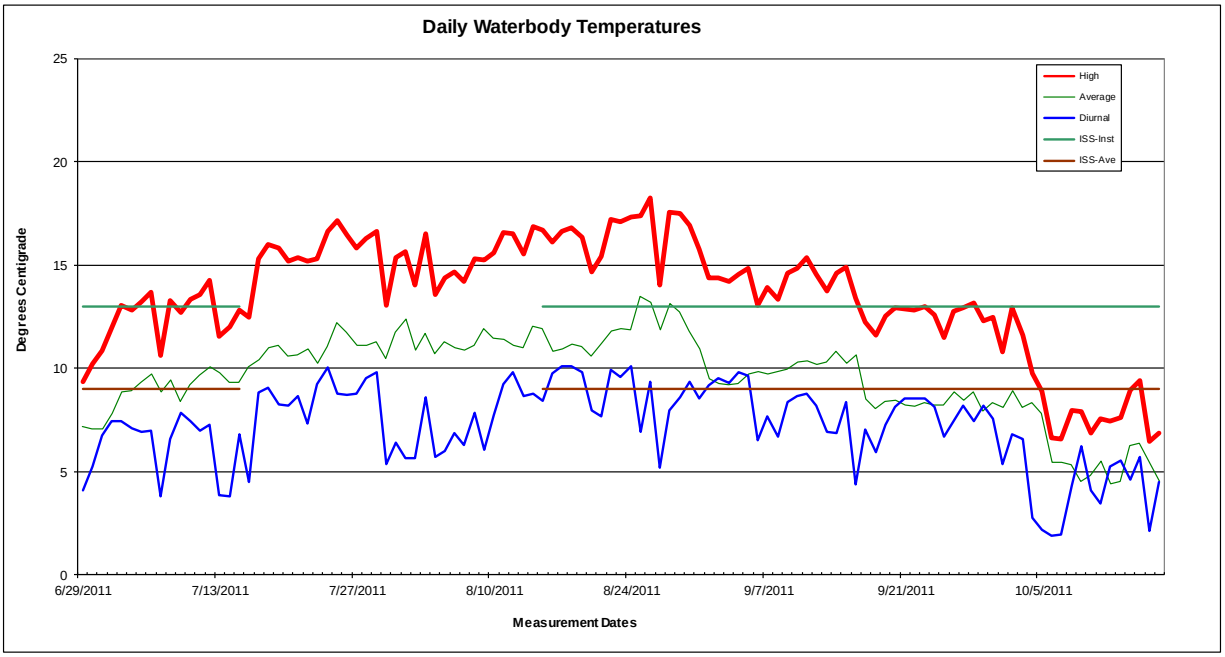
DEQ Summary of Temperature Data

Data Source: DEQ Idaho Falls Office
Water Body: Squaw Creek
Data Collection Site: 0.2 mile below Cash Creek
Data Period: 6/29/2011 - 10/17/2011

MDMT = 18.2, 26 Aug
MWMT = 17.0, 29 Aug
MDAT = 13.5, 25 Aug
MWAT = 12.6, 29 Aug

HUC4 Number: 17060201
HUC4 Name: Upper Salmon

Waterbody ID Number: SL021_04



Idaho Salmonid Spawning
Criteria Exceedance Summary

Criteria	Exceedance Counts Nmbr	Prcnt	
13 °C Instantaneous Spring	7	41%	
9 °C Average Spring	9	53%	
Spring Days Eval'd w/in Dates	17	15-Apr	15-Jul
13 °C Instantaneous Fall	35	55%	
9 °C Average Fall	33	52%	
Fall Days Eval'd w/in Dates	64	15-Aug	31-Dec
13 °C Instantaneous Total *	42	52%	
9 °C Average Total *	42	52%	
Tot Days Eval'd w/in Both Dates *	81		

* If spring & fall dates overlap double counting may occur.

DEQ 2013 thermograph and exceedance table for the Salmon River above Squaw Creek (AU ID17060201SL027_05)

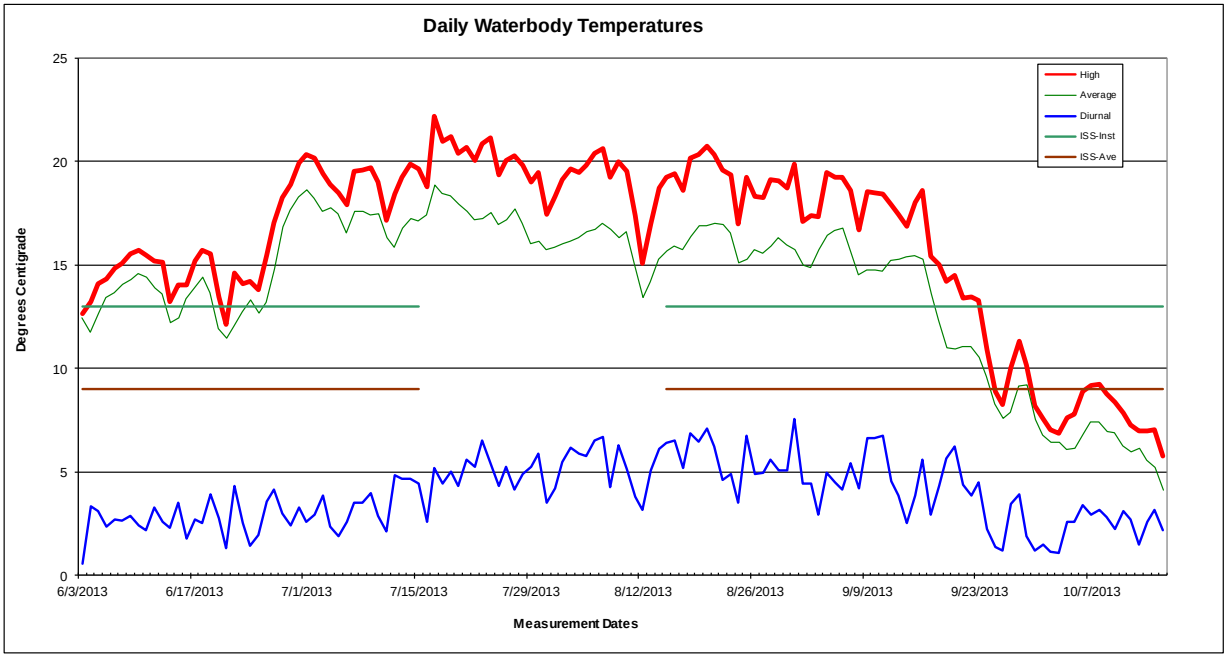
DEQ Summary of Temperature Data

Data Source: DEQ Idaho Falls Office
Water Body: Salmon River
Data Collection Site: Above Squaw Creek
Data Period: 6/3/2013 - 10/16/2013

MDMT = 22.2, 17 Jul
MWMT = 20.9, 23 Jul
MDAT = 18.8, 17 Jul
MWAT = 18.0, 22 Jul

HUC4 Number: 17060201
HUC4 Name: Upper Salmon

Waterbody ID Number: SL027_05



Idaho Salmonid Spawning
Criteria Exceedance Summary

Criteria	Exceedance Counts Nmbr	Prcnt	
13 °C Instantaneous Spring	41	95%	
9 °C Average Spring	43	100%	
Spring Days Eval'd w/in Dates	43	1-Apr	15-Jul
13 °C Instantaneous Fall	40	63%	
9 °C Average Fall	43	68%	
Fall Days Eval'd w/in Dates	63	15-Aug	31-Dec
13 °C Instantaneous Total *	81	76%	
9 °C Average Total *	86	81%	
Tot Days Eval'd w/in Both Dates *	106		

DEQ 2013 thermograph and exceedance table for the Salmon River above Slate Creek (AU ID17060201SL031_05)

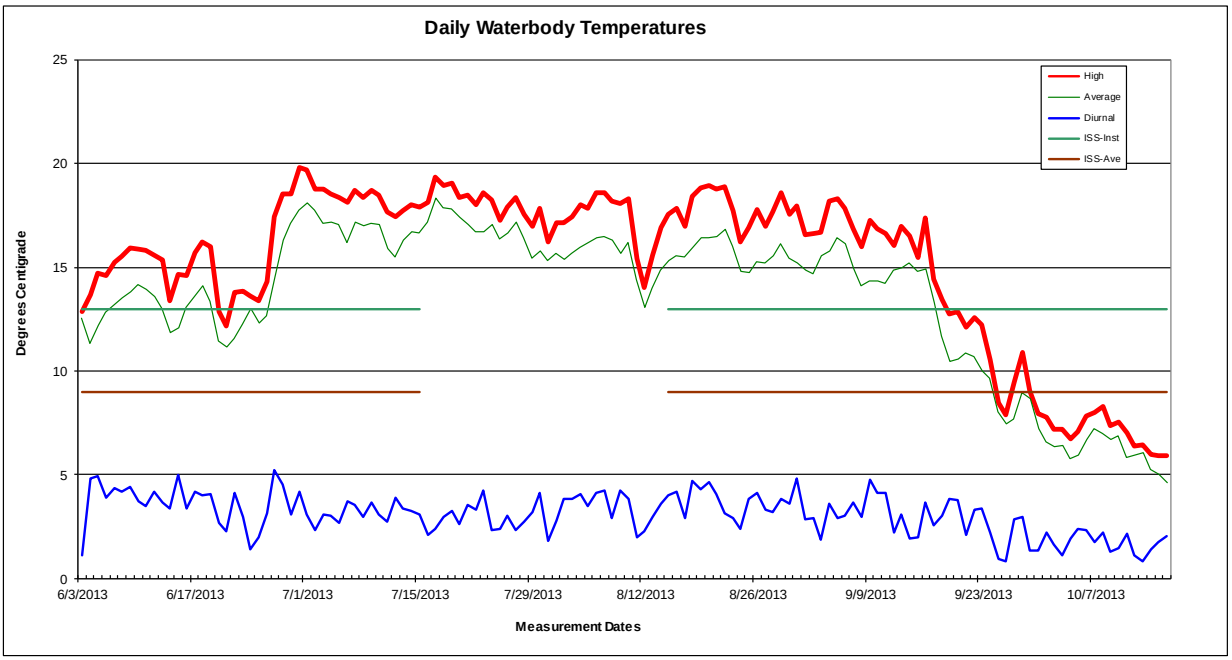
DEQ Summary of Temperature Data

Data Source: DEQ Idaho Falls Office
Water Body: Salmon River
Data Collection Site: Above Slate Creek
Data Period: 6/3/2013 - 10/16/2013

MDMT = 19.8, 30 Jun
MWMT = 19.0, 04 Jul
MDAT = 18.3, 17 Jul
MWAT = 17.5, 22 Jul

HUC4 Number: 17060201
HUC4 Name: Upper Salmon

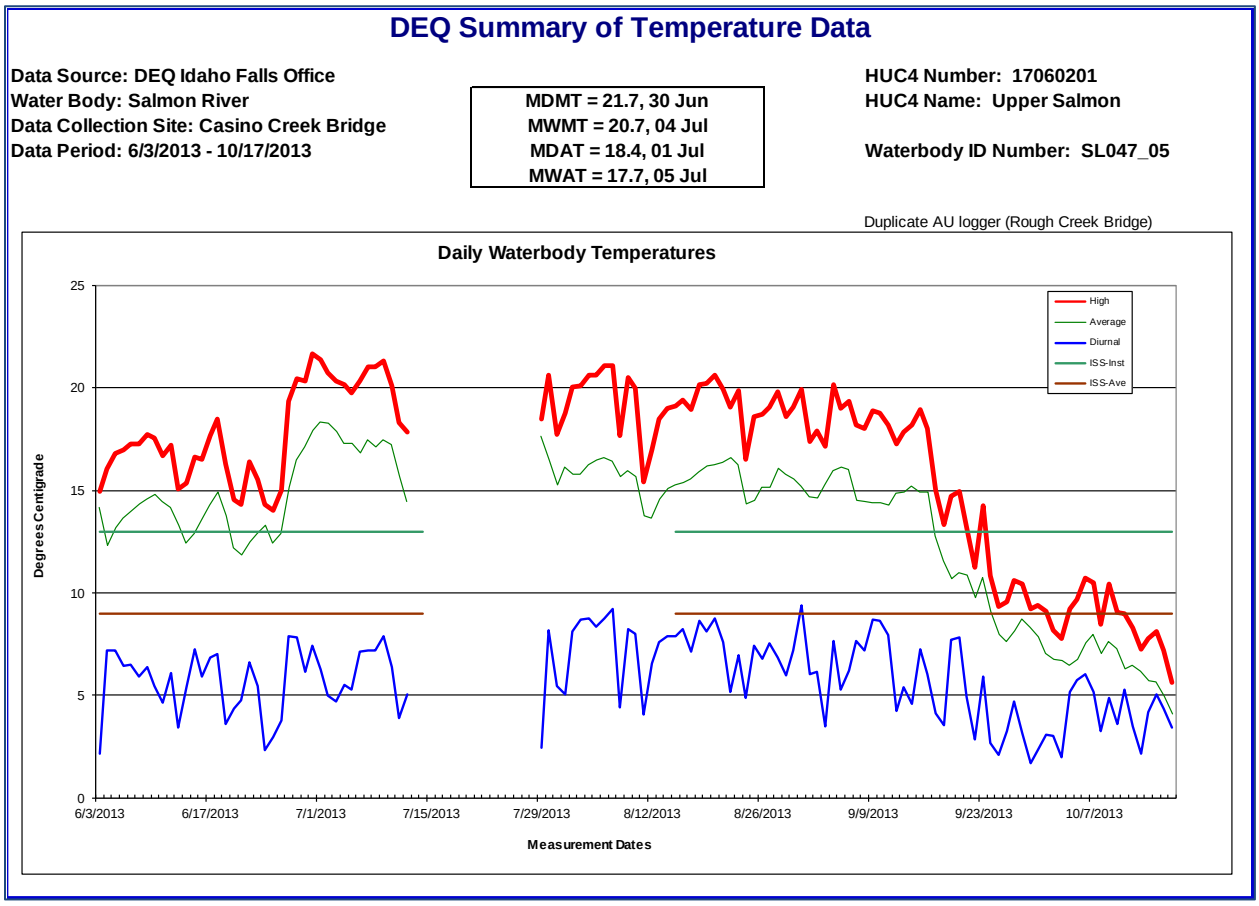
Waterbody ID Number: SL031_05



Idaho Salmonid Spawning
Criteria Exceedance Summary

Criteria	Exceedance Counts Nmbr	Prcnt	
13 °C Instantaneous Spring	40	93%	
9 °C Average Spring	43	100%	
Spring Days Eval'd w/in Dates	43	1-Apr	15-Jul
13 °C Instantaneous Fall	35	56%	
9 °C Average Fall	41	65%	
Fall Days Eval'd w/in Dates	63	15-Aug	31-Dec
13 °C Instantaneous Total *	75	71%	
9 °C Average Total *	84	79%	
Tot Days Eval'd w/in Both Dates *	106		

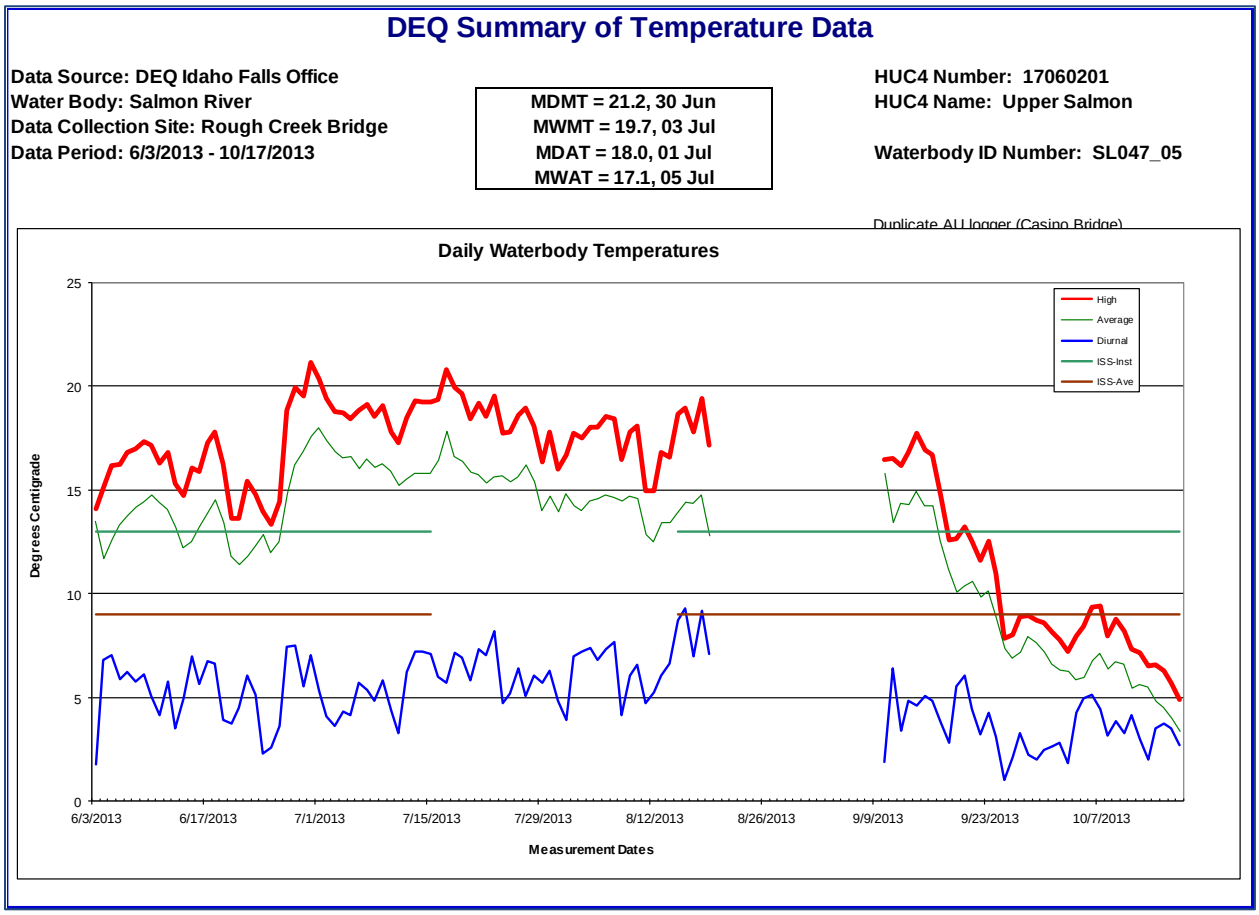
DEQ 2013 thermograph and exceedance table for the Salmon River at Casino Creek Bridge (AU ID17060201SL047_05)



Idaho Salmonid Spawning Criteria Exceedance Summary			
	Exceedance Counts		
Criteria	Nmbr	Prcnt	
13 °C Instantaneous Spring	40	100%	
9 °C Average Spring	40	100%	
Spring Days Eval'd w/in Dates	40	1-Apr	15-Jul
13 °C Instantaneous Fall	39	61%	
9 °C Average Fall	41	64%	
Fall Days Eval'd w/in Dates	64	15-Aug	31-Dec
13 °C Instantaneous Total *	79	76%	
9 °C Average Total *	81	78%	
Tot Days Eval'd w/in Both Dates *	104		

- Note: Temperature logger found on streambank. Data are removed between July 12 and 29, 2013.
- This temperature logger was a duplicate for the logger deployed at Rough Creek Bridge.

DEQ 2013 thermograph and exceedance table for the Salmon River at Rough Creek Bridge (AU ID17060201SL047_05) – Duplicate



Idaho Salmonid Spawning
Criteria Exceedance Summary

Criteria	Exceedance Counts Nmbr	Prcnt	
13 °C Instantaneous Spring	43	100%	
9 °C Average Spring	43	100%	
Spring Days Eval'd w/in Dates	43	1-Apr	15-Jul
13 °C Instantaneous Fall	14	33%	
9 °C Average Fall	19	44%	
Fall Days Eval'd w/in Dates	43	15-Aug	31-Dec
13 °C Instantaneous Total *	57	66%	
9 °C Average Total *	62	72%	
Tot Days Eval'd w/in Both Dates *	86		

- Note: Temperature logger found on streambank. Data are removed between August 19 and September 10, 2013.
- This temperature logger was a duplicate for the logger deployed at Casino Creek Bridge.

DEQ 2013 thermograph and exceedance table for the Salmon River below Redfish Creek (AU ID17060201SL063_05)

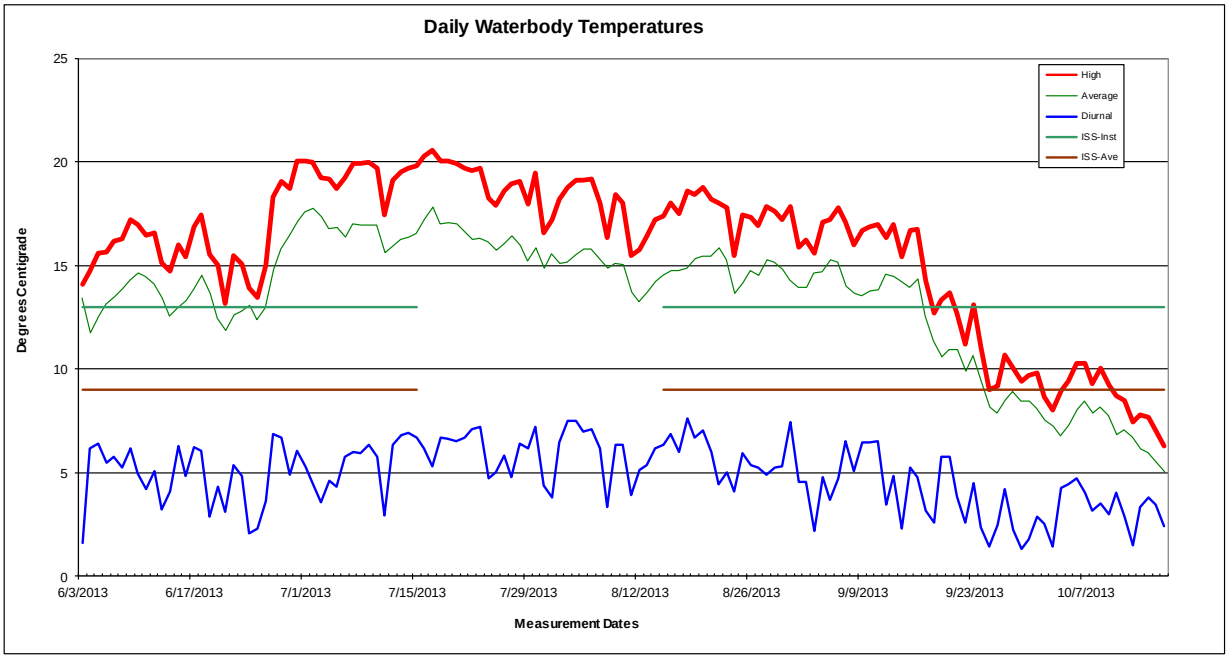
DEQ Summary of Temperature Data

Data Source: DEQ Idaho Falls Office
Water Body: Salmon River
Data Collection Site: Below Redfish
Data Period: 6/3/2013 - 10/17/2013

MDMT = 20.6, 17 Jul
MWMT = 20.1, 21 Jul
MDAT = 17.8, 17 Jul
MWAT = 17.1, 05 Jul

HUC4 Number: 17060201
HUC4 Name: Upper Salmon

Waterbody ID Number: SL063_05



Idaho Salmonid Spawning
Criteria Exceedance Summary

Criteria	Exceedance Counts Nmbr	Prcnt	
13 °C Instantaneous Spring	43	100%	
9 °C Average Spring	43	100%	
Spring Days Eval'd w/in Dates	43	1-Apr	15-Jul
13 °C Instantaneous Fall	37	58%	
9 °C Average Fall	41	64%	
Fall Days Eval'd w/in Dates	64	15-Aug	31-Dec
13 °C Instantaneous Total *	80	75%	
9 °C Average Total *	84	79%	
Tot Days Eval'd w/in Both Dates *	107		

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Appendix F. Beneficial Use Reconnaissance Program Monitoring Index Scores and Idaho Major Rivers Survey Results

Stream Beneficial Use Reconnaissance Program

BURP data 1998–2013.

AU	BURP ID	Location Name	Date	Stream Macroinvertebrate Index		Stream Habitat Index		Stream Fish Index	
				Index	Condition	Index	Condition	Index	Condition
SL001_02	1998SIDFA133	Shep Creek	08/19/1998	61	3	43	1		
SL002_03	2011SIDFA015	Morgan Creek	07/19/2011	83	3	82	3	96	3
SL003_02	1998SIDFA122	Alder Creek	08/11/1998	81	3	86	3	95	3
	1998SIDFA120	Trail Creek	08/11/1998	77	3	50	1		
	1998SIDFA121	Van Horn Creek	08/11/1998	83	3	56	1		
	1998SIDFA124	Alder Creek	08/12/1998	82	3	61	2		
	1998SIDFA123	Morgan Creek	08/12/1998	76	3	71	3	79	2
SL003_03	1998SIDFA119	Bear Creek	08/11/1998	77	3	35	1	70	2
SL004_02	1998SIDFA118	Little West Fork Morgan Creek	08/11/1998	69	3	78	3		
	1998SIDFA117	West Fork Morgan Creek	08/11/1998	82	3	59	2	98	3
SL005_02	1998SIDFA116	Blowfly Creek	08/11/1998	77	3	66	3	86	3
SL006_02	2008SIDFA140	West Fork Morgan Creek	07/09/2008	69	3	79	3	79	2
SL007_04	2001SIDFA133	Challis Creek	09/10/2001	70	3	71	3		
SL008_03	1998SIDFA125	Darling Creek	08/12/1998	50	1	60	2		
SL009_02	1998SIDFA126	White Valley Creek	08/12/1998	76	3	73	3	89	3
SL010_02	1998SIDFA109	Eddy Creek	08/05/1998	68	3	71	3	98	3
SL011_02	1998SIDFA111	Bear Creek	08/10/1998	73	3	88	3		
	1998SIDFA112	Twin Creek	08/10/1998	74	3	82	3	65	1
	1998SIDFA113	West Fork Creek	08/10/1998	56	2	83	3		
	1998SIDFA110	Bear Creek	08/05/1998	67	3	74	3	98	3
SL012_02	2006SIDFA061	Challis Creek	07/25/2006	83	3	70	3	73	2
	1998SIDFA115		08/10/1998	83	3	82	3	73	2
	1998SIDFA114	Lodgepole Creek	08/10/1998	65	3	61	2		
SL012_03	2002SIDFA064	Challis Creek	08/26/2002	65	3	65	2		
SL013_02	1998SIDFA130	Mill Creek	08/19/1998	78	3	72	3	91	3
SL013_03	2010SDEQA2152	Mill Creek	07/29/2010	67	3	66	3	62	1
	1998SIDFA131		08/19/1998	86	3	69	3	94	3
	2002SIDFA065		08/26/2002	51	2	64	2		
SL015_02	2002SIDFA066	Garden Creek	08/27/2002	84	3	82	3		
	2001SIDFA129		09/06/2001	91	3	74	3	99	3
SL016_02	1998SIDFA107	Birch Creek	08/04/1998	80	3	62	2	89	3
SL017_02	1998SIDFA108	Bayhorse Creek	08/05/1998	76	3	77	3	89	3
SL020_02	2013SIDFA020	Kinnikinic Creek	07/16/2013						
	2003SIDFA126		08/13/2003	77	3	70	3	85	3
	2002SIDFA069		08/27/2002	85	3	84	3	46	1
SL021_02	1998SIDFA097	Second Creek	07/28/1998	63	3	61	2	79	2
SL021_04	2013SIDFA022	Squaw Creek	07/16/2013						
SL022_02	1998SIDFA098	Cash Creek	07/28/1998	84	3	42	1		
SL023_04	2002SIDFA070	Squaw Creek	08/28/2002	74	3	65	2	80	2
	2002SIDFA074		08/29/2002	65	3	53	1	80	2
	2001SIDFA134		09/11/2001	54	2	69	3	58	1
	2001SIDFA130		09/06/2001	27	0	50	1	73	2
SL025_02	2001SIDFA135	Cinnabar Creek	09/11/2001	77	3	58	2		
SL028_03	2001SIDFA136	Thompson Creek	09/11/2001	63	3	70	3	92	3
SL030_02	1998SIDFA096	Buckskin Creek	07/28/1998	48	1	75	3	67	2
SL031_02	1998SIDFA089	Muley Creek	07/22/1998	74	3	73	3		
	1998SIDFA091	Peach Creek	07/22/1998	76	3	77	3		
SL031_03	1998SIDFA090	Peach Creek	07/22/1998	66	3	63	2	83	3
SL032_02	1998SIDFA070	Blind Creek	07/14/1998	73	3	57	1		
	1998SIDFA071	Jerrys Creek	07/14/1998	64	3	57	1		
	1998SIDFA076	Silver Creek	07/20/1998	48	1	74	3		
SL032_04	1998SIDFA077	Rankin Creek	07/20/1998	79	3	68	3	79	2
SL033_03	1998SIDFA078	Ramey Creek	07/20/1998	54	2	60	2	96	3
SL034_02	1998SIDFA073	Fourth of July Creek	07/15/1998	60	3	91	3	85	3
	1998SIDFA079	Greylock Creek	07/20/1998	50	1	73	3		
	1998SIDFA082	Yankee Fork	07/21/1998	81	3	63	2		

AU	BURP ID	Location Name	Date	Stream Macroinvertebrate Index		Stream Habitat Index		Stream Fish Index	
				Index	Condition	Index	Condition	Index	Condition
SL034_03	1998SIDFA086	Ninemile Creek	07/21/1998	58	2	86	3	60	1
	2011SIDFA029	Yankee Fork	07/28/2011	84	3	88	3	61	1
	2011SIDFA030		07/28/2011	81	3	81	3	81	2
SL034_04	2005SIDFA024	Yankee Fork	07/12/2005	72	3	65	2	67	2
SL035_02	1998SIDFA074	Fivemile Creek	07/15/1998	56	2	62	2		
SL036_02	1998SIDFA084	Elevenmile Creek	07/21/1998	64	3	77	3	99	3
SL037_02	1998SIDFA080	McKay Creek	07/21/1998	57	2	78	3	84	3
	1998SIDFA081		07/21/1998	80	3	67	3	83	3
SL038_02	1998SIDFA083	Twelvemile Creek	07/21/1998	26	0	66	3	65	1
SL039_02	1998SIDFA085	Tenmile Creek	07/21/1998	78	3	78	3		
SL040_02	1998SIDFA087	Eightmile Creek	07/21/1998	77	3	69	3	57	1
	1998SIDFA088	Unnamed tributary to Eightmile	07/21/1998	53	2	65	2		
SL040_03	1998SIDFA075	Eightmile Creek	07/15/1998	65	3	49	1	85	3
SL041_03	2008SIDFA144	Jordan Creek	07/15/2008	63	3	43	1		
	2008SIDFA152		07/22/2008	66	3	48	1	78	2
SL042_03	2002SIDFA079	Jordan Creek	09/04/2002	78	3	69	3	78	2
SL047_02	1998SIDFA069	Lower Harden Creek	07/14/1998	58	2	73	3	99	3
SL048_02	2001SIDFA143	Coal Creek	09/17/2001	71	3	76	3		
SL048_03	2001SIDFA144	Basin Creek	09/17/2001	48	1	67	3	27	0
	2002SIDFA083		09/05/2002	63	3	61	2	87	3
SL049_02	2001SIDFA145	East Basin Creek	09/17/2001	39	1	72	3	90	3
	2002SIDFA081		09/04/2002	71	3	71	3	81	2
SL050_03	2001SIDFA146	Basin Creek	09/18/2001	56	2	57	1	77	2
	2002SIDFA080		09/04/2002	71	3	57	1	97	3
SL051_02	1998SIDFA067	Job Creek	07/14/1998	47	1	46	1	75	2
	1998SIDFA066	Park Creek	07/14/1998	49	1	49	1	88	3
SL052_02	1998SIDFA072	Stanley Creek	07/15/1998	58	2	45	1	82	3
SL053_03	2006SIDFA073	Valley Creek	08/01/2006	68	3	74	3	76	2
	2001SIDFA148		09/18/2001	77	3	66	3	54	1
	2002SIDFA084		09/05/2002	68	3	75	3		
SL055_02	1998SIDFA063	Trap Creek	07/13/1998	51	2	87	3	79	2
SL056_02	1998SIDFA064	Meadow Creek	07/13/1998	51	2	63	2		
SL057_02	1998SIDFA065	Elk Creek	07/13/1998	46	1	80	3	73	2
	2004SIDFA112		08/18/2004	76	3	61	2	90	3
	2002SIDFA089		09/09/2002	69	3	64	2	83	3
SL058_02	2001SIDFA147	Stanley Lake Creek	09/18/2001	65	3	66	3	65	1
SL060_02	2001SIDFA141	Iron Creek	09/13/2001	50	1	78	3	90	3
	2002SIDFA086		09/06/2002	86	3	65	2	87	3
SL065_02	2001SIDFA149	Fishhook Lake Creek	09/18/2001	73	3	84	3	79	2
SL068_02	1998SIDFA061	Boundary Creek	07/07/1998	52	2	79	3	92	3
SL069_02	2008SIDFA175	UNT to Huckleberry Creek	08/12/2008	51	2	62	2		
	2008SIDFA181		08/12/2008	61	3	59	2		
SL069_03	1998SIDFA060	Huckleberry Creek	07/07/1998	77	3	66	3	77	2
SL069_04	2008SIDFA174	Huckleberry Creek	08/11/2008	60	3	72	3	90	3
SL070_02	1998SIDFA102	Decker Creek	07/29/1998	31	0	60	2	77	2
SL071_02	1998SIDFA101	Huckleberry Creek	07/29/1998	64	3	48	1	87	3
SL073_02	2001SIDFA153	Mays Creek	09/19/2001	64	3	49	1		
SL073_05	2001SIDFA155	Salmon River	09/19/2001	61	3	60	2		
SL074_02	1998SIDFA100	Hell Roaring Creek	07/29/1998	43	1	69	3	8	0
SL075_02	1998SIDFA059	Vat Creek	07/07/1998	44	1	60	2	75	2
SL075_03	1998SIDFA058	Cabin Creek	07/07/1998	57	2	78	3	98	3
SL080_03	2002SIDFA097	Alpine Creek	09/11/2002	84	3	66	3	52	1
SL081_02	1998SIDFA057	Salmon River	07/06/1998	72	3	74	3	89	3
	1998SIDFA056		07/06/1998	35	1	62	2	94	3
	1998SIDFA055	Taylor Creek	07/06/1998	47	1	53	1		
SL082_02	2002SIDFA095	Beaver Creek	09/10/2002	86	3	58	2	94	3
SL083_03	2002SIDFA093	Smiley Creek	09/10/2002	69	3	56	1	88	3
	2011SIDFA019		07/20/2011	76	3	68	3	82	3
SL085_02	2010SDEQA2076	Pole Creek	07/28/2010	73	3	83	3	44	1
	1998SIDFA054	Rainbow Creek	07/06/1998	75	3	66	3		

AU	BURP ID	Location Name	Date	Stream Macroinvertebrate Index		Stream Habitat Index		Stream Fish Index	
				Index	Condition	Index	Condition	Index	Condition
SL086_03	2011SIDFA020	Champion Creek	07/20/2011	59	3	56	1	98	3
	1998SIDFA135		08/20/1998	67	3	65	2	33	0
SL087_02	2006SIDFA067	Fourth of July Creek	07/26/2006	76	3	77	3	92	3
	2011SIDFA028		07/27/2011	66	3	82	3	91	3
	2001SIDFA152		09/19/2001	84	3	74	3	91	3
SL087_03	2005SIDFA030	Fourth of July Creek	07/13/2005	50	1	68	3		
	2006SIDFA066		07/26/2006	82	3	71	3	65	1
	2002SIDFA101		09/11/2002	81	3	58	2	33	0
	2001SIDFA151		09/19/2001	41	1	65	2	86	3
SL088_02	2011SIDFA021	Fisher Creek	07/20/2011	57	2	84	3	82	3
	2006SIDFA075		08/02/2006	75	3	66	3		
	2006SIDFA076		08/02/2006	82	3	63	2	94	3
	2006SIDFA077		08/02/2006	76	3	64	2		
	2001SIDFA150		09/19/2001	60	3	63	2	59	1
SL089_02	2008SIDFA178	Williams Creek	08/12/2008	69	3	51	1	55	1
SL090_02	2008SIDFA180	Gold Creek	08/12/2008	55	2	52	1	74	2
SL091_02	1998SIDFA062	Little Casino Creek	07/08/1998	57	2	69	3	95	3
SL092_02	1998SIDFA068	Big Casino Creek	07/14/1998	70	3	72	3	81	2
SL093_02	2001SIDFA142	Rough Creek	09/17/2001	74	3	68	3	78	2
SL094_03	1998SIDFA134	Warm Springs Creek	08/20/1998	80	3	72	3	58	1
SL099_02	1998SIDFA092	Last Chance Creek	07/27/1998	57	2	73	3		
	1998SIDFA093	Livingston Creek	07/27/1998	35	1	79	3		
	1998SIDFA094	Slate Creek	07/27/1998	43	1	64	2		
	1998SIDFA095		07/27/1998	65	3	66	3		
SL099_03	2013SIDFA019	Slate Creek	07/15/2013						
	2011SIDFA018		07/20/2011	63	3	65	2	76	2
	1998SIDFA099		07/28/1998	56	2	72	3	57	1
	2002SIDFA075		09/03/2002	77	3	63	2	64	1
	2002SIDFA076		09/03/2002	81	3	71	3	73	2
SL100_02	2011SIDFA017	Holman Creek	07/19/2011	58	2	76	3	66	1
SL105_02	1998SIDFA104	Jim Creek	08/03/1998	63	3	71	3		
SL105_03	1998SIDFA103	Big Boulder Creek	08/03/1998	65	3	72	3		
SL106_02	1998SIDFA132	Little Boulder Creek	08/19/1998	76	3	81	3		
SL109_02	1998SIDFA136	Germania Creek	08/20/1998	60	3	65	2		
	1998SIDFA137	Three Cabins Creek	08/20/1998	56	2	85	3		
SL110_04	1998SIDFA129	East Fork Salmon River	08/18/1998	46	1	56	1		
	2001SIDFA139		09/12/2001	71	3	69	3		
SL114_02	1998SIDFA128	Roaring Creek	08/18/1998	62	3	87	3		
SL114_03	1998SIDFA127	West Pass Creek	08/18/1998	55	2	68	3		
SL118_04	2011SIDFA016	Herd Creek	07/19/2011	61	3	72	3	97	3
SL124_04	2010SDEQA2012	Road Creek	07/29/2010	41	1	42	1		
	2001SIDFA137		09/11/2001	61	3	63	2		
SL125_03	2006SIDFA072	Road Creek	08/01/2006	70	3	51	1	61	1
	1998SIDFA106	Bear Creek	08/04/1998	70	3	64	2	43	1
SL126_02	1998SIDFA105	Mosquito Creek	08/04/1998	36	1	49	1	57	1

UNT: unnamed tributary
Blank cells indicate data are not available; this could be because data were not collected.
Data for 2013 are not yet available at the time of writing this TMDL and 5-year review; location information is included.

Idaho Major Rivers Survey

Idaho Major Rivers Survey data (2006–2008)

Stream Name	Salmon River	Salmon River	Salmon River
Assessment Unit	ID17060201SL016_06	ID17060201SL027_05	ID17060201SL047_05
Site ID	RDEQA076	RDEQA075	RDEQA059
Latitude	44.39209921	44.24841125	44.26134045
Longitude	-114.2665013	-114.5152617	-114.8552667
River/Stream	RIVER	RIVER	RIVER
DEQ Bioregion	Central and South Mountains	Central and South Mountains	Central and South Mountains
Level 3 Ecoregion	Middle Rockies	Idaho Batholith	Idaho Batholith
Aggregate Ecoregion	Western Mountains	Western Mountains	Western Mountains
Nitrate-Nitrite (mg/L)		0.22	
TP (mg/L)	0.011	0.016	0.005
Water Temperature (ºC)	17.5	19	15.7
pH	8.6	8.7	8.5
Sp. Cond. (µS/cm²)	137	120	90.2
RMI	23	23	21
RMI Score	3	3	3
RMI Condition	GOOD	GOOD	GOOD
3MI	15	15	13
3MI Score	5	5	5
3MI Condition	GOOD	GOOD	GOOD
RFI	91	84	95
RFI Score	3	3	3
RFI Condition	GOOD	GOOD	GOOD
Biological Condition	GOOD*	GOOD*	GOOD*

* Biological condition was corrected from (Pappani 2010) from POOR to GOOD based on a printing error in the 2010 publication (Pappani, personal communication, October 2014).

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Appendix G. Bacteria

Laboratory data sheets from 2011 monitoring are included in this appendix.

Datasheets may contain data collected from nearby subbasins.

IAS EnviroChem
3314 Pole Line Rd. • Pocatello, ID 83201
Phone: (208) 237-3300 • Fax: (208) 237-3336
email: iasec3308@iasenvirochem.com • www.iasenvirochem.com

Idaho Falls DEQ
Steve Robinson
900 N. Skyline, Suite B
Idaho Falls, ID 83402

Date Submitted: 08/30/2011
Date Reported: 08/31/2011

Certificate of Analysis

Sample Description: Smiley Creek 19
Lab Tracking #: I108226-01
Sampling Date/Time: 08/29/11 11:00

Analyte	*Result*	*Units*	*Method*	*Analyzed*	*Analyst*
E. coli	12.2	MPN/100 mL	SM9223B	08/30/2011	MPH

Sample Description: Champion Creek 20
Lab Tracking #: I108226-02
Sampling Date/Time: 08/29/11 11:15

Analyte	*Result*	*Units*	*Method*	*Analyzed*	*Analyst*
E. coli	2.0	MPN/100 mL	SM9223B	08/30/2011	MPH

Sample Description: Fourth of July Creek 28
Lab Tracking #: I108226-03
Sampling Date/Time: 08/29/11 11:25

Analyte	*Result*	*Units*	*Method*	*Analyzed*	*Analyst*
E. coli	2.0	MPN/100 mL	SM9223B	08/30/2011	MPH

Sample Description: Fisher Creek 21
Lab Tracking #: I108226-04
Sampling Date/Time: 08/29/11 11:40

Analyte	*Result*	*Units*	*Method*	*Analyzed*	*Analyst*
E. coli	30.5	MPN/100 mL	SM9223B	08/30/2011	MPH

Sample Description: Knapp Creek 31
Lab Tracking #: I108226-05
Sampling Date/Time: 08/29/11 12:45

Analyte	*Result*	*Units*	*Method*	*Analyzed*	*Analyst*
E. coli	11.9	MPN/100 mL	SM9223B	08/30/2011	MPH

Sample Description: Yankee Fork 2 30
Lab Tracking #: I108226-06
Sampling Date/Time: 08/29/11 14:35

Analyte	*Result*	*Units*	*Method*	*Analyzed*	*Analyst*
E. coli	30.5	MPN/100 mL	SM9223B	08/30/2011	MPH

IAS EnviroChem
3314 Pole Line Rd. • Pocatello, ID 83201
Phone: (208) 237-3300 • Fax: (208) 237-3336
email: iasec3308@iasenvirochem.com • www.iasenvirochem.com

Idaho Falls DEQ
Steve Robinson
900 N. Skyline, Suite B
Idaho Falls, ID 83402

Date Submitted: 08/30/2011
Date Reported: 08/31/2011

Certificate of Analysis

Sample Description: Yankee Fork 29
Lab Tracking #: I108226-07
Sampling Date/Time: 08/29/11 14:45

Analyte	*Result*	*Units*	*Method*	*Analyzed*	*Analyst*
E. coli	69.1	MPN/100 mL	SM9223B	08/30/2011	MPH

Sample Description: Slate Creek 18
Lab Tracking #: I108226-08
Sampling Date/Time: 08/29/11 16:40

Analyte	*Result*	*Units*	*Method*	*Analyzed*	*Analyst*
E. coli	2.0	MPN/100 mL	SM9223B	08/30/2011	MPH

Sample Description: Holman Creek 17
Lab Tracking #: I108226-09
Sampling Date/Time: 08/29/11 16:50

Analyte	*Result*	*Units*	*Method*	*Analyzed*	*Analyst*
E. coli	24.9	MPN/100 mL	SM9223B	08/30/2011	MPH

Sample Description: Herd Creek 16
Lab Tracking #: I108226-10
Sampling Date/Time: 08/29/11 17:20

Analyte	*Result*	*Units*	*Method*	*Analyzed*	*Analyst*
E. coli	727.0	MPN/100 mL	SM9223B	08/30/2011	MPH

Sample Description: Alder Creek 2 24
Lab Tracking #: I108226-11
Sampling Date/Time: 08/30/11 7:15

Analyte	*Result*	*Units*	*Method*	*Analyzed*	*Analyst*
E. coli	187.2	MPN/100 mL	SM9223B	08/30/2011	MPH

Sample Description: Alder Creek 1 23
Lab Tracking #: I108226-12
Sampling Date/Time: 08/30/11 7:20

Analyte	*Result*	*Units*	*Method*	*Analyzed*	*Analyst*
E. coli	101.7	MPN/100 mL	SM9223B	08/30/2011	MPH

IAS EnviroChem
3314 Pole Line Rd. • Pocatello, ID 83201
Phone: (208) 237-3300 • Fax: (208) 237-3336
email: iasec3308@iasenvirochem.com • www.iasenvirochem.com

Idaho Falls DEQ
Steve Robinson
900 N. Skyline, Suite B
Idaho Falls, ID 83402

Date Submitted: 09/07/2011
Date Reported: 09/08/2011

Certificate of Analysis

Sample Description: Basin Creek 2 09
Lab Tracking #: I109027-01
Sampling Date/Time: 09/07/11 10:30

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	1203.3	MPN/100 mL	SM9223B	09/07/2011	MPH

Sample Description: Agency Creek 10
Lab Tracking #: I109027-02
Sampling Date/Time: 09/06/11 11:10

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	488.4	MPN/100 mL	SM9223B	09/07/2011	MPH

Sample Description: Herd Creek 16
Lab Tracking #: I109027-03
Sampling Date/Time: 09/06/11 13:15

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	218.7	MPN/100 mL	SM9223B	09/07/2011	MPH

Sample Description: Summit Creek 01
Lab Tracking #: I109027-04
Sampling Date/Time: 09/06/11 16:20

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	>2419.2	MPN/100 mL	SM9223B	09/07/2011	MPH

Sample Description: Canyon Creek 08
Lab Tracking #: I109027-05
Sampling Date/Time: 09/07/11 9:50

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	248.9	MPN/100 mL	SM9223B	09/07/2011	MPH

Sample Description: Barnes Creek 38
Lab Tracking #: I109027-06
Sampling Date/Time: 09/07/11 10:45

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	26.9	MPN/100 mL	SM9223B	09/07/2011	MPH

IAS EnviroChem
3314 Pole Line Rd. • Pocatello, ID 83201
Phone: (208) 237-3300 • Fax: (208) 237-3336
email: iasec3308@iasenvirochem.com • www.iasenvirochem.com

Idaho Falls DEQ
Steve Robinson
900 N. Skyline, Suite B
Idaho Falls, ID 83402

Date Submitted: 09/15/2011
Date Reported: 09/16/2011

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Sample Description: Basin Creek 2 09
Lab Tracking #: I109104-01
Sampling Date/Time: 09/14/11 10:30

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	488.4	MPN/100 mL	SM9223B	09/15/2011	MPH

Sample Description: Agency Creek 10
Lab Tracking #: I109104-02
Sampling Date/Time: 09/14/11 11:05

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	325.5	MPN/100 mL	SM9223B	09/15/2011	MPH

Sample Description: Herd Creek 16
Lab Tracking #: I109104-03
Sampling Date/Time: 09/14/11 13:10

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	178.5	MPN/100 mL	SM9223B	09/15/2011	MPH

Sample Description: Summit Creek 01
Lab Tracking #: I109104-04
Sampling Date/Time: 09/14/11 16:15

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	161.6	MPN/100 mL	SM9223B	09/15/2011	MPH

Sample Description: Canyon Creek 08
Lab Tracking #: I109104-05
Sampling Date/Time: 09/15/11 8:45

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	260.3	MPN/100 mL	SM9223B	09/15/2011	MPH

Sample Description: Shirley Creek 24
Lab Tracking #: I109104-06
Sampling Date/Time: 09/15/11 9:25

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	613.1	MPN/100 mL	SM9223B	09/15/2011	MPH

ND = Not Detected
All solids are reported on a dry weight basis unless otherwise noted.

G. Ryan Pattie
Laboratory Director

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IAS EnviroChem
3314 Pole Line Rd. • Pocatello, ID 83201
Phone: (208) 237-3300 • Fax: (208) 237-3336
email: iasec3308@iasenvirochem.com • www.iasenvirochem.com

Idaho Falls DEQ
Steve Robinson
900 N. Skyline, Suite B
Idaho Falls, ID 83402

Date Submitted: 09/22/2011
Date Reported: 09/23/2011

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Sample Description: Basin Creek 2
Lab Tracking #: I109183-01
Sampling Date/Time: 09/21/11 10:15

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	344.8	MPN/100 mL	SM9223B	09/22/2011	MPH

Sample Description: Agency Creek 10
Lab Tracking #: I109183-02
Sampling Date/Time: 09/21/11 10:45

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	117.8	MPN/100 mL	SM9223B	09/22/2011	MPH

Sample Description: Herd Creek 16
Lab Tracking #: I109183-03
Sampling Date/Time: 09/21/11 13:10

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	107.6	MPN/100 mL	SM9223B	09/22/2011	MPH

Sample Description: Summit Creek 01
Lab Tracking #: I109183-04
Sampling Date/Time: 09/21/11 16:15

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	139.6	MPN/100 mL	SM9223B	09/22/2011	MPH

Sample Description: Canyon Creek 08
Lab Tracking #: I109183-05
Sampling Date/Time: 09/22/11 8:45

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	172.2	MPN/100 mL	SM9223B	09/22/2011	MPH

Sample Description: Shirley Creek 24
Lab Tracking #: I109183-06
Sampling Date/Time: 09/22/11 9:25

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	980.4	MPN/100 mL	SM9223B	09/22/2011	MPH

ND = Not Detected
All solids are reported on a dry weight basis unless otherwise noted.

G. Ryan Pattie
Laboratory Director

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IAS EnviroChem
3314 Pole Line Rd. • Pocatello, ID 83201
Phone: (208) 237-3300 • Fax: (208) 237-3336
email: iasec3308@iasenvirochem.com • www.iasenvirochem.com

Idaho Falls DEQ
Steve Robinson
900 N. Skyline, Suite B
Idaho Falls, ID 83402

Date Submitted: 09/29/2011
Date Reported: 09/30/2011

Certificate of Analysis

Sample Description: Herd Creek 16
Lab Tracking #: I109223-01
Sampling Date/Time: 09/28/11 9:35

Analyte	*Result*	*Units*	*Method*	*Analyzed*	*Analyst*
E. coli	579.4	MPN/100 mL	SM9223B	09/29/2011	MPH

Sample Description: Canyon Creek 08
Lab Tracking #: I109223-02
Sampling Date/Time: 09/28/11 13:00

Analyte	*Result*	*Units*	*Method*	*Analyzed*	*Analyst*
E. coli	61.7	MPN/100 mL	SM9223B	09/29/2011	MPH

Sample Description: Shirley Creek 24
Lab Tracking #: I109223-03
Sampling Date/Time: 09/28/11 13:35

Analyte	*Result*	*Units*	*Method*	*Analyzed*	*Analyst*
E. coli	66.3	MPN/100 mL	SM9223B	09/29/2011	MPH

ND = Not Detected
All solids are reported on a dry weight basis unless otherwise noted.

G. Ryan Pattie
Laboratory Director

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Appendix H. PNV Load Analysis Tables and Figures

In the following load analysis tables, all AU numbers start with ID17060201SL. Significant figures are controlled by the lowest level in the calculation, typically that of the channel width. Some rounding errors may result.

Table H1. Existing and target solar loads for Aspen Creek (ID17060201SL024_02).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
024_02	Aspen Creek	1	120	meadow	55%	2.87	1	100	300	60%	2.55	1	100	300	0	0%
024_02	Aspen Creek	2	200	subalpine fir/dry-gentle	100%	0.00	1	200	0	90%	0.64	1	200	100	100	-10%
024_02	Aspen Creek	3	50	meadow	55%	2.87	1	50	100	60%	2.55	1	50	100	0	0%
024_02	Aspen Creek	4	210	subalpine fir/dry-gentle	100%	0.00	1	200	0	90%	0.64	1	200	100	100	-10%
024_02	Aspen Creek	5	140	meadow	55%	2.87	1	100	300	60%	2.55	1	100	300	0	0%
024_02	Aspen Creek	6	320	subalpine fir/dry-gentle	100%	0.00	1	300	0	90%	0.64	1	300	200	200	-10%
024_02	Aspen Creek	7	150	meadow	55%	2.87	1	200	600	60%	2.55	1	200	500	(100)	0%
024_02	Aspen Creek	8	360	subalpine fir/dry-gentle	100%	0.00	1	400	0	90%	0.64	1	400	300	300	-10%
024_02	Aspen Creek	9	90	meadow	55%	2.87	1	90	300	60%	2.55	1	90	200	(100)	0%
024_02	Aspen Creek	10	480	subalpine fir/dry-gentle	100%	0.00	2	1,000	0	90%	0.64	2	1,000	600	600	-10%
024_02	Aspen Creek	11	530	DF/lodgepole gentle	80%	1.28	2	1,000	1,000	80%	1.28	2	1,000	1,000	0	0%
024_02	Aspen Creek	12	910	DF/lodgepole gentle	100%	0.00	2	2,000	0	90%	0.64	2	2,000	1,000	1,000	-10%
024_02	Aspen Creek	13	1200	DF/lodgepole gentle	99%	0.06	3	4,000	300	90%	0.64	3	4,000	3,000	3,000	-9%
024_02	Aspen Creek	14	920	dry DF w/o Ppine	84%	1.02	4	4,000	4,000	90%	0.64	4	4,000	3,000	(1,000)	0%
024_02	Aspen Creek	15	930	dry DF w/o Ppine	84%	1.02	4	4,000	4,000	70%	1.91	4	4,000	8,000	4,000	-14%
024_02	1st to Aspen	1	90	lake	0%	6.38	1	90	600	0%	6.38	1	90	600	0	0%
024_02	1st to Aspen	2	690	subalpine fir/dry-gentle	100%	0.00	1	700	0	90%	0.64	1	700	400	400	-10%
024_02	1st to Aspen	3	110	subalpine fir/dry-gentle	80%	1.28	1	100	100	80%	1.28	1	100	100	0	0%
024_02	1st to Aspen	4	1600	subalpine fir/dry-gentle	100%	0.00	2	3,000	0	90%	0.64	2	3,000	2,000	2,000	-10%
							Totals		12,000					22,000	11,000	

Table H2. Existing and target solar loads for Challis Creek (ID17060201SL009_03).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
009_03	Challis Creek	1	730	Geyer willow	29%	4.53	9	7,000	30,000	20%	5.10	9	7,000	40,000	10,000	-9%
009_03	Challis Creek	2	350	Geyer willow	29%	4.53	9	3,000	10,000	10%	5.74	9	3,000	20,000	10,000	-19%
009_03	Challis Creek	3	500	Geyer willow	29%	4.53	9	5,000	20,000	20%	5.10	9	5,000	30,000	10,000	-9%
009_03	Challis Creek	4	710	cottonwood	63%	2.36	9	6,000	10,000	40%	3.83	9	6,000	20,000	10,000	-23%
009_03	Challis Creek	5	600	cottonwood	63%	2.36	9	5,000	10,000	20%	5.10	9	5,000	30,000	20,000	-43%
009_03	Challis Creek	6	270	cottonwood	63%	2.36	9	2,000	5,000	0%	6.38	9	2,000	10,000	5,000	-63%
009_03	Challis Creek	7	1970	cottonwood	59%	2.62	10	20,000	52,000	30%	4.47	10	20,000	89,000	37,000	-29%
009_03	Challis Creek	8	840	cottonwood	59%	2.62	10	8,400	22,000	0%	6.38	10	8,400	54,000	32,000	-59%
009_03	Challis Creek	9	190	cottonwood	59%	2.62	10	1,900	5,000	10%	5.74	10	1,900	11,000	6,000	-49%
009_03	Challis Creek	10	870	cottonwood	59%	2.62	10	8,700	23,000	20%	5.10	10	8,700	44,000	21,000	-39%
009_03	Challis Creek	11	870	cottonwood	54%	2.93	11	9,600	28,000	40%	3.83	11	9,600	37,000	9,000	-14%
009_03	Challis Creek	12	870	cottonwood	54%	2.93	11	9,600	28,000	30%	4.47	11	9,600	43,000	15,000	-24%
009_03	Challis Creek	13	120	cottonwood	54%	2.93	11	1,300	3,800	10%	5.74	11	1,300	7,500	3,700	-44%
009_03	Challis Creek	14	320	cottonwood	54%	2.93	11	3,500	10,000	20%	5.10	11	3,500	18,000	8,000	-34%
009_03	Challis Creek	15	430	cottonwood	54%	2.93	11	4,700	14,000	40%	3.83	11	4,700	18,000	4,000	-14%
009_03	Challis Creek	16	430	cottonwood	54%	2.93	11	4,700	14,000	30%	4.47	11	4,700	21,000	7,000	-24%
								Totals	280,000					490,000	210,000	

Table H3. Existing and target solar loads for Challis Creek (ID17060201SL009_04).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
009_04	Challis Creek	1	190	cottonwood	51%	3.13	12	2,300	7,200	30%	4.47	12	2,300	10,000	2,800	-21%
009_04	Challis Creek	2	110	cottonwood	51%	3.13	12	1,300	4,100	10%	5.74	12	1,300	7,500	3,400	-41%
009_04	Challis Creek	3	440	cottonwood	51%	3.13	12	5,300	17,000	20%	5.10	12	5,300	27,000	10,000	-31%
009_04	Challis Creek	4	270	cottonwood	51%	3.13	12	3,200	10,000	40%	3.83	12	3,200	12,000	2,000	-11%
009_04	Challis Creek	5	300	cottonwood	51%	3.13	12	3,600	11,000	50%	3.19	12	3,600	11,000	0	-1%
009_04	Challis Creek	6	230	cottonwood	51%	3.13	12	2,800	8,800	20%	5.10	12	2,800	14,000	5,200	-31%
009_04	Challis Creek	7	880	cottonwood	51%	3.13	12	11,000	34,000	30%	4.47	12	11,000	49,000	15,000	-21%
								Totals	92,000					130,000	38,000	

Table H4. Existing and target solar loads for Challis Creek (ID17060201SL007_04).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
007_04	Challis Creek	1	150	cottonwood	51%	3.13	12	1,800	5,600	40%	3.83	12	1,800	6,900	1,300	-11%
007_04	Challis Creek	2	600	cottonwood	48%	3.32	13	7,800	26,000	20%	5.10	13	7,800	40,000	14,000	-28%
007_04	Challis Creek	3	450	cottonwood	48%	3.32	13	5,900	20,000	40%	3.83	13	5,900	23,000	3,000	-8%
007_04	Challis Creek	4	850	cottonwood	48%	3.32	13	11,000	36,000	20%	5.10	13	11,000	56,000	20,000	-28%
007_04	Challis Creek	5	420	cottonwood	48%	3.32	13	5,500	18,000	40%	3.83	13	5,500	21,000	3,000	-8%
007_04	Challis Creek	6	90	cottonwood	48%	3.32	13	1,200	4,000	20%	5.10	13	1,200	6,100	2,100	-28%
007_04	Challis Creek	7	130	cottonwood	48%	3.32	13	1,700	5,600	40%	3.83	13	1,700	6,500	900	-8%
007_04	Challis Creek	8	40	cottonwood	48%	3.32	13	520	1,700	20%	5.10	13	520	2,700	1,000	-28%
007_04	Challis Creek	9	170	cottonwood	48%	3.32	13	2,200	7,300	40%	3.83	13	2,200	8,400	1,100	-8%
007_04	Challis Creek	10	90	cottonwood	45%	3.51	14	1,300	4,600	20%	5.10	14	1,300	6,600	2,000	-25%
007_04	Challis Creek	11	520	cottonwood	45%	3.51	14	7,300	26,000	40%	3.83	14	7,300	28,000	2,000	-5%
007_04	Challis Creek	12	400	cottonwood	45%	3.51	14	5,600	20,000	50%	3.19	14	5,600	18,000	(2,000)	0%
007_04	Challis Creek	13	220	cottonwood	45%	3.51	14	3,100	11,000	20%	5.10	14	3,100	16,000	5,000	-25%
007_04	Challis Creek	14	1100	cottonwood	45%	3.51	14	15,000	53,000	30%	4.47	14	15,000	67,000	14,000	-15%
007_04	Challis Creek	15	430	cottonwood	45%	3.51	14	6,000	21,000	0%	6.38	14	6,000	38,000	17,000	-45%
							Totals		260,000					340,000	84,000	

Table H5. Existing and target solar loads for the Salmon River (ID17060201SL063_05).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
063_05	Salmon River	1	500	sage/conifer	11%	5.68	36	18,000	100,000	6%	6.00	36	18,000	110,000	10,000	-5%
063_05	Salmon River	2	500	sage/conifer	9%	5.81	49	24,000	140,000	22%	5.00	49	24,000	120,000	(20,000)	0%
063_05	Salmon River	3	500	sage/conifer	9%	5.81	47	23,000	130,000	12%	5.59	47	23,000	130,000	0	0%
063_05	Salmon River	4	500	sage/conifer	9%	5.81	47	23,000	130,000	10%	5.75	47	23,000	130,000	0	0%
063_05	Salmon River	5	500	sage/conifer	10%	5.74	39	19,000	110,000	5%	6.04	39	19,000	110,000	0	-5%
063_05	Salmon River	6	500	sage/conifer	13%	5.55	30	15,000	83,000	5%	6.07	30	15,000	91,000	8,000	-8%
063_05	Salmon River	7	500	sage/conifer	12%	5.61	32	16,000	90,000	6%	6.02	32	16,000	96,000	6,000	-6%
063_05	Salmon River	8	500	sage/conifer	12%	5.61	32	16,000	90,000	8%	5.87	32	16,000	94,000	4,000	-4%
063_05	Salmon River	9	500	sage/conifer	11%	5.68	38	19,000	110,000	7%	5.94	38	19,000	110,000	0	-4%
063_05	Salmon River	10	500	Geyer willow	8%	5.87	35	18,000	110,000	4%	6.09	35	18,000	110,000	0	-4%
063_05	Salmon River	11	500	Geyer willow	8%	5.87	33	17,000	100,000	3%	6.19	33	17,000	110,000	10,000	-5%
063_05	Salmon River	12	500	Geyer willow	8%	5.87	34	17,000	100,000	4%	6.12	34	17,000	100,000	0	-4%
063_05	Salmon River	13	500	Geyer willow	7%	5.93	36	18,000	110,000	3%	6.22	36	18,000	110,000	0	-4%
063_05	Salmon River	14	500	Geyer willow	8%	5.87	33	16,000	94,000	3%	6.22	33	16,000	99,000	5,000	-5%
063_05	Salmon River	15	500	Geyer willow	5%	6.06	52	26,000	160,000	3%	6.18	52	26,000	160,000	0	-2%
063_05	Salmon River	16	500	Geyer willow	7%	5.93	38	19,000	110,000	3%	6.17	38	19,000	120,000	10,000	-4%
063_05	Salmon River	17	500	Geyer willow	7%	5.93	41	21,000	120,000	2%	6.25	41	21,000	130,000	10,000	-5%
063_05	Salmon River	18	160	Geyer willow	5%	6.06	49	7,800	47,000	2%	6.26	49	7,800	49,000	2,000	-3%
									1,900,000					2,000,000	45,000	

Table H6. Existing and target solar loads for the Salmon River (ID17060201SL047_05).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
047_05	Salmon River	1	340	Geyer willow	4%	6.12	62	21,000	130,000	3%	6.22	62	21,000	130,000	0	-1%
047_05	Salmon River	2	500	Geyer willow	7%	5.93	40	20,000	120,000	3%	6.21	40	20,000	120,000	0	-4%
047_05	Salmon River	3	500	Geyer willow	6%	6.00	47	23,000	140,000	3%	6.20	47	23,000	140,000	0	-3%
047_05	Salmon River	4	500	Geyer willow	6%	6.00	43	22,000	130,000	3%	6.19	43	22,000	140,000	10,000	-3%
047_05	Salmon River	5	500	Geyer willow	6%	6.00	46	23,000	140,000	3%	6.19	46	23,000	140,000	0	-3%
047_05	Salmon River	6	500	Geyer willow	6%	6.00	46	23,000	140,000	3%	6.19	46	23,000	140,000	0	-3%
047_05	Salmon River	7	500	sage/conifer	9%	5.81	46	23,000	130,000	4%	6.13	46	23,000	140,000	10,000	-5%
047_05	Salmon River	8	500	sage/conifer	8%	5.87	59	29,000	170,000	3%	6.18	59	29,000	180,000	10,000	-5%
047_05	Salmon River	9	500	sage/conifer	10%	5.74	43	21,000	120,000	4%	6.10	43	21,000	130,000	10,000	-6%
047_05	Salmon River	10	500	sage/conifer	8%	5.87	51	26,000	150,000	12%	5.59	51	26,000	150,000	0	0%
047_05	Salmon River	11	500	sage/conifer	11%	5.68	38	19,000	110,000	4%	6.14	38	19,000	120,000	10,000	-7%
047_05	Salmon River	12	500	sage/conifer	10%	5.74	42	21,000	120,000	4%	6.14	42	21,000	130,000	10,000	-6%
047_05	Salmon River	13	500	sage/conifer	10%	5.74	40	20,000	110,000	7%	5.96	40	20,000	120,000	10,000	-3%
047_05	Salmon River	14	500	sage/conifer	6%	6.00	76	38,000	230,000	4%	6.13	76	38,000	230,000	0	-2%
047_05	Salmon River	15	500	sage/conifer	9%	5.81	49	25,000	150,000	4%	6.13	49	25,000	150,000	0	-5%
047_05	Salmon River	16	500	sage/conifer	10%	5.74	43	22,000	130,000	4%	6.14	43	22,000	140,000	10,000	-6%
047_05	Salmon River	17	500	sage/conifer	9%	5.81	47	24,000	140,000	4%	6.12	47	24,000	150,000	10,000	-5%
047_05	Salmon River	18	500	sage/conifer	8%	5.87	50	25,000	150,000	4%	6.14	50	25,000	150,000	0	-4%
047_05	Salmon River	19	500	sage/conifer	9%	5.81	47	23,000	130,000	6%	5.97	47	23,000	140,000	10,000	-3%
047_05	Salmon River	20	500	sage/conifer	10%	5.74	39	20,000	110,000	8%	5.85	39	20,000	120,000	10,000	-2%
047_05	Salmon River	21	500	sage/conifer	8%	5.87	54	27,000	160,000	4%	6.12	54	27,000	170,000	10,000	-4%
047_05	Salmon River	22	500	sage/conifer	8%	5.87	55	27,000	160,000	5%	6.04	55	27,000	160,000	0	-3%
047_05	Salmon River	23	500	DF/lodgepole steep	24%	4.85	35	17,000	82,000	5%	6.07	35	17,000	100,000	18,000	-19%
047_05	Salmon River	24	500	DF/lodgepole steep	18%	5.23	48	24,000	130,000	5%	6.08	48	24,000	150,000	20,000	-13%
047_05	Salmon River	25	500	DF/lodgepole steep	28%	4.59	30	15,000	69,000	7%	5.92	30	15,000	89,000	20,000	-21%
047_05	Salmon River	26	500	DF/lodgepole steep	18%	5.23	48	24,000	130,000	4%	6.13	48	24,000	150,000	20,000	-14%
047_05	Salmon River	27	500	DF/lodgepole steep	23%	4.91	36	18,000	88,000	6%	6.00	36	18,000	110,000	22,000	-17%
047_05	Salmon River	28	500	DF/lodgepole steep	17%	5.30	49	24,000	130,000	7%	5.94	49	24,000	140,000	10,000	-10%
047_05	Salmon River	29	500	DF/lodgepole steep	16%	5.36	53	26,000	140,000	8%	5.88	53	26,000	150,000	10,000	-8%
047_05	Salmon River	30	500	DF/lodgepole steep	18%	5.23	48	24,000	130,000	8%	5.84	48	24,000	140,000	10,000	-10%
047_05	Salmon River	31	500	DF/lodgepole steep	28%	4.59	29	15,000	69,000	9%	5.80	29	15,000	87,000	18,000	-19%
047_05	Salmon River	32	500	DF/lodgepole steep	18%	5.23	47	23,000	120,000	8%	5.86	47	23,000	130,000	10,000	-10%
047_05	Salmon River	33	500	DF/lodgepole steep	22%	4.98	38	19,000	95,000	15%	5.41	38	19,000	100,000	5,000	-7%
047_05	Salmon River	34	500	DF/lodgepole steep	28%	4.59	30	15,000	69,000	8%	5.86	30	15,000	88,000	19,000	-20%
047_05	Salmon River	35	500	DF/lodgepole steep	28%	4.59	29	14,000	64,000	6%	5.98	29	14,000	84,000	20,000	-22%
047_05	Salmon River	36	500	DF/lodgepole steep	31%	4.40	26	13,000	57,000	8%	5.88	26	13,000	76,000	19,000	-23%
047_05	Salmon River	37	500	DF/lodgepole steep	30%	4.47	27	14,000	63,000	20%	5.09	27	14,000	71,000	8,000	-10%
047_05	Salmon River	38	500	DF/lodgepole steep	21%	5.04	41	21,000	110,000	6%	6.00	41	21,000	130,000	20,000	-15%
047_05	Salmon River	39	500	DF/lodgepole steep	25%	4.79	34	17,000	81,000	6%	6.02	34	17,000	100,000	19,000	-19%
047_05	Salmon River	40	500	DF/lodgepole steep	25%	4.79	33	17,000	81,000	9%	5.79	33	17,000	98,000	17,000	-16%
047_05	Salmon River	41	500	DF/lodgepole steep	36%	4.08	22	11,000	45,000	18%	5.23	22	11,000	57,000	12,000	-18%
									4,800,000					5,200,000	420,000	

Table H7. Existing and target solar loads for the Salmon River (ID17060201SL031_05).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
031_05	Salmon River	1	500	dry DF w/o Ppine	16%	5.36	32	16,000	86,000	11%	5.68	32	16,000	91,000	5,000	-5%
031_05	Salmon River	2	500	dry DF w/o Ppine	18%	5.23	29	15,000	78,000	15%	5.45	29	15,000	82,000	4,000	-3%
031_05	Salmon River	3	500	dry DF w/o Ppine	21%	5.04	24	12,000	60,000	5%	6.03	24	12,000	72,000	12,000	-16%
031_05	Salmon River	4	500	dry DF w/o Ppine	15%	5.42	34	17,000	92,000	7%	5.93	34	17,000	100,000	8,000	-8%
031_05	Salmon River	5	500	dry DF w/o Ppine	17%	5.30	30	15,000	79,000	8%	5.89	30	15,000	88,000	9,000	-9%
031_05	Salmon River	6	500	dry DF w/o Ppine	13%	5.55	41	21,000	120,000	7%	5.93	41	21,000	120,000	0	-6%
031_05	Salmon River	7	500	dry DF w/o Ppine	20%	5.10	26	13,000	66,000	16%	5.36	26	13,000	70,000	4,000	-4%
031_05	Salmon River	8	500	dry DF w/o Ppine	17%	5.30	31	16,000	85,000	9%	5.79	31	16,000	93,000	8,000	-8%
031_05	Salmon River	9	500	dry DF w/o Ppine	12%	5.61	43	21,000	120,000	6%	5.99	43	21,000	130,000	10,000	-6%
031_05	Salmon River	10	500	dry DF w/o Ppine	13%	5.55	41	21,000	120,000	9%	5.80	41	21,000	120,000	0	-4%
031_05	Salmon River	11	500	dry DF w/o Ppine	10%	5.74	56	28,000	160,000	12%	5.62	56	28,000	160,000	0	0%
031_05	Salmon River	12	500	dry DF w/o Ppine	12%	5.61	44	22,000	120,000	11%	5.71	44	22,000	130,000	10,000	-1%
031_05	Salmon River	13	500	dry DF w/o Ppine	24%	4.85	21	11,000	53,000	21%	5.04	21	11,000	55,000	2,000	-3%
031_05	Salmon River	14	500	dry DF w/o Ppine	16%	5.36	32	16,000	86,000	9%	5.82	32	16,000	93,000	7,000	-7%
031_05	Salmon River	15	500	dry DF w/o Ppine	13%	5.55	40	20,000	110,000	9%	5.81	40	20,000	120,000	10,000	-4%
031_05	Salmon River	16	500	dry DF w/o Ppine	15%	5.42	35	18,000	98,000	11%	5.69	35	18,000	100,000	2,000	-4%
031_05	Salmon River	17	500	dry DF w/o Ppine	17%	5.30	30	15,000	79,000	6%	6.03	30	15,000	90,000	11,000	-11%
031_05	Salmon River	18	500	dry DF w/o Ppine	15%	5.42	34	17,000	92,000	6%	5.98	34	17,000	100,000	8,000	-9%
031_05	Salmon River	19	500	dry DF w/o Ppine	16%	5.36	32	16,000	86,000	9%	5.81	32	16,000	93,000	7,000	-7%
031_05	Salmon River	20	500	dry DF w/o Ppine	14%	5.49	37	19,000	100,000	18%	5.21	37	19,000	99,000	(1,000)	0%
031_05	Salmon River	21	500	dry DF w/o Ppine	13%	5.55	42	21,000	120,000	12%	5.59	42	21,000	120,000	0	-1%
031_05	Salmon River	22	500	dry DF w/o Ppine	12%	5.61	43	21,000	120,000	9%	5.80	43	21,000	120,000	0	-3%
031_05	Salmon River	23	500	dry DF w/o Ppine	13%	5.55	41	21,000	120,000	4%	6.12	41	21,000	130,000	10,000	-9%
031_05	Salmon River	24	500	dry DF w/o Ppine	11%	5.68	49	24,000	140,000	5%	6.06	49	24,000	150,000	10,000	-6%
031_05	Salmon River	25	500	dry DF w/o Ppine	9%	5.81	65	32,000	190,000	4%	6.14	65	32,000	200,000	10,000	-5%
031_05	Salmon River	26	500	dry DF w/o Ppine	15%	5.42	35	18,000	98,000	5%	6.09	35	18,000	110,000	12,000	-11%
031_05	Salmon River	27	500	dry DF w/o Ppine	11%	5.68	50	25,000	140,000	5%	6.03	50	25,000	150,000	10,000	-6%
031_05	Salmon River	28	500	dry DF w/o Ppine	11%	5.68	48	24,000	140,000	7%	5.92	48	24,000	140,000	0	-4%
031_05	Salmon River	29	500	dry DF w/o Ppine	13%	5.55	42	21,000	120,000	3%	6.19	42	21,000	130,000	10,000	-10%
031_05	Salmon River	30	500	dry DF w/o Ppine	10%	5.74	51	26,000	150,000	4%	6.10	51	26,000	160,000	10,000	-6%
031_05	Salmon River	31	500	dry DF w/o Ppine	19%	5.17	27	14,000	72,000	6%	6.01	27	14,000	84,000	12,000	-13%
031_05	Salmon River	32	500	dry DF w/o Ppine	13%	5.55	41	20,000	110,000	11%	5.69	41	20,000	110,000	0	-2%
031_05	Salmon River	33	500	dry DF w/o Ppine	10%	5.74	51	26,000	150,000	7%	5.91	51	26,000	150,000	0	-3%
031_05	Salmon River	34	500	dry DF w/o Ppine	12%	5.61	43	22,000	120,000	12%	5.63	43	22,000	120,000	0	0%
031_05	Salmon River	35	500	dry DF w/o Ppine	9%	5.81	63	31,000	180,000	5%	6.05	63	31,000	190,000	10,000	-4%
031_05	Salmon River	36	500	dry DF w/o Ppine	10%	5.74	53	27,000	160,000	4%	6.14	53	27,000	170,000	10,000	-6%
031_05	Salmon River	37	500	dry DF w/o Ppine	12%	5.61	45	22,000	120,000	5%	6.08	45	22,000	130,000	10,000	-7%
031_05	Salmon River	38	500	Geyer willow	6%	6.00	45	23,000	140,000	4%	6.10	45	23,000	140,000	0	-2%
031_05	Salmon River	39	500	Geyer willow	5%	6.06	57	29,000	180,000	4%	6.15	57	29,000	180,000	0	-1%
031_05	Salmon River	40	500	Geyer willow	4%	6.12	60	30,000	180,000	4%	6.14	60	30,000	180,000	0	0%
031_05	Salmon River	41	500	Geyer willow	6%	6.00	47	23,000	140,000	4%	6.14	47	23,000	140,000	0	-2%
031_05	Salmon River	42	500	Geyer willow	4%	6.12	63	32,000	200,000	7%	5.95	63	32,000	190,000	(10,000)	0%
031_05	Salmon River	43	500	Geyer willow	5%	6.06	59	30,000	180,000	4%	6.09	59	30,000	180,000	0	-1%
031_05	Salmon River	44	500	Geyer willow	6%	6.00	43	22,000	130,000	3%	6.18	43	22,000	140,000	10,000	-3%
031_05	Salmon River	45	280	Geyer willow	7%	5.93	41	11,000	65,000	3%	6.22	41	11,000	68,000	3,000	-4%
									5,400,000					5,600,000	230,000	

Table H8. Existing and target solar loads for the Salmon River (ID17060201SL027_05).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
027_05	Salmon River	1	220	Geyer willow	7%	5.93	41	9,100	54,000	3%	6.18	41	9,100	56,000	2,000	-4%
027_05	Salmon River	2	500	Geyer willow	7%	5.93	41	21,000	120,000	3%	6.16	41	21,000	130,000	10,000	-4%
027_05	Salmon River	3	500	Geyer willow	5%	6.06	57	29,000	180,000	3%	6.16	57	29,000	180,000	0	-2%
027_05	Salmon River	4	500	Geyer willow	5%	6.06	51	26,000	160,000	4%	6.11	51	26,000	160,000	0	-1%
027_05	Salmon River	5	500	Geyer willow	5%	6.06	52	26,000	160,000	8%	5.88	52	26,000	150,000	(10,000)	0%
027_05	Salmon River	6	500	Geyer willow	6%	6.00	48	24,000	140,000	5%	6.06	48	24,000	150,000	10,000	-1%
027_05	Salmon River	7	500	Geyer willow	5%	6.06	51	25,000	150,000	4%	6.11	51	25,000	150,000	0	-1%
027_05	Salmon River	8	500	Geyer willow	5%	6.06	50	25,000	150,000	4%	6.13	50	25,000	150,000	0	-1%
027_05	Salmon River	9	500	Geyer willow	6%	6.00	46	23,000	140,000	3%	6.21	46	23,000	140,000	0	-3%
027_05	Salmon River	10	500	Geyer willow	4%	6.12	63	32,000	200,000	3%	6.18	63	32,000	200,000	0	-1%
027_05	Salmon River	11	500	Geyer willow	5%	6.06	50	25,000	150,000	3%	6.20	50	25,000	150,000	0	-2%
027_05	Salmon River	12	500	Geyer willow	6%	6.00	48	24,000	140,000	2%	6.23	48	24,000	150,000	10,000	-4%
027_05	Salmon River	13	500	Geyer willow	5%	6.06	53	27,000	160,000	3%	6.19	53	27,000	170,000	10,000	-2%
027_05	Salmon River	14	500	Geyer willow	4%	6.38	61	30,000	190,000	5%	6.06	61	0	0	(190,000)	0%
027_05	Salmon River	15	500	Geyer willow	5%	6.06	58	29,000	180,000	6%	6.00	58	29,000	170,000	(10,000)	0%
									2,300,000					2,100,000	-170,000	

Table H9. Existing and target solar loads for Squaw Creek (ID17060201SL023_02).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
023_02	Squaw Creek	1	1500	dry DF w/o Ppine	94%	0.38	1	2,000	800	90%	0.64	1	2,000	1,000	200	-4%
023_02	Squaw Creek	2	380	dry DF w/o Ppine	92%	0.51	3	1,000	500	80%	1.28	3	1,000	1,000	500	-12%
023_02	Squaw Creek	3	600	dry DF w/o Ppine	84%	1.02	4	2,000	2,000	80%	1.28	4	2,000	3,000	1,000	-4%
023_02	Squaw Creek	4	290	DF/lodgepole gentle	99%	0.06	4	1,000	60	90%	0.64	4	1,000	600	500	-9%
023_02	Squaw Creek	5	450	DF/lodgepole gentle	97%	0.19	5	2,000	400	90%	0.64	5	2,000	1,000	600	-7%
023_02	Squaw Creek	6	460	Geyer willow	45%	3.51	5	2,000	7,000	20%	5.10	5	2,000	10,000	3,000	-25%
023_02	Pack Creek	1	2000	subalpine fir/dry-steep	99%	0.06	2	4,000	300	90%	0.64	2	4,000	3,000	3,000	-9%
023_02	Rough Creek	1	890	subalpine fir/dry-steep	99%	0.06	2	2,000	100	90%	0.64	2	2,000	1,000	900	-9%
023_02	Rough Creek	2	680	dry DF w/o Ppine	92%	0.51	3	2,000	1,000	80%	1.28	3	2,000	3,000	2,000	-12%
023_02	Willow Creek	1	370	subalpine fir/WBP	100%	0.00	1	400	0	90%	0.64	1	400	300	300	-10%
023_02	Willow Creek	2	160	subalpine fir/dry-steep	99%	0.06	1	200	10	80%	1.28	1	200	300	300	-19%
023_02	Willow Creek	3	650	subalpine fir/dry-steep	99%	0.06	2	1,000	60	70%	1.91	2	1,000	2,000	2,000	-29%
023_02	Willow Creek	4	180	subalpine fir/dry-steep	99%	0.06	2	400	30	80%	1.28	2	400	500	500	-19%
023_02	Willow Creek	5	140	subalpine fir/dry-steep	99%	0.06	2	300	20	80%	1.28	2	300	400	400	-19%
023_02	Willow Creek	6	410	subalpine fir/dry-steep	97%	0.19	3	1,000	200	90%	0.64	3	1,000	600	400	-7%
023_02	Willow Creek	7	600	DF/lodgepole gentle	99%	0.06	3	2,000	100	90%	0.64	3	2,000	1,000	900	-9%
023_02	Willow Creek	8	390	DF/lodgepole gentle	99%	0.06	4	2,000	100	90%	0.64	4	2,000	1,000	900	-9%
023_02	Willow Creek	9	290	DF/lodgepole gentle	99%	0.06	4	1,000	60	80%	1.28	4	1,000	1,000	900	-19%
023_02	Willow Creek	10	230	DF/lodgepole gentle	99%	0.06	4	900	60	90%	0.64	4	900	600	500	-9%
023_02	Willow Creek	11	230	DF/lodgepole gentle	99%	0.06	4	900	60	80%	1.28	4	900	1,000	900	-19%
023_02	Willow Creek	12	200	DF/lodgepole gentle	99%	0.06	4	800	50	90%	0.64	4	800	500	500	-9%
023_02	Willow Creek	13	310	dry DF w/o Ppine	76%	1.53	5	2,000	3,000	80%	1.28	5	2,000	3,000	0	0%
023_02	Willow Creek	14	920	DF/lodgepole gentle	97%	0.19	5	5,000	1,000	90%	0.64	5	5,000	3,000	2,000	-7%
023_02	Willow Creek	15	140	Geyer willow	45%	3.51	5	700	2,000	20%	5.10	5	700	4,000	2,000	-25%
023_02	1st to Willow	1	650	subalpine fir/dry-gentle	100%	0.00	1	700	0	80%	1.28	1	700	900	900	-20%
023_02	1st to Willow	2	780	subalpine fir/dry-gentle	100%	0.00	2	2,000	0	90%	0.64	2	2,000	1,000	1,000	-10%
023_02	1st to Willow	3	260	subalpine fir/dry-steep	99%	0.06	2	500	30	70%	1.91	2	500	1,000	1,000	-29%
023_02	2nd to Willow	1	160	meadow	55%	2.87	1	200	600	60%	2.55	1	200	500	(100)	0%
023_02	2nd to Willow	2	690	subalpine fir/dry-gentle	100%	0.00	1	700	0	90%	0.64	1	700	400	400	-10%
023_02	2nd to Willow	3	370	DF/lodgepole gentle	100%	0.00	2	700	0	90%	0.64	2	700	400	400	-10%
023_02	3rd to Willow	1	140	lake	0%	6.38	80	11,000	70,000	0%	6.38	80	11,000	70,000	0	0%
023_02	3rd to Willow	2	600	DF/lodgepole gentle	100%	0.00	1	600	0	90%	0.64	1	600	400	400	-10%
023_02	3rd to Willow	3	160	Geyer willow	82%	1.15	2	300	300	80%	1.28	2	300	400	100	-2%
023_02	3rd to Willow	4	50	pond	0%	6.38	15	750	4,800	0%	6.38	15	750	4,800	0	0%
023_02	3rd to Willow	5	70	Geyer willow	82%	1.15	2	100	100	80%	1.28	2	100	100	0	-2%
023_02	3rd to Willow	6	370	DF/lodgepole gentle	100%	0.00	2	700	0	90%	0.64	2	700	400	400	-10%
023_02	Sheep Creek	1	730	meadow	55%	2.87	1	700	2,000	60%	2.55	1	700	2,000	0	0%
023_02	Sheep Creek	2	580	meadow	31%	4.40	2	1,000	4,000	30%	4.47	2	1,000	4,000	0	-1%
023_02	Sheep Creek	3	870	Geyer willow	64%	2.30	3	3,000	7,000	70%	1.91	3	3,000	6,000	(1,000)	0%
023_02	Sheep Creek	4	580	Geyer willow	64%	2.30	3	2,000	5,000	70%	1.91	3	2,000	4,000	(1,000)	0%
023_02	Un-named	1	790	subalpine fir/dry-steep	99%	0.06	1	800	50	90%	0.64	1	800	500	500	-9%
023_02	Un-named	2	140	DF/lodgepole steep	98%	0.13	1	100	10	90%	0.64	1	100	60	50	-8%
023_02	Un-named	3	130	Geyer willow	93%	0.45	1	100	40	80%	1.28	1	100	100	60	-13%
023_02	Un-named	4	590	DF/lodgepole steep	98%	0.13	2	1,000	100	90%	0.64	2	1,000	600	500	-8%
023_02	Un-named	5	840	alder	86%	0.89	2	2,000	2,000	80%	1.28	2	2,000	3,000	1,000	-6%
023_02	Lavine Creek	1	310	subalpine fir/WBP	100%	0.00	1	300	0	90%	0.64	1	300	200	200	-10%
023_02	Lavine Creek	2	190	rangeland	65%	2.23	1	200	400	70%	1.91	1	200	400	0	0%
023_02	Lavine Creek	3	340	subalpine fir/dry-steep	99%	0.06	1	300	20	90%	0.64	1	300	200	200	-9%
023_02	Lavine Creek	4	850	dry DF w/o Ppine	94%	0.38	2	2,000	800	80%	1.28	2	2,000	3,000	2,000	-14%
023_02	Lavine Creek	5	160	dry DF w/o Ppine	94%	0.38	2	300	100	90%	0.64	2	300	200	100	-4%
023_02	Lavine Creek	6	280	alder	86%	0.89	2	600	500	80%	1.28	2	600	800	300	-6%
023_02	Lavine Creek	7	150	dry DF w/o Ppine	94%	0.38	2	300	100	90%	0.64	2	300	200	100	-4%
023_02	Lavine Creek	8	490	alder	72%	1.79	3	1,000	2,000	70%	1.91	3	1,000	2,000	0	-2%
023_02	Lavine Creek	9	470	DF/lodgepole steep	98%	0.13	3	1,000	100	90%	0.64	3	1,000	600	500	-8%
023_02	Lavine Creek	10	680	alder	72%	1.79	3	2,000	4,000	80%	1.28	3	2,000	3,000	(1,000)	0%

Table H9 (cont.). Existing and target solar loads for Squaw Creek (ID17060201SL023_02).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
023_02	Leg Creek	1	630	dry DF w/o Ppine	94%	0.38	1	600	200	90%	0.64	1	600	400	200	-4%
023_02	Leg Creek	2	530	dry DF w/o Ppine	94%	0.38	1	500	200	80%	1.28	1	500	600	400	-14%
023_02	Leg Creek	3	340	alder	86%	0.89	2	700	600	60%	2.55	2	700	2,000	1,000	-26%
023_02	Leg Creek	4	570	alder	86%	0.89	2	1,000	900	70%	1.91	2	1,000	2,000	1,000	-16%
023_02	Leg Creek	5	290	alder	86%	0.89	2	600	500	80%	1.28	2	600	800	300	-6%
023_02	Leg Creek	6	170	alder	86%	0.89	2	300	300	90%	0.64	2	300	200	(100)	0%
023_02	Trail Creek	1	200	meadow	55%	2.87	1	200	600	60%	2.55	1	200	500	(100)	0%
023_02	Trail Creek	2	610	subalpine fir/dry-gentle	100%	0.00	1	600	0	90%	0.64	1	600	400	400	-10%
023_02	Trail Creek	3	50	meadow	55%	2.87	1	50	100	60%	2.55	1	50	100	0	0%
023_02	Trail Creek	4	740	subalpine fir/dry-gentle	100%	0.00	2	1,000	0	90%	0.64	2	1,000	600	600	-10%
023_02	Trail Creek	5	360	DF/lodgepole gentle	100%	0.00	2	700	0	80%	1.28	2	700	900	900	-20%
023_02	Trail Creek	6	670	subalpine fir/dry-gentle	100%	0.00	3	2,000	0	90%	0.64	3	2,000	1,000	1,000	-10%
023_02	Trail Creek	7	420	dry DF w/o Ppine	92%	0.51	3	1,000	500	90%	0.64	3	1,000	600	100	-2%
023_02	Trail Creek	8	780	dry DF w/o Ppine	84%	1.02	4	3,000	3,000	90%	0.64	4	3,000	2,000	(1,000)	0%
023_02	Trail Creek	9	210	dry DF w/o Ppine	76%	1.53	5	1,000	2,000	90%	0.64	5	1,000	600	(1,000)	0%
023_02	Trail Creek	10	190	dry DF w/o Ppine	69%	1.98	6	1,000	2,000	90%	0.64	6	1,000	600	(1,000)	0%
023_02	Trail Creek	11	780	alder	43%	3.64	6	5,000	20,000	60%	2.55	6	5,000	10,000	(10,000)	0%
023_02	Trail Creek	12	660	dry DF w/o Ppine	69%	1.98	6	4,000	8,000	90%	0.64	6	4,000	3,000	(5,000)	0%
023_02	Trail Creek	13	630	alder	43%	3.64	6	4,000	10,000	60%	2.55	6	4,000	10,000	0	0%
023_02	1st to Trail	1	720	subalpine fir/WBP	100%	0.00	1	700	0	90%	0.64	1	700	400	400	-10%
023_02	1st to Trail	2	490	meadow	55%	2.87	1	500	1,000	50%	3.19	1	500	2,000	1,000	-5%
023_02	1st to Trail	3	500	DF/lodgepole gentle	100%	0.00	2	1,000	0	90%	0.64	2	1,000	600	600	-10%
023_02	1st to Trail	4	250	meadow	31%	4.40	2	500	2,000	40%	3.83	2	500	2,000	0	0%
023_02	1st to Trail	5	120	DF/lodgepole gentle	100%	0.00	2	200	0	90%	0.64	2	200	100	100	-10%
023_02	1st to Trail	6	320	meadow	31%	4.40	2	600	3,000	40%	3.83	2	600	2,000	(1,000)	0%
023_02	1st to Trail	7	1200	dry DF w/o Ppine	92%	0.51	3	4,000	2,000	90%	0.64	3	4,000	3,000	1,000	-2%
023_02	2nd to Trail	1	3100	subalpine fir/dry-gentle	100%	0.00	2	6,000	0	90%	0.64	2	6,000	4,000	4,000	-10%
023_02	2nd to Trail	2	1000	dry DF w/o Ppine	84%	1.02	4	4,000	4,000	90%	0.64	4	4,000	3,000	(1,000)	0%
023_02	3rd to Trail	1	60	subalpine fir/dry-gentle	100%	0.00	1	60	0	90%	0.64	1	60	40	40	-10%
023_02	3rd to Trail	2	120	meadow	55%	2.87	1	100	300	60%	2.55	1	100	300	0	0%
023_02	3rd to Trail	3	250	subalpine fir/dry-gentle	100%	0.00	1	300	0	90%	0.64	1	300	200	200	-10%
023_02	3rd to Trail	4	410	meadow	55%	2.87	1	400	1,000	60%	2.55	1	400	1,000	0	0%
023_02	3rd to Trail	5	390	subalpine fir/dry-gentle	100%	0.00	2	800	0	80%	1.28	2	800	1,000	1,000	-20%
023_02	3rd to Trail	6	160	meadow	31%	4.40	2	300	1,000	50%	3.19	2	300	1,000	0	0%
023_02	3rd to Trail	7	270	DF/lodgepole gentle	100%	0.00	2	500	0	80%	1.28	2	500	600	600	-20%
023_02	3rd to Trail	8	450	meadow	31%	4.40	2	900	4,000	30%	4.47	2	900	4,000	0	-1%
023_02	3rd to Trail	9	790	dry DF w/o Ppine	92%	0.51	3	2,000	1,000	80%	1.28	3	2,000	3,000	2,000	-12%
023_02	3rd to Trail	10	160	dry DF w/o Ppine	92%	0.51	3	500	300	90%	0.64	3	500	300	0	-2%

Table H9 (cont.). Existing and target solar loads for Squaw Creek (ID17060201SL023_02).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
023_02	Martin Creek	1	830	alpine	55%	2.87	1	800	2,000	60%	2.55	1	800	2,000	0	0%
023_02	Martin Creek	2	340	subalpine fir/dry-gentle	100%	0.00	2	700	0	90%	0.64	2	700	400	400	-10%
023_02	Martin Creek	3	370	subalpine fir/dry-steep	99%	0.06	2	700	40	70%	1.91	2	700	1,000	1,000	-29%
023_02	Martin Creek	4	670	subalpine fir/dry-steep	97%	0.19	3	2,000	400	80%	1.28	3	2,000	3,000	3,000	-17%
023_02	Martin Creek	5	540	DF/lodgepole steep	97%	0.19	4	2,000	400	90%	0.64	4	2,000	1,000	600	-7%
023_02	Martin Creek	6	210	DF/lodgepole steep	97%	0.19	4	800	200	90%	0.64	4	800	500	300	-7%
023_02	1st to Martin	1	270	meadow	55%	2.87	1	300	900	60%	2.55	1	300	800	(100)	0%
023_02	1st to Martin	2	1000	subalpine fir/dry-steep	99%	0.06	2	2,000	100	90%	0.64	2	2,000	1,000	900	-9%
023_02	1st to Martin	3	190	DF/lodgepole gentle	99%	0.06	3	600	40	90%	0.64	3	600	400	400	-9%
023_02	1st to Martin	4	280	subalpine fir/dry-gentle	100%	0.00	3	800	0	90%	0.64	3	800	500	500	-10%
023_02	1st to Martin	5	360	DF/lodgepole steep	98%	0.13	3	1,000	100	90%	0.64	3	1,000	600	500	-8%
023_02	2nd to Martin	1	220	meadow	55%	2.87	1	200	600	60%	2.55	1	200	500	(100)	0%
023_02	2nd to Martin	2	470	subalpine fir/WBP	100%	0.00	1	500	0	90%	0.64	1	500	300	300	-10%
023_02	2nd to Martin	3	1000	subalpine fir/dry-gentle	100%	0.00	2	2,000	0	90%	0.64	2	2,000	1,000	1,000	-10%
023_02	2nd to Martin	4	1300	subalpine fir/dry-steep	97%	0.19	3	4,000	800	90%	0.64	3	4,000	3,000	2,000	-7%
023_02	2nd to Martin	5	450	DF/lodgepole steep	97%	0.19	4	2,000	400	90%	0.64	4	2,000	1,000	600	-7%
023_02	trib to 2nd	1	1500	subalpine fir/dry-steep	99%	0.06	2	3,000	200	90%	0.64	2	3,000	2,000	2,000	-9%
023_02	trib to 2nd	2	240	dry DF w/o Ppine	92%	0.51	3	700	400	90%	0.64	3	700	400	0	-2%
023_02	3rd to Martin	1	750	subalpine fir/dry-steep	99%	0.06	1	800	50	90%	0.64	1	800	500	500	-9%
023_02	3rd to Martin	2	1600	dry DF w/o Ppine	92%	0.51	3	5,000	3,000	90%	0.64	3	5,000	3,000	0	-2%
023_02	4th to Martin	1	590	alder	91%	0.57	1	600	300	90%	0.64	1	600	400	100	-1%
023_02	4th to Martin	2	100	alder	91%	0.57	1	100	60	70%	1.91	1	100	200	100	-21%
023_02	4th to Martin	3	130	alder	91%	0.57	1	100	60	50%	3.19	1	100	300	200	-41%
023_02	4th to Martin	4	560	alder	86%	0.89	2	1,000	900	80%	1.28	2	1,000	1,000	100	-6%
023_02	4th to Martin	5	300	DF/lodgepole steep	98%	0.13	2	600	80	90%	0.64	2	600	400	300	-8%
023_02	5th to Martin	1	340	meadow	55%	2.87	1	300	900	60%	2.55	1	300	800	(100)	0%
023_02	5th to Martin	2	570	meadow	55%	2.87	1	600	2,000	60%	2.55	1	600	2,000	0	0%
023_02	5th to Martin	3	450	subalpine fir/dry-steep	99%	0.06	2	900	60	90%	0.64	2	900	600	500	-9%
023_02	5th to Martin	4	620	DF/lodgepole gentle	100%	0.00	2	1,000	0	90%	0.64	2	1,000	600	600	-10%
023_02	5th to Martin	5	2700	DF/lodgepole steep	98%	0.13	3	8,000	1,000	90%	0.64	3	8,000	5,000	4,000	-8%
023_02	5th to Martin	6	340	dry DF w/o Ppine	84%	1.02	4	1,000	1,000	90%	0.64	4	1,000	600	(400)	0%
023_02	Trealor Creek	1	920	dry DF w/o Ppine	94%	0.38	1	900	300	90%	0.64	1	900	600	300	-4%
023_02	Trealor Creek	2	1100	DF/lodgepole gentle	100%	0.00	2	2,000	0	90%	0.64	2	2,000	1,000	1,000	-10%
023_02	Trealor Creek	3	120	dry DF w/o Ppine	92%	0.51	3	400	200	50%	3.19	3	400	1,000	800	-42%
023_02	Trealor Creek	4	230	dry DF w/o Ppine	92%	0.51	3	700	400	90%	0.64	3	700	400	0	-2%
023_02	Trealor Creek	5	500	Geyer willow	64%	2.30	3	2,000	5,000	80%	1.28	3	2,000	3,000	(2,000)	0%
023_02	Trealor Creek	6	750	Geyer willow	64%	2.30	3	2,000	5,000	50%	3.19	3	2,000	6,000	1,000	-14%
023_02	Trealor Creek	7	150	Geyer willow	53%	3.00	4	600	2,000	60%	2.55	4	600	2,000	0	0%
023_02	Trealor Creek	8	1400	Geyer willow	53%	3.00	4	6,000	20,000	40%	3.83	4	6,000	20,000	0	-13%
							Totals		240,000					290,000	48,000	

Table H10. Existing and target solar loads for Squaw Creek (ID17060201SL023_03).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
023_03	Squaw Creek	1	140	Geyer willow	40%	3.83	6	800	3,000	10%	5.74	6	800	5,000	2,000	-30%
023_03	Squaw Creek	2	120	Geyer willow	40%	3.83	6	700	3,000	40%	3.83	6	700	3,000	0	0%
023_03	Squaw Creek	3	980	dry DF w/o Ppine	69%	1.98	6	6,000	10,000	70%	1.91	6	6,000	10,000	0	0%
023_03	Squaw Creek	4	250	dry DF w/o Ppine	69%	1.98	6	2,000	4,000	80%	1.28	6	2,000	3,000	(1,000)	0%
023_03	Squaw Creek	5	640	dry DF w/o Ppine	64%	2.30	7	4,000	9,000	60%	2.55	7	4,000	10,000	1,000	-4%
023_03	Squaw Creek	6	580	alder	38%	3.96	7	4,000	20,000	40%	3.83	7	4,000	20,000	0	0%
023_03	Squaw Creek	7	380	dry DF w/o Ppine	64%	2.30	7	3,000	7,000	70%	1.91	7	3,000	6,000	(1,000)	0%
023_03	Squaw Creek	8	290	alder	34%	4.21	8	2,000	8,000	50%	3.19	8	2,000	6,000	(2,000)	0%
023_03	Squaw Creek	9	140	alder	34%	4.21	8	1,000	4,000	40%	3.83	8	1,000	4,000	0	0%
023_03	Squaw Creek	10	180	alder	34%	4.21	8	1,000	4,000	40%	3.83	8	1,000	4,000	0	0%
023_03	Squaw Creek	11	670	alder	34%	4.21	8	5,000	20,000	50%	3.19	8	5,000	20,000	0	0%
023_03	Squaw Creek	12	440	alder	34%	4.21	8	4,000	20,000	40%	3.83	8	4,000	20,000	0	0%
023_03	Martin Creek	1	1200	DF/lodgepole steep	95%	0.32	5	6,000	2,000	90%	0.64	5	6,000	4,000	2,000	-5%
023_03	Martin Creek	2	260	alder	50%	3.19	5	1,000	3,000	60%	2.55	5	1,000	3,000	0	0%
023_03	Martin Creek	3	640	DF/lodgepole steep	94%	0.38	6	4,000	2,000	90%	0.64	6	4,000	3,000	1,000	-4%
023_03	Martin Creek	4	180	alder	43%	3.64	6	1,000	4,000	60%	2.55	6	1,000	3,000	(1,000)	0%
023_03	Martin Creek	5	220	DF/lodgepole steep	94%	0.38	6	1,000	400	90%	0.64	6	1,000	600	200	-4%
023_03	Martin Creek	6	360	alder	43%	3.64	6	2,000	7,000	50%	3.19	6	2,000	6,000	(1,000)	0%
023_03	Martin Creek	7	460	DF/lodgepole steep	94%	0.38	6	3,000	1,000	90%	0.64	6	3,000	2,000	1,000	-4%
023_03	Martin Creek	8	310	alder	38%	3.96	7	2,000	8,000	50%	3.19	7	2,000	6,000	(2,000)	0%
023_03	Martin Creek	9	1200	dry DF w/o Ppine	64%	2.30	7	8,000	20,000	70%	1.91	7	8,000	20,000	0	0%
							Totals		160,000					160,000	-800	

Table H11. Existing and target solar loads for Squaw Creek (ID17060201SL023_04).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
023_04	Squaw Creek	1	320	alder	34%	4.21	8	3,000	10,000	40%	3.83	8	3,000	10,000	0	0%
023_04	Squaw Creek	2	130	alder	34%	4.21	8	1,000	4,000	30%	4.47	8	1,000	4,000	0	-4%
023_04	Squaw Creek	3	130	alder	34%	4.21	8	1,000	4,000	40%	3.83	8	1,000	4,000	0	0%
023_04	Squaw Creek	4	90	alder	34%	4.21	8	700	3,000	60%	2.55	8	700	2,000	(1,000)	0%
023_04	Squaw Creek	5	270	alder	34%	4.21	8	2,000	8,000	40%	3.83	8	2,000	8,000	0	0%
023_04	Squaw Creek	6	1300	alder	34%	4.21	8	10,000	40,000	30%	4.47	8	10,000	40,000	0	-4%
023_04	Squaw Creek	7	140	alder	34%	4.21	8	1,000	4,000	30%	4.47	8	1,000	4,000	0	-4%
023_04	Squaw Creek	8	190	alder	34%	4.21	8	2,000	8,000	40%	3.83	8	2,000	8,000	0	0%
023_04	Squaw Creek	9	320	alder	34%	4.21	8	3,000	10,000	50%	3.19	8	3,000	10,000	0	0%
023_04	Squaw Creek	10	1100	alder	34%	4.21	8	9,000	40,000	30%	4.47	8	9,000	40,000	0	-4%
023_04	Squaw Creek	11	370	alder	34%	4.21	8	3,000	10,000	20%	5.10	8	3,000	20,000	10,000	-14%
023_04	Squaw Creek	12	420	alder	34%	4.21	8	3,000	10,000	10%	5.74	8	3,000	20,000	10,000	-24%
							Totals		150,000					170,000	19,000	

Table H12. Existing and target solar loads for Squaw Creek (ID17060201SL021_04).

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m^2/day)	Segment Width (m)	Segment Area (m^2)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
021_04	Squaw Creek	1	890	alder	34%	4.21	8	7,000	30,000	10%	5.74	8	7,000	40,000	10,000	-24%
021_04	Squaw Creek	2	480	alder	34%	4.21	8	4,000	20,000	20%	5.10	8	4,000	20,000	0	-14%
021_04	Squaw Creek	3	440	alder	34%	4.21	8	4,000	20,000	10%	5.74	8	4,000	20,000	0	-24%
021_04	Squaw Creek	4	250	alder	34%	4.21	8	2,000	8,000	20%	5.10	8	2,000	10,000	2,000	-14%
021_04	Squaw Creek	5	130	alder	34%	4.21	8	1,000	4,000	40%	3.83	8	1,000	4,000	0	0%
021_04	Squaw Creek	6	650	alder	34%	4.21	8	5,000	20,000	30%	4.47	8	5,000	20,000	0	-4%
021_04	Squaw Creek	7	140	alder	34%	4.21	8	1,000	4,000	10%	5.74	8	1,000	6,000	2,000	-24%
021_04	Squaw Creek	8	640	alder	34%	4.21	8	5,000	20,000	30%	4.47	8	5,000	20,000	0	-4%
021_04	Squaw Creek	9	190	alder	34%	4.21	8	2,000	8,000	40%	3.83	8	2,000	8,000	0	0%
021_04	Squaw Creek	10	650	Geyer willow	31%	4.40	8	5,000	20,000	30%	4.47	8	5,000	20,000	0	-1%
021_04	Squaw Creek	11	1000	Geyer willow	31%	4.40	8	8,000	40,000	10%	5.74	8	8,000	50,000	10,000	-21%
021_04	Squaw Creek	12	310	Geyer willow	31%	4.40	8	2,000	9,000	0%	6.38	8	2,000	10,000	1,000	-31%
021_04	Squaw Creek	13	120	Geyer willow	31%	4.40	8	1,000	4,000	10%	5.74	8	1,000	6,000	2,000	-21%
021_04	Squaw Creek	14	140	Geyer willow	31%	4.40	8	1,000	4,000	0%	6.38	8	1,000	6,000	2,000	-31%
021_04	Squaw Creek	15	170	Geyer willow	31%	4.40	8	1,000	4,000	10%	5.74	8	1,000	6,000	2,000	-21%
021_04	Squaw Creek	16	460	Geyer willow	31%	4.40	8	4,000	20,000	20%	5.10	8	4,000	20,000	0	-11%
021_04	Squaw Creek	17	310	Geyer willow	31%	4.40	8	2,000	9,000	10%	5.74	8	2,000	10,000	1,000	-21%
021_04	Squaw Creek	18	280	Geyer willow	31%	4.40	8	2,000	9,000	20%	5.10	8	2,000	10,000	1,000	-11%
021_04	Squaw Creek	19	480	Geyer willow	31%	4.40	8	4,000	20,000	10%	5.74	8	4,000	20,000	0	-21%
021_04	Squaw Creek	20	440	Geyer willow	31%	4.40	8	4,000	20,000	20%	5.10	8	4,000	20,000	0	-11%
021_04	Squaw Creek	21	260	Geyer willow	31%	4.40	8	2,000	9,000	10%	5.74	8	2,000	10,000	1,000	-21%
021_04	Squaw Creek	22	100	Geyer willow	31%	4.40	8	800	4,000	20%	5.10	8	800	4,000	0	-11%
021_04	Squaw Creek	23	370	Geyer willow	31%	4.40	8	3,000	10,000	10%	5.74	8	3,000	20,000	10,000	-21%
021_04	Squaw Creek	24	940	Geyer willow	31%	4.40	8	8,000	40,000	0%	6.38	8	8,000	50,000	10,000	-31%
021_04	Squaw Creek	25	550	Geyer willow	31%	4.40	8	4,000	20,000	10%	5.74	8	4,000	20,000	0	-21%
021_04	Squaw Creek	26	380	Geyer willow	31%	4.40	8	3,000	10,000	0%	6.38	8	3,000	20,000	10,000	-31%
021_04	Squaw Creek	27	1100	Geyer willow	31%	4.40	8	9,000	40,000	10%	5.74	8	9,000	50,000	10,000	-21%
021_04	Squaw Creek	28	660	Geyer willow	31%	4.40	8	5,000	20,000	0%	6.38	8	5,000	30,000	10,000	-31%
							Totals		450,000					530,000	84,000	

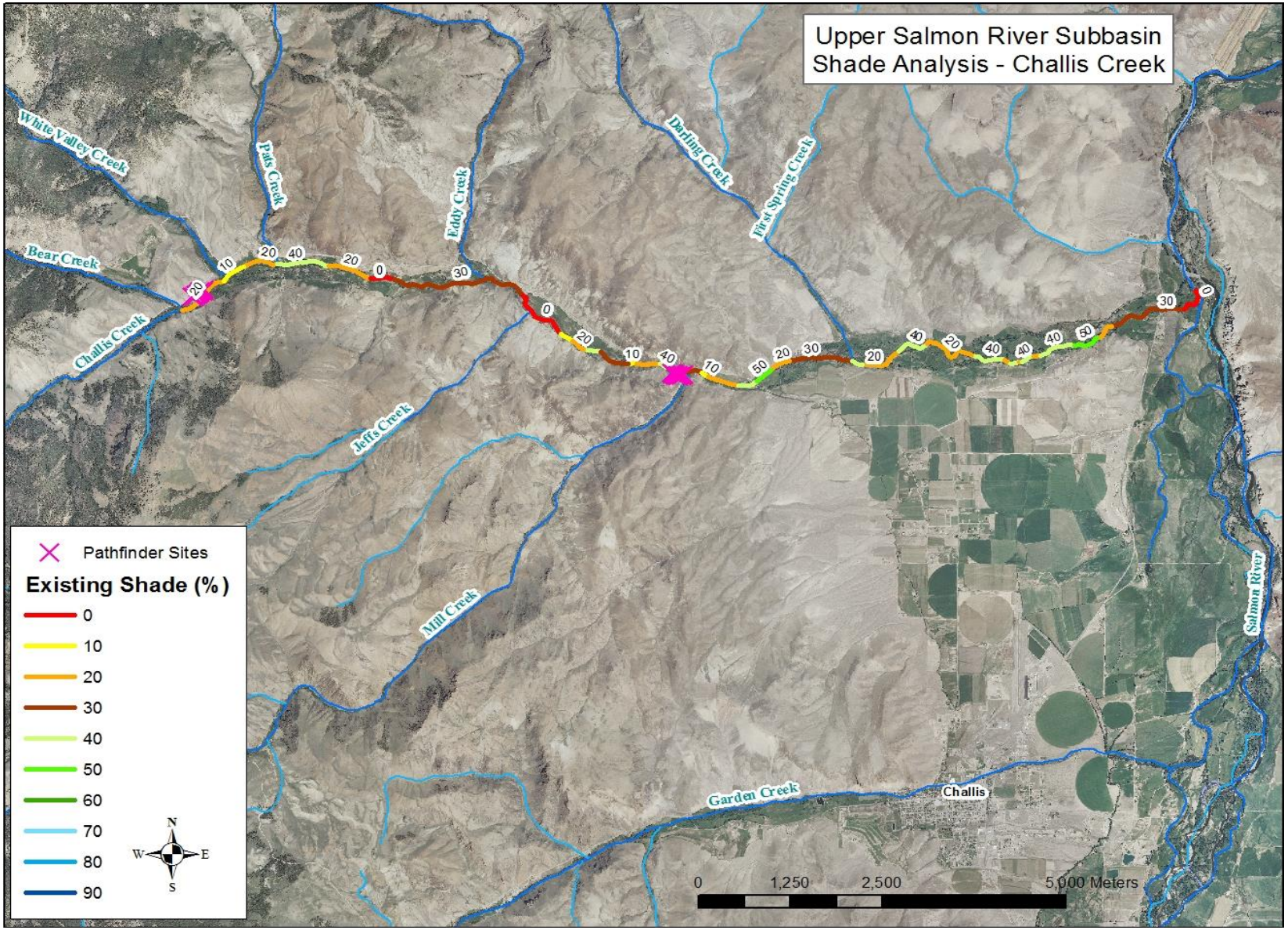


Figure H1. Existing shade estimated for Challis Creek by aerial photo interpretation.

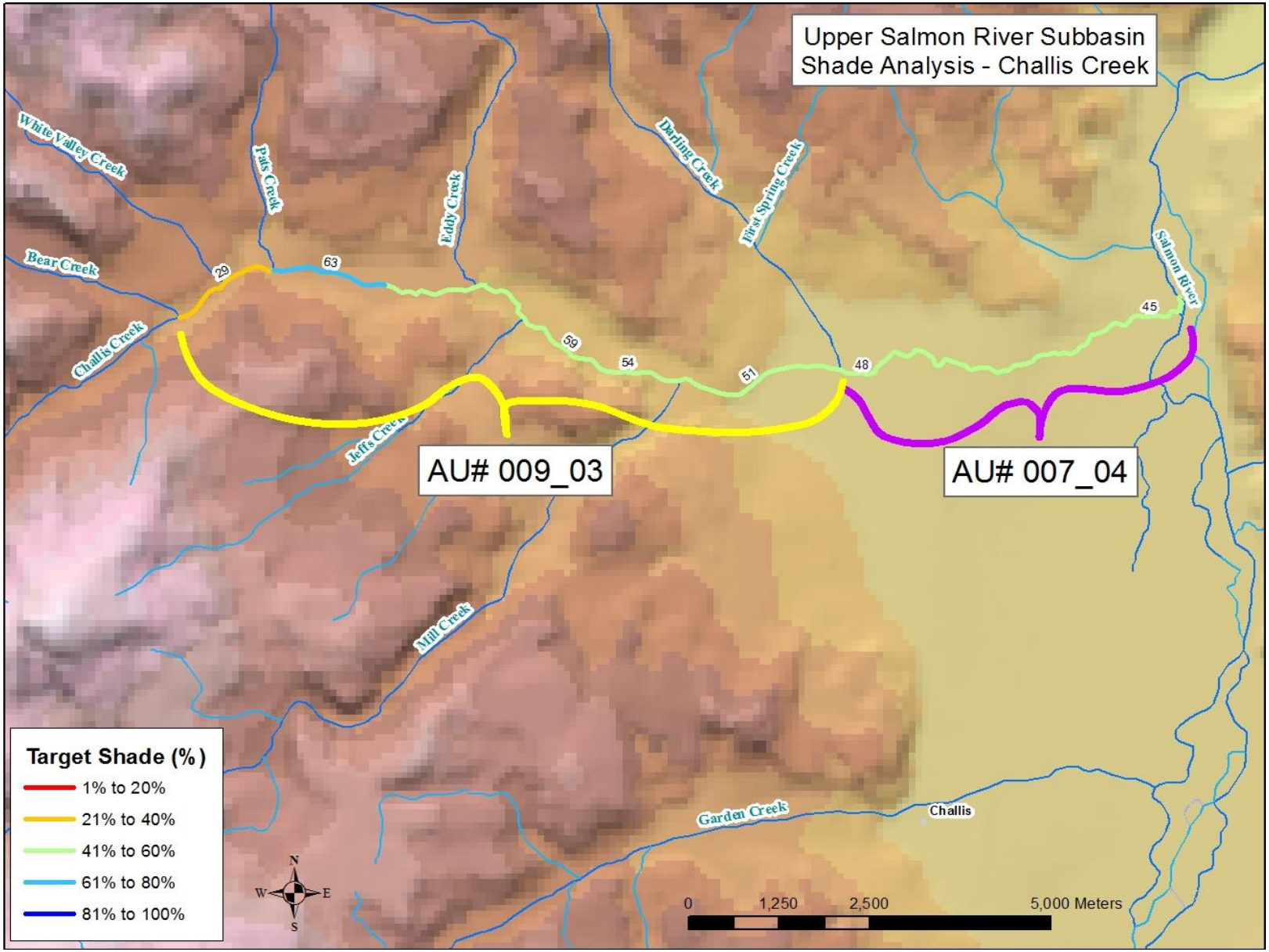


Figure H2. Target shade for Challis Creek.

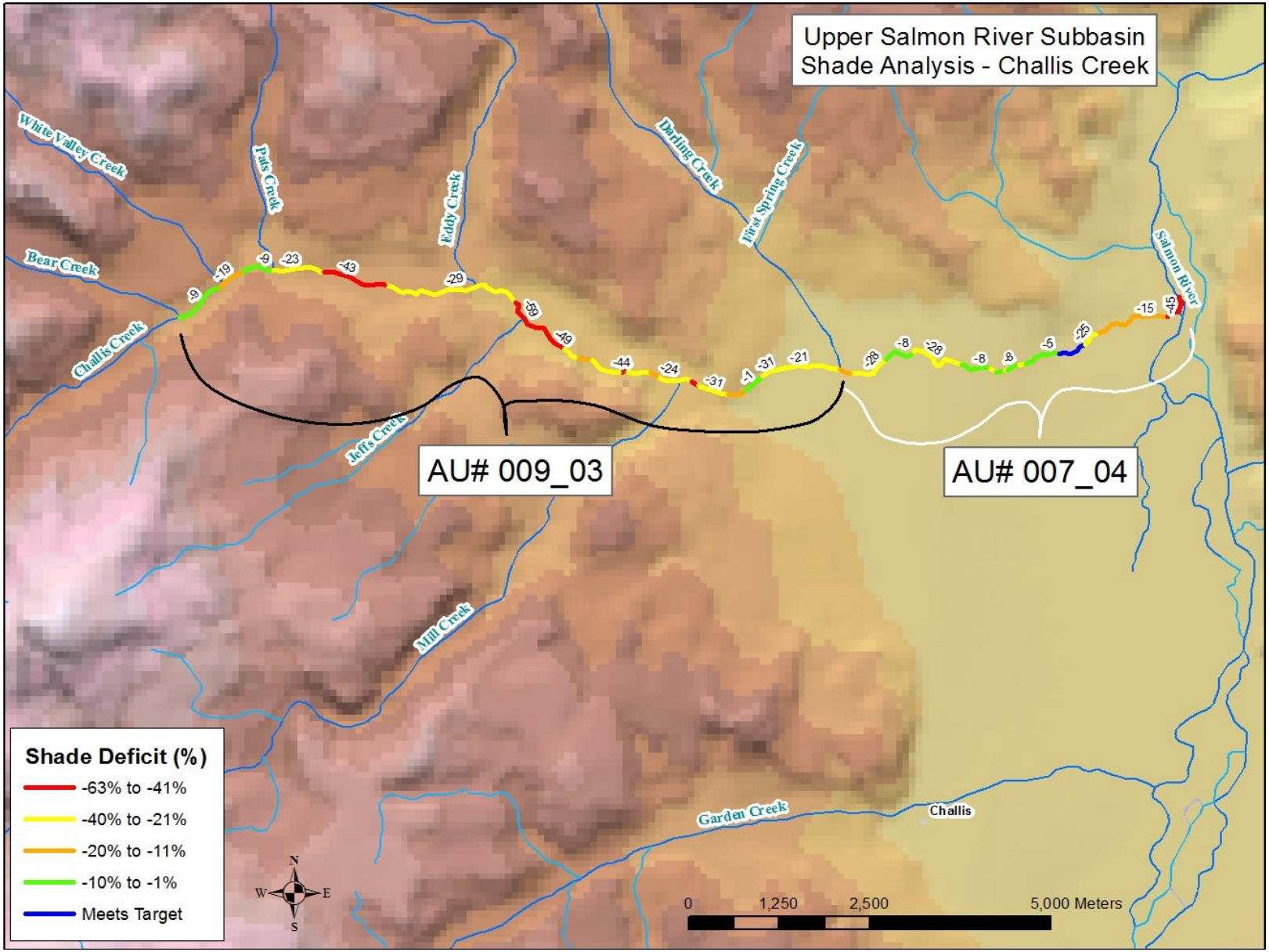


Figure H3. Lack of shade (difference between existing and target) for Challis Creek.

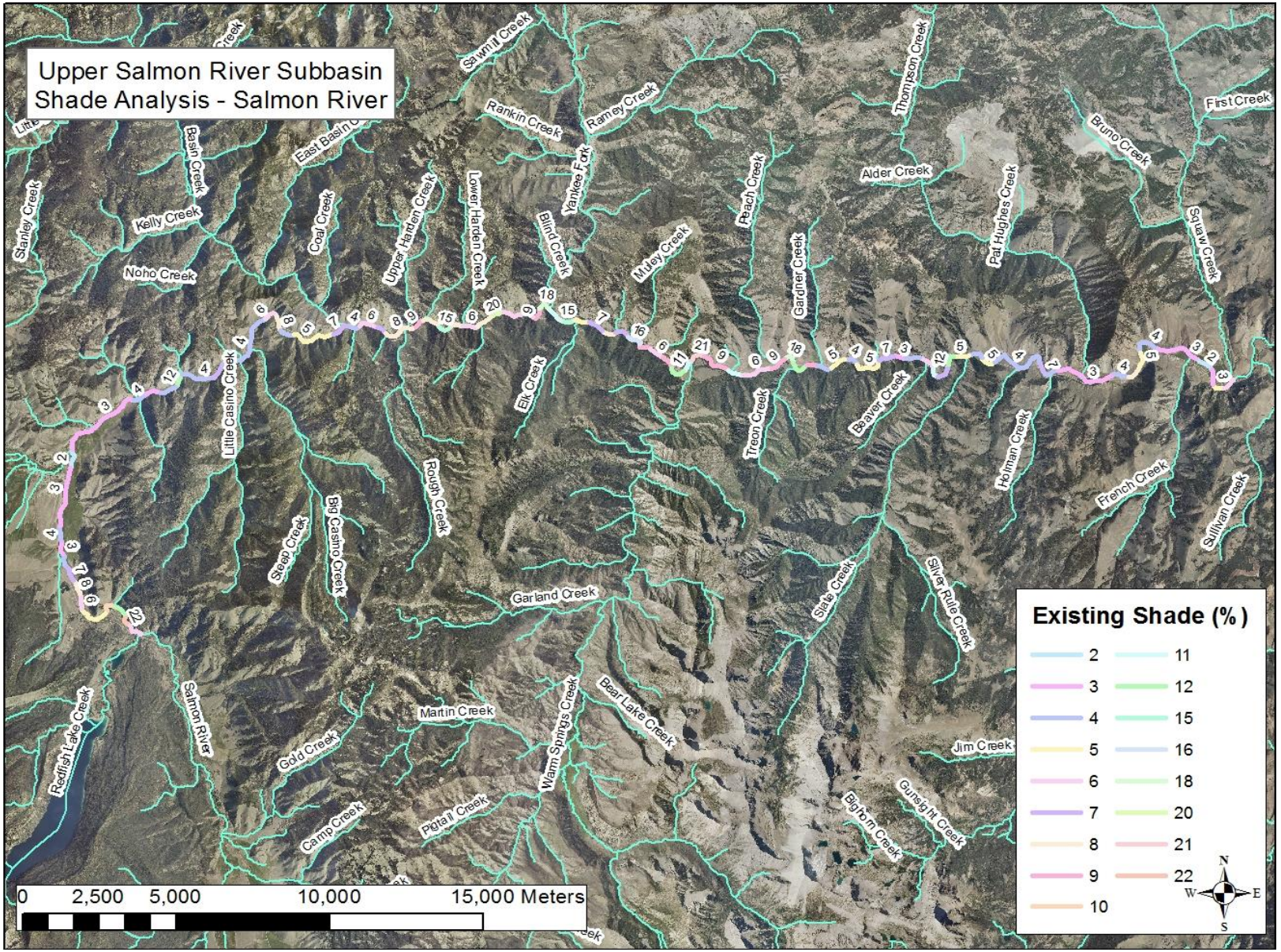


Figure H4. Existing shade estimated for the Salmon River by Heat Source modeling (shade-alator).

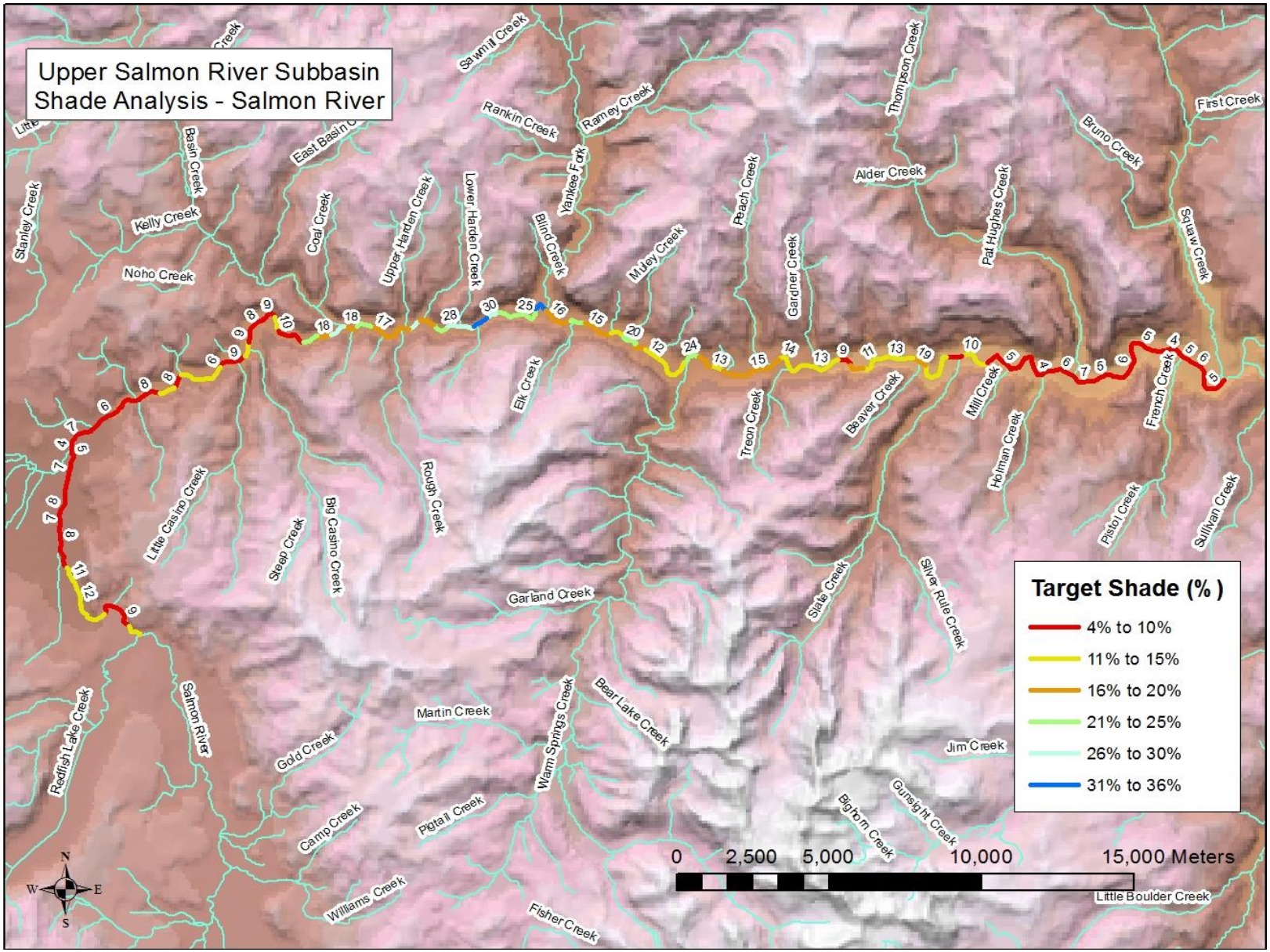


Figure H5. Target shade for the Salmon River.

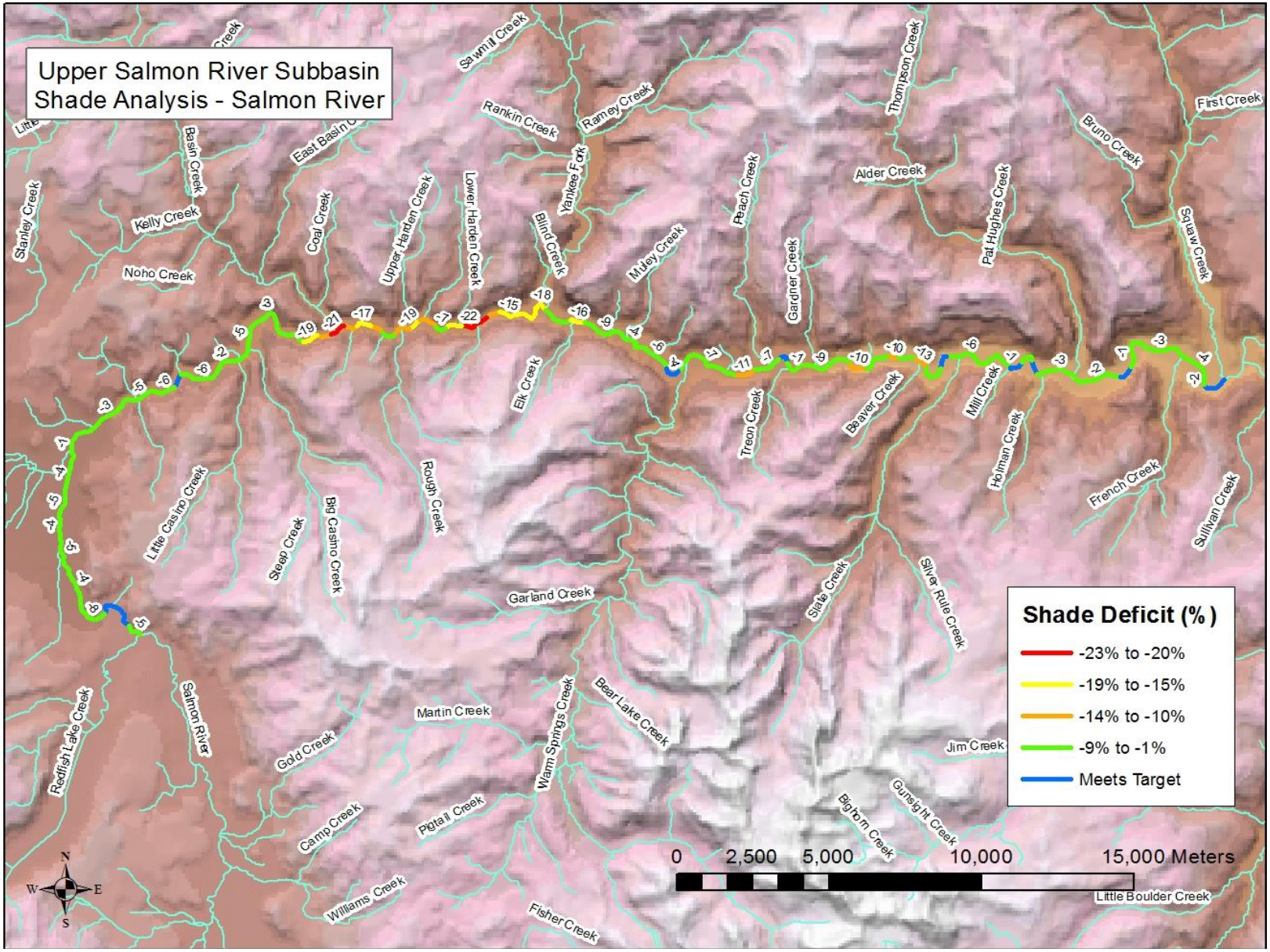


Figure H6. Lack of shade (difference between existing and target) for the Salmon River.

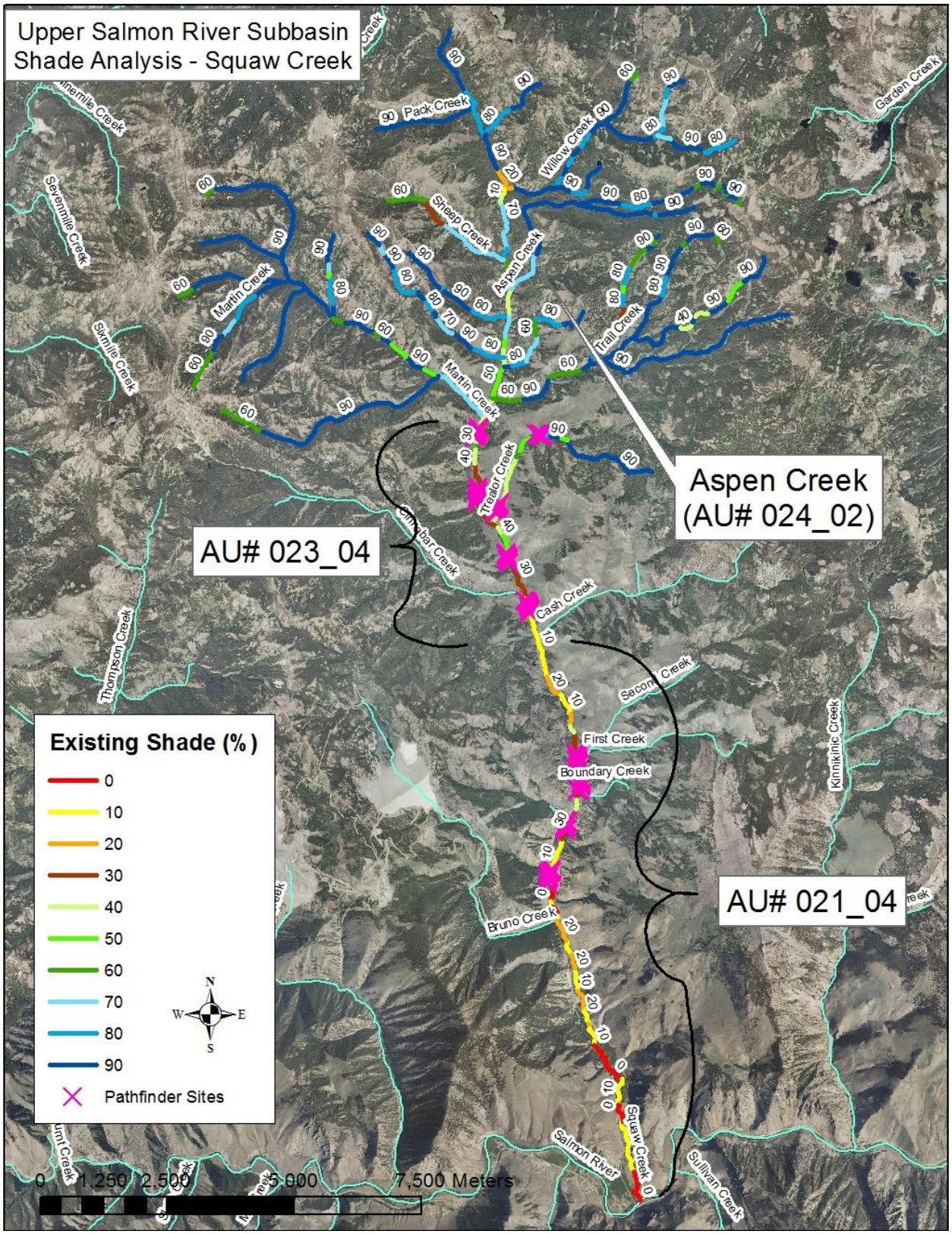


Figure H7. Existing shade estimated for Squaw Creek watershed by aerial photo interpretation.

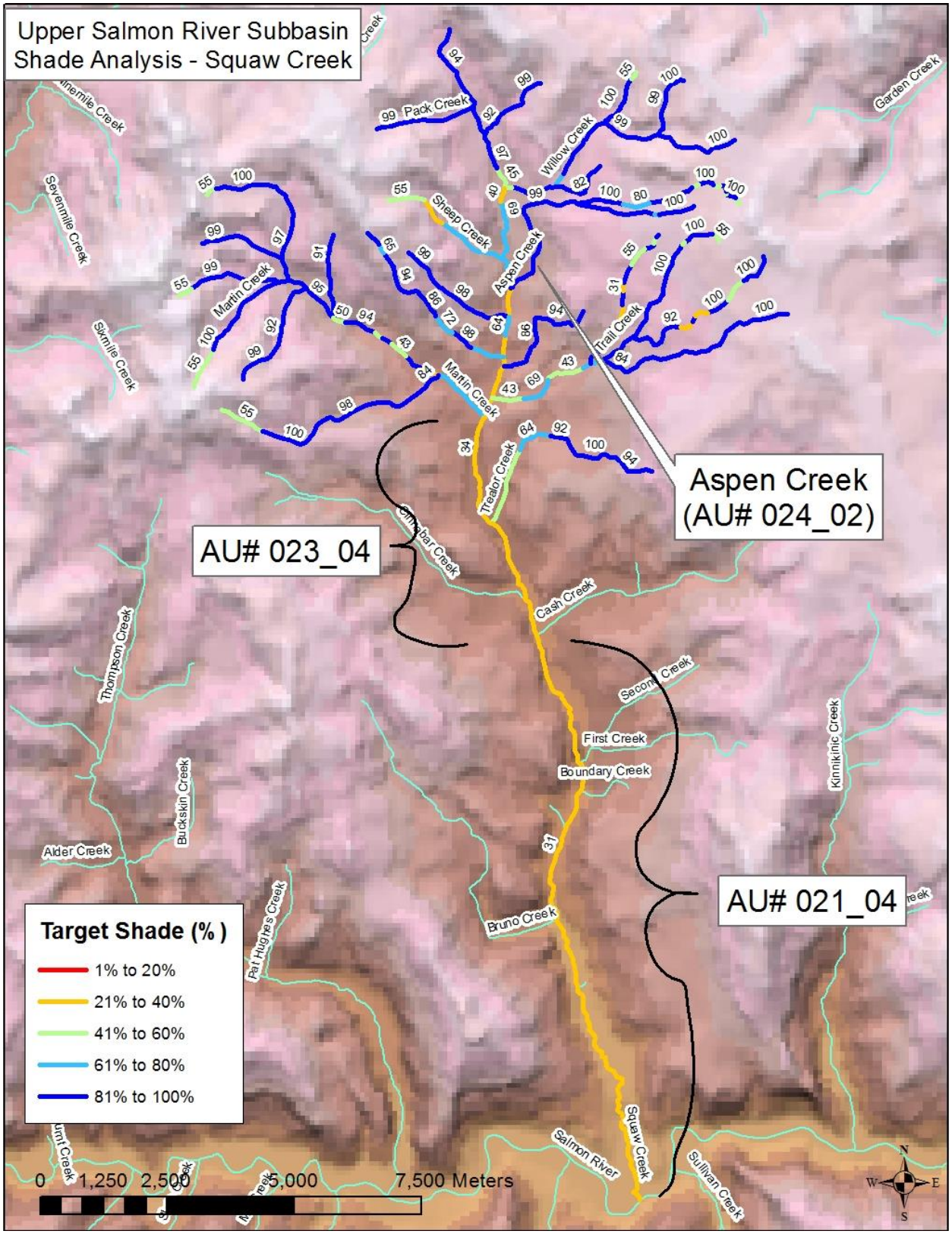


Figure H8. Target shade for Squaw Creek watershed.

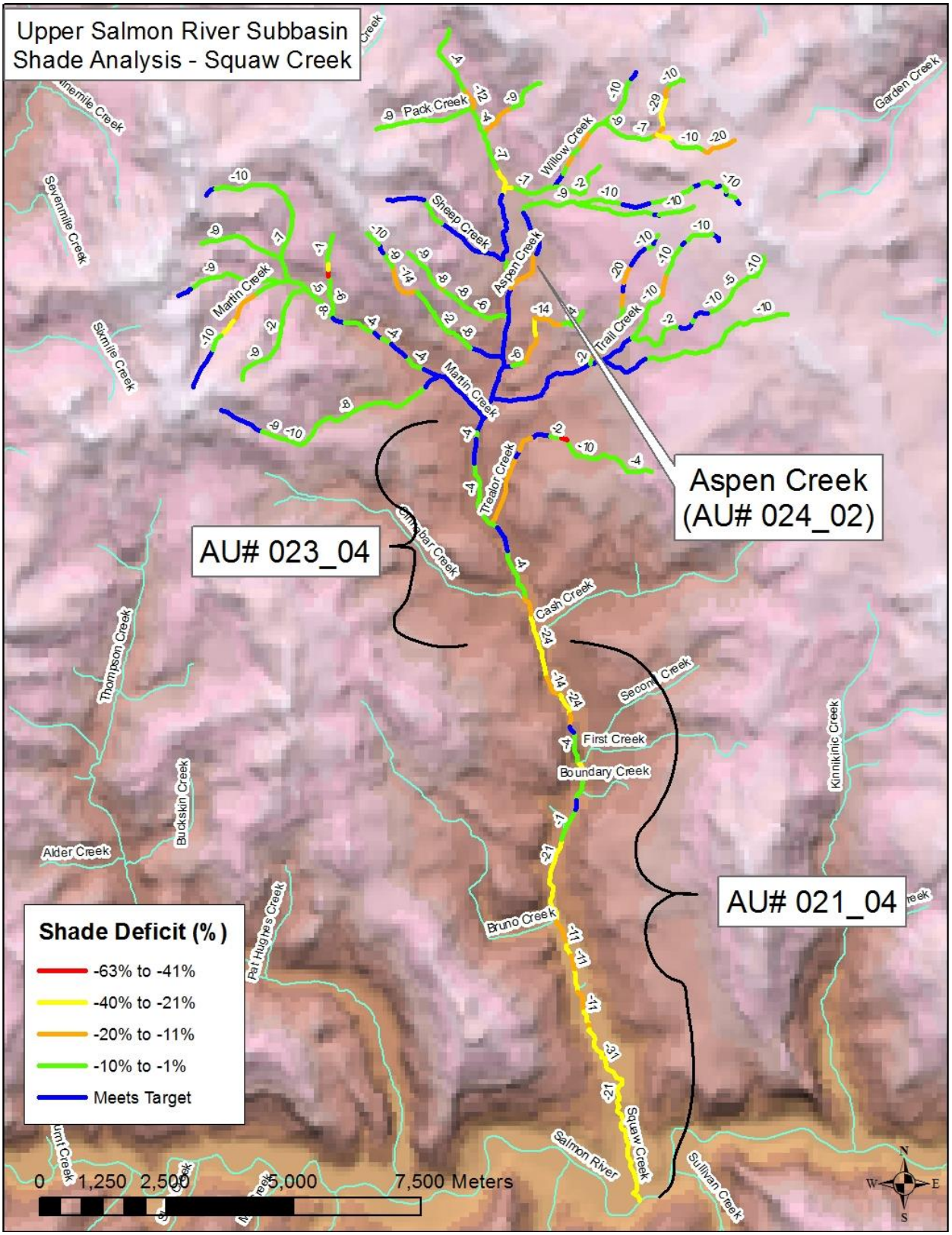


Figure H9. Lack of shade (difference between existing and target) for Squaw Creek watershed.

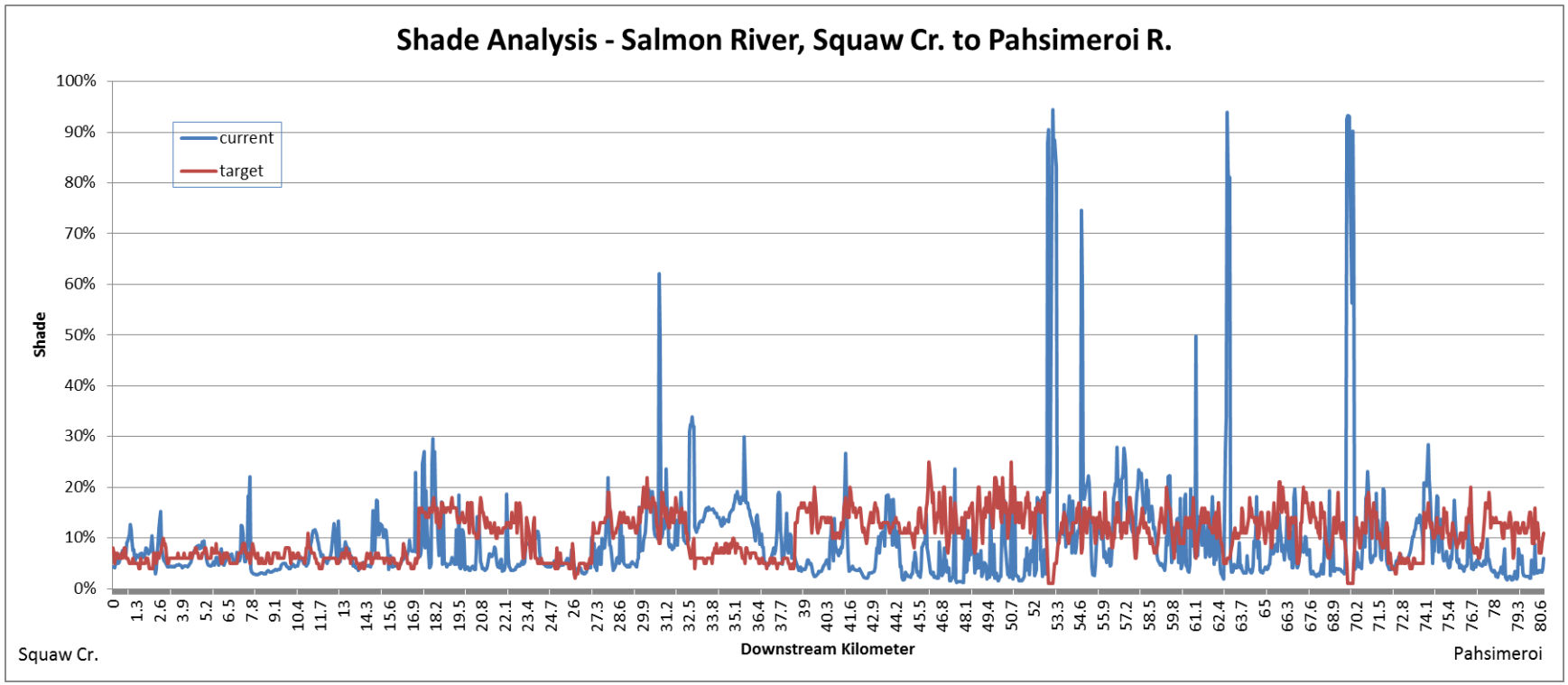


Figure H10. Existing shade estimated for Salmon River (Squaw Creek to Pahsimeroi River) by Heat Source modeling (shade-alator) and corresponding shade targets. Shade spikes are from vegetated islands.

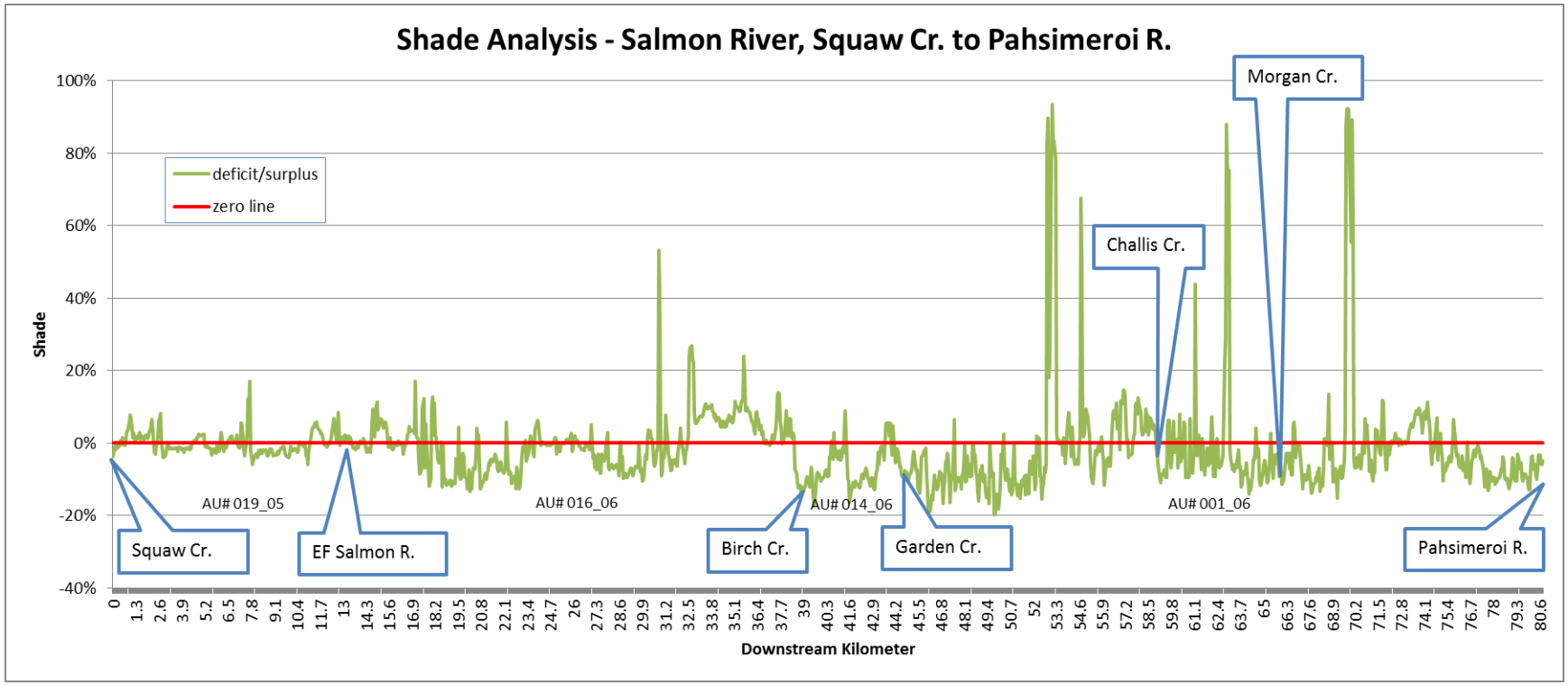
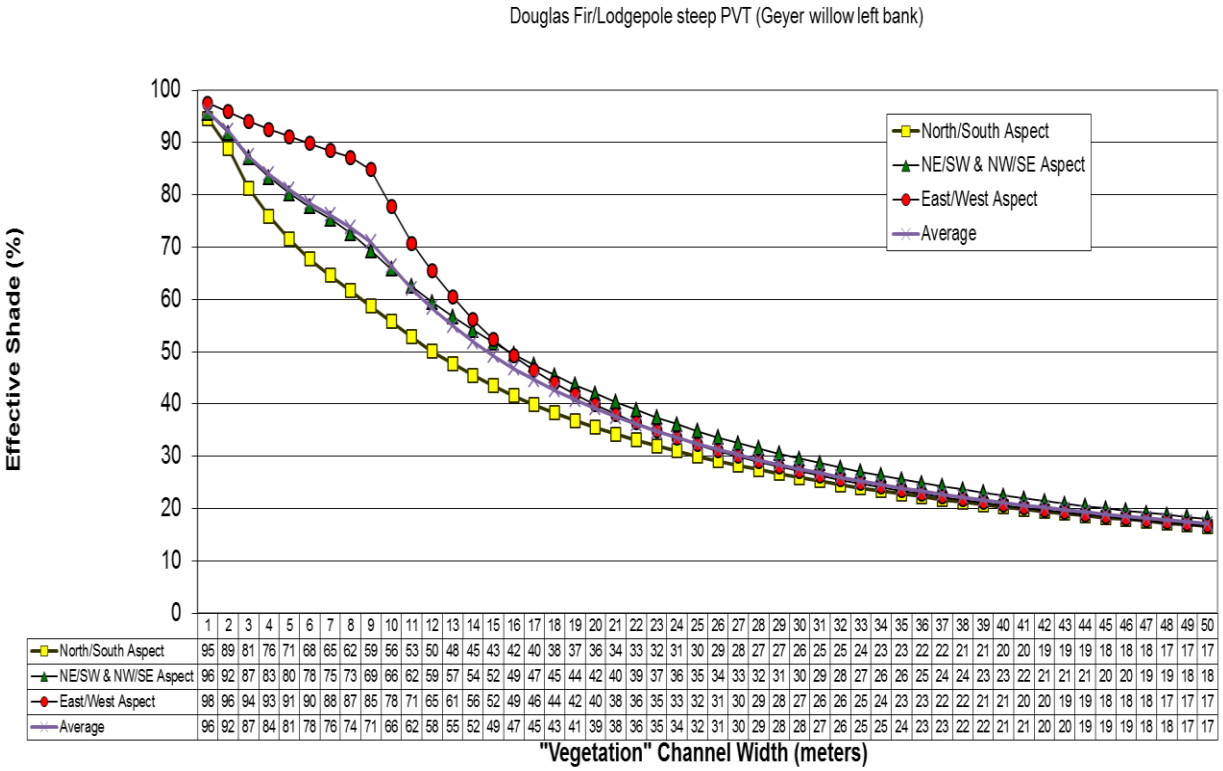


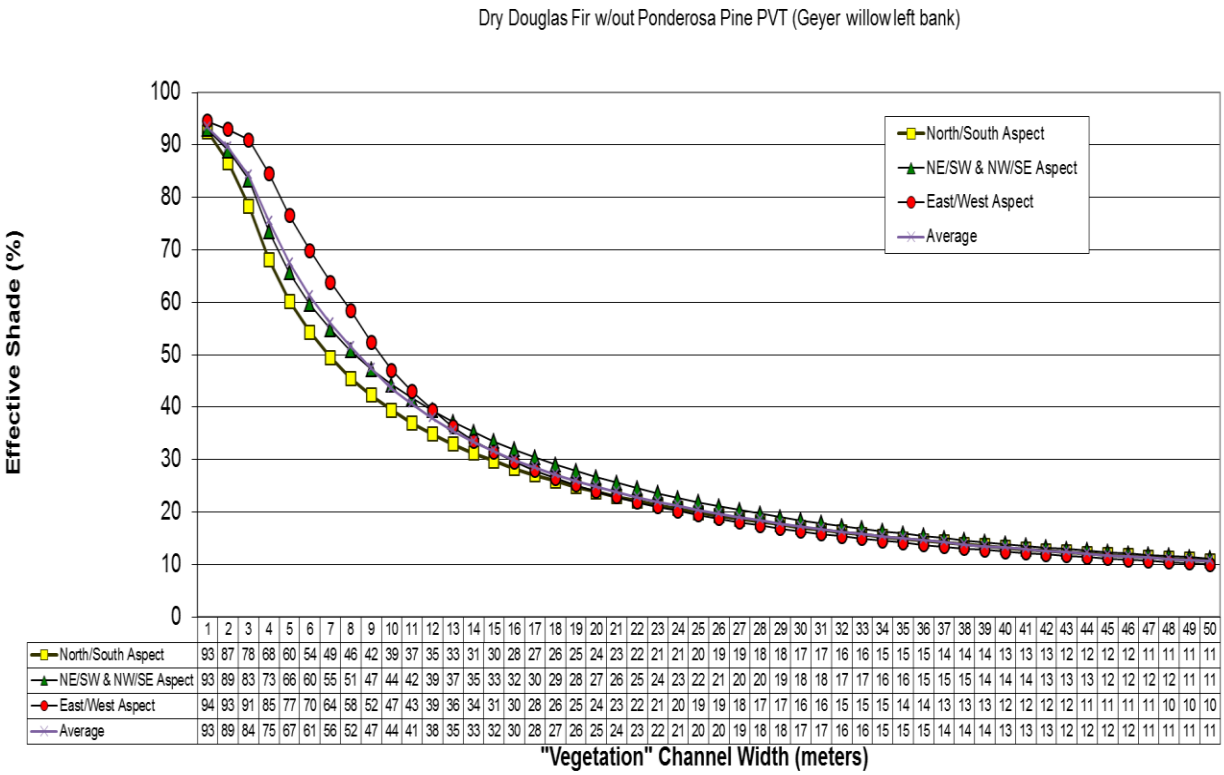
Figure H11. Differences between existing and target shade (also known as the deficit/surplus shade) for Salmon River, Squaw Creek to Pahsimeroi River. Creek names below the zero line are AU boundary locations.

Potential Natural Vegetation Shade Curves specific to the Upper Salmon River Subbasin



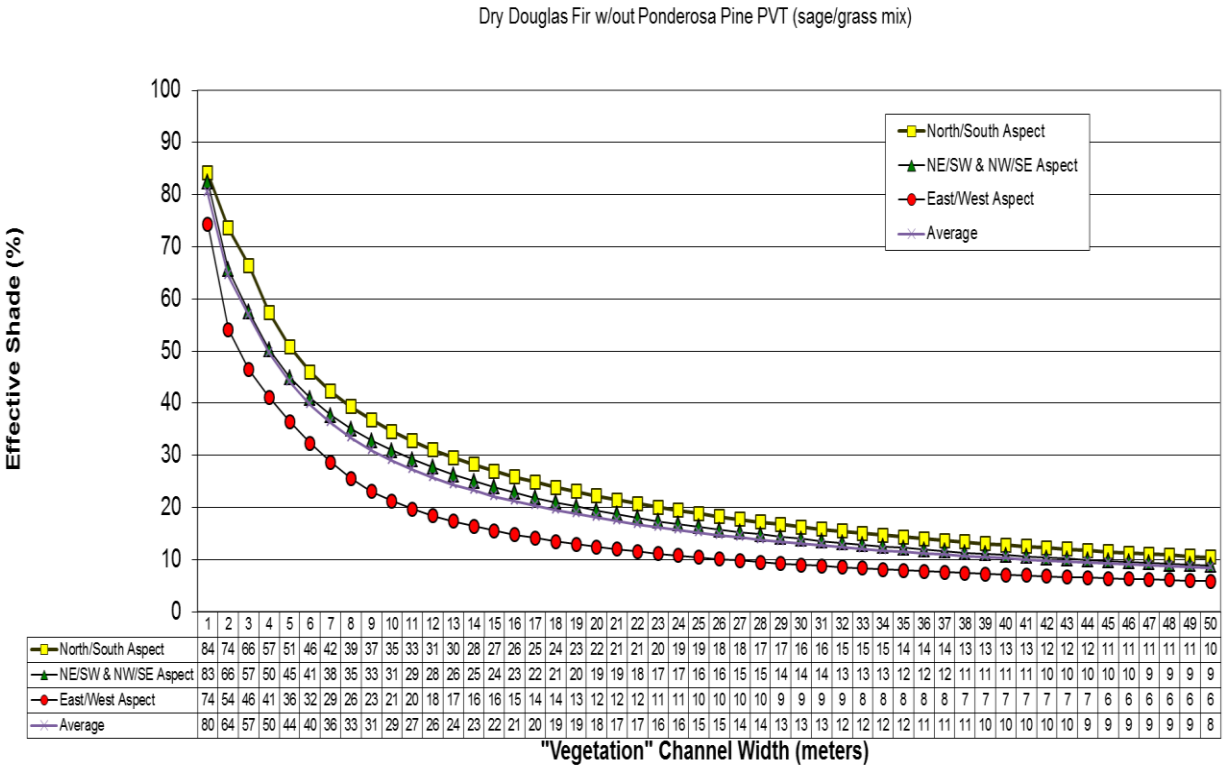
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North/South Aspect	95	89	81	76	71	68	65	62	59	56	53	50	48	45	43	42	40	38	37	36	34	33	32	31	30	29	28	27	27	26	25	25	24	23	23	22	22	21	21	20	20	19	19	19	18	18	18	17	17	17
NE/SW & NW/SE Aspect	96	92	87	83	80	78	75	73	69	66	62	59	57	54	52	49	47	45	44	42	40	39	37	36	35	34	33	32	31	30	29	28	27	26	26	25	24	24	23	23	22	21	21	21	20	20	19	19	18	18
East/West Aspect	98	96	94	93	91	90	88	87	85	78	71	65	61	56	52	49	46	44	42	40	38	36	35	33	32	31	30	29	28	27	26	26	25	24	23	23	22	22	21	21	20	20	19	19	18	18	18	17	17	17
Average	96	92	87	84	81	78	76	74	71	66	62	58	55	52	49	47	45	43	41	39	38	36	35	34	32	31	30	29	28	28	27	26	25	25	24	23	23	22	22	21	21	20	20	20	19	19	18	18	17	17

Figure H12. Target shade curve for the Salmon River (Douglas-fir/lodgepole steep right bank and Geyer willow/reedgrass left bank).



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North/South Aspect	93	87	78	68	60	54	49	46	42	39	37	35	33	31	30	28	27	26	25	24	23	22	21	21	20	19	19	18	18	17	17	16	16	15	15	15	14	14	14	13	13	13	12	12	12	12	11	11	11	11
NE/SW & NW/SE Aspect	93	89	83	73	66	60	55	51	47	44	42	39	37	35	33	32	30	29	28	27	26	25	24	23	22	21	20	20	19	18	18	17	17	16	16	15	15	15	14	14	14	13	13	13	12	12	12	12	11	11
East/West Aspect	94	93	91	85	77	70	64	58	52	47	43	39	36	34	31	30	28	26	25	24	23	22	21	20	19	19	18	17	17	16	16	15	15	15	14	14	13	13	13	12	12	12	12	11	11	11	11	10	10	10
Average	93	89	84	75	67	61	56	52	47	44	41	38	35	33	32	30	28	27	26	25	24	23	22	21	20	20	19	18	18	17	17	16	16	15	15	15	14	14	14	13	13	13	12	12	12	12	11	11	11	11

Figure H13. Target shade curve for the Salmon River (dry Douglas-fir without Ponderosa pine right bank and Geyer willow/reedgrass left bank).



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North/South Aspect	84	74	66	57	51	46	42	39	37	35	33	31	30	28	27	26	25	24	23	22	21	21	20	19	19	18	18	17	17	16	16	15	15	15	14	14	14	13	13	13	13	12	12	12	11	11	11	11	11	10
NE/SW & NW/SE Aspect	83	66	57	50	45	41	38	35	33	31	29	28	26	25	24	23	22	21	20	19	19	18	17	17	16	16	15	15	14	14	14	13	13	13	12	12	12	11	11	11	11	10	10	10	10	10	9	9	9	9
East/West Aspect	74	54	46	41	36	32	29	26	23	21	20	18	17	16	16	15	14	14	13	12	12	12	11	11	10	10	10	10	9	9	9	9	8	8	8	8	8	7	7	7	7	7	7	7	7	6	6	6	6	6
Average	80	64	57	50	44	40	36	33	31	29	27	26	24	23	22	21	20	19	19	18	17	17	16	16	15	15	14	14	13	13	13	12	12	12	12	11	11	11	10	10	10	10	10	9	9	9	9	9	9	8

Figure H14. Target shade curve for the Salmon River (sage/conifer mix).

Appendix I. Public Participation and Public Comments

This TMDL addendum was developed with participation from Salmon Basin Advisory Group because there is not a formal Watershed Advisory Group for this watershed. The BAG provided its support to begin the start of the comment period at the October 21, 2015 meeting. The comment period was conducted February 12 –March 16, 2016. Comments were received from the Idaho Conservation League and EPA. The comments (in *italics)* and responses (in **bold)** are below.

ICL Comments on Upper Salmon PNV TMDL

Shade-Deficient AUs
A temperature TMDL was not developed for Challis Creek or Aspen Creek on the basis that they lacked temperature data. These two creeks have the largest excess loads of 43% and 50%, respectively. As the WQIP states, the larger deficiencies should be prioritized for restoring background temperatures. If thermal data is lacking for these streams, it seems prudent that DEQ collect temperature data to determine impairment and create a TMDL if needed. We are curious if DEQ has any field excursions planned in the near future to collect temperature data for these streams.

The third order of Challis Creek and the 2nd order Aspen Creek do in fact have temperature TMDLs as evidenced by the load tables. Somehow we misinterpreted these results and described it as not receiving a TMDL. That language will be corrected as the streams clearly lack shade and have load tables constructed.

The WQIP uses bankfull width when assessing PNV shade coverage and potential water temperature reductions. While convenient to measure, the bankfull stage of a river doesn't represent critical conditions, or as stated in the WQIP, "the conditions when water quality standards are most likely to be violated." In regards to temperature, water quality standards for temperatures are most likely to be violated when a streams width/depth ratio is high. Therefore, when estimating temperature loads to a river, DEQ should utilize the most vulnerable stream geometry (i.e. the highest width/depth ratio for each stream). Tools such as digital elevation models (DEMs), geographic information systems (GIS), and the Army Corp. of Engineers' Hydrologic Engineering Center River Analysis System (HEC-RAS) provide a means to evaluate width/depth ratios in streams without the need to perform channel surveys throughout the entire watershed. We encourage DEQ to utilize these tools in order to better assess the current loading on streams.

Bankfull width is used in the shade analysis because that is where the riparian plant community begins on the banks of the stream. While some minor plant growth can occur within the bankfull channel during the growing season, it is generally small, not shade producing and unreliable for shade production. Only gravel bars and depositional areas can grow a little bit of grass or ruderals during the growing season. Cobble and boulder areas do not. The PNV-style temperature TMDL process uses the bankfull margin to indicate the start of shade producing perennial plant community.

This TMDL has not quantified what impact stream diversions may have on stream temperature. We are aware that, pursuant to IDAPA 58.01.02.050.01, TMDL limits cannot supersede water rights allocations. However, if diversions were analyzed and shown to be impacting stream temperature, we believe having this metric would be useful in defining practical target thresholds and the efficacy of TMDLs. Further, measuring stream temperature impacts from diversions might avoid disproportionately relying on other TMDL compliance measures.

Water diversions may affect stream temperature positively or negatively. However, as part of state law we are expressly forbidden from interfering with the rights of appropriations in any way. The inclusion of water rights effects in TMDLs could be construed as interference, and therefore, we will not include such information in a state TMDL. As stated in the TMDL, diversions notwithstanding, reaching shade targets as discussed in the TMDL will protect what water remains in the channel and allow the stream to meet water quality standards for temperature. This TMDL will lead to cooler water by achieving shade that would be expected under natural conditions and water temperatures resulting from that shade. DEQ encourages local landowners and holders of water rights to voluntarily do whatever they can to help instream flow for the purpose of keeping channel water cooler for aquatic life.

Time Frame for Temperature TMDLs
DEQ estimates that, if TMDLs are successful, stream temperatures will achieve background levels within 10-20 years due to the amount of time required for riparian communities to grow and mature. We are curious if there are any benchmarks associated with this time frame. For example, assuming it takes a full 20 years to reach background temperatures, will there be a benchmark stating temperatures have to decrease by 50% in year 10? We believe intermittent goals would aid in evaluating the success of these TMDLs during the more frequent 5-year reviews.

The 10 to 20 year time frame is a rough estimate based on plant community development in general along streams. This estimate is not intended to be accurate, tree communities may take 50 years to reach maturity if starting from zero. Some shrub communities recover very quickly and can reach mature sizes in five (5) years. Since the disturbance of plant communities generally results from non-point source activities, recovery is based on voluntary efforts to return plant communities to a healthy state. Specific projects designed to address riparian development are in a better position to estimate time of recovery and to specify any benchmarks. Since the TMDL itself will be reviewed periodically, we intend to further monitor shade development and to report findings in TMDL reviews.

Impact of NPDES Point Sources
In Section 3.1, the WQIP lists three NPDES-permitted point sources of pollution including the Thompson Creek Mine (TCM), Sawtooth Fish Farm (SFF), and Grouse Creek Mine. Later in section 5.1.4.2, only the TCM and SFF are listed as point sources. There seems to be a discrepancy between these two sections, as section 3.1 states that the Grouse Creek Mine "[i]s not active except for contaminant cleanup and management. Discharges from this location are either meet permitted limits." We interpret this statement as claiming the Grouse Creek Mine site may be an active discharger, and therefore believe it should be included in Section 5.1.4.2.

The text was updated to include the current status of NPDES permits.

Comments received from EPA

1. Page 27. We offer multiple comments regarding source analyses and inventory.

• *Beginning on page 27, IDEQ states there are only three active or actively discharging NPDES sources in watershed and that these facilities do not discharge pollutants of concern. It would benefit the transparency and reviewability of the source analysis if IDEQ provided: (1) data and/or permit conditions demonstrating that listed facilities do not cause or contribute to impairments and (2) a map that includes all potential sources etc. along with a color-coded map that depicts AUs impaired by sediment differently than AUs impaired by other pollutants. In this way, the public and EPA can spatially assess the proximity of a POC (pollutants of concern) source to the matching impairment (e.g., sediment sources to sediment impairments).*

The map under figure 4 has been replaced to show the relationship between NPDES permits and TMDL waters by pollutant. There are no discharges to TMDL waters.

• *Bayhorse Mining District is mentioned on page 32 but not included in Figure 4 as a potential source.*

The Bayhorse Mining District has been added to Figure 4.

• *The TMDL does not appear to quantify or include a wasteload allocation for current sources. For example, page xii and Figure 4 describe or depict multiple permitted facilities or activities such as construction general permits and multi-sector general permits. In reviewing permits for these facilities or activities, permit parameters such as total suspended solids appear to have relevance to TMDL pollutants such as sediment. We note that in the absence of a quantified WLA, discharge of POCs from permitted sources is zero. Such zero discharge requirements would apply to permitted activities, abandoned or reclaimed mines; and Superfund areas that periodically discharge POCs. We encourage IDEQ to allocate a portion or the loading capacity to current sources.*

No sediment TMDLs are in the vicinity of discharges. Although some discharges are near temperature TMDL waters, we do not believe they have a thermal consequence.

• *The TMDL does not appear to quantify or include a wasteload allocation for future sources. IDEQ may wish to set aside a portion of the loading capacity to allow for future permitted sources or activities.*

DEQ does not anticipate future sources to these waters.

• *Several of our comments speak to the goal of presenting a source analysis that is transparent and reproducible to the public. In this spirit, we request the opportunity to speak with you to describe the steps and information we believe are helpful in achieving this goal. Such steps could include: (1) listing of all active, inactive, and potential sources of pollutants of concern and (2) a*

map showing all existing and potential sources in relation to impaired AUs where impaired AUs are delineated by impairment type/POC.

2. Methods for determining the E. coli TMDL (pages 90 – 93) are unclear.

- *For example, it is not quite clear how the load capacity (target?) of 35,679 expressed as cfu.cfs (Table 29) or cfu/cfs (Table 30) was calculated. It would be helpful for the TMDL to describe the equation or formula used to determine the target. In providing this information, please note that TMDLs must be expressed in daily units (such as cfu /day) rather than indicator density (cfu/100 mL).*

- *Allocation and capacities have missing or different units. For example, Table 29 provides a target (load capacity?) E. coli value of 35,679 cfu.cfs whereas the load allocation + MOS value does not prescribe units.*

- *TMDL components do not appear to equal the load capacity or target. For example, the target value (load capacity) is less than the load allocation + MOS in Tables 29 and 30. As discussed on page 64 of the TMDL and required by rule, the load capacity is the sum of WLA, LA, and MOS.*

Our desire was to provide a load allocation for E coli based on monthly average flows. In this manner future sampling during any month of the year could provide quick comparisons to target loads. For E coli the translation from a WQS in colony forming units per milliliter (cfu/mL) to flow measured in cubic feet per second (cfs) creates unusual looking loads (100,000s to millions of cfu). We have added formula and editing to help ease the reader through this process.

3. We support IDEQ's PNV and shade curve approach for situations when and where assumptions of the method are met. However, we note that water diversions are mentioned to occur within the Upper Salmon River watershed. Diversion or removal of flow has the potential to reduce thermal resilience of the impacted reach. For situations where diversions are substantive, the assumption that implementation of PNV will result in natural conditions may not be fully valid. For the purpose of transparency in source analyses, IDEQ is encouraged to list and map known diversions in Section 3 (Pollutant Source Inventory).

To address this comment, we offer that IDEQ could: (1) further elaborate on the assumptions of the PNV approach as it relates to flow diversions, and (2) provide some context (qualitative or quantitative) as to the relative importance of flow diversion in achieving water quality standards, and (3) discuss any limitations in the ability to alter flow diversions.

Diversions and water rights in general are highly variable entities. We cannot begin to describe the complexities associate with hundreds, perhaps thousands of water rights, when they are used, when they are not, where they are located, etc. We have found that the Dept. of Water Resources also struggles with these issues. We are not the experts in diversion and water rights, we will not speculate about where they are or how much they divert. We will simply refer anyone interested to the Dept. of Water Resources for that information.

4. We note that shade tables for four AUs of the Salmon River from Squaw Creek to Pahsimeroi River were not included in the TMDL. We request these tables be

included in a revised TMDL or possibly as link to a website to support a complete record and linkage analysis.

We have added these large tables to our website as suggested.

5. Determination of Sediment Load Capacities. We support and appreciate IDEQ's effort to manage sediment loads based on flow regime using flow duration curves. In reviewing proposed load allocations, we experienced some difficulty in reconciling values developed from bank erosion calculations (pages 183-195) with information included in Tables 25, 26 and 27.

For example, computations on page 188 for AU 17060201SL_131_04 (Warm Spring Hole in Rock Creek to mouth) yield the following values:

Current Load=3,957.8 tons/year; Load Capacity=246.8 tons/year; Margin of Safety=396 tons/year. In this example, the load capacity is less than the margin of safety. According to the TMDL equation, LC = MOS + WLA + LA (page 64), the MOS should be less than load capacity. Appendices and Tables 25 – 27 should be revised to include a load capacity that is the sum of the MOS, LA, and WLA for AUs impaired by sediment. In keeping with this same AU, Table 26 prescribes a Load Allocation as follows:

April 1 – June 31: 61 tons per day (…note June has 30 days) Remainder with flow – 3.8 tons per day

*It's not clear these load allocations align with computations in the Appendix (page 188). Specifically, for the period of April 1 - June '31' (total of ~91 days*61 tons/day = 5,551 tons) and remainder of year (274 days * 3.8 tons per day = 1,042 tons). Thus, load allocations in Table 26 sum to approximately 5,551 + 1042 = 6,592 tons / year while the Appendix (page 188) has a load capacity of 246.8 tons/year. According to the TMDL equation, LC = MOS + WLA + LA, the load allocation must be less than or equal to the load capacity. In this instance, the load allocation appears to be greater than the load capacity. We experienced similar challenges in understanding sediment TMDL components for AU 17060201SL132_02/03/04.*

A more detailed discussion of how load capacities and allocations are determined is encouraged and could be aided by a flowchart graphic.

We have found a glitch in our SEI calculator; it was calculating MOS loads based on 10% of the existing load instead of the load capacity. It was not noticeable when existing loads were similar to load capacities. But when existing loads were very large, the MOS ended up looking large, sometime larger than the load capacity itself. We have resolved the issue, corrected all the loads in the spreadsheets and document text, and we have supplied additional explanation on how loads are generated.

1 Current permit status obtained from EPA's Enforcement and Compliance History Online (ECHO)database, accessed online at: https://echo.epa.gov

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Appendix J. Distribution List

Once submitted to EPA, this document will be posted to the DEQ web page and distributed to private landowners, non-profit groups, state and federal agencies involved in agriculture and other land use activities. Specific entities receiving copies include:

Salmon BAG Members
BLM, Challis Field Office
Salmon-Challis National Forest
Upper Salmon Basin Watershed Program
Thompson Creek Mine
Hecla Mining, Grouse Creek Unit
Trout Unlimited
The Nature Conservancy

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