Lemhi River Subbasin Total Maximum Daily Loads and Five-Year Review

Addendum to the Lemhi River Subbasin Assessment and TMDL

Idaho Department of Environmental Quality

October 2012

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Acknowledgments

Cover photo from Idaho Department of Environmental Quality Beneficial Use Reconnaissance Program staff on the Lemhi River, site 2005SIDFA048 on July 18, 2005.

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Abbreviations, Acronyms, and Symbols

§ Section (usually a section of federal or state rules or statutes)

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

ADB U.S. Environmental Protection Agency's Assessment Database

AU assessment unit

BAG basin advisory group

BLM United States Bureau of Land Management

BMP best management practice

BURP Beneficial Use Reconnaissance Program

C Celsius

CFR Code of Federal Regulations (refers to citations in the federal administrative rules)

cfs cubic feet per second

CGP Construction General Permit

CW cold water

CWA Clean Water Act

CWAL cold water aquatic life

DEQ Idaho Department of Environmental Quality

DWS domestic water supply

EPA United States Environmental Protection Agency

F Fahrenheit

FS fully supporting

GIS geographic information systems

IDAPA Refers to citations of Idaho administrative rules

IDWR Idaho Department of Water Resources

kWh kilowatt-hour

LA load allocation

LC load capacity

m meter

mi mile

mg/L milligrams per liter

mL milliliter

MOS margin of safety

NB natural background

NFS not fully supporting

NPDES National Pollutant Discharge Elimination System

NREL National Renewable Energy Laboratory

NRCS Natural Resources Conservation Service

NSDZ near stream disturbance zone

PCR primary contact recreation

PNV potential natural vegetation

ppm part(s) per million

PVT potential vegetation type

SBA subbasin assessment

SCR secondary contact recreation

SFI DEQ's stream fish index

SHI DEQ's stream habitat index

SMI DEQ's stream macroinvertebrate index

spp. species (multiple)

SRW special resource water

SS salmonid spawning

SWPPP Stormwater Pollution Prevention Plan

TMDL total maximum daily load

USBWP Upper Salmon Basin Watershed Project

USGS United States Geological Survey

WAG watershed advisory group

WLA wasteload allocation

Executive Summary

This total maximum daily load (TMDL) document presents an addendum for the *Lemhi River Watershed TMDL* (DEQ 1999) approved by the U.S. Environmental Protection Agency (EPA) in 2000 by addressing additional assessment units (AUs) in Category 5: “Impaired Waters,” of the 2010 Integrated Report. This document also provides information that satisfies the requirements of a 5-year review of the original TMDL.

Regulatory Requirements

This document has been prepared in accordance with federal and state regulations. The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation’s waters. States and tribes, pursuant to Section 303 of the CWA, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation’s waters whenever possible. Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list of impaired waters. Currently this list (i.e., the Integrated Report) must be published every 2 years. 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.

Subbasin at a Glance

The Lemhi River subbasin (hydrologic unit code 17060204) is located in east-central Idaho southeast of the town of Salmon and lies entirely within Lemhi County. The Lemhi River flows northwest between the Lemhi Range and the Beaverhead Mountains until its confluence with the Salmon River near the town of Salmon, Idaho.

Features of the Lemhi River subbasin, the tributary watersheds, and descriptions of individual streams are detailed in the Lemhi River subbasin assessment (DEQ 1998). Comprehensive biological and instream water quality data were presented and analyzed in the 1998 subbasin assessment and resultant *Lemhi River Watershed TMDL* (DEQ 1999). This TMDL addendum summarizes pertinent subbasin characteristics and any additional data that affect water quality and beneficial uses in the Lemhi River subbasin.

This document addresses the assessment units (AUs) listed in Category 5 for impaired waters on Idaho’s current 2010 Integrated Report (Figure A). This document examines water quality status for these AUs and summarizes completed or ongoing watershed improvement projects in the subbasin. The TMDL analyses quantify pollutant loads and allocate load reductions needed to return listed waters to a condition meeting water quality standards.

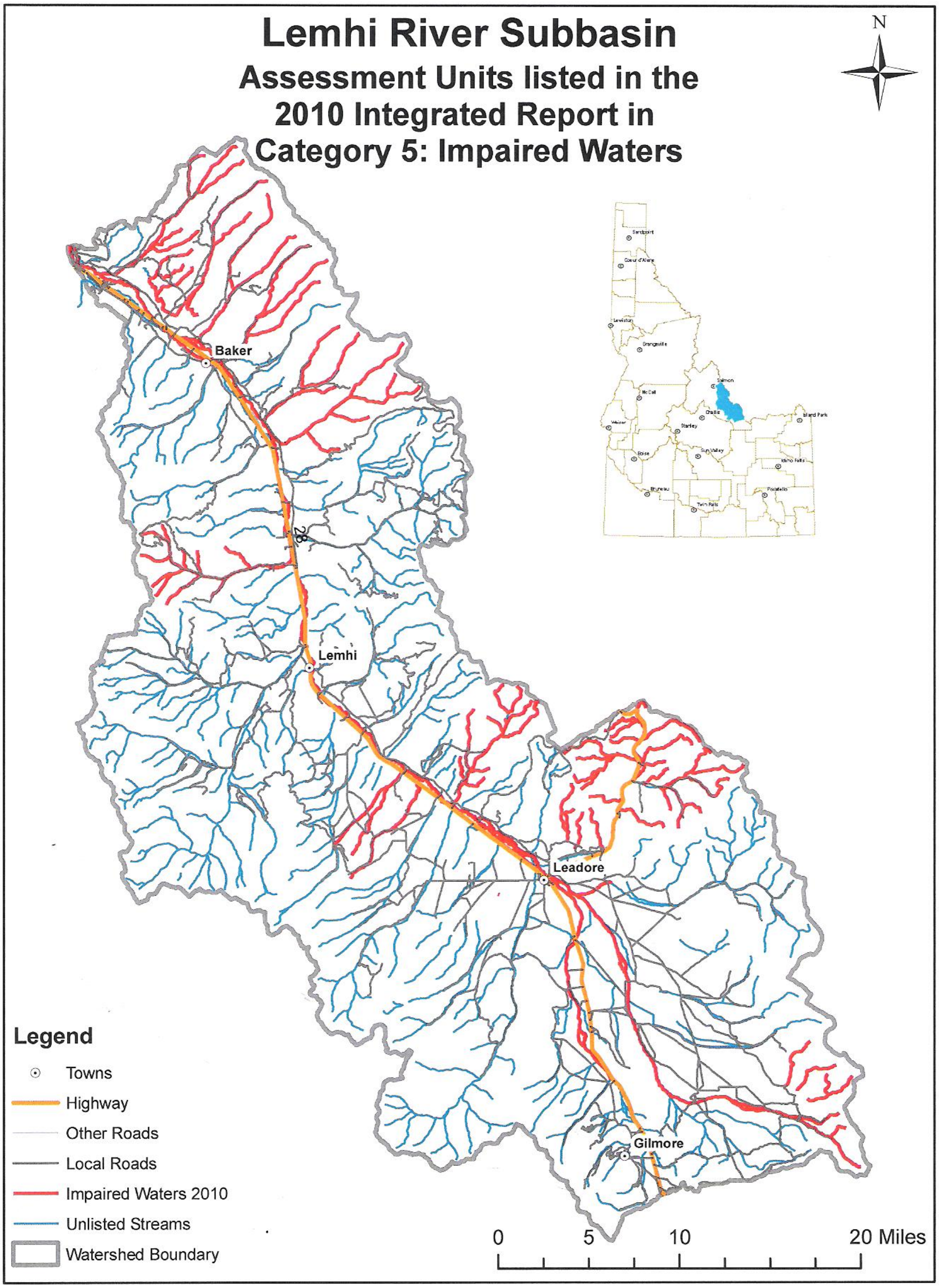

Figure A. Impaired waters listed in the 2010 Integrated Report.

Key Findings

Idaho's 2010 Integrated Report lists assessment units (AUs) in Category 5 for suspected water quality impairments. This document presents a determination of the status of these AUs as an addendum to the *Lemhi River Watershed TMDL* (DEQ 1999) approved by EPA in 2000. In addition, the results of ongoing monitoring and watershed improvement projects are reported as a five-year TMDL review in this document.

The original TMDL (DEQ 1999) allocated load reductions for sediment for Bohannon, Eighteenmile, Geertson, Kirtley, McDevitt, Sandy, and Wimpey Creeks, load reductions for bacteria for Lemhi River, and a temperature load reduction for Kirtley Creek. Based on EPA approval of these TMDLs, and after conversion of the stream segments into AUs for the Integrated Report (IR), the 2010 IR lists these TMDLs as applying to 23 stream segments, listed in Category 4a for "Total Maximum Daily Load Completed and Approved."

Some AUs were left in Category 5 of the 2008 and 2010 IR due to the conversion from designating impaired waters on the 1998 §303(d) list as "water quality limited segments" to designating impaired waters as AUs based on GIS stream order analysis. Another administrative issue that caused listed segments to carry over to the 2010 IR was that some of the AUs still listed in Category 5 for apparently unknown pollutants had already been determined to be impaired by sediment and were previously placed in Category 4a of the 2008 IR for completed TMDLs. Three AUs of the Lemhi River were added to the 2010 IR for suspected temperature impairment. Additional AUs were added to the 2010 IR through biological and habitat assessment results from Idaho Department of Environmental Quality (DEQ) Beneficial Use Reconnaissance Program (BURP) monitoring. The 2nd order segment of Eighteenmile Creek was listed for combined habitat/biota assessments but was determined to be impaired for temperature through the PNV temperature TMDL process.

Further investigation by DEQ showed that some listed AUs have been historically dewatered year-round except for overflow put back in the channel when it was not required for irrigation and should more appropriately be listed in Category 4c for low flow alteration. At this time, the land uses of these streams are becoming increasingly driven by the restoration efforts of the Upper Salmon Basin Watershed Project to re-establish streamflow in the old channels and reconnect the streams with the Lemhi River. Temperature was determined to be impairing water quality in 18 AUs, including 7 AUs that had not previously been listed in Category 5, and temperature load allocations are provided in this document. *Escherichia coli* (*E. coli*) was determined to be impairing water quality in one AU and a bacteria TMDL is provided for restoring beneficial uses to this AU. A summary of assessment outcomes for AUs listed in the 2010 IR are given in Table A. The "TMDL Completed" column in Table A refers to new TMDLs in this addendum based on current determinations of watershed conditions.

Table A. Summary of assessment outcomes for assessment units listed in Category 5, "Impaired Waters," of the 2010 Integrated Report.

Assessment Unit/ Water Body Segment	Listed Pollutant(s)	TMDL Completed	Recommended Changes to Idaho's Integrated Report	Justification
ID17060204SL001_06 Lemhi River—Kenney Creek to mouth	Temperature; Total coliform	Yes	List in Category 4a for temperature; Delist from Category 5 for total coliform	Temperature TMDL completed based on PNV[1;] EPA-approved TMDLs for *E. coli* and fecal coliform in 2000
ID17060204SL007a_03 McDevitt Creek—diversion to mouth	Low flow alterations	No	List in Category 4c; Delist from Category 5	Low flow should be listed in Category 4c and not Category 5
ID17060204SL026a_02 Mill Creek—diversion to mouth	Sediment; Cause unknown (nutrients suspected)	No	Leave in Category 4c; Delist from Category 5	Low flow alterations; Other flow regime alterations are sole cause of impairment
ID17060204SL027_02 Walter Creek—source to mouth	Combined biota/habitat bioassessments	No	Leave in Category 4c; Delist from Category 5	Low flow alterations are sole cause of impairment
ID17060204SL030_04 Lemhi River—confluence of Eighteenmile Creek and Texas Creek	Temperature	Yes	List in Category 4a	Temperature TMDL completed based on Potential Natural Vegetation (PNV)
ID17060204SL030_05 Lemhi River—confluence of Eighteenmile Creek and Texas Creek	Temperature	Yes	List in Category 4a	Temperature TMDL completed based on PNV
ID17060204SL036_03 Texas Creek	Combined biota/habitat bioassessments; Sediment; Fecal coliform	No	Leave in Category 5	Data gaps—inaccessible due to private land use in entire AU
ID17060204SL041_04 Eighteenmile Creek—Hawley Creek to mouth	Temperature	Yes	List in Category 4a	Temperature TMDL completed based on PNV
ID17060204SL042_03 Eighteenmile Creek—Clear Creek to Hawley Creek	Temperature	Yes	List in Category 4a; List in Category 4c for low flow alterations	Temperature TMDL completed based on PNV; Low flow alterations
ID17060204SL043_03 Eighteenmile Creek—Divide Creek to Hawley Creek	Fishes bioassessments; Temperature	Yes	Delist for fishes bioassessments; List in Category 4a for temperature; List in Category 4c for low flow alterations	Temperature TMDL completed based on PNV; Low flow alterations
ID17060204SL045_02 Eighteenmile Creek—source to Divide Creek	Combined biota/habitat bioassessments	Yes	Delist for combined biota; List in Category 4a for temperature; List in Category 4c for low flow alterations	Temperature TMDL completed based on PNV; Low flow alterations
ID17060204SL050a_03 Hawley Creek—diversion to mouth	Cause unknown (nutrients suspected)	No	Delist for cause unknown; List in Category 4c	No nutrient sources;Low flow alterations are sole cause of impairment

Assessment Unit/ Water Body Segment	Listed Pollutant(s)	TMDL Completed	Recommended Changes to Idaho's Integrated Report	Justification
ID17060204SL051b_02 Canyon Creek—source to diversion	Combined biota/habitat bioassessment; *Escherichia coli*	Yes	Delist for combined biota; List in Category 4c; List in Category 4a for *E. coli*	*E. coli* TMDL completed; Low flow alterations
ID17060204SL052a_02 Little Eightmile Creek—diversion to (mouth)	Temperature	Yes	List in Category 4a	Temperature TMDL completed based on PNV
ID17060204SL052b_02 Little Eightmile Creek—source to diversion	Temperature	Yes	List in Category 4a	Temperature TMDL completed based on PNV
ID17060204SL062b_02 Sandy Creek—source to diversion	Temperature	Yes	List in Category 4a	Temperature TMDL completed based on PNV
ID17060204SL064a_02 Bohannon Creek—diversion to mouth	Temperature	Yes	List in Category 4a	Temperature TMDL completed based on PNV
ID17060204SL064b_02 Bohannon Creek—source to diversion	Temperature	Yes	List in Category 4a; List in Category 4c for low flow alterations	Temperature TMDL completed based on PNV; Low flow alterations
ID17060204SL066a_03 Kirtley Creek—diversion to mouth	Has existing temperature TMDL	Yes	Keep in Category 4a and Category 4c	Revises existing temperature TMDL; PNV method here replaces earlier load allocation method

Additional AUs that were not listed in Category 5 of the 2010 IR were confluent with AUs that are listed for temperature. The following list summarizes the AUs that receive a source temperature load allocation in conjunction with temperature-listed AUs in this TMDL. These AUs are not suspected of impairment, but receive a shade load allocation in section 5.1.7 of this document.

- ID17060204SL003a_06 Withington Creek—diversion to mouth (actually west channel of Lemhi River)
- ID17060204SL004_06 Haynes Creek—source to mouth (actually west channel of Lemhi River)
- ID17060204SL005_06 Lemhi River—Hayden Creek to Kenney Creek
- ID17060204SL024_05 Lemhi River—Peterson Creek to Hayden Creek
- ID17060204SL025_05 Lemhi River—confluence of Big and Little Eightmile Creeks to Peterson Creek
- ID17060204SL062a_02 Sandy Creek—source to diversion
- ID17060204SL066b_02 Kirtley Creek

For streams impaired by temperature, effective shade targets were established based on the concept that maximum shading under potential natural vegetation (PNV) results 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 that was field verified with Solar Pathfinder data.

All streams examined had excess heat loads as a result of lack of shade. Generally, shade loss has occurred most dramatically in the lower-elevation cottonwood riparian zone. Loading tables and figures showing lack of shade can be used to can be used to prioritize implementation efforts in key areas.

The Salmon-Challis National Forest has collected data—including instream temperature, percent bank stability, and subsurface fine sediment—for key streams on forest land in the Lemhi River subbasin. Hawley Creek (ID17060204SL050a_03 & ID17060204SL050b_03) and Canyon Creek (ID17060204SL051a_03, ID17060204SL051b_02 & ID17060204SL051b_03) will be investigated further for possible listing as temperature impaired in the next listing cycle, although it is likely that they will remain in Category 4c because of low flow conditions affecting temperature.

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1. Subbasin Assessment—Watershed Characterization

This total maximum daily load (TMDL) document presents an addendum for the *Lemhi River Watershed TMDL* (DEQ 1999) approved by the U.S. Environmental Protection Agency (EPA) in 2000 by addressing assessment units (AUs) currently listed in Category 5: "Impaired Waters," of the 2010 Integrated Report. This document examines water quality status for these AUs as an addendum to the original TMDL. Results of ongoing monitoring and watershed improvement projects are also provided as a 5-year review of the original TMDL.

1.1. Introduction—Regulatory Requirements

This document was prepared in compliance with both federal and state regulatory requirements. The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the CWA, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible.

Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. This list is included as part of the biennial integrated report as the list of Category 5 waters. For waters identified on this list, states and tribes must develop a TMDL for the pollutants, set at a level to achieve water quality standards.

This document addresses the 18 AUs listed in Category 5, "Impaired Waters," of Idaho's current 2010 Integrated Report and 6 additional AUs that were previously unlisted, confluent with AUs impaired by temperature. The subbasin assessment examines the status, extent of impairment, and causes of water quality limitation throughout the subbasin. The TMDL analyses quantify pollutant loads and allocate load reductions needed to return listed waters to a condition meeting water quality standards and supporting beneficial uses.

1.2. Public Participation and Comment Opportunities

The development of this Lemhi River subbasin TMDL addendum will include a public comment period on this draft document. After all interested parties have an opportunity to review and comment on the water quality issues impacting this subbasin, the Idaho Department of Environmental Quality (DEQ) will respond to the comments by amending the document or clarifying issues as necessary.

1.3. Physical and Biological Characteristics

Features of the Lemhi River subbasin, the tributary watersheds, and descriptions of individual streams are discussed extensively in the Lemhi River subbasin assessment (DEQ 1998). Comprehensive biological and instream water quality data were presented and analyzed in the 1998 subbasin assessment and resultant *Lemhi River Watershed TMDL* (DEQ 1999) approved by EPA in 2000. This TMDL addendum will summarize pertinent characteristics and any additional data that affect water quality and beneficial uses in the Lemhi River subbasin.

1.3.1. Climate and Hydrology

During the period of record from 1965 through 2010, the Western Regional Climate Center weather station operating in Leadore, Idaho, has recorded the following annual averages (Western Regional Climate Center 2010):

- Average maximum temperature = 55 ºF[1]
- Average minimum temperature = 23.4 ºF
- Average total precipitation = 8.00 inches
- Average total snowfall = 17.9 inches

Agriculture has long been established in the Lemhi River valley due to fertile soils. Since the region is so dry, with less than 8 inches of rain per year historically recorded at Leadore, surface water is extensively diverted for agricultural irrigation (Donato 1998).

In progressively higher elevations up the slopes of the subbasin, precipitation ranges from 17.5 to 42.5 inches per year. Since most of the water in the subbasin arrives as snow, snowmelt in the spring can be the most active hydrologic event of the year, transporting a majority of any instream pollutant loads (Donato 1998).

1.3.2. Subbasin Characteristics

The Lemhi River subbasin (17060204) is located in east-central Idaho southeast of the town of Salmon, entirely within Lemhi County. The Lemhi River flows northwest between the Lemhi Range and the Beaverhead Mountains until its confluence with the Salmon River near the town of Salmon, Idaho. The historic Lewis and Clark expedition crossed the continental divide into Idaho at the Lemhi Pass just east of the Lemhi River.

Descending from the mountain ranges, 5 streams flow together to form the Lemhi River. This confluence of Canyon, Hawley, Eighteenmile, Texas, and Big Timber Creeks occurs near the town of Leadore. These streams join streamflow in a large wetland complex to form the headwaters of the Lemhi River. From this point, State Highway 28 parallels the length of the Lemhi River. Agricultural development further downstream alters the meandering streamflow in the low-gradient river valley. Two stream gages operate in the subbasin: one near the town of Lemhi where the Lemhi River averages 256 cubic feet per second (cfs) annual streamflow (1956–2010) and one lower in the watershed below a major diversion where the river averages 247 cfs annual streamflow (1994–2010). Figure 1 depicts the location, relief, and major tributaries of the Lemhi River subbasin.

[1] A unit conversion chart is provided in Appendix A.

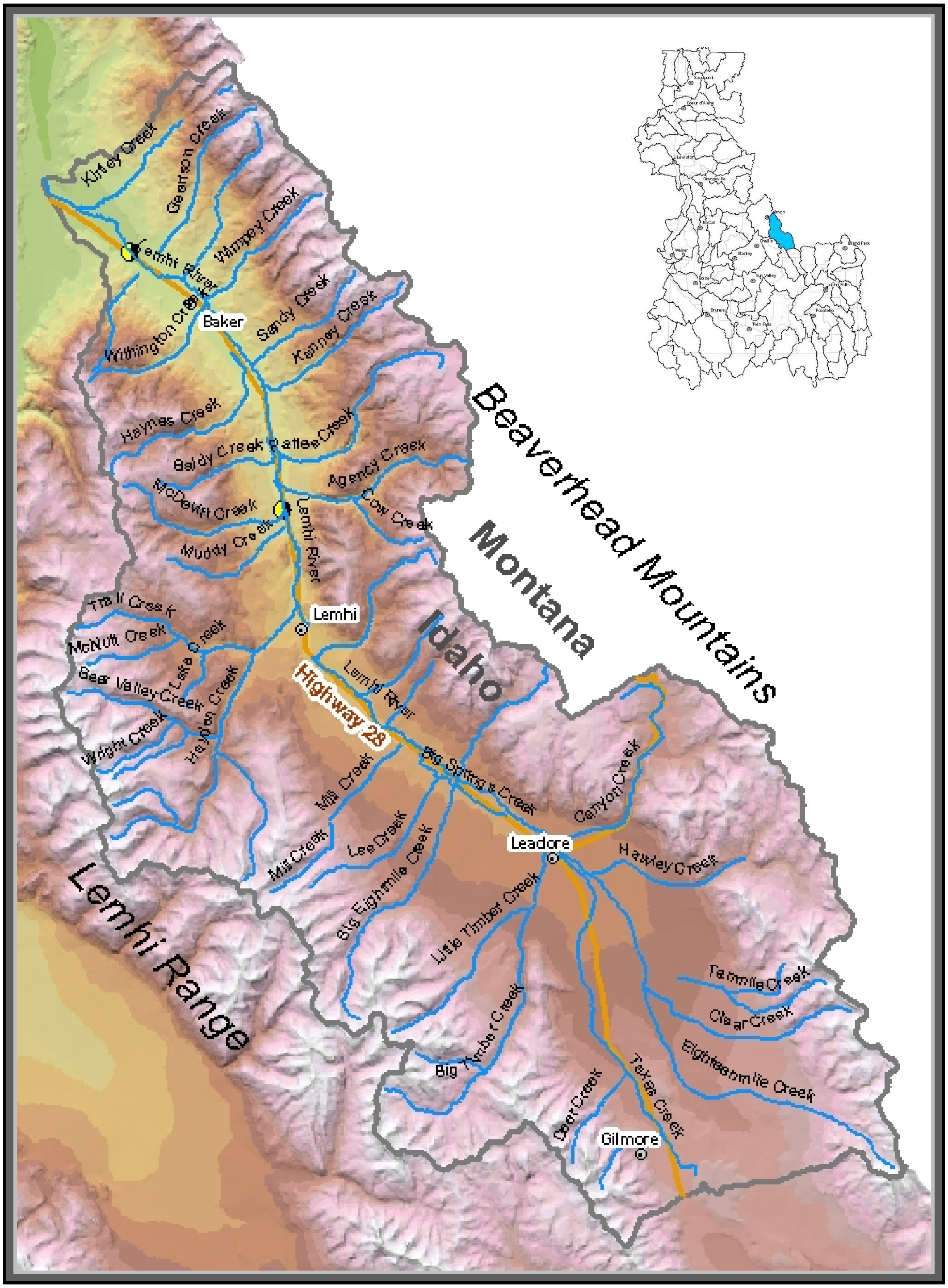

Figure 1. Lemhi River subbasin in east-central Idaho.

Elevation ranges from about 7,000 feet on the slopes—where higher-gradient streams flow swiftly with the highest rainfall in the subbasin—to about 4,000 feet in the valley bottom, where the streams decrease in velocity and energy in response to the gentler gradient. Unconsolidated sediments that are associated with the Lemhi River and its tributaries create alluvial fans on the margins of the valley at the mouths of gulches and streams. These alluvial deposits are extensive, with a long history of silt deposition where the tributaries slow at lower gradients. Many tributaries in the subbasin are disconnected from the Lemhi River, sinking into these unconsolidated sediments before they can flow as surface water into the river. Additionally, diversions from the Lemhi River and its tributaries that irrigate nearly 90,000 acres of cropland May through September remove additional surface flow. However, much of the diverted water returns to the river by ground water flow through these unconsolidated alluvial sediments (Donato 1998).

1.4. Cultural Characteristics

Details regarding the cultural characteristics of the subbasin are provided in the Lemhi River subbasin assessment (DEQ 1998) and the original *Lemhi River Watershed TMDL* (DEQ 1999). The following sections provide a summary of updated information on Lemhi County and the town of Leadore, the primary community in this region.

1.4.1. Land Ownership and Population

Since the original TMDL (DEQ 1999), the delineation of many watersheds has been altered by a cooperative effort among the Idaho Department of Water Resources (IDWR), the Natural Resources Conservation Service (NRCS), and various state and local agencies. The Idaho Watershed Boundary 5th and 6th Field Delineation Project (IDWR 2008b) implemented changes in many Idaho watershed boundaries to coordinate with surrounding states and more accurately reflect drainage patterns. Consequently, for the Lemhi River subbasin, the total acreage, proportions in land ownership distribution, and other land area characteristics may differ from the original TMDL analysis. Table 1 and Figure 2 detail the current distribution of land ownership for this subbasin.

Table 1. Current land ownership in the Lemhi River subbasin.

Land Owner	Current Acreage	Percent of Total Current
Private	151,383	18%
Public		
Bureau of Land Management	311,584	39%
State of Idaho	24,700	3%
U.S. Forest Service	320,166	40%
Total	807,833	100%

This subbasin contains more than 80% public lands. The Leadore Ranger District of the Salmon-Challis National Forest manages the upland regions on the shrubland and forested slopes. The river valley is managed by the Salmon Field Office of the Bureau of Land Management (BLM) or is privately owned.

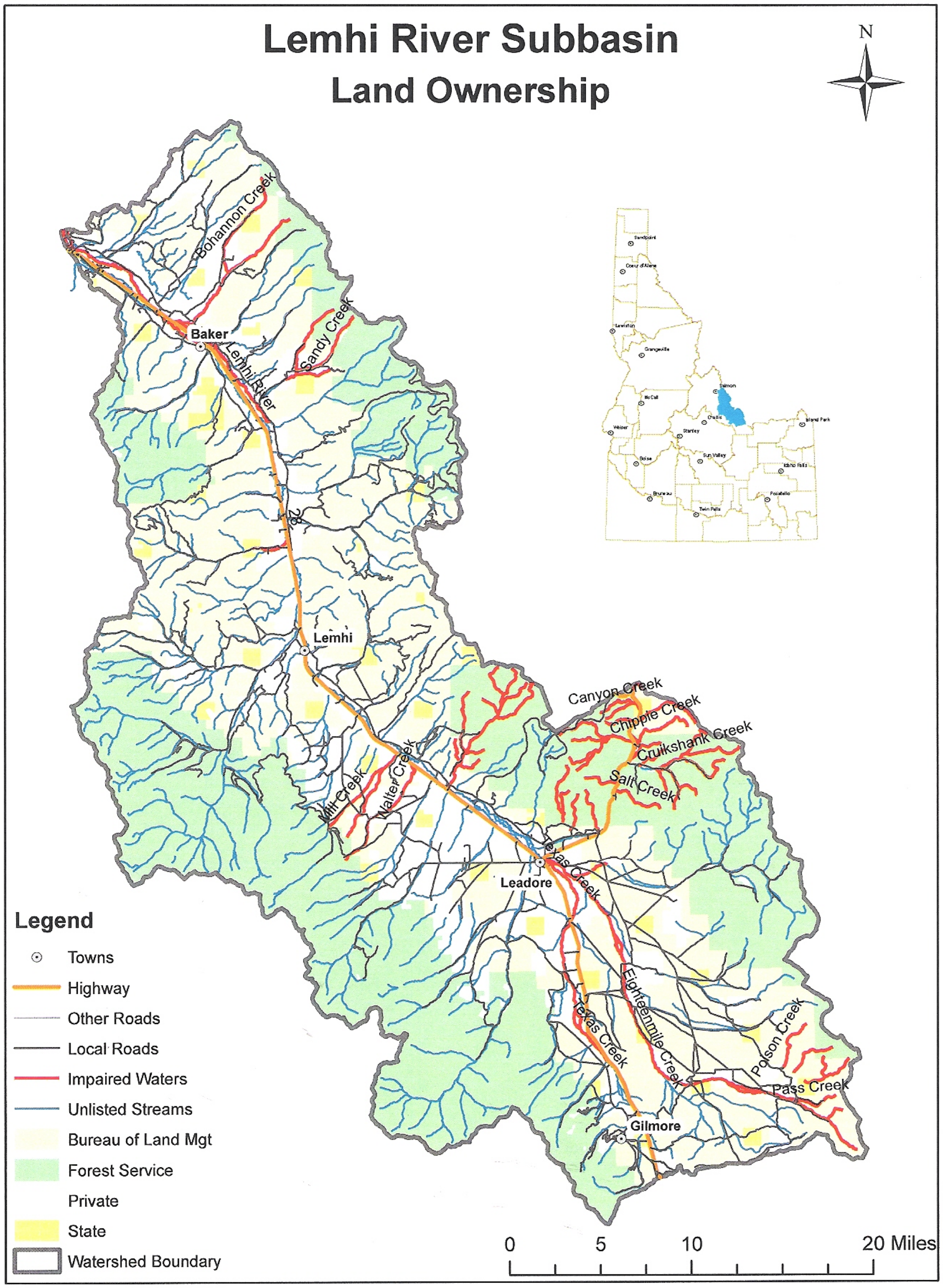

Figure 2. Land owner distribution (U.S. Bureau of Land Management data—2010).

The land area in this subbasin is almost all rural. The population of 7,930 residents in Lemhi County grew 1.3% between 2000 and 2009. The county is sparsely populated, with less than 2 residents per square mile (U.S. Census Bureau 2009). Leadore, the largest town in the Lemhi River subbasin, had 83 residents in 2010, up from 74 in 1990 (Idaho Department of Commerce 2011).

1.4.2. Economics

Employment in Lemhi County is predominantly in the service industries, particularly state and local government. Farming employs 16% of the county's workforce, and construction and manufacturing employ 21%. Since most of the land area in Lemhi County is publicly owned, land management agencies like the Forest Service, BLM, and Idaho Department of Fish and Game employ many of the county's workers. Historically, mining supported a thriving economy in this area, but mine closures have reduced the number of highly paid workers (Idaho Department of Labor 2010). In Leadore, most residents are employed in the local school district or the Leadore Ranger District of the Salmon-Challis National Forest (Idaho Department of Commerce 2010).

Water quality is still impacted by historic mining activities where mine tailings are still apparent in the Bohannon Creek drainage. The streambanks have reduced canopy cover and unconsolidated tailings mobilized in streams can block fish migration and eliminate proper hydrologic functioning of the floodplain, allowing opportunities for excess erosion.

Agricultural management methods can impact water quality by cropland runoff or if streambanks become unstable from livestock trampling, which can allow an excess sediment load. These activities also have the potential to remove vegetative cover that would normally stabilize streambanks and provide shade.

Irrigation withdrawals for cropland have been extensive throughout the Lemhi subbasin. Even though DEQ has no jurisdiction over water rights and does not provide load allocations for flow alteration, the Idaho Governor's Office of Species Conservation (OSC) has been active in negotiating for more streamflow in the tributaries, ultimately contributing to fish passage in the Lemhi River (OSC, personal communication, December 2011).

2. Subbasin Assessment—Water Quality Concerns and Status

2.1. Water Quality Limited Assessment Units Occurring in the Subbasin

Section 303(d) of the CWA states that waters that are unable to support their beneficial uses and that do not meet water quality standards must be listed as water quality limited waters. Idaho complies with this and other federal rules by publishing an integrated report that lists all the surface waters of Idaho and categorizes them into 5 categories:

- Category 1—Waters of the state attaining all standards
- Category 2—Waters of the state attaining some (most) standards
- Category 3—Waters of the state with insufficient data and information to determine if any standards are attained
- Category 4—Waters of the state impaired or threatened for one or more standards but not needing a TMDL
- Category 5—Waters of the state for which a TMDL is needed

Category 4 further classifies surface waters into one of three subcategories: Category 4a for water bodies with EPA-approved TMDLs; Category 4b for waters with pollution control requirements in place, other than a TMDL; and Category 4c for waters impaired by nonpollutants. Streams with human-induced flow and habitat alteration are impaired by pollution instead of specific pollutants according to §502(6) and §502(19) of the CWA, and TMDLs are not required for flow alteration and habitat alteration (i.e., nonpollutants) consistent with EPA guidance. Impaired waters listed in Category 5 require TMDLs to allocate pollutant loads that will restore the water bodies to full support status (DEQ 2009). AUs can be listed in more than one category (e.g., Category 5 for a pollutant such as bacteria and Category 4c for a nonpollutant such as flow alteration).

2.1.1. Idaho’s Integrated Report

The current DEQ reference for water quality limited segments in Idaho is the 2010 Integrated Report (IR). Table 2 shows the AUs and pollutants that are currently listed in Category 5 of the 2010 IR for impairment.

Table 2. Assessment units reported in Category 5, "Impaired Waters," of the 2010 Integrated Report.

Assessment Unit Name	Assessment Unit ID Number	Impaired Stream Miles	Pollutants	Listing Basis
Lemhi River—Kenney Creek to mouth	ID17060204SL001_06	24.63	Temperature; Total coliform	1998 303(d) list EPA add
McDevitt Creek—diversion to mouth	ID17060204SL007a_03	2.35	Low flow alterations	Error—flow alterations should be listed in 4c
Mill Creek—diversion to mouth	ID17060204SL026a_02	10.41	Sedimentation/Siltation; Cause unknown (nutrients suspected)	1994 303(d) list
Walter Creek—source to mouth	ID17060204SL027_02	7.84	Combined biota/habitat bioassessments	2002 303(d) list
Lemhi River—confluence of Eighteenmile Creek and Texas Creek	ID17060204SL030_04	6.56	Temperature	1998 303(d) list EPA add
Lemhi River—confluence of Eighteenmile Creek and Texas Creek	ID17060204SL030_05	10.39	Temperature	1998 303(d) list EPA add
Texas Creek	ID17060204SL036_03	14.93	Combined biota/habitat bioassessments; Sedimentation/Siltation; Fecal coliform	2002 303(d) list
Eighteenmile Creek—Hawley Creek to mouth	ID17060204SL041_04	2.21	Temperature	Added 3/27/2006
Eighteenmile Creek—Clear Creek to Hawley Creek	ID17060204SL042_03	8.39	Temperature	Added 3/27/2006
Eighteenmile Creek—Divide Creek to Hawley Creek	ID17060204SL043_03	5.96	Fishes bioassessments; Temperature	Temperature added 3/27/2006
Eighteenmile Creek—source to Divide Creek	ID17060204SL045_02	29.68	Combined biota/habitat bioassessments assumed to result from temperature	2002 303(d) list
Hawley Creek—diversion to mouth	ID17060204SL050a_03	2.2	Cause unknown (nutrients suspected)	1994 303(d) list
Canyon Creek—source to diversion	ID17060204SL051b_02	70.11	Combined biota/habitat bioassessments; *Escherichia coli*	1998 303(d) list; *E. coli* added 2010
Little Eightmile Creek—diversion to (mouth)	ID17060204SL052a_02	0.43	Temperature	Added 3/27/2006
Little Eightmile Creek—source to diversion	ID17060204SL052b_02	25.33	Temperature	Added 3/27/2006
Sandy Creek—source to diversion	ID17060204SL062b_02	12.33	Temperature	Added 3/27/2006
Bohannon Creek—diversion to mouth	ID17060204SL064a_02	1.36	Temperature	Added 3/27/2006
Bohannon Creek—source to diversion	ID17060204SL064b_02	13.58	Temperature	Added 3/27/2006

Table 3 lists the AUs that are impaired by nonpollutants in Category 4c of the 2010 IR. No TMDL will be developed for the AUs in Category 4c, which lists streams with altered flow regimes or habitat alteration.

Table 3. Assessment units reported in Category 4c, "Waters Impaired by Nonpollutants," of the 2010 Integrated Report.

Assessment Unit Name	Assessment Unit ID Number	Impaired Stream Miles	Pollution
Mill Creek—diversion to mouth	ID17060204SL026a_02	10.41	Low flow alterations; Other flow regime alterations
Walter Creek—source to mouth	ID17060204SL027_02	7.84	Low flow alterations
Lemhi River—confluence of Eighteenmile Creek and Texas Creek	ID17060204SL030_05	10.39	Low flow alterations
Texas Creek	ID17060204SL036_03	14.93	Other flow regime alterations
Eighteenmile Creek—Hawley Creek to mouth	ID17060204SL041_04	2.21	Low flow alterations
Little Eightmile Creek—diversion to (mouth)	ID17060204SL052a_02	0.43	Low flow alterations
Sandy Creek—diversion to mouth	ID17060204SL062a_02	2.1	Low flow alterations
Sandy Creek—source to diversion	ID17060204SL062b_02	12.33	Low flow alterations
Bohannon Creek—diversion to mouth	ID17060204SL064a_02	1.36	Low flow alterations
Geertson Creek—diversion to mouth	ID17060204SL065a_02	11.44	Low flow alterations
Geertson Creek—source to diversion	ID17060204SL065b_02	14.71	Low flow alterations
Kirtley Creek—diversion to mouth	ID17060204SL066a_03	2.28	Low flow alterations

Table 4 lists the AUs that have existing load allocations from the original *Lemhi River Watershed TMDL* (DEQ 1999) approved by EPA in 2000.

Table 4. Assessment units reported in Category 4a, "EPA-Approved TMDLs," of the 2010 Integrated Report.

Assessment Unit Name	Assessment Unit ID Number	Impaired Stream Miles	Pollutants
Lemhi River—Kenney Creek to mouth	ID17060204SL001_06	24.63	*Escherichia coli*; Fecal coliform
Lemhi River—Hayden Creek to Kenney Creek	ID17060204SL005_06	12.77	*Escherichia coli*
McDevitt Creek—diversion to mouth	ID17060204SL007a_03	2.35	Sedimentation/Siltation
McDevitt Creek—source to diversion	ID17060204SL007b_02	19.07	Sedimentation/Siltation
McDevitt Creek—source to diversion	ID17060204SL007b_03	4.44	Sedimentation/Siltation
Lemhi River—Peterson Creek to Hayden Creek	ID17060204SL024_05	9.6	*Escherichia coli*
Lemhi River—confluence of Big and Little Eightmile Creeks	ID17060204SL025_05	5.86	*Escherichia coli*
Lemhi River—confluence of Eighteenmile Creek and Texas Creek	ID17060204SL030_04	6.56	*Escherichia coli*
Lemhi River—confluence of Eighteenmile Creek and Texas Creek	ID17060204SL030_05	10.39	Fecal coliform
Eighteenmile Creek—Hawley Creek to mouth	ID17060204SL041_04	2.21	Sedimentation/Siltation
Eighteenmile Creek—Clear Creek to Hawley Creek	ID17060204SL042_03	8.39	Sedimentation/Siltation
Eighteenmile Creek—Divide Creek to Hawley Creek	ID17060204SL043_03	5.96	Sedimentation/Siltation
Eighteenmile Creek—source to Divide Creek	ID17060204SL045_02	29.68	Sedimentation/Siltation
Kenney Creek—source to mouth	ID17060204SL061_02	20.7	*Escherichia coli*
Sandy Creek—diversion to mouth	ID17060204SL062a_02	2.1	Sedimentation/Siltation
Sandy Creek—source to diversion	ID17060204SL062b_02	12.33	Sedimentation/Siltation
Wimpey Creek—source to mouth	ID17060204SL063_02	19.66	Sedimentation/Siltation
Bohannon Creek—diversion to mouth	ID17060204SL064a_02	1.36	Sedimentation/Siltation
Bohannon Creek—source to diversion	ID17060204SL064b_02	13.58	Sedimentation/Siltation

Assessment Unit Name	Assessment Unit ID Number	Impaired Stream Miles	Pollutants
Geertson Creek—diversion to mouth	ID17060204SL065a_02	11.44	Sedimentation/Siltation
Geertson Creek—source to diversion	ID17060204SL065b_02	14.71	Sedimentation/Siltation
Kirtley Creek—diversion to mouth	ID17060204SL066a_03	2.28	Sedimentation/Siltation; Temperature
Kirtley Creek	ID17060204SL066b_02	19.41	Sedimentation/Siltation

Idaho's IR is a guide for developing and implementing water quality improvement plans to protect water quality and achieve federal and state water quality standards. The findings of this TMDL addendum and ongoing assessment in the subbasin will be reported in the 2012 IR.

2.2. Applicable Water Quality Standards and Beneficial Uses

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 briefly described in the following paragraphs. The *Water Body Assessment Guidance*, second edition (Grafe et al. 2002) gives a more detailed description of beneficial use identification for use assessment purposes.

2.2.1. Existing Uses

Existing uses under the CWA are "those beneficial uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards." The existing instream water uses and the level of water quality necessary to protect the uses shall be maintained and protected (IDAPA 58.01.02.010.08 and .02.010.36). Existing uses include uses actually occurring, whether or not the level of water quality to fully support the uses exists.

2.2.2. Designated Uses

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

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

Designated uses are specifically listed for water bodies in Idaho in tables in the Idaho water quality standards (see IDAPA 58.01.02.100 in addition to citations for existing uses).

2.2.3. Presumed Uses

In Idaho, most water bodies do not yet have specific use designations indicated in the water quality standards. In accordance with IDAPA 58.01.02.101.01, these undesignated uses are to be designated. Prior to designation, undesignated waters shall be protected for beneficial uses including recreational use and habitat for aquatic life. In the interim, and without information on existing uses, DEQ presumes that most waters in the state will support cold water aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01.a). To protect these so-called "presumed uses," DEQ will apply the numeric cold water aquatic life criteria and primary or secondary contact recreation criteria to undesignated waters.

If an additional use exists, then additional numeric criteria would apply. For example, if salmonid spawning is an additional use, specific criteria for dissolved oxygen and water temperature apply (IDAPA 58.01.02.250.f.i and ii). However, if cold water aquatic life is not found to be an existing use, seasonal cold water, warm water, or modified aquatic life use designations would apply with their applicable numeric criteria (IDAPA 58.01.02.250). Uses that apply to all waters of the state include agricultural and industrial water supply, wildlife habitat, and aesthetics.

Table 5 lists the designated, existing, or presumed beneficial uses for AUs listed in Category 5 of the 2010 IR for impaired waters. These beneficial uses are identified in Idaho's water quality standards.

Table 5. Beneficial uses of assessment units listed in Category 5, "Impaired Waters," of the 2010 Integrated Report.

Assessment Unit Name	Assessment Unit ID Number	Designated, Existing, or Presumed Beneficial Uses[a]
Lemhi River—Kenney Creek to mouth	ID17060204SL001_06	CW, SS, PCR, DWS
McDevitt Creek –diversion to mouth	ID17060204SL007a_03	CW, SCR
Mill Creek—diversion to mouth	ID17060204SL026a_02	CW, SCR
Walter Creek—source to mouth	ID17060204SL027_02	CW, SCR
Lemhi River—confluence of Eighteenmile Creek and Texas Creek	ID17060204SL030_04	CW, SS, PCR, DWS
Lemhi River—confluence of Eighteenmile Creek and Texas Creek	ID17060204SL030_05	CW, SS, PCR, DWS
Texas Creek	ID17060204SL036_03	CW, SCR
Eighteenmile Creek—Hawley Creek to mouth	ID17060204SL041_04	CW, SCR
Eighteenmile Creek—Clear Creek to Hawley Creek	ID17060204SL042_03	CW, SCR
Eighteenmile Creek—Divide Creek to Hawley Creek	ID17060204SL043_03	CW, SCR
Eighteenmile Creek—source to Divide Creek	ID17060204SL045_02	CW, SS, SCR
Hawley Creek—diversion to mouth	ID17060204SL050a_03	CW, SCR
Canyon Creek—source to diversion	ID17060204SL051b_02	CW, SS, SCR
Little Eightmile Creek—diversion to (mouth)	ID17060204SL052a_02	CW, SCR
Little Eightmile Creek—source to diversion	ID17060204SL052b_02	CW, SS, SCR
Sandy Creek—source to diversion	ID17060204SL062b_02	CW, SS, SCR
Bohannon Creek—diversion to mouth	ID17060204SL064a_02	CW, SCR
Bohannon Creek—source to diversion	ID17060204SL064b_02	CW, SS, SCR

[a] CW – cold water, SS – salmonid spawning, PCR – primary contact recreation, SCR – secondary contact recreation, DWS – domestic water supply

Additional AUs have been given load allocations for temperature impairment in this TMDL addendum that had not previously been included in Idaho's IR. The beneficial uses for these "unlisted but impaired" AUs are given in Table 6.

Table 6. Beneficial uses of assessment units that had not previously been included in Category 5 of Idaho's 2010 Integrated Report but are adjacent to assessment units listed for temperature.

Assessment Unit Name	Assessment Unit ID Number	Designated, Existing, or Presumed Beneficial Uses[a]
Withington Creek—diversion to mouth (actually west channel of Lemhi River)	ID17060204SL003a_06	CW, SCR
Haynes Creek—source to mouth (actually west channel of Lemhi River)	ID17060204SL004_06	CW, SCR
Lemhi River—Hayden Creek to Kenney Creek	ID17060204SL005_06	CW, SS, PCR, DWS
Lemhi River—Peterson Creek to Hayden Creek	ID17060204SL024_05	CW, SS, PCR, DWS
Lemhi River—confluence of Big and Little Eightmile Creeks to Peterson Creek	ID17060204SL025_05	CW, SS, PCR, DWS
Sandy Creek—source to diversion	ID17060204SL062a_02	CW, SS, SCR
Kirtley Creek—diversion to mouth[1]	ID17060204SL066a_03	CW, SS, SCR

[a] CW – cold water, SS – salmonid spawning, PCR – primary contact recreation, SCR – secondary contact recreation, DWS – domestic water supply
[1] Has existing sediment and temperature TMDL, but PNV method here replaces earlier load allocation method

2.3. Criteria to Support Beneficial Uses

Beneficial uses are protected by a set of criteria, which include *narrative* criteria for pollutants such as sediment and nutrients and *numeric* criteria for pollutants such as bacteria, dissolved oxygen, pH, ammonia, temperature, and turbidity (IDAPA 58.01.02.250). Table 7 includes the numeric criteria referenced in this TMDL.

Table 7. Selected numeric criteria supportive of designated beneficial uses in Idaho water quality standards.

Designated and Existing Beneficial Uses				
Water Quality Parameter	**Primary Contact Recreation**	**Secondary Contact Recreation**	**Cold Water Aquatic Life**	**Salmonid Spawning (During Spawning and Incubation Periods for Inhabiting Species)**
Water Quality Standards: IDAPA 58.01.02.250 & 251				
Bacteria	Less than 126 *E. coli* organisms/100 mL[a] as a geometric mean of 5 samples over 30 days; no single sample greater than 406 *E. coli* organisms/100 mL	Less than 126 *E. coli* organisms/100 mL as a geometric mean of 5 samples over 30 days; no single sample greater than 576 *E. coli* organisms/100 mL		
Temperature[b]			22 °C or less daily maximum; 19 °C or less daily average	13 °C or less daily maximum; 9 °C or less daily average

[a] *Escherichia coli* organisms per 100 milliliters
[b] 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.

2.3.1. 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 DEQ is generally from March 15 to July 15 each year (Grafe et al. 2002). Fall spawning can occur from September 1 and continue with incubation into the following spring up to June 1. Per IDAPA 58.01.02.250.02.f.ii., the water quality criteria that need to be met during spawning and incubation periods are:

- 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.

2.3.2. Natural Background Provisions

For potential natural vegetation temperature (PNV) TMDLs, it is assumed that natural temperatures may exceed the water quality criteria during hot 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 ground water sources of heat) and natural background provisions of Idaho water quality standards apply. According to IDAPA 58.01.02.200.09:

> 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.

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).

Figure 3 provides an outline of the stream assessment process from DEQ's *Water Body Assessment Guidance* (Grafe et al. 2002) for determining support status of the beneficial uses of cold water aquatic life, salmonid spawning, and contact recreation. When any AU is assessed as "not fully supporting" its beneficial use, it is listed in Category 5 of the IR and receives a pollutant load allocation in a TMDL.

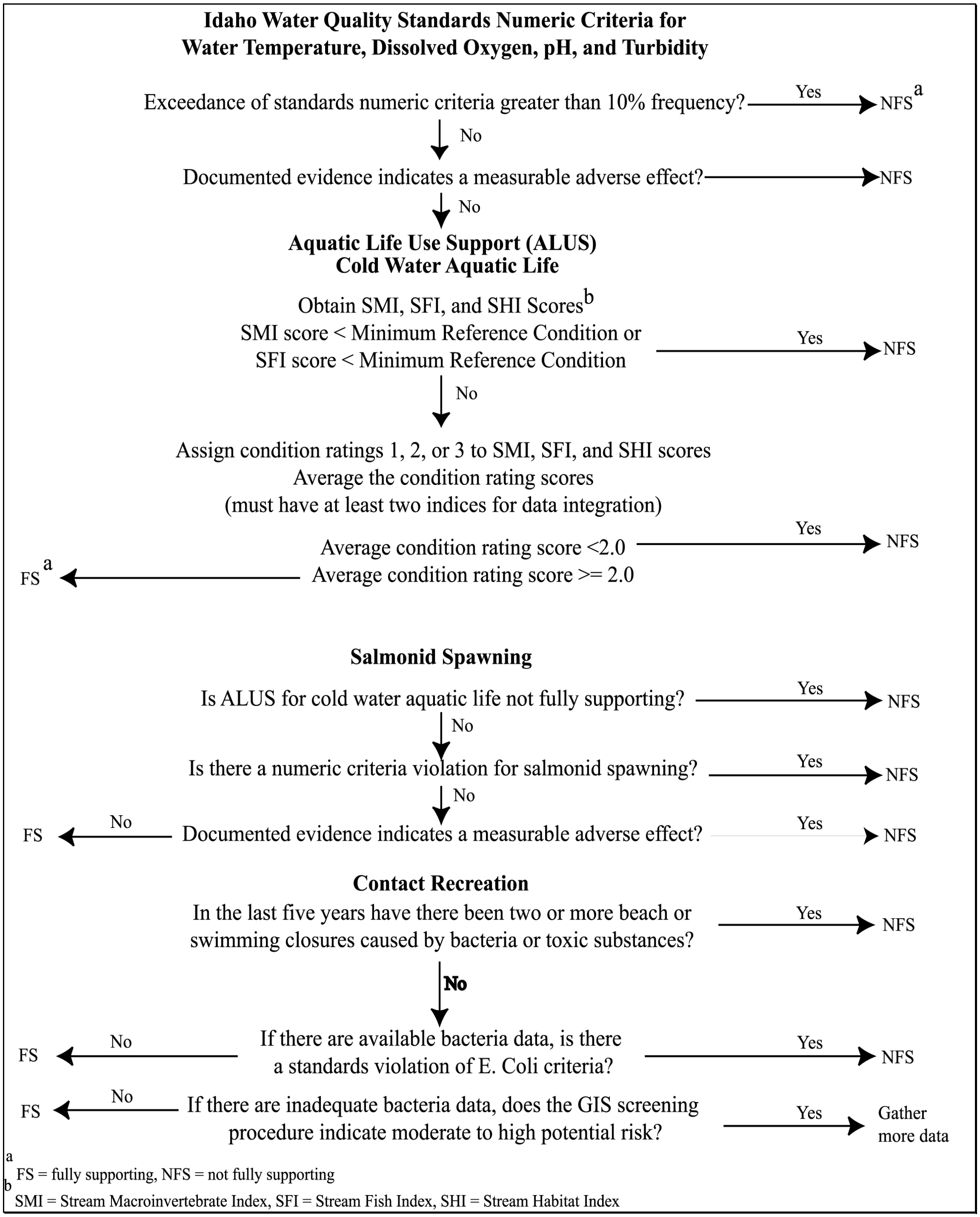

Figure 3. Determination steps and criteria for determining support status of beneficial uses.

2.4. Summary and Analysis of Existing Water Quality Data

This section provides additional data collected since the *Lemhi River Watershed TMDL* (DEQ 1999) was approved by EPA in 2000. A summary of data sources used in this analysis is provided in Appendix B.

2.4.1. Flow Characteristics

Historically, the U.S. Geological Survey (USGS) has operated various stream gaging stations on tributaries of the Lemhi River. Based on daily flow recordings, Table 8 shows the minimum, average, and maximum daily flow for the period of record at each stream gage.

Table 8. Summary of streamflow data at historic U.S. Geological Survey stream gaging stations.

Gaging Station		Minimum daily streamflow (cfs)[a]	Average daily streamflow (cfs)	Maximum daily streamflow (cfs)	Period of Record
13303000	Texas Creek near Leadore, ID	5	21	100	1938–1963
13303500	Big Timber Creek above diversions near Leadore, ID	13	44	295	1912–2004
13304000	West Fork Timber Creek near Leadore, ID	1	17	78	May–Sep 1912
13304200	Big Springs Creek near Leadore, ID	24	32	46	1959–1961
13304490	Big Eightmile Creek below Devil's Canyon near Leadore, ID	9	25	96	May–Oct 2004
13304500	Eightmile Creek near Leadore, ID	16	68	240	May–Sep 1912
13305260	Bohannon Creek above diversions near Salmon, ID	4	10	24	May–Oct 2004

[a] cfs = cubic feet per second

Big Timber Creek, which drains many ephemeral 1st-order streams from the steep forested slopes of the Lemhi Range, produced the highest maximum daily streamflow on average throughout the years of measurement. Even though Eightmile Creek produced the highest average daily streamflow, the measurements were only from one water year in 1912, and Big Timber Creek had the longest period of record. Big Springs Creek and Texas Creek, the other streams with longer periods of record, have comparatively lower average daily streamflow.

Currently, the USGS operates two real-time stream gaging stations in the Lemhi River subbasin, both on the main stem Lemhi River. Station USGS 13305000 (Lemhi River near Lemhi, ID) is at 4,960 feet in elevation, drains 897 square miles, and averaged 256 cfs annual streamflow during the period of record from 1956 through 2010 (Figure 4).

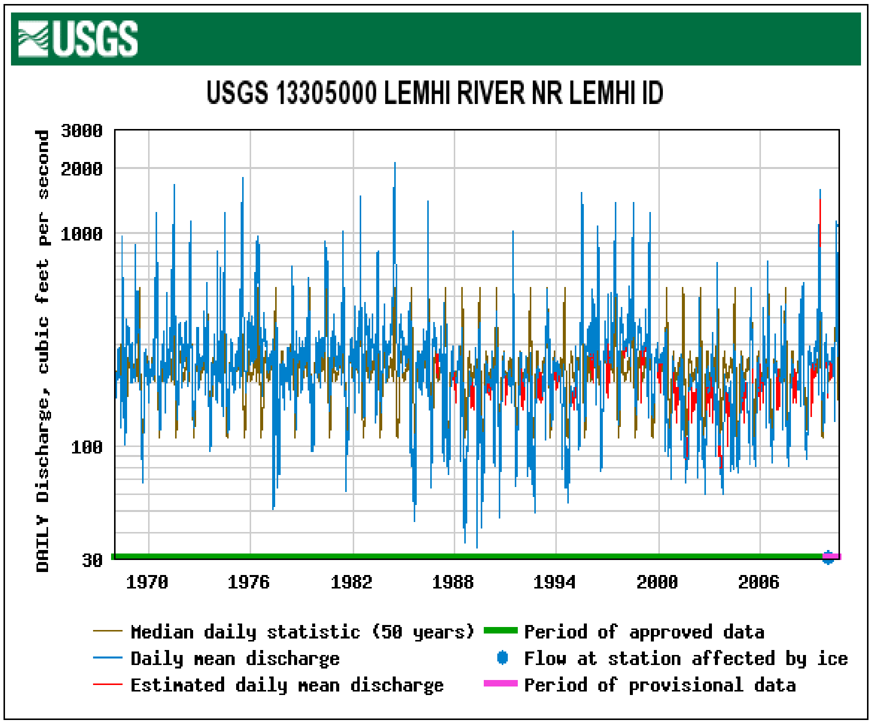

Figure 4. Daily streamflow in the Lemhi River near Lemhi, Idaho.

Station 13305310 (Lemhi River below L5 diversion near Salmon, ID) is at 4,165 feet in elevation, drains 1,216 square miles, and averaged 247 cfs annual streamflow during the period of record from 1992 through 2010 (Figure 5).

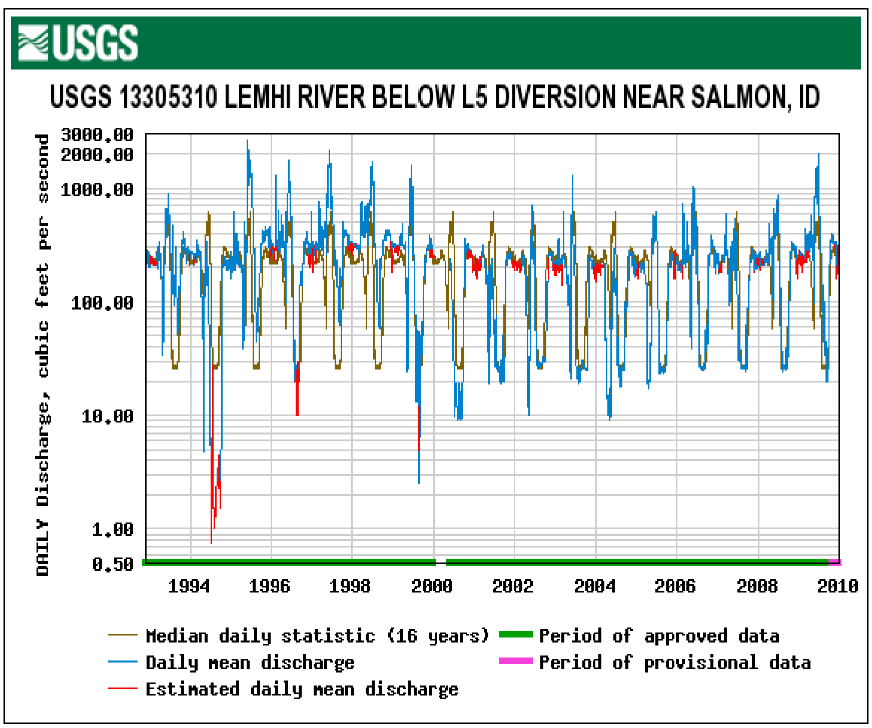

Figure 5. Daily streamflow in the Lemhi River near Salmon, Idaho.

Streamflow is roughly equivalent at both gages, with yearly averages around 250 cfs. Consistent streamflows—in a reach this length with significant tributary input and diversion withdrawals—is indicative of a low-gradient system dominated by ground water at base flow. The peak flows occur regularly in June, attributable to snowmelt; the lowest flows occur in August and September due to irrigation withdrawals during the growing season. However, by November, streamflow increases to more than 200 cfs on average from November through April, re-establishing a stable base flow due to ground water return flow.

At lower elevations in the subbasin, tributaries to the Lemhi River decrease in velocity in response to lower gradients. Where velocity slows, extensive alluvial sediments have been deposited at the mouths of gulches and streams throughout the valley. Many tributaries come directly out of canyons from the Beaverhead Mountains and Lemhi Range onto alluvial fans in the river valley. These areas have historically been used as crop land. Subsequently, the tributaries in the alluvial areas are extensively flow-altered. Being loose-grained and highly transmissive, the alluvial deposits of the Lemhi River valley exacerbate the disconnections between many tributaries and the Lemhi River. However, recent restoration activities being administered by the Idaho Governor's Office of Species Conservation (OSC) are restoring some historic connections between currently dewatered portions of tributaries and the Lemhi River.

A USGS investigation of the relationship between surface water and ground water in the Lemhi River basin demonstrated how quickly the alluvium transmits ground water (Donato 1998). The study determined water gains and losses in early August during active agricultural irrigation and in late October when irrigation is inactive. Donato identified a natural hydrologic barrier between the cities of Lemhi and Tendoy that divides the basin into an upper and lower region. The lower Lemhi River valley exhibits shallower bedrock with a thinner alluvium. In contrast, the alluvial layer in the upper valley averages 200 feet thick and up to 3,300 feet wide. The thicker alluvial layers allow ground water to be transmitted more quickly and extensively. Figure 6 shows Donato's estimated extent of the alluvium based on earlier studies and well depth data in the river valley.

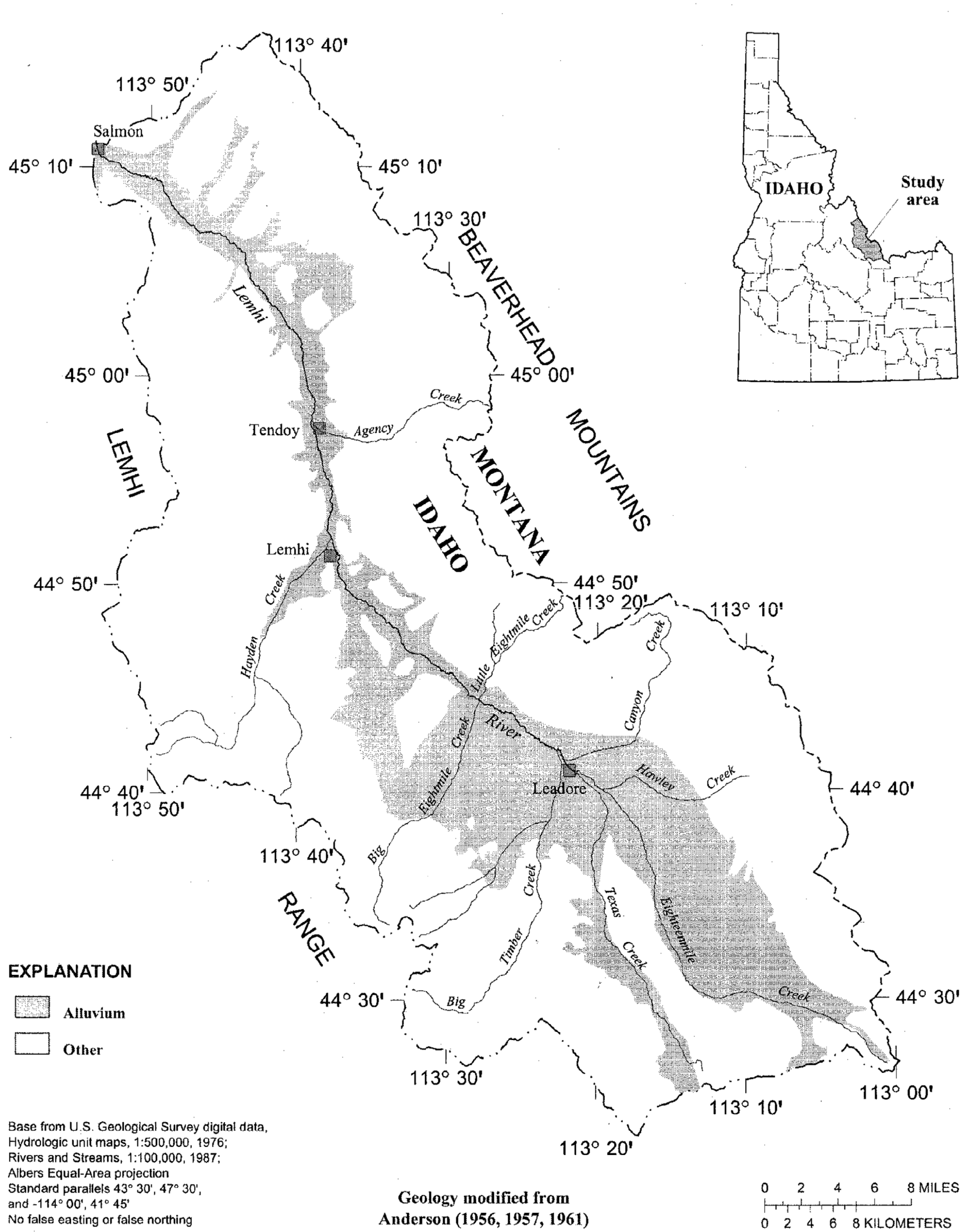

Figure 6. Extent of alluvium in U.S. Geological Survey hydrological study in Lemhi River valley. (Source: Donato 1998)

Donato (1998) identified ground water underflow as an important component of the basin's annual water budget. Wells in the alluvial layer and surface waters respond quickly to irrigation return flow. Irrigation return flow to the Lemhi River is a more significant component in the upper hydrologic region since the alluvium is more extensive in this area.

The IDWR performed a seepage study in the upper Lemhi River subbasin from Leadore to the confluence with Big Springs Creek (IDWR 2008a). IDWR measured streamflows, diversion rates, and return flows via seepage and tributary inputs in the Lemhi River to quantify gaining and losing reaches. A summary of the gains and losses throughout the study reach is shown in Table 9.

Table 9. Summary of the Idaho Department of Water Resources upper Lemhi River seepage study.

Lemhi River Summary	Flow (cubic feet per second)
Initial flow/input	6.912
Diverted rate out of the Lemhi River	30.542
Tributary/injection input	25.445
Cumulative reach losses	-11.646
Cumulative reach gains	66.590
Calculated output	56.759
Measured output	56.759

The output calculated by IDWR equaled the measured output of the study reach just below the confluence with Big Springs Creek, showing the accuracy of the calculations. The "cumulative reach gains" in Table 9 are from ground water return flow to the Lemhi River during a 2-day period. Essentially, this study shows that this reach of the Lemhi River gains significantly from ground water during the study period in July. The IDWR study reach is within Donato's "upper basin" with its extensive alluvium.

Evidence from these USGS and IDWR studies as well as field investigations by DEQ indicates that many tributaries to the Lemhi River enter the valley alluvium and flow into the river as ground water rather than surface water due to irrigation diversions exacerbated by naturally-transmissive alluvial soils. The irrigation return flow infiltrates and returns to the Lemhi River as ground water. Certain segments of these tributaries are appropriately listed in Category 4c for low flow alteration, as shown previously in Table 3.

The following section details AUs that are currently listed in Category 5 for impaired water quality that should be listed in Category 4c for flow alteration.

ID17060204SL007a_03 McDevitt Creek—source to mouth

By some unknown error, this AU was listed in 2008 in Category 5 of the IR for "Low flow alterations." It is well-established that streams with human-induced flow and habitat alteration are impaired by pollution instead of specific pollutants according to §502(6) and §502(19) of the CWA, and TMDLs are not required for flow alteration and habitat alteration (i.e., nonpollutants), consistent with EPA guidance. Therefore, this AU should more appropriately be listed in Category 4c of the IR for "Low flow alterations" and de-listed from Category 5 for "Low flow alterations."

ID17060204SL026a_02 Mill Creek—diversion to mouth

This AU is appropriately listed in Category 4c of the IR for "Low flow alterations" and "Other flow regime alterations," and it is also currently listed in Category 5 for "Sedimentation/Siltation" and "Cause unknown (nutrients suspected)." Up to 2011, a headgate at the upstream point of this AU has historically diverted all of the flow of Mill Creek into the L-52 ditch for irrigating cropland. Until the removal of the diversion structure, the only water existing in this AU was excess return flow from diverted irrigation water. However, due to work between 2004 and 2011 by the Upper Salmon Basin Watershed Project, this headgate structure was removed and Mill Creek streamflow is now connected with the Lemhi River. This AU also includes Ferry Creek, which had been entirely dewatered and has also been restored recently to connectivity with the Lemhi River.

In the 1998 §303(d) list, the Mill Creek "water quality limited segment--3082" was listed for flow alteration and suspected nutrient and sediment impairment. The suspected nutrient and sediment impairments were based on low habitat ratings from Beneficial Use Reconnaissance Program (BURP) scores. The stream habitat index was low due to low flow issues from the diversion, but the biological assessment for the BURP sites in this AU all showed full support. The habitat and bioassessment data support the theory that flow alteration is the sole source of water quality impairment.

No other pollutant sources or pathways have been identified other than historic flow alteration. There are no confined animal feeding operations or other nutrient sources in the Mill Creek watershed and grazing is limited in this AU. DEQ investigation showed no evidence of nuisance algae and an analysis of streambank stability showed that Mill Creek meets the surrogate sediment target of 80% stability.

Due to extensive restoration work in this watershed and evidence that historic flow alteration is the sole source of impairment, this AU should be de-listed from Category 5 for "Sedimentation/Siltation" and "Cause unknown (nutrients suspected)" and remain in Category 4c of the IR for "Low flow alterations" and "Other flow regime alterations."

ID17060204SL027_02 Walter Creek—source to mouth

This AU is appropriately listed in Category 4c of the IR for "Low flow alterations," and it is also currently listed in Category 5 for "Combined biota/habitat bioassessments." Until recently, the entirety of this AU had been diverted into a canal for irrigating croplands adjacent to Highway 28. The Upper Salmon Basin Watershed Project administered a conservation easement in 2010 to allow the stream to begin to re-establish a distinct channel and connect it with the river valley.

This AU was not listed in the 1998 §303(d) list, but it appeared on the 2002 IR listed for an unknown pollutant based on a low BURP score in 1997. Even though the streambanks were 100% covered and stable, with 1.1 cfs streamflow and high percentages of fine sediment on the date of sampling, the site failed the habitat and macroinvertebrate scores. Further field investigations determined that water was present in the channel from irrigation returns too infrequently to form a defined stream channel or riparian area. No other pollutant sources or pathways have been identified than historic flow alteration.

Due to extensive restoration work in this watershed and evidence that historic flow alteration is the sole source of impairment, this AU should be de-listed from Category 5 for "Combined biota/habitat bioassessments" and remain in Category 4c of the IR for "Low flow alterations."

ID17060204SL050a_03 Hawley Creek—diversion to mouth

Hawley Creek from the point of diversion to the mouth is currently listed in Category 5 of the IR for "Cause unknown (nutrients suspected impairment)." It should be appropriately listed in Category 4c for "Low flow alterations," since there are no confined animal feeding operations or other sources of nutrients in this AU and no impairments other than flow alteration.

This AU lies entirely in an alluvial fan as it exits a canyon. At this point, most of the flow has been diverted for irrigation into the "HC-1, HC-2, and HC-3 ditches." As recently as 2008 during DEQ field investigations, the course of the channel was difficult to trace, with any surface water disappearing into the alluvium and resurfacing sporadically.

However, recent work by the Upper Salmon Basin Watershed Project has re-established flow into a defined channel and re-connected the flow to Eighteenmile Creek and subsequently to Lemhi River. This and other restoration work will be summarized in Section 4 of this document.

In the 1998 §303(d) list, the Hawley Creek "water quality limited segment--3082" was listed for suspected nutrient and sediment impairment. The suspected nutrient and sediment impairments were based on low macroinvertebrate and habitat ratings from BURP scores. Investigation of the BURP field forms showed that very few of the fields were filled out because the flow was less than 1 cfs, making this an unassessed AU. In the 2002 IR both this AU and ID17060204SL050b_03, an upstream segment of Hawley Creek, were listed for nutrients and sediment. However, in 2004, ID17060204SL050b_03 was determined to be full support. Apparently, this lower segment that is still listed in Category 5 went unassessed because it was dry on subsequent BURP field investigations. There was no documentation why sediment was dropped as a suspected impairment and nutrients remained on the list.

Due to extensive restoration work in this watershed and evidence that historic flow alteration is the sole source of impairment, this AU should be de-listed from Category 5 for "Cause unknown (nutrients suspected impairment)" and listed in Category 4c of the IR for "Low flow alterations."

2.4.2. Water Column Data

The Salmon-Challis National Forest has collected data—including instream temperature, percent bank stability, and subsurface fine sediment—for key streams on forest land in the Lemhi River subbasin (Appendix C). Pertinent data are summarized in Tables 10 and 11 for streams listed in Category 5, "Impaired Waters," of the 2010 Integrated Report.

Table 10. Salmon-Challis National Forest instream temperature data summary.

Stream (Beneficial Uses)[a]	Year	Absolute Maximum Temperature (ºC)	Maximum 7-day Moving Maximum Temperature (ºC)
Mill Creek (CWAL, SS)	2006	13.3	12.8
	2009	12.9	12.0
Hawley Creek (CWAL)	2004	17.2	16.3
	2007	17.9	16.6
	2008	16	15.6
	2009	15.2	14.6
Canyon Creek (CWAL)	2004	18	17.2
	2006	18.7	17.9
	2009	16	15.6
Frank Hall Creek (CWAL, SS)	2009	14.1	13.6
Little Eightmile Creek (CWAL)	2009	13.7	13.2

[a] CWAL = cold water aquatic life; SS = salmonid spawning

Hawley Creek and Little Eightmile Creek meet the cold water aquatic life temperature criterion of 19 ºC maximum daily average. The other monitored streams are designated for salmonid spawning in addition to cold water aquatic life. Only Mill Creek meets the daily maximum 13 ºC criterion for salmonid spawning. Frank Hall Creek and Little Eightmile Creek showed minimal temperature violations that come within the 10% exceedance guidance for listing based on temperature. Hawley Creek and Canyon Creek will be investigated further for possible listing as temperature impaired in the next listing cycle.

The Forest Service also monitored sediment on certain streams. Appendix C presents all of the Forest Service sediment data, and Table 11 shows mean percent bank stability and percent subsurface fine sediment over the 16 years of ongoing monitoring for the streams within listed AUs.

Table 11. Salmon-Challis National Forest sediment data summary, 1993–2009.

Stream	Mean Percent Bank Stability	Mean Percent Fines at Depth
Little Eightmile Creek	81.5	24.2
Canyon Creek	92.1	24.1
Hawley Creek	94.3	21.2
Mill Creek	92.3	14.5

These portions of listed streams that are on Forest Service land all meet the sediment targets of at least 80% streambank stability and no more than 28% subsurface fine sediment. These targets have been established in many of DEQ's EPA-approved sediment TMDLs such as the *Lemhi River Watershed TMDL* (1999). Sediment targets based on subsurface fine sediments are protective of salmonid spawning habitat, and increasing streambank stability is a means to reducing subsurface fine sediment.

In addition to the sediment analyses on Forest Service land, DEQ performed field investigations during 2008 to identify sediment impairment on BLM and private land. For the AUs listed in Category 5, of the 2010 Integrated Report, no further sediment impairment was identified other than on the streams with EPA-approved sediment load allocations from earlier analyses. Results of the streambank erosion inventories are presented as monitoring results in section 4 of this document. The data and worksheets used to calculate sediment loads are shown in Appendix D.

The USGS gaging station in the Lemhi River near Lemhi, Idaho, recorded instream water temperature during May through September from 1997 through 2005. The daily maximum and the daily average temperatures, calculated over the period of record, are shown in Figure 7.

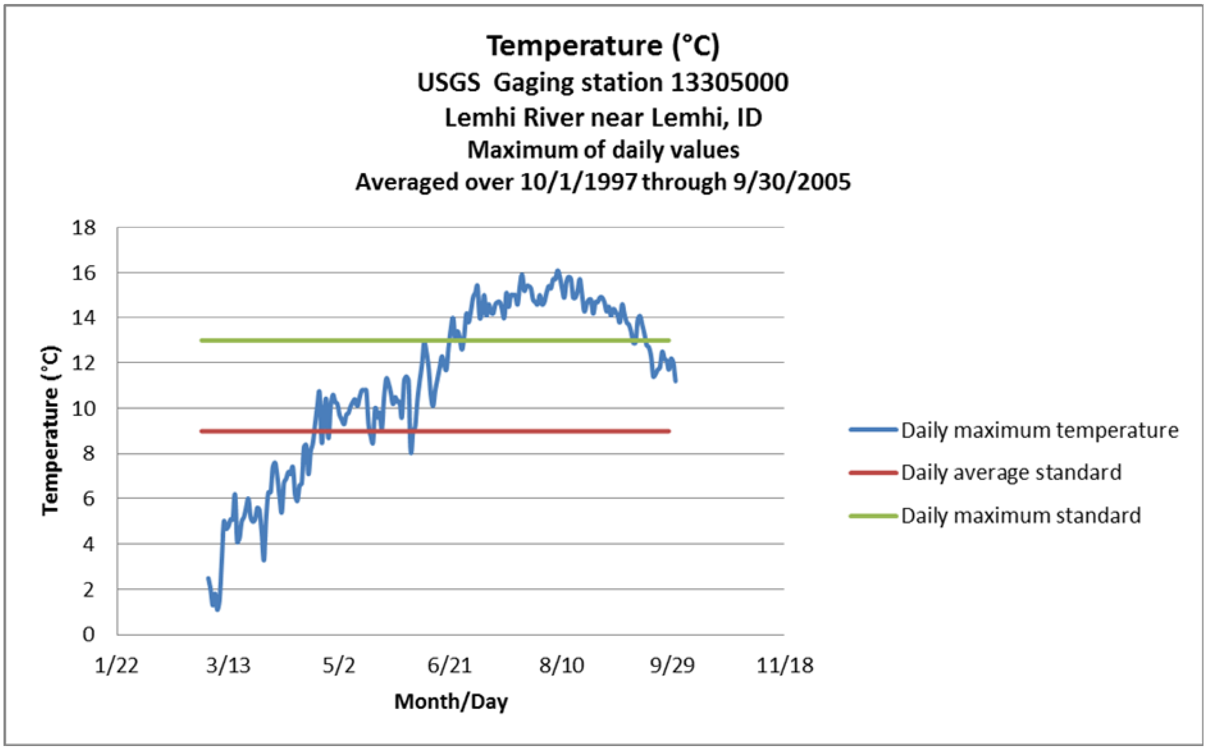

Figure 7. Instream temperature at U.S. Geological Survey gage 13305000 (Lemhi River near Lemhi, Idaho).

Temperature criteria from Idaho's water quality standards to support salmonid spawning as a beneficial use include 13 ºC as a daily maximum water temperature and 9 ºC as a daily average water temperature. As detailed in section 2.3.1 of this document, the spawning and incubation period that applies to these standards is March 15–July 15 and in the fall after September 1. From the Lemhi River USGS temperature data near Lemhi, Idaho, the daily maximum temperature typically exceeds 13 ºC during salmonid spawning periods from mid-June to July 15, and again from September 1 through September 15. The daily average temperature shows some exceedances during the salmonid spawning period from April 20 to June 6 on average and typically exceeds the 9 ºC daily average water temperature from June 6 through July 15. Another period of daily average water temperature exceedances occurs after September 1.

Maximum temperatures peak in July and August when streamflow is lowest in the Lemhi River for irrigation withdrawals. DEQ performed field investigations during summer 2007 to identify issues that may impact instream water temperatures. Those data and analyses are presented in detail in section 5 of this document to establish temperature TMDLs based on potential natural riparian vegetation.

2.4.3. Biological and Other Data

The EPA Assessment Database (ADB) compiles bioassessment data that have been collected statewide from 1994 through 2008. 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 that have 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 Lemhi River subbasin has been extensively monitored for beneficial use support status through such bioassessment protocols (Figure 8).

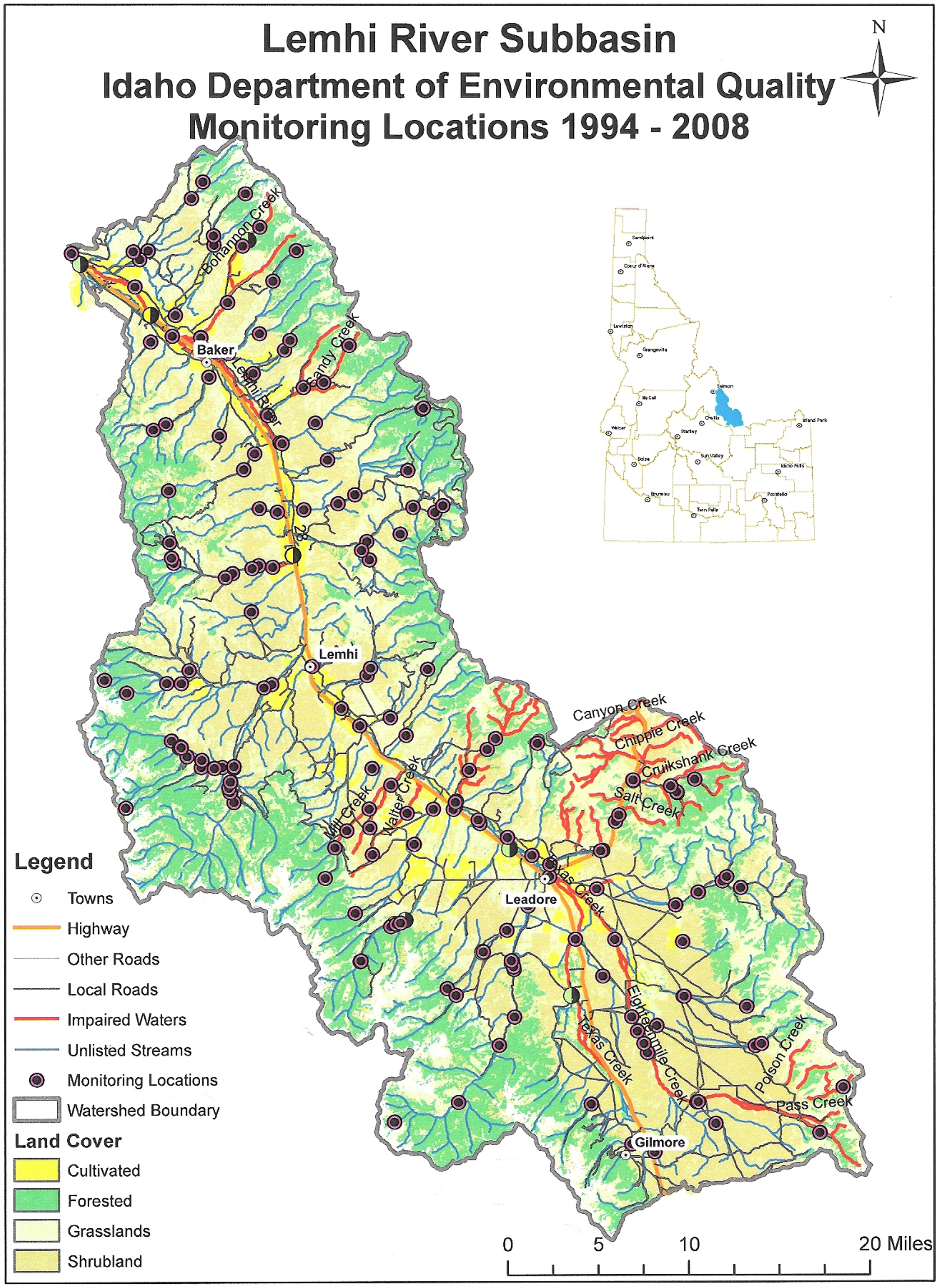

Figure 8. Idaho Department of Environmental Quality bioassessment monitoring locations.

The ADB data for the Lemhi River subbasin demonstrate that out of 133 locations monitored for support status of the cold water aquatic life beneficial use, 107 sites fully supported the use and 26 sites did not. Out of 57 sites monitored for salmonid spawning support status, 43 were fully supporting and 14 were not.

Figure 9 shows the monitoring locations resulting in a not fully supporting status determination that are currently listed in Category 5 of the 2010 Integrated Report. Temperature and bacteria data from outside agencies are also used to assess support status of AUs. Bacteria data from the Lemhi Soil and Water Conservation District were collected at locations in the listed reaches of the Lemhi River designated as LMH105 and LMH109 in Figure 9.

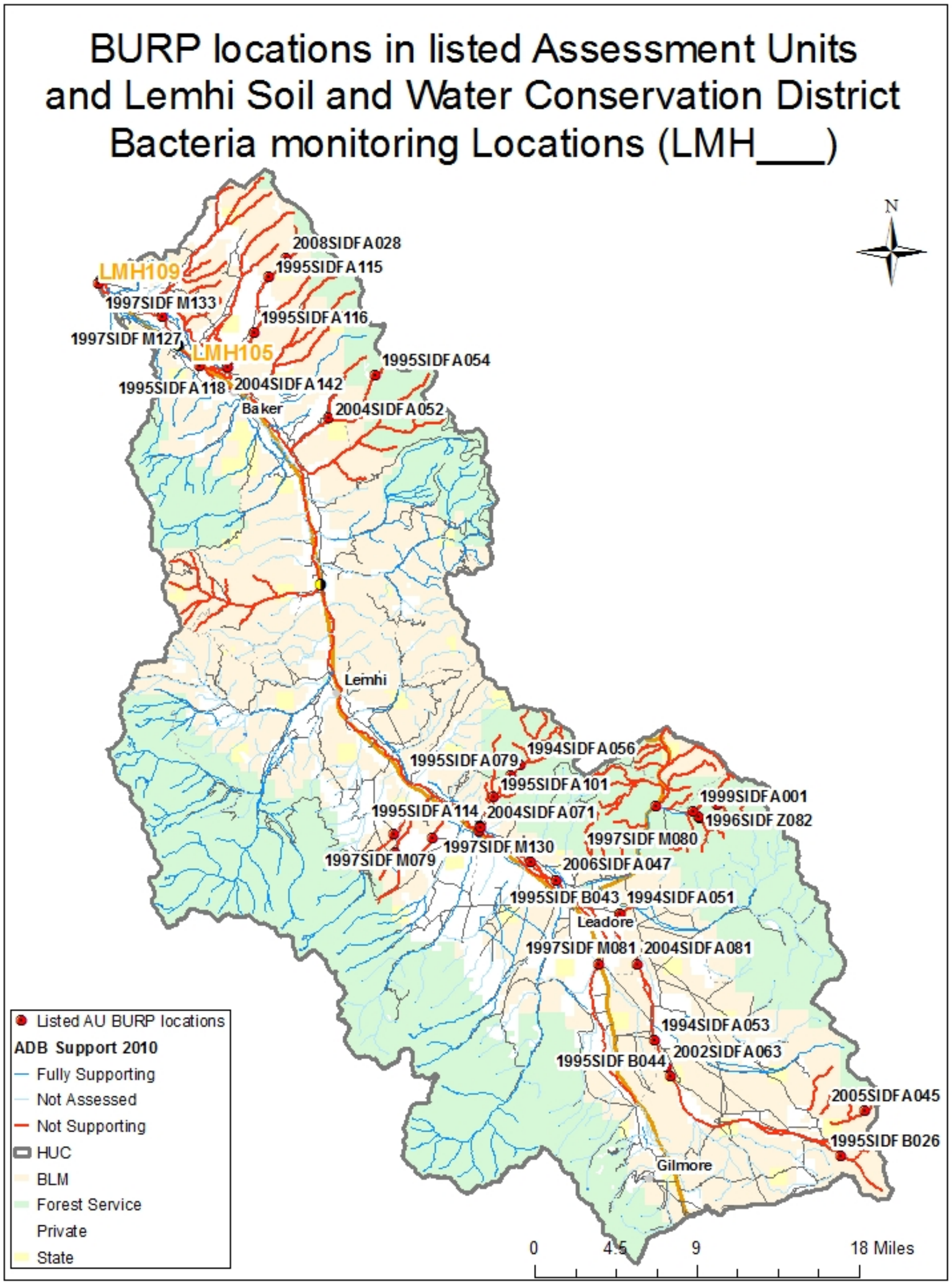

Figure 9. Bioassessment monitoring locations resulting in a not fully supporting status determination.

Pertinent BURP data and DEQ bacteria data are presented in Table 12. Where the stream fish index (SFI) is blank (—), a fishing effort was not made and only the macroinvertebrate and habitat scores are available. If the average score of the indices is greater than or equal to 2, the AU is fully supporting; if the average score is less than 2, the AU is not fully supporting. The bacteria data summarized in Table 12 are presented in full in Appendix E.

Table 12. Bioassessment results and bacteria data for assessment units listed in Category 5 of the 2010 Integrated Report.

BURP ID	Date	Index Ratings				Flow (cubic feet/second)	Temperature (°C)
		SMI[a]	SHI[b]	SFI[c]	Average Score		
ID17060204SL001_06, Lemhi River—Kenney Creek to mouth							
1997SIDFM126	8/25/1997	49.14	69	—	2.5	182.14	15
1997SIDFM127	8/25/1997	43.13	66	—	2.5	175.08	18
1997SIDFM133	8/28/1997	50.01	64	—	2.5	197	14
DEQ, 9/2008—Six locations sampled for bacteria did not show instantaneous *E. coli* exceedances. DEQ, 5/2011—Geometric mean of 444 organisms/100 milliliters (mL) at gaging station 13305310 Lemhi Soil and Water Conservation District, 2002 to 2006—Overall average geometric means: LMH105 = 377 organisms/100 mL; LMH109 = 433 organisms/100 mL							
ID17060204SL026a_02, Mill Creek—diversion to mouth							
1994SIDFA050	7/28/1994	No flow					
1995SIDFA051	7/17/1995	73.81	50	—	2	13.2	—
1995SIDFA080	8/8/1995	62.64	36	—	2	3	—
1997SIDFM087	7/30/1997	73.52	40	—	2	3	15
ID17060204SL027_02, Walter Creek—source to mouth							
1997SIDFM079	7/28/1997	27.95	54	—	0	1.1	20
2007SIDFA070	7/23/2007	No flow					
ID17060204SL030_04, Lemhi River—confluence to Eighteenmile Creek and Texas Creek							
1997SIDFM129	8/27/1997	57.46	47	—	2	47.14	10
2007SIDFA084	7/31/2007	49.78	64	41.04	2	28.29	12.1
ID17060204SL030_05, Lemhi River—confluence to Eighteenmile Creek and Texas Creek							
1997SIDFM130	8/27/1997	63.35	42	—	2	59.7	13
1997SIDFM131	8/27/1997	51.98	57	—	2.5	94.9	17
ID17060204SL036_03, Texas Creek							
1997SIDFM081	7/29/1997	61.55	50	58.81	1.67	42.2	15
2004SIDFA074	8/5/2004	No flow					
DEQ, 5/2011—Instantaneous value of 59 organisms/100 mL							
ID17060204SL041_04, Eighteenmile Creek—Hawley Creek to mouth							
2007SIDFA082	7/30/2007	52.18	45	77.04	0	1.91	15.6
ID17060204SL042_03, Eighteenmile Creek—Clear Creek to Hawley Creek							
2004SIDFA081	8/10/2004	45.69	41	—	1	2.2	13.6
ID17060204SL043_03, Eighteenmile Creek—Divide Creek to Hawley Creek							
1994SIDFA053	8/1/1994	70.87	56	76.29	2.33	1.52	—
1995SIDFB044	7/18/1994	No data—beaver complex					
2002SIDFA063	8/22/2002	45.35	41	41.91	1.33	1	7.6
2007SIDFA080	7/30/2007	69.34	43	81.45	2.33	2.55	15.1
ID17060204SL045_02, Eighteenmile Creek—source to Divide Creek							
1995SIDFB026	7/17/1995	43.54	61	95.42	2	27.1	—
1997SIDFL077	7/28/1997	26	54	59.81	0	3	14
2005SIDFA045	7/18/2005	No data—inaccessible					
2007SIDFA0811	7/30/2007	No flow					

BURP ID	Date	Index Ratings				Flow (cubic feet/second)	Temperature (°C)
		SMI[a]	SHI[b]	SFI[c]	Average Score		
ID17060204SL050a_03, Hawley Creek—diversion to mouth							
1994SIDFA051	7/28/1994	No flow					
1995SIDFB043	7/18/1995	15.23	20	—	0	2.3	—
ID17060204SL051b_02, Canyon Creek—source to diversion							
1996SIDFZ081	7/18/1996	69.4	61	—	2.5	0.5	7.5
1996SIDFZ082	7/18/1996	No data—beaver complex					
1996SIDFZ083	7/18/1996	44.58	50	—	1	3.5	16
1997SIDFM080	7/28/1997	58.6	31	77.53	1.67	0.7	12
1999SIDFA001	9/13/1999	89.23	42	63.9	1.67	0.6	6.6
2007SIDFA058	7/16/2007	46.15	50	85.44	1.67	2.68	16.8
ID17060204SL052a_02, Little Eightmile Creek—diversion to (mouth)							
1995SIDFA114	9/12/1995	67.22	42	—	2	0.96	—
2004SIDFA071	8/4/2004	No flow					
ID17060204SL052b_02, Little Eightmile Creek—source to diversion							
1994SIDFA056	8/2/1994	No data—inaccessible					
1995SIDFA079	8/8/1995	No data—inaccessible					
1995SIDFA101	5/12/1995	69.38	59	95	3	5.01	—
ID17060204SL062b_02, Sandy Creek—source to diversion							
1994SIDFA045	7/26/1994	63.98	69	87.34	3	0.35	—
1995SIDFA054	7/18/1995	36.76	48	—	1	4.4	—
2004SIDFA052	7/28/2004	No data—inaccessible					
ID17060204SL064a_02, Bohannon Creek—diversion to mouth							
1995SIDFA118	9/27/1995	45.77	1	—	1.5	0.31	—
2004SIDFA142	8/30/2004	No flow					
ID17060204SL064b_02, Bohannon Creek—source to diversion							
1995SIDFA115	9/13/1995	84.41	57	—	2	6.75	—
1995SIDFA116	9/13/1995	80.71	55	83.8	2.67	5.2	—
2008SIDSA028	5/20/2008	No data—inaccessible					

[a] SMI = stream macroinvertebrate index
[b] SHI = stream habitat index
[c] SFI = stream fish index

2.4.4. Assessment Unit Summary

A summary of the data analysis, literature review, and field investigations and a list of conclusions for AUs included in Category 5 of the 2010 IR follows. This section includes changes that will be documented in the next IR once the TMDLs in this document have been approved by EPA

ID17060204SL001_06, Lemhi River—Kenney Creek to mouth

- Listed for total coliform and temperature.
- This AU is listed in Category 4a for approved TMDLs for both *E. coli* and fecal coliform.
- Data show shade conditions under PNV are not met and load allocation is set in section 5 of this document.

- Delist from Category 5, for total coliform since it already has approved *E. coli* and fecal coliform TMDLs. Monitoring will continue for E. coli as designated in the current water quality standards.
- List temperature in Category 4a for EPA-approved TMDLs.

ID17060204SL007a_03 McDevitt Creek—source to mouth

- By some unknown error, this AU was listed in 2008 in Category 5 of the IR for "Low flow alterations."
- List in Category 4c of the IR for "Low flow alterations" and delist from Category 5 for "Low flow alterations."

ID17060204SL026a_02, Mill Creek—diversion to mouth

- Listed for sedimentation/siltation and cause unknown (nutrients suspected impairment).
- Data and DEQ investigation show that sediment targets are met, no sources of nutrients exist, and the reach is dewatered.
- TMDL approved by EPA in 2000 indicated that this segment is dewatered the majority of the year and will not have a load allocation developed.
- Remove salmonid spawning as beneficial use in ADB since there is no data or evidence suggesting it is an existing use and it is not not designated for salmonid spawning; but is presumed to support cold water aquatic life and secondary contact recreation beneficial uses.
- Delist from Category 5, for sediment and cause unknown, and leave in Category 4c for low flow and other flow regime alterations.

ID17060204SL027_02, Walter Creek—source to mouth

- Listed for combined biota/habitat bioassessments.
- Evidence shows water exists in channel from irrigation returns too infrequently to form a defined stream channel or riparian area. No other pollutant sources or pathways have been identified than historic flow alteration.
- Delist from Category 5 and leave in Category 4c for low flow alterations.

ID17060204SL030_04, Lemhi River—confluence of Eighteenmile Creek and Texas Creek

- Listed for temperature.
- Data show shade conditions under PNV are not met, and load allocation is set in section 5 of this document.
- List temperature in Category 4a for EPA-approved TMDLs.

ID17060204SL030_05, Lemhi River—confluence of Eighteenmile Creek and Texas Creek

- Listed for temperature.

- Data show shade conditions under PNV are not met, and load allocation is set in section 5 of this document.
- List temperature in Category 4a for EPA-approved TMDLs.

ID17060204SL036_03, Texas Creek

- Listed for combined biota/habitat bioassessments, sedimentation/siltation, and fecal coliform.
- Requires additional data to determine impairment(s) in addition to flow regime alterations. It is unlikely DEQ will be able to completely assess this AU since it lies entirely on private land and access is denied. DEQ collected one grab sample from a public bridge crossing Texas Creek in May 2011 that resulted in an instantaneous value of 59 organisms/100 mL, which meets the criterion for secondary contact recreation.
- Leave in Category 5, until data gaps are filled. Leave in Category 4c for flow regime alterations.

ID17060204SL041_04, Eighteenmile Creek—Hawley Creek to mouth

- Listed for temperature.
- Data show shade conditions under PNV are not met, and load allocation is set in section 5 of this document.
- Sediment TMDL approved by EPA in 2000.
- Delist from Category 5, and list in Category 4a for temperature. Leave in Category 4a for sediment and Category 4c for low flow alterations.

ID17060204SL042_03, Eighteenmile Creek—Clear Creek to Hawley Creek

- Listed for temperature.
- Data show shade conditions under PNV are not met, and load allocation is set in section 5 of this document.
- Sediment TMDL approved by EPA in 2000.
- Delist from Category 5 and list in Category 4a for temperature. Leave in Category 4a for sediment. List in Category 4c for low flow alterations.

ID17060204SL043_03, Eighteenmile Creek—Divide Creek to Hawley Creek

- Listed for fishes bioassessments and temperature.
- Data show shade conditions under PNV are not met, and load allocation is set in section 5 of this document.
- Sediment TMDL approved by EPA in 2000.
- Delist fishes bioassessments as impairment as an artifact in ADB from earlier assessments. The term fishes bioassessments is duplicative of combined biota/habitat bioassessments. Delist from Category 5 and list in Category 4a for temperature. Leave in Category 4a for sediment. List in Category 4c for low flow alterations.

ID17060204SL045_02, Eighteenmile Creek—source to Divide Creek

- Listed for combined biota/habitat bioassessments.
- Data show shade conditions under PNV are not met, and load allocation is set in section 5 of this document.
- Sediment TMDL approved by EPA in 2000.
- Delist combined biota/habitat bioassessments from Category 5 and list in Category 4a for temperature. Leave in Category 4a for sediment. List in Category 4c for low flow alterations.

ID17060204SL050a_03, Hawley Creek—diversion to mouth

- Listed for cause unknown (nutrients suspected impairment).
- Evidence shows water exists in this reach infrequently due to diversions and sinks rapidly into the alluvium when present.
- There are no sources of nutrients so delist for cause unknown.
- Delist from Category 5, and list in Category 4c for low flow alterations.

ID17060204SL051b_02, Canyon Creek—source to diversion

- Listed for combined biota/habitat bioassessments and *Escherichia coli*.
- Data show that the *E. coli* target for secondary contact recreation is not met in two Canyon Creek tributaries—Cruikshank Creek and Wildcat Creek--and a bacteria TMDL is provided.
- Delist from Category 5 for combined biota/habitat bioassessments as low flow alteration is the cause of impariement; and list in Category 4a for *E. coli* and in Category 4c for low flow alterations.

ID17060204SL052a_02, Little Eightmile Creek—diversion to (mouth)

- Listed for temperature.
- Data show shade conditions under PNV are not met, and load allocation is set in section 5 of this document.
- Delist from Category 5 and list in Category 4a for temperature.

ID17060204SL052b_02, Little Eightmile Creek—source to diversion

- Listed for temperature.
- Data show shade conditions under PNV are not met, and load allocation is set in section 5 of this document.
- Delist from Category 5 and list in Category 4a for temperature.

ID17060204SL062b_02, Sandy Creek—source to diversion

- Listed for temperature.
- Data show shade conditions under PNV are not met, and load allocation is set in section 5 of this document.
- Sediment TMDL approved by EPA in 2000.

- Delist from Category 5 and list in Category 4a for temperature. Leave in Category 4a for sediment. Leave in Category 4c for low flow alteration.

ID17060204SL064a_02, Bohannon Creek—diversion to mouth

- Listed for temperature.
- Data show shade conditions under PNV are not met, and load allocation is set in section 5 of this document.
- Sediment TMDL approved by EPA in 2000.
- Delist from Category 5 and list in Category 4a for temperature. Leave in Category 4a for sediment. Leave in Category 4c for low flow alteration.

ID17060204SL064b_02, Bohannon Creek—source to diversion

- Listed for temperature.
- Data show shade conditions under PNV are not met, and load allocation is set in section 5 of this document.
- Sediment TMDL approved by EPA in 2000.
- Delist from Category 5 and list in Category 4a for temperature. Leave in Category 4a for sediment. List in Category 4c for low flow alteration.

ID17060204SL066a_03, Kirtley Creek—diversion to mouth

- Currently listed in Category 4a for temperature.
- Keep in Category 4a for new PNV method temperature TMDL that overrides the methodology of the temperature TMDL approved by EPA in 2000.

3. Subbasin Assessment—Pollutant Source Inventory

Pollution within the Lemhi River subbasin is primarily from excess sediment, bacterial contamination, and elevated instream temperature. Load allocations for sediment and bacteria were established in the *Lemhi River Watershed TMDL* (DEQ 1999) approved by EPA in 2000.

3.1. Sources of Pollutants of Concern

3.1.1. Point Sources

Point sources are sources of pollutants from known discharge locations. There are no known National Pollutant Discharge Elimination System (NPDES) permitted point sources discharging to listed waters in this subbasin. Thus, there are no wasteload allocations.

3.1.2. Nonpoint Sources

A detailed discussion of nonpoint sources is provided in the *Lemhi River Watershed TMDL* (DEQ 1999) approved by EPA in 2000. In summary, all pollutants are from nonpoint sources in this subbasin. Potential pollutants include sediment, bacteria, and temperature. Potential sources of these pollutants could include streambank modification and erosion, flow regulation and irrigation return water, road construction, pasture treatment, and mine tailings. Recreational activities may cause nonpoint sources of pollution where streambanks are becoming degraded by high use. Livestock grazing in riparian areas and erosion from roads and cultivated fields are common sources of excess sediment delivery to the streams. Destabilized streambanks also contribute to reducing riparian vegetation that would provide shade, which leads to excess solar load and increased instream water temperatures.

4. Monitoring and Status of Water Quality Improvements and Summary of Five-year TMDL Review

This 5-year TMDL review complies with Idaho Statute 39-3611(7) to reevaluate the *Lemhi River Watershed TMDL* (DEQ 1999) approved by EPA in 2000. This review describes current water quality status and recent pollution control efforts in the subbasin. The assessment of instream targets, pollutant allocations, and analysis of the original TMDL is conducted with input and support from the watershed advisory group (WAG) and basin advisory group (BAG).

4.1. Ongoing Sediment Monitoring

Percent bank stability and subsurface fine sediment percentages measure progress toward reaching surrogate sediment targets of at least 80% bank stability and no more than 28% subsurface fine sediment. These targets have been established in many of DEQ's EPA-approved sediment TMDLs, such as the *Lemhi River Watershed TMDL* (DEQ 1999). A sediment target based on subsurface fine sediments is protective of cold water aquatic life and salmonid spawning habitat. Increasing streambank stability is a means of reducing subsurface fine sediment.

The Salmon-Challis National Forest collects sediment data for key streams on Forest Service land in the Lemhi River subbasin. Measurements of streambank stability and percent subsurface fine sediment from 1993 through 2009 are presented in Appendix C. Streams listed as impaired in the 2010 Integrated Report and monitored by the Forest Service include Little Eightmile, Canyon, Hawley, and Mill Creeks. The portions of listed streams that are on Forest Service land all meet the sediment targets of 80% streambank stability and 28% subsurface fine sediment.

In 2008, DEQ field investigations monitored sediment impairment to streams on BLM and private lands. Ongoing sediment monitoring is part of the 5-year review process for checking progress toward meeting the sediment targets identified in the original *Lemhi River Watershed TMDL* (DEQ 1999). A brief summary of sediment monitoring methods and all of the calculations and results of the streambank erosion inventories are provided in Appendix D. Table 13 summarizes the results, showing the current sediment load calculated from the streambank erosion inventories and the load capacities, which are the natural background assimilative capacities of each monitored stream. Load reductions allocated in the 1999 TMDL are provided for comparison to current conditions. DEQ does not issue additional sediment load allocations with this addendum. The sediment load allocations in the original TMDL will remain in effect.

Several water quality improvement projects have been administered by the BLM such as road improvements and culvert replacements to enhance fish passage which can be found in Appendix I.

Table 13. Streambank erosion inventory summary.

Assessment Unit	Current Load (tons/year) 2008 data	Load Capacity (tons/year) 2008 data	Load reduction needed to meet load capacity from 2008 data	Load reduction allocated in 1999 TMDL
ID17060204SL007b_03 McDevitt Creek—Lower	18	22	0	54% overall average
ID17060204SL007b_03 McDevitt Creek—Lower Middle	5	9	0	
ID17060204SL007b_03 McDevitt Creek—Upper Middle	4	14	0	
ID17060204SL007b_03 McDevitt Creek—Upper	3	15	0	
ID17060204SL026a_02 Mill Creek	1	2	0	Not monitored
ID17060204SL042_03 Eighteenmile Creek—Lower	352	351	0 (within 10% margin of error)	77% overall average
ID17060204SL043_03 Eighteenmile Creek—Middle	6	20	0	
ID17060204SL045_02 Eighteenmile Creek—Upper	13	19	0	
ID17060204SL062b_02 Sandy Creek	18	12	36%	20%
ID17060204SL063_02 Wimpey Creek	1030	206	80%	76%
ID17060204SL064b_02 Bohannon Creek—Upper	30	35	0	69%
ID17060204SL064b_02 Bohannon Creek—Middle	208	119	42%	
ID17060204SL064a_02 Bohannon Creek—Lower	14	15	0	
ID17060204SL065b_02 Geertson Creek	3	8	0	62%
ID17060204SL066b_02 Kirtley Creek	Not monitored			67%

Sandy Creek, Wimpey Creek and the middle reach of Bohannon Creek are not currently meeting their sediment loading capacities. None of the other streams have exceeded the assimilative loading capacity with the current load. Sandy Creek load reduction increased from 20% load reduction allocated in the 1999 TMDL to 36%. Bohannon Creek received load allocations in the range of 51% to 95% sediment reduction in the original TMDL. In this assessment, the upper and lower reaches met the load capacity and only the middle reach requires a 43% load reduction. This shows an improving trend for streambank erosion in Bohannon Creek.

In the original TMDL, 4 reaches of Wimpey Creek received load allocations in the range of 58% to 93% sediment reduction. In this assessment, Wimpey Creek requires an overall 80% reduction from the 2008 monitoring results, which lies in the range of its earlier condition.

The original TMDL identified mass wasting as the predominant pollutant source in the Wimpey Creek watershed. Mass wasting is harder to address with watershed improvement projects than instream erosion.

Other creeks that received a sediment load allocation in the original TMDL were McDevitt, Eighteenmile, Geertson and Kirtley Creeks. In this assessment, all of these streams are meeting their assimilative capacities for sediment loading, which shows an improving trend. Mill Creek was monitored for instream erosion in 2008 but not 2009 and it is meeting its load capacity. Overall, these results show that watershed improvement projects are reducing excess sedimentation in the Lemhi River subbasin.

Also during 2008, DEQ collected subsurface fine sediment data via the McNeil sediment core sampling method. In streams with salmonid spawning habitat, a sediment core of the substrate is gathered and separated into 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. Table 14 provides the results of subsurface fine sediment measurements in the Lemhi River subbasin.

Table 14. McNeil sediment core results.

Assessment Unit	Mean Percentage Fine Sediment
ID17060204SL007b_03 McDevitt Creek—Lower	36
ID17060204SL007b_03 McDevitt Creek—Lower Middle	59
ID17060204SL007b_03 McDevitt Creek—Upper Middle	40
ID17060204SL009_05 Hayden Creek	15
ID17060204SL026a_02 Mill Creek	23
ID17060204SL043_03 Eighteenmile Creek—Middle	42
ID17060204SL043_03 Eighteenmile Creek—Lower	36
ID17060204SL045_02 Eighteenmile Creek—Upper	33
ID17060204SL063_02 Wimpey Creek	36
ID17060204SL064b_02 Bohannon Creek—Middle	24
ID17060204SL064a_02 Bohannon Creek—Lower	25
ID17060204SL065b_02 Geertson Creek	39

Hayden Creek, Mill Creek, and both sites on Bohannon Creek meet the target of 28% fine sediment. McDevitt Creek exceeds the target, even though it has stable streambanks. This fact indicates that the stream is in the process of repairing and stabilizing the streambanks but still has excess fine sediment in the substrate. These fine sediments will continue to be flushed downstream after more scouring high-water events occur. Eighteenmile Creek is also on an improving trend, with stabilizing streambanks and some excess fine sediment to be flushed downstream. Wimpey Creek does not meet the 28% target, and the streambanks are still showing excess erosion. This creek may be a good place to target for watershed improvement projects. Geertson Creek does not meet the subsurface fine sediment target but does show evidence of stabilizing streambanks and appears to be on an improving trend.

AUs with sediment load allocations in the original TMDL will be left in Category 4a of the next integrated report with the existing load allocations.

4.2. Water Quality Improvements

Many watershed improvement projects with diverse funding sources have been completed or are ongoing in the Lemhi River subbasin. Land management agencies have worked together and with private land owners to implement best management practices (BMPs) that restore proper hydrologic functioning to impaired streams and prevent degradation in key salmonid migration corridors.

The Salmon-Challis National Forest has monitored streams for sediment and temperature issues since 1993. This monitoring is summarized in section 2.4.2 and Appendix C of this document. Since publication of the *Lemhi River Watershed TMDL* in 1999, extensive work has been completed on exclosures to exclude cattle from streambanks. In addition to routine maintenance operations, livestock access to streambanks has been limited by exclosures in the following areas:

- The entire upper Mill Creek watershed from the headwaters to the confluence with Little Mill Creek has been fenced to exclude cattle access.
- The Ryegrass Project, in a tributary to Hayden Creek, excluded access on 12 acres.
- In a tributary to Hawley Creek, a stream crossing for cattle access was hardened to establish stable streambanks.
- A 5-acre exclosure around Tyler Springs protects the contributing headwaters to Alder Creek.

The BLM’s Salmon Field Office has administered the Leadville Mill Tailings Project. During 2004, mine tailings were removed from the floodplain, allowing Canyon Creek to access its historic floodplain. Mines were closed and bat gates were installed to protect their habitat. Tailings and repository areas were revegetated with perennial grasses and forbs. This project will stabilize an area that had been a potential source of heavy metal contamination to Canyon Creek during floods. Stabilization also allows restoration of proper hydrological functioning to the stream and improved fish access.

After completion of the *Lemhi River Subbasin Total Maximum Daily Load (TMDL) Agricultural Implementation Plan* (Idaho Soil Conservation Commission 2001), the Lemhi Soil and Water Conservation District and the Idaho Soil and Water Conservation Commission administered multiple projects, including the following:

- 11 animal feeding operations were brought into compliance with total containment of runoff and waste and elimination of cattle using live water as a source of drinking water. In total, these facilities feed 3,175 head of cattle. The total cost of BMP installation on the 11 facilities was $483,972.

- 3 irrigation improvement projects were completed to reduce irrigation-induced erosion and increase irrigation efficiency. These BMPs treated 339 acres at a total cost of $222,053.

These projects are only a summary of BMPs installed using State of Idaho and §319 funds (§319 of the CWA established a grant program that funds nonpoint source pollution management activities). BMPs installed using federal funds—such as Farm Bill programs or from the NRCS—are not included in this summary. Contact the Salmon NRCS office for Farm Bill data on these projects if further information is needed.

The Upper Salmon Basin Watershed Project (USBWP) works with the Lemhi Soil and Water Conservation District and other natural resource agencies to assist landowners with conservation efforts. Tables in Appendix F detail the USBWP watershed improvement projects implemented from 1994 to 2011. In summary, the USBWP has aided in 63 total projects and 89 conservation actions in the Lemhi River watershed, including the following:

- 46.7 cfs of flow restored
- 3.0 stream miles treated
- 31.3 river miles fenced
- 40.5 miles of fence installed
- 1,081.7 acres treated

The USBWP has implemented some key projects that apply to the flow-altered streams that are currently listed in Category 5 of the IR. Although the sole cause of impairment at the time of listing was flow alteration and DEQ is recommending delisting them from Category 5 and listing them in Category 4c, these projects have restored the connections of the tributaries with the Lemhi River.

ID17060204SL045_02 Eighteenmile Creek—Divide Creek to Hawley Creek

Flow alteration is being addressed by the Office of Species Conservation and USBWP. Eighteenmile Creek used to be extensively flow-altered in the early 2000s and joined in a wetland complex at Leadore to form the headwaters of the Lemhi River. However, recent improvements have created a well-defined channel that flows distinctly into the Lemhi River, allowing fish passage. Extensive site assessments, seepage studies and instream flow studies have recently been published, showing the hydrologic and habitat improvements already accomplished in this and other Eighteenmile Creek AUs (Bureau of Reclamation 2011, Idaho Department of Water Resources 2008). Improvements in the flow regime will allow streambank-building events that will improve the erosion and lack of shade and make progress toward meeting the sediment and temperature load allocations.

ID17060204SL050a_03 Hawley Creek—diversion to mouth

Hawley Creek had been historically dewatered in this AU. Figure 10 is from a presentation by the Upper Salmon Basin Watershed Project showing the listed segment, which lies entirely within an alluvial fan as it comes out from the canyon upstream. From this point where the canyon area comes onto the alluvial fan, irrigation withdrawals labeled in the figure as the “HC-1, HC-2, and HC-3 ditches” withdraw the majority of the water from the historic channel. However, recent work by the Upper Salmon Basin Watershed Project have re-established flow in the old channel and re-connected the flow to Eighteenmile Creek and the Lemhi River.

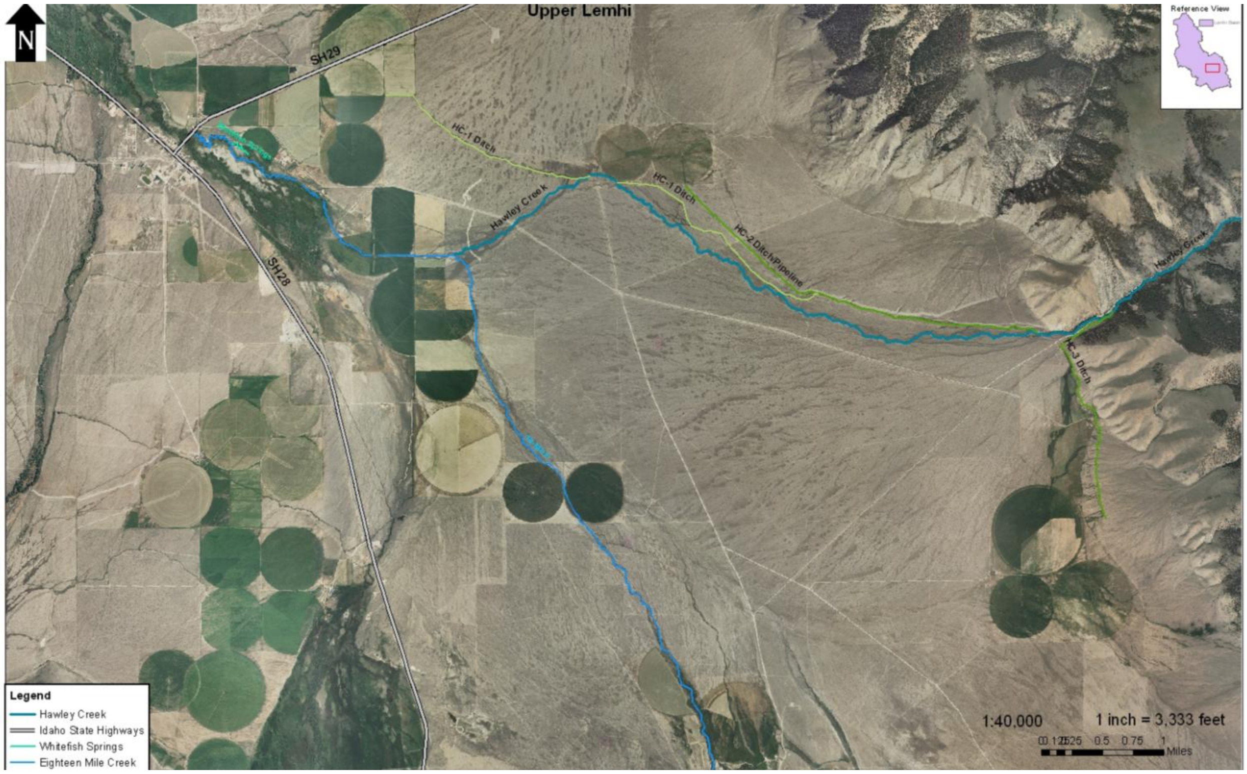

Figure 10. Relationship of Lower Eighteenmile Creek (which includes Hawley Creek, Whitefish Springs).

ID17060204SL026a_02 Mill Creek—diversion to mouth

Figures 11 and 12, from a presentation by the Upper Salmon Basin Watershed Project, show the headgate structure that had been diverting all of the flow of Mill Creek into the L-52 ditch before it was removed and Mill Creek was reconnected to Lemhi River.

Figure 11. Re-establishment of connectivity of Mill Creek to the Lemhi River.

This AU also includes Ferry Creek, which had been entirely dewatered and now has been restored to connectivity with the Lemhi River.

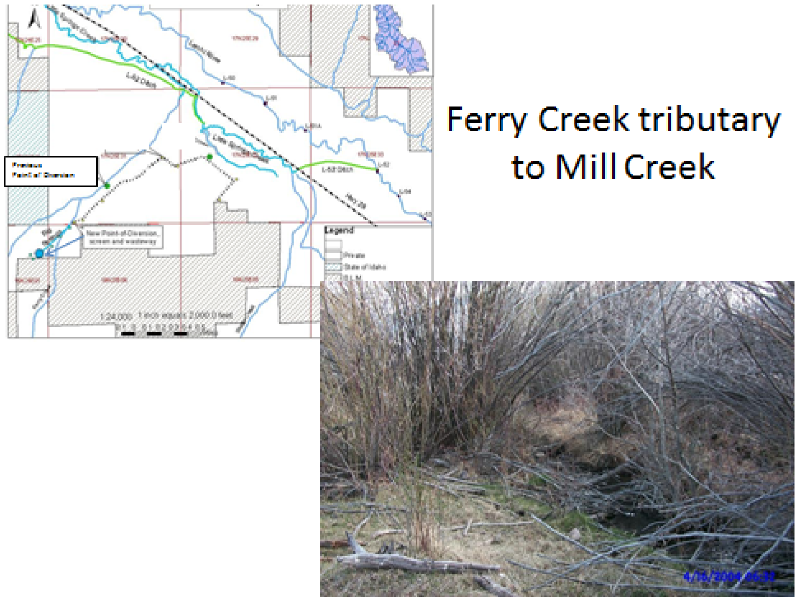

Figure 12. Re-established connectivity of Ferry Creek to Lemhi River.

ID17060204SL026a_02 Walter Creek—source to mouth

As in Mill Creek and Ferry Creek, Walter Creek is currently on the road to reconnection with Lemhi River. Figure 13 shows where a conservation easement was completed in 2010 to allow the stream to re-establish a distinct channel, flowing freely into the Lemhi River.

Figure 13. Conservation easement along Walter Creek.

5. Total Maximum Daily Load(s)

A TMDL prescribes an upper limit (or 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 broken out on their own because they represent a part of the load not subject to control. Because of uncertainties regarding load quantification and the relation of specific loads to attainment of water quality standards, the rules regarding TMDLs (Water quality planning and management, 40 CFR Part 130) require a margin of safety be a part of the TMDL. Practically, the margin of safety and natural background are reductions in the load capacity available for allocation to pollutant sources.

The load capacity can be represented by the following equation:

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

Where:

LC = load capacity

MOS = margin of safety

NB = natural background

LA = load allocation (nonpoint sources)

WLA = wasteload allocation (point sources)

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 determined, the remaining load capacity is allocated among pollutant sources (i.e., load allocation and wasteload allocation). When the breakdown and allocation are complete, the result is a TMDL, which must equal the load capacity.

Another step in a load analysis is the quantification of current pollutant loads by source. This step allows the specification of load reductions as percentages from current conditions, considers equities in load reduction responsibility, and is necessary in order for pollutant trading to occur. 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, determination of critical conditions can be more complicated than it may appear on the surface.

A load is fundamentally a quantity of a 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. 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. However, loads must typically be expressed in terms of daily loading for most pollutants.

5.1. Temperature TMDLs

5.1.1. Instream Water Quality Targets

For the Lemhi River subbasin temperature TMDLs, a PNV approach was utilized. The Idaho water quality standards include a provision (IDAPA 58.01.02.200.09) establishing 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 the natural level of shade and channel width become the target of the TMDL. The instream temperature that results from attaining these conditions is consistent with the water quality standards, even if it exceeds numeric temperature criteria.

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

Potential Natural Vegetation for Temperature TMDLs

There are several important contributors of heat to a stream, including ground water temperature, air temperature, and direct solar radiation (Poole and Berman 2001). Of these, direct solar radiation is the source of heat that is most likely to be controlled or manipulated. 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 affects how closely riparian vegetation grows together and water storage in the alluvial aquifer. Streamside vegetation and channel morphology are the factors influencing shade that are most likely to have been influenced by anthropogenic activities and that can be most readily corrected and addressed by a TMDL.

Depending on how much vertical elevation surrounds the stream, vegetation further away from the riparian corridor can provide shade. However, riparian vegetation provides a substantial amount of stream shading by virtue of its proximity. 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 spot with a Solar Pathfinder or with other optical equipment that operates 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 the stream’s 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 shaded and how much is exposed to direct solar radiation.

PNV along a stream is that riparian plant community that has grown 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. Anything less than PNV results in the stream heating up from anthropogenically created additional solar inputs.

We can estimate PNV shade from models of plant community structure (shade curves for specific riparian plant communities), and we can measure or estimate existing vegetative cover or shade. Comparing the two (i.e., existing versus potential) tells us how much excess solar load the stream is receiving and what potential there is to decrease solar gain. Streams disturbed by wildfire require their own time to recover. Streams that have been disturbed by human activity may require additional restoration above and beyond natural recovery.

Existing shade was estimated for 4 water bodies in the Lemhi River subbasin from visual interpretations of aerial photos. These estimates were partially field verified by measuring shade with a Solar Pathfinder at systematically located points along the streams (see below for methodology). 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. A shade curve shows the relationship between effective shade and stream width. As a stream gets wider, the shade decreases as the 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.

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 analysis, an average of the data from the Pocatello, Idaho, and Helena, Montana, stations was used. The difference between existing and potential solar load, assuming existing load is higher, is the load reduction necessary to bring the stream back into compliance with water quality standards.

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

Pathfinder Methodology

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 spot where the tracing is made. To adequately characterize the effective shade on a reach of stream, 10 traces were taken at systematic 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. Traces were taken following the manufacturer's instructions. Systematic sampling was used because it is easiest to accomplish while still not biasing the location of sampling. For each sampled reach, the sampler started at a unique location, such as 100 meters from a bridge or fence line, and worked upstream or downstream, stopping to take additional traces at fixed intervals (e.g., every 50 meters, 50 paces, etc.). One can also randomly locate points of measurement by generating random numbers to be used as interval distances.

Field staff also measured bankfull widths, took notes, and photographed the stream at several unique locations. Special attention was given to changes in riparian plant communities and plant species composition (for large, dominant, shade-producing species). When possible, field staff also takes densiometer readings at the same location as Solar Pathfinder traces. This data provides the potential to develop relationships between canopy cover and effective shade for a given stream.

Aerial Photo Interpretation

Estimates of shade based on plant type and natural breaks in vegetation density were marked out on 1:100,000 or 1:250,000 hydrographies. Each interval was assigned a single shade 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 stretch of stream is estimated somewhere between 50% and 59%, that section of stream receives a shade class value of 50%. The estimate is based on a general intuitive observation about the kind of vegetation present, its density, and the width of the stream. 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%). Streams with more open canopies where portions of the stream may be visible usually fall into moderate shade-class intervals (40, 50, or 60%).

It is important to note that visual estimates made from aerial photos are strongly influenced by canopy cover. It is not always possible to visualize or anticipate shade characteristics resulting from topography and landform. DEQ assumes that canopy cover and shade are similar based on research conducted by the Oregon Department of Environmental Quality.

The visual estimates of shade in this TMDL were partially field verified with a Solar Pathfinder. The Pathfinder 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). The estimate of shade made from aerial photo interpretation does not always take into account topography or shading that may occur from physical features other than vegetation. 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.

Stream Morphology

Measures of current bankfull width or near stream disturbance zone (NSDZ) width may not reflect widths that were present under PNV. As impacts to streams and riparian areas occur, width-to-depth ratios tend to increase such that streams become wider and shallower. Shadows produced by vegetation cover a lower percentage of the water surface in wider streams, and widened streams can also have less vegetative cover if shoreline vegetation has been eroded away.

The only factor not developed from the aerial photo work described previously is channel width (i.e., NSDZ or bankfull width). Accordingly, this parameter must be estimated from available information. DEQ uses 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 14).

Idaho Regional Curves - Bankfull Width

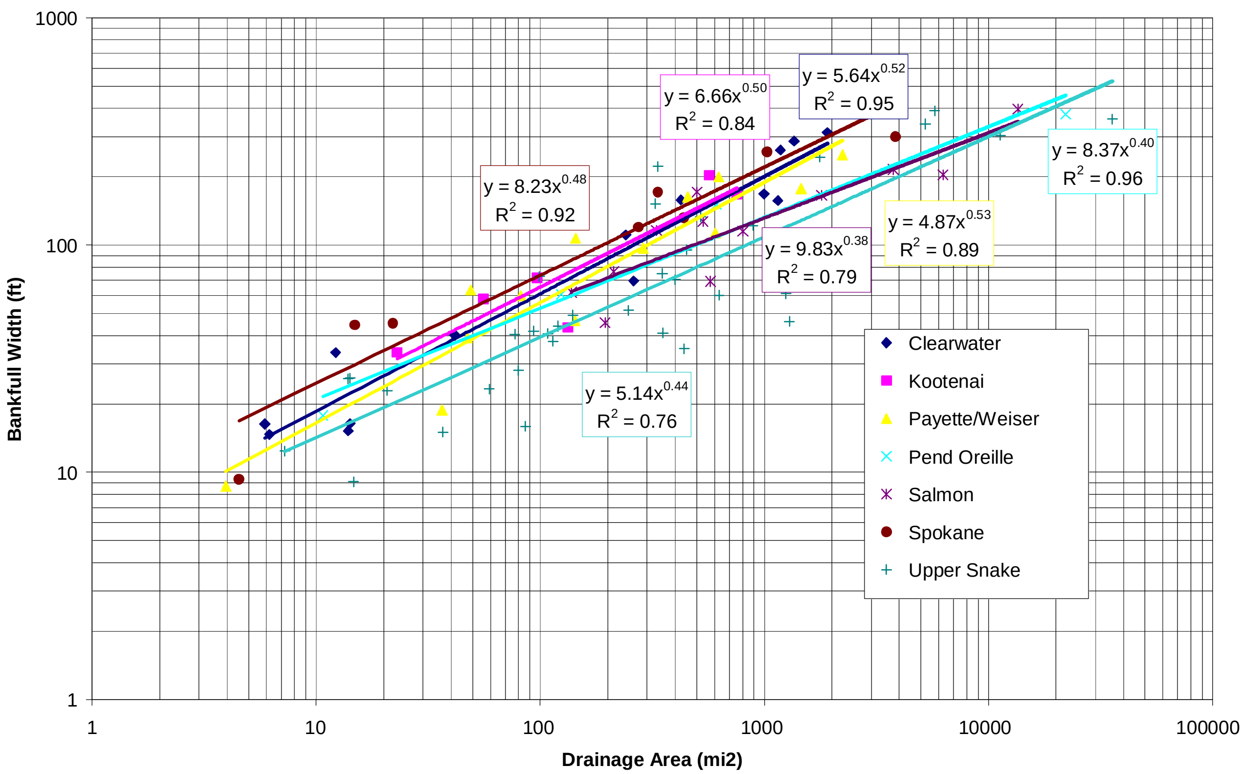

Figure 14. Bankfull width as a function of drainage area.

For each stream evaluated in the load analysis, bankfull width was estimated based on drainage area and the Salmon Basin regional curve from Figure 14. Additionally, existing width is evaluated from available data. If the stream's existing width is wider than predicted by the Salmon Basin curve in Figure 14, then the figure estimate of bankfull width is used in the load analysis for natural width. If existing width is smaller, existing width is used in the load analysis for natural width. In all cases, existing widths were smaller than regional curve predictions (Table 15), so existing data were used for natural widths in these areas.

Table 15. Estimates of bankfull width based on Salmon Basin regional curve (Salmon), Upper Snake regional curve (US) and existing measurements.

Location	area (sq mi)	US (m)	Salm (m)	existing (m)
Lemhi River @ mouth	1261.2	36	45	17
Lemhi River ab Kirtley Cr	1231.9	36	45	14
Lemhi River ab Wimpey Cr	1120.4	34	43	15.4
Lemhi River ab Kenney Cr	1031.3	33	42	
Lemhi River ab Hayden Cr	733.7	29	37	11.8
Lemhi River bl Hwy 29	399	22	29	13.3
Eighteenmile Cr ab Bull Cr	111.5	12	18	4.1
Eighteenmile Cr ab Divide Cr	12.8	5	8	4.1
Little Eightmile Cr @ mouth	19.5	6	9	6
Little Eightmile Cr @ NF boundary	14	5	8	
Little Eightmile Cr ab fork	3.9	3	5	
Sandy Cr @ mouth	13.8	5	8	5
Sandy Cr ab WF	5.6	3	6	
Bohannon Cr @ mouth	21.1	6	10	8
Bohannon Cr ab EF	7.9	4	7	5
Kirtley Cr @ mouth	19.3	6	9	6
Kirtley Cr bl tailings	18.1	6	9	
Kirtley Cr @ NF/EF confluence	5.6	3	6	

**Note*: Existing measurements are estimates from aerial photo interpretation.

5.1.2. Design Conditions

The Lemhi River subbasin is within the Middle Rockies level III Ecoregion (McGrath et al. 2001). Little Eightmile, Sandy, Bohannon and Kirtley Creeks originate near the Western Beaverhead Mountains level IV Ecoregion with Douglas-fir (*Psuedotsuga menziesii*), lodgepole pine (*Pinus contorta*), aspen (*Populus tremuloides*), and subalpine fir (*Abies lasiocarpa*) in bands on north-facing slopes and mountain big sagebrush (*Artemisia tridentata* subspecies *vaseyana*), mountain brush, and grass dominating south-facing slopes. These streams then flow into the Dry Gneissic-Schistose-Volcanic Hills level IV Ecoregion underlain by Quaternary and Tertiary volcanic rock. This area is similar to and slightly wetter than the Dry Intermontane region below it. Along the Lemhi River valley bottom is the Dry Intermontane Sagebrush Valleys level IV Ecoregion known for low precipitation due to high mountain rain-shadow and deep valley fill, both resulting in little surface drainage of water. Eighteenmile Creek originates in the Barren Hills Level IV Ecoregion with open Douglas-fir–lodgepole–subalpine fir forests and aspen groves in narrow elevation bands predominantly on north-facing slopes. Most of Eighteenmile Creek and all of the Lemhi River are within the Dry Intermontane Sagebrush Valleys Ecoregion.

The tributaries to the Lemhi River examined in this TMDL document originate from below the Continental Divide in the Beaverhead Mountains of the Bitterroot Range—the chain of mountains that separates Idaho from Montana. Most tributaries examined begin alternating through conifer forest vegetation types of subalpine fir or Douglas-fir and grass-like (graminoid) meadow vegetation types, although we began examining Kirtley Creek from the north fork/east fork confluence below the forest. Bohannon Creek and Little Eightmile Creek have some small grass-dominated meadows in their headwaters. Eighteenmile Creek has a series of grass meadows both in its headwaters and periodically downstream associated with spring seeps. In fact, Eighteenmile Creek appears to terminate and rejuvenate itself as springs halfway through its drainage. Most tributaries experience aspen and shrub-dominated vegetation types before ultimately entering a deciduous tree vegetation type as they enter the Lemhi River valley. Sandy Creek appears to transition quickly from conifer vegetation to cottonwoods with only minor shrub and aspen components and the portion of Kirtley Creek that was examined was entirely within the deciduous tree type.

The conifer forest vegetation type is likely a mixed species forest with lodgepole pine and Douglas-fir the predominant species and subalpine fir at higher elevations and north-facing slopes. Occasionally at high elevations or associated with spring seeps, grass meadows with a small amount of shrubs will dominate the streamside vegetation. The deciduous tree vegetation type is largely comprised of a cottonwood (*Populus* spp.) tree gallery forest with occasional willow (*Salix* spp.) understory. The shrub vegetation type is presumably mostly willows, although other shrub species such as alder (*Alnus* spp.), dogwood (*Cornus sericea*), and hawthorn (*Crataegus* spp.) may occur, especially at higher elevations.

5.1.3. Target Selection

To determine PNV shade targets for the Lemhi River subbasin, DEQ first examined the potential vegetation type (PVT) concept of the Salmon-Challis National Forest. Bohannon, Sandy, and Eighteenmile Creeks begin in a subalpine fir PVT, either “subalpine fir-moist,” “subalpine fir with whitebark pine,” or “subalpine fir, dry-gentle/steep.” Shade curves developed by DEQ (Shumar and de Varona 2009) for these PVTs were used to derive shade targets on these streams.

Alternating with the subalpine fir PVTs are usually grass- or graminoid-dominated meadows. Another shade curve has been developed by DEQ specifically for graminoid vegetation (Shumar and de Varona 2009). Further downstream, the vegetation type transitions to a “dry Douglas-fir without ponderosa pine” PVT or sometimes “Douglas-fir/lodgepole-steep” PVT. Alternating with the Douglas-fir PVTs is shrub-dominated riparian vegetation best represented by the Geyer’s willow/reedgrass shade curve developed by DEQ for non-forested sites in southern Idaho. Additionally, aspen communities are found intermingled within this zone. Little Eightmile Creek is unique among the streams because it lacks the subalpine fir component but begins with grass, aspen, shrub, and Douglas-fir in alternation. Upper Lemhi River was placed into the Geyer willow/sedge community type which is slightly moister than the Geyer willow/reedgrass type. Eventually, all monitored streams reach a cottonwood gallery forest as they approach the lower Lemhi River valley. We have chosen to use the black cottonwood vegetation type to develop shade targets in this area. All shade curves described here can be found in DEQ’s PNV temperature TMDL procedures manual (Shumar and de Varona 2009).

5.1.4. Monitoring Points

The accuracy of the aerial photo interpretations was partially field verified with a Solar Pathfinder at 6 locations within the subbasin: 2 sites were located on Eighteenmile Creek and the remaining 4 were on the Lemhi River. All sites were used to improve our interpretation of shade on these streams. The results of field verification showed that the original interpretations were slightly off by 2% ± 6.6 (mean ± 95% confidence interval). These data were used to recalibrate our visual estimates and adjust the existing shade levels accordingly. Existing shade values presented in this TMDL document are the result of these adjustments.

Effective shade monitoring can take place on any reach throughout the Lemhi River subbasin and be compared to estimates of existing shade seen on Figures 15, 18, 21, 24, 27, and 30 and in Tables 16–21. Those areas with the largest disparity between existing shade estimates and shade targets should be monitored with Solar Pathfinders to verify the existing shade levels and to determine progress towards meeting shade targets. It is important to note that many existing shade estimates have not been field verified and may require adjustment during the TMDL implementation process. Stream segments for each existing shade interval vary in length depending on 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 towards target levels. Ten equally spaced Solar Pathfinder measurements within that segment averaged together should suffice to determine new shade levels in the future.

5.1.5. Load Capacity

The load capacity for a stream under PNV conditions is essentially the solar loading allowed under the shade targets specified for the reaches within that stream. These loads are determined by multiplying the solar load received by a flat-plate collector (under full sun) for a given period of time by the percent of 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), then 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 NREL weather stations in Pocatello, Idaho, and Helena, Montana, and averaged the two values. The solar loads used in this TMDL are spring/summer averages (i.e., an average load for the 6-month period from April through September). These months coincide with the time of year when stream temperatures are increasing and when deciduous vegetation is in leaf.

Tables 16–21 and Figures 16, 19, 22, 25, 28, and 31 show the PNV shade targets and their corresponding potential summer load (in kilowatt-hours per square meter per day [kWh/m^2/day] and kilowatt-hours per day [kWh/day]) that serve as the load capacities for the streams. Existing and potential 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.

The effective existing shade calculations are based on the 6-month period from April through September. This time period coincides with the critical time period when temperatures affect beneficial uses such as spring and fall salmonid spawning and when cold water aquatic life criteria may be exceeded. 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. Thus, solar loading in these streams is evaluated from spring (April) to early fall (September).

Load capacities for the various streams examined vary from 5.1 million kWh/day for the Lemhi River (Table 19) to 12,000 kWh/day on Sandy Creek (Table 21).

5.1.6. Estimates of Existing Pollutant Loads

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

Existing loads in this temperature TMDL come from estimates of existing shade as determined from aerial photo interpretations. 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 stations. Existing shade data are presented in Tables 16–21 and Figures 15, 18, 21, 24, 27, and 30. Like load capacities (target loads), existing loads in Tables 16–21 are presented on an area basis (kWh/m^2/day) and as a total load (kWh/day), which is summed at the bottom of the applicable columns.

The difference between potential load and existing load is also summed for the entire table. Should existing load exceed potential load, this difference becomes the excess load, which is discussed in the load allocation section and becomes the basis for calculating lack of shade (Figures 17, 20, 23, 26, 29, and 32). The percent reduction shown in the right-hand columns of each table represents how much total excess load exists in relation to total existing load.

Existing loads varied from 7.6 million kWh/day on the Lemhi River (Table 19) to 59,000 kWh/day on Sandy Creek (Table 21).

Table 16. Existing and potential solar loads for Bohannon Creek.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
064b_02	Bohannon Creek	1	120	Subalpine fir/moist	95%	0.30	3	400	100	80%	1.19	3	400	500	400	-15%
064b_02	Bohannon Creek	2	200	Graminoid meadow	21%	4.69	3	600	3,000	20%	4.75	3	600	3,000	0	-1%
064b_02	Bohannon Creek	3	290	DF/lodgepole-steep	98%	0.12	3	900	100	90%	0.59	3	900	500	400	-8%
064b_02	Bohannon Creek	4	600	Graminoid meadow	21%	4.69	3	2,000	9,000	40%	3.56	3	2,000	7,000	(2,000)	0%
064b_02	Bohannon Creek	5	170	Graminoid meadow	16%	4.99	4	700	3,000	10%	5.35	4	700	4,000	1,000	-6%
064b_02	Bohannon Creek	6	830	DF/lodgepole-steep	97%	0.18	4	3,000	500	90%	0.59	4	3,000	2,000	2,000	-7%
064b_02	Bohannon Creek	7	140	Geyers/reedgrass	50%	2.97	4	600	2,000	50%	2.97	4	600	2,000	0	0%
064b_02	Bohannon Creek	8	220	dry Doug Fir w/o Pp	84%	0.95	4	900	900	90%	0.59	4	900	500	(400)	0%
064b_02	Bohannon Creek	9	110	Geyers/reedgrass	50%	2.97	4	400	1,000	50%	2.97	4	400	1,000	0	0%
064b_02	Bohannon Creek	10	560	aspen/conifer	96%	0.24	4	2,000	500	80%	1.19	4	2,000	2,000	2,000	-16%
064b_02	Bohannon Creek	11	400	Geyers/reedgrass	50%	2.97	4	2,000	6,000	40%	3.56	4	2,000	7,000	1,000	-10%
064b_02	Bohannon Creek	12	460	aspen/conifer	96%	0.24	4	2,000	500	90%	0.59	4	2,000	1,000	500	-6%
064b_02	Bohannon Creek	13	490	aspen/conifer	94%	0.36	5	2,000	700	90%	0.59	5	2,000	1,000	300	-4%
064b_02	Bohannon Creek	14	1370	aspen/conifer	94%	0.36	5	7,000	2,000	80%	1.19	5	7,000	8,000	6,000	-14%
064b_02	Bohannon Creek	15	170	black cottonwood	94%	0.36	5	900	300	40%	3.56	5	900	3,000	3,000	-54%
064b_02	Bohannon Creek	16	850	black cottonwood	94%	0.36	5	4,000	1,000	0%	5.94	5	4,000	20,000	20,000	-94%
064b_02	Bohannon Creek	17	1250	black cottonwood	92%	0.48	6	8,000	4,000	60%	2.38	6	8,000	20,000	20,000	-32%
064b_02	Bohannon Creek	18	580	black cottonwood	92%	0.48	6	3,000	1,000	80%	1.19	6	3,000	4,000	3,000	-12%
064b_02	Bohannon Creek	19	1040	black cottonwood	92%	0.48	6	6,000	3,000	40%	3.56	6	6,000	20,000	20,000	-52%
064b_02	Bohannon Creek	20	190	black cottonwood	92%	0.48	6	1,000	500	50%	2.97	6	1,000	3,000	3,000	-42%
064b_02	Bohannon Creek	21	220	black cottonwood	92%	0.48	6	1,000	500	80%	1.19	6	1,000	1,000	500	-12%
064b_02	Bohannon Creek	22	2520	black cottonwood	89%	0.65	7	20,000	10,000	70%	1.78	7	20,000	40,000	30,000	-19%
064b_02	Bohannon Creek	23	910	black cottonwood	89%	0.65	7	6,000	4,000	60%	2.38	7	6,000	10,000	6,000	-29%
064b_02	Bohannon Creek	24	370	black cottonwood	86%	0.83	8	3,000	2,000	50%	2.97	8	3,000	9,000	7,000	-36%
064a_02	Bohannon Creek	25	920	black cottonwood	86%	0.83	8	7,000	6,000	70%	1.78	8	7,000	10,000	4,000	-16%
064a_02	Bohannon Creek	26	360	black cottonwood	86%	0.83	8	3,000	2,000	60%	2.38	8	3,000	7,000	5,000	-26%
064a_02	Bohannon Creek	27	250	black cottonwood	86%	0.83	8	2,000	2,000	40%	3.56	8	2,000	7,000	5,000	-46%
064a_02	Bohannon Creek	28	740	black cottonwood	86%	0.83	8	6,000	5,000	60%	2.38	8	6,000	10,000	5,000	-26%
							Totals		71,000					200,000	140,000	

Table 17. Existing and potential solar loads for Eighteenmile Creek.

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
045_02	Eighteenmile Cr	1	890	graminoid meadow	55%	2.67	1	900	2,000	50%	2.97	1	900	3,000	1,000	-5%
045_02	Eighteenmile Cr	2	570	subalpine fir w/WBP	100%	0.00	1	600	0	80%	1.19	1	600	700	700	-20%
045_02	Eighteenmile Cr	3	610	subalpine fir dry-gentle	100%	0.00	1	600	0	80%	1.19	1	600	700	700	-20%
045_02	Eighteenmile Cr	4	330	graminoid meadow	55%	2.67	1	300	800	50%	2.97	1	300	900	100	-5%
045_02	Eighteenmile Cr	5	980	subalpine fir dry-gentle	100%	0.00	1	1,000	0	70%	1.78	1	1,000	2,000	2,000	-30%
045_02	Eighteenmile Cr	6	470	grass/sage	65%	2.08	1	500	1,000	50%	2.97	1	500	1,000	0	-15%
045_02	Eighteenmile Cr	7	640	grass/sage	39%	3.62	2	1,000	4,000	30%	4.16	2	1,000	4,000	0	-9%
045_02	Eighteenmile Cr	8	410	dry DF w/o Ppine	94%	0.36	2	800	300	80%	1.19	2	800	1,000	700	-14%
045_02	Eighteenmile Cr	9	220	Geyers/reedgrass	79%	1.25	2	400	500	60%	2.38	2	400	1,000	500	-19%
045_02	Eighteenmile Cr	10	880	aspen	99%	0.06	2	2,000	100	70%	1.78	2	2,000	4,000	4,000	-29%
045_02	Eighteenmile Cr	11	1240	Geyers/reedgrass	79%	1.25	2	2,000	2,000	60%	2.38	2	2,000	5,000	3,000	-19%
045_02	Eighteenmile Cr	12	950	Geyers/reedgrass	79%	1.25	2	2,000	2,000	70%	1.78	2	2,000	4,000	2,000	-9%
045_02	Eighteenmile Cr	13	950	Geyers/reedgrass	79%	1.25	2	2,000	2,000	60%	2.38	2	2,000	5,000	3,000	-19%
045_02	Eighteenmile Cr	14	630	Geyers/reedgrass	61%	2.32	3	2,000	5,000	10%	5.35	3	2,000	10,000	5,000	-51%
045_02	Eighteenmile Cr	15	750	Geyers/reedgrass	61%	2.32	3	2,000	5,000	40%	3.56	3	2,000	7,000	2,000	-21%
045_02	Eighteenmile Cr	16	160	Geyers/reedgrass	61%	2.32	3	500	1,000	10%	5.35	3	500	3,000	2,000	-51%
045_02	Eighteenmile Cr	17	1170	Geyers/reedgrass	61%	2.32	3	4,000	9,000	50%	2.97	3	4,000	10,000	1,000	-11%
045_02	Eighteenmile Cr	18	320	Geyers/reedgrass	61%	2.32	3	1,000	2,000	0%	5.94	3	1,000	6,000	4,000	-61%
045_02	Eighteenmile Cr	19	2100	Geyers/reedgrass	61%	2.32	3	6,000	10,000	40%	3.56	3	6,000	20,000	10,000	-21%
045_02	Eighteenmile Cr	20	630	Geyers/reedgrass	50%	2.97	4	3,000	9,000	40%	3.56	4	3,000	10,000	1,000	-10%
045_02	Eighteenmile Cr	21	270	grass/sage	21%	4.69	4	1,000	5,000	0%	5.94	4	1,000	6,000	1,000	-21%
045_02	Eighteenmile Cr	22	570	grass/sage	21%	4.69	4	2,000	9,000	10%	5.35	4	2,000	10,000	1,000	-11%
045_02	Eighteenmile Cr	23	1900	grass/sage	21%	4.69	4	8,000	40,000	0%	5.94	4	8,000	50,000	10,000	-21%
045_02	Eighteenmile Cr	24	1560	Geyers/reedgrass	50%	2.97	4	6,000	20,000	40%	3.56	4	6,000	20,000	0	-10%
045_02	Eighteenmile Cr	25	700	grass/sage	17%	4.93	5	4,000	20,000	0%	5.94	5	4,000	20,000	0	-17%
043_03	Eighteenmile Cr	26	400	grass/sage	17%	4.93	5	2,000	10,000	10%	5.35	5	2,000	10,000	0	-7%
043_03	Eighteenmile Cr	27	510	Geyers/reedgrass	43%	3.39	5	3,000	10,000	20%	4.75	5	3,000	10,000	0	-23%
043_03	Eighteenmile Cr	28	450	Geyers/reedgrass	43%	3.39	5	2,000	7,000	30%	4.16	5	2,000	8,000	1,000	-13%
043_03	Eighteenmile Cr	29	770	Geyers/reedgrass	43%	3.39	5	4,000	10,000	20%	4.75	5	4,000	20,000	10,000	-23%
043_03	Eighteenmile Cr	30	560	Geyers/reedgrass	43%	3.39	5	3,000	10,000	10%	5.35	5	3,000	20,000	10,000	-33%
043_03	Eighteenmile Cr	31	770	Geyers/reedgrass	43%	3.39	5	4,000	10,000	20%	4.75	5	4,000	20,000	10,000	-23%
043_03	Eighteenmile Cr	32	320	Geyers/reedgrass	43%	3.39	5	2,000	7,000	10%	5.35	5	2,000	10,000	3,000	-33%
043_03	Eighteenmile Cr	33	820	Geyers/reedgrass	43%	3.39	5	4,000	10,000	10%	5.35	5	4,000	20,000	10,000	-33%
043_03	Eighteenmile Cr	34	820	Geyers/reedgrass	43%	3.39	5	4,000	10,000	10%	5.35	5	4,000	20,000	10,000	-33%
043_03	Eighteenmile Cr	35	1810	Geyers/reedgrass	43%	3.39	5	9,000	30,000	10%	5.35	5	9,000	50,000	20,000	-33%
043_03	Eighteenmile Cr	36	910	Geyers/reedgrass	43%	3.39	5	5,000	20,000	30%	4.16	5	5,000	20,000	0	-13%
043_03	Eighteenmile Cr	37	680	Geyers/reedgrass	43%	3.39	5	3,000	10,000	10%	5.35	5	3,000	20,000	10,000	-33%
043_03	Eighteenmile Cr	38	420	Geyers/reedgrass	43%	3.39	5	2,000	7,000	10%	5.35	5	2,000	10,000	3,000	-33%
043_03	Eighteenmile Cr	39	450	Geyers/reedgrass	43%	3.39	5	2,000	7,000	30%	4.16	5	2,000	8,000	1,000	-13%
043_03	Eighteenmile Cr	40	130	Geyers/reedgrass	43%	3.39	5	700	2,000	10%	5.35	5	700	4,000	2,000	-33%
042_03	Eighteenmile Cr	41	160	Geyers/reedgrass	43%	3.39	5	800	3,000	10%	5.35	5	800	4,000	1,000	-33%
042_03	Eighteenmile Cr	42	410	Geyers/reedgrass	43%	3.39	5	2,000	7,000	20%	4.75	5	2,000	10,000	3,000	-23%
042_03	Eighteenmile Cr	43	440	Geyers/reedgrass	43%	3.39	5	2,000	7,000	10%	5.35	5	2,000	10,000	3,000	-33%
042_03	Eighteenmile Cr	44	1790	Geyers/reedgrass	43%	3.39	5	9,000	30,000	20%	4.75	5	9,000	40,000	10,000	-23%
042_03	Eighteenmile Cr	45	230	Geyers/reedgrass	43%	3.39	5	1,000	3,000	10%	5.35	5	1,000	5,000	2,000	-33%
042_03	Eighteenmile Cr	46	1400	Geyers/reedgrass	43%	3.39	5	7,000	20,000	20%	4.75	5	7,000	30,000	10,000	-23%
042_03	Eighteenmile Cr	47	430	Geyers/reedgrass	43%	3.39	5	2,000	7,000	10%	5.35	5	2,000	10,000	3,000	-33%
042_03	Eighteenmile Cr	48	6530	grass/sage	17%	4.93	5	30,000	100,000	0%	5.94	5	30,000	200,000	100,000	-17%
041_04	Eighteenmile Cr	49	1500	grass/sage	17%	4.93	5	8,000	40,000	0%	5.94	5	8,000	50,000	10,000	-17%
041_04	Eighteenmile Cr	50	490	Geyers/reedgrass	43%	3.39	5	2,000	7,000	20%	4.75	5	2,000	10,000	3,000	-23%
041_04	Eighteenmile Cr	51	380	Geyers/reedgrass	43%	3.39	5	2,000	7,000	10%	5.35	5	2,000	10,000	3,000	-33%
041_04	Eighteenmile Cr	52	1240	Geyers/reedgrass	43%	3.39	5	6,000	20,000	0%	5.94	5	6,000	40,000	20,000	-43%
							Totals		560,000					870,000	310,000	

Table 18. Existing and potential solar loads for Kirtley Creek.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
066b_02	Kirtley Creek	1	130	black cottonwood	96%	0.24	3	400	100	90%	0.59	3	400	200	100	-6%
066b_02	Kirtley Creek	2	960	black cottonwood	96%	0.24	3	3,000	700	80%	1.19	3	3,000	4,000	3,000	-16%
066b_02	Kirtley Creek	3	30	black cottonwood	96%	0.24	3	90	20	0%	5.94	3	90	500	500	-96%
066b_02	Kirtley Creek	4	150	black cottonwood	96%	0.24	3	500	100	80%	1.19	3	500	600	500	-16%
066b_02	Kirtley Creek	5	740	black cottonwood	96%	0.24	3	2,000	500	70%	1.78	3	2,000	4,000	4,000	-26%
066b_02	Kirtley Creek	6	310	black cottonwood	96%	0.24	3	900	200	90%	0.59	3	900	500	300	-6%
066b_02	Kirtley Creek	7	530	black cottonwood	96%	0.24	4	2,000	500	20%	4.75	4	2,000	10,000	10,000	-76%
066b_02	Kirtley Creek	8	910	black cottonwood	96%	0.24	4	4,000	1,000	70%	1.78	4	4,000	7,000	6,000	-26%
066b_02	Kirtley Creek	9	250	black cottonwood	96%	0.24	4	1,000	200	40%	3.56	4	1,000	4,000	4,000	-56%
066b_02	Kirtley Creek	10	550	black cottonwood	96%	0.24	4	2,000	500	80%	1.19	4	2,000	2,000	2,000	-16%
066b_02	Kirtley Creek	11	280	black cottonwood	96%	0.24	4	1,000	200	40%	3.56	4	1,000	4,000	4,000	-56%
066b_02	Kirtley Creek	12	420	black cottonwood	94%	0.36	5	2,000	700	70%	1.78	5	2,000	4,000	3,000	-24%
066b_02	Kirtley Creek	13	110	black cottonwood	94%	0.36	5	600	200	20%	4.75	5	600	3,000	3,000	-74%
066b_02	Kirtley Creek	14	340	black cottonwood	94%	0.36	5	2,000	700	60%	2.38	5	2,000	5,000	4,000	-34%
066b_02	Kirtley Creek	15	310	black cottonwood	94%	0.36	5	2,000	700	80%	1.19	5	2,000	2,000	1,000	-14%
066b_02	Kirtley Creek	16	140	black cottonwood	94%	0.36	5	700	200	30%	4.16	5	700	3,000	3,000	-64%
066b_02	Kirtley Creek	17	490	black cottonwood	94%	0.36	5	2,000	700	70%	1.78	5	2,000	4,000	3,000	-24%
066b_02	Kirtley Creek	18	250	black cottonwood	94%	0.36	5	1,000	400	40%	3.56	5	1,000	4,000	4,000	-54%
066b_02	Kirtley Creek	19	300	black cottonwood	94%	0.36	5	2,000	700	90%	0.59	5	2,000	1,000	300	-4%
066b_02	Kirtley Creek	20	1020	black cottonwood	92%	0.48	6	6,000	3,000	70%	1.78	6	6,000	10,000	7,000	-22%
066b_02	Kirtley Creek	21	550	black cottonwood	92%	0.48	6	3,000	1,000	40%	3.56	6	3,000	10,000	9,000	-52%
066a_03	Kirtley Creek	1	330	black cottonwood	92%	0.48	6	2,000	1,000	80%	1.19	6	2,000	2,000	1,000	-12%
066a_03	Kirtley Creek	2	530	black cottonwood	92%	0.48	6	3,000	1,000	50%	2.97	6	3,000	9,000	8,000	-42%
066a_03	Kirtley Creek	3	1260	black cottonwood	92%	0.48	6	8,000	4,000	30%	4.16	6	8,000	30,000	30,000	-62%
066a_03	Kirtley Creek	4	710	black cottonwood	92%	0.48	6	4,000	2,000	10%	5.35	6	4,000	20,000	20,000	-82%
066a_03	Kirtley Creek	5	270	black cottonwood	92%	0.48	6	2,000	1,000	50%	2.97	6	2,000	6,000	5,000	-42%
066a_03	Kirtley Creek	6	130	black cottonwood	92%	0.48	6	800	400	10%	5.35	6	800	4,000	4,000	-82%
066a_03	Kirtley Creek	7	150	black cottonwood	92%	0.48	6	900	400	80%	1.19	6	900	1,000	600	-12%
066a_03	Kirtley Creek	8	130	black cottonwood	92%	0.48	6	800	400	60%	2.38	6	800	2,000	2,000	-32%
066a_03	Kirtley Creek	9	160	black cottonwood	92%	0.48	6	1,000	500	10%	5.35	6	1,000	5,000	5,000	-82%
							Totals		23,000					160,000	150,000	

Table 19. Existing and potential solar loads for the Lemhi River.

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
030_04	Lemhi River	1	50	Geyer willow	21%	4.69	13	650	3,100	0%	5.94	13	650	3,900	800	-21%
030_04	Lemhi River	2	380	Geyer willow	21%	4.69	13	4,900	23,000	20%	4.75	13	4,900	23,000	0	-1%
030_04	Lemhi River	3	560	Geyer willow	21%	4.69	13	7,300	34,000	0%	5.94	13	7,300	43,000	9,000	-21%
030_04	Lemhi River	4	210	Geyer willow	21%	4.69	13	2,700	13,000	10%	5.35	13	2,700	14,000	1,000	-11%
030_04	Lemhi River	5	160	Geyer willow	21%	4.69	13	2,100	9,900	0%	5.94	13	2,100	12,000	2,100	-21%
030_04	Lemhi River	6	390	Geyer willow	21%	4.69	13	5,100	24,000	10%	5.35	13	5,100	27,000	3,000	-11%
030_05	Lemhi River	7	360	Geyer willow	21%	4.69	13	4,700	22,000	10%	5.35	13	4,700	25,000	3,000	-11%
030_05	Lemhi River	8	1230	Geyer willow	21%	4.69	13	16,000	75,000	0%	5.94	13	16,000	95,000	20,000	-21%
030_05	Lemhi River	9	2590	Geyer willow	21%	4.69	13	34,000	160,000	20%	4.75	13	34,000	160,000	0	-1%
030_05	Lemhi River	10	5490	Geyer willow	21%	4.69	13	71,000	330,000	10%	5.35	13	71,000	380,000	50,000	-11%
030_05	Lemhi River	11	3360	Geyer willow	21%	4.69	13	44,000	210,000	0%	5.94	13	44,000	260,000	50,000	-21%
030_05	Lemhi River	12	320	Geyer willow	21%	4.69	13	4,200	20,000	20%	4.75	13	4,200	20,000	0	-1%
030_05	Lemhi River	13	480	Geyer willow	21%	4.69	13	6,200	29,000	0%	5.94	13	6,200	37,000	8,000	-21%
030_05	Lemhi River	14	320	Geyer willow	21%	4.69	13	4,200	20,000	20%	4.75	13	4,200	20,000	0	-1%
025_05	Lemhi River	15	870	Geyer willow	21%	4.69	13	11,000	52,000	10%	5.35	13	11,000	59,000	7,000	-11%
025_05	Lemhi River	16	1090	Geyer willow	21%	4.69	13	14,000	66,000	0%	5.94	13	14,000	83,000	17,000	-21%
025_05	Lemhi River	17	100	Geyer willow	21%	4.69	13	1,300	6,100	20%	4.75	13	1,300	6,200	100	-1%
025_05	Lemhi River	18	440	Geyer willow	21%	4.69	13	5,700	27,000	0%	5.94	13	5,700	34,000	7,000	-21%
025_05	Lemhi River	19	260	Geyer willow	21%	4.69	13	3,400	16,000	20%	4.75	13	3,400	16,000	0	-1%
025_05	Lemhi River	20	540	Geyer willow	21%	4.69	13	7,000	33,000	0%	5.94	13	7,000	42,000	9,000	-21%
025_05	Lemhi River	21	850	Geyer willow	21%	4.69	13	11,000	52,000	30%	4.16	13	11,000	46,000	(6,000)	0%
025_05	Lemhi River	22	1080	Geyer willow	21%	4.69	13	14,000	66,000	10%	5.35	13	14,000	75,000	9,000	-11%
025_05	Lemhi River	23	1160	Geyer willow	21%	4.69	13	15,000	70,000	20%	4.75	13	15,000	71,000	1,000	-1%
025_05	Lemhi River	24	430	Geyer willow	21%	4.69	13	5,600	26,000	10%	5.35	13	5,600	30,000	4,000	-11%
025_05	Lemhi River	25	530	Geyer willow	21%	4.69	13	6,900	32,000	0%	5.94	13	6,900	41,000	9,000	-21%
025_05	Lemhi River	26	790	Geyer willow	21%	4.69	13	10,000	47,000	20%	4.75	13	10,000	48,000	1,000	-1%
025_05	Lemhi River	27	760	Geyer willow	19%	4.81	14	11,000	53,000	10%	5.35	14	11,000	59,000	6,000	-9%
025_05	Lemhi River	28	440	Geyer willow	19%	4.81	14	6,200	30,000	30%	4.16	14	6,200	26,000	(4,000)	0%
025_05	Lemhi River	29	80	Geyer willow	19%	4.81	14	1,100	5,300	10%	5.35	14	1,100	5,900	600	-9%
024_05	Lemhi River	30	350	Geyer willow	19%	4.81	14	4,900	24,000	10%	5.35	14	4,900	26,000	2,000	-9%
024_05	Lemhi River	31	280	Geyer willow	19%	4.81	14	3,900	19,000	40%	3.56	14	3,900	14,000	(5,000)	0%
024_05	Lemhi River	32	1050	Geyer willow	19%	4.81	14	15,000	72,000	20%	4.75	14	15,000	71,000	(1,000)	0%
024_05	Lemhi River	33	270	Geyer willow	19%	4.81	14	3,800	18,000	0%	5.94	14	3,800	23,000	5,000	-19%
024_05	Lemhi River	34	1410	Geyer willow	19%	4.81	14	20,000	96,000	10%	5.35	14	20,000	110,000	14,000	-9%
024_05	Lemhi River	35	590	Geyer willow	19%	4.81	14	8,300	40,000	0%	5.94	14	8,300	49,000	9,000	-19%
024_05	Lemhi River	36	760	Geyer willow	19%	4.81	14	11,000	53,000	30%	4.16	14	11,000	46,000	(7,000)	0%
024_05	Lemhi River	37	850	Geyer willow	19%	4.81	14	12,000	58,000	20%	4.75	14	12,000	57,000	(1,000)	0%
024_05	Lemhi River	38	130	Geyer willow	19%	4.81	14	1,800	8,700	0%	5.94	14	1,800	11,000	2,300	-19%
024_05	Lemhi River	39	410	Geyer willow	19%	4.81	14	5,700	27,000	20%	4.75	14	5,700	27,000	0	0%
024_05	Lemhi River	40	690	Geyer willow	19%	4.81	14	9,700	47,000	0%	5.94	14	9,700	58,000	11,000	-19%
024_05	Lemhi River	41	260	Geyer willow	19%	4.81	14	3,600	17,000	10%	5.35	14	3,600	19,000	2,000	-9%
024_05	Lemhi River	42	360	Geyer willow	19%	4.81	14	5,000	24,000	0%	5.94	14	5,000	30,000	6,000	-19%
024_05	Lemhi River	43	190	Geyer willow	19%	4.81	14	2,700	13,000	10%	5.35	14	2,700	14,000	1,000	-9%
024_05	Lemhi River	44	290	Geyer willow	19%	4.81	14	4,100	20,000	0%	5.94	14	4,100	24,000	4,000	-19%
024_05	Lemhi River	45	1650	Geyer willow	19%	4.81	14	23,000	110,000	10%	5.35	14	23,000	120,000	10,000	-9%
024_05	Lemhi River	46	400	Geyer willow	19%	4.81	14	5,600	27,000	0%	5.94	14	5,600	33,000	6,000	-19%
024_05	Lemhi River	47	890	Geyer willow	19%	4.81	14	12,000	58,000	10%	5.35	14	12,000	64,000	6,000	-9%
024_05	Lemhi River	48	900	Geyer willow	19%	4.81	14	13,000	63,000	20%	4.75	14	13,000	62,000	(1,000)	0%
024_05	Lemhi River	49	250	Geyer willow	19%	4.81	14	3,500	17,000	0%	5.94	14	3,500	21,000	4,000	-19%
024_05	Lemhi River	50	90	Geyer willow	19%	4.81	14	1,300	6,300	10%	5.35	14	1,300	6,900	600	-9%
024_05	Lemhi River	51	310	Geyer willow	19%	4.81	14	4,300	21,000	0%	5.94	14	4,300	26,000	5,000	-19%
024_05	Lemhi River	52	910	Geyer willow	19%	4.81	14	13,000	63,000	10%	5.35	14	13,000	69,000	6,000	-9%
024_05	Lemhi River	53	450	Geyer willow	19%	4.81	14	6,300	30,000	20%	4.75	14	6,300	30,000	0	0%
024_05	Lemhi River	54	940	Geyer willow	19%	4.81	14	13,000	63,000	10%	5.35	14	13,000	69,000	6,000	-9%
024_05	Lemhi River	55	300	Geyer willow	19%	4.81	14	4,200	20,000	20%	4.75	14	4,200	20,000	0	0%

Table 19 (cont.). Existing and potential solar loads for the Lemhi River.

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
005_06	Lemhi River	56	790	blk cottonwood	56%	2.61	15	12,000	31,000	20%	4.75	14	11,000	52,000	21,000	-36%
005_06	Lemhi River	57	180	blk cottonwood	56%	2.61	15	2,700	7,100	10%	5.35	14	2,500	13,000	5,900	-46%
005_06	Lemhi River	58	710	blk cottonwood	56%	2.61	15	11,000	29,000	0%	5.94	14	9,900	59,000	30,000	-56%
005_06	Lemhi River	59	140	blk cottonwood	56%	2.61	15	2,100	5,500	10%	5.35	14	2,000	11,000	5,500	-46%
005_06	Lemhi River	60	310	blk cottonwood	56%	2.61	15	4,700	12,000	20%	4.75	14	4,300	20,000	8,000	-36%
005_06	Lemhi River	61	3720	blk cottonwood	56%	2.61	15	56,000	150,000	10%	5.35	14	52,000	280,000	130,000	-46%
005_06	Lemhi River	62	2230	blk cottonwood	56%	2.61	15	33,000	86,000	20%	4.75	15	33,000	160,000	74,000	-36%
005_06	Lemhi River	63	3870	blk cottonwood	56%	2.61	15	58,000	150,000	10%	5.35	15	58,000	310,000	160,000	-46%
005_06	Lemhi River	64	620	blk cottonwood	56%	2.61	15	9,300	24,000	0%	5.94	15	9,300	55,000	31,000	-56%
005_06	Lemhi River	65	450	blk cottonwood	56%	2.61	15	6,800	18,000	10%	5.35	15	6,800	36,000	18,000	-46%
005_06	Lemhi River	66	640	blk cottonwood	56%	2.61	15	9,600	25,000	20%	4.75	15	9,600	46,000	21,000	-36%
005_06	Lemhi River	67	560	blk cottonwood	56%	2.61	15	8,400	22,000	10%	5.35	15	8,400	45,000	23,000	-46%
005_06	Lemhi River	68	630	blk cottonwood	56%	2.61	15	9,500	25,000	0%	5.94	15	9,500	56,000	31,000	-56%
005_06	Lemhi River	69	460	blk cottonwood	56%	2.61	15	6,900	18,000	30%	4.16	15	6,900	29,000	11,000	-26%
005_06	Lemhi River	70	230	blk cottonwood	56%	2.61	15	3,500	9,100	0%	5.94	15	3,500	21,000	12,000	-56%
005_06	Lemhi River	71	320	blk cottonwood	56%	2.61	15	4,800	13,000	10%	5.35	15	4,800	26,000	13,000	-46%
005_06	Lemhi River	72	280	blk cottonwood	56%	2.61	15	4,200	11,000	0%	5.94	15	4,200	25,000	14,000	-56%
005_06	Lemhi River	73	960	blk cottonwood	56%	2.61	15	14,000	37,000	10%	5.35	15	14,000	75,000	38,000	-46%
005_06	Lemhi River	74	2650	blk cottonwood	56%	2.61	15	40,000	100,000	0%	5.94	15	40,000	240,000	140,000	-56%
005_06	Lemhi River	75	580	blk cottonwood	56%	2.61	15	8,700	23,000	10%	5.35	15	8,700	47,000	24,000	-46%
004_06	west channel	76	3830	blk cottonwood	56%	2.61	15	57,000	150,000	10%	5.35	15	57,000	300,000	150,000	-46%
004_06	Lemhi River	77	610	blk cottonwood	56%	2.61	15	9,200	24,000	0%	5.94	15	9,200	55,000	31,000	-56%
003a_06	Lemhi River	78	1000	blk cottonwood	56%	2.61	15	15,000	39,000	0%	5.94	15	15,000	89,000	50,000	-56%
003a_06	Lemhi River	79	3680	blk cottonwood	56%	2.61	15	55,000	140,000	10%	5.35	15	55,000	290,000	150,000	-46%
003a_06	Lemhi River	80	650	blk cottonwood	56%	2.61	15	9,800	26,000	0%	5.94	15	9,800	58,000	32,000	-56%
003a_06	Lemhi River	81	420	blk cottonwood	56%	2.61	15	6,300	16,000	10%	5.35	15	6,300	34,000	18,000	-46%
001_06	east channel	82	380	blk cottonwood	92%	0.48	6	2,000	1,000	80%	1.19	6	2,000	2,000	1,000	-12%
001_06	Lemhi River	83	220	blk cottonwood	92%	0.48	6	1,000	500	50%	2.97	6	1,000	3,000	3,000	-42%
001_06	Lemhi River	84	140	blk cottonwood	92%	0.48	6	800	400	70%	1.78	6	800	1,000	600	-22%
001_06	Lemhi River	85	530	blk cottonwood	92%	0.48	6	3,000	1,000	50%	2.97	6	3,000	9,000	8,000	-42%
001_06	Lemhi River	86	580	blk cottonwood	92%	0.48	6	3,000	1,000	80%	1.19	6	3,000	4,000	3,000	-12%
001_06	Lemhi River	87	410	blk cottonwood	92%	0.48	6	2,000	1,000	30%	4.16	6	2,000	8,000	7,000	-62%
001_06	Lemhi River	88	2040	blk cottonwood	92%	0.48	6	10,000	5,000	70%	1.78	6	10,000	20,000	20,000	-22%
001_06	Lemhi River	89	780	blk cottonwood	92%	0.48	6	5,000	2,000	10%	5.35	6	5,000	30,000	30,000	-82%
001_06	Lemhi River	90	3740	blk cottonwood	92%	0.48	6	20,000	10,000	50%	2.97	6	20,000	60,000	50,000	-42%
001_06	channel rejoin	91	230	blk cottonwood	44%	3.33	20	4,600	15,000	0%	5.94	20	4,600	27,000	12,000	-44%
001_06	Lemhi River	92	1280	blk cottonwood	44%	3.33	20	26,000	86,000	10%	5.35	20	26,000	140,000	54,000	-34%
001_06	Lemhi River	93	490	blk cottonwood	44%	3.33	20	9,800	33,000	0%	5.94	20	9,800	58,000	25,000	-44%
001_06	Lemhi River	94	990	blk cottonwood	44%	3.33	20	20,000	67,000	10%	5.35	20	20,000	110,000	43,000	-34%
001_06	Lemhi River	95	130	blk cottonwood	44%	3.33	20	2,600	8,600	0%	5.94	20	2,600	15,000	6,400	-44%
001_06	Lemhi River	96	140	blk cottonwood	44%	3.33	20	2,800	9,300	10%	5.35	20	2,800	15,000	5,700	-34%
001_06	Lemhi River	97	270	blk cottonwood	44%	3.33	20	5,400	18,000	0%	5.94	20	5,400	32,000	14,000	-44%
001_06	Lemhi River	98	640	blk cottonwood	44%	3.33	20	13,000	43,000	10%	5.35	20	13,000	69,000	26,000	-34%
001_06	Lemhi River	99	970	blk cottonwood	44%	3.33	20	19,000	63,000	0%	5.94	20	19,000	110,000	47,000	-44%
001_06	Lemhi River	100	2050	blk cottonwood	44%	3.33	20	41,000	140,000	10%	5.35	20	41,000	220,000	80,000	-34%
001_06	Lemhi River	101	640	blk cottonwood	44%	3.33	20	13,000	43,000	0%	5.94	20	13,000	77,000	34,000	-44%
001_06	Lemhi River	102	2240	blk cottonwood	44%	3.33	20	45,000	150,000	10%	5.35	20	45,000	240,000	90,000	-34%
001_06	Lemhi River	103	530	blk cottonwood	44%	3.33	20	11,000	37,000	0%	5.94	20	11,000	65,000	28,000	-44%
001_06	Lemhi River	104	1150	blk cottonwood	44%	3.33	20	23,000	77,000	10%	5.35	20	23,000	120,000	43,000	-34%
001_06	Lemhi River	105	680	blk cottonwood	44%	3.33	20	14,000	47,000	0%	5.94	20	14,000	83,000	36,000	-44%
001_06	Lemhi River	106	1630	blk cottonwood	44%	3.33	20	33,000	110,000	10%	5.35	20	33,000	180,000	70,000	-34%
001_06	Lemhi River	107	3340	blk cottonwood	44%	3.33	20	67,000	220,000	0%	5.94	20	67,000	400,000	180,000	-44%
001_06	Lemhi River	108	550	blk cottonwood	44%	3.33	20	11,000	37,000	10%	5.35	20	11,000	59,000	22,000	-34%
001_06	Lemhi River	109	1430	blk cottonwood	44%	3.33	20	29,000	96,000	0%	5.94	20	29,000	170,000	74,000	-44%
								Totals	5,100,000					7,600,000	2,500,000	

Table 20. Existing and potential solar loads for Little Eightmile Creek.

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
052b_02	Little Eightmile Cr	1	350	graminoid meadow	55%	2.67	1	400	1,000	50%	2.97	1	400	1,000	0	-5%
052b_02	Little Eightmile Cr	2	310	aspen	100%	0.00	1	300	0	60%	2.38	1	300	700	700	-40%
052b_02	Little Eightmile Cr	3	1200	Geyers/reedgrass	92%	0.48	1	1,000	500	80%	1.19	1	1,000	1,000	500	-12%
052b_02	Little Eightmile Cr	4	370	dry DF w/o Ppine	94%	0.36	2	700	200	90%	0.59	2	700	400	200	-4%
052b_02	Little Eightmile Cr	5	330	dry DF w/o Ppine	94%	0.36	2	700	200	80%	1.19	2	700	800	600	-14%
052b_02	Little Eightmile Cr	6	730	Geyers/reedgrass	79%	1.25	2	1,000	1,000	70%	1.78	2	1,000	2,000	1,000	-9%
052b_02	Little Eightmile Cr	7	420	dry DF w/o Ppine	94%	0.36	2	800	300	90%	0.59	2	800	500	200	-4%
052b_02	Little Eightmile Cr	8	460	Geyers/reedgrass	61%	2.32	3	1,000	2,000	60%	2.38	3	1,000	2,000	0	-1%
052b_02	Little Eightmile Cr	9	690	dry DF w/o Ppine	92%	0.48	3	2,000	1,000	80%	1.19	3	2,000	2,000	1,000	-12%
052b_02	Little Eightmile Cr	10	480	aspen	99%	0.06	3	1,000	60	50%	2.97	3	1,000	3,000	3,000	-49%
052b_02	Little Eightmile Cr	11	1030	dry DF w/o Ppine	84%	0.95	4	4,000	4,000	80%	1.19	4	4,000	5,000	1,000	-4%
052b_02	Little Eightmile Cr	12	1240	dry DF w/o Ppine	84%	0.95	4	5,000	5,000	70%	1.78	4	5,000	9,000	4,000	-14%
052b_02	Little Eightmile Cr	13	720	Geyers/reedgrass	43%	3.39	5	4,000	10,000	50%	2.97	5	4,000	10,000	0	7%
052b_02	Little Eightmile Cr	14	360	black cottonwood	94%	0.36	5	2,000	700	90%	0.59	5	2,000	1,000	300	-4%
052b_02	Little Eightmile Cr	15	1290	black cottonwood	94%	0.36	5	6,000	2,000	80%	1.19	5	6,000	7,000	5,000	-14%
052b_02	Little Eightmile Cr	16	190	black cottonwood	92%	0.48	6	1,000	500	40%	3.56	6	1,000	4,000	4,000	-52%
052b_02	Little Eightmile Cr	17	450	black cottonwood	92%	0.48	6	3,000	1,000	60%	2.38	6	3,000	7,000	6,000	-32%
052b_02	Little Eightmile Cr	18	540	black cottonwood	92%	0.48	6	3,000	1,000	50%	2.97	6	3,000	9,000	8,000	-42%
052b_02	Little Eightmile Cr	19	430	black cottonwood	92%	0.48	6	3,000	1,000	60%	2.38	6	3,000	7,000	6,000	-32%
052b_02	Little Eightmile Cr	20	450	black cottonwood	92%	0.48	6	3,000	1,000	70%	1.78	6	3,000	5,000	4,000	-22%
052b_02	Little Eightmile Cr	21	330	black cottonwood	92%	0.48	6	2,000	1,000	30%	4.16	6	2,000	8,000	7,000	-62%
052a_02	Little Eightmile Cr	22	430	black cottonwood	92%	0.48	6	3,000	1,000	0%	5.94	6	3,000	20,000	20,000	-92%
052a_02	Little Eightmile Cr	23	260	black cottonwood	92%	0.48	6	2,000	1,000	70%	1.78	6	2,000	4,000	3,000	-22%
							Totals		35,000					110,000	76,000	

Table 21. Existing and potential solar loads for Sandy Creek.

Segment Details					Target					Existing					Summary	
AU	Stream Name	Number (top to bottom)	Length (m)	Vegetation Type	Shade	Solar Radiation (kWh/m²/ day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Shade	Solar Radiation (kWh/m²/ day)	Segment Width (m)	Segment Area (m²)	Solar Load (kWh/day)	Excess Load (kWh/day)	Lack of Shade
062b_02	Sandy Creek	1	1780	subalpine fir-moist	96%	0.24	1	2,000	500	90%	0.59	1	2,000	1,000	500	-6%
062b_02	Sandy Creek	2	2200	dry DF w/o Ppine	94%	0.36	2	4,000	1,000	90%	0.59	2	4,000	2,000	1,000	-4%
062b_02	Sandy Creek	3	400	dry DF w/o Ppine	94%	0.36	2	800	300	80%	1.19	2	800	1,000	700	-14%
062b_02	Sandy Creek	4	770	Geyers/reedgrass	79%	1.25	2	2,000	2,000	60%	2.38	2	2,000	5,000	3,000	-19%
062b_02	Sandy Creek	5	590	aspen/conifer	99%	0.06	3	2,000	100	80%	1.19	3	2,000	2,000	2,000	-19%
062b_02	Sandy Creek	6	1830	black cottonwood	96%	0.24	3	5,000	1,000	80%	1.19	3	5,000	6,000	5,000	-16%
062b_02	Sandy Creek	7	450	black cottonwood	96%	0.24	4	2,000	500	90%	0.59	4	2,000	1,000	500	-6%
062b_02	Sandy Creek	8	1380	black cottonwood	96%	0.24	4	6,000	1,000	80%	1.19	4	6,000	7,000	6,000	-16%
062a_02	Sandy Creek	9	1840	black cottonwood	94%	0.36	5	9,000	3,000	60%	2.38	5	9,000	20,000	20,000	-34%
062a_02	Sandy Creek	10	310	black cottonwood	94%	0.36	5	2,000	700	80%	1.19	5	2,000	2,000	1,000	-14%
062a_02	Sandy Creek	11	580	black cottonwood	94%	0.36	5	3,000	1,000	70%	1.78	5	3,000	5,000	4,000	-24%
062a_02	Sandy Creek	12	410	black cottonwood	94%	0.36	5	2,000	700	50%	2.97	5	2,000	6,000	5,000	-44%
062a_02	Sandy Creek	13	210	black cottonwood	94%	0.36	5	1,000	400	80%	1.19	5	1,000	1,000	600	-14%
							Totals		12,000					59,000	49,000	

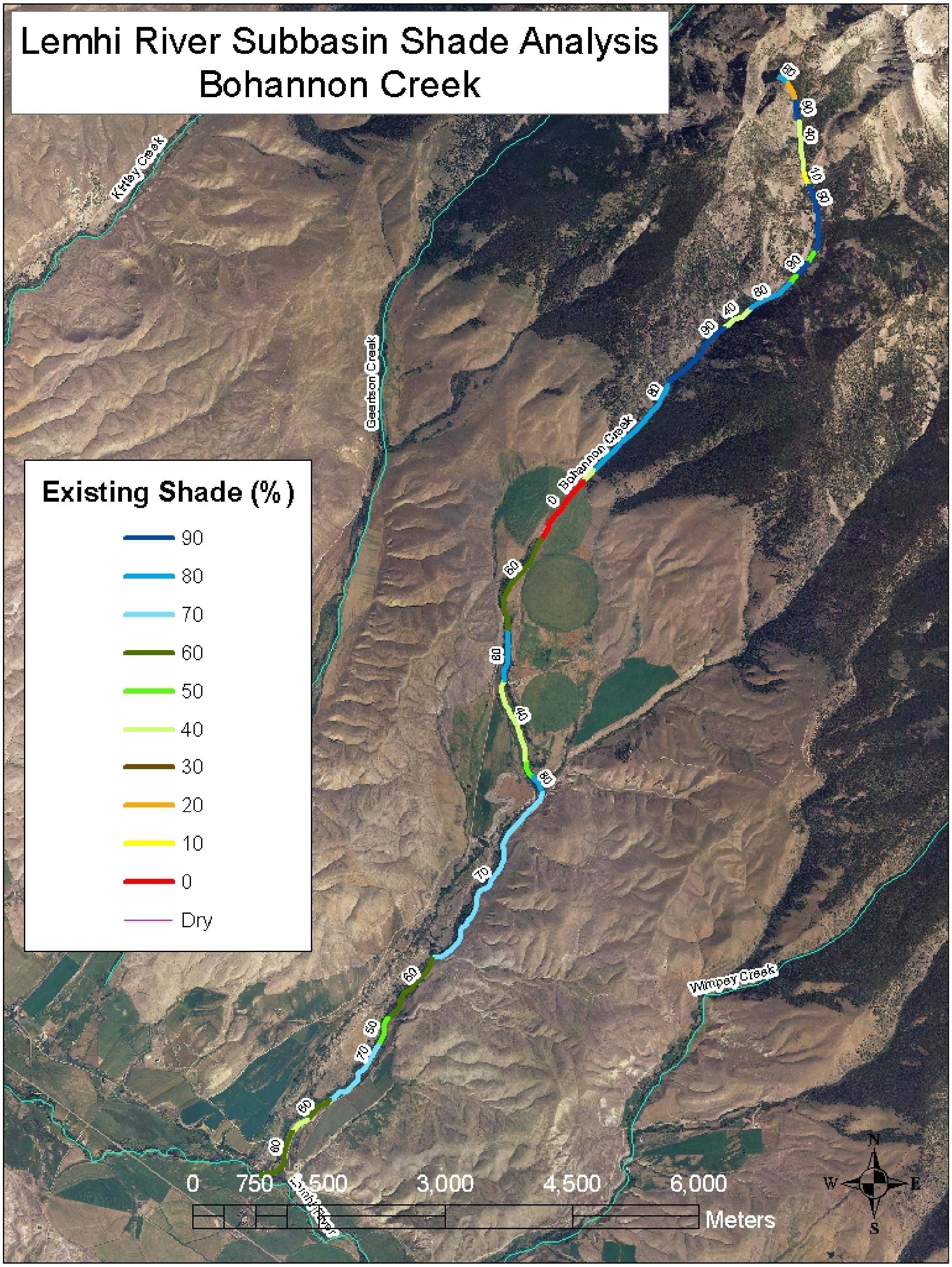

Figure 15. Existing shade estimated for Bohannon Creek by aerial photo interpretation.

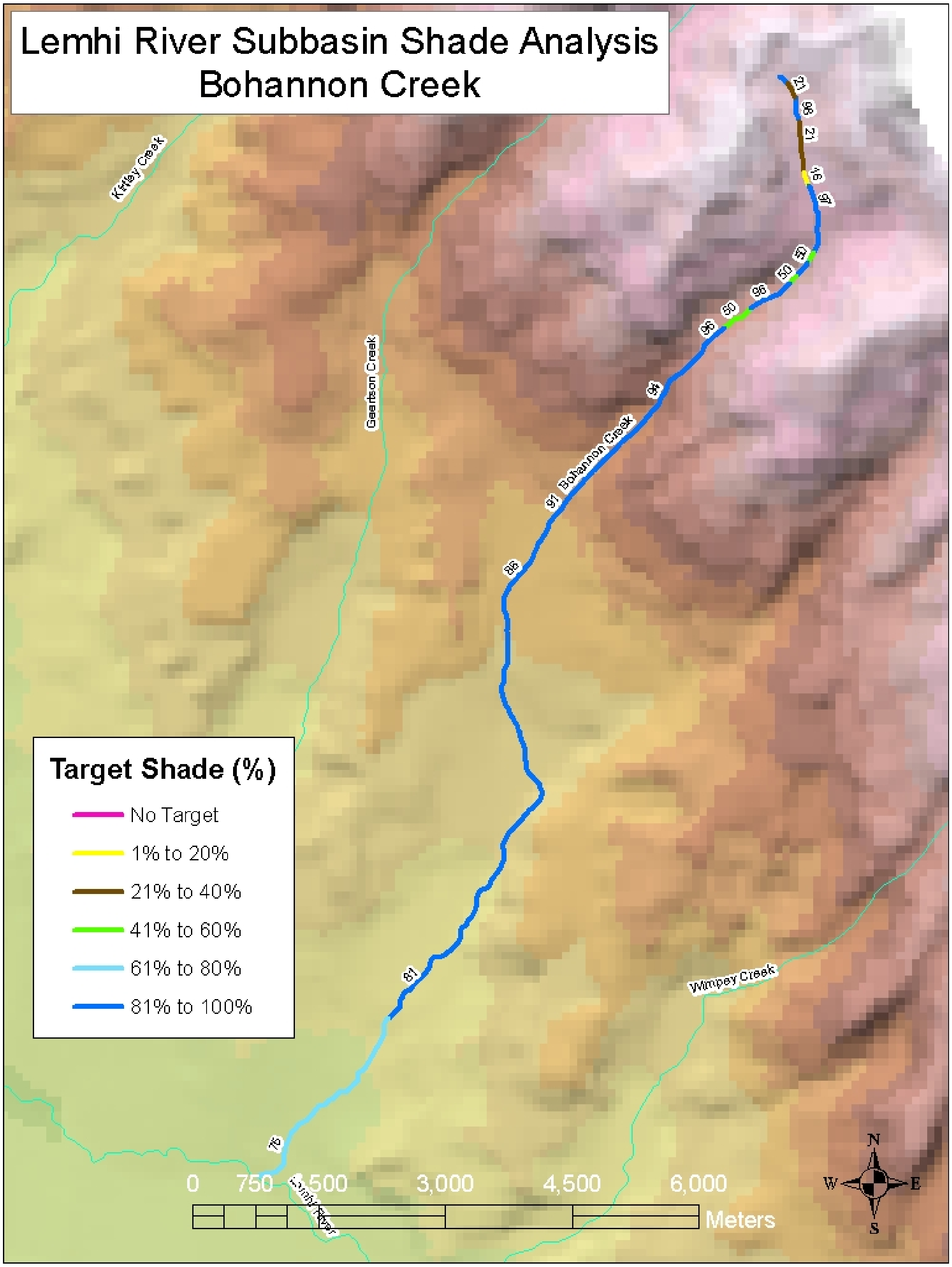

Figure 16. Target shade for Bohannon Creek.

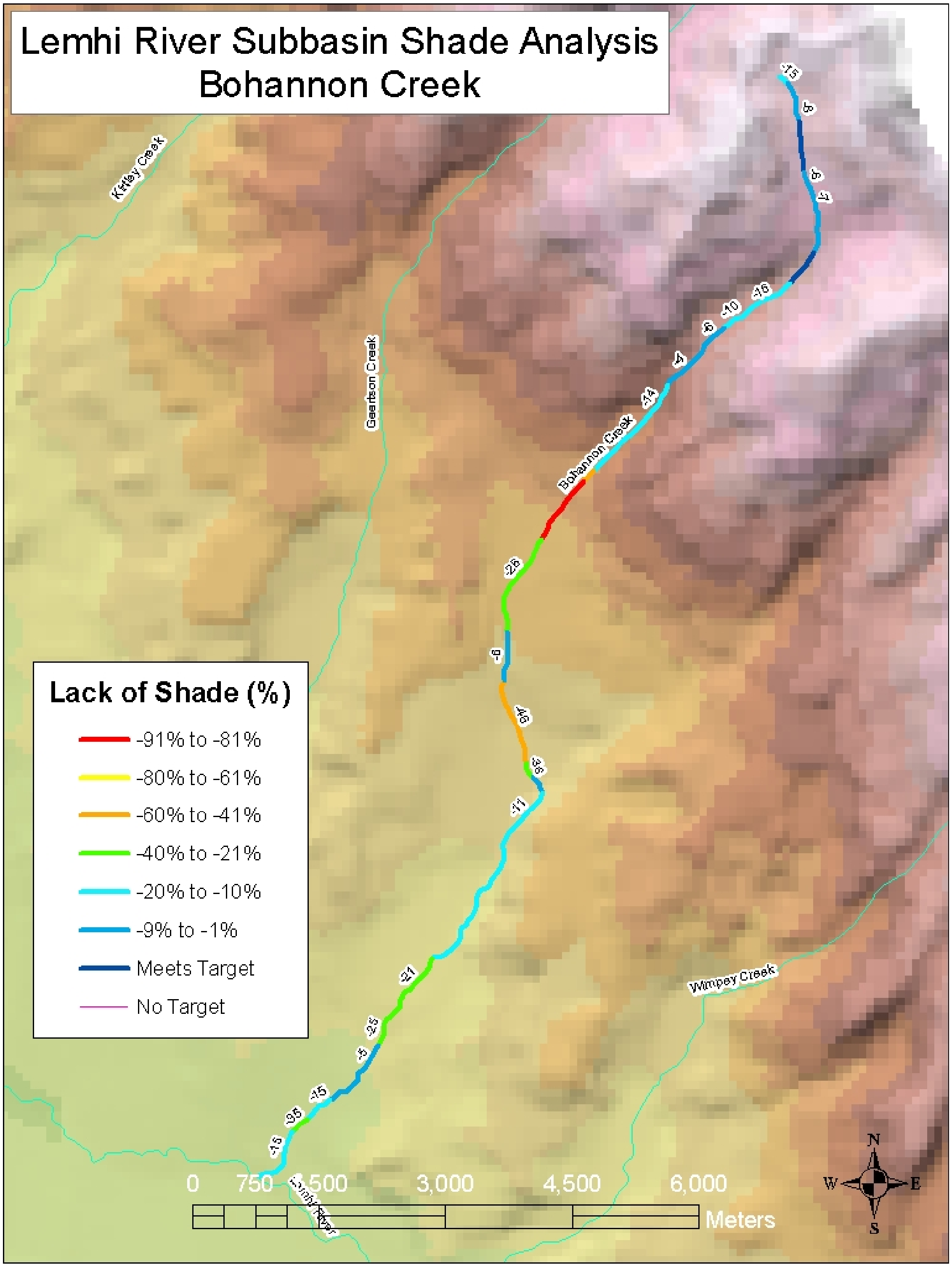

Figure 17. Lack of shade for Bohannon Creek.

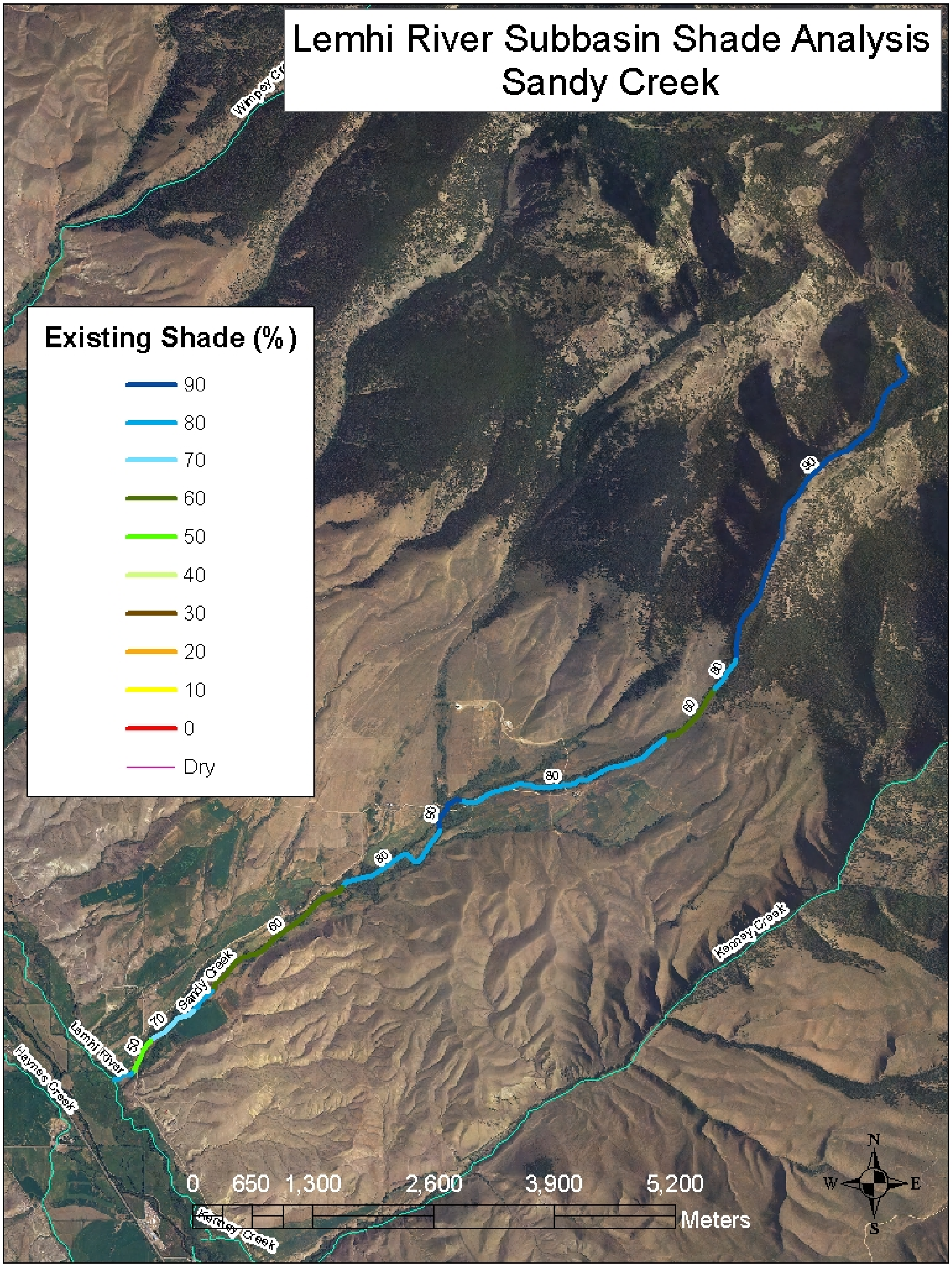

Figure 18. Existing shade estimated for Sandy Creek by aerial photo interpretation.

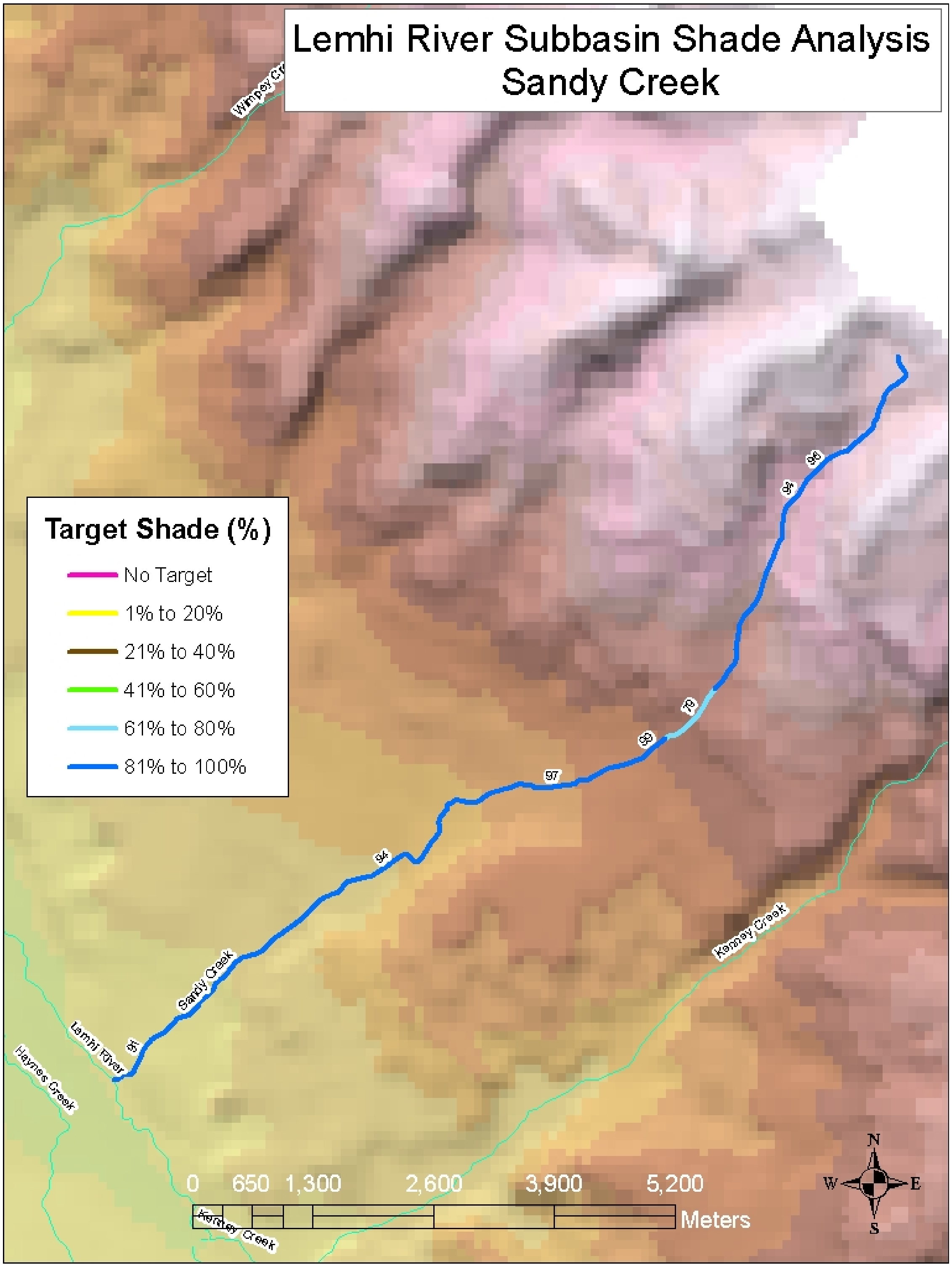

Figure 19. Target shade for Sandy Creek.

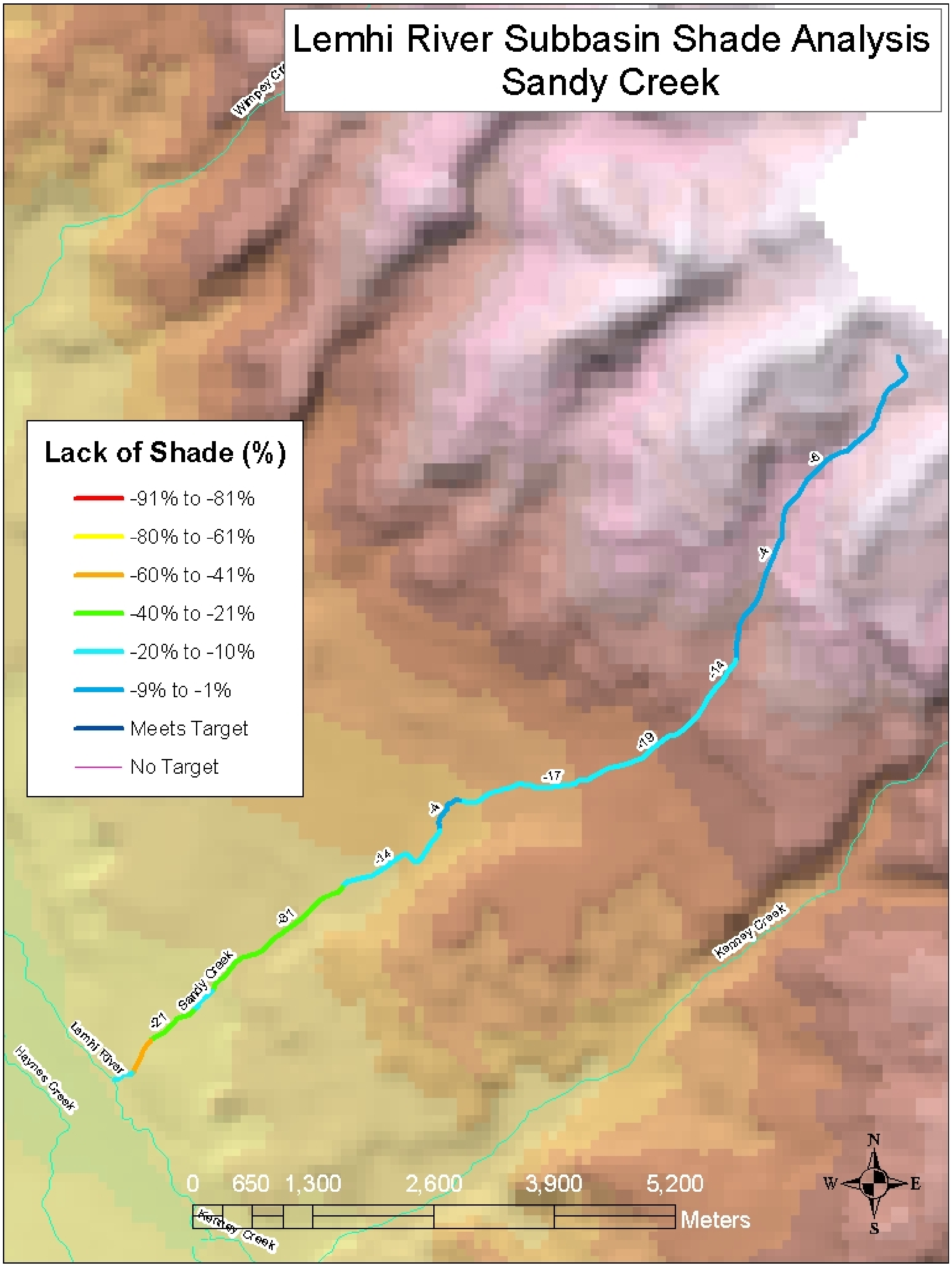

Figure 20. Lack of shade for Sandy Creek.

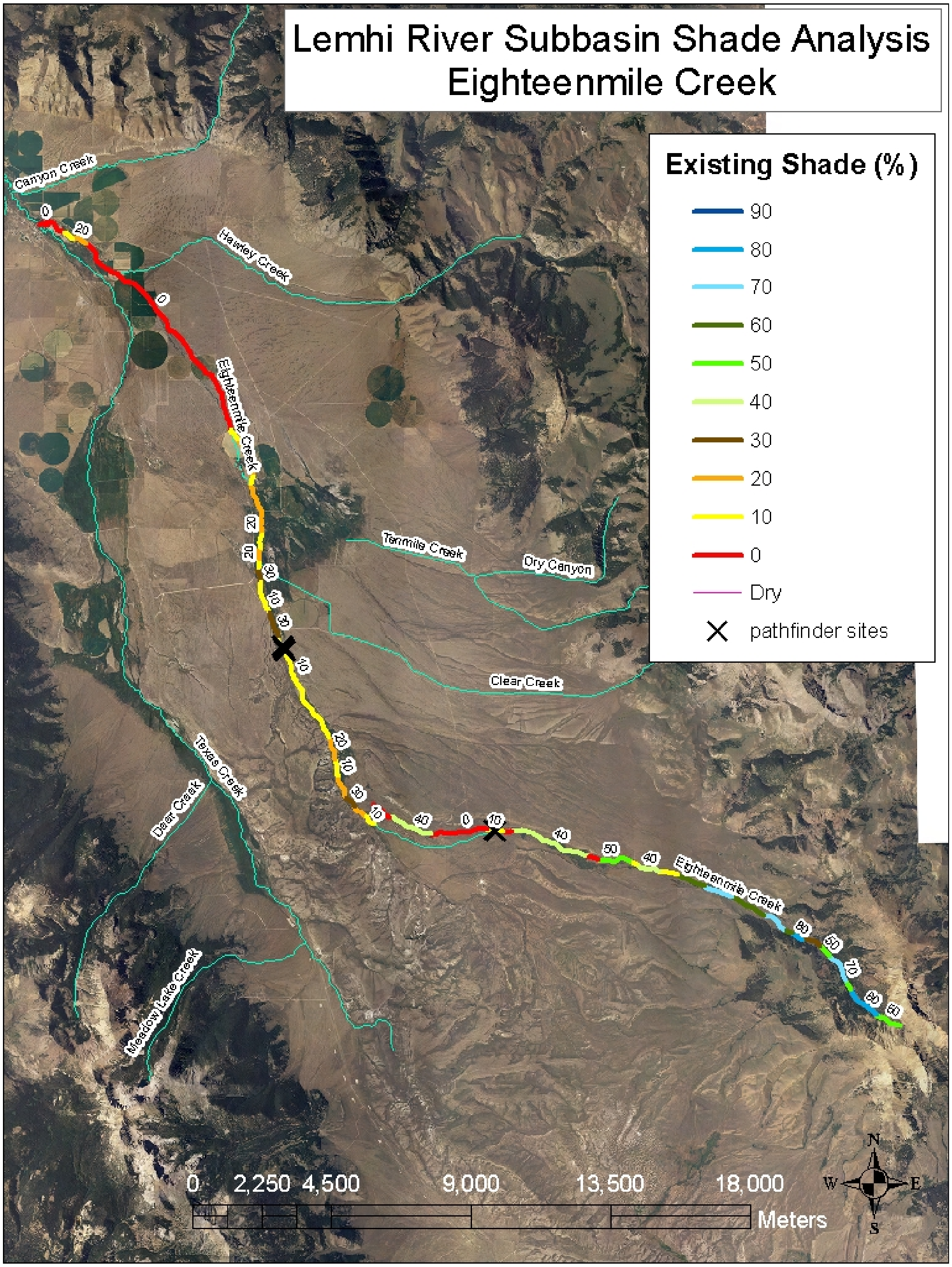

Figure 21. Existing shade estimated for Eighteenmile Creek by aerial photo interpretation.

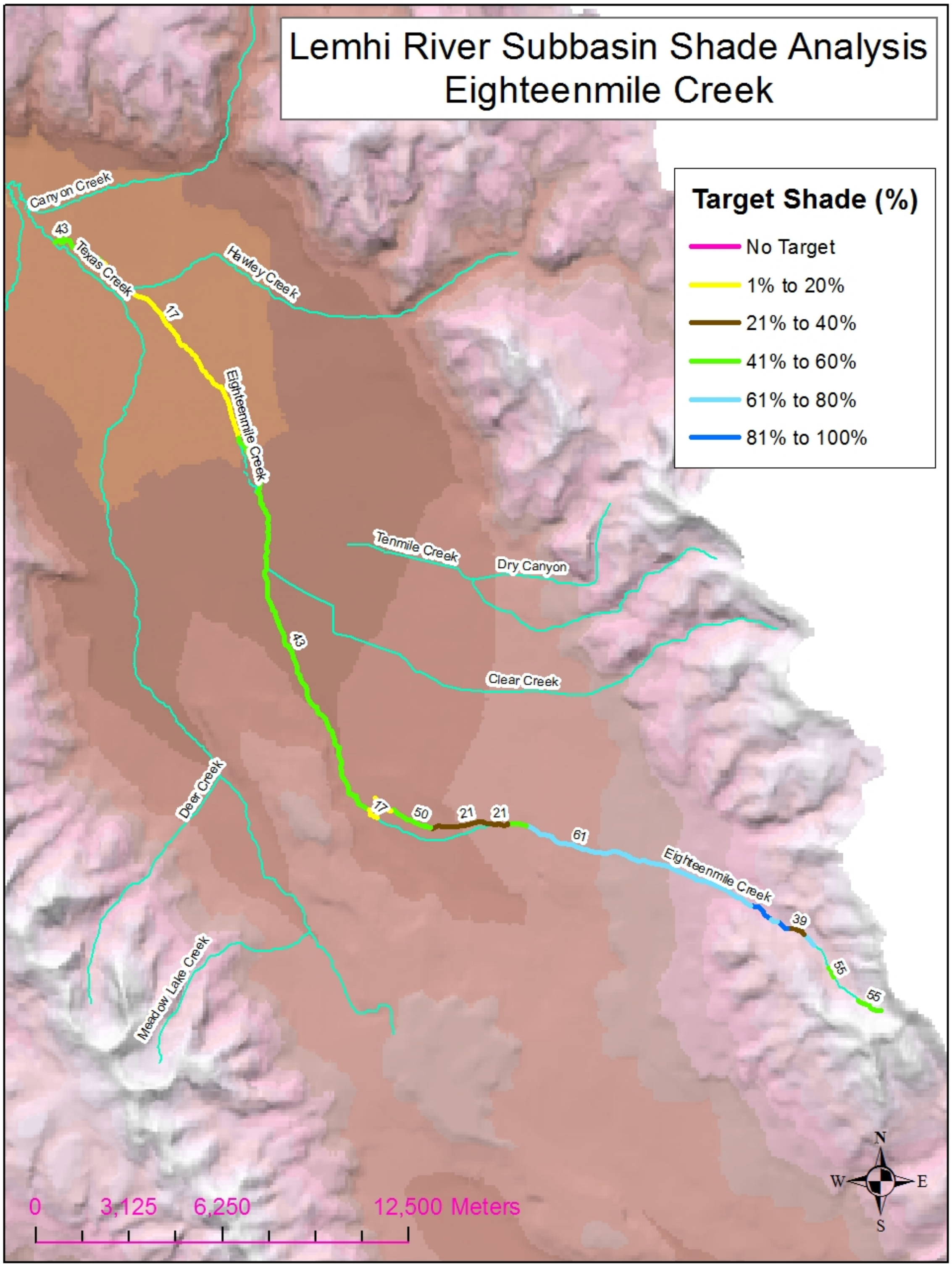

Figure 22. Target shade for Eighteenmile Creek.

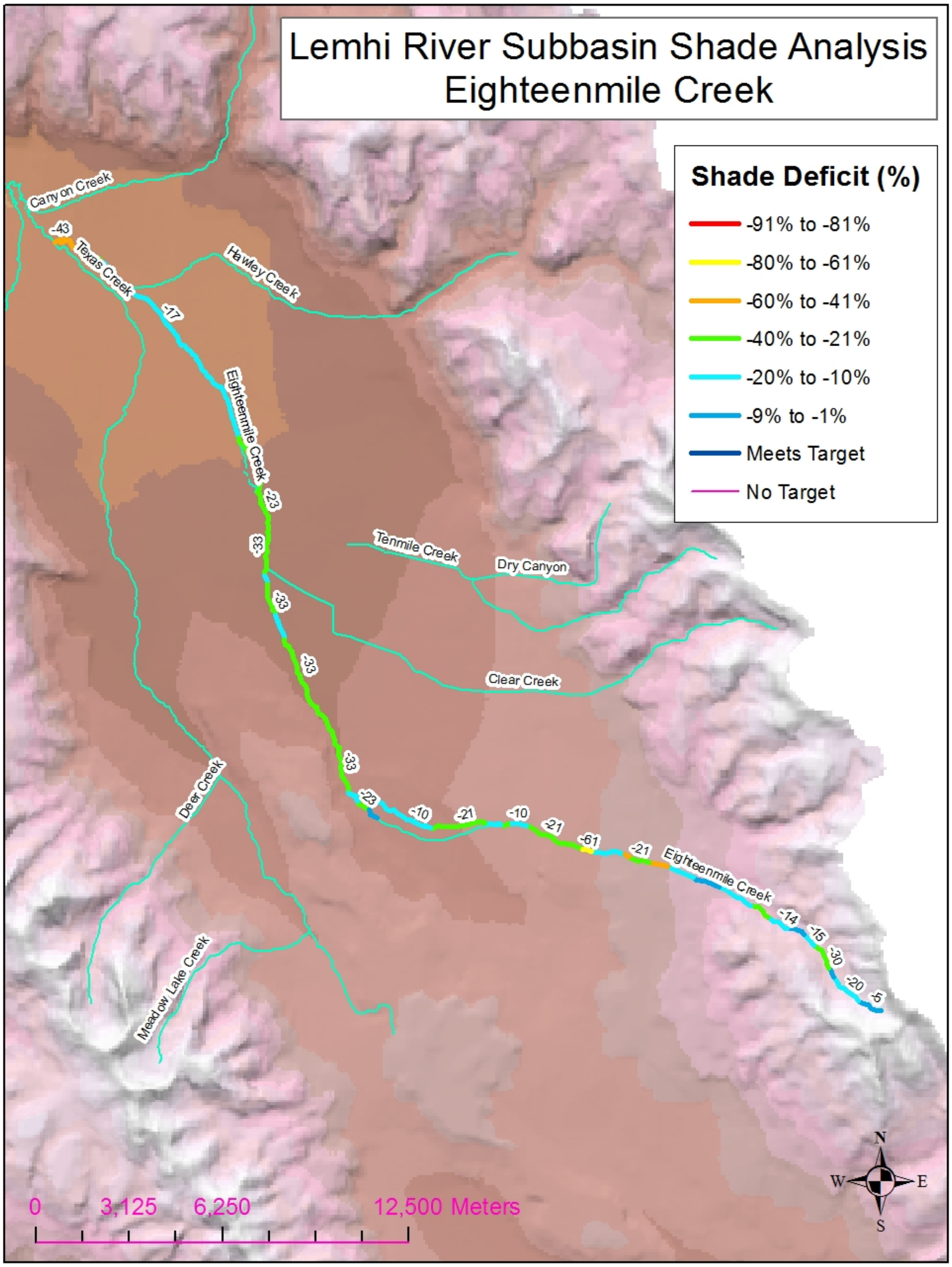

Figure 23. Lack of shade for Eighteenmile Creek.

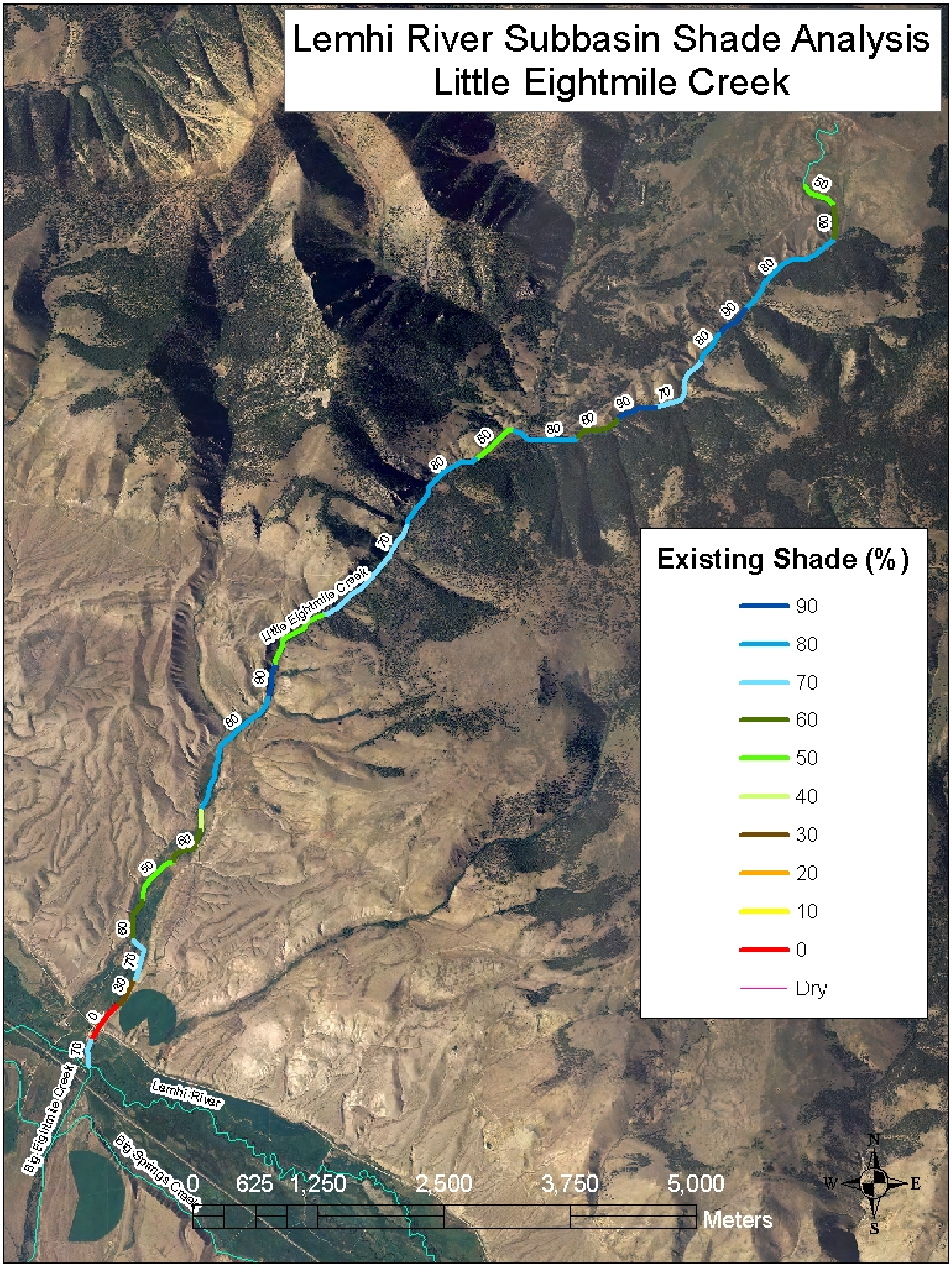

Figure 24. Existing shade estimated for Little Eightmile Creek by aerial photo interpretation.

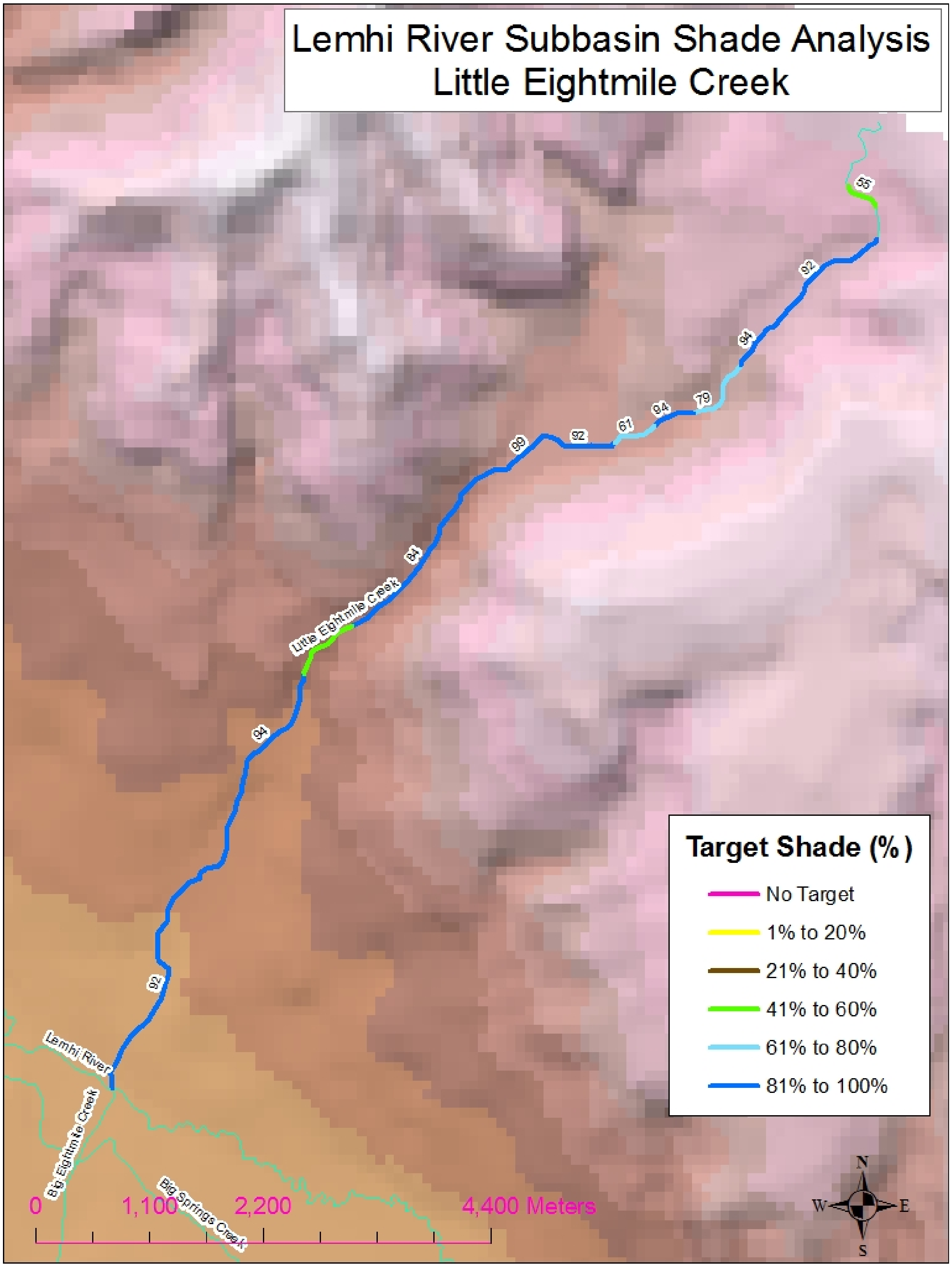

Figure 25. Target shade for Little Eightmile Creek.

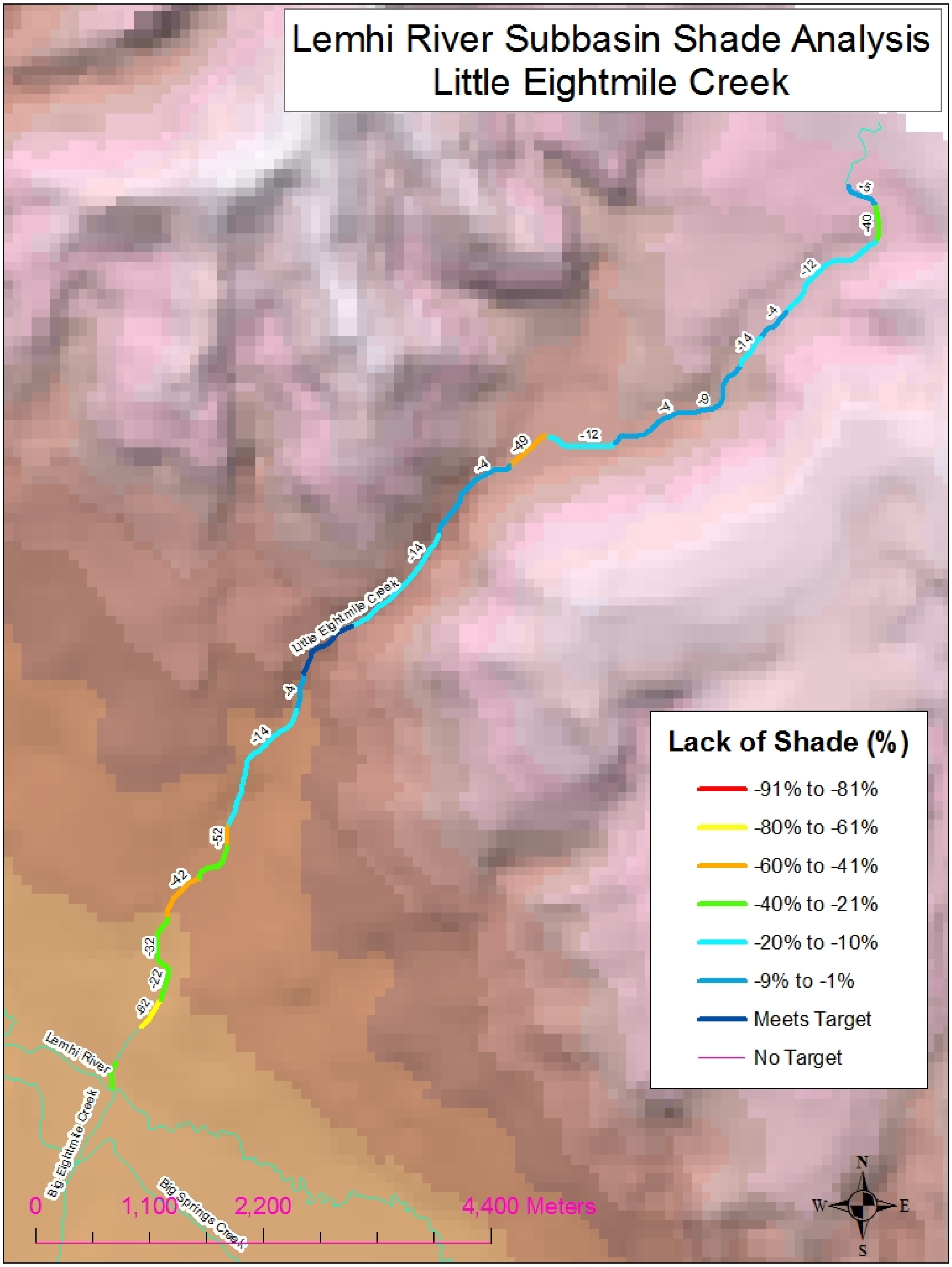

Figure 26. Lack of shade for Little Eightmile Creek.

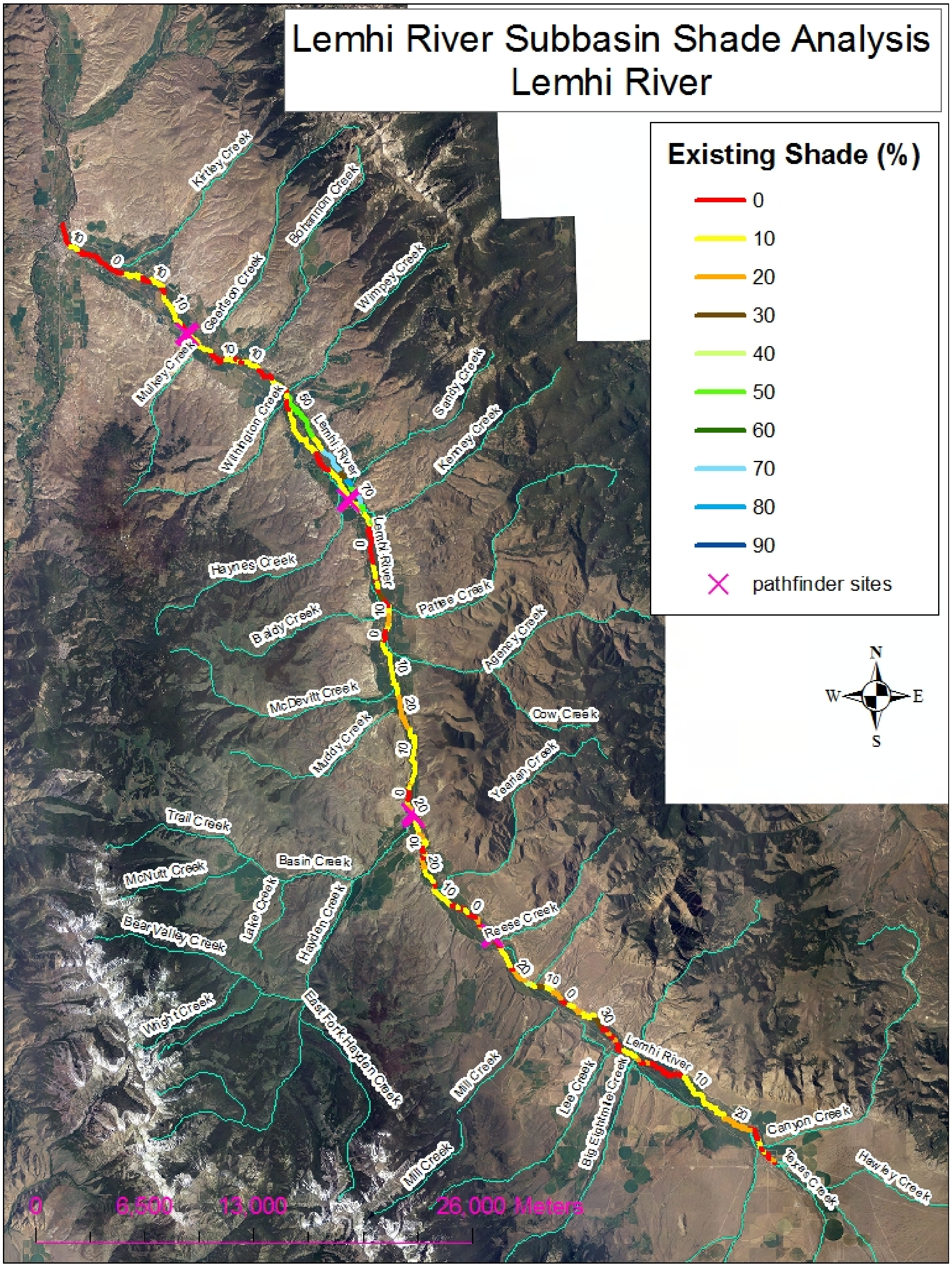

Figure 27. Existing shade estimated for the Lemhi River by aerial photo interpretation.

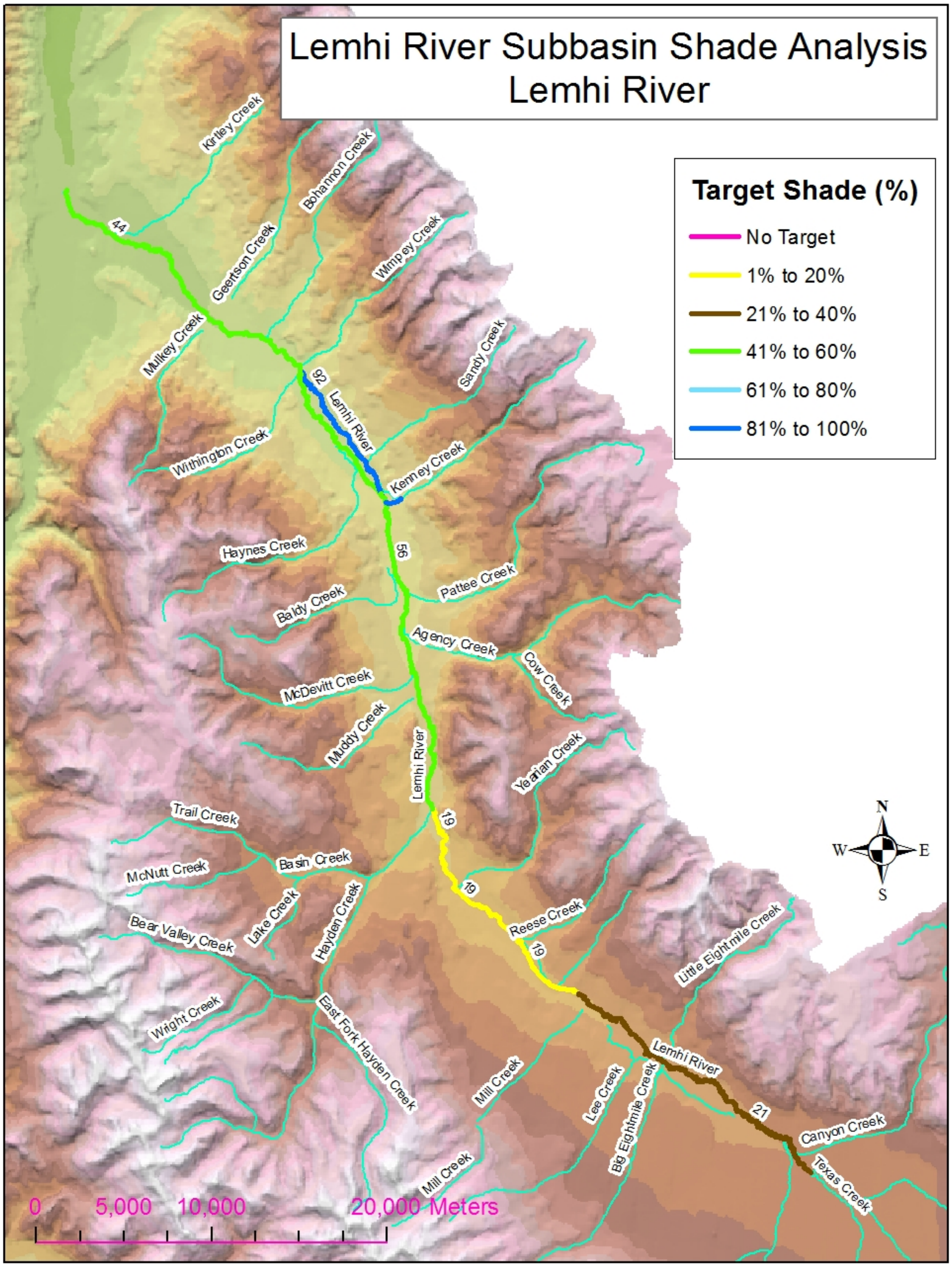

Figure 28. Target shade for the Lemhi River.

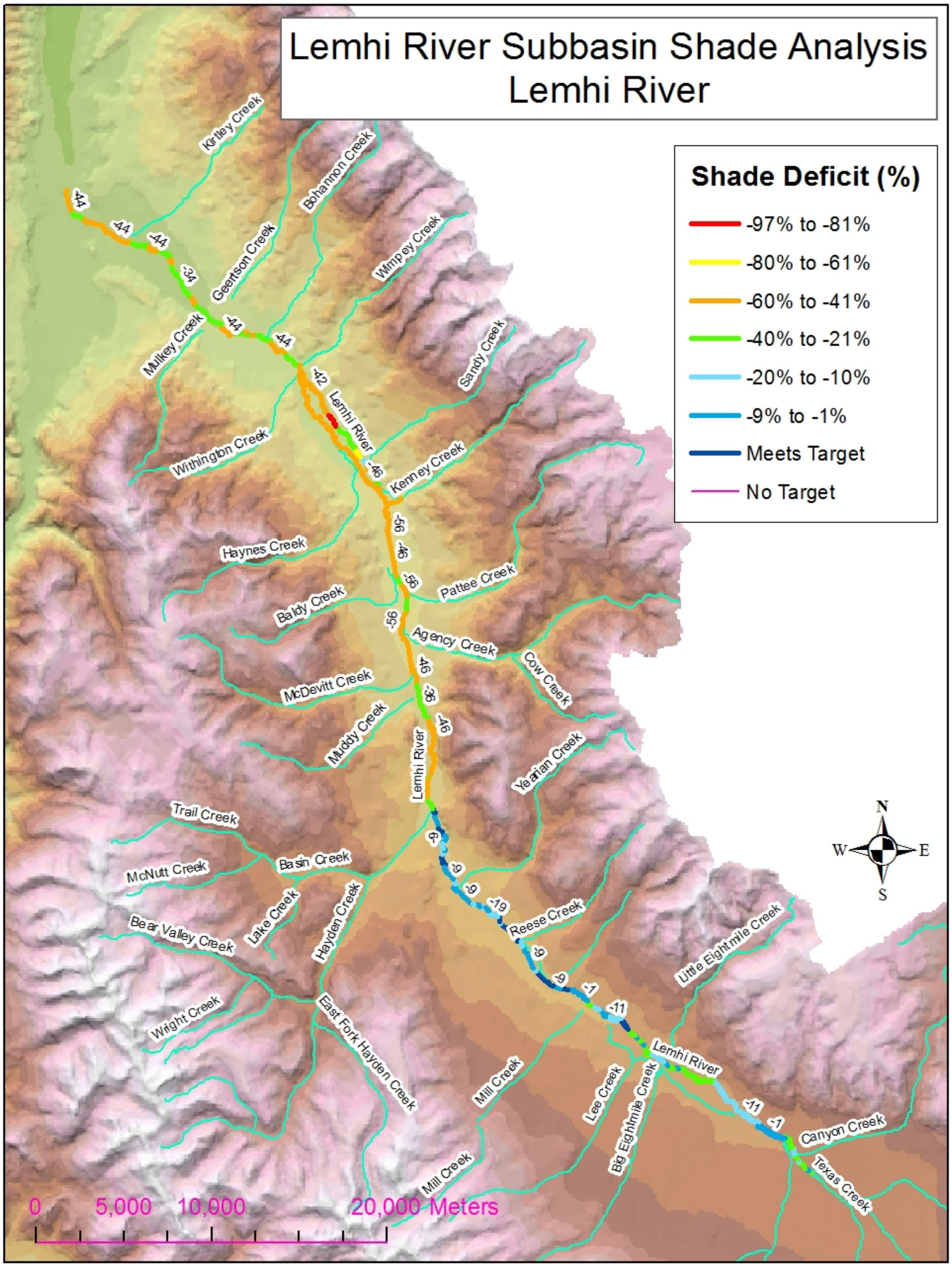

Figure 29. Lack of shade for the Lemhi River.

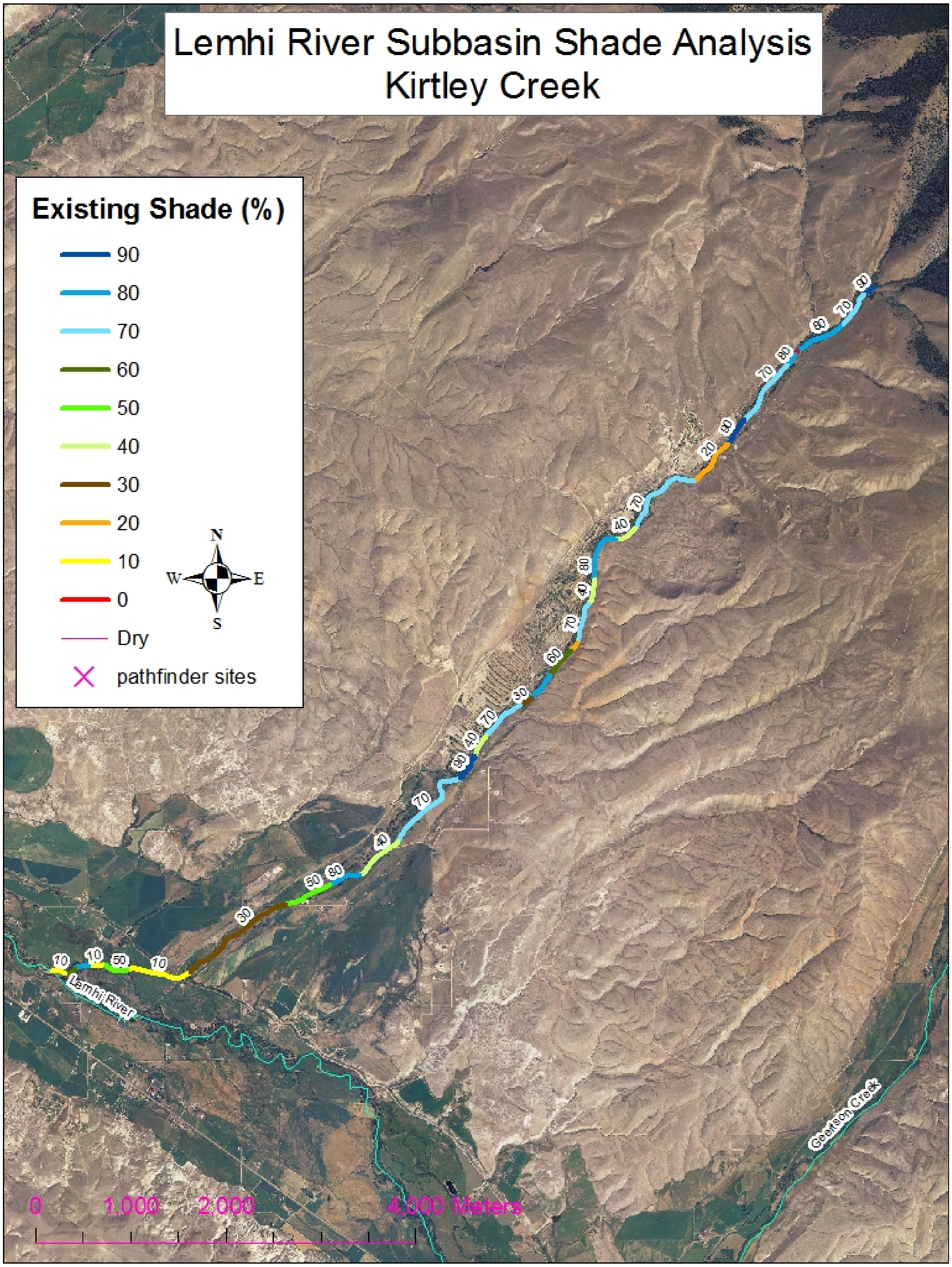

Figure 30. Existing shade estimated for Kirtley Creek by aerial photo interpretation.

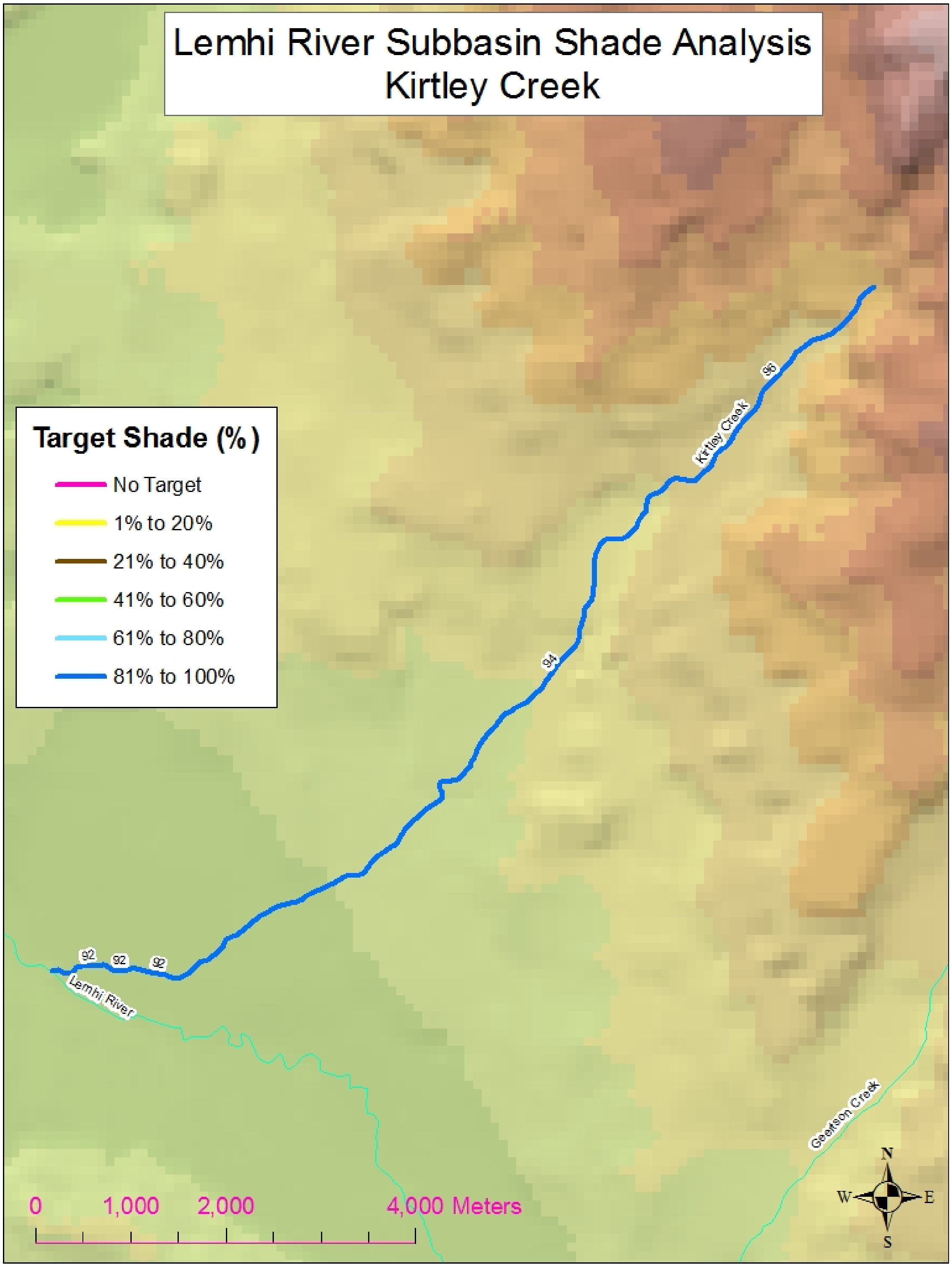

Figure 31. Target shade for Kirtley Creek.

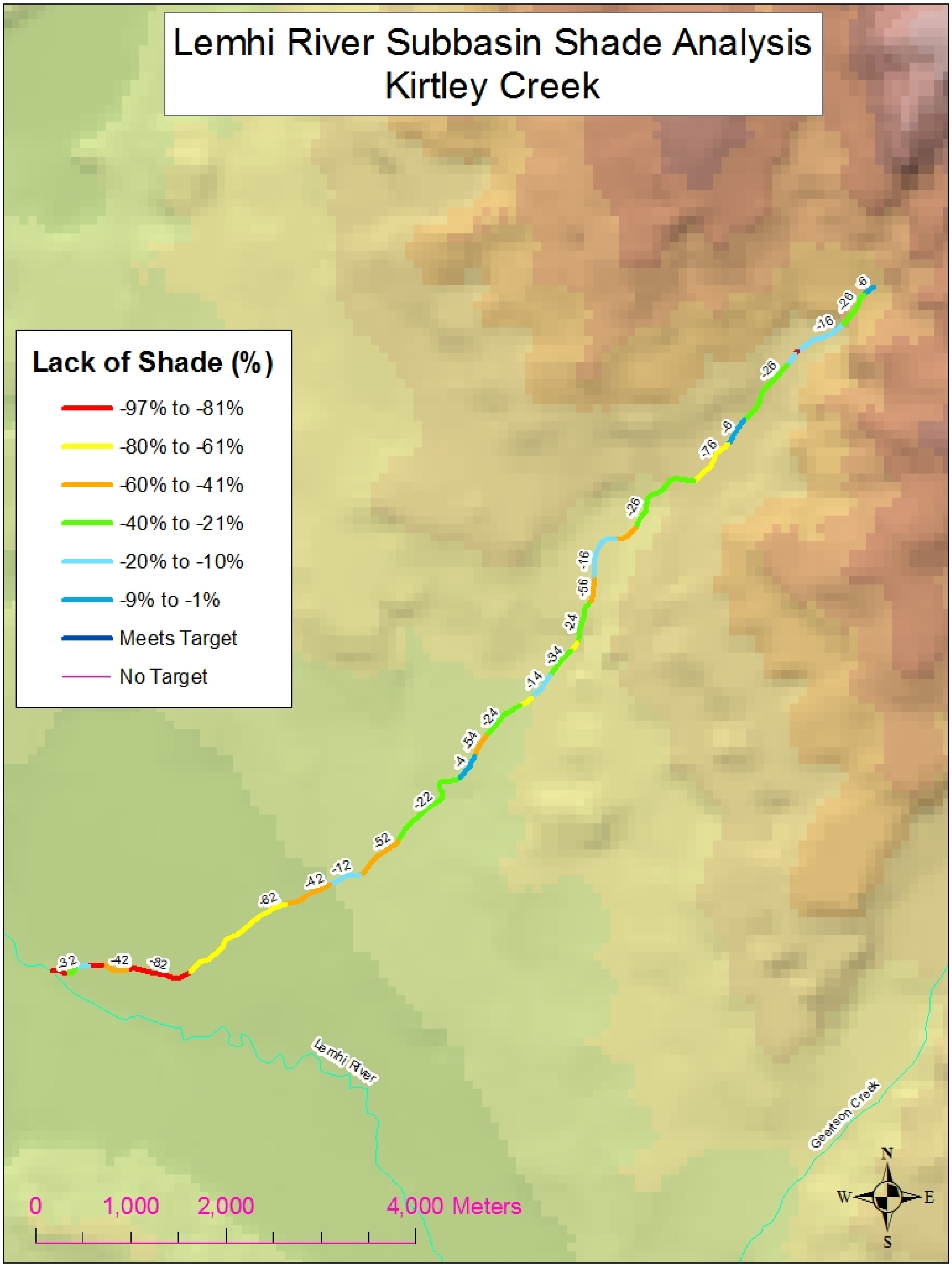

Figure 32. Lack of shade for Kirtley Creek.

5.1.7. Load Allocation

Because this TMDL is based on PNV, which is equivalent to background solar 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. Load allocations are therefore stream reach specific and are dependent upon the target load for a given reach. Tables 16–21 show the target shade, which is converted to a target solar load by multiplying the inverse fraction (1 minus shade fraction) by the average load received by a flat-plate collector for the months of April–September. The result is the load capacity of the stream and it 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 upon background conditions for achieving water quality standards, all tributaries to the waters examined here must also be in natural conditions to prevent excess heat loads to the system.

Table 22 shows the total existing, total target, and excess heat load (kWh/day) as well as the proportion in excess 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. Table 22 lists the tributaries in order of their excess loads, from highest to lowest. Therefore, large water bodies tend to be listed first and small tributaries are listed last.

Although the following analysis focuses on total heat loads for streams, it is important to note that differences between existing shade and target shade, as depicted in the lack-of-shade figures (Figures 17, 20, 23, 26, 29, and 32) 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 (Tables 16–21) contains a final column that lists the lack of shade on the stream. This value is derived from subtracting the target shade from the existing shade for each segment. Thus, stream segments with the largest shade deficit are in the worst shape. The average lack of shade derived from that last column in each loading table is also listed in the table below and provides a general comparison among streams.

Table 22. Total existing, target, and excess solar loads; proportion in excess; and average lack of shade for all water bodies examined.

Water Body	Total Existing Load (kWh/day)[a]	Total Target Load (kWh/day)	Excess Load (kWh/day)	Proportion Excess/ Existing (%)	Average Lack of Shade (%)
Lemhi River	7,600,000	5,100,000	2,500,000	33	-26
Eighteenmile Creek	870,000	560,000	310,000	36	-24
Kirtley Creek	160,000	23,000	150,000	94	-40
Bohannon Creek	200,000	71,000	140,000	70	-21
Little Eightmile Creek	110,000	35,000	76,000	69	-23
Sandy Creek	59,000	12,000	49,000	83	-18

[a] kWh/day = kilowatt-hours per day

All streams examined lacked shade. Most streams had excess loads that were greater than 69% of their total existing loads, although the two largest water bodies were at one third of the load in excess. The Lemhi River had the highest excess load at 2.5 million kWh/day (33% of the total existing load). The Lemhi River is also the largest water body in the analysis with a target load of 5.1 million kWh/day. Sandy Creek, the smallest stream examined, had the lowest excess load at 49,000 kWh/day, however it was 83% of its total existing load.

Most of the shade loss in these streams results from agricultural conversion in the black cottonwood vegetation type, where targets are high because they are based on large trees and existing shade is low or nonexistent. Lack of shade in the conifer zone is generally not as severe as in the black cottonwood vegetation type, often less than a 10% difference between target and existing shade values.

A certain amount of excess load and hence percent necessary reduction 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 is a unique integer, there is usually a difference between them. For example, say a particular stretch of stream has a target shade of 86% based on its vegetation type and natural bankfull width. If existing shade on that stretch of stream were at target level, it would be recorded as 80% existing shade 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.

5.1.8. Wasteload Allocation

Other than the Mollie Gulch Feedlot (IDU000180), near where Little Eightmile Creek joins the Lemhi River, and the Nelson Angus Ranch Feedlot (IDU000192), near the mouth of the Lemhi River, there are no known NPDES permitted point source discharges in the affected watersheds. Thus, there are no wasteload allocations for this TMDL. Should a point source be proposed that would have thermal consequence on these waters, then background provisions addressing such discharges in Idaho water quality standards (IDAPA 58.01.02.200.09 and.02.401.01) should be involved.

5.1.9. 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 interval, which likely underestimates actual shade in the load analysis. Although the load 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.

5.1.10. Seasonal Variation

This TMDL is based on average summer loads. All loads have been calculated to be inclusive of the 6-month period from April through September. This time period was chosen because it represents the time period when the combination of increasing air and water temperatures coincides with increasing solar inputs and increasing vegetative shade. The critical time period is June when spring salmonid spawning occurs, July and August when maximum temperatures are more likely to exceed cold water aquatic life criteria, and September when fall salmonid spawning occurs. 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.

5.2. Bacteria TMDL

One AU is listed for *E. coli* on the 2010 IR: Canyon Creek—source to diversion, ID17060204SL051b_02. This AU is designated for the recreational use of secondary contact recreation. As a result, bacteria targets will be those water quality criteria for secondary contact recreation. Thus, the number of colonies of *E. coli* shall not exceed either the single instantaneous measure of 576 colonies/100 mL or the geometric mean of 126 colonies/100 mL for 5 samples collected in a 30-day period every 3 to 7 days.

This AU consists of the 1st- and 2nd-order tributaries to Canyon Creek, including Cruikshank Creek, Wildcat Creek, and Frank Hall Creek, shown as the red streams in Figure 33. Whereas much of this AU historically had limited connectivity to the main stem Canyon Creek due to alluvial sediments and irrigation withdrawals, the Upper Salmon Basin Watershed Project has undertaken management of the Lemhi River subbasin and is active in reconnecting streams to the Lemhi River. The reconnecting activities have progressed so far that Chinook salmon could be reoccupying Canyon Creek within the next 10 years.

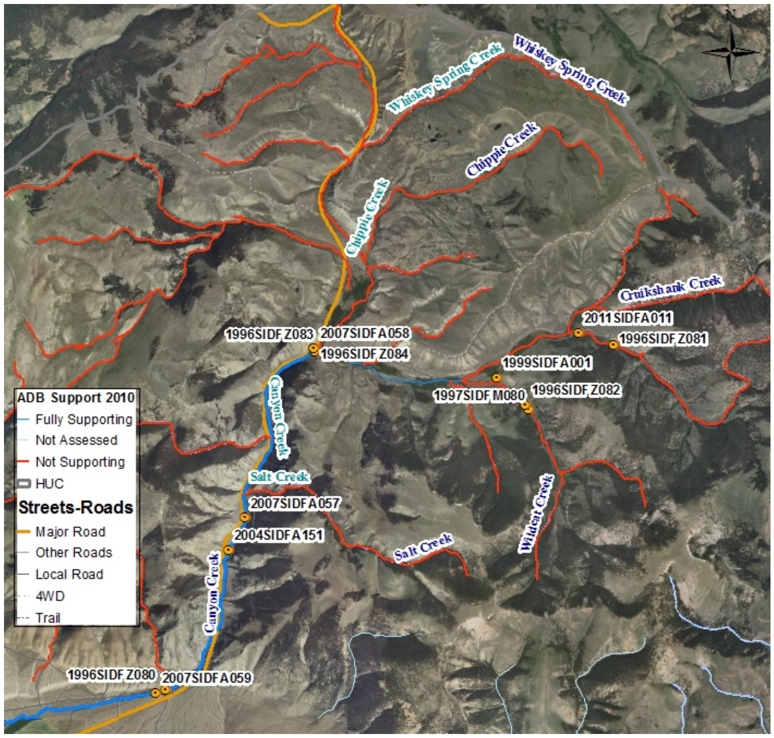

Figure 33. First- and second-order tributaries to Canyon Creek

This AU was first listed in 1998 for impairments in Cruikshank Creek. This listing was based on *E. coli* results at the 1996SIDFZ084 BURP site of a geometric mean of 1,207 colonies/100 mL. Results of this and further bacteria monitoring in AU ID17060204SL051b_02 are shown in Table 23.

Table 23. Bacteria monitoring results in the Canyon Creek drainage.

Stream	BURP site ID	Date	*E. coli* (colonies/100 mL)
Cruikshank Creek	1996SIDFZ084	8/9/1999	1,207 geomean
Wildcat Creek	1996SIDFZ082	7/26/1999	921 geomean
Canyon Creek	2004SIDFA151	9/15/2004	73 single sample
Frank Hall Creek	2011SIDFA011	8/23/2011	79 single sample

The original listing on the 1998 §303(d) list was for "WQLS—5265, Cruikshank Creek, Headwaters to Canyon Creek, stream miles 3.21." The listing in the 2002 integrated report was expanded to 70.11 stream miles for ID17060204SL051b_02. There are no new data for this listing—it was a GIS-based assignment that listed the entire AU based on Cruikshank Creek being impaired by bacteria. No other impairments have been identified in this AU.

5.2.1. In-stream Water Quality Targets

In-stream water quality targets for AU ID17060204SL051b_02 in the Canyon Creek watershed were set from the Idaho water quality standards. The water quality standards relate beneficial use impairment to a numeric standard (e.g., "...Waters designated for recreation are not to contain *E. coli* bacteria…" IDAPA 58.01.02.251.01). The target developed for bacteria impairment is the *E. coli* water quality standard.

5.2.1.1. Design Conditions

Bacteria affect the creek 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 should fall within the critical period when the bacteria contamination is most likely to occur.

5.2.1.2. Target Selection

The State of Idaho water quality standards prescribe *E. coli* criteria for both primary and secondary contact recreation. The likely public uses of the rural Canyon Creek area is secondary contact recreation, if any. To support the beneficial use of secondary contact recreation, the number of *E. coli* colonies may not exceed either a single instantaneous sample of 576 colonies/100 mL or a geometric mean of 126 colonies/100 mL for 5 samples collected every 3 to 7 days within a 30-day period.

5.2.1.3. Monitoring Points

AU ID17060204SL051b_02 should be monitored for compliance with the *E. coli* bacteria secondary contact recreation criteria at the BURP locations where exceedances originally occurred:

- Cruikshank Creek 1996SIDFZ084—N 44.758 W -113.15
- Wildcat Creek 1996SIDFZ082—N 44.749 W -113.211

Even though later bacteria monitoring in Canyon Creek and Frank Hall Creek met the secondary contact recreation criteria, the original locations should be revisited to evaluate current conditions.

5.2.2. Load Capacity

In bacteria TMDLs, the water quality standard is the load capacity of a system. By using a percentage of the target or "load capacity," the calculations become unitless percentages, which overcome the inherent problem of calculating loads from a parameter that does not lend itself to load calculations. Allocations can then be made from this percentage of the load and must be met at all times. Grazing accounts for 80% of the load allocation. The remaining 20% will be distributed between the margin of safety (10%) and the wildlife (natural background) component (10%).

5.2.3. Estimates of Existing Pollutant Loads

For future monitoring, natural background will be estimated from bacteria data collected during the noncritical period (April through May and October through November). The nonpoint source load will be the difference in the previous number and average bacteria counts collected during the critical period for recreation (May through October).

Historic monitoring in 1999 resulted in *E. coli* geomean exceedances in Cruikshank Creek (1,207 colonies/100 mL) and Wildcat Creek (921 colonies/100 mL). This bacteria TMDL is based on those measurements.

Grazing by domestic cattle historically occurred in the uplands of the Canyon Creek watershed. However, modern range management has limited grazing in this AU. Currently, this AU is in the "Grizzly Hill Cattle and Horse Allotment" and managed by the Leadore Ranger District of the Salmon-Challis National Forest. The biological assessment dated November 17, 2010, lists the condition of Cruikshank Creek:

> Cruikshank Creek is entirely on private land except for approximately the first 100 meters near the confluence with Canyon Creek which is on National Forest System lands. Cruikshank Creek enters Canyon Creek below the private land on Canyon Creek….Above the confluence with Wildcat Creek the riparian area along Cruikshank Creek is characterized by dense stands of willows. The streambanks and cover are good. (Garcia 2010, p. 3–4)

Further, the biological assessment identifies steelhead populations in Canyon Creek and bull trout populations in Rough Canyon Creek but no Endangered Species Act (ESA) listed fish streams or ESA-designated critical habitat in Cruikshank Creek. Units with riparian areas are only used for trailing on and off allotment.

The Idaho Governor's Office of Species Conservation (OSC) assumed operations for the Upper Salmon Basin Watershed Project, which was created in 2000, from the Idaho Soil and Water Conservation Commission and then took on the Idaho Soil Conservation Commission's salmon recovery efforts in 2010. The OSC is active in conserving species and their habitat while maintaining responsible land use, leading the state in restoring habitats for threatened and endangered species.

The OSC has indicated very limited possible potential sources and pathways of *E. coli* in this assessment. Grazing occurred historically but is no longer a source of concern since the OSC has assumed operations for the Upper Salmon Basin Watershed Project. Ongoing salmon recovery efforts in the Lemhi River subbasin have made great strides in restoring habitat for all aquatic life.

5.2.4. Load Allocations

Even though potential sources and pathways of bacteria are limited, DEQ is allocating a load reduction for *E. coli* based on historic data so that ongoing monitoring will occur in this AU. The load allocation is presented in Table 24.

Table 24. Bacteria load allocation for Canyon Creek tributaries (geometric mean of number of colonies per 100 milliliter sample).

Stream/ Assessment Unit	Load Capacity	Natural Background	Margin of Safety	Load Allocation	Total Load	Load Reduction	Percent Reduction
Cruikshank Creek	126	13	13	100%	1,207	1107	92%
Wildcat Creek	126	13	13	100%	921	821	89%
Average percent reduction required for Canyon Creek tributaries in ID17060204SL051b_02							90.5%

Bacterial concentrations vary from one sample to the next due to the short life span of bacteria and unpredictable source discharge. Therefore, ongoing monitoring should be performed to determine if beneficial uses are supported at an average 90.5% reduction of *E. coli*.

To support the beneficial use of secondary contact recreation, the number of *E. coli* colonies must not exceed either a single instantaneous sample of 576 colonies/100 mL or a geometric mean of 126 colonies/100 mL for 5 samples collected in a 30-day period 3 to 7 days apart. Since this target is not seasonal, it is applied as a daily load allocation.

5.2.4.1. Margin of Safety

For the Canyon Creek tributaries bacteria TMDL, an explicit margin of safety is set at 10%, and an additional 10% is allocated to the natural background bacterial population contributed by wildlife. In addition, any conservative approaches used in the various calculations required by a TMDL will be included as an implicit component of the MOS.

5.2.4.2. Seasonal Variation

In the Canyon Creek tributaries, 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 and return flow. 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.

5.2.4.3. Wasteload Allocation

There are no point sources within the Canyon Creek watershed, so no wasteload allocation is established.

5.2.4.4. Reasonable Assurance

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 18 months of EPA approval of a TMDL document. The applicable 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 5-year review of the TMDL. If full support status has not been achieved, further implementation will be necessary and further reassessment performed until full support status is reached. Monitoring will be done at least every 5 years. If full support status is reached, the requirements of the TMDL will be considered complete.

5.3. Construction Stormwater Requirements

5.3.1. Construction Stormwater

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

5.3.1.1. The Construction General Permit

If a construction project disturbs more than 1 acre of land (or is part of larger common development that will disturb more than 1 acre), the operator is required to apply for a Construction General Permit (CGP) from EPA after developing a site-specific Stormwater Pollution Prevention Plan (SWPPP).

5.3.1.2. Stormwater Pollution Prevention Plan

In order to obtain the CGP, operators must develop a site-specific SWPPP. Operators must document the erosion, sediment, and pollution controls they intend to use; inspect the controls periodically; and maintain BMPs throughout the life of the project.

5.3.1.3. 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. TMDLs developed in the past that did not have a wasteload allocation for construction stormwater activities will also be considered in compliance with provisions of the TMDL if they obtain a CGP under the NPDES program and implement the appropriate BMPs.

Typically, operators must follow specific requirements to be consistent with any local pollutant allocations. Many communities throughout Idaho are currently developing rules for post construction stormwater management. Sediment is usually the main pollutant of concern in stormwater from construction sites. The application of specific BMPs from Idaho's *Catalog of Stormwater Best Management Practices for Idaho Cities and Counties* (DEQ 2005) is generally sufficient to meet the standards and requirements of the CGP, unless local ordinances have more stringent and site-specific standards that are applicable.

5.3.2. Remaining Available Load/Reserve for Growth

The remaining available load (future loading targets) should be apportioned, to the extent possible, taking into account both spatial (location) and temporal (seasonal) distribution of sources.

5.4. Pollution Trading

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

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

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

Pollutant trading is recognized in Idaho's water quality standards at IDAPA 58.01.02.055.06. Currently, DEQ's policy is to allow for pollutant trading as a means to meet TMDLs, thus restoring water quality limited water bodies to compliance with water quality standards.

DEQ's *Water Quality Pollutant Trading Guidance* (DEQ 2010) sets forth the procedures to be followed for pollutant trading. No pollutant trading is currently planned for the watersheds in the Lemhi River subbasin.

5.4.1. Trading Components

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

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

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

5.4.2. Watershed-Specific Environmental Protection

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

5.4.3. Trading Framework

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

The elements of a trading document are described in DEQ's *Water Quality Pollutant Trading Guidance* (DEQ 2010).

5.5. Public Participation

WAGs are involved in TMDL development and review. The basic process for developing TMDLs and implementation plans is as follows:

1. DEQ's director appoints BAG members for each of Idaho's basins.
2. DEQ prepares an "Integrated Report" every 2 years that highlights which water bodies in Idaho appear to be degraded.

3. DEQ begins the subbasin assessment (SBA) and TMDL process for individual degraded watersheds.
4. DEQ (with help from the BAG) forms a WAG for a specific watershed/TMDL.
5. With the assistance of the WAG, DEQ develops an SBA and any necessary TMDLs for the watershed.
6. The WAG comments on the SBA/TMDL.
7. DEQ considers and incorporates WAG comments, as appropriate, into the SBA/TMDL.
8. The public comments on the SBA/TMDL.
9. DEQ considers and incorporates public comments, as appropriate, into the SBA/TMDL.
10. DEQ sends the document to EPA for approval.
11. DEQ and the WAG develop, and then implement, a plan to reach the goals of the TMDL.

The WAG and the public are key elements in TMDL development. When requested, DEQ will provide the WAG with all available information pertinent to the SBA/TMDL, such as monitoring data, water quality assessments, and relevant reports. The WAG also has the opportunity to actively participate in preparing the SBA/TMDL documents.

Once a draft SBA/TMDL is complete, it is reviewed first by the WAG, then by the public. If a WAG is not in agreement with an SBA/TMDL after WAG comments have been considered and incorporated, the WAG's position and the basis for it will be documented in the public notice of availability of the SBA/TMDL for review. If the WAG still disagrees with the SBA/TMDL after public comments have been considered and incorporated, DEQ must incorporate the WAG's dissenting opinion.

A summary of public comments and participation were included as Appendices G and H, respectively.

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 (Tables 16–21). These tables need to be updated—first to field verify the existing shade levels that have not yet been field verified and second to monitor progress towards achieving reductions and the goals of the TMDL. Using the Solar Pathfinder to measure existing shade levels in the field is important to achieving both objectives. It is likely that further field verification will 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 field verified. Implementation strategies should include Solar Pathfinder monitoring to simultaneously field verify the TMDL and mark progress towards achieving desired solar load reductions.

Implementation of the bacteria TMDL is already in effect with the current management of grazing allotments limiting cattle access to riparian habitat. Grazing management will continue to improve the condition of the Canyon Creek watershed.

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

5.6.1. Time Frame

Twenty years are allotted for meeting the temperature load allocations after implementation strategies have been in place. This time frame allows for two or three channel-forming events to stabilize the banks and for riparian vegetation to spread and increase canopy cover.

5.6.2. Approach, Monitoring Strategy, and Responsible Parties

Progress is being made toward the goals set in the 2001 agricultural implementation plan prepared for DEQ by the Lemhi Soil and Water Conservation District, Idaho Soil Conservation Commissions, and NRCS (Idaho Soil Conservation Commission 2001). Lead agencies and landowners of key riparian habitat are working cooperatively to increase streambank stability and vegetative cover. 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. The Upper Salmon Basin Watershed Program collaborates to improve habitat for salmonids while providing for the needs of irrigated agriculture and local economy.

5.7. Conclusions

Certain AUs currently listed in the 2010 IR for various causes have been determined to be impaired solely due to flow alteration. Mill Creek, Walter Creek (also including Ferry Creek), and Hawley Creek have been historically dewatered for irrigation. However, these streams have undergone extensive watershed improvement projects to reconnect their flow with the Lemhi River.

Effective shade targets were established 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, which was then field verified in some locations with Solar Pathfinder data.

All streams examined had excess heat loads as a result of lack of shade. Generally, shade loss has occurred most dramatically in the lower-elevation cottonwood riparian zone. Load analysis tables and lack of shade figures can be used to identify those stream segments that lack the most shade and hence have the greatest excess load per linear meter of stream. These data can be used to prioritize implementation efforts to restore and enhance shade on the streams examined.

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.

Although grazing is being managed for minimum impact to water quality in the entire Lemhi subbasin, a bacteria TMDL is provided for one AU for tributaries to Canyon Creek due to historic exceedances of the secondary contact recreation *E. coli* standard so that bacteria monitoring will continue.

Only Texas Creek remains unmonitored. That entire AU is in private ownership and access for monitoring is denied.

Table 25 summarizes the findings of the TMDL analyses.

Table 25. Summary of assessment outcomes for assessment units listed in Category 5, "Impaired Waters," of the 2010 Integrated Report.

Assessment Unit/ Water Body Segment	Listed Pollutant(s)	TMDL Completed	Recommended Changes to Idaho's Integrated Report	Justification
ID17060204SL001_06 Lemhi River—Kenney Creek to mouth	Temperature; Total coliform	Yes	List in Category 4a for temperature; Delist from Category 5 for total coliform	Temperature TMDL completed based on PNV[1;] EPA-approved TMDLs for *E. coli* and fecal coliform in 2000
ID17060204SL007a_03 McDevitt Creek—diversion to mouth	Low flow alterations	No	List in Category 4c; Delist from Category 5	Low flow should be listed in Category 4c and not Category 5
ID17060204SL026a_02 Mill Creek—diversion to mouth	Sediment; Cause unknown (nutrients suspected)	No	Leave in Category 4c; Delist from Category 5	Low flow alterations; Other flow regime alterations are sole cause of impairment
ID17060204SL027_02 Walter Creek—source to mouth	Combined biota/habitat bioassessments	No	Leave in Category 4c; Delist from Category 5	Low flow alterations are sole cause of impairment
ID17060204SL030_04 Lemhi River—confluence of Eighteenmile Creek and Texas Creek	Temperature	Yes	List in Category 4a	Temperature TMDL completed based on Potential Natural Vegetation (PNV)
ID17060204SL030_05 Lemhi River—confluence of Eighteenmile Creek and Texas Creek	Temperature	Yes	List in Category 4a	Temperature TMDL completed based on PNV
ID17060204SL036_03 Texas Creek	Combined biota/habitat bioassessments; Sediment; Fecal coliform	No	Leave in Category 5	Data gaps—inaccessible due to private land use in entire AU
ID17060204SL041_04 Eighteenmile Creek—Hawley Creek to mouth	Temperature	Yes	List in Category 4a	Temperature TMDL completed based on PNV
ID17060204SL042_03 Eighteenmile Creek—Clear Creek to Hawley Creek	Temperature	Yes	List in Category 4a; List in Category 4c for low flow alterations	Temperature TMDL completed based on PNV; Low flow alterations
ID17060204SL043_03 Eighteenmile Creek—Divide Creek to Hawley Creek	Fishes bioassessments; Temperature	Yes	Delist for fishes bioassessments; List in Category 4a for temperature; List in Category 4c for low flow alterations	Temperature TMDL completed based on PNV; Low flow alterations

Assessment Unit/ Water Body Segment	Listed Pollutant(s)	TMDL Completed	Recommended Changes to Idaho's Integrated Report	Justification
ID17060204SL045_02 Eighteenmile Creek—source to Divide Creek	Combined biota/habitat bioassessments	Yes	Delist for combined biota; List in Category 4a for temperature; List in Category 4c for low flow alterations	Temperature TMDL completed based on PNV; Low flow alterations
ID17060204SL050a_03 Hawley Creek—diversion to mouth	Cause unknown (nutrients suspected)	No	Delist for cause unknown; List in Category 4c	No nutrient sources;Low flow alterations are sole cause of impairment
ID17060204SL051b_02 Canyon Creek—source to diversion	Combined biota/habitat bioassessment; *Escherichia coli*	Yes	Delist for combined biota; List in Category 4c; List in Category 4a for E. coli	*E. coli* TMDL completed; Low flow alterations
ID17060204SL052a_02 Little Eightmile Creek—diversion to (mouth)	Temperature	Yes	List in Category 4a	Temperature TMDL completed based on PNV
ID17060204SL052b_02 Little Eightmile Creek—source to diversion	Temperature	Yes	List in Category 4a	Temperature TMDL completed based on PNV
ID17060204SL062b_02 Sandy Creek—source to diversion	Temperature	Yes	List in Category 4a	Temperature TMDL completed based on PNV
ID17060204SL064a_02 Bohannon Creek—diversion to mouth	Temperature	Yes	List in Category 4a	Temperature TMDL completed based on PNV
ID17060204SL064b_02 Bohannon Creek—source to diversion	Temperature	Yes	List in Category 4a; List in Category 4c for low flow alterations	Temperature TMDL completed based on PNV; Low flow alterations
ID17060204SL066a_03 Kirtley Creek—diversion to mouth	Has existing temperature TMDL	Yes	Keep in Category 4a and Category 4c	Revises existing temperature TMDL; PNV method here replaces earlier load allocation method

Additional AUs that were not listed in Category 5 of the 2010 IR were confluent with AUs that are listed for temperature. The following list summarizes the AUs that receive a source temperature load allocation in conjunction with temperature-listed AUs in this TMDL. These AUs are not suspected of impairment, but receive a shade load allocation in Section 5.1.7 of this document.

- ID17060204SL003a_06 Withington Creek—diversion to mouth (actually west channel of Lemhi River)
- ID17060204SL004_06 Haynes Creek—source to mouth (actually west channel of Lemhi River)
- ID17060204SL005_06 Lemhi River—Hayden Creek to Kenney Creek
- ID17060204SL024_05 Lemhi River—Peterson Creek to Hayden Creek
- ID17060204SL025_05 Lemhi River—confluence of Big and Little Eightmile Creeks to Peterson Creek
- ID17060204SL062a_02 Sandy Creek—source to diversion

- ID17060204SL066b_02 Kirtley Creek

Implementation strategies for TMDLs produced using PNV-based shade and solar loads should incorporate the load analysis tables in that section.

Implementation of the bacteria TMDL is already in effect with the current management of grazing allotments limiting cattle access to riparian habitat. Grazing management will continue to improve the condition of the Canyon Creek watershed.

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

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GIS Data

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Glossary

305(b)	Refers to section 305 subsection "b" of the Clean Water Act. The term "305(b)" generally describes a report of each state's water quality and is the principle means by which the U.S. Environmental Protection Agency, Congress, and the public evaluate whether U.S. waters meet water quality standards, the progress made in maintaining and restoring water quality, and the extent of the remaining problems.
§303(d)	Refers to section 303 subsection "d" of the Clean Water Act. 303(d) requires states to develop a list of water bodies that do not meet water quality standards. This section also requires total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and the TMDLs are subject to U.S. Environmental Protection Agency approval.
Algae	Non-vascular (without water-conducting tissue) aquatic plants that occur as single cells, colonies, or filaments.
Alluvium	Unconsolidated recent stream deposition.
Anthropogenic	Relating to, or resulting from, the influence of human beings on nature.
Anti-Degradation	Refers to the U.S. Environmental Protection Agency's interpretation of the Clean Water Act goal that states and tribes maintain, as well as restore, water quality. This applies to waters that meet or are of higher water quality than required by state standards. State rules provide that the quality of those high quality waters may be lowered only to allow important social or economic development and only after adequate public participation (IDAPA 58.01.02.051). In all cases, the existing beneficial uses must be maintained. State rules further define lowered water quality to be 1) a measurable change, 2) a change adverse to a use, and 3) a change in a pollutant relevant to the water's uses (IDAPA 58.01.02.003.61).
Aquatic	Occurring, growing, or living in water.
Aquifer	An underground, water-bearing layer or stratum of permeable rock, sand, or gravel capable of yielding of water to wells or springs.
Assemblage (aquatic)	An association of interacting populations of organisms in a given water body; for example, a fish assemblage or a benthic macroinvertebrate assemblage (also see Community) (EPA 1996).
Assessment Database (ADB)	The ADB is a relational database application designed for the U.S. Environmental Protection Agency for tracking water quality assessment data, such as use attainment and causes and sources of impairment. States need to track this information and many other types of assessment data for thousands of water bodies and integrate it into meaningful reports. The

ADB is designed to make this process accurate, straightforward, and user-friendly for participating states, territories, tribes, and basin commissions.

Assessment Unit (AU)

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

Assimilative Capacity

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

Beneficial Use

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

Beneficial Use Reconnaissance Program (BURP)

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

Best Management Practices (BMPs)

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

Biota

The animal and plant life of a given region.

Biotic

A term applied to the living components of an area.

Clean Water Act (CWA)

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

Coliform Bacteria

A group of bacteria predominantly inhabiting the intestines of humans and animals but also found in soil. Coliform bacteria are commonly used as indicators of the possible presence of pathogenic organisms (also see Fecal Coliform Bacteria, *E. coli*, and Pathogens).

Criteria

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

Cubic Feet per Second (cfs)

A unit of measure for the rate of flow or discharge of water. One cubic foot per second is the rate of flow of a stream with a cross-section of one square foot flowing at a mean velocity of one foot per second. At a steady rate, one cubic foot per second is equal to 448.8 gallons per minute and 10,984 acre-feet per day.

Depth Fines

Percent by weight of particles of small size within a vertical core of volume of a streambed or lake bottom sediment. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 6.5 millimeters depending on the observer and methodology used. The depth sampled varies but is typically about one foot (30 centimeters).

Designated Uses

Those water uses identified in state water quality standards that must be achieved and maintained as required under the Clean Water Act.

Discharge

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

Disturbance

Any event or series of events that disrupts ecosystem, community, or population structure and alters the physical environment.

E. coli

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

Environment

The complete range of external conditions, physical and biological, that affect a particular organism or community.

Ephemeral Stream

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

Exceedance

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

Existing Beneficial Use or Existing Use

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

Fecal Coliform Bacteria

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

Flow

See Discharge.

Fully Supporting

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

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

Geographic Information Systems (GIS)
A georeferenced database.

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

Ground Water
Water found beneath the soil surface saturating the layer in which it is located. Most ground water originates as rainfall, is free to move under the influence of gravity, and usually emerges again as streamflow.

Habitat
The living place of an organism or community.

Headwater
The origin or beginning of a stream.

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

Hydrologic Cycle
The cycling of water from the atmosphere to the earth (precipitation) and back to the atmosphere (evaporation and plant transpiration). Atmospheric moisture, clouds, rainfall, runoff, surface water, ground water, and water infiltrated in soils are all part of the hydrologic cycle.

Hydrologic Unit
One of a nested series of numbered and named watersheds arising from a national standardization of watershed delineation. The initial 1974 effort (USGS 1987) described four levels (region, subregion, accounting unit, cataloging unit) of watersheds throughout the United States. The fourth level is uniquely identified by an eight-digit code built of two-digit fields for each level in the classification. Originally termed a cataloging unit, fourth-field hydrologic units have been more commonly called subbasins. Fifth- and sixth-field hydrologic units have since been delineated for much of the country and are known as watershed and subwatersheds, respectively.

Hydrologic Unit Code (HUC)
The number assigned to a hydrologic unit. Often used to refer to fourth-field hydrologic units.

Hydrology
The science dealing with the properties, distribution, and circulation of water.

Intermittent Stream
1) A stream that flows only part of the year, such as when the ground water table is high or when the stream receives water from springs or from surface sources such as melting snow in mountainous areas. The stream ceases to flow above the streambed when losses from evaporation or seepage exceed the available streamflow. 2) A stream that has a period of zero flow for at least one week during most years.

Irrigation Return Flow	Surface (and subsurface) water that leaves a field following the application of irrigation water and eventually flows into streams.
Load Allocation (LA)	A portion of a water body's load capacity for a given pollutant that is given to a particular nonpoint source (by class, type, or geographic area).
Load(ing)	The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Loading is the product of flow (discharge) and concentration.
Load(ing) Capacity (LC)	A determination of how much pollutant a water body can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, and a margin of safety, it becomes a total maximum daily load.
Macroinvertebrate	An invertebrate animal (without a backbone) large enough to be seen without magnification and retained by a 500 micrometer mesh (U.S. #30) screen.
Margin of Safety (MOS)	An implicit or explicit portion of a water body's loading capacity set aside to allow the uncertainly about the relationship between the pollutant loads and the quality of the receiving water body. This is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The MOS is not allocated to any sources of pollution.
Mean	Describes the central tendency of a set of numbers. The arithmetic mean (calculated by adding all items in a list, then dividing by the number of items) is the statistic most familiar to most people.
Median	The middle number in a sequence of numbers. If there are an even number of numbers, the median is the average of the two middle numbers. For example, 4 is the median of 1, 2, 4, 14, 16; 6 is the median of 1, 2, 5, 7, 9, 11.
Metric	1) A discrete measure of something, such as an ecological indicator (e.g., number of distinct taxon). 2) The metric system of measurement.
Milligrams per Liter (mg/L)	A unit of measure for concentration. In water, it is essentially equivalent to parts per million (ppm).
Monitoring	A periodic or continuous measurement of the properties or conditions of some medium of interest, such as monitoring a water body.
Mouth	The location where flowing water enters into a larger water body.

National Pollutant Discharge Elimination System (NPDES)
A national program established by the Clean Water Act for permitting point sources of pollution. Discharge of pollution from point sources is not allowed without a permit.

Natural Condition
The condition that exists with little or no anthropogenic influence.

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 discernible point or origin. They include, but are not limited to, irrigated and non-irrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.

Not Assessed (NA)
A concept and an assessment category describing water bodies that have been studied, but are missing critical information needed to complete an assessment.

Not Attainable
A concept and an assessment category describing water bodies that demonstrate characteristics that make it unlikely that a beneficial use can be attained (e.g., a stream that is dry but designated for salmonid spawning).

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

Not Fully Supporting Cold Water
At least one biological assemblage has been significantly modified beyond the natural range of its reference condition.

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

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

Organic Matter
Compounds manufactured by plants and animals that contain principally carbon.

Parameter
A variable, measurable property whose value is a determinant of the characteristics of a system, such as temperature, dissolved oxygen, and fish populations are parameters of a stream or lake.

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

coliform bacteria, are used by the state of Idaho as the indicator for the presence of pathogenic microorganisms.

Perennial Stream

A stream that flows year-around in most years.

pH

The negative $\log_{10}$ of the concentration of hydrogen ions, a measure which in water ranges from very acidic (pH = 1) to very alkaline (pH = 14). A pH of 7 is neutral. Surface waters usually measure between pH 6 and 9.

Phosphorus

An element essential to plant growth, often in limited supply, and thus considered a nutrient.

Point Source

A source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable "point" of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater.

Pollutant

Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

Pollution

A very broad concept that encompasses human-caused changes in the environment which alter the functioning of natural processes and produce undesirable environmental and health effects. This includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.

Population

A group of interbreeding organisms occupying a particular space; the number of humans or other living creatures in a designated area.

Qualitative

Descriptive of kind, type, or direction.

Quantitative

Descriptive of size, magnitude, or degree.

Reach

A stream section with fairly homogenous physical characteristics.

Reconnaissance

An exploratory or preliminary survey of an area.

Reference

A physical or chemical quantity whose value is known and thus is used to calibrate or standardize instruments.

Reference Condition

1) A condition that fully supports applicable beneficial uses with little effect from human activity and represents the highest level of support attainable.
2) A benchmark for populations of aquatic ecosystems used to describe desired conditions in a biological assessment and acceptable or unacceptable departures from them. The reference condition can be determined through examining regional reference sites, historical conditions, quantitative models, and expert judgment (Hughes 1995).

Riffle

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

Riparian

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

River

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

Runoff

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

Sediments

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

Species

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

Stream

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

Stream Order

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

Stormwater Runoff

Rainfall that quickly runs off the land after a storm. In developed watersheds the water flows off roofs and pavement into storm drains that may feed quickly and directly into the stream. The water often carries pollutants picked up from these surfaces.

Subbasin

A large watershed of several hundred thousand acres. This is the name commonly given to 4th-field hydrologic units (also see Hydrologic Unit).

Subbasin Assessment (SBA)

A watershed-based problem assessment that is the first step in developing a total maximum daily load in Idaho.

Subwatershed

A smaller watershed area delineated within a larger watershed, often for purposes of describing and managing localized conditions. Also proposed for adoption as the formal name for 6th-field hydrologic units.

Surface Fines

Sediments of small size deposited on the surface of a streambed or lake bottom. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 6.5 millimeters depending on the observer and methodology used. Results are typically expressed as a percentage of observation points with fine sediment.

Surface Runoff

Precipitation, snow melt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of nonpoint source pollutants in rivers, streams, and lakes. Surface runoff is also called overland flow.

Surface Water

All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors that are directly influenced by surface water.

Total Maximum Daily Load (TMDL)

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

Tributary

A stream feeding into a larger stream or lake.

Wasteload Allocation (WLA)

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

Water Body

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

Water Column

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

Water Pollution

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

Water Quality

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

Water Quality Criteria

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

Water Quality Limited

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

Water Quality Limited Segment (WQLS)

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

Water Quality Standards

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

Water Table

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

Watershed

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

Wetland

An area that is at least some of the time saturated by surface or ground water so as to support with vegetation adapted to saturated soil conditions. Examples include swamps, bogs, fens, and marshes.

Appendix A. Unit Conversion Chart

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

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

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

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Appendix B. Data Sources

Water Body	Data Source	Type of Data	When Collected
Lemhi River	U.S. Geological Survey	Time series temperature data	10/1/1997 through 9/30/2005
Lemhi River	U.S. Geological Survey	Streamflow	1912, 1938 through present
Canyon Creek, Hawley Creek, Little Eightmile Creek, Mill Creek	Salmon-Challis National Forest	Percent bank stability and mean percent fines less than 0.25 inches at depth	1993 through 2009
Canyon Creek, Frank Hall Creek, Hawley Creek, Little Eightmile Creek, Mill Creek	Salmon-Challis National Forest	Instream temperature	2004 through 2009
Mill Creek, Eighteenmile Creek, Hawley Creek, Sandy Creek, Bohannon Creek	DEQ Idaho Falls Regional Office	Sediment	July through August 2008
Lemhi River, Texas Creek, Canyon Creek tributaries	DEQ Idaho Falls Regional Office	*E. coli* bacteria	September 2008
Bohannon Creek, Eighteenmile Creek, Lemhi River, Kirtley Creek, Little Eightmile Creek, Sandy Creek	DEQ State Technical Services Office	Pathfinder effective shade and stream width	September 2007
Bohannon Creek, Eighteenmile Creek, Lemhi River, Kirtley Creek, Little Eightmile Creek, Sandy Creek	DEQ State Technical Services Office	Aerial photo interpretation of existing shade and stream width estimation	2007, revised December 2009
Bohannon Creek, Eighteenmile Creek, Kirtley Creek, Lemhi River, Little Eightmile Creek, Sandy Creek	DEQ IDASA Database	Temperature	1994 through 2008
Lemhi River, Mill Creek, Walter Creek, Texas Creek, Eighteenmile Creek, Hawley Creek, Frank Hall Creek, Wildcat Creek, Canyon Creek, Little Eightmile Creek, Sandy Creek, Bohannon Creek	DEQ IDASA Database	Physical habitat and biological assessments	1994 through 2008

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Appendix C. Salmon-Challis National Forest Sediment and Temperature Data for the Lemhi River Subbasin

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Salmon-Challis National Forest
Lemhi Subbasin Depth Fines Data
Mean Percent Fines <.25" at Depth

Station	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Bear Valley Creek 1A	16.5	20.3	28.2	26.8	34.5	19.4	11.6	19.2	19.7	26.5	15.9	18.8	16.5		12	29.9
Bear Valley Creek 2A	26.2	27.8														
Bear Valley Creek 3A	18.9	30.8	24.1	29.4				25.7								
Bear Valley Creek 4A	9.4	14			23	25.3				26.4						
Big Bear Creek 1R	20.1	46.9	54.6	32.1	27.5	39.7	15.1		29.9	33.7	22	18.4	13.4	21.9	27.9	36.3
Big Eightmile Creek 1R	31.6	19.3		22.9	16.4	17.9	20.3	13.4	12.5		21	9.3				
Big Eightmile Creek 2R	22.2	14.5	21.8	13.5	21.6	11.9		22.8		20	11.9	9.3				
Big Timber Creek 1R	32.1	33.1	26.9	31.4	24.6	14.7	15.6	21.6	19.4	29.5	12.4	10.3			22.3	16.8
Canyon Creek 1R	22.8	27.8	30.2	28.5	16.5	13.1	13.4	24.4	36.1	41.8	13.7	17.5	16.8	29.3		30
EF Hayden Creek 1R	28.2	21.3						27.8								
EF Hayden Creek 2R	34	40.5			34.2	40.5	46.5	43.1	48.8	43.7	52.7	46.9	44.4			
Hawley Creek 1R	22.6	22.5	26.4	18.9	14.8	19.1	23.9	35.4	22.1	26.3	26.7	20.2	12.8		16.3	16.1
Hayden Creek 1A	14.3	21.8	16.8	15.8	20.5	12.7	13.5	17.4	19.3	13.7	8.7	23.6			7.3	23.6
Haynes Creek 1R	22.3	12.1									11.7	11.9	9			
Kenney Creek 1R	22.1	22.1												5.9		
Little Eightmile Creek 1R	26.2		26.1				20.8					32.5				20
MF Little Timber Creek 1R	21.1	15.5										45				17.5
Mill Creek 1R	16.6	20.8					7	17.5	13.4		15.4	9.7				15.4
NF Little Timber Creek 1R	25.1	23.7										13.5	9.48			
Pattee Creek 1R	18.1	30.3							18.2	11.7	19	22.3	13.3	18.4	19.2	15.8
Reservoir Creek 1R	40.1	30.7	34.4	37.6	24.2	29.2		41.5		44	32.3	41		17.3	31.6	25.9
Withington Creek 1R	18.6	13.3									16.4		9.8	15.4	9	15.4

Salmon-Challis National Forest

Lemhi Subbasin Summary Bank Stability Measurements

Percent Bank Stability

Station	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Lemhi River																	
Bear Valley Creek 1A		46.0	83.0	96.5	70.0	82.5	83.0	79.0	91.0	87.0	64.5	95.5	90.5		97.5	83	99.5
Bear Valley Creek 2A																	
Bear Valley Creek 3A		78.0	90.0	93.0				72.0									
Bear Valley Creek 4A		92.0			85.0	88.0				94.0	64						
Big Bear Creek 1R			85.5			86.0	86.5	91.0	94.0	91.5	92.0	95.5		100.0	97.0	94	95
Big Eightmile Creek 1R		100.0		91.0	79.0	88.5	69.0	84.0	86.0		88.5						
Big Eightmile Creek 2R		91.5	95.5	93.0	73.0	93.5		85.0		80.5	91.0	96					92
Big Timber Creek 1R		89.0	97.0	96.0	88.0	99.0	100.0	92.0	89.5	79.5	90.0	97.5			100.0	92.5	
Canyon Creek 1R		99.0	98.5	95.0	88.0	84.0	80.0	81.0	92.5	87.0	98.5	88.5	99.0	100.0		99	
EF Hayden Creek 1R																	
EF Hayden Creek 2R		100.0			91.0	94.0	94.5	99.0	96.0	100.0	97.0	99	98.0				
Hawley Creek 1R		88.0	97.0	89.0	91.1	96.0	99.0	94.5	91.0	92.0	96.0	93.5	94.5		100.0	96	97
Hayden Creek 1A		93.5	98.0	93.5	84.0	80.0	84.5	87.0	89.0	80.0	99.0	95.5			100.0	97.5	92
Haynes Creek 1R		92.0						55.0			86.5	92.5	76.5				
Kenney Creek 1R		91.5									74.5			95.0			
Little Eightmile Creek 1R			100.0				75.5					59				85	88
MF Little Timber Creek 1R		78.0										89					98.5
Mill Creek 1R		91.0					88.0	93.0	82.0		95.5	97				99.5	
NF Little Timber Creek 1R		95.0										98.5	96.0				92.5
Pattee Creek 1R		86.5							76.0	86.0	80	91.5	83.5	81.0	88.0	85	73
Reservoir Creek 1R		84.0	94.0	68.0	90.5	78.0		64.0		91.5	86.0	89		90.0	95.5	88	56
Withington Creek 1R		98.0									76.5		92.5	85.0	84.5	79	

Temperature Data for Impaired Waters listed in Category 5 of the 2010 Integrated Report

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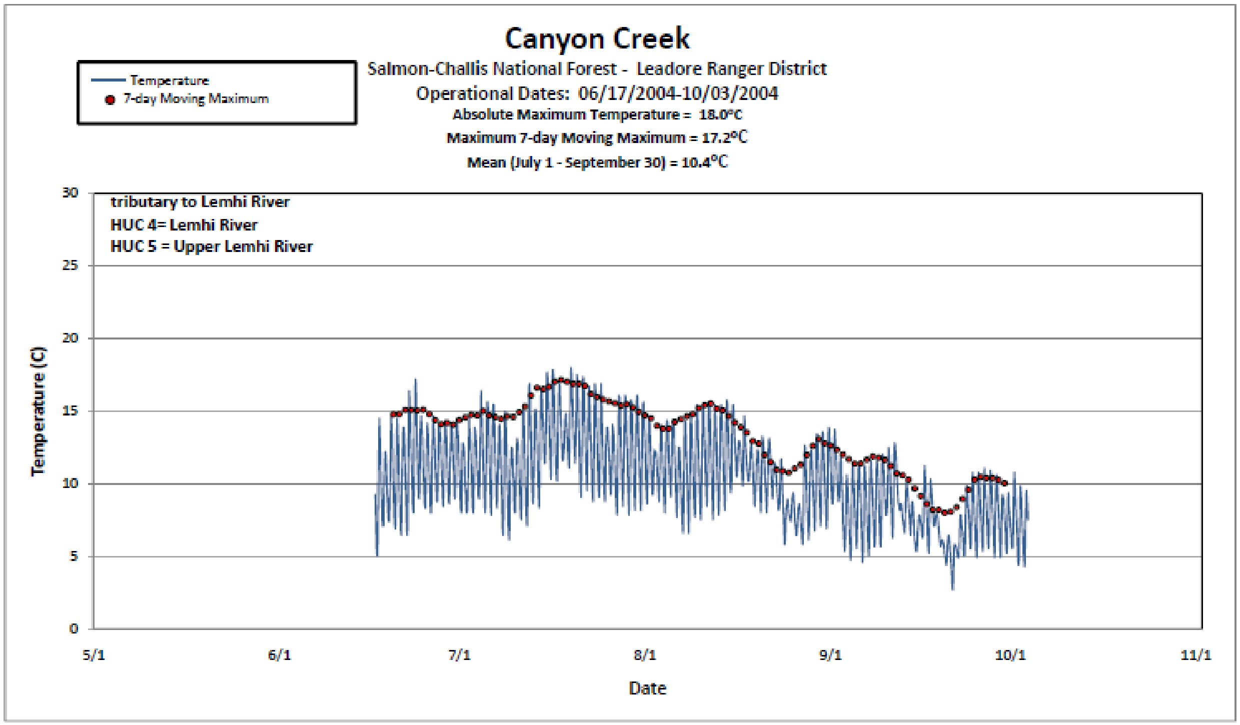

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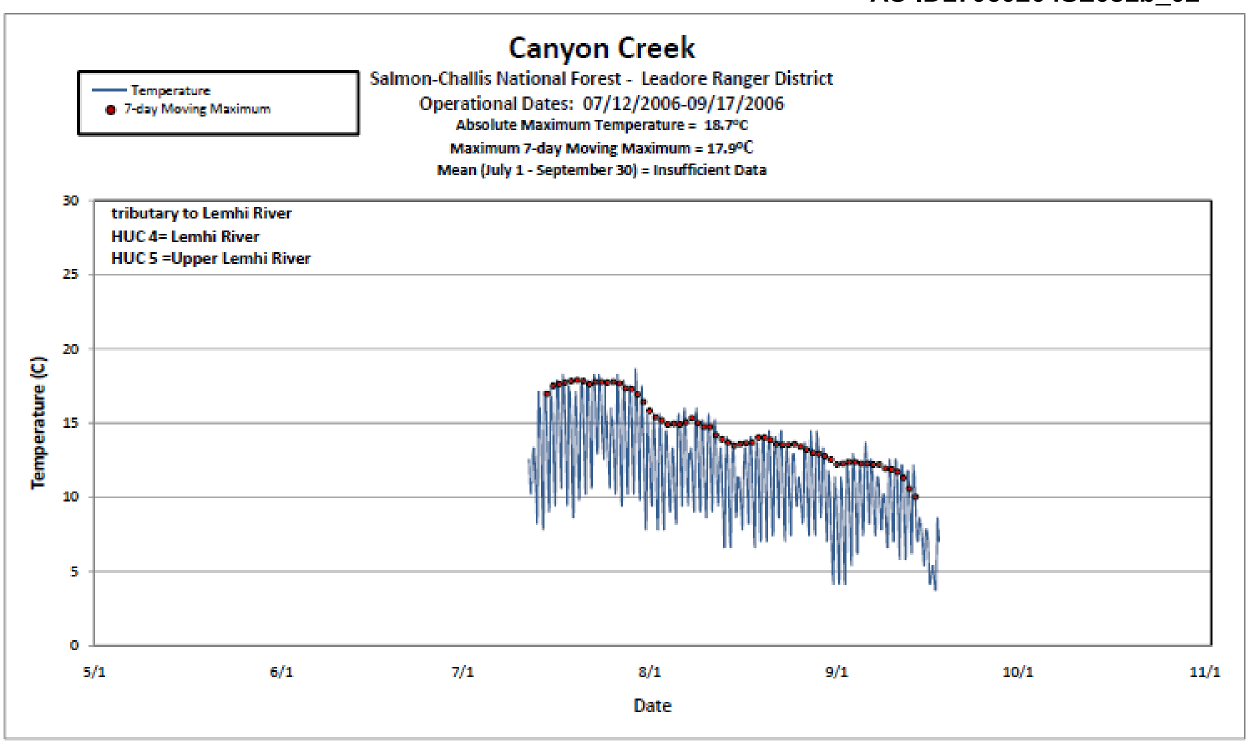

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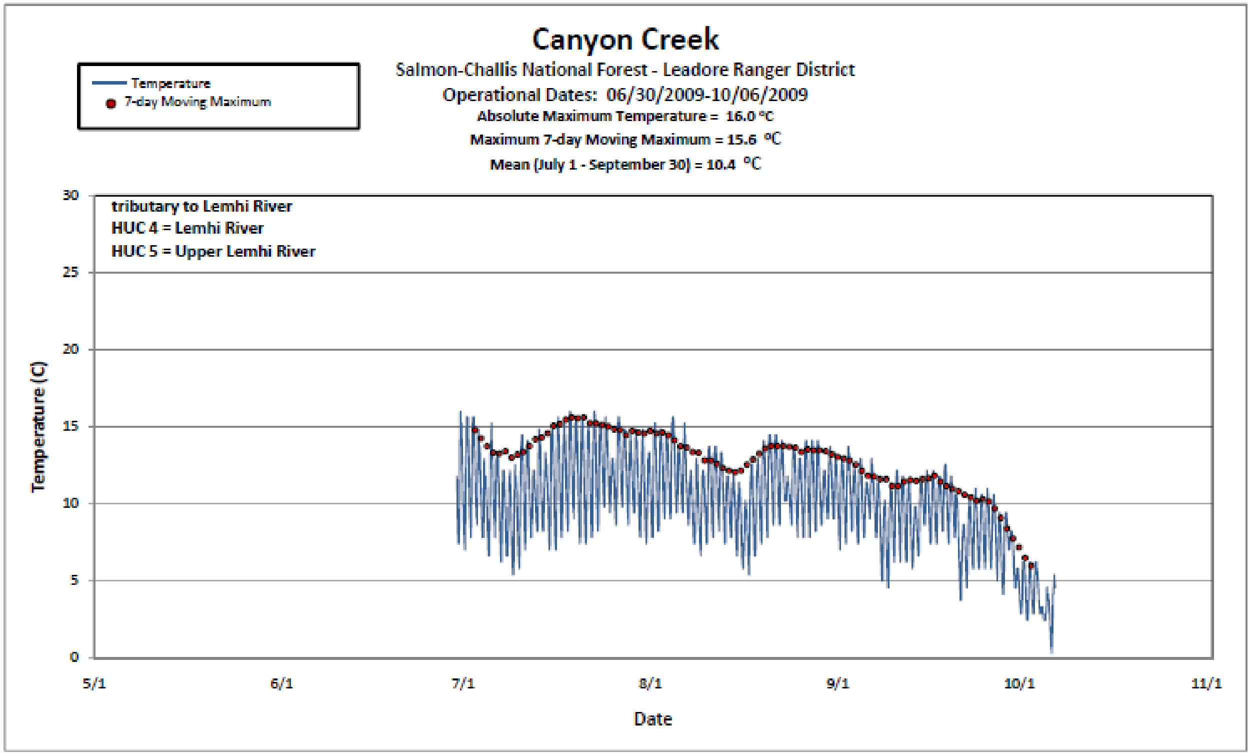

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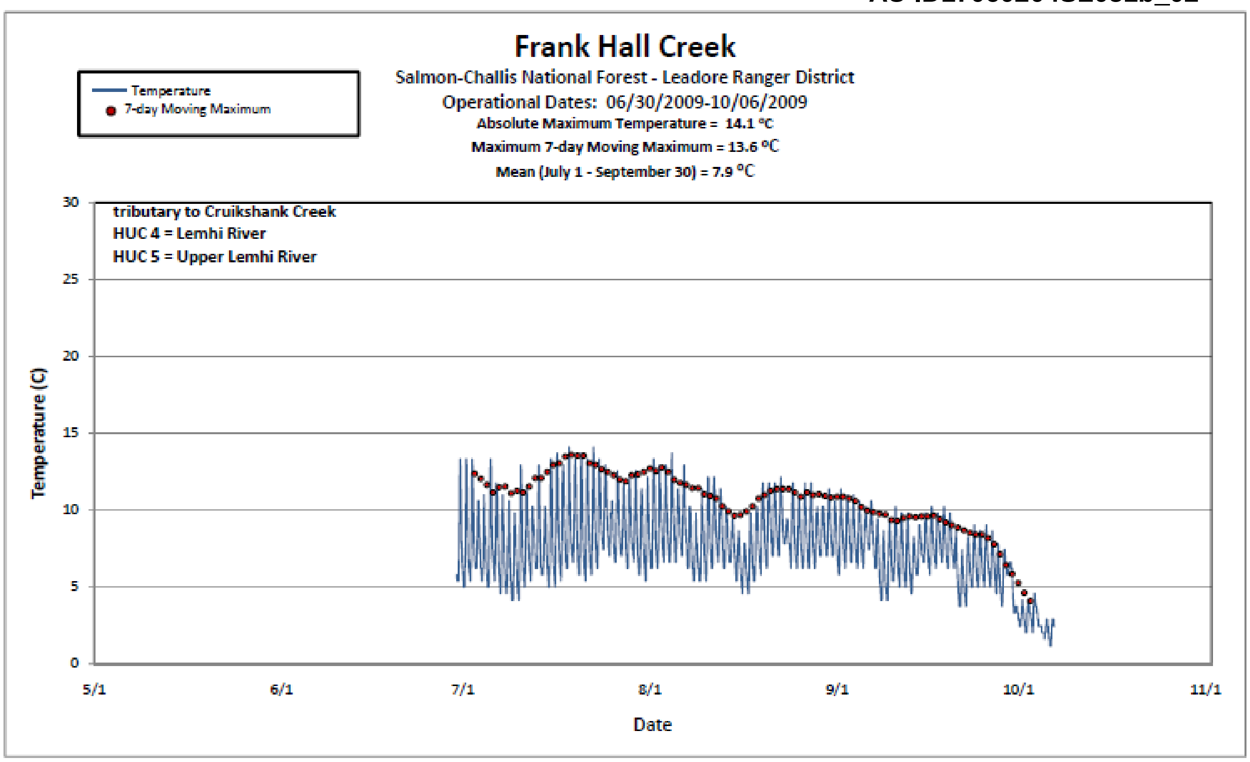

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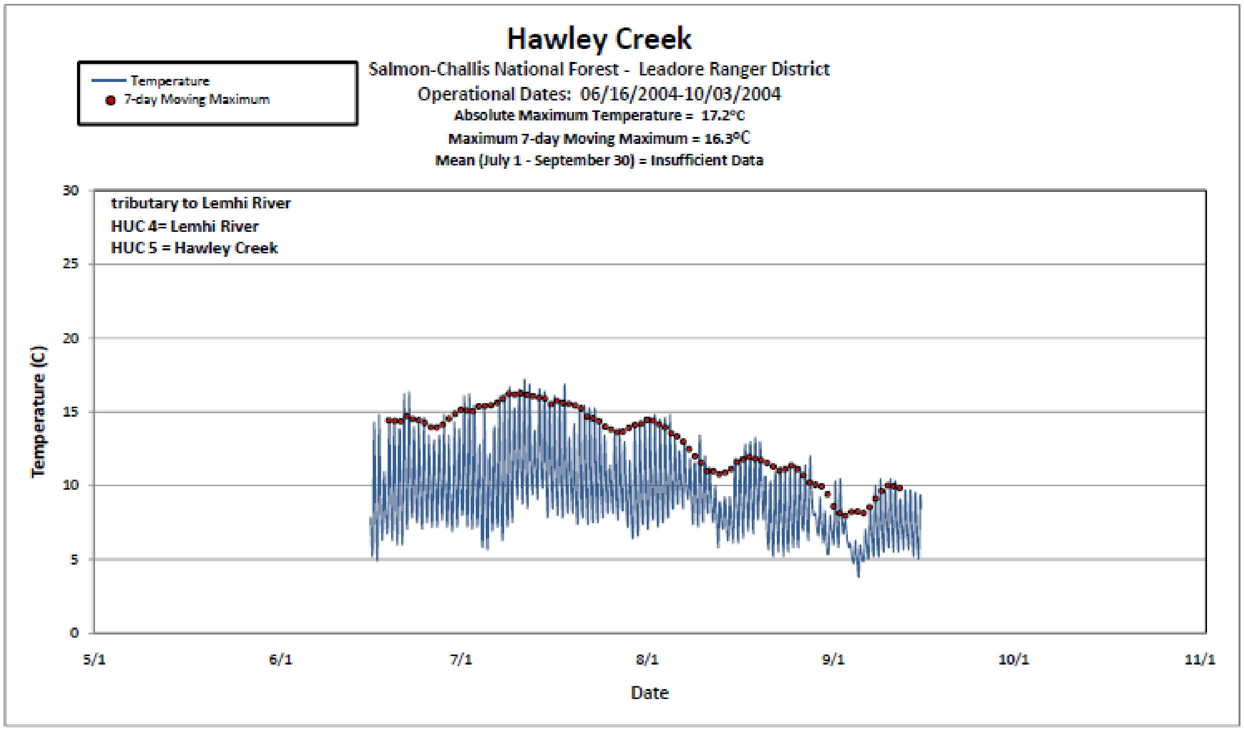

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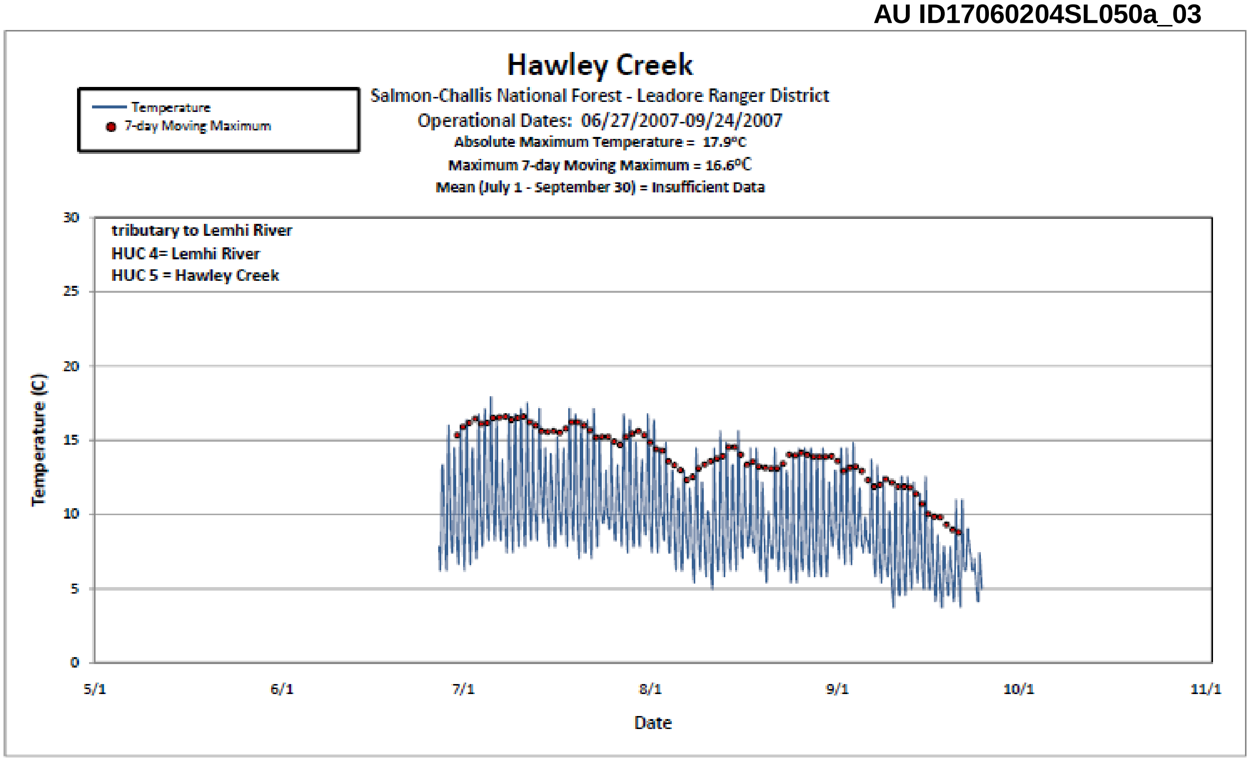

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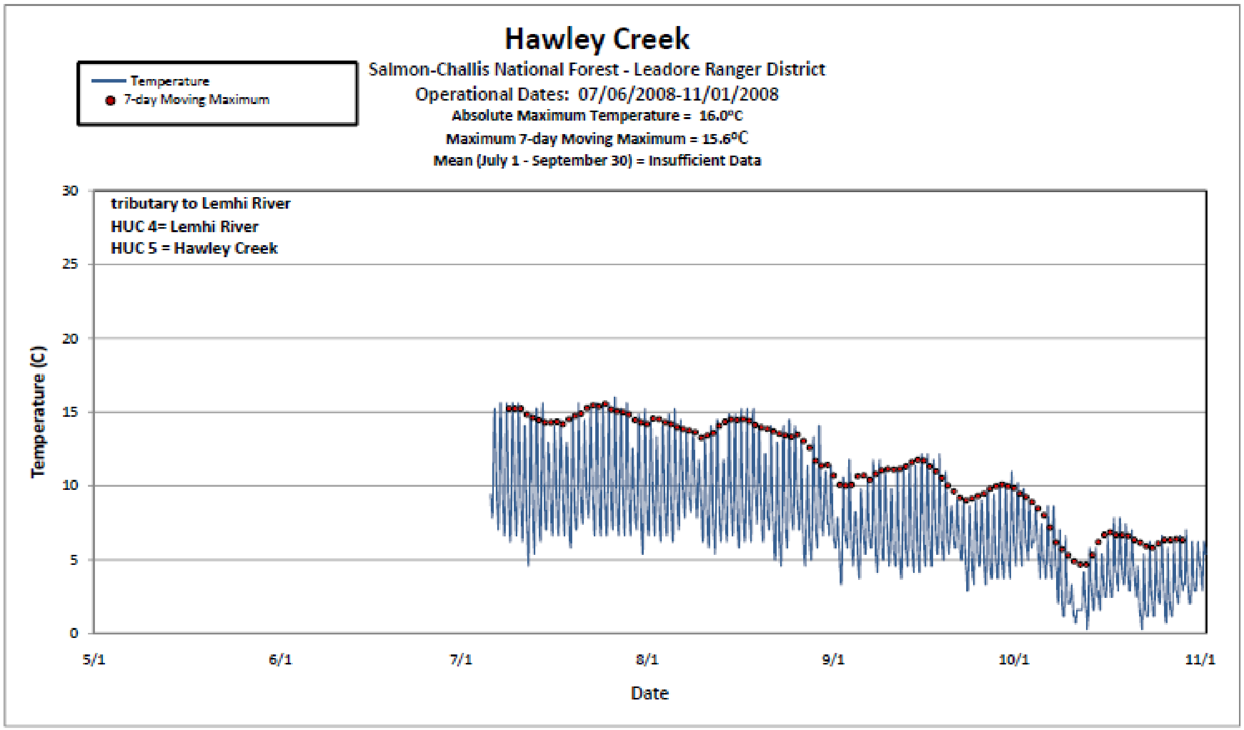

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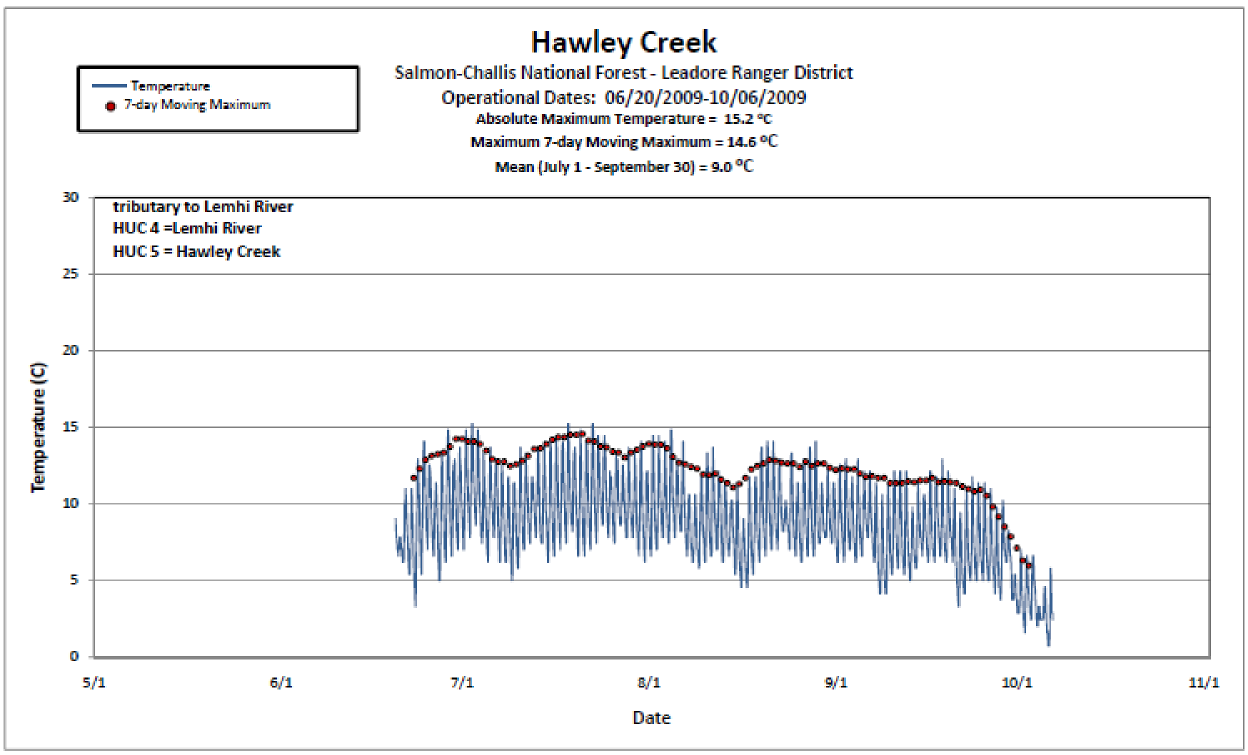

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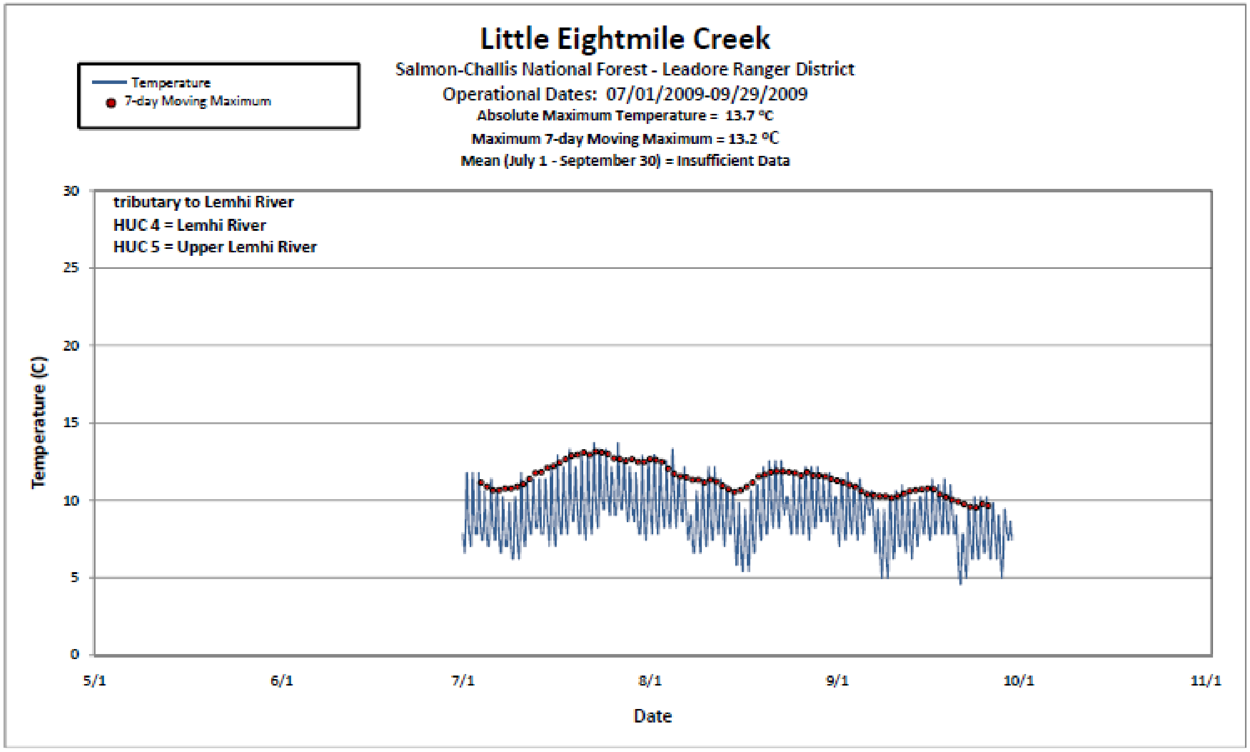

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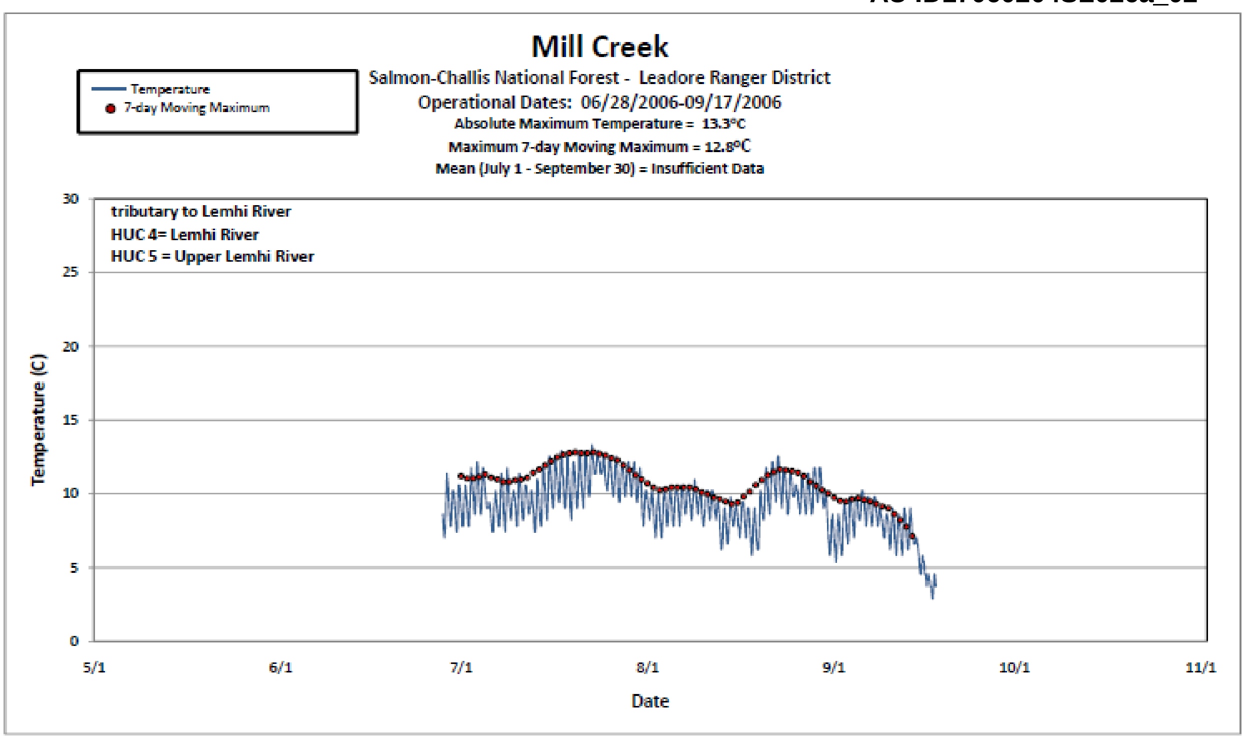

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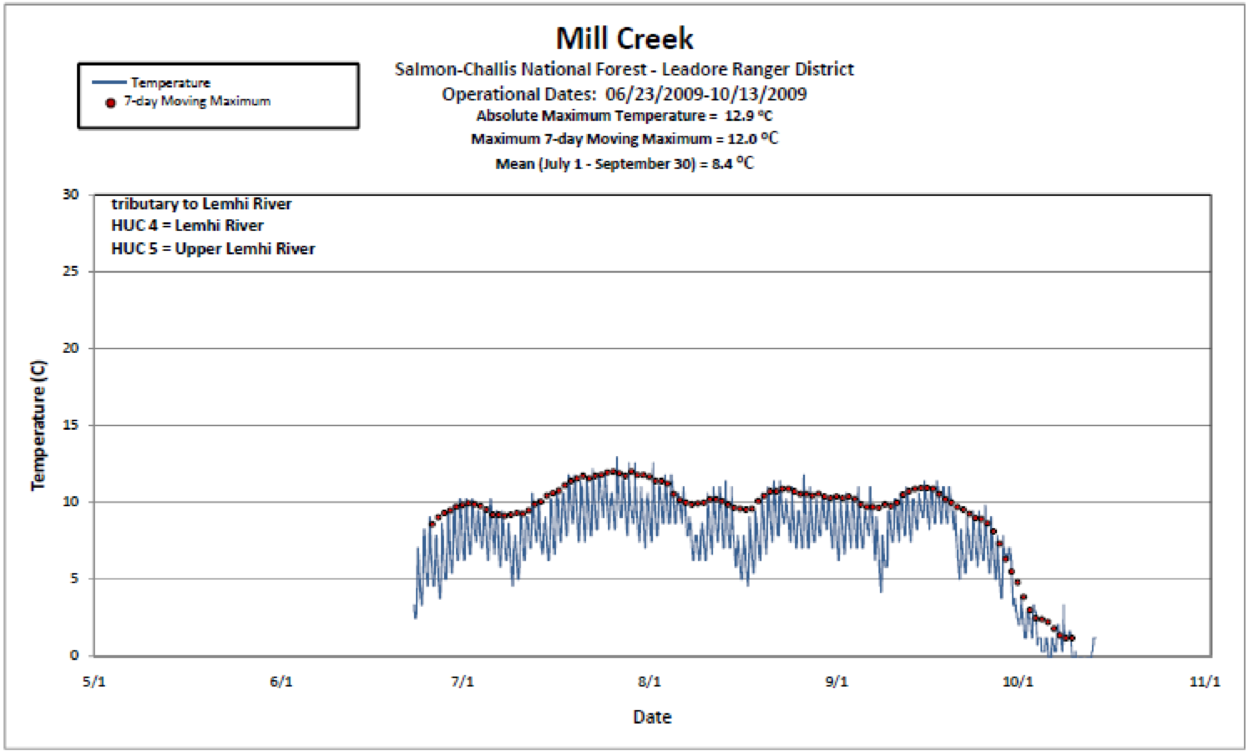
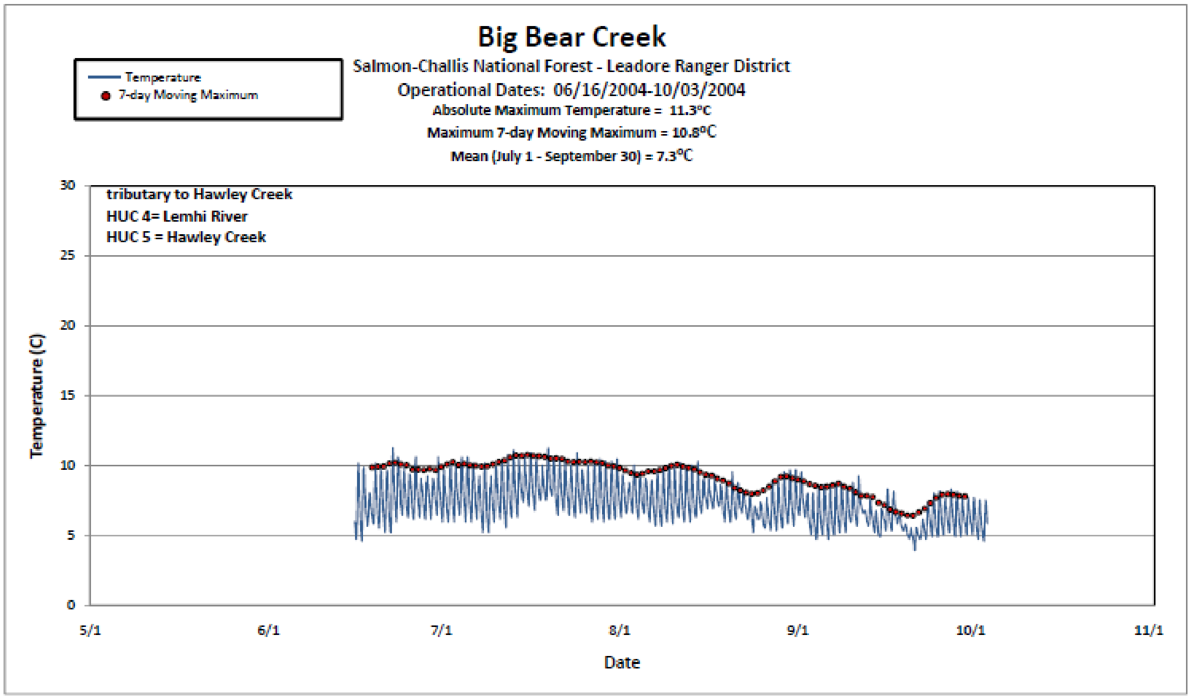
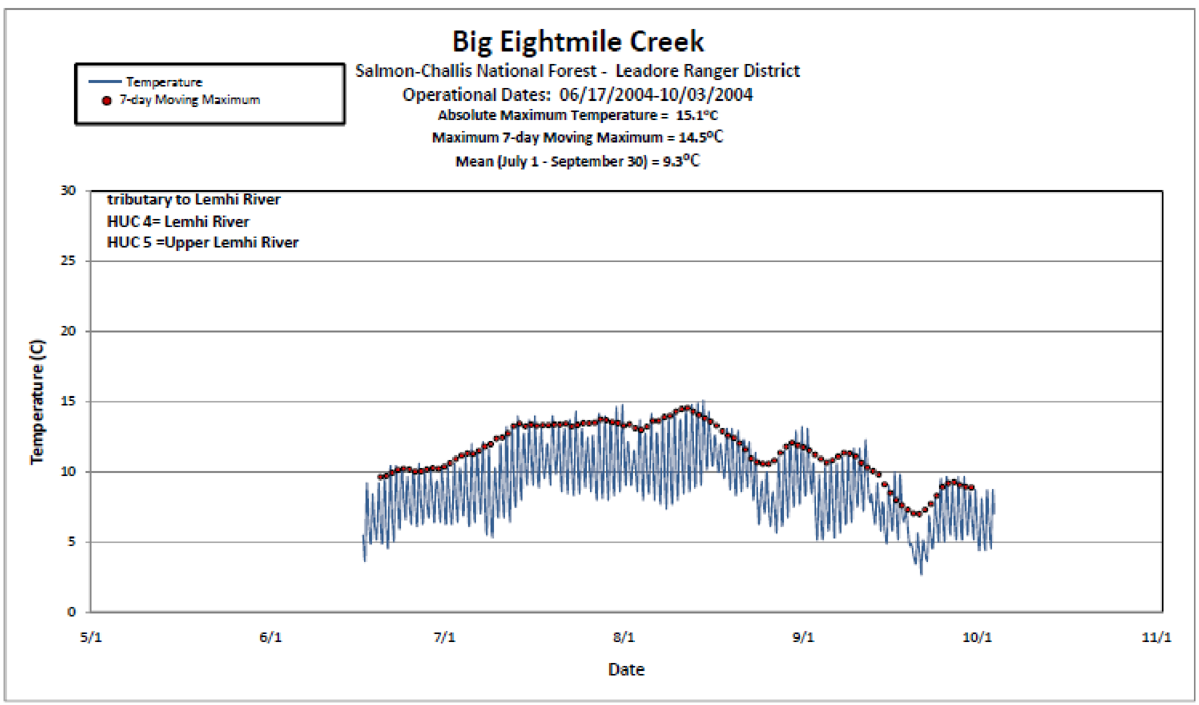
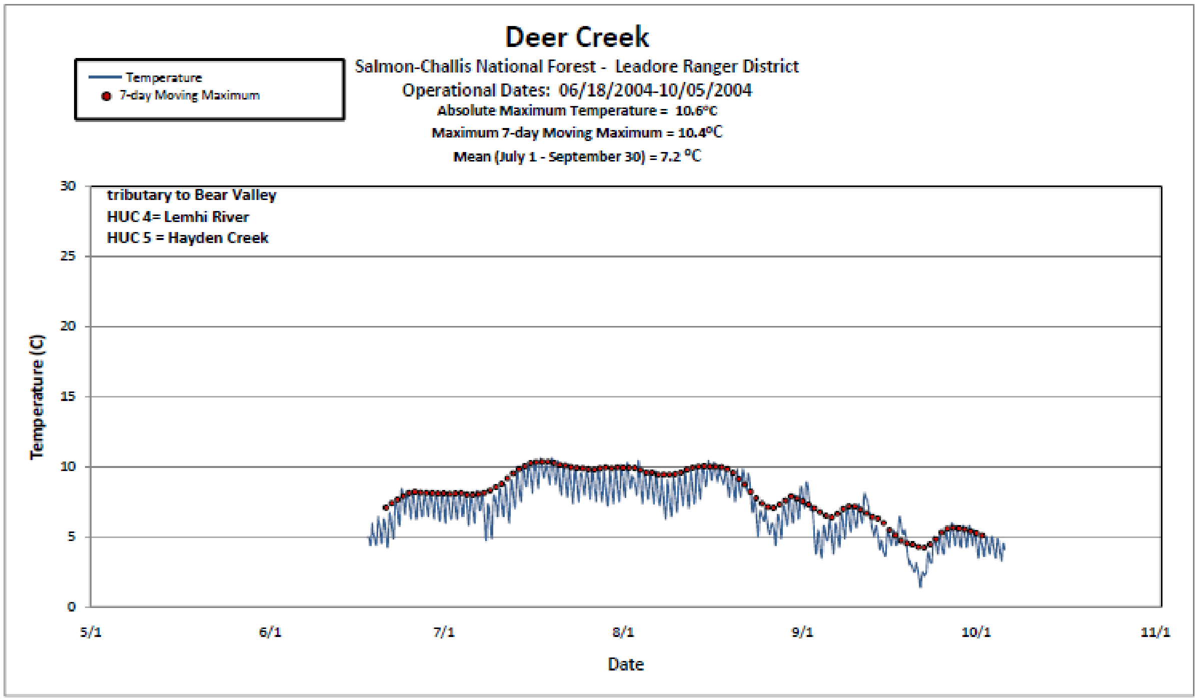
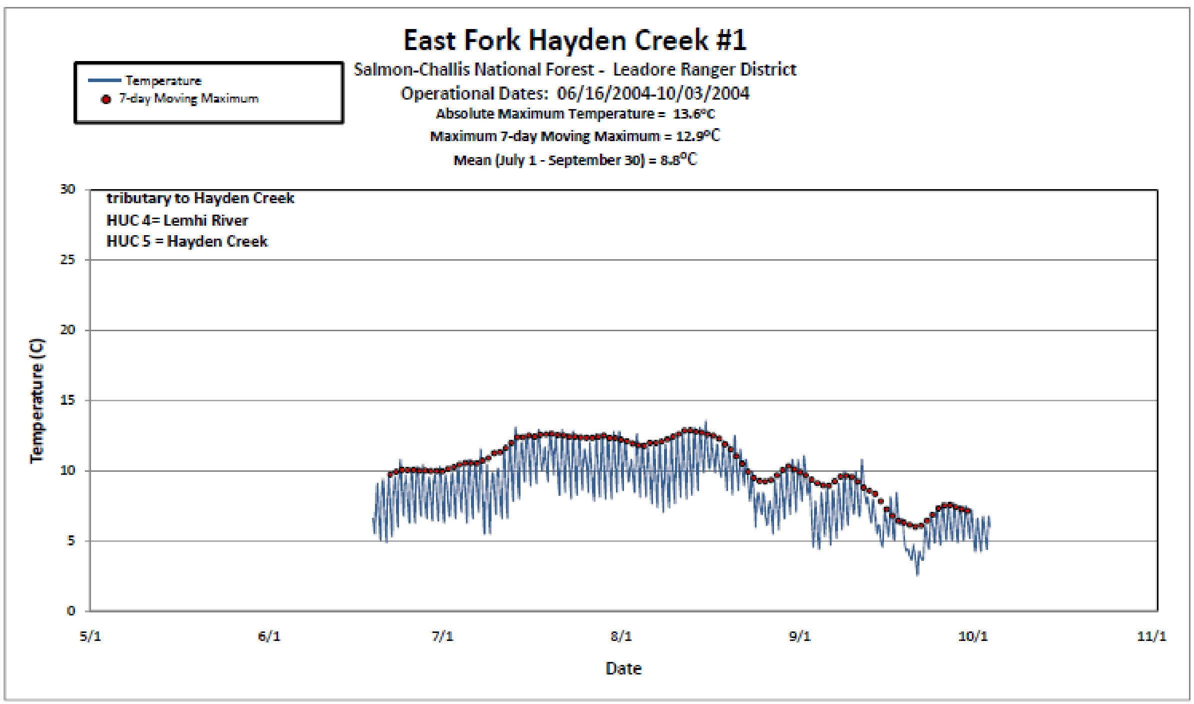


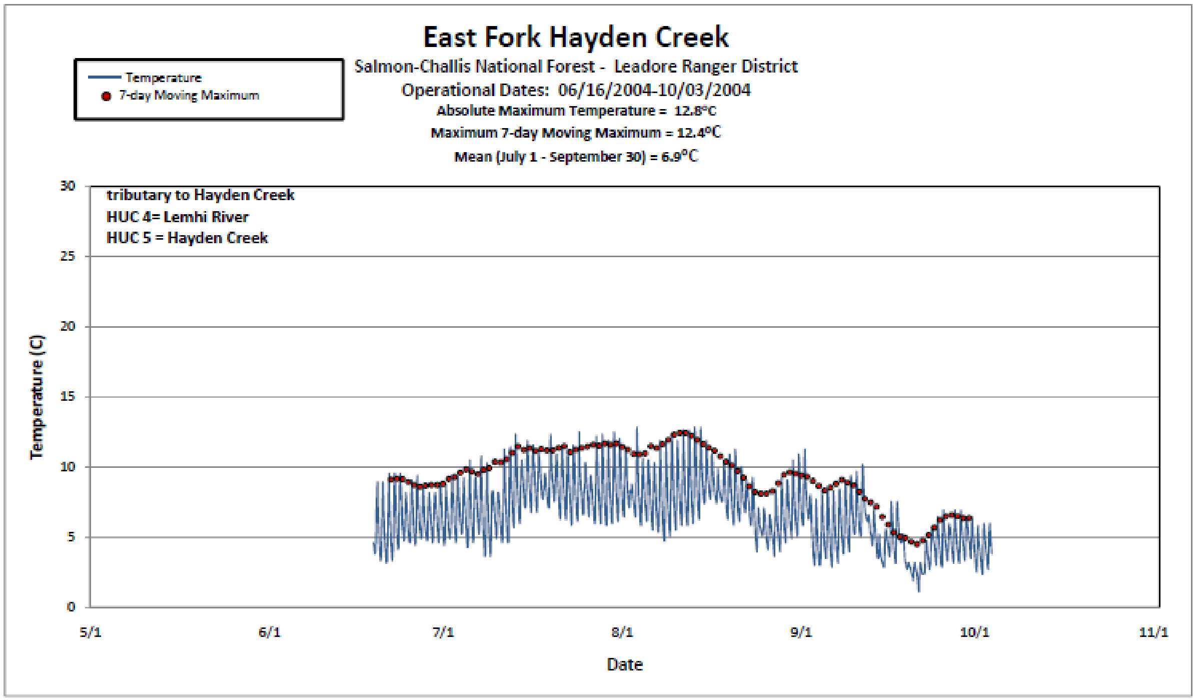
Temperature Data for Waters not listed in Category 5 of the 2010 Integrated Report

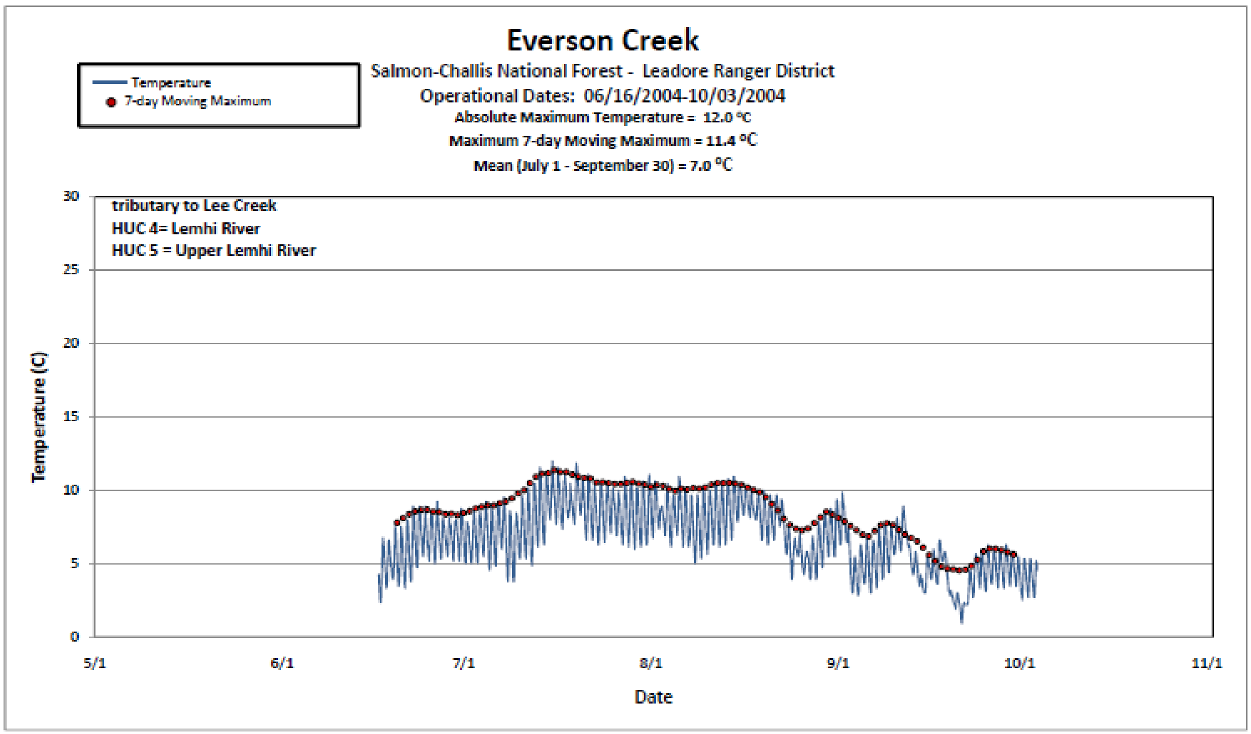


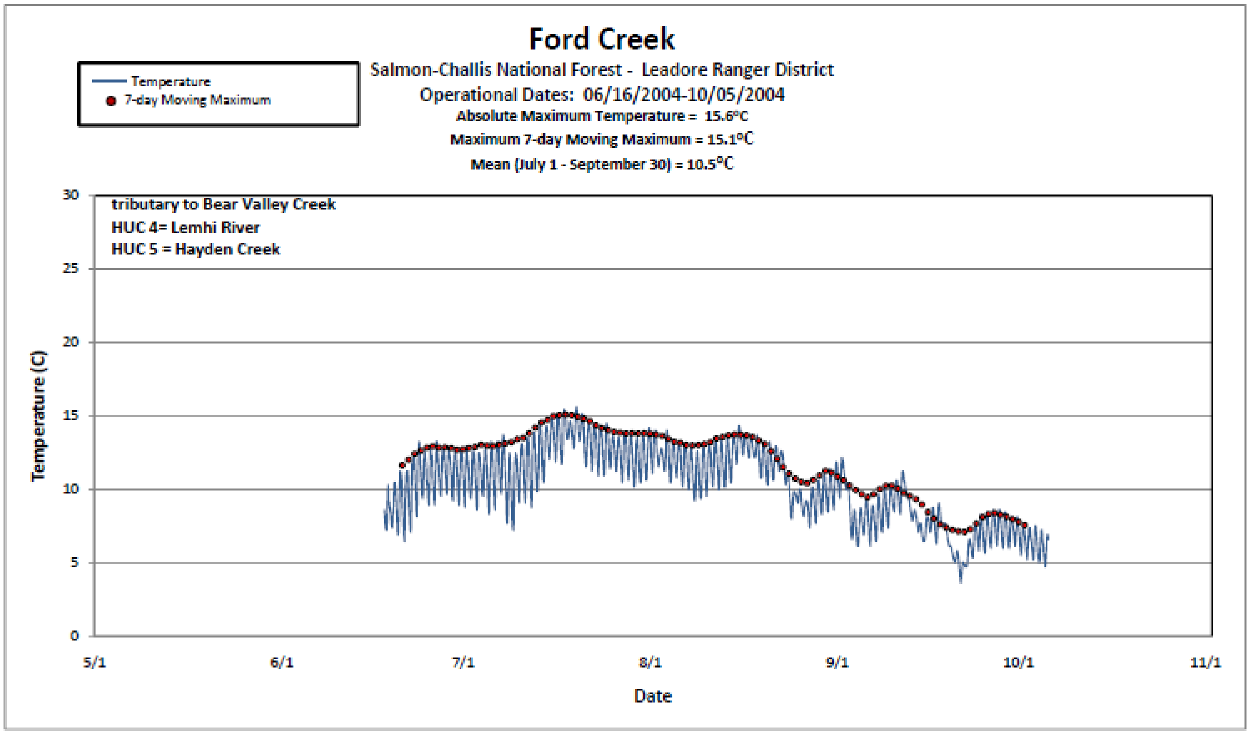


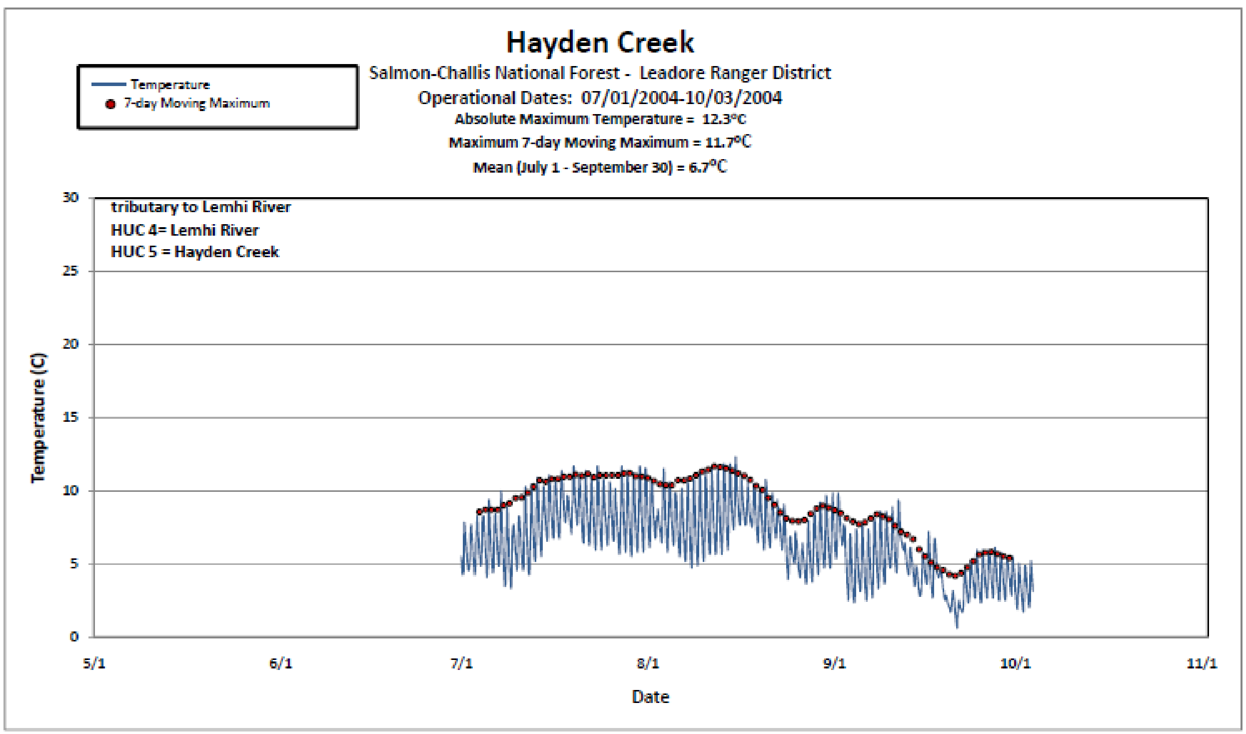

Deer Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/18/2004-10/05/2004
Absolute Maximum Temperature = 10.6°C
Maximum 7-day Moving Maximum = 10.4°C
Mean (July 1 - September 30) = 7.2 °C
Temperature
7-day Moving Maximum
tributary to Bear Valley
HUC 4= Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

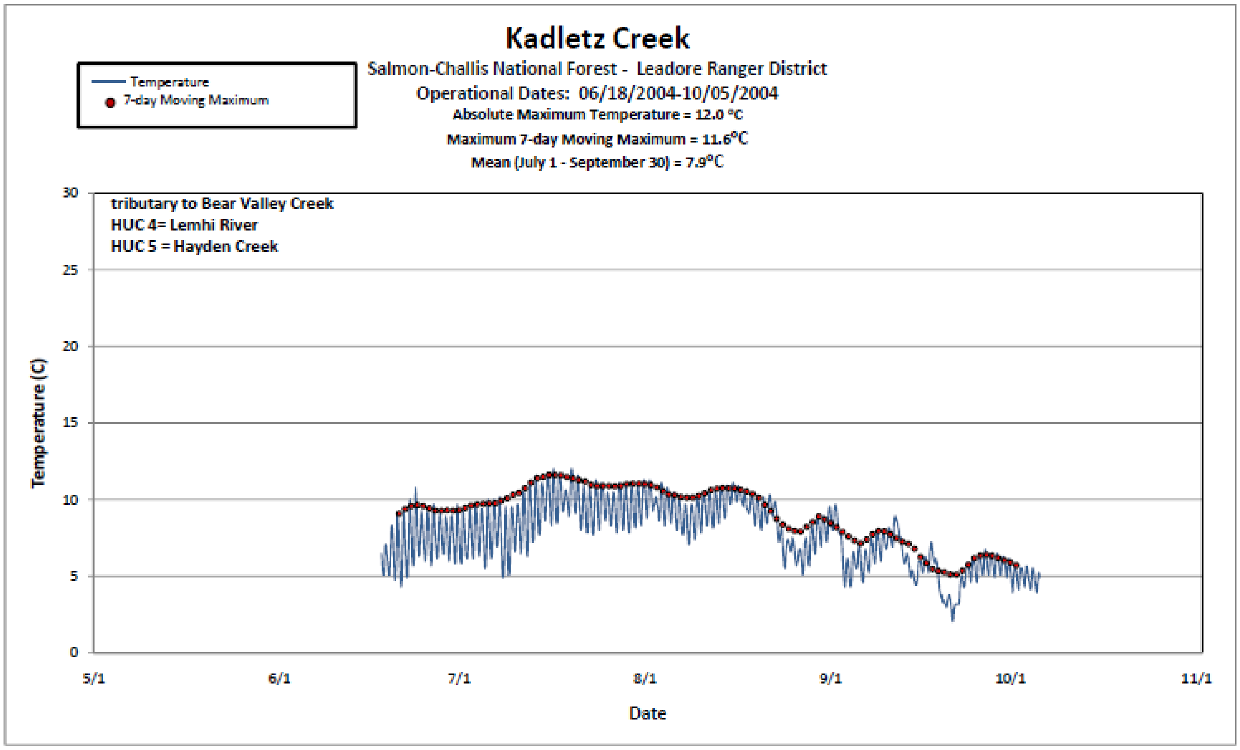

East Fork Hayden Creek #1
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/16/2004-10/03/2004
Absolute Maximum Temperature = 13.6°C
Maximum 7-day Moving Maximum = 12.9°C
Mean (July 1 - September 30) = 8.8°C
Temperature
7-day Moving Maximum
tributary to Hayden Creek
HUC 4= Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

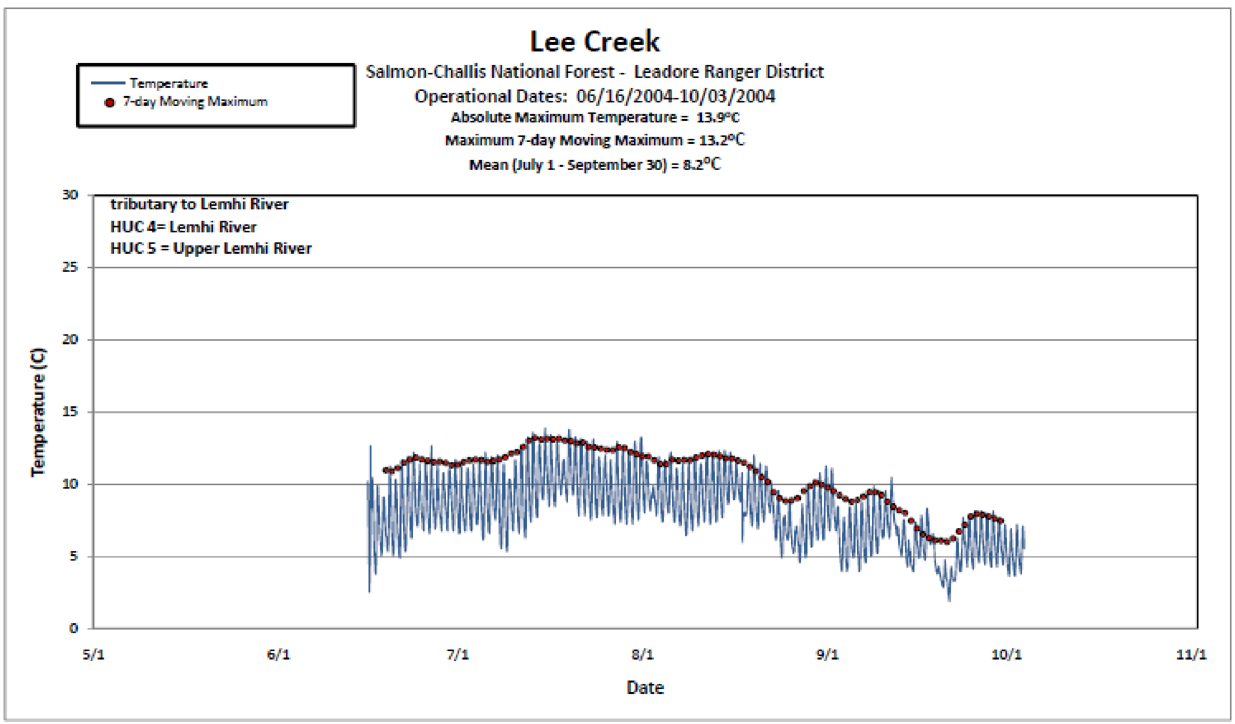

East Fork Hayden Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/16/2004-10/03/2004
Absolute Maximum Temperature = 12.8°C
Maximum 7-day Moving Maximum = 12.4°C
Mean (July 1 - September 30) = 6.9°C
Temperature
7-day Moving Maximum
tributary to Hayden Creek
HUC 4= Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
Date
5/1
6/1
7/1
8/1
9/1
10/1
11/1

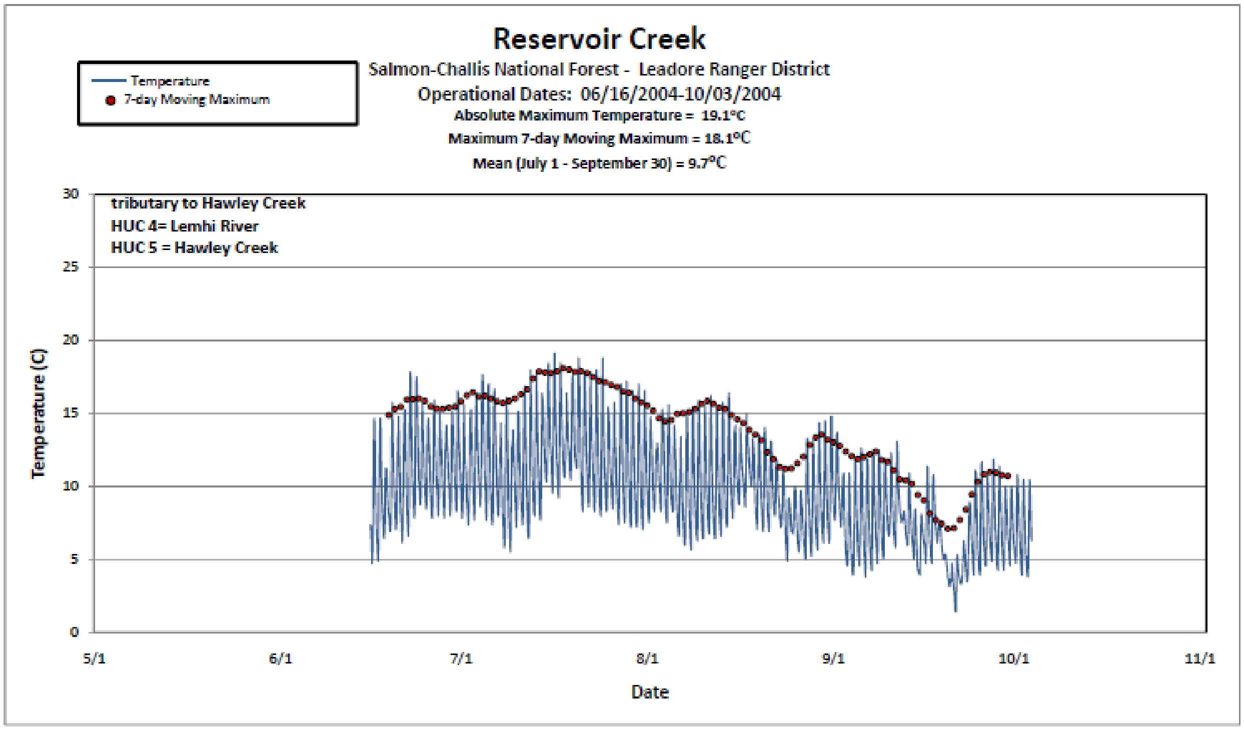

Everson Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/16/2004-10/03/2004
Absolute Maximum Temperature = 12.0 °C
Maximum 7-day Moving Maximum = 11.4 °C
Mean (July 1 - September 30) = 7.0 °C
Temperature
7-day Moving Maximum
tributary to Lee Creek
HUC 4= Lemhi River
HUC 5 = Upper Lemhi River
Temperature (C)
Date
5/1
6/1
7/1
8/1
9/1
10/1
11/1

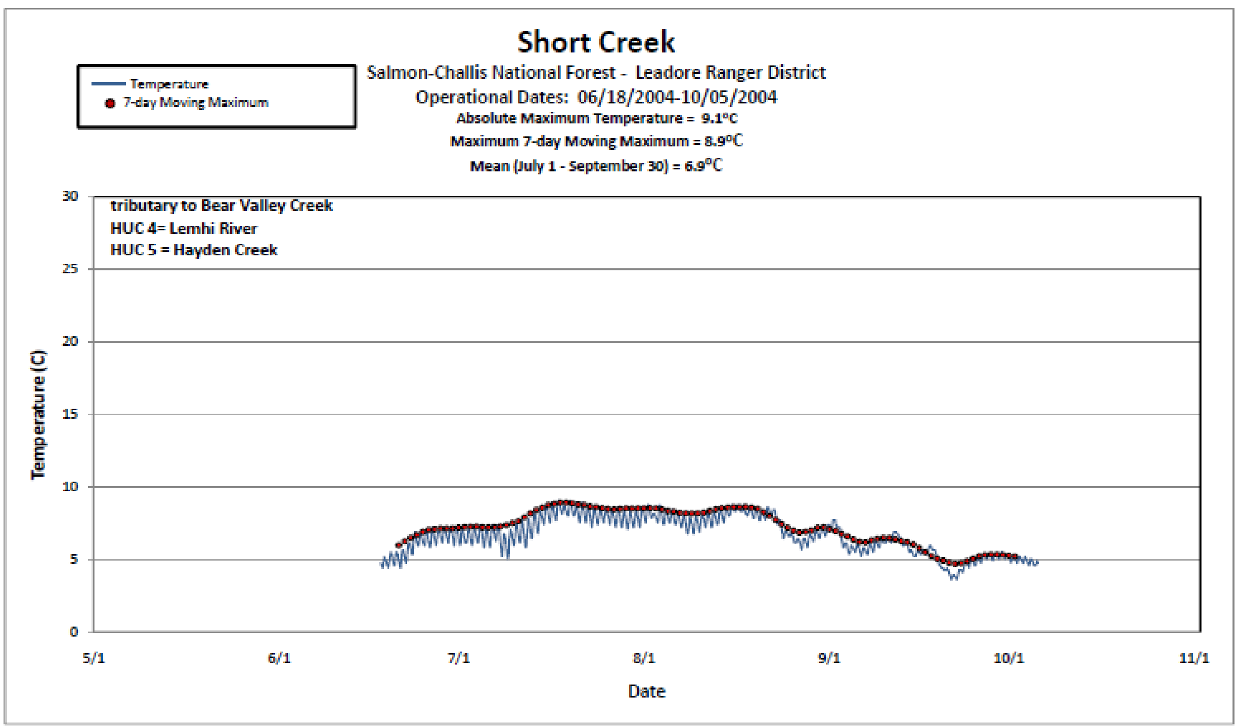

Ford Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/16/2004-10/05/2004
Absolute Maximum Temperature = 15.6°C
Maximum 7-day Moving Maximum = 15.1°C
Mean (July 1 - September 30) = 10.5°C
Temperature
7-day Moving Maximum
tributary to Bear Valley Creek
HUC 4= Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
Date
5/1
6/1
7/1
8/1
9/1
10/1
11/1

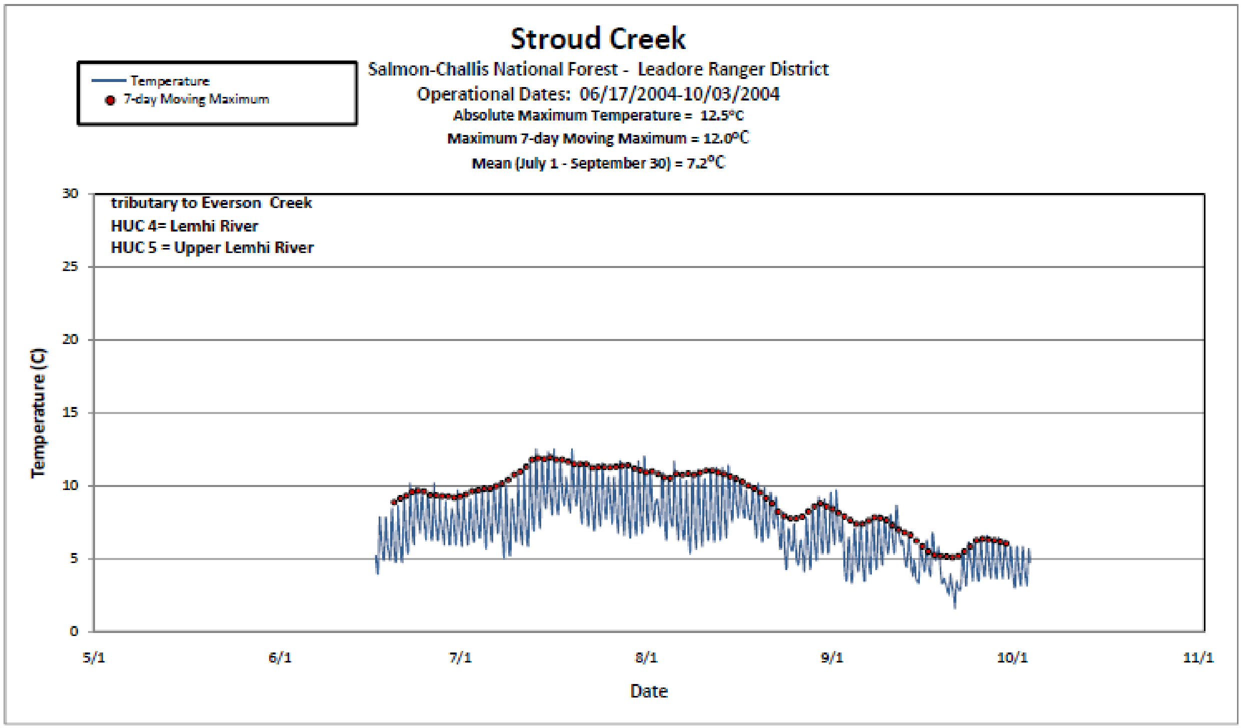

Hayden Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/01/2004-10/03/2004
Absolute Maximum Temperature = 12.3°C
Maximum 7-day Moving Maximum = 11.7°C
Mean (July 1 - September 30) = 6.7°C
Temperature
7-day Moving Maximum
tributary to Lemhi River
HUC 4= Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
Date
5/1
6/1
7/1
8/1
9/1
10/1
11/1

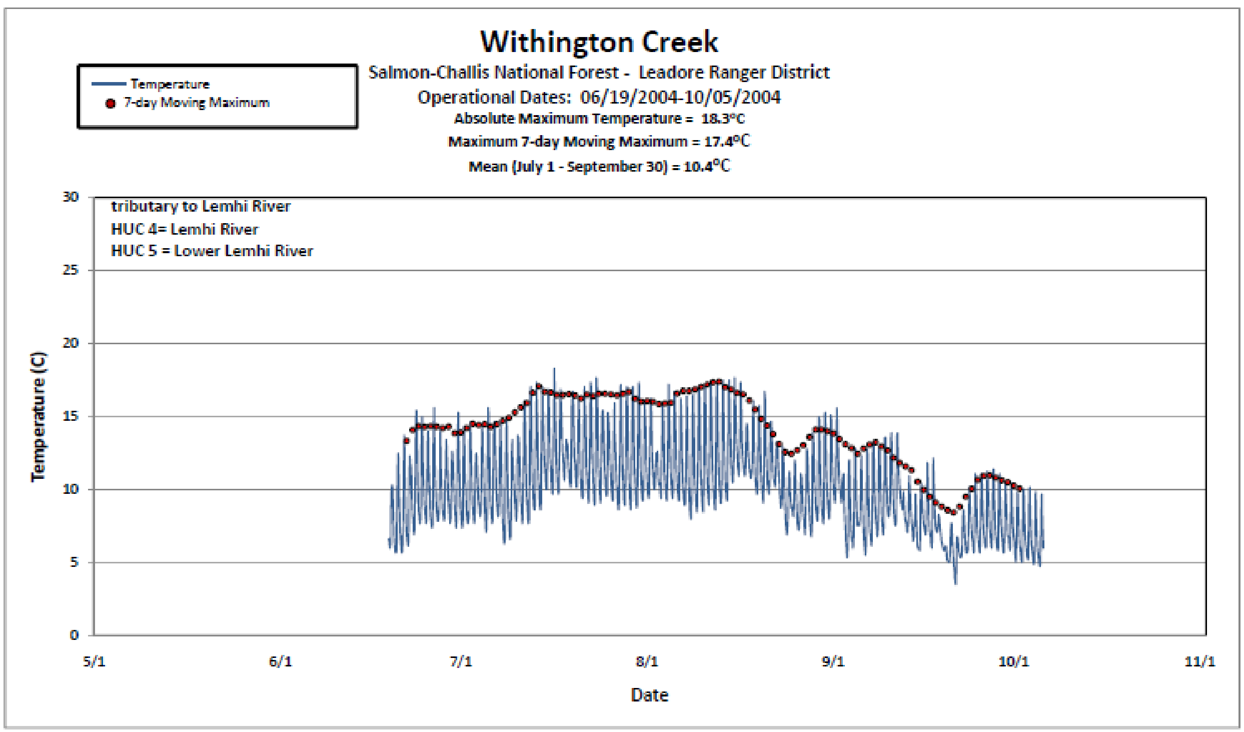

Kadletz Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/18/2004-10/05/2004
Absolute Maximum Temperature = 12.0 °C
Maximum 7-day Moving Maximum = 11.6°C
Mean (July 1 - September 30) = 7.9°C
Temperature
7-day Moving Maximum
tributary to Bear Valley Creek
HUC 4= Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

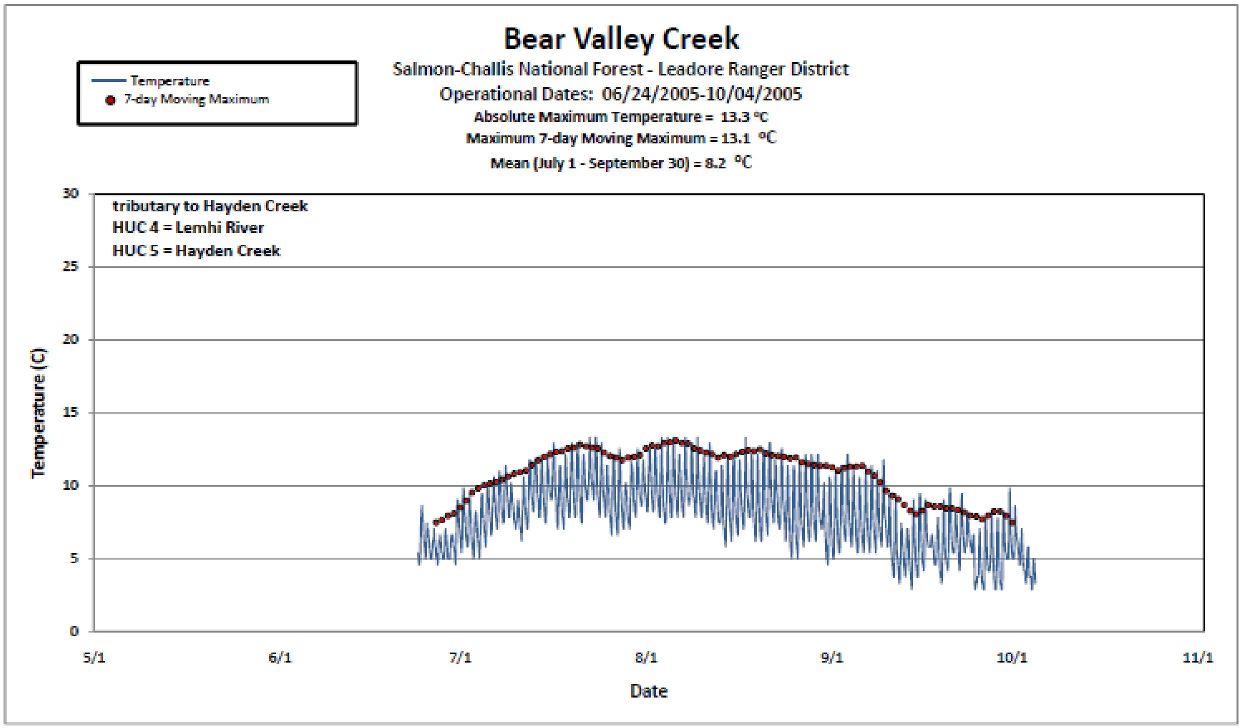

Lee Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/16/2004-10/03/2004
Absolute Maximum Temperature = 13.9°C
Maximum 7-day Moving Maximum = 13.2°C
Mean (July 1 - September 30) = 8.2°C
Temperature
7-day Moving Maximum
tributary to Lemhi River
HUC 4= Lemhi River
HUC 5 = Upper Lemhi River
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

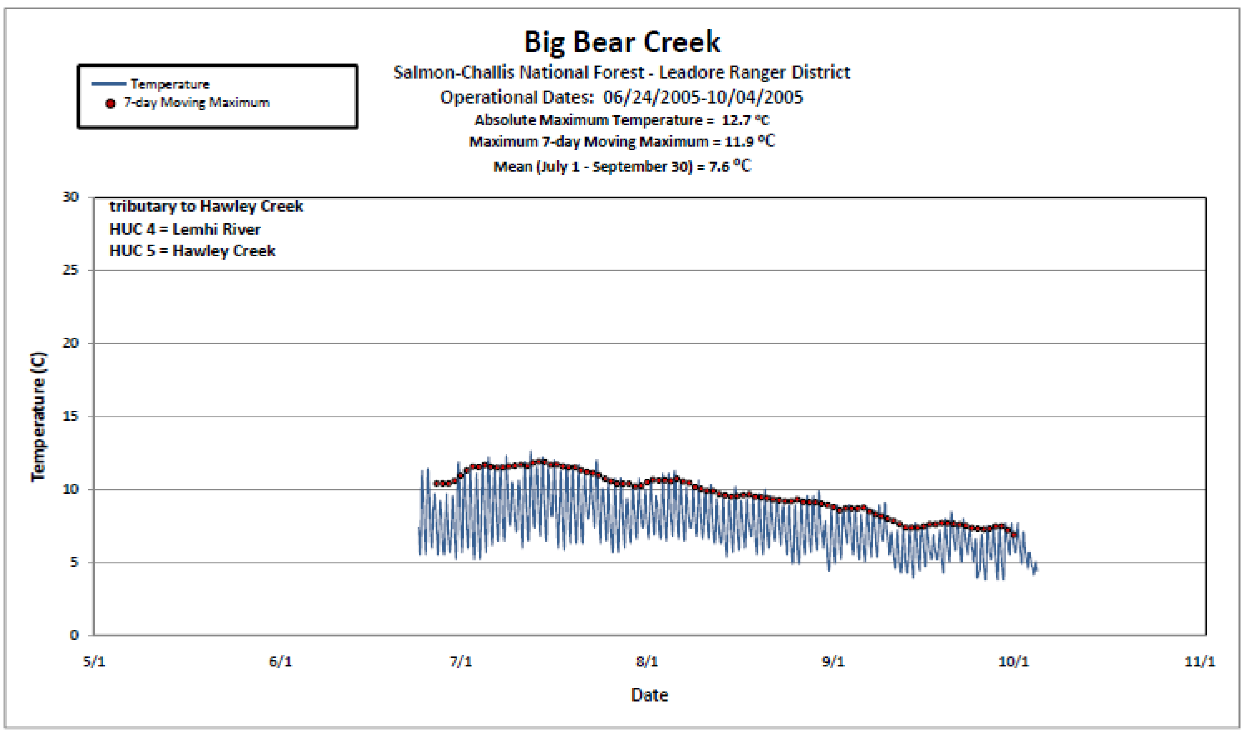

Reservoir Creek
Temperature
7-day Moving Maximum
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/16/2004-10/03/2004
Absolute Maximum Temperature = 19.1°C
Maximum 7-day Moving Maximum = 18.1°C
Mean (July 1 - September 30) = 9.7°C
tributary to Hawley Creek
HUC 4= Lemhi River
HUC 5 = Hawley Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

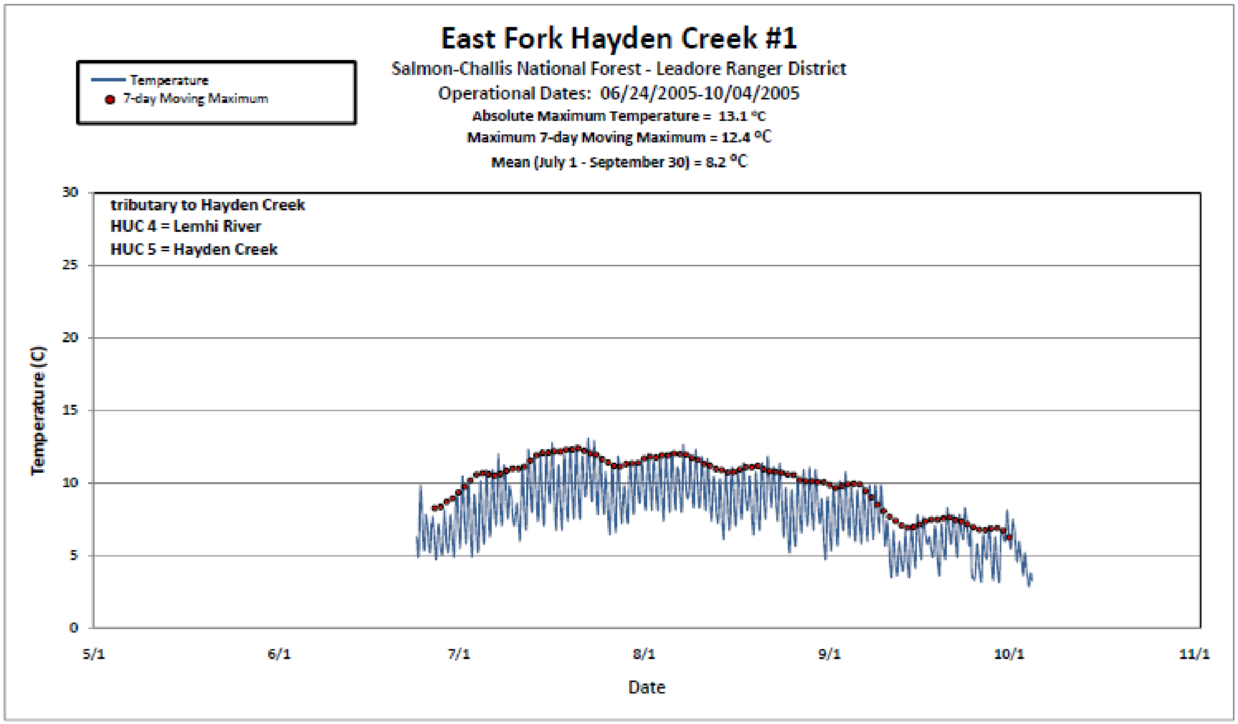

Short Creek
Temperature
7-day Moving Maximum
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/18/2004-10/05/2004
Absolute Maximum Temperature = 9.1°C
Maximum 7-day Moving Maximum = 8.9°C
Mean (July 1 - September 30) = 6.9°C
tributary to Bear Valley Creek
HUC 4= Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

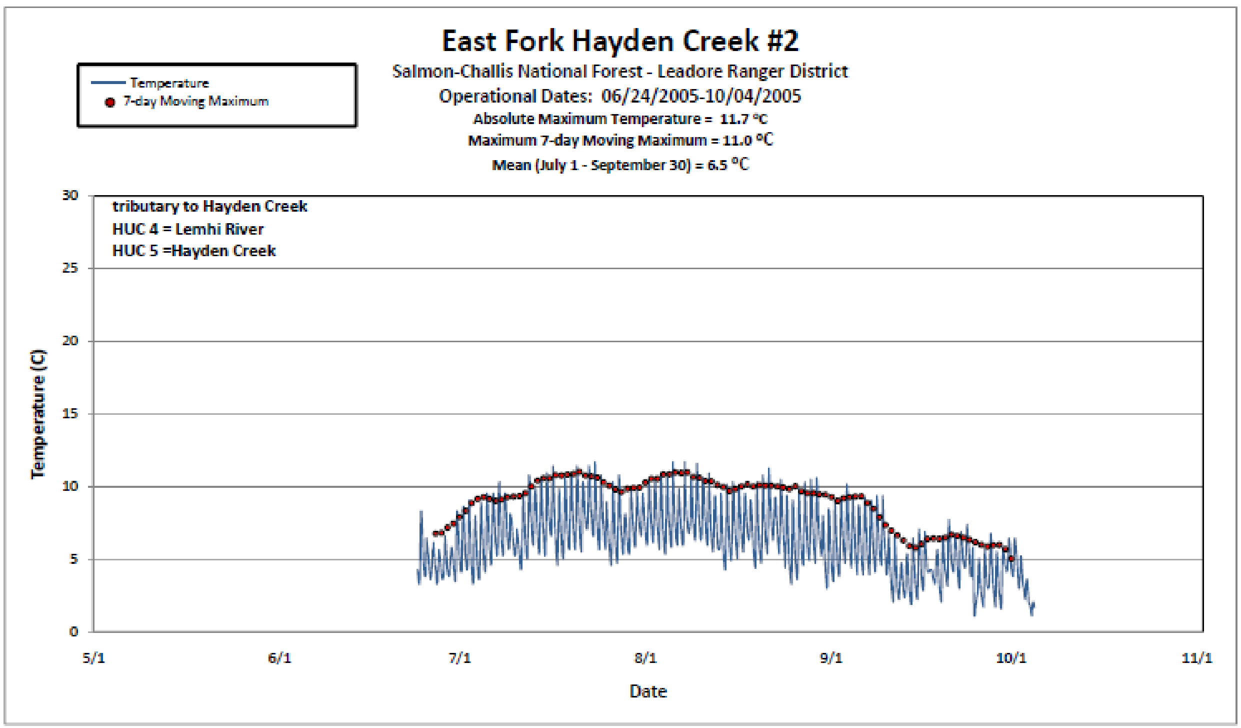

Stroud Creek
Temperature
7-day Moving Maximum
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/17/2004-10/03/2004
Absolute Maximum Temperature = 12.5°C
Maximum 7-day Moving Maximum = 12.0°C
Mean (July 1 - September 30) = 7.2°C
tributary to Everson Creek
HUC 4= Lemhi River
HUC 5 = Upper Lemhi River
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

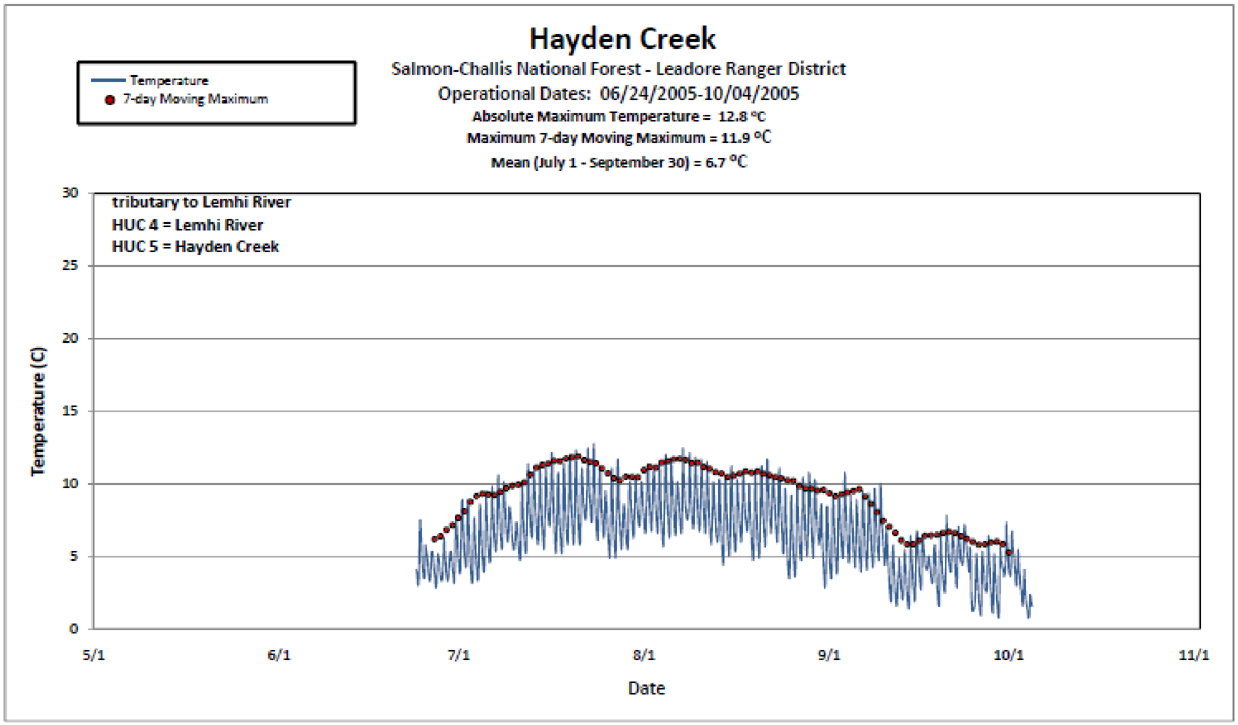

Withington Creek
Temperature
7-day Moving Maximum
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/19/2004-10/05/2004
Absolute Maximum Temperature = 18.3°C
Maximum 7-day Moving Maximum = 17.4°C
Mean (July 1 - September 30) = 10.4°C
tributary to Lemhi River
HUC 4= Lemhi River
HUC 5 = Lower Lemhi River
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

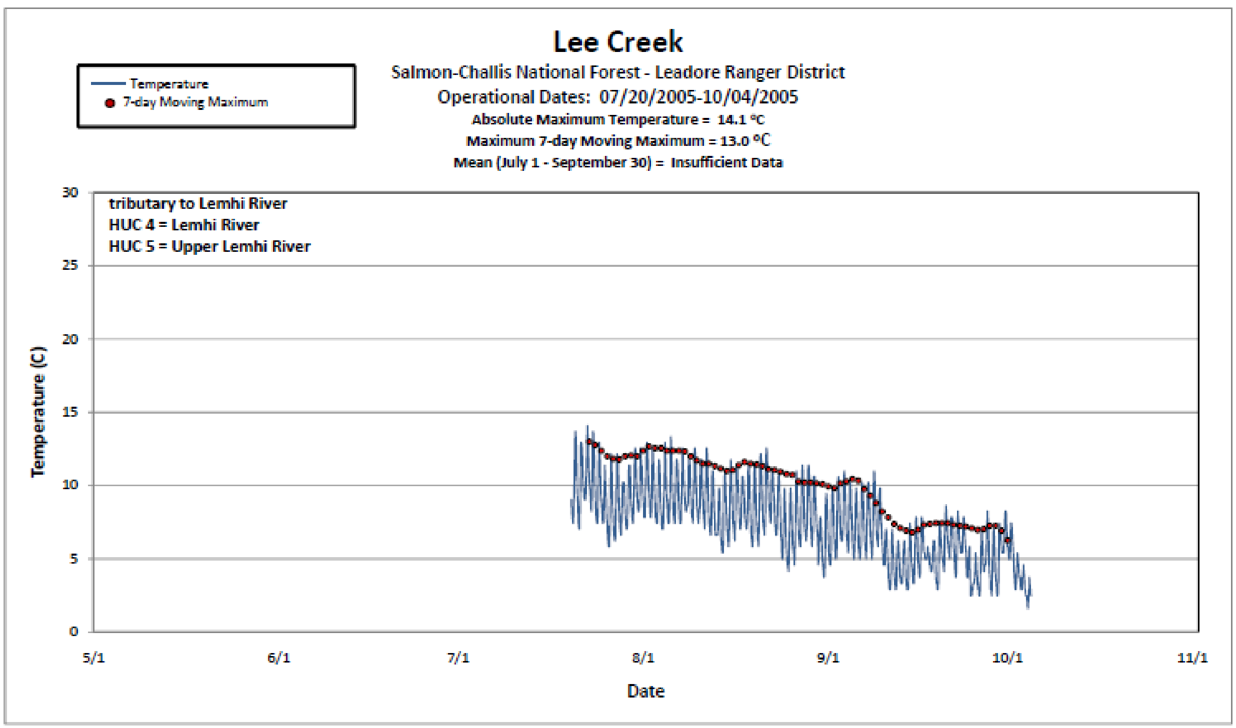

Bear Valley Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/24/2005-10/04/2005
Absolute Maximum Temperature = 13.3 °C
Maximum 7-day Moving Maximum = 13.1 °C
Mean (July 1 - September 30) = 8.2 °C
Temperature
7-day Moving Maximum
tributary to Hayden Creek
HUC 4 = Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
Date
5/1
6/1
7/1
8/1
9/1
10/1
11/1

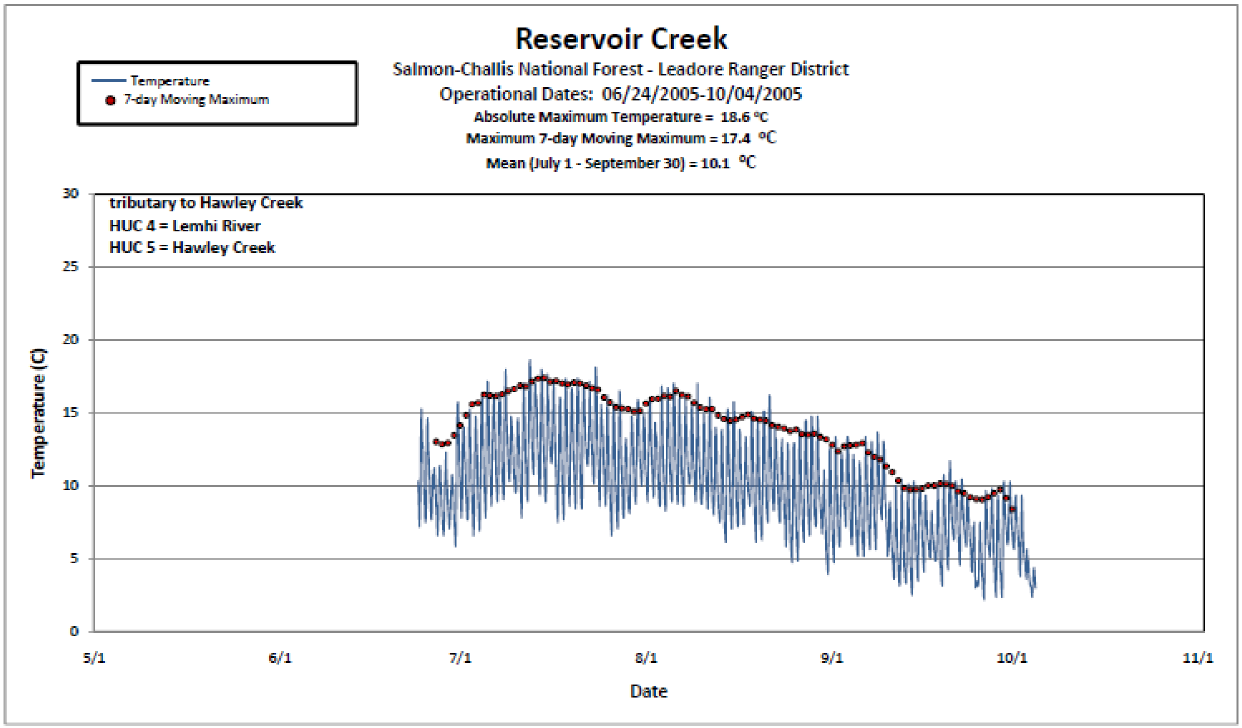

Big Bear Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/24/2005-10/04/2005
Absolute Maximum Temperature = 12.7 °C
Maximum 7-day Moving Maximum = 11.9 °C
Mean (July 1 - September 30) = 7.6 °C
Temperature
7-day Moving Maximum
tributary to Hawley Creek
HUC 4 = Lemhi River
HUC 5 = Hawley Creek
Temperature (C)
Date
5/1
6/1
7/1
8/1
9/1
10/1
11/1

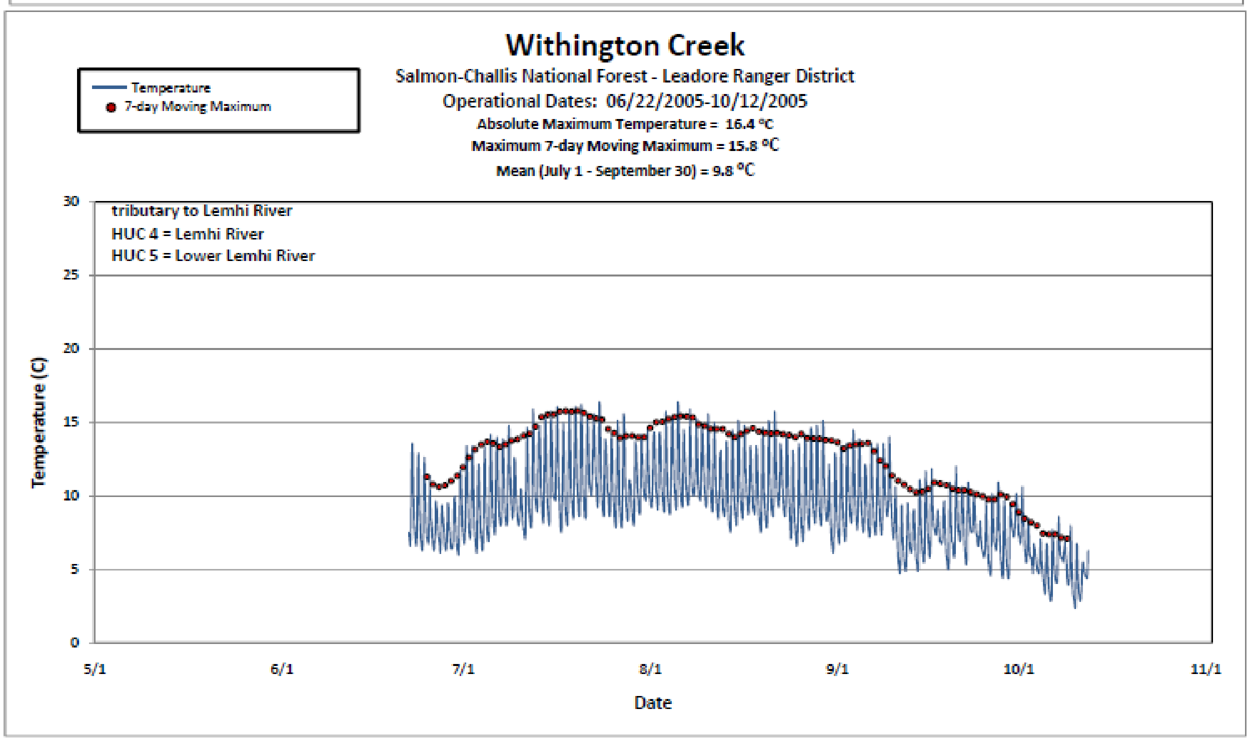

East Fork Hayden Creek #1
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/24/2005-10/04/2005
Absolute Maximum Temperature = 13.1 °C
Maximum 7-day Moving Maximum = 12.4 °C
Mean (July 1 - September 30) = 8.2 °C
Temperature
7-day Moving Maximum
tributary to Hayden Creek
HUC 4 = Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
0
5
10
15
20
25
30
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

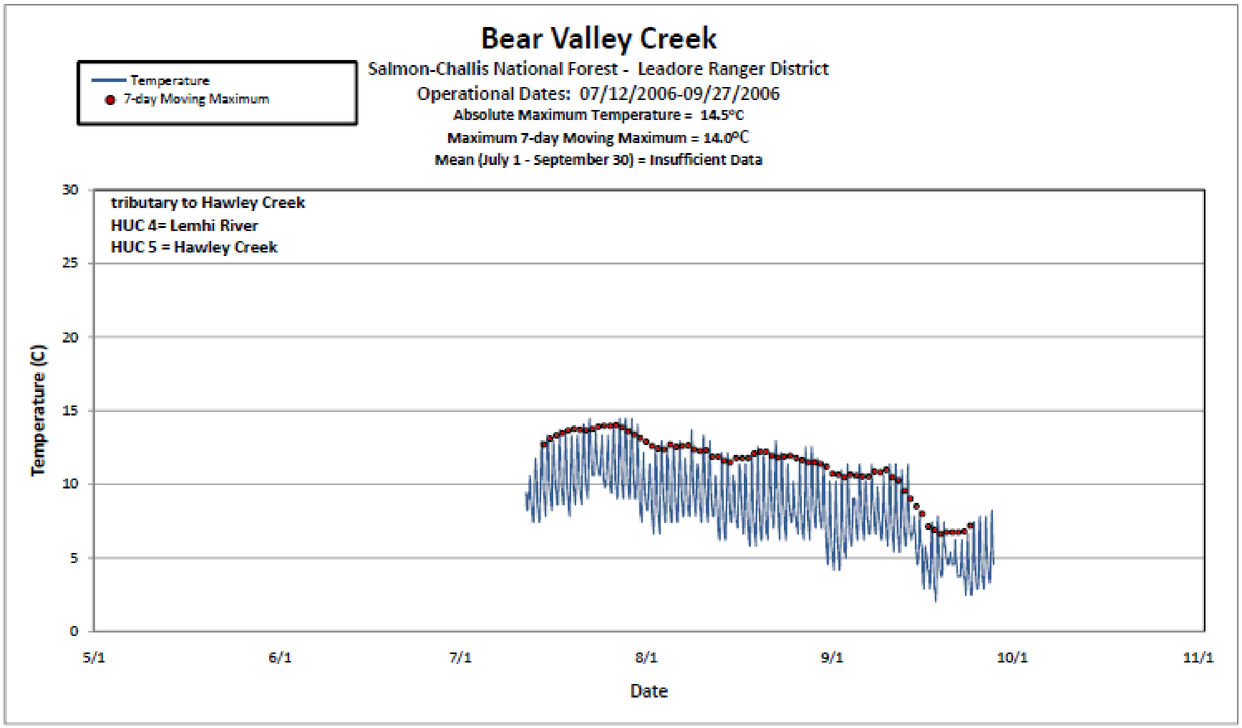

East Fork Hayden Creek #2
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/24/2005-10/04/2005
Absolute Maximum Temperature = 11.7 °C
Maximum 7-day Moving Maximum = 11.0 °C
Mean (July 1 - September 30) = 6.5 °C
Temperature
7-day Moving Maximum
tributary to Hayden Creek
HUC 4 = Lemhi River
HUC 5 =Hayden Creek
Temperature (C)
0
5
10
15
20
25
30
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

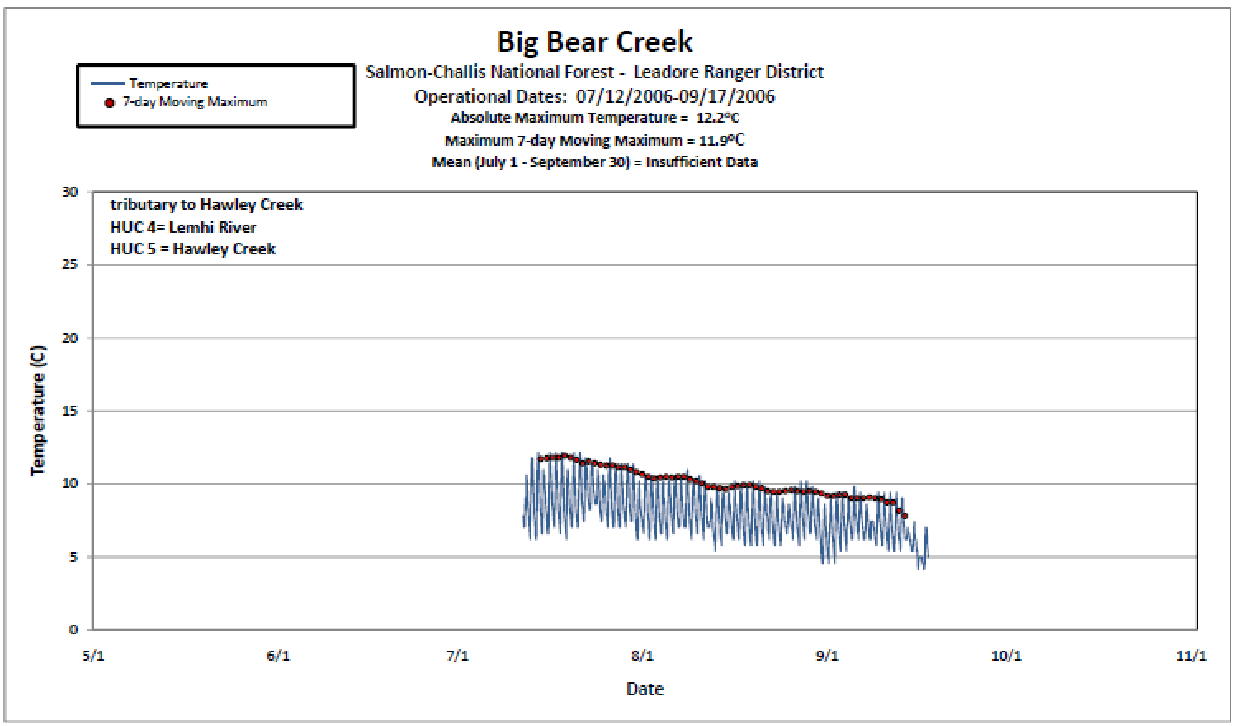

Hayden Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/24/2005-10/04/2005
Absolute Maximum Temperature = 12.8 °C
Maximum 7-day Moving Maximum = 11.9 °C
Mean (July 1 - September 30) = 6.7 °C
Temperature
7-day Moving Maximum
tributary to Lemhi River
HUC 4 = Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
0
5
10
15
20
25
30
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

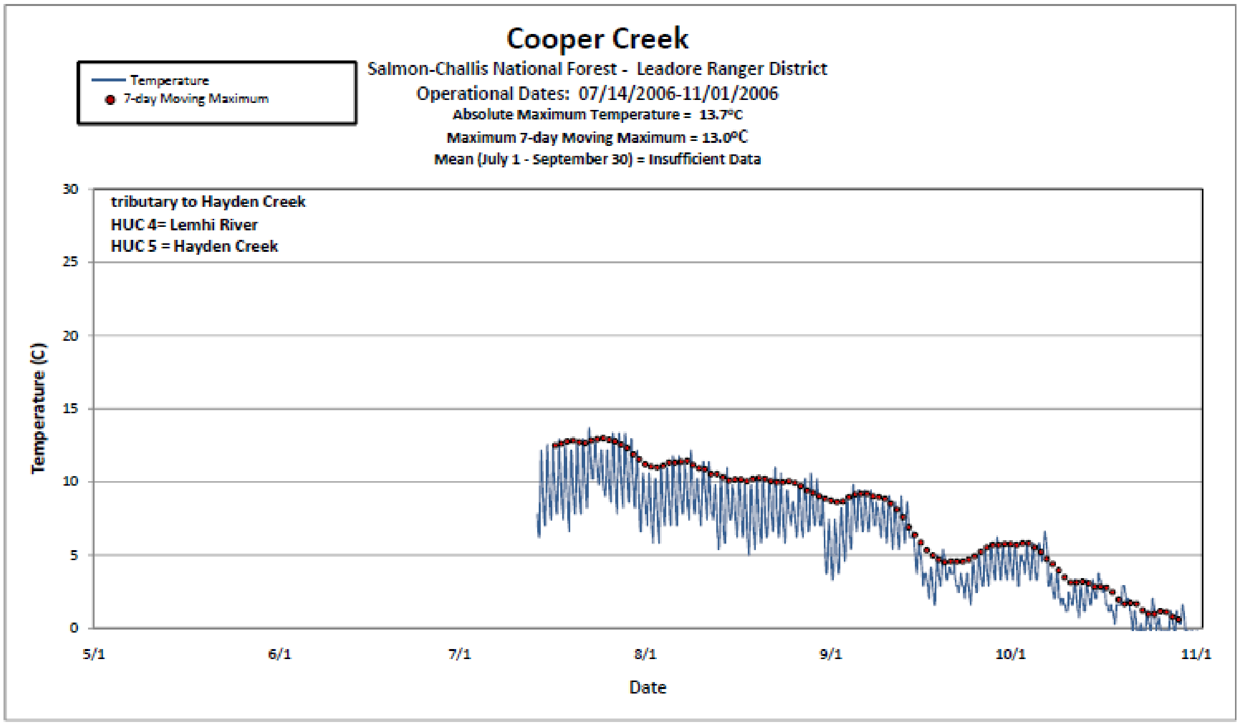

Lee Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/20/2005-10/04/2005
Absolute Maximum Temperature = 14.1 °C
Maximum 7-day Moving Maximum = 13.0 °C
Mean (July 1 - September 30) = Insufficient Data
Temperature
7-day Moving Maximum
tributary to Lemhi River
HUC 4 = Lemhi River
HUC 5 = Upper Lemhi River
Temperature (C)
0
5
10
15
20
25
30
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

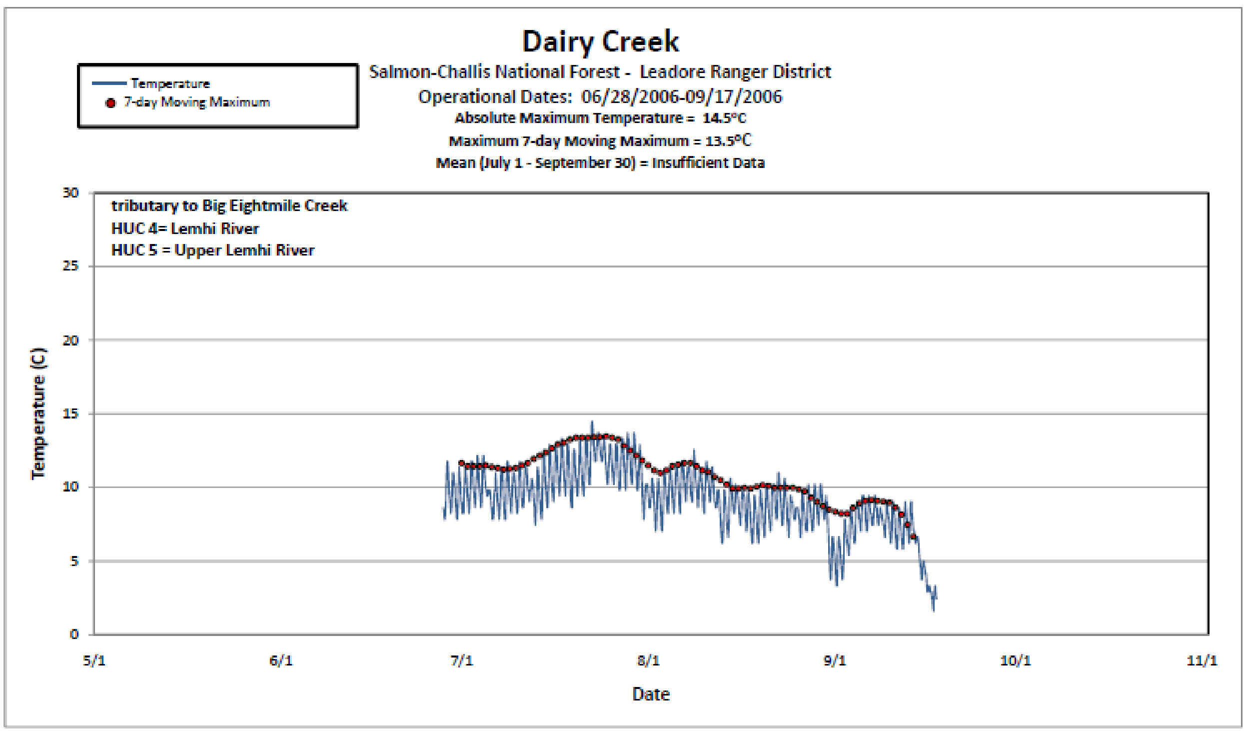

Reservoir Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/24/2005-10/04/2005
Absolute Maximum Temperature = 18.6 °C
Maximum 7-day Moving Maximum = 17.4 °C
Mean (July 1 - September 30) = 10.1 °C
Temperature
7-day Moving Maximum
tributary to Hawley Creek
HUC 4 = Lemhi River
HUC 5 = Hawley Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

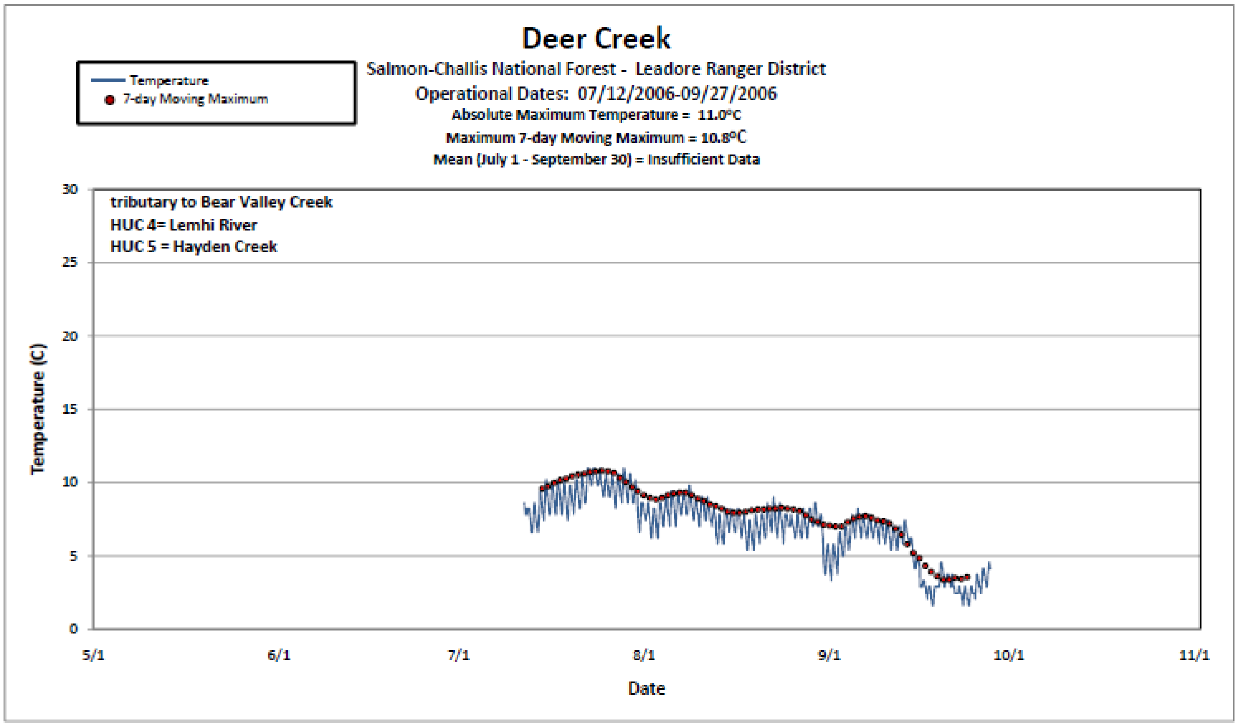

Withington Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/22/2005-10/12/2005
Absolute Maximum Temperature = 16.4 °C
Maximum 7-day Moving Maximum = 15.8 °C
Mean (July 1 - September 30) = 9.8 °C
Temperature
7-day Moving Maximum
tributary to Lemhi River
HUC 4 = Lemhi River
HUC 5 = Lower Lemhi River
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

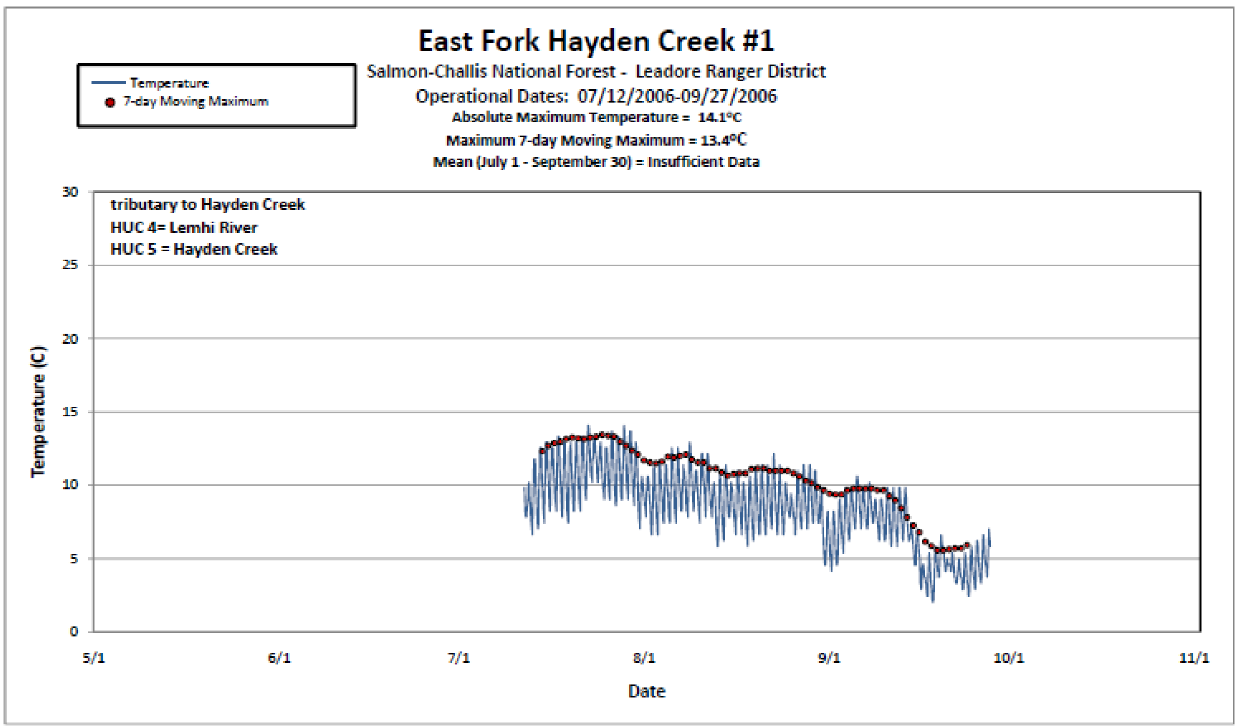

Bear Valley Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/12/2006-09/27/2006
Absolute Maximum Temperature = 14.5°C
Maximum 7-day Moving Maximum = 14.0°C
Mean (July 1 - September 30) = Insufficient Data
Temperature
7-day Moving Maximum
tributary to Hawley Creek
HUC 4= Lemhi River
HUC 5 = Hawley Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

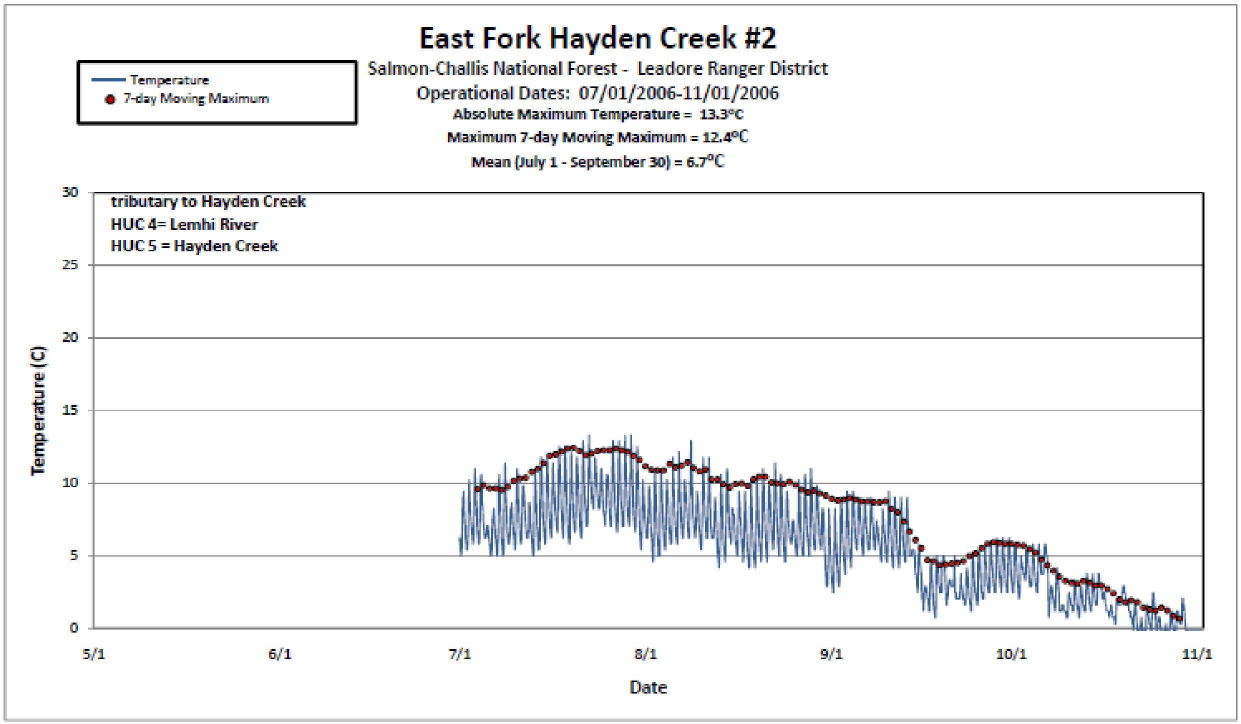

Big Bear Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/12/2006-09/17/2006
Absolute Maximum Temperature = 12.2°C
Maximum 7-day Moving Maximum = 11.9°C
Mean (July 1 - September 30) = Insufficient Data
Temperature
7-day Moving Maximum
tributary to Hawley Creek
HUC 4= Lemhi River
HUC 5 = Hawley Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

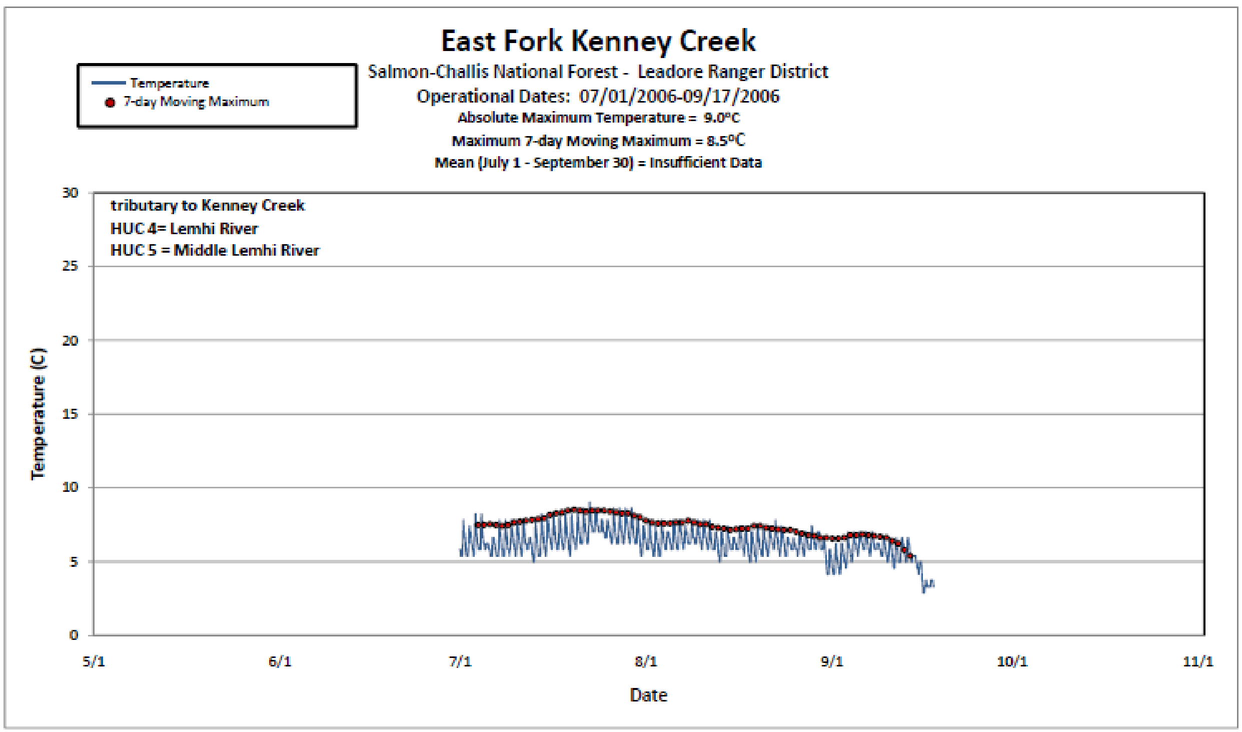

Cooper Creek
Temperature
7-day Moving Maximum
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/14/2006-11/01/2006
Absolute Maximum Temperature = 13.7°C
Maximum 7-day Moving Maximum = 13.0°C
Mean (July 1 - September 30) = Insufficient Data
tributary to Hayden Creek
HUC 4= Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

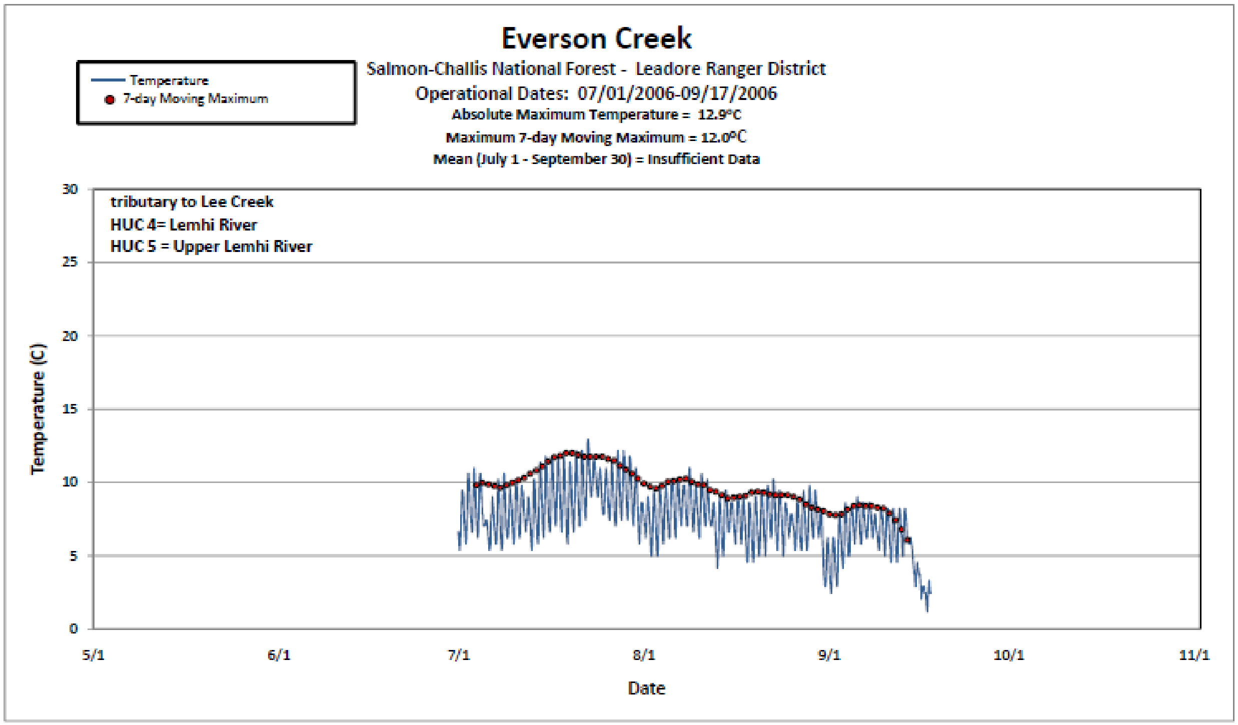

Dairy Creek
Temperature
7-day Moving Maximum
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/28/2006-09/17/2006
Absolute Maximum Temperature = 14.5°C
Maximum 7-day Moving Maximum = 13.5°C
Mean (July 1 - September 30) = Insufficient Data
tributary to Big Eightmile Creek
HUC 4= Lemhi River
HUC 5 = Upper Lemhi River
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

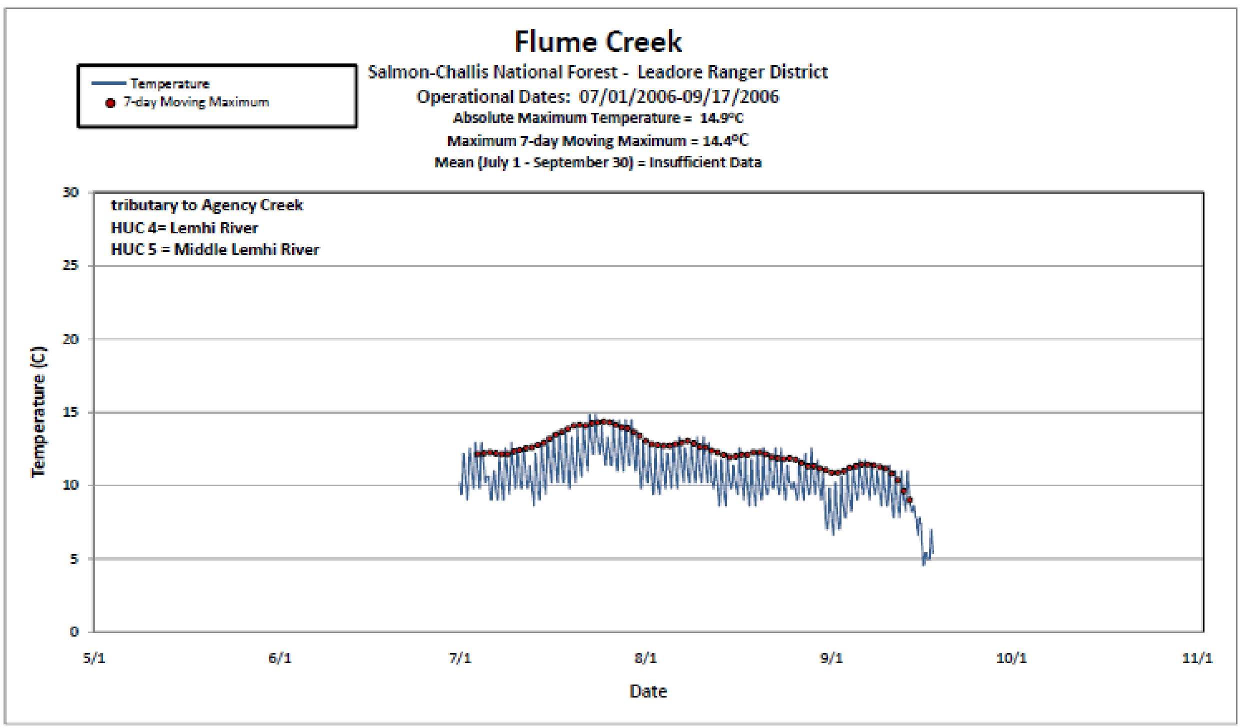

Deer Creek
Temperature
7-day Moving Maximum
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/12/2006-09/27/2006
Absolute Maximum Temperature = 11.0°C
Maximum 7-day Moving Maximum = 10.8°C
Mean (July 1 - September 30) = Insufficient Data
tributary to Bear Valley Creek
HUC 4= Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
0
5
10
15
20
25
30
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

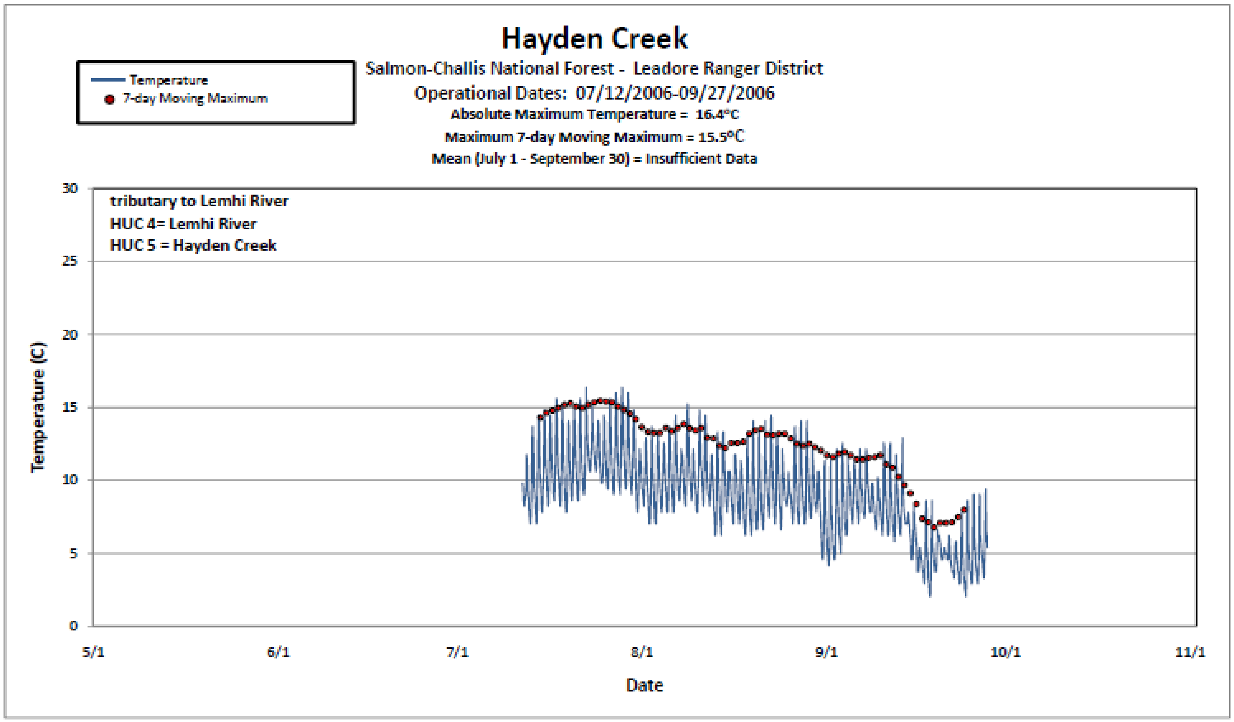

East Fork Hayden Creek #1
Temperature
7-day Moving Maximum
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/12/2006-09/27/2006
Absolute Maximum Temperature = 14.1°C
Maximum 7-day Moving Maximum = 13.4°C
Mean (July 1 - September 30) = Insufficient Data
tributary to Hayden Creek
HUC 4= Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
0
5
10
15
20
25
30
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

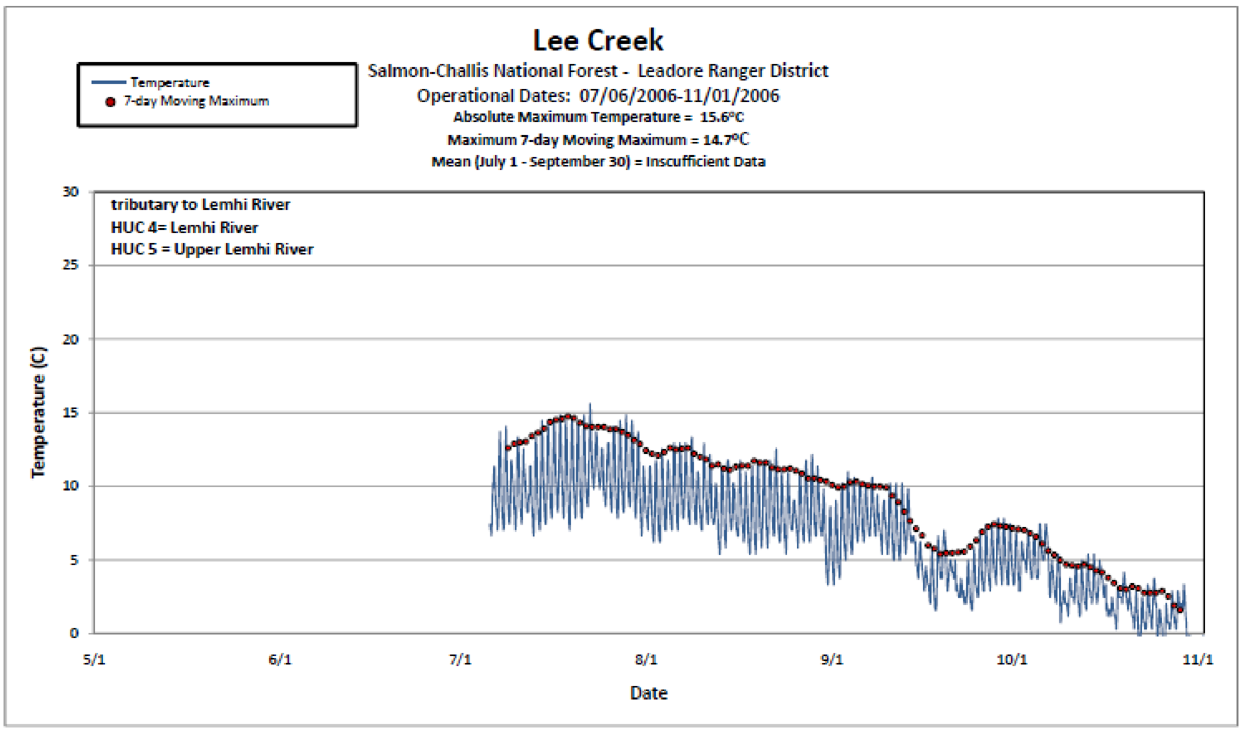

East Fork Hayden Creek #2
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/01/2006-11/01/2006
Absolute Maximum Temperature = 13.3°C
Maximum 7-day Moving Maximum = 12.4°C
Mean (July 1 - September 30) = 6.7°C
Temperature
7-day Moving Maximum
tributary to Hayden Creek
HUC 4= Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

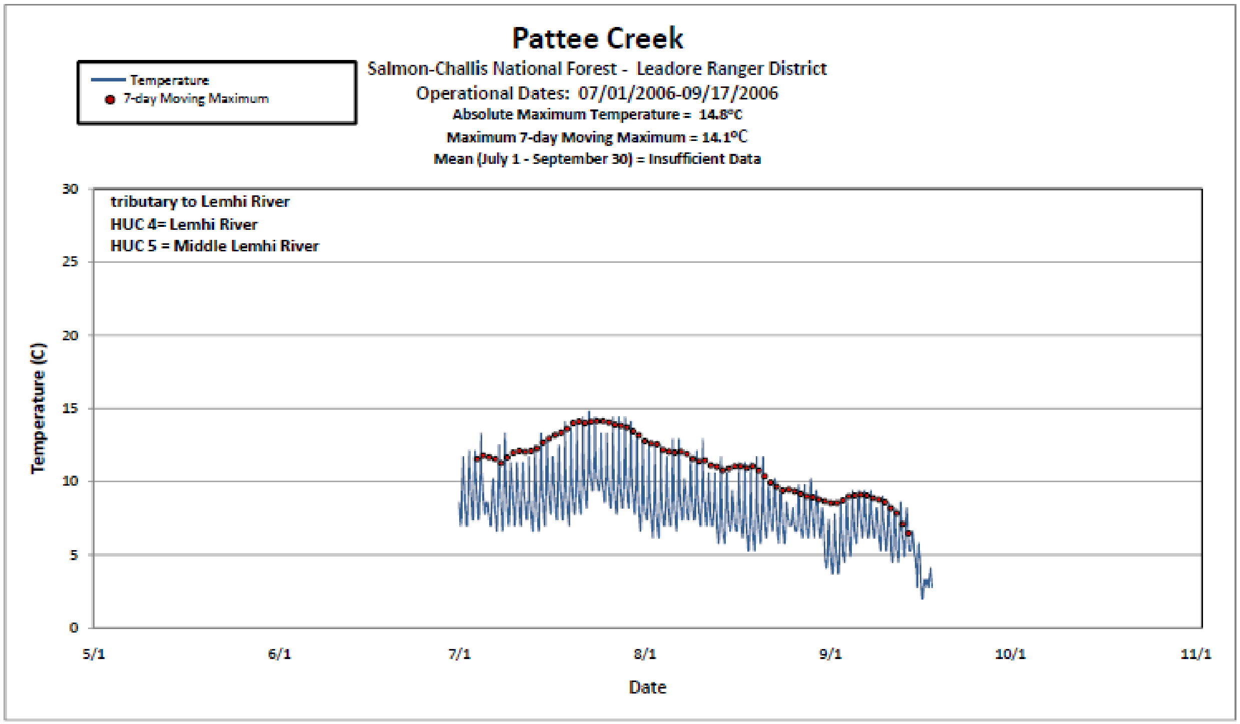

East Fork Kenney Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/01/2006-09/17/2006
Absolute Maximum Temperature = 9.0°C
Maximum 7-day Moving Maximum = 8.5°C
Mean (July 1 - September 30) = Insufficient Data
Temperature
7-day Moving Maximum
tributary to Kenney Creek
HUC 4= Lemhi River
HUC 5 = Middle Lemhi River
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

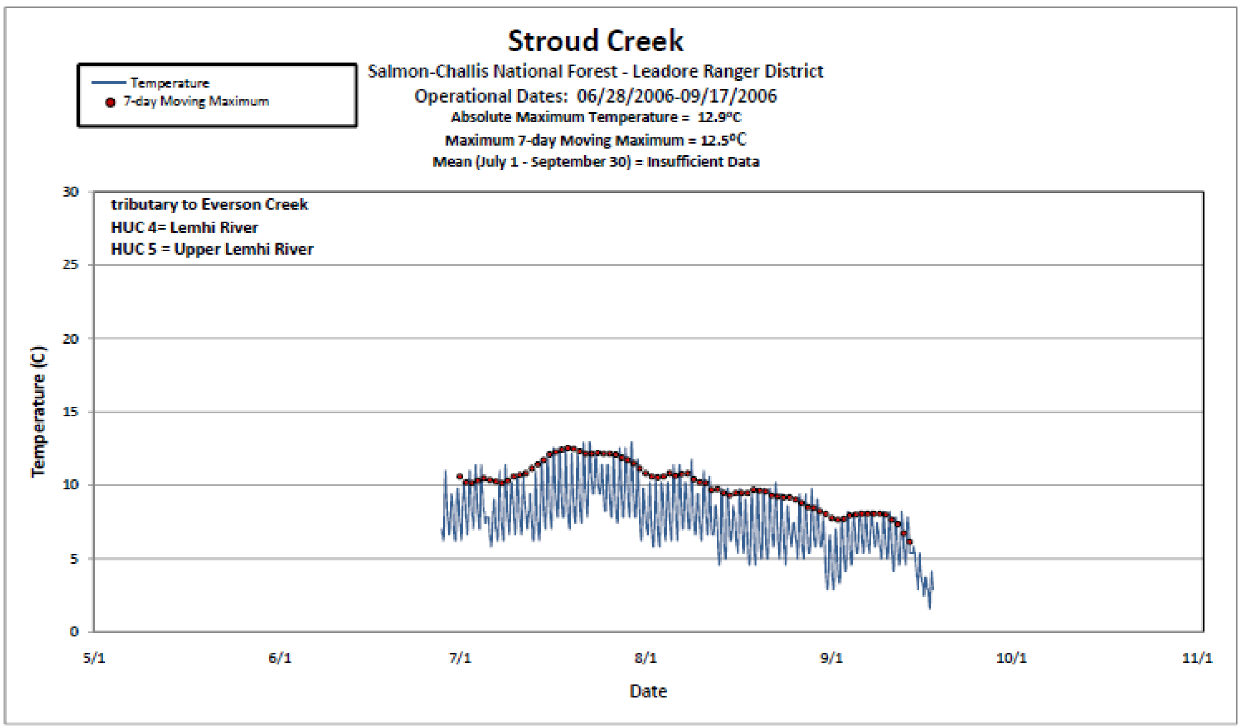

Everson Creek
Temperature
7-day Moving Maximum
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/01/2006-09/17/2006
Absolute Maximum Temperature = 12.9°C
Maximum 7-day Moving Maximum = 12.0°C
Mean (July 1 - September 30) = Insufficient Data
tributary to Lee Creek
HUC 4= Lemhi River
HUC 5 = Upper Lemhi River
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

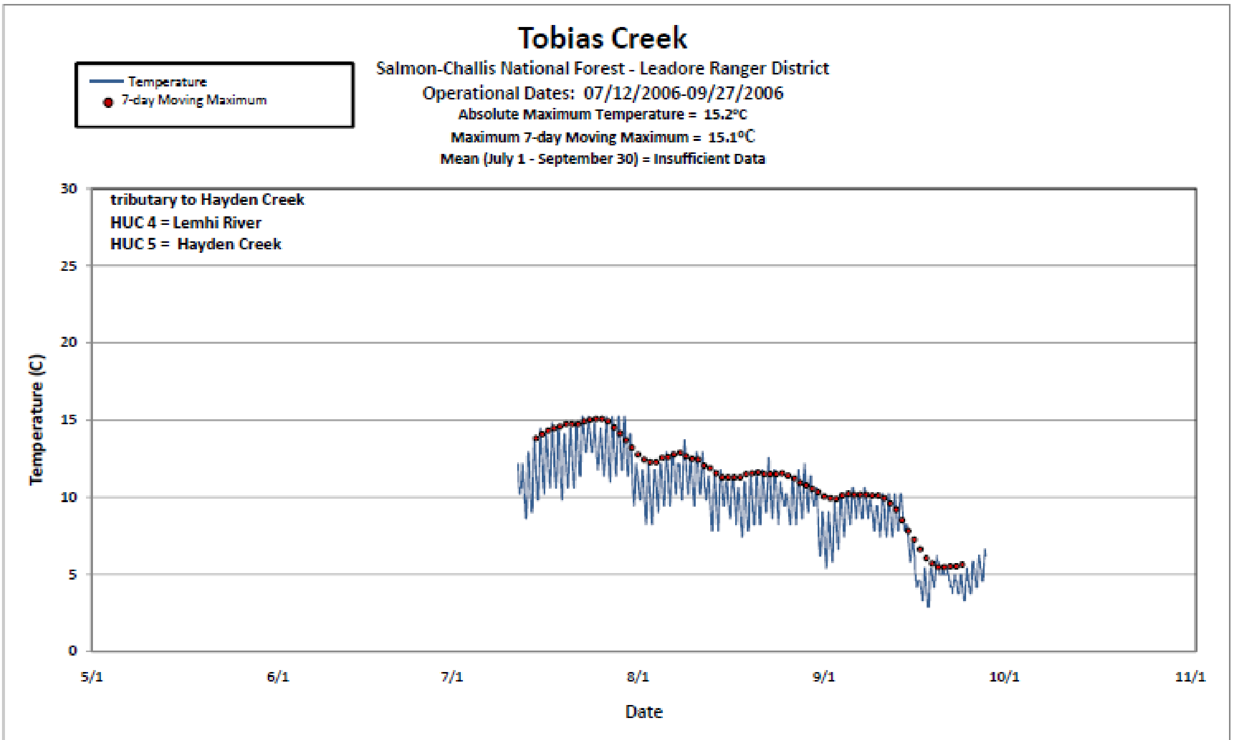

Flume Creek
Temperature
7-day Moving Maximum
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/01/2006-09/17/2006
Absolute Maximum Temperature = 14.9°C
Maximum 7-day Moving Maximum = 14.4°C
Mean (July 1 - September 30) = Insufficient Data
tributary to Agency Creek
HUC 4= Lemhi River
HUC 5 = Middle Lemhi River
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

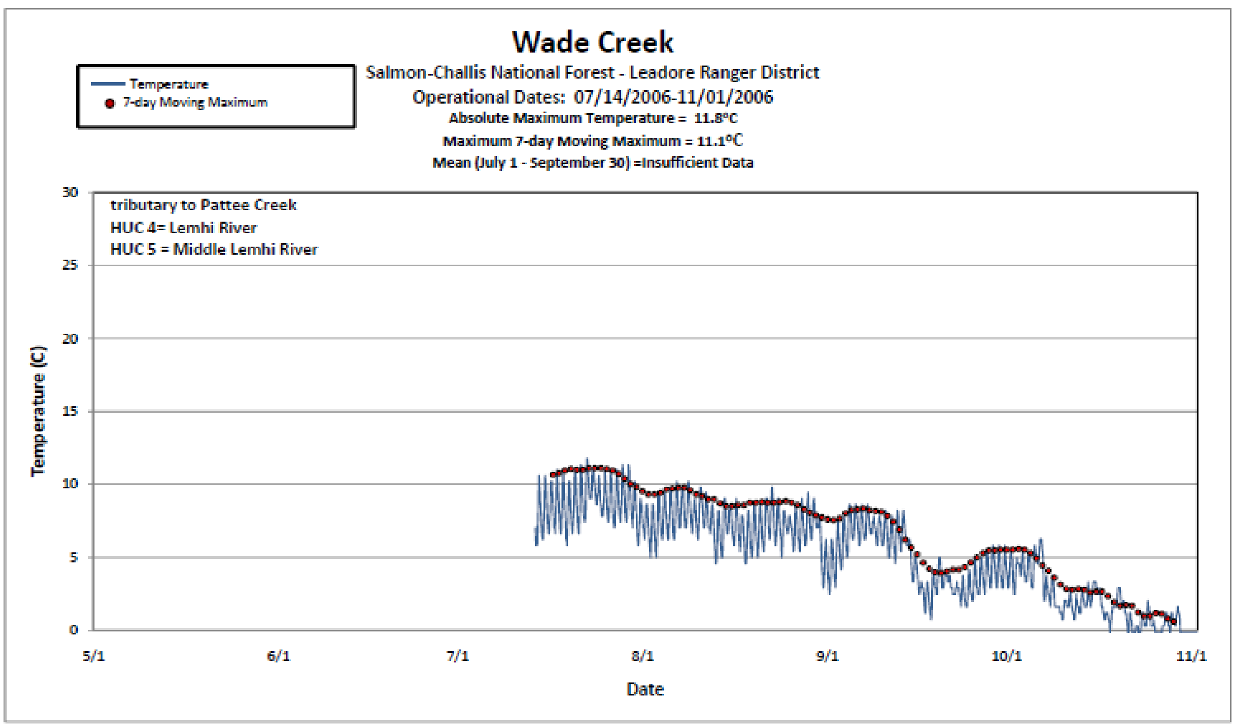

Hayden Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/12/2006-09/27/2006
Absolute Maximum Temperature = 16.4°C
Maximum 7-day Moving Maximum = 15.5°C
Mean (July 1 - September 30) = Insufficient Data
Temperature
7-day Moving Maximum
tributary to Lemhi River
HUC 4= Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

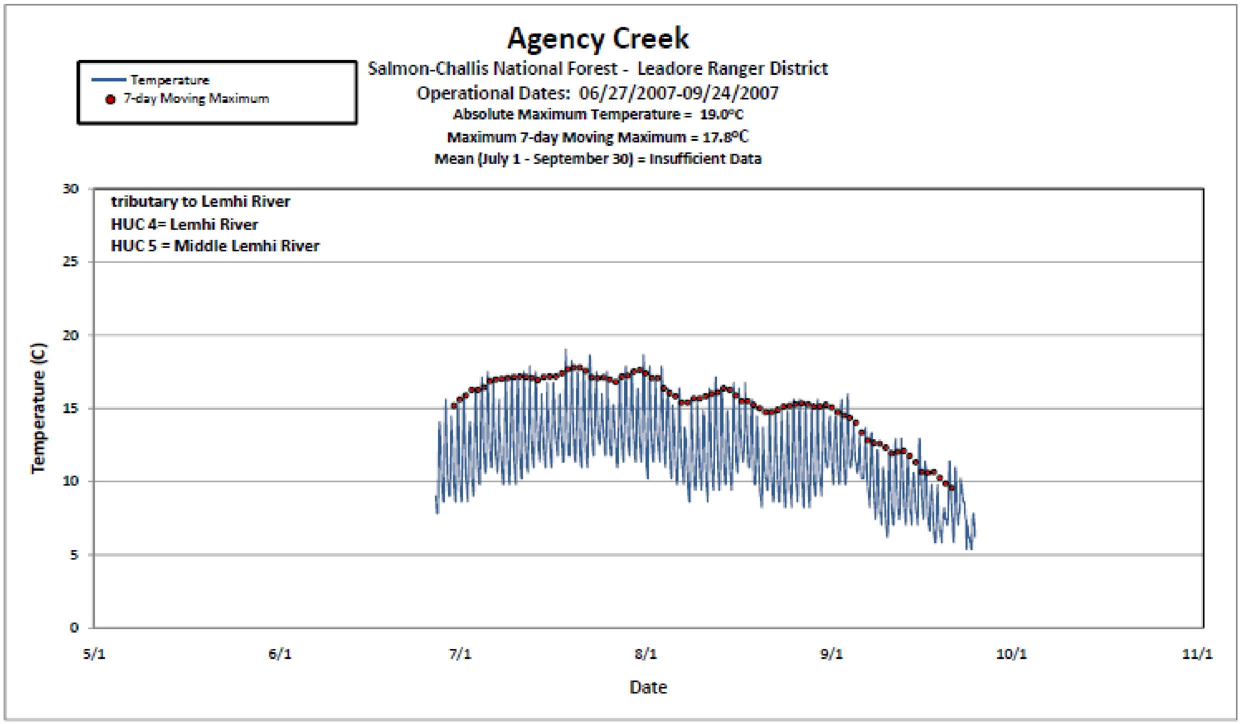

Lee Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/06/2006-11/01/2006
Absolute Maximum Temperature = 15.6°C
Maximum 7-day Moving Maximum = 14.7°C
Mean (July 1 - September 30) = Inscufficient Data
Temperature
7-day Moving Maximum
tributary to Lemhi River
HUC 4= Lemhi River
HUC 5 = Upper Lemhi River
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

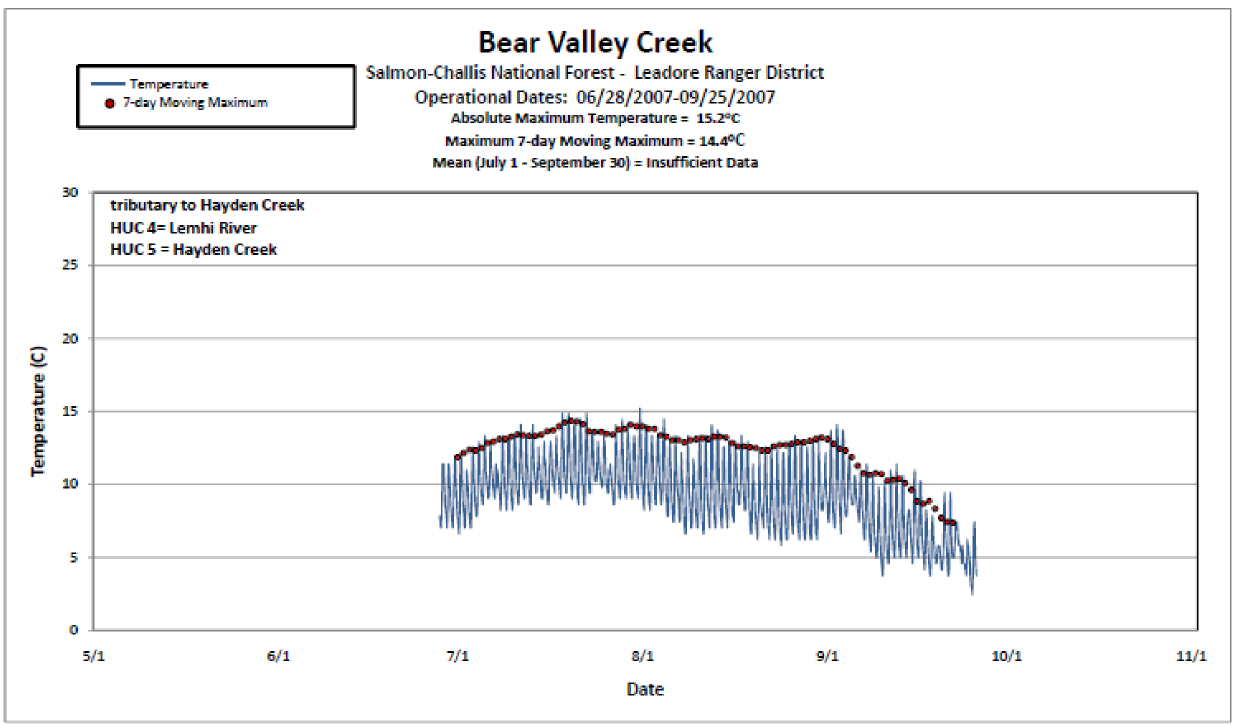

Pattee Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/01/2006-09/17/2006
Absolute Maximum Temperature = 14.8°C
Maximum 7-day Moving Maximum = 14.1°C
Mean (July 1 - September 30) = Insufficient Data
Temperature
7-day Moving Maximum
tributary to Lemhi River
HUC 4= Lemhi River
HUC 5 = Middle Lemhi River
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

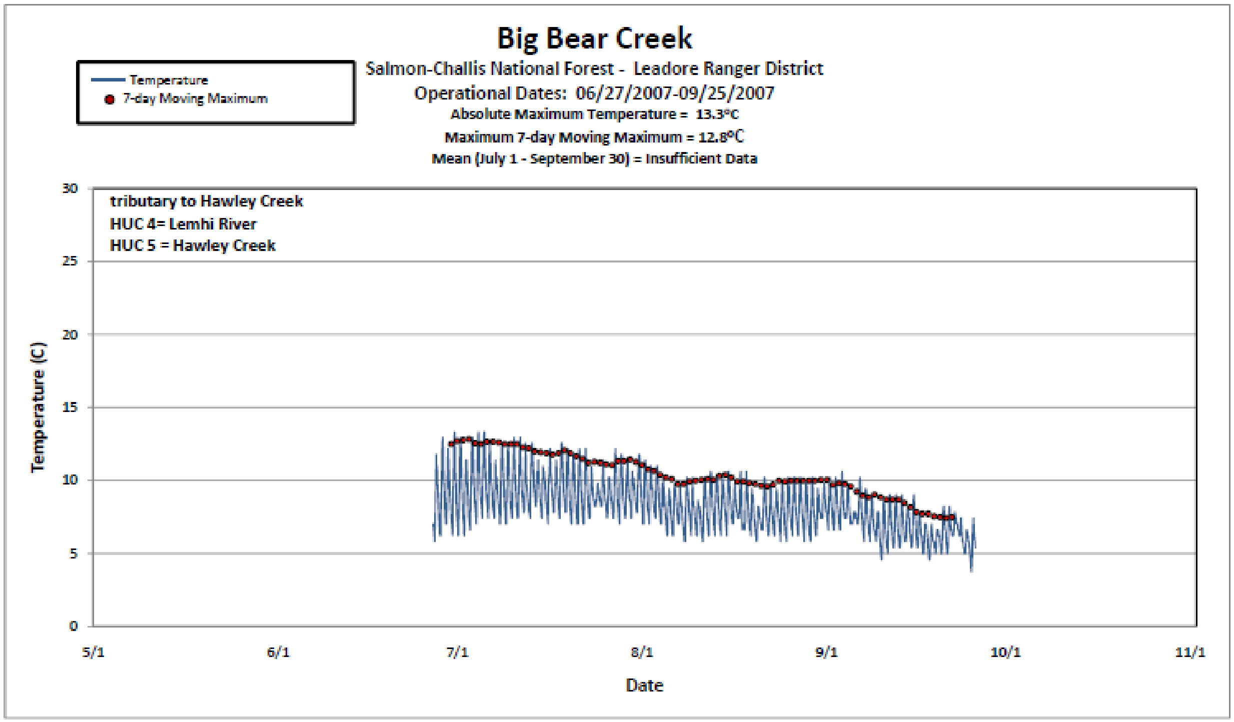

Stroud Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/28/2006-09/17/2006
Absolute Maximum Temperature = 12.9°C
Maximum 7-day Moving Maximum = 12.5°C
Mean (July 1 - September 30) = Insufficient Data
Temperature
7-day Moving Maximum
tributary to Everson Creek
HUC 4= Lemhi River
HUC 5 = Upper Lemhi River
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

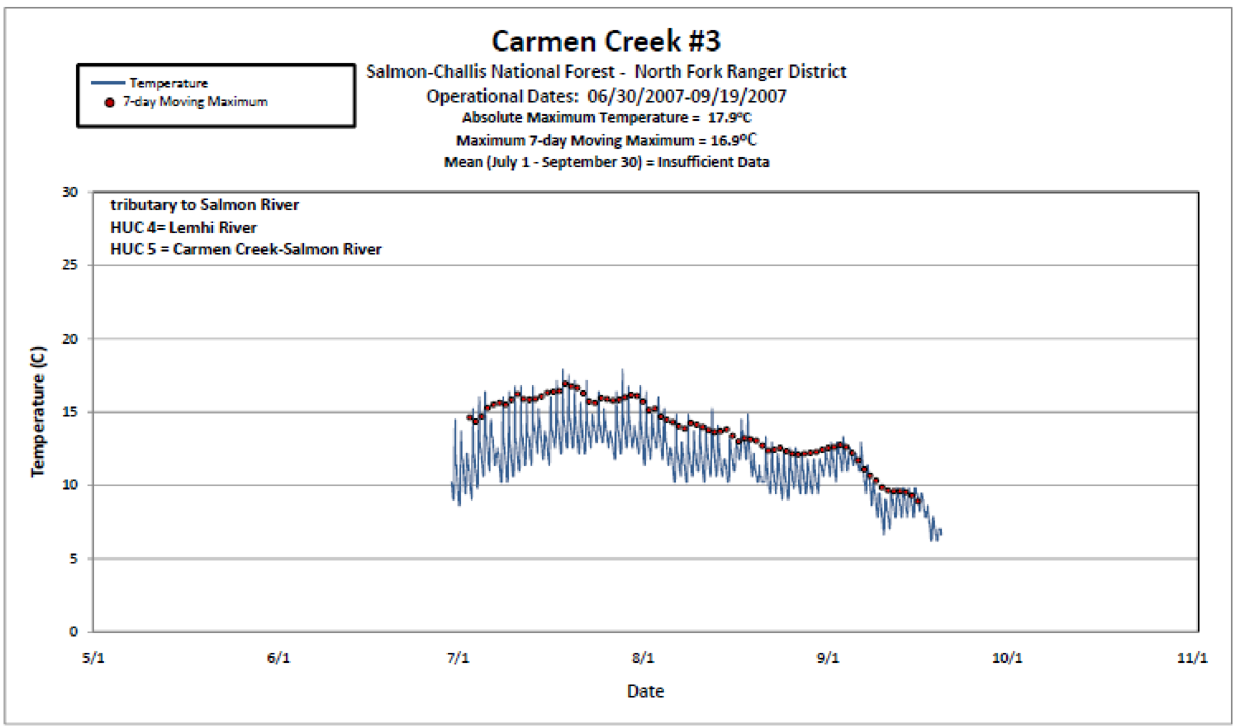

Tobias Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/12/2006-09/27/2006
Absolute Maximum Temperature = 15.2°C
Maximum 7-day Moving Maximum = 15.1°C
Mean (July 1 - September 30) = Insufficient Data
Temperature
7-day Moving Maximum
tributary to Hayden Creek
HUC 4 = Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

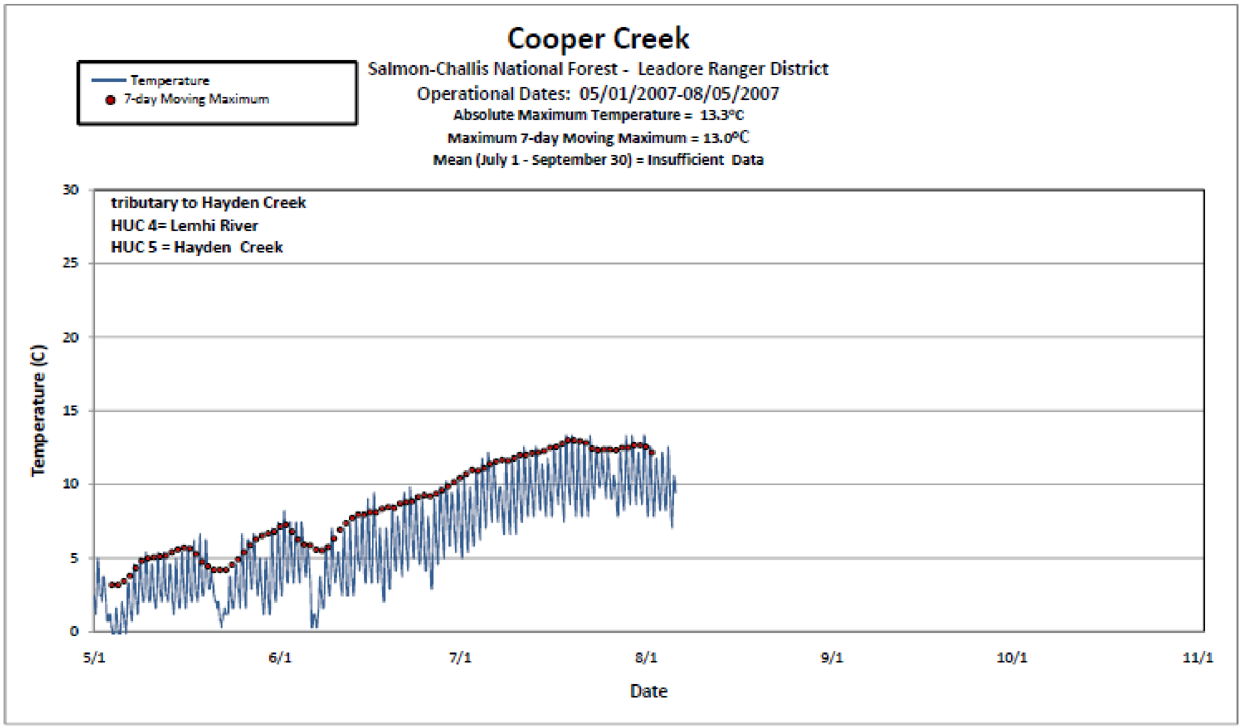

Wade Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/14/2006-11/01/2006
Absolute Maximum Temperature = 11.8°C
Maximum 7-day Moving Maximum = 11.1°C
Mean (July 1 - September 30) =Insufficient Data
Temperature
7-day Moving Maximum
tributary to Pattee Creek
HUC 4= Lemhi River
HUC 5 = Middle Lemhi River
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

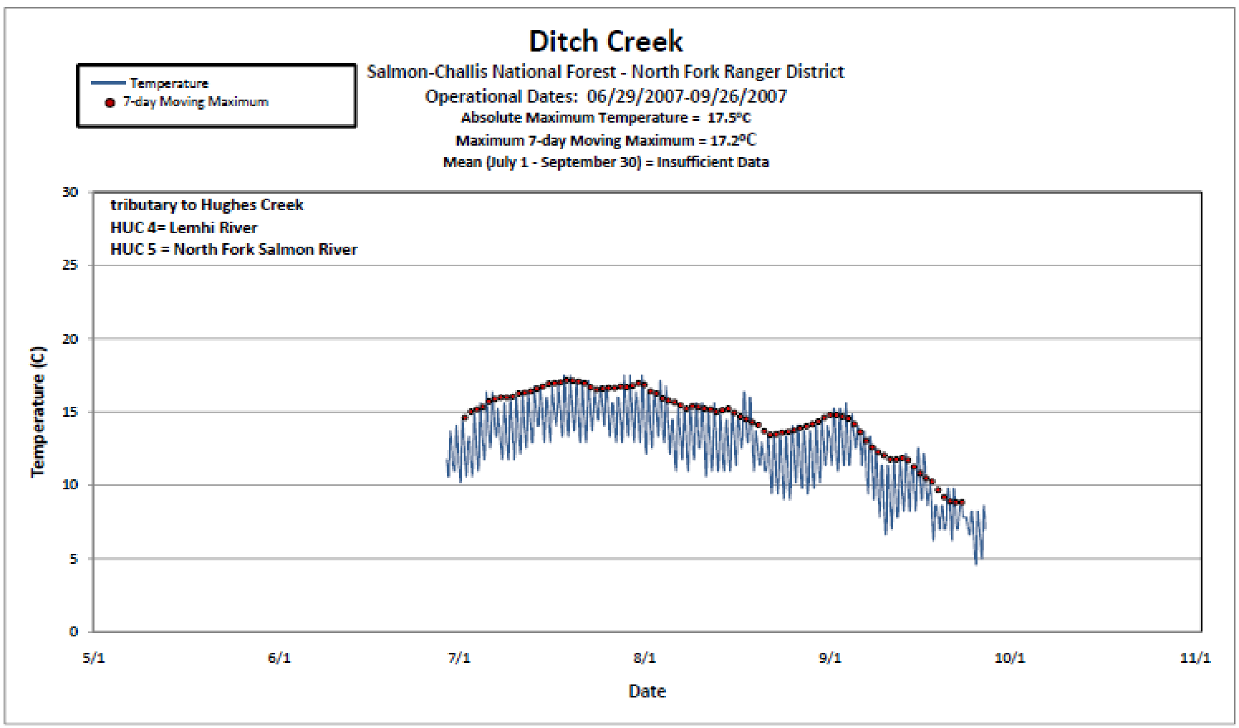

Agency Creek
Temperature
7-day Moving Maximum
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/27/2007-09/24/2007
Absolute Maximum Temperature = 19.0°C
Maximum 7-day Moving Maximum = 17.8°C
Mean (July 1 - September 30) = Insufficient Data
tributary to Lemhi River
HUC 4= Lemhi River
HUC 5 = Middle Lemhi River
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

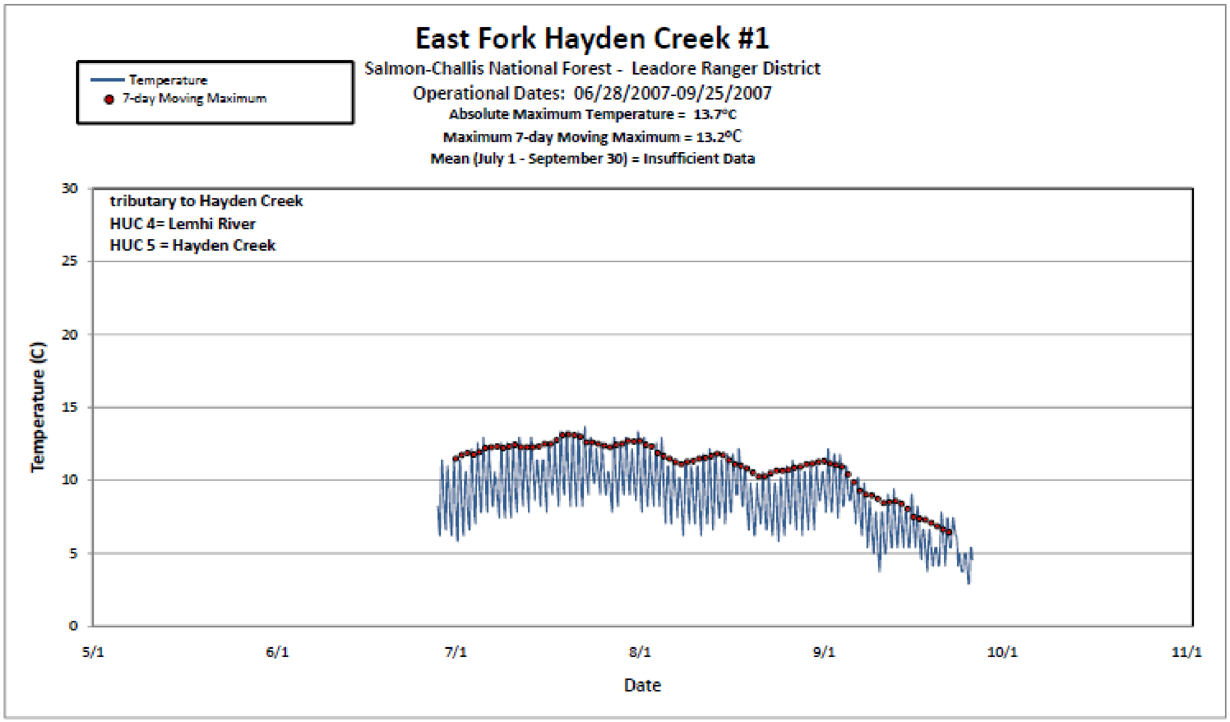

Bear Valley Creek
Temperature
7-day Moving Maximum
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/28/2007-09/25/2007
Absolute Maximum Temperature = 15.2°C
Maximum 7-day Moving Maximum = 14.4°C
Mean (July 1 - September 30) = Insufficient Data
tributary to Hayden Creek
HUC 4= Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

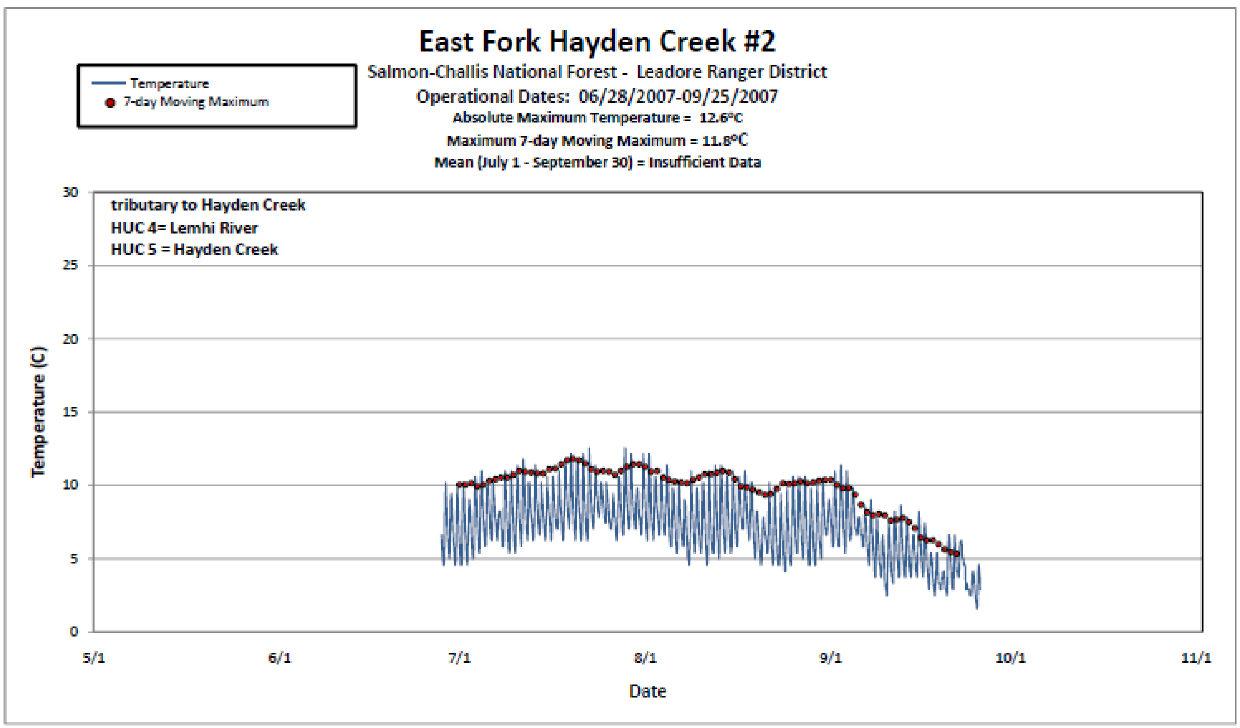

Big Bear Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/27/2007-09/25/2007
Absolute Maximum Temperature = 13.3ºC
Maximum 7-day Moving Maximum = 12.8ºC
Mean (July 1 - September 30) = Insufficient Data
Temperature
7-day Moving Maximum
tributary to Hawley Creek
HUC 4= Lemhi River
HUC 5 = Hawley Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

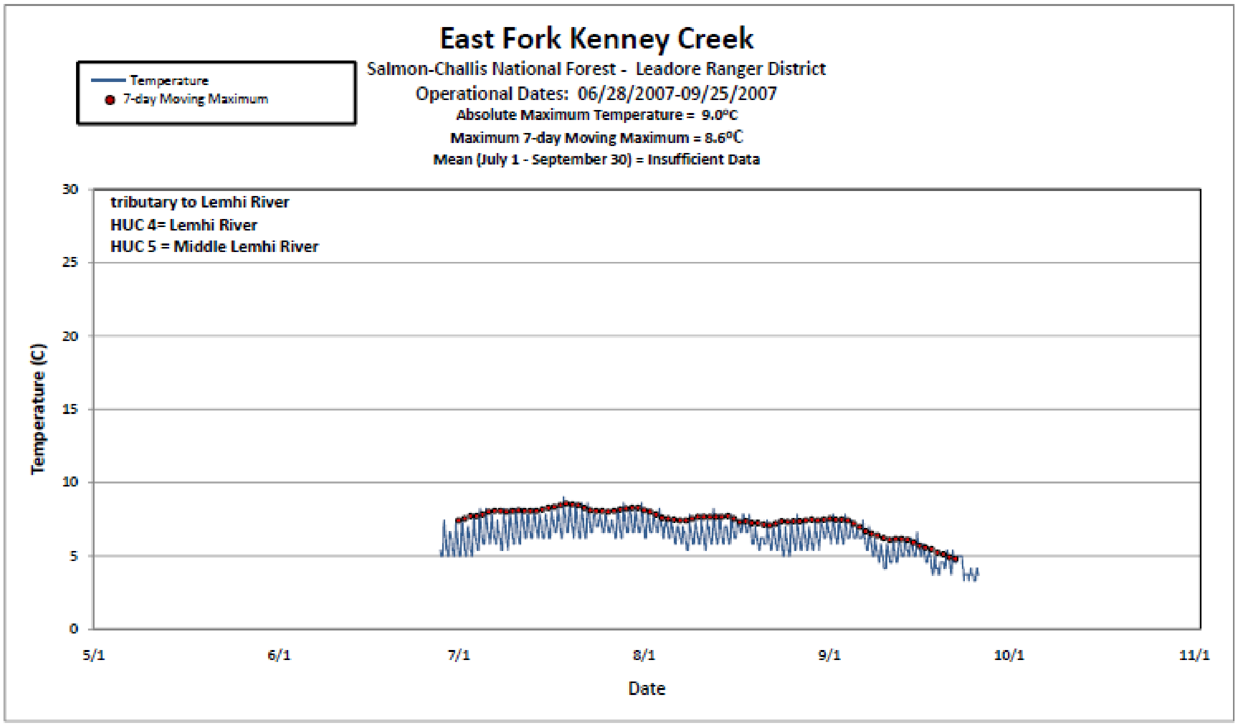

Carmen Creek #3
Salmon-Challis National Forest - North Fork Ranger District
Operational Dates: 06/30/2007-09/19/2007
Absolute Maximum Temperature = 17.9ºC
Maximum 7-day Moving Maximum = 16.9ºC
Mean (July 1 - September 30) = Insufficient Data
Temperature
7-day Moving Maximum
tributary to Salmon River
HUC 4= Lemhi River
HUC 5 = Carmen Creek-Salmon River
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

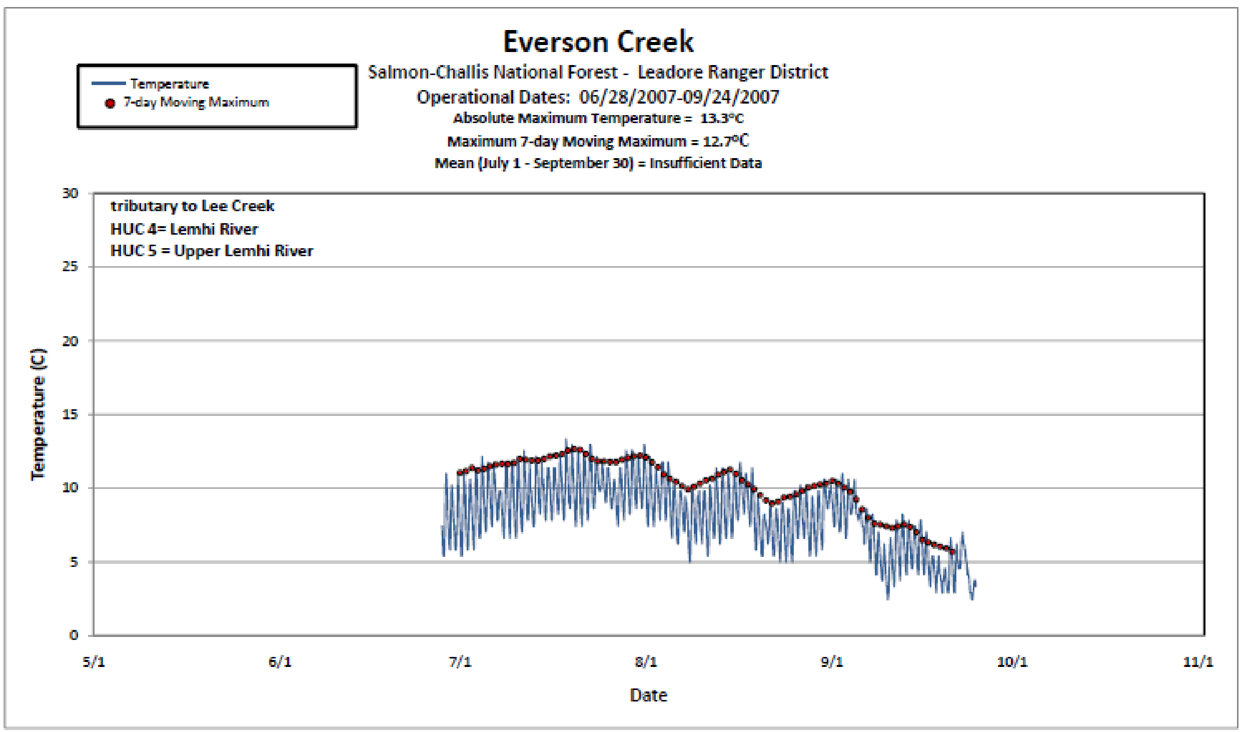

Cooper Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 05/01/2007-08/05/2007
Absolute Maximum Temperature = 13.3°C
Maximum 7-day Moving Maximum = 13.0°C
Mean (July 1 - September 30) = Insufficient Data
Temperature
7-day Moving Maximum
tributary to Hayden Creek
HUC 4= Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
Date
0
5
10
15
20
25
30
5/1
6/1
7/1
8/1
9/1
10/1
11/1

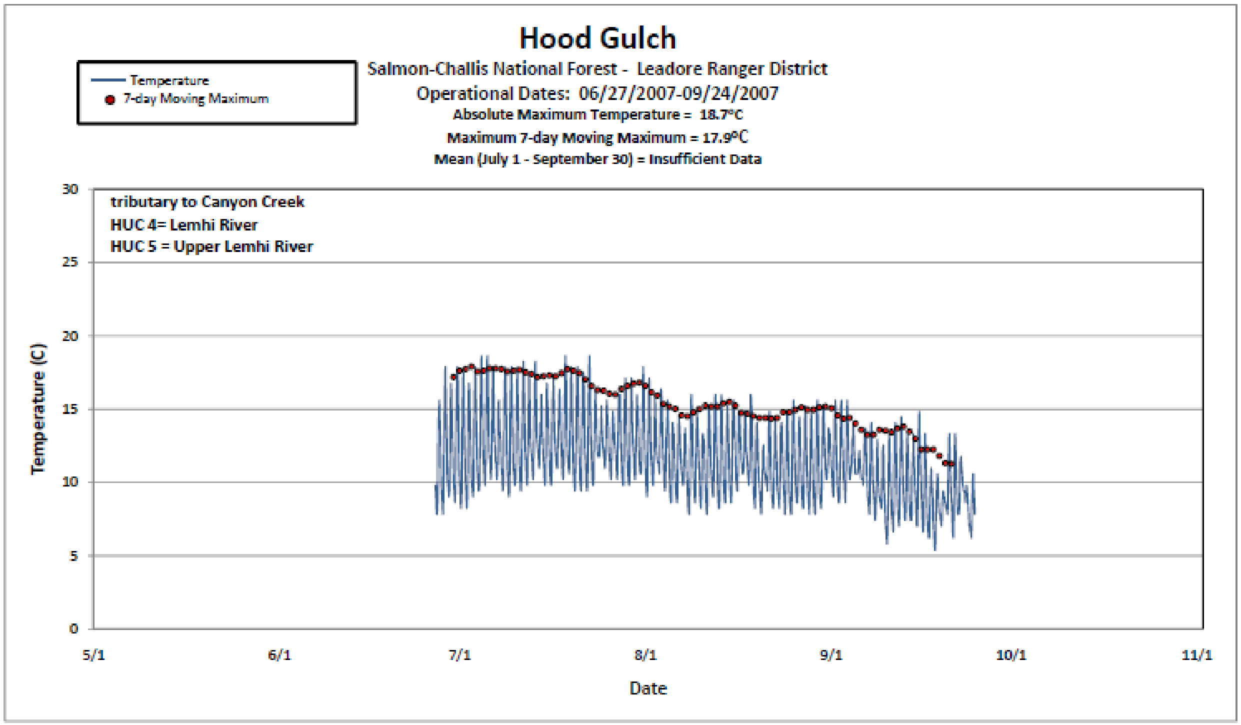

Ditch Creek
Salmon-Challis National Forest - North Fork Ranger District
Operational Dates: 06/29/2007-09/26/2007
Absolute Maximum Temperature = 17.5°C
Maximum 7-day Moving Maximum = 17.2°C
Mean (July 1 - September 30) = Insufficient Data
Temperature
7-day Moving Maximum
tributary to Hughes Creek
HUC 4= Lemhi River
HUC 5 = North Fork Salmon River
Temperature (C)
Date
0
5
10
15
20
25
30
5/1
6/1
7/1
8/1
9/1
10/1
11/1

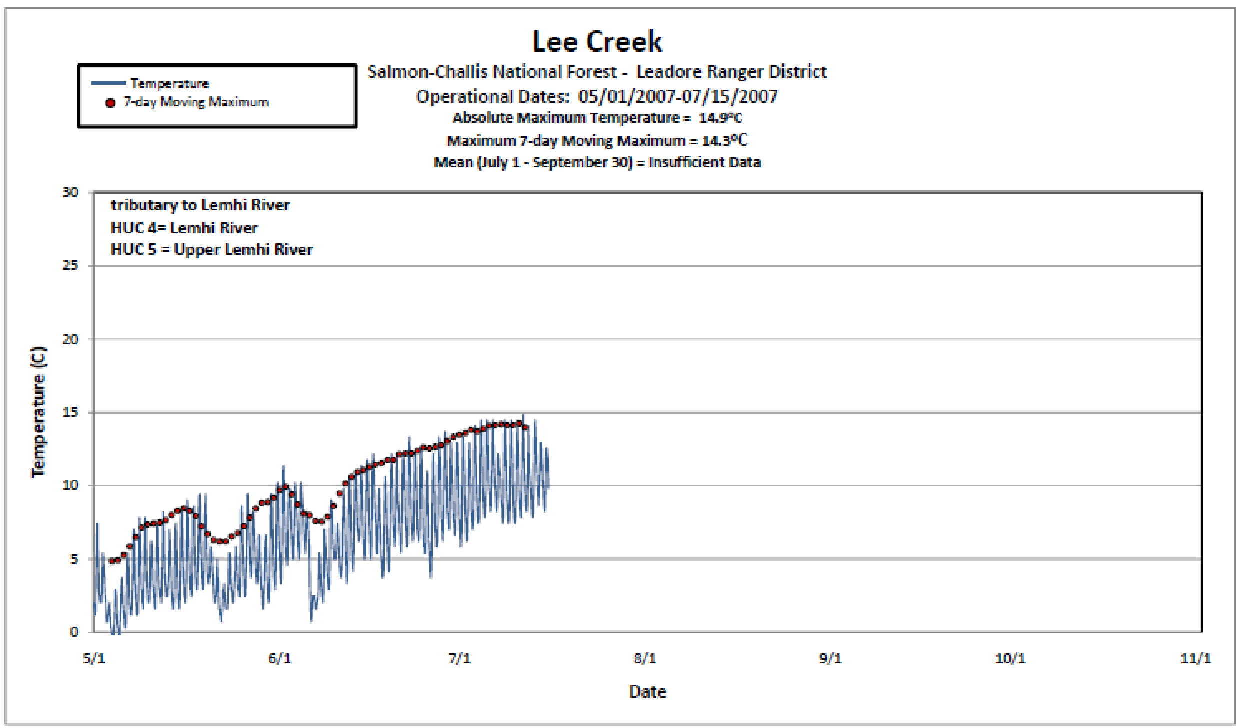

East Fork Hayden Creek #1
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/28/2007-09/25/2007
Absolute Maximum Temperature = 13.7°C
Maximum 7-day Moving Maximum = 13.2°C
Mean (July 1 - September 30) = Insufficient Data
Temperature
7-day Moving Maximum
tributary to Hayden Creek
HUC 4= Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
0
5
10
15
20
25
30
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

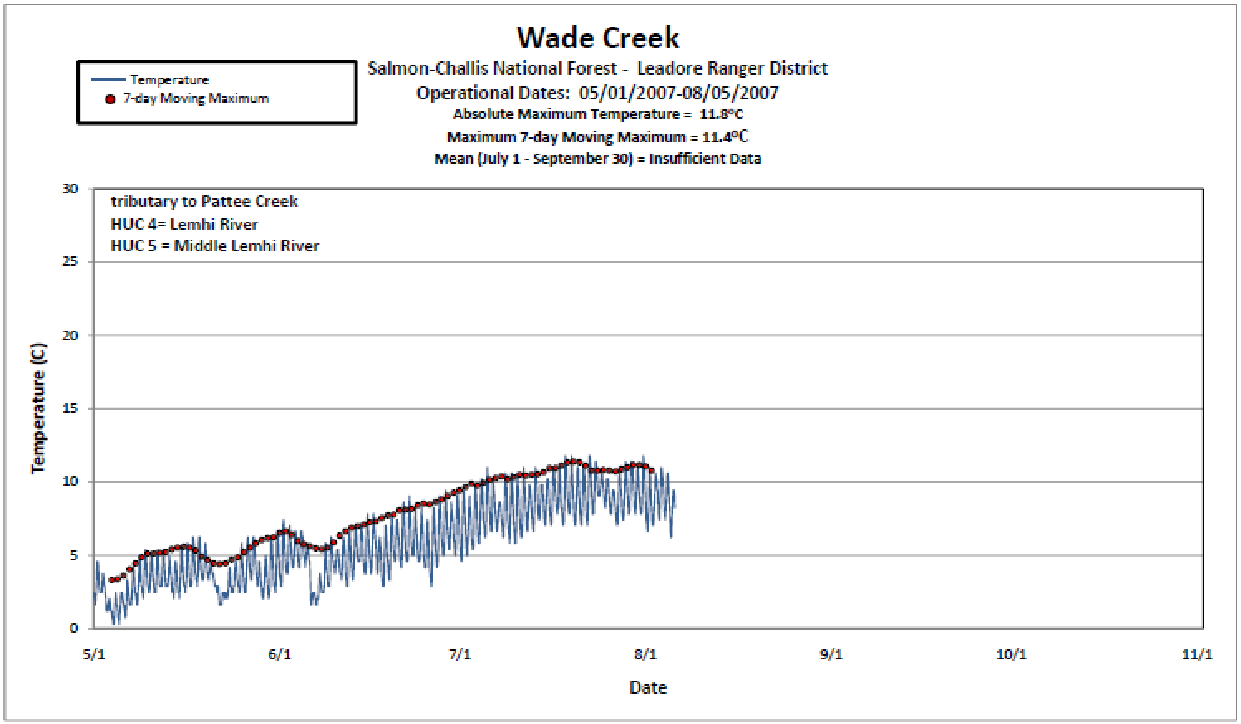

East Fork Hayden Creek #2
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/28/2007-09/25/2007
Absolute Maximum Temperature = 12.6°C
Maximum 7-day Moving Maximum = 11.8°C
Mean (July 1 - September 30) = Insufficient Data
Temperature
7-day Moving Maximum
tributary to Hayden Creek
HUC 4= Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
0
5
10
15
20
25
30
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

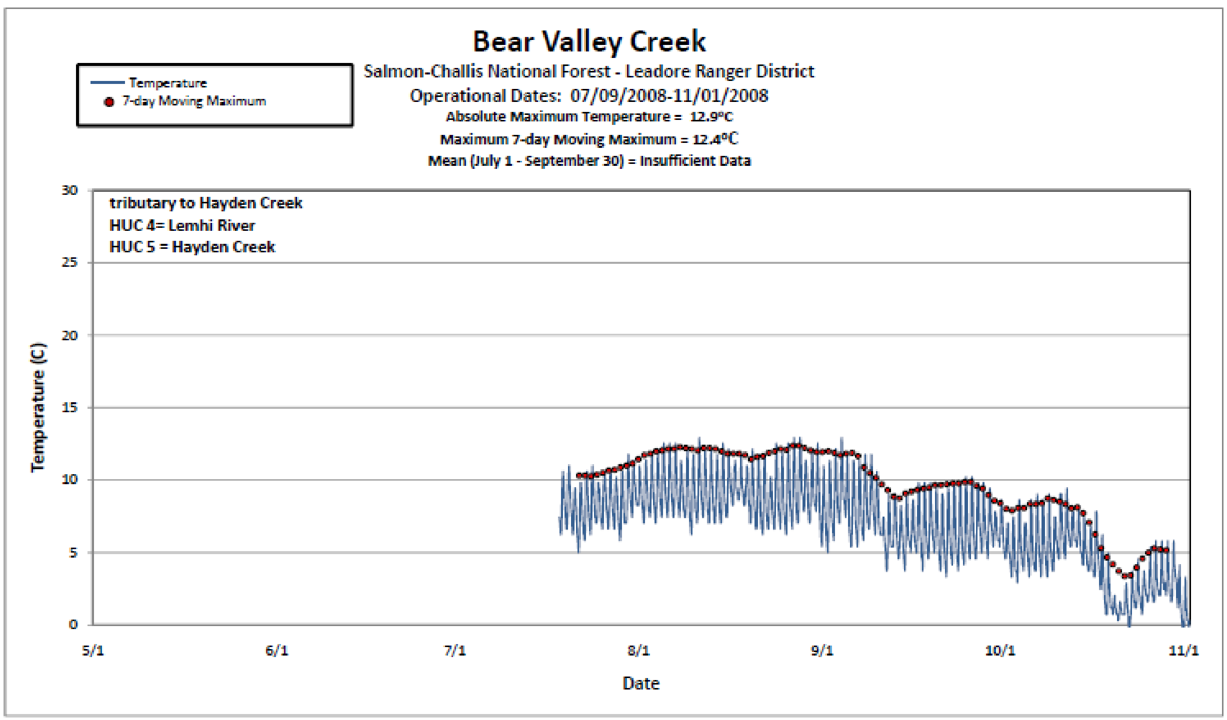

East Fork Kenney Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/28/2007-09/25/2007
Absolute Maximum Temperature = 9.0°C
Maximum 7-day Moving Maximum = 8.6°C
Mean (July 1 - September 30) = Insufficient Data
Temperature
7-day Moving Maximum
tributary to Lemhi River
HUC 4= Lemhi River
HUC 5 = Middle Lemhi River
Temperature (C)
0
5
10
15
20
25
30
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

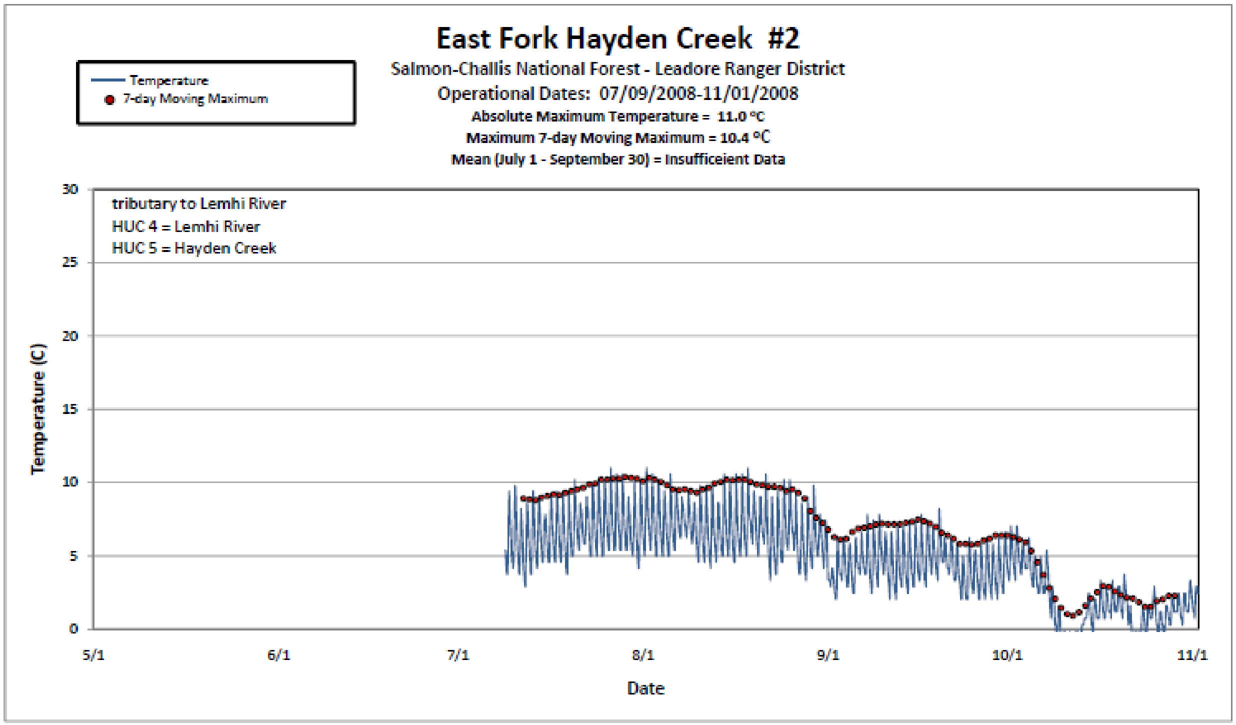

Everson Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/28/2007-09/24/2007
Absolute Maximum Temperature = 13.3°C
Maximum 7-day Moving Maximum = 12.7°C
Mean (July 1 - September 30) = Insufficient Data
Temperature
7-day Moving Maximum
tributary to Lee Creek
HUC 4= Lemhi River
HUC 5 = Upper Lemhi River
Temperature (C)
0
5
10
15
20
25
30
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

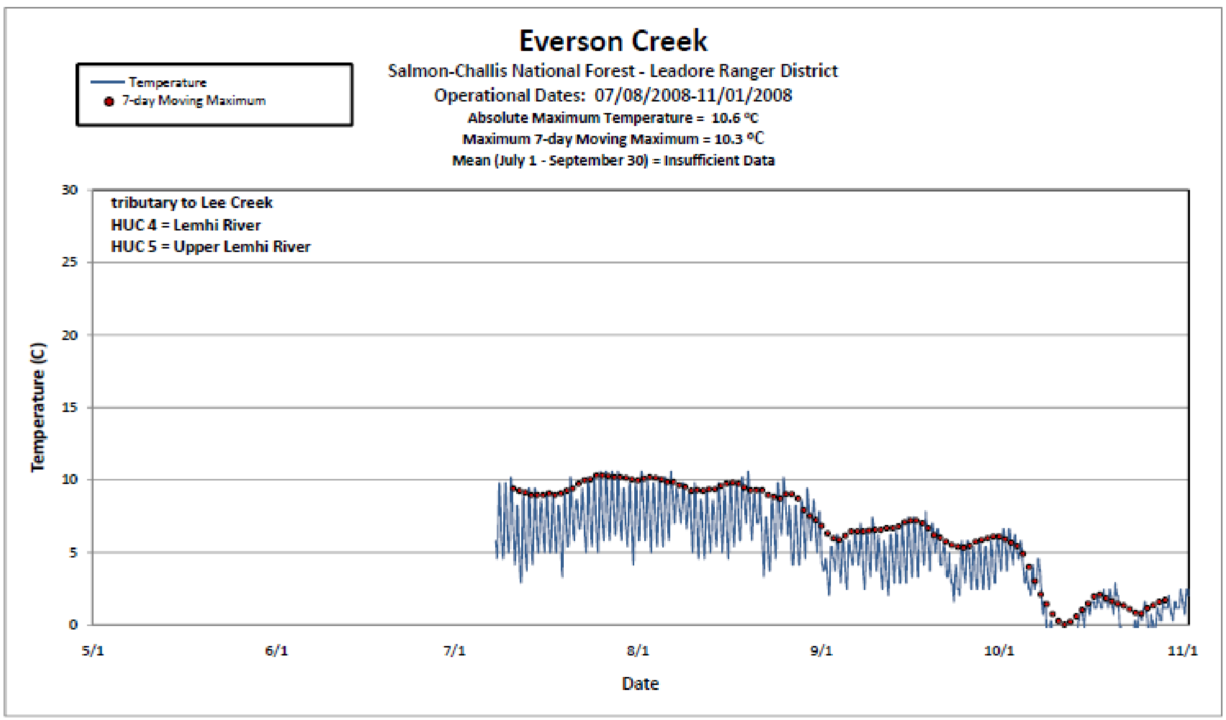

Hood Gulch
Temperature
7-day Moving Maximum
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/27/2007-09/24/2007
Absolute Maximum Temperature = 18.7°C
Maximum 7-day Moving Maximum = 17.9°C
Mean (July 1 - September 30) = Insufficient Data
tributary to Canyon Creek
HUC 4= Lemhi River
HUC 5 = Upper Lemhi River
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

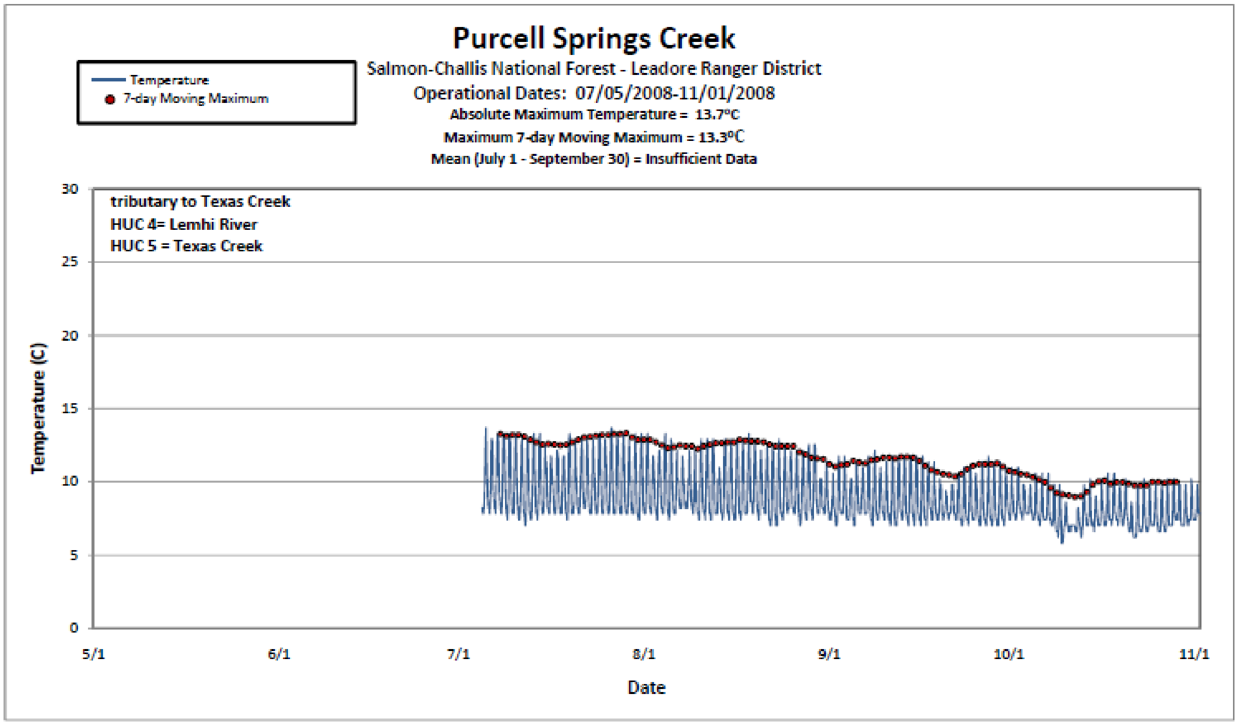

Lee Creek
Temperature
7-day Moving Maximum
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 05/01/2007-07/15/2007
Absolute Maximum Temperature = 14.9°C
Maximum 7-day Moving Maximum = 14.3°C
Mean (July 1 - September 30) = Insufficient Data
tributary to Lemhi River
HUC 4= Lemhi River
HUC 5 = Upper Lemhi River
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

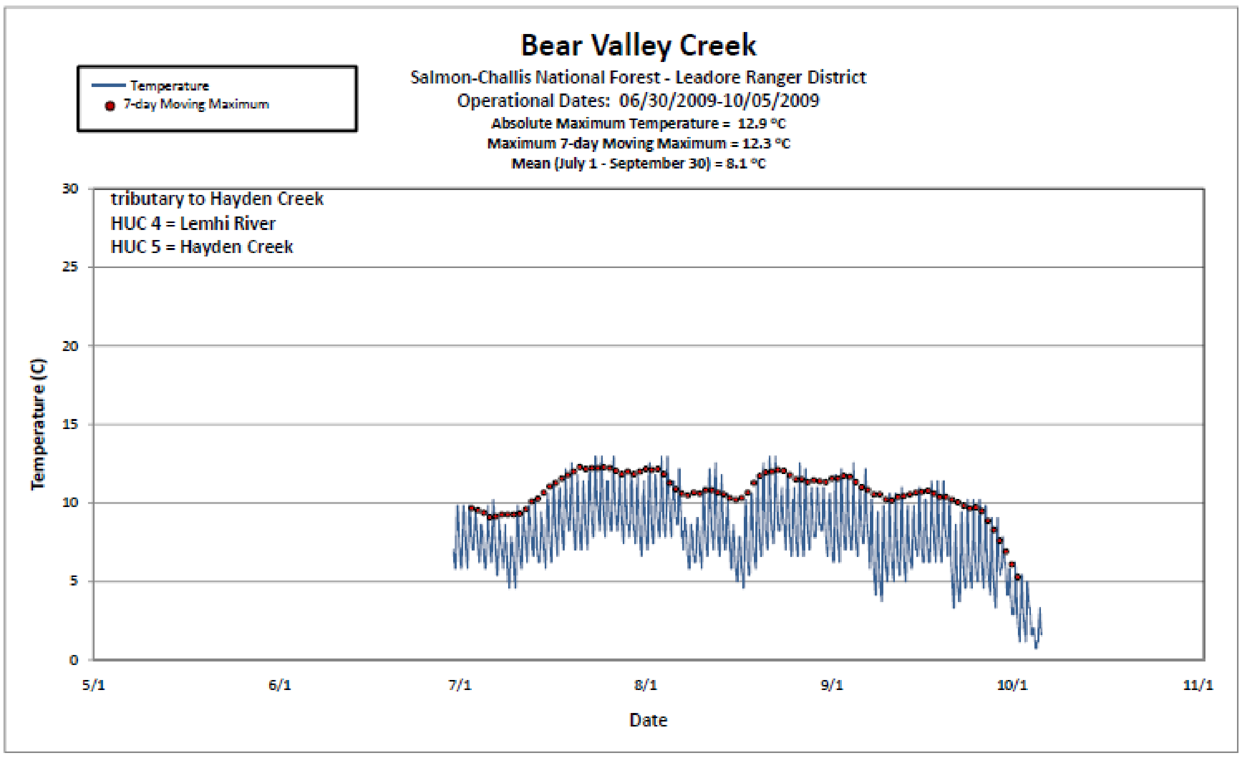

Wade Creek
Temperature
7-day Moving Maximum
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 05/01/2007-08/05/2007
Absolute Maximum Temperature = 11.8°C
Maximum 7-day Moving Maximum = 11.4°C
Mean (July 1 - September 30) = Insufficient Data
tributary to Pattee Creek
HUC 4= Lemhi River
HUC 5 = Middle Lemhi River
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

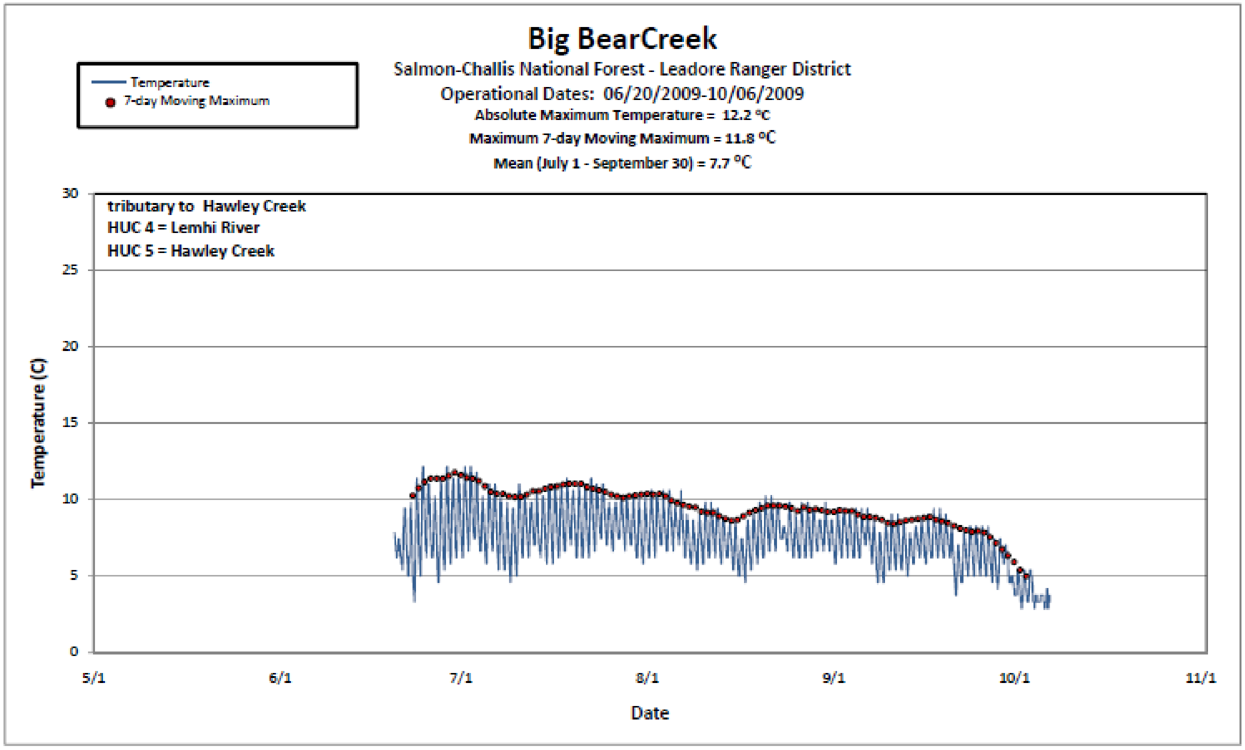

Bear Valley Creek
Temperature
7-day Moving Maximum
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/09/2008-11/01/2008
Absolute Maximum Temperature = 12.9°C
Maximum 7-day Moving Maximum = 12.4°C
Mean (July 1 - September 30) = Insufficient Data
tributary to Hayden Creek
HUC 4= Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

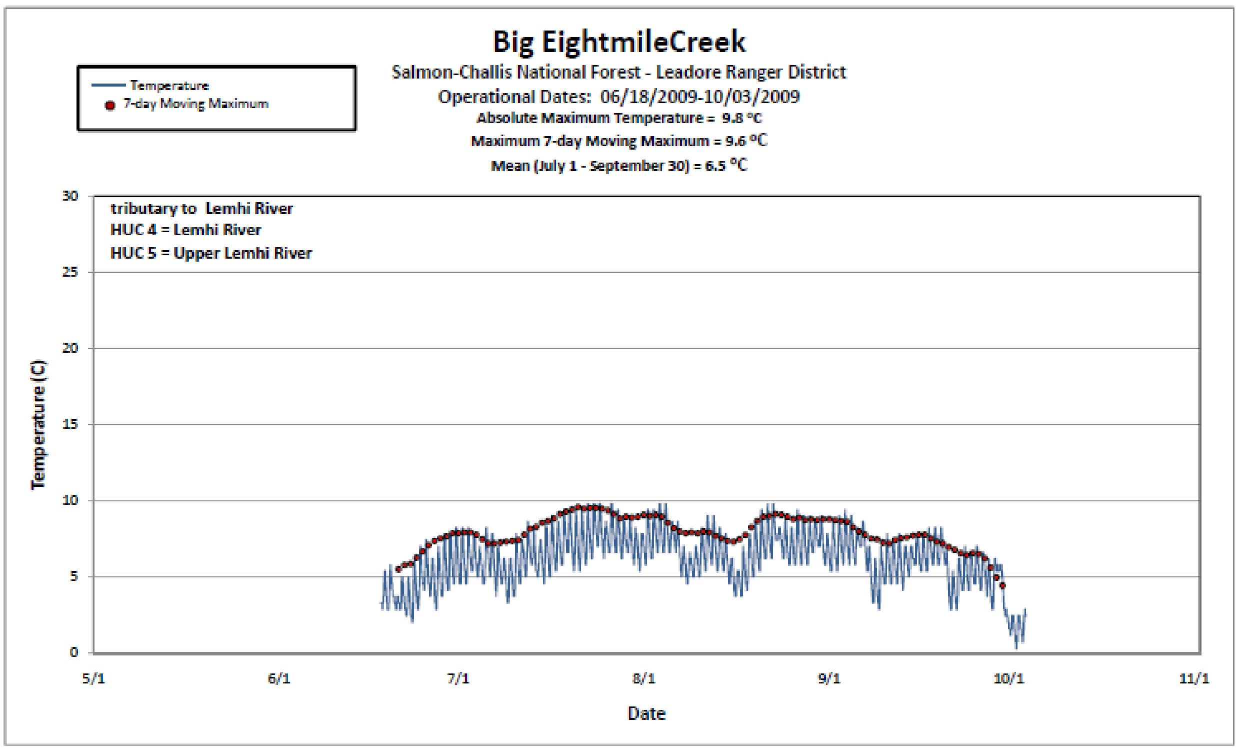

East Fork Hayden Creek #2
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/09/2008-11/01/2008
Absolute Maximum Temperature = 11.0 °C
Maximum 7-day Moving Maximum = 10.4 °C
Mean (July 1 - September 30) = Insufficeient Data
Temperature
7-day Moving Maximum
tributary to Lemhi River
HUC 4 = Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

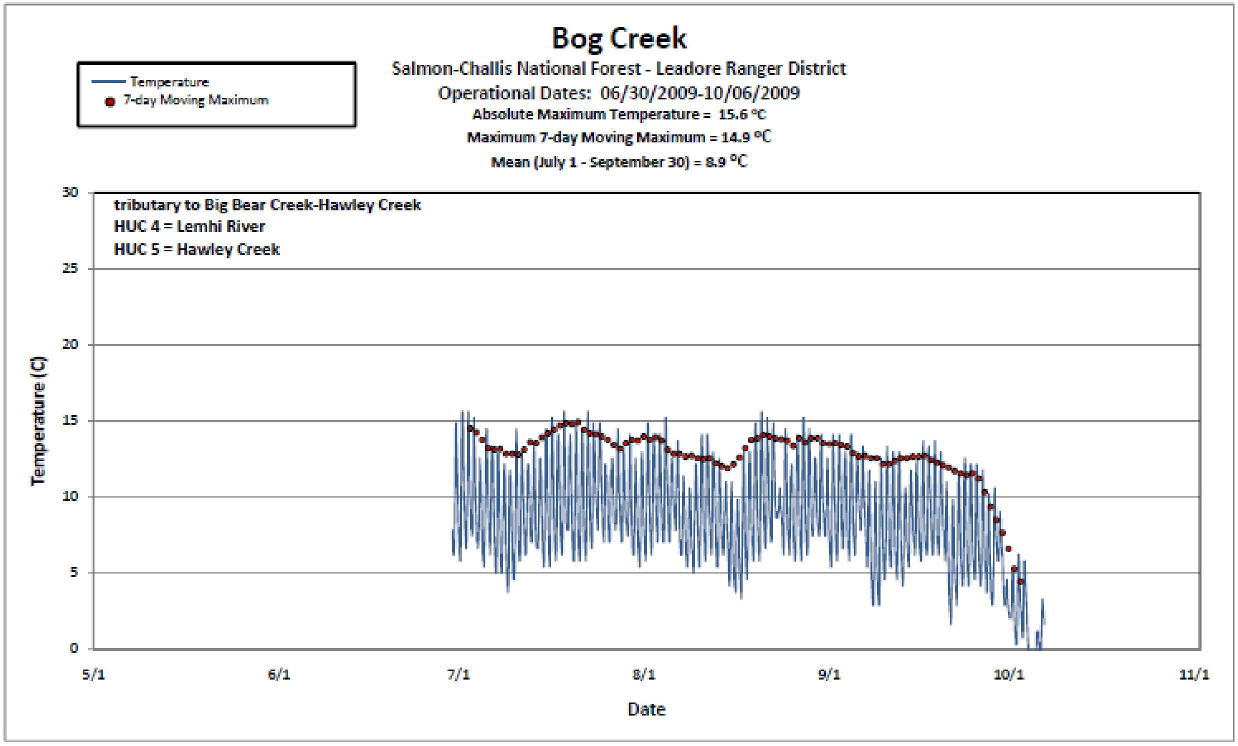

Everson Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/08/2008-11/01/2008
Absolute Maximum Temperature = 10.6 °C
Maximum 7-day Moving Maximum = 10.3 °C
Mean (July 1 - September 30) = Insufficient Data
Temperature
7-day Moving Maximum
tributary to Lee Creek
HUC 4 = Lemhi River
HUC 5 = Upper Lemhi River
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

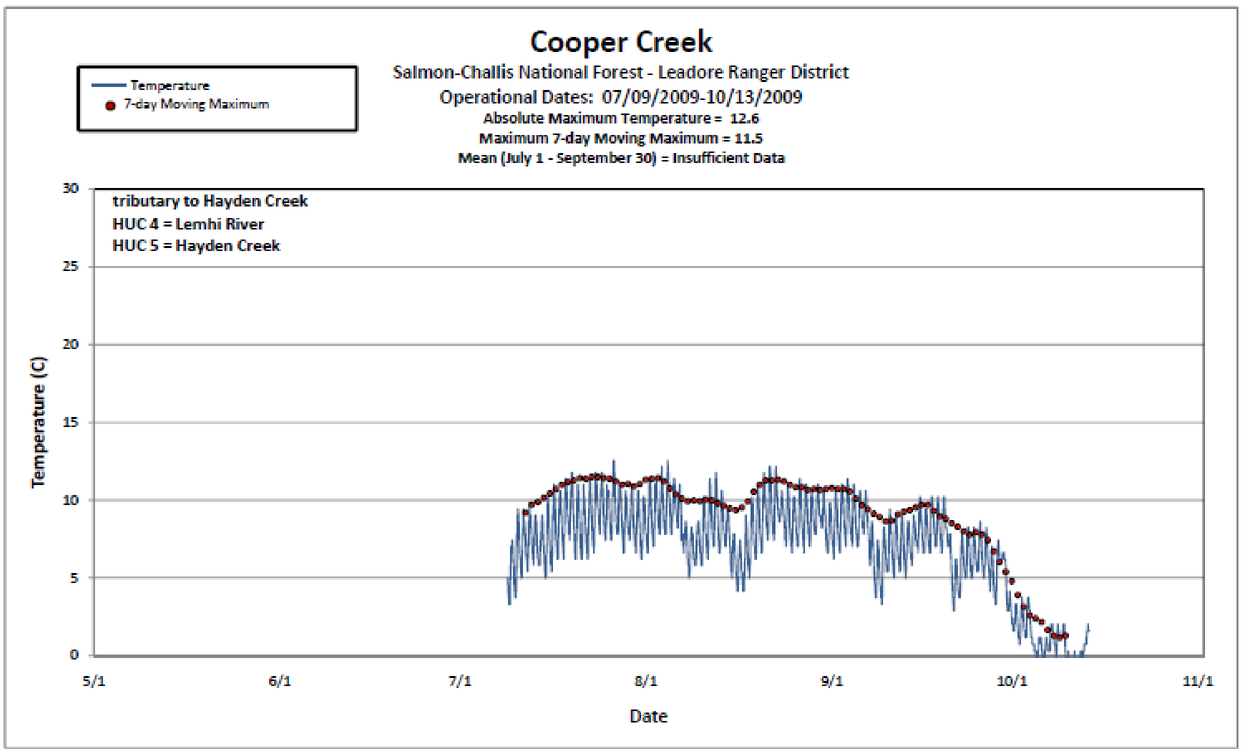

Purcell Springs Creek
Temperature
7-day Moving Maximum
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/05/2008-11/01/2008
Absolute Maximum Temperature = 13.7°C
Maximum 7-day Moving Maximum = 13.3°C
Mean (July 1 - September 30) = Insufficient Data
tributary to Texas Creek
HUC 4= Lemhi River
HUC 5 = Texas Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

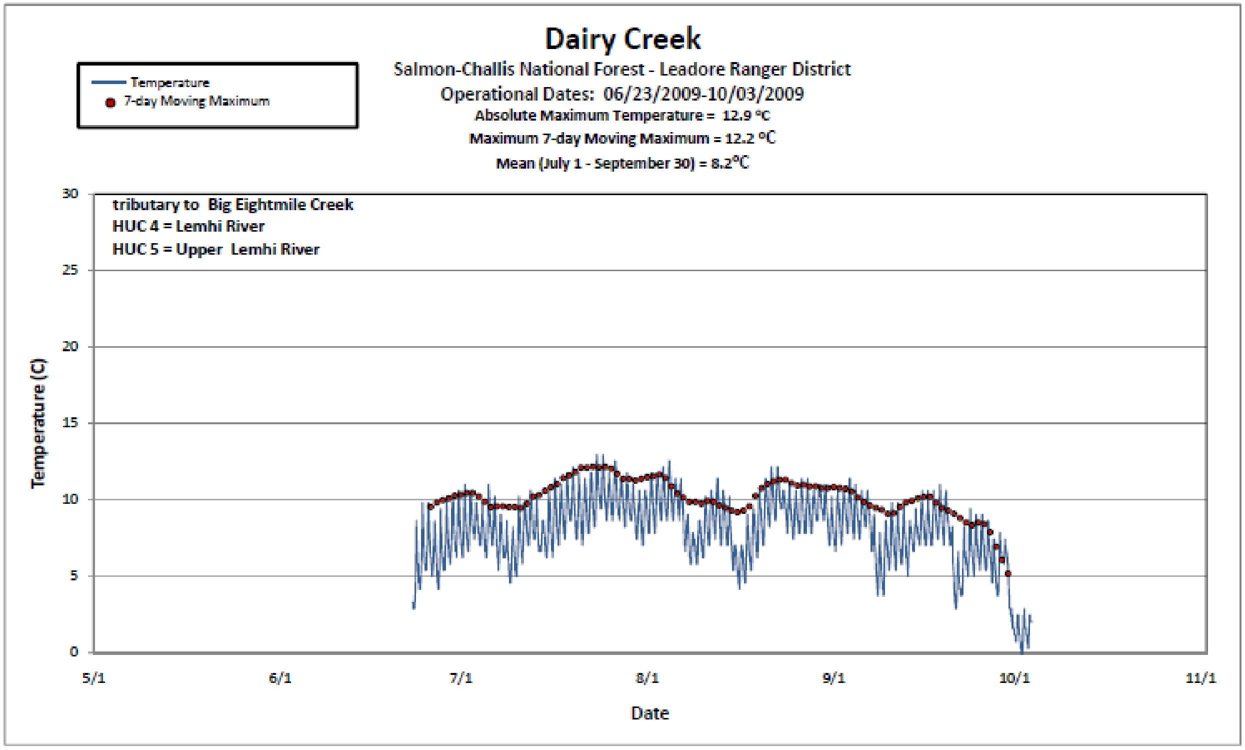

Bear Valley Creek
Temperature
7-day Moving Maximum
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/30/2009-10/05/2009
Absolute Maximum Temperature = 12.9 °C
Maximum 7-day Moving Maximum = 12.3 °C
Mean (July 1 - September 30) = 8.1 °C
tributary to Hayden Creek
HUC 4 = Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

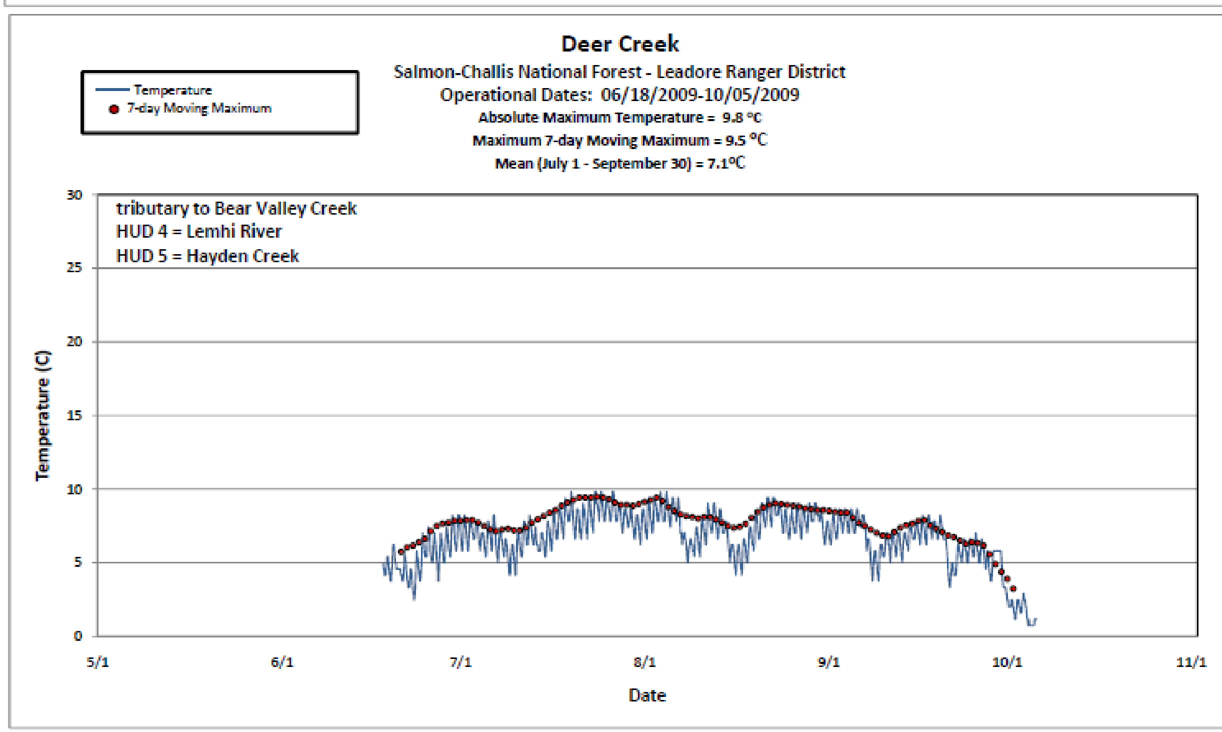

Big BearCreek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/20/2009-10/06/2009
Absolute Maximum Temperature = 12.2 °C
Maximum 7-day Moving Maximum = 11.8 °C
Mean (July 1 - September 30) = 7.7 °C
Temperature
7-day Moving Maximum
tributary to Hawley Creek
HUC 4 = Lemhi River
HUC 5 = Hawley Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

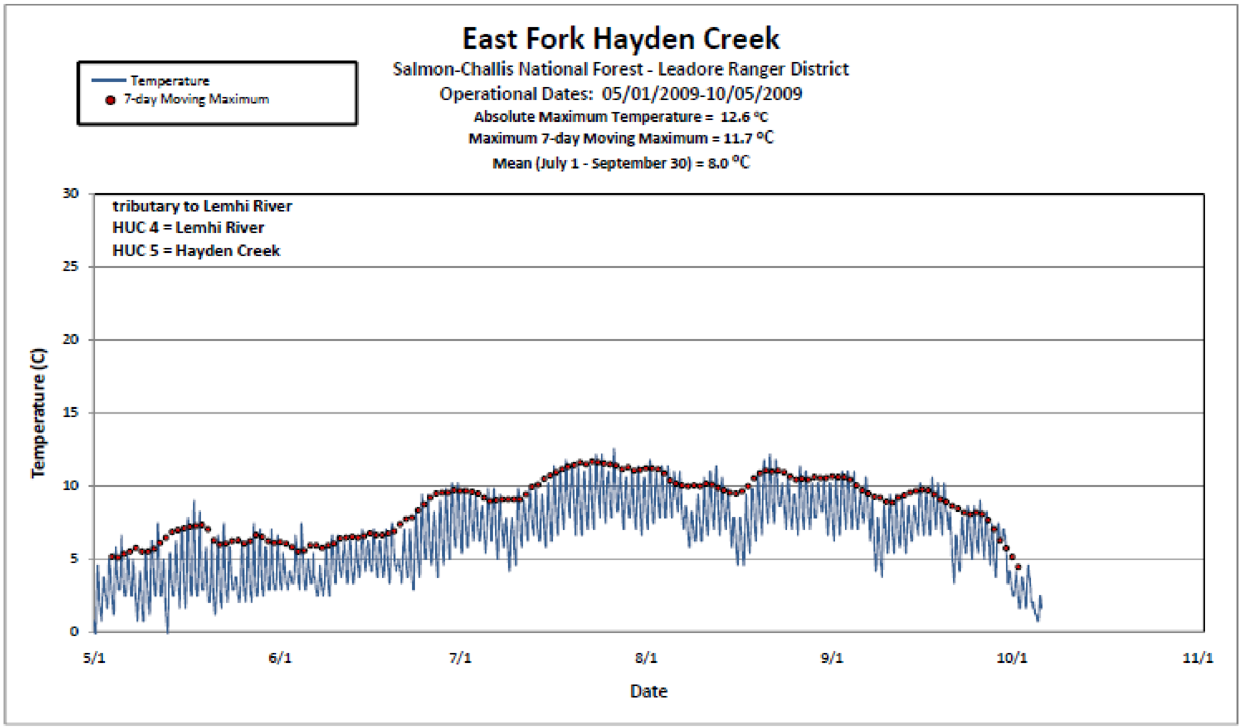

Big EightmileCreek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/18/2009-10/03/2009
Absolute Maximum Temperature = 9.8 °C
Maximum 7-day Moving Maximum = 9.6 °C
Mean (July 1 - September 30) = 6.5 °C
Temperature
7-day Moving Maximum
tributary to Lemhi River
HUC 4 = Lemhi River
HUC 5 = Upper Lemhi River
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

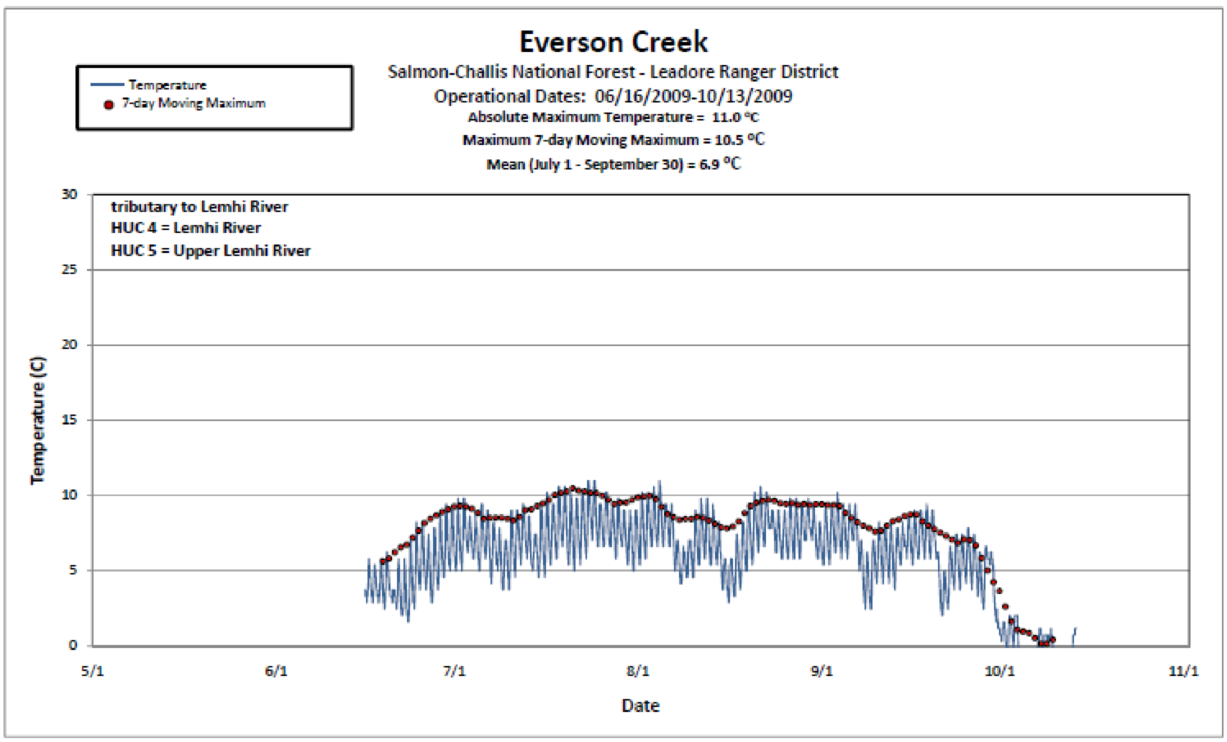

Bog Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/30/2009-10/06/2009
Absolute Maximum Temperature = 15.6 °C
Maximum 7-day Moving Maximum = 14.9 °C
Mean (July 1 - September 30) = 8.9 °C
Temperature
7-day Moving Maximum
tributary to Big Bear Creek-Hawley Creek
HUC 4 = Lemhi River
HUC 5 = Hawley Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

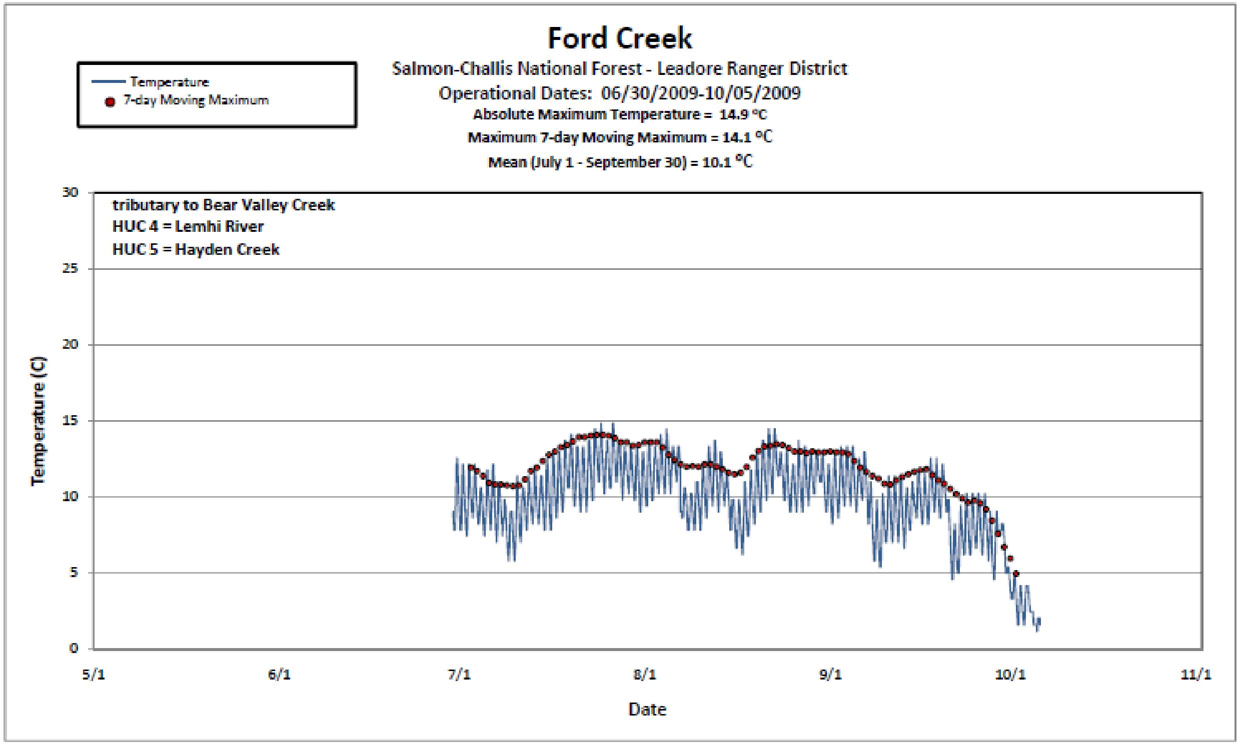

Cooper Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/09/2009-10/13/2009
Absolute Maximum Temperature = 12.6
Maximum 7-day Moving Maximum = 11.5
Mean (July 1 - September 30) = Insufficient Data
Temperature
7-day Moving Maximum
tributary to Hayden Creek
HUC 4 = Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

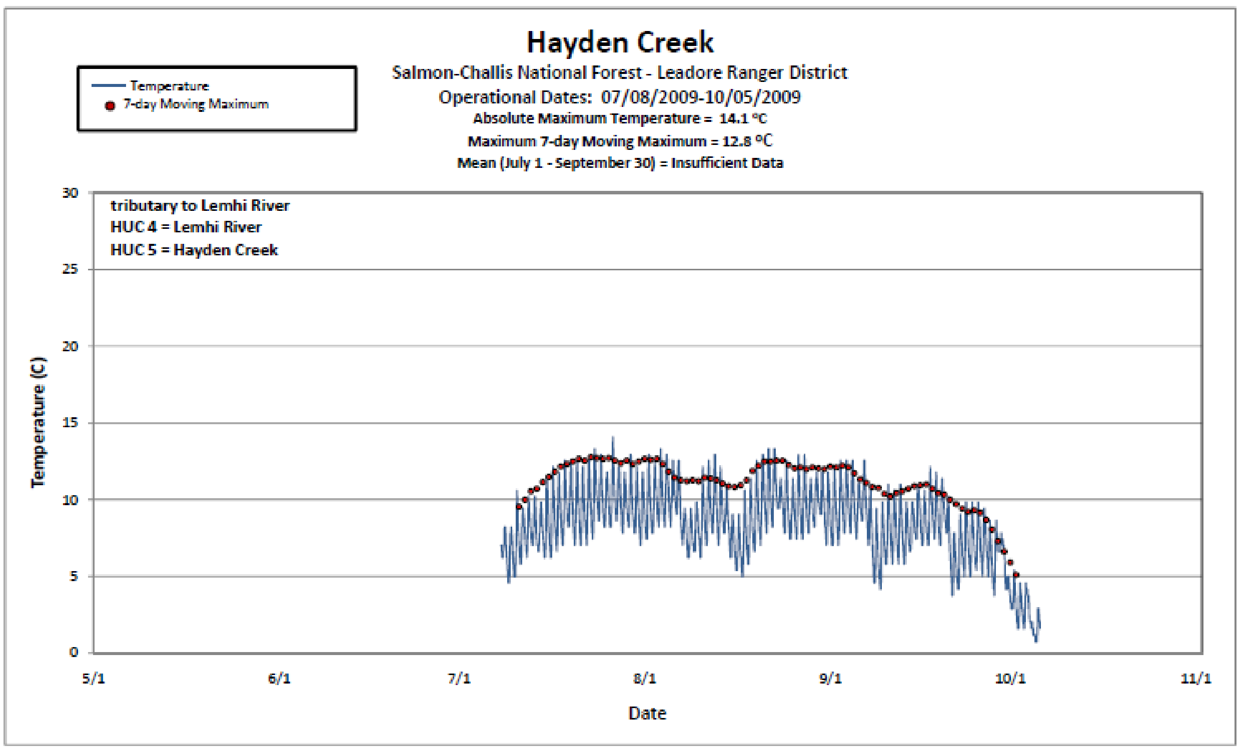

Dairy Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/23/2009-10/03/2009
Absolute Maximum Temperature = 12.9 °C
Maximum 7-day Moving Maximum = 12.2 °C
Mean (July 1 - September 30) = 8.2°C
Temperature
7-day Moving Maximum
tributary to Big Eightmile Creek
HUC 4 = Lemhi River
HUC 5 = Upper Lemhi River
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

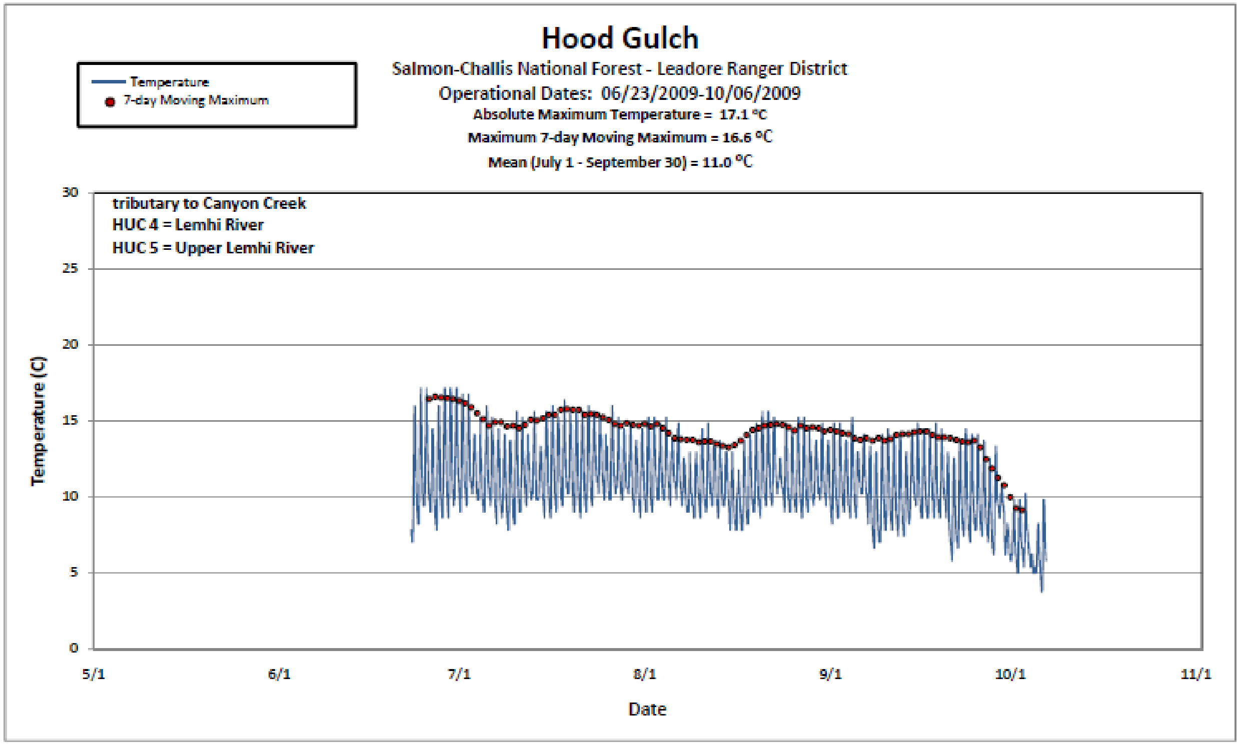

Deer Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/18/2009-10/05/2009
Absolute Maximum Temperature = 9.8 °C
Maximum 7-day Moving Maximum = 9.5 °C
Mean (July 1 - September 30) = 7.1°C
Temperature
7-day Moving Maximum
tributary to Bear Valley Creek
HUD 4 = Lemhi River
HUD 5 = Hayden Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

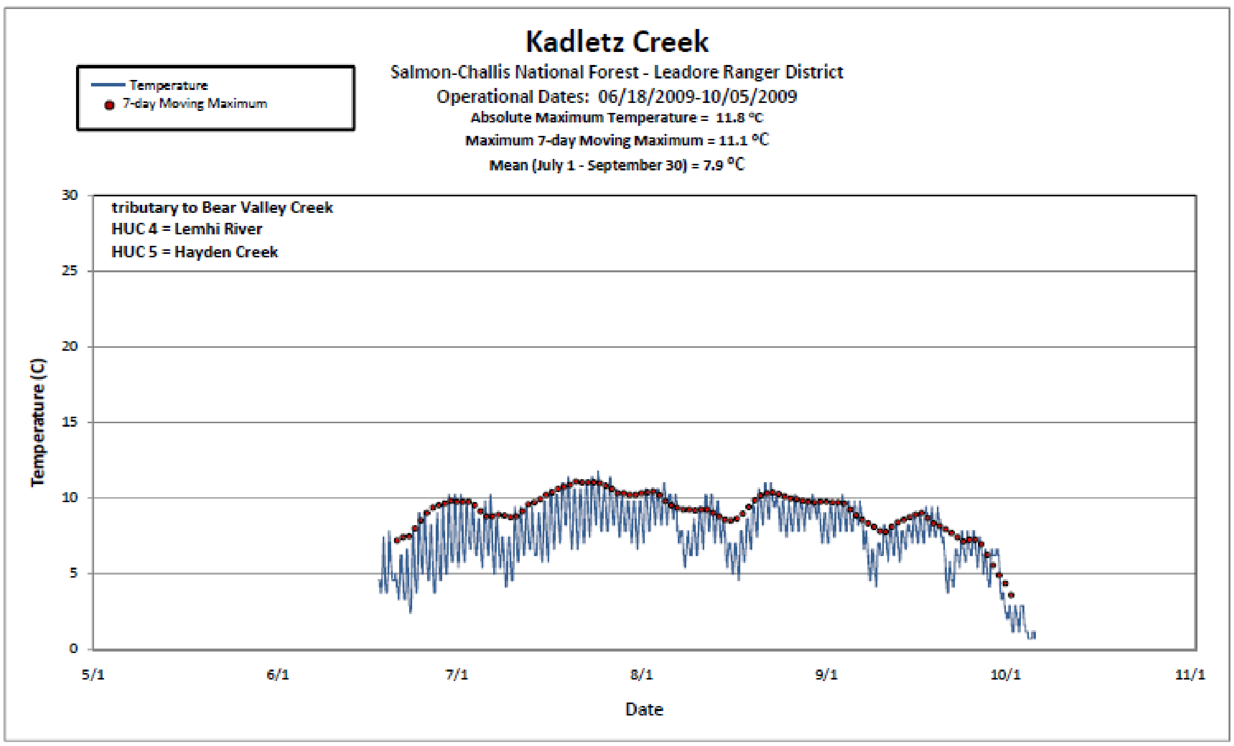

East Fork Hayden Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 05/01/2009-10/05/2009
Absolute Maximum Temperature = 12.6 °C
Maximum 7-day Moving Maximum = 11.7 °C
Mean (July 1 - September 30) = 8.0 °C
Temperature
7-day Moving Maximum
tributary to Lemhi River
HUC 4 = Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
Date
0
5
10
15
20
25
30
5/1
6/1
7/1
8/1
9/1
10/1
11/1

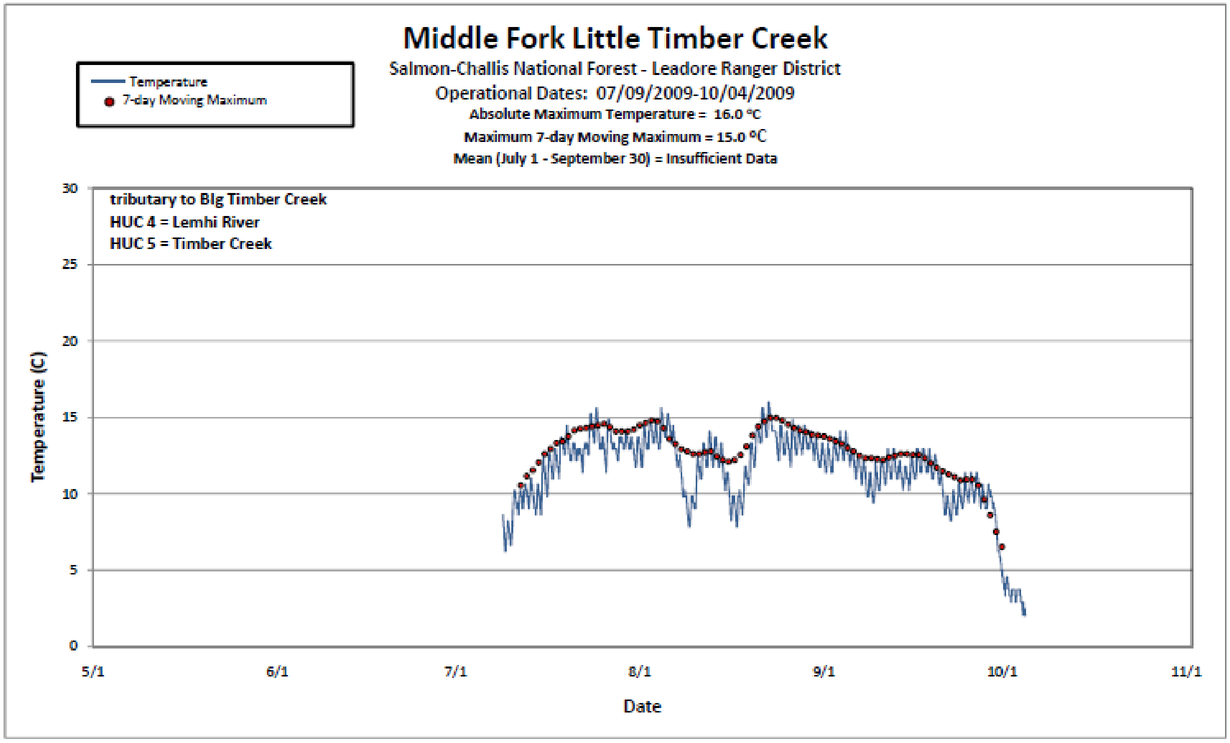

Everson Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/16/2009-10/13/2009
Absolute Maximum Temperature = 11.0 °C
Maximum 7-day Moving Maximum = 10.5 °C
Mean (July 1 - September 30) = 6.9 °C
Temperature
7-day Moving Maximum
tributary to Lemhi River
HUC 4 = Lemhi River
HUC 5 = Upper Lemhi River
Temperature (C)
Date
0
5
10
15
20
25
30
5/1
6/1
7/1
8/1
9/1
10/1
11/1

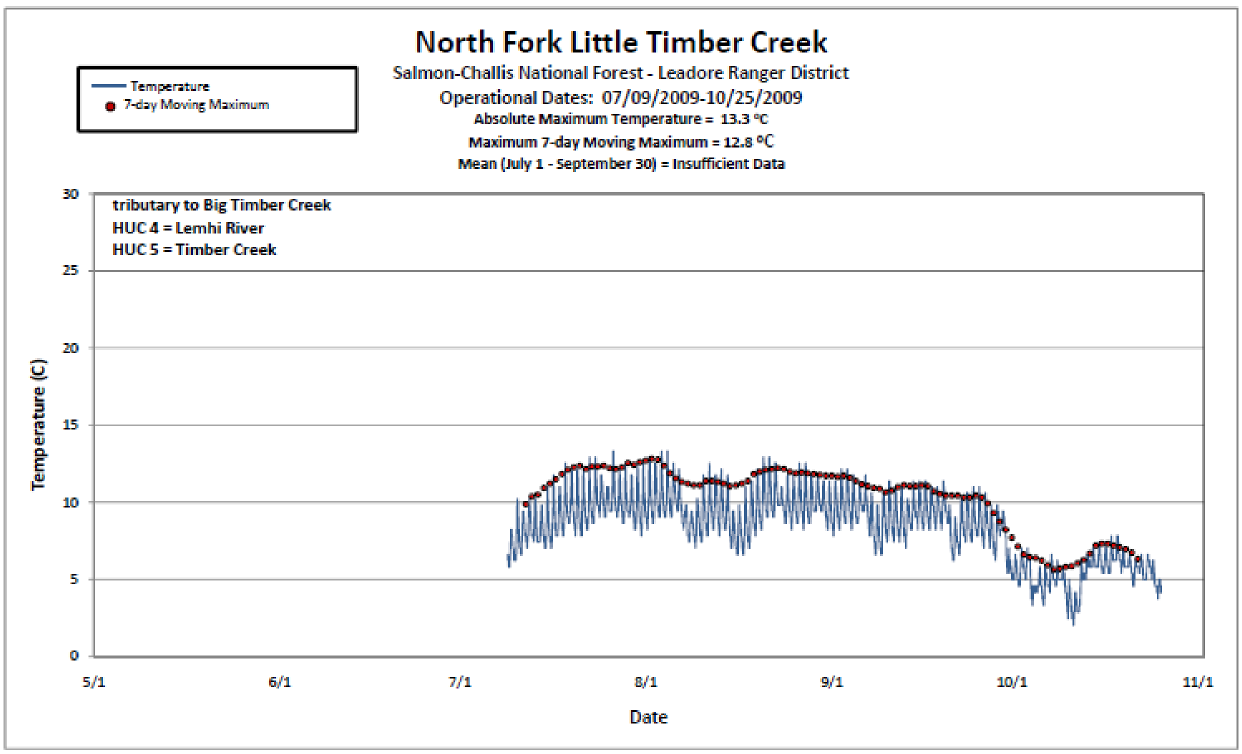

Ford Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/30/2009-10/05/2009
Absolute Maximum Temperature = 14.9 °C
Maximum 7-day Moving Maximum = 14.1 °C
Mean (July 1 - September 30) = 10.1 °C
Temperature
7-day Moving Maximum
tributary to Bear Valley Creek
HUC 4 = Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
0
5
10
15
20
25
30
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

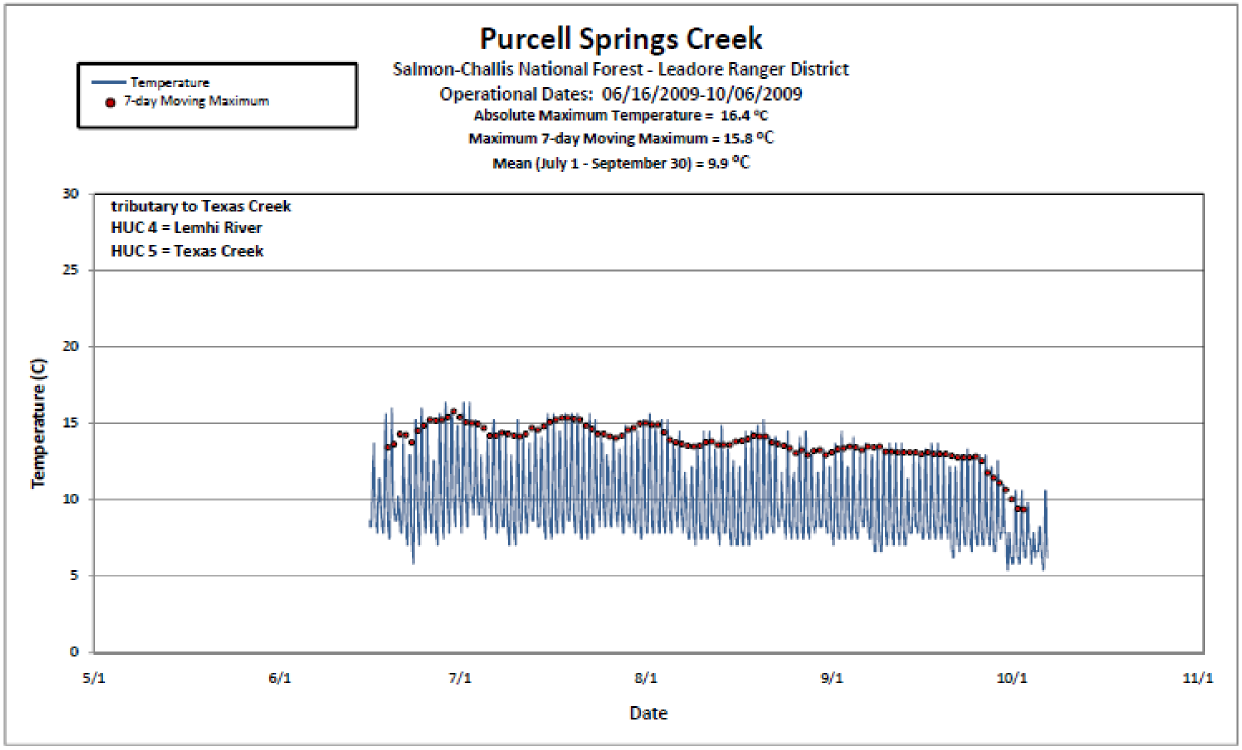

Hayden Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/08/2009-10/05/2009
Absolute Maximum Temperature = 14.1 °C
Maximum 7-day Moving Maximum = 12.8 °C
Mean (July 1 - September 30) = Insufficient Data
Temperature
7-day Moving Maximum
tributary to Lemhi River
HUC 4 = Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
0
5
10
15
20
25
30
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

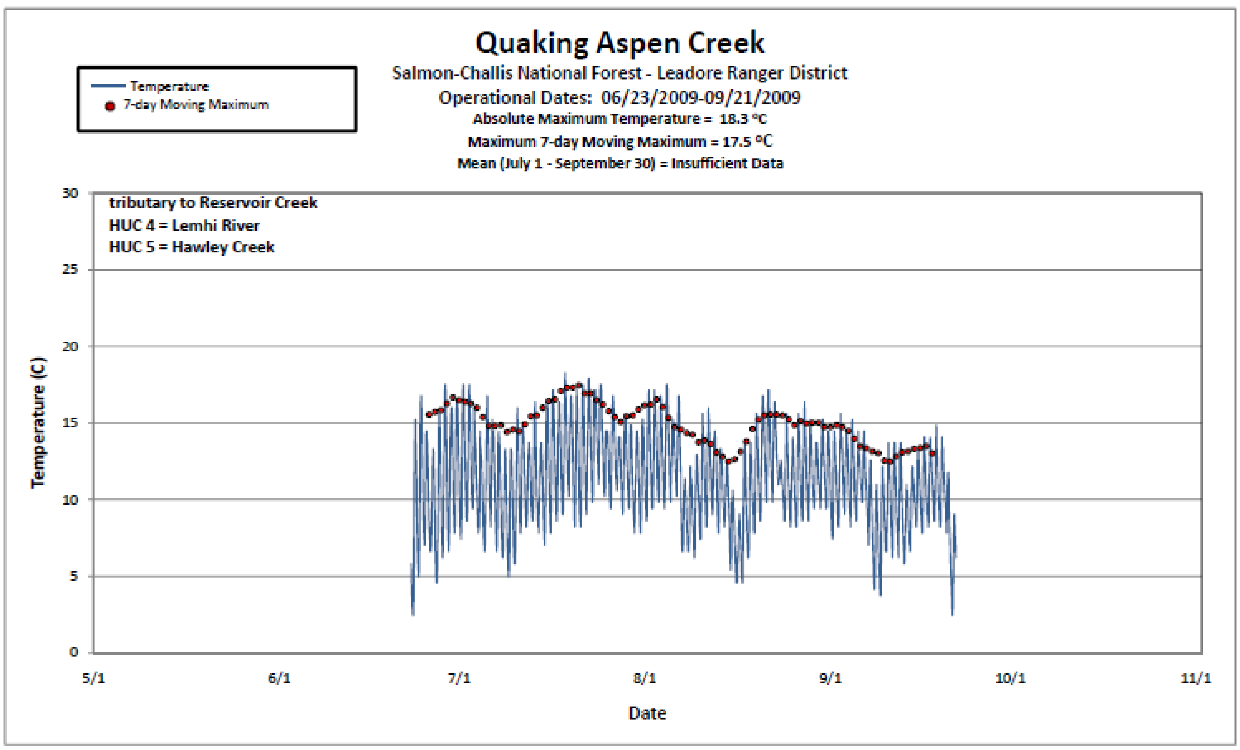

Hood Gulch
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/23/2009-10/06/2009
Absolute Maximum Temperature = 17.1 °C
Maximum 7-day Moving Maximum = 16.6 °C
Mean (July 1 - September 30) = 11.0 °C
Temperature
7-day Moving Maximum
tributary to Canyon Creek
HUC 4 = Lemhi River
HUC 5 = Upper Lemhi River
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

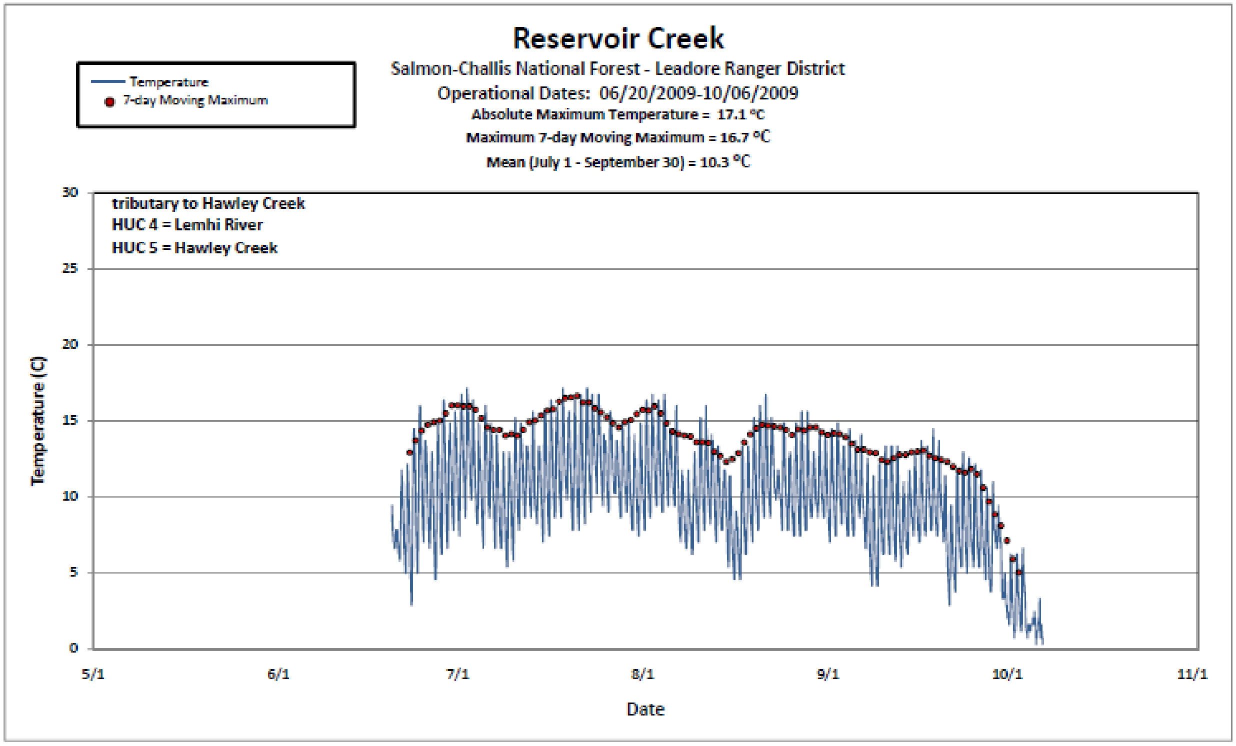

Kadletz Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/18/2009-10/05/2009
Absolute Maximum Temperature = 11.8 °C
Maximum 7-day Moving Maximum = 11.1 °C
Mean (July 1 - September 30) = 7.9 °C
Temperature
7-day Moving Maximum
tributary to Bear Valley Creek
HUC 4 = Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

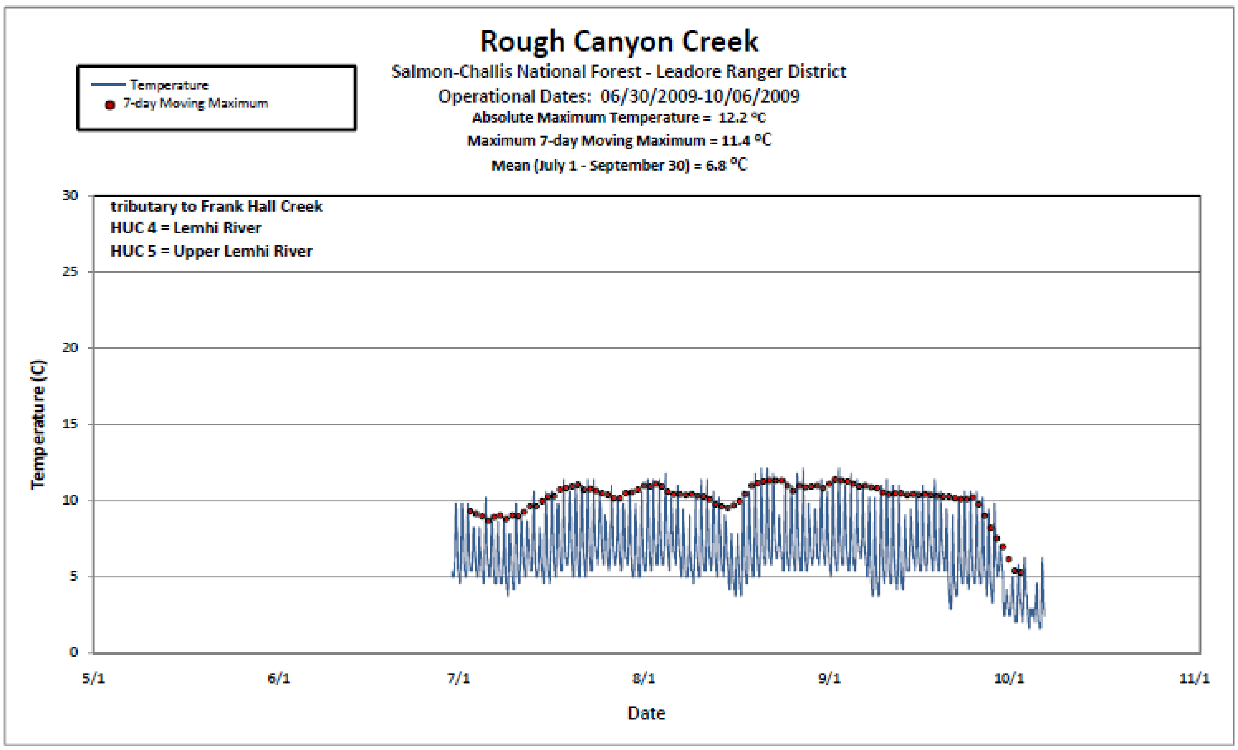

Middle Fork Little Timber Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/09/2009-10/04/2009
Absolute Maximum Temperature = 16.0 °C
Maximum 7-day Moving Maximum = 15.0 °C
Mean (July 1 - September 30) = Insufficient Data
Temperature
7-day Moving Maximum
tributary to Big Timber Creek
HUC 4 = Lemhi River
HUC 5 = Timber Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

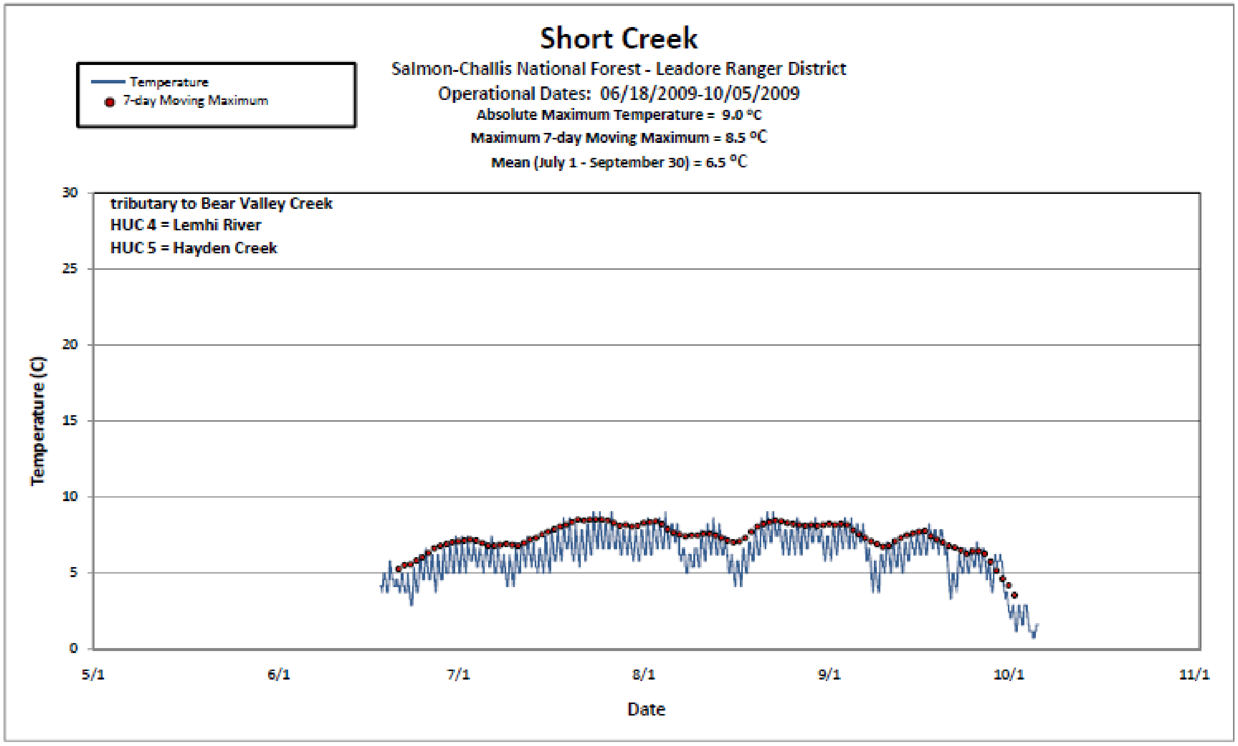

North Fork Little Timber Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 07/09/2009-10/25/2009
Absolute Maximum Temperature = 13.3 °C
Maximum 7-day Moving Maximum = 12.8 °C
Mean (July 1 - September 30) = Insufficient Data
Temperature
7-day Moving Maximum
tributary to Big Timber Creek
HUC 4 = Lemhi River
HUC 5 = Timber Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

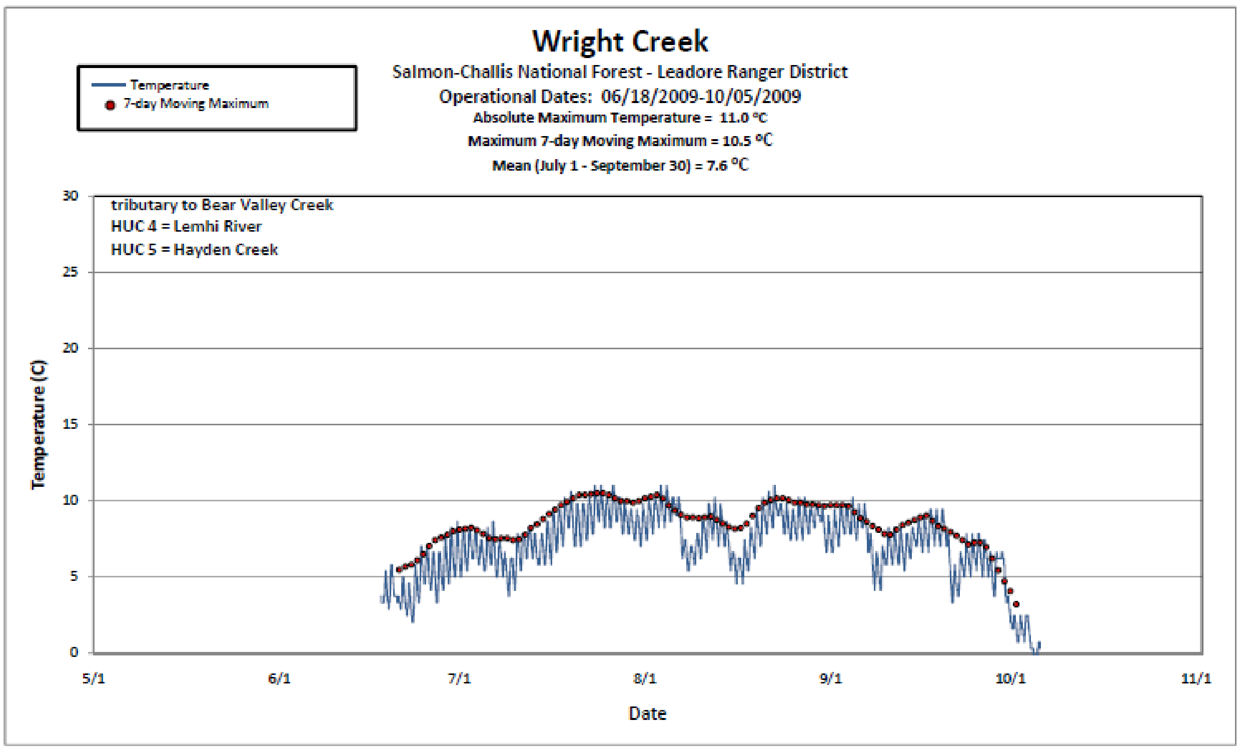

Purcell Springs Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/16/2009-10/06/2009
Absolute Maximum Temperature = 16.4 °C
Maximum 7-day Moving Maximum = 15.8 °C
Mean (July 1 - September 30) = 9.9 °C
Temperature
7-day Moving Maximum
tributary to Texas Creek
HUC 4 = Lemhi River
HUC 5 = Texas Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date


Quaking Aspen Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/23/2009-09/21/2009
Absolute Maximum Temperature = 18.3 °C
Maximum 7-day Moving Maximum = 17.5 °C
Mean (July 1 - September 30) = Insufficient Data
Temperature
7-day Moving Maximum
tributary to Reservoir Creek
HUC 4 = Lemhi River
HUC 5 = Hawley Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date


Reservoir Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/20/2009-10/06/2009
Absolute Maximum Temperature = 17.1 °C
Maximum 7-day Moving Maximum = 16.7 °C
Mean (July 1 - September 30) = 10.3 °C
Temperature
7-day Moving Maximum
tributary to Hawley Creek
HUC 4 = Lemhi River
HUC 5 = Hawley Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date


Rough Canyon Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/30/2009-10/06/2009
Absolute Maximum Temperature = 12.2 °C
Maximum 7-day Moving Maximum = 11.4 °C
Mean (July 1 - September 30) = 6.8 °C
Temperature
7-day Moving Maximum
tributary to Frank Hall Creek
HUC 4 = Lemhi River
HUC 5 = Upper Lemhi River
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date


Short Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/18/2009-10/05/2009
Absolute Maximum Temperature = 9.0 °C
Maximum 7-day Moving Maximum = 8.5 °C
Mean (July 1 - September 30) = 6.5 °C
Temperature
7-day Moving Maximum
tributary to Bear Valley Creek
HUC 4 = Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date


Wright Creek
Salmon-Challis National Forest - Leadore Ranger District
Operational Dates: 06/18/2009-10/05/2009
Absolute Maximum Temperature = 11.0 °C
Maximum 7-day Moving Maximum = 10.5 °C
Mean (July 1 - September 30) = 7.6 °C
Temperature
7-day Moving Maximum
tributary to Bear Valley Creek
HUC 4 = Lemhi River
HUC 5 = Hayden Creek
Temperature (C)
30
25
20
15
10
5
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
Date

Appendix D. Sediment Data—DEQ Idaho Falls Regional Office

The Idaho Department of Environmental Quality (DEQ) collected sediment data in 2008 to evaluate progress toward the surrogate sediment targets for instream erosion of 80% bank stability and 28% subsurface fine sediment (DEQ 2000). 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 are presented in detail in the Lemhi River subbasin assessment and total maximum daily load (TMDL) (DEQ 1999) approved by the U.S. Environmental Protection Agency (EPA) in 2000.

In summary, the streambank erosion inventories are used to estimate background and existing streambank erosion derived from Natural Resources Conservation Service (NRCS) methods. 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 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 allocation for a sediment TMDL. McNeil sediment core samples measure percent subsurface fine sediment, which is a direct measure of beneficial use support status of salmonid spawning. Table 1 summarizes the findings of the DEQ streambank erosion inventories and copies of the completed worksheets follow. Following the worksheets, Table 2 presents the McNeil sediment core results summary, with the sediment core sampling forms following.

Table 1. Streambank erosion inventory summary.

Assessment Unit	Current Load (tons/year)	Load Capacity (tons/year)	Load Allocation (tons/year)
ID17060204SL064b_02 Bohannon Creek—Upper	30	35	None
ID17060204SL064b_02 Bohannon Creek—Middle	208	119	89
ID17060204SL064a_02 Bohannon Creek—Lower	14	15	None
ID17060204SL045_02 Eighteenmile Creek—Upper	13	19	None
ID17060204SL043_03 Eighteenmile Creek—Middle	6	20	None
ID17060204SL042_03 Eighteenmile Creek—Lower	352	351	None
ID17060204SL007b_03 McDevitt Creek—Lower	18	22	None
ID17060204SL007b_03 McDevitt Creek—Lower Middle	5	9	None

Assessment Unit	Current Load (tons/year)	Load Capacity (tons/year)	Load Allocation (tons/year)
ID17060204SL007b_03 McDevitt Creek—Upper Middle	4	14	None
ID17060204SL007b_02 McDevitt Creek—Upper	3	15	None
ID17060204SL065b_02 Geertson Creek	3	8	None
ID17060204SL063_02 Wimpey Creek	1030	206	824
ID17060204SL026a_02 Mill Creek	1	2	None
ID17060204SL062b_02 Sandy Creek	18	12	None

STREAMBANK EROSION INVENTORY WORKSHEET

Stream:	Bohannon Creek	**Stream Segment Location (DD)**		
Section:	Upper BURP	*Upstream:*	N 45.174174	W 113.709465
Date:	7/9/2008	*Downstream:*	N 45.171149	W 113.709379
Field Crew:		**Landuse and Notes:**		Private

AU ID17060204SL064b_02
Bohannon Creek-Upper

Streambank Erosion Calculations

Average Bank Height	2.7	ft
Total Inventoried Bank Length	1134	ft
Inventoried Bank Length	2268	ft
Erosive Bank Length	192.5	ft
Bank Eroding Segment Length	385	ft
Percent Eroding Bank	0.17	%
Eroding Area	1039.5	ft^2
Recession Rate	0.04	
Bulk Density	105	lb/ft^2
Bank Erosion over Sampled Reach	2.18	tons/year/sample reach
Erosion Rate	10.16	tons/mile/year
Feet of similar stream type*	14350	ft
Eroding Bank Extrapolation	5256.91358	ft
Total Streambank Erosion	29.81	tons/year

Summary for Load Reductions

Current Load		Load Capacity		
Erosion Rate (t/mi/yr)	**Total Erosion (t/y)**	**Erosion Rate (ton/mi/yr)**	**Total Erosion (t/yr)**	**% reduction**
10.16	29.81	11.98	35.12	-17.82

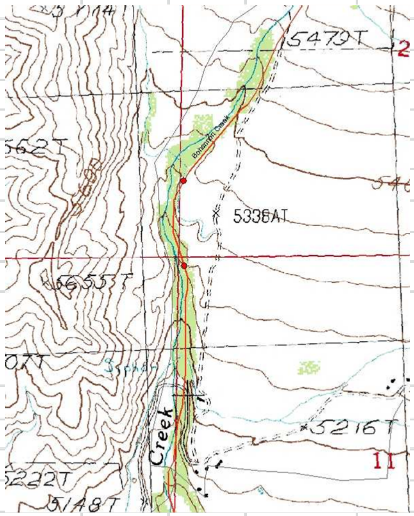
Animal access, grazing impacts to vegetation

Streambank Erosion Reduction Calculations

Eroding Area With Load Reductions	1224.72	ft^2
Erosion over sampled reach (with 20% load reduction)	2.57	tons/yr/sample
Erosion Rate	11.98	tons/mile/year
Feet of Similar Stream Type	14350	ft
Eroding Bank Extrapoltation (with reduction)	6193.6	ft
Total Streambank Erosion	35.12	tons/year

Recession Rate Calculation Worksheet

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



STREAMBANK EROSION INVENTORY WORKSHEET

Stream:	Bohannon Creek	**Stream Segment Location (DD)**			
Section:	Middle BURP Site #2	*Upstream:*	N 45.141039	W 113.7143	
Date:	7/9/2008	*Downstream:*	N 45.135677	W 113.7186	
Field Crew:		**Landuse and Notes:**		Private	

AU ID17060204SL064b_02
Bohannon Creek-Middle

Streambank Erosion Calculations

Average Bank Height	4.68	ft
Total Inventoried Bank Length	1000	ft
Inventoried Bank Length	2000	ft
Erosive Bank Length	349	ft
Bank Eroding Segment Length	698	ft
Percent Eroding Bank	0.35	%
Eroding Area	3266.64	ft^2
Recession Rate	0.105	
Bulk Density*	110	lb/ft^2
Bank Erosion over Sampled Reach	18.86	tons/year/sample reach
Erosion Rate	99.61	tons/mile/year
Feet of similar stream type*	10000	ft
Eroding Bank Extrapolation	7678	ft
Total Streambank Erosion	207.51	tons/year

Streambank Erosion Reduction Calculations

Eroding Area With Load Reductions	1872	ft^2
Erosion over sampled reach (with 20% load reduction)	10.81	tons/yr/sample
Erosion Rate	57.08	tons/mile/year
Feet of Similar Stream Type	10000	ft
Eroding Bank Extrapoltation (with reduction)	4400	ft
Total Streambank Erosion	118.92	tons/year

Summary for Load Reductions

Current Load		Load Capacity		
Erosion Rate (t/mi/yr)	Current Load (t/y)	Erosion Rate (ton/mi/yr)	Load Capacity (t/yr)	% reduction
99.61	207.51	57.08	118.92	42.69

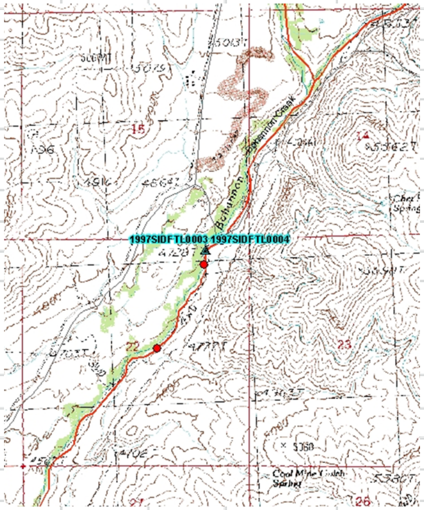
Load Allocation = 88.59

*ID752, 62 & 223

Mine dumps; very cobbly loam

Recession Rate Calculation Worksheet

Slope Factor	Rating
Bank Stability (0-3)	2.5
Bank Condition (0-3)	2
Vegetative/cover on Banks (0-3)	1
Bank/Channel Shape - downcutting (0-3)	0
Channel Bottom (0-2)	0
Deposition (0-1)	1
Total = Slight (0-4); Moderate (5-8); Severe (9+)	6.5
Recession Rate	**0.105**



STREAMBANK EROSION INVENTORY WORKSHEET

Stream:	Bohannon Creek	**Stream Segment Location (DD)**		
Section:	Lower	*Upstream:*	N 45.134201	W 113.721305
Date:	7/9/2008	*Downstream:*	N 45.126673	W 113.728447
Field Crew:		**Landuse and Notes:**		Private

AU ID17060204SL064a_02
Bohannon Creek-Lower

Streambank Erosion Calculations

Average Bank Height	1.36	ft
Total Inventoried Bank Length	1000	ft
Inventoried Bank Length	2000	ft
Erosive Bank Length	189	ft
Bank Eroding Segment Length	378	ft
Percent Eroding Bank	0.19	%
Eroding Area	514.08	ft^2
Recession Rate	0.06	
Bulk Density*	85	lb/ft^2
Bank Erosion over Sampled Reach	1.31	tons/year/sample reach
Erosion Rate	6.92	tons/mile/year
Feet of similar stream type*	10000	ft
Eroding Bank Extrapolation	4158	ft
Total Streambank Erosion	14.42	tons/year

Streambank Erosion Reduction Calculations

Eroding Area With Load Reductions	544	ft^2
Erosion over sampled reach (with 20% load reduction)	1.39	tons/yr/sample
Erosion Rate	7.32	tons/mile/year
Feet of Similar Stream Type	10000	ft
Eroding Bank Extrapoltation (with reduction)	4400	ft
Total Streambank Erosion	15.26	tons/year

Summary for Load Reductions

Current Load		Load Capacity		
Erosion Rate (t/mi/yr)	**Current Load (t/y)**	**Erosion Rate (ton/mi/yr)**	**Load Capacity (t/yr)**	**% reduction**
6.92	14.42	7.32	15.26	-5.82

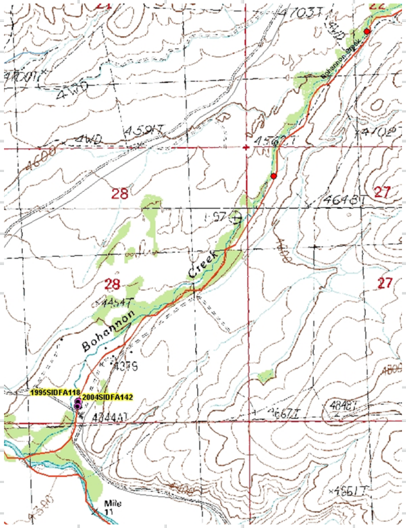
Load Allocation = -0.84

*ID752: 62, 129 & 163

Mine dumps; gravelly silt loam; silt loam

Recession Rate Calculation Worksheet

Slope Factor	**Rating**
Bank Stability (0-3)	1
Bank Condition (0-3)	1
Vegetative/cover on Banks (0-3)	1
Bank/Channel Shape - downcutting (0-3)	0
Channel Bottom (0-2)	1
Deposition (0-1)	1
Total = Slight (0-4); Moderate (5-8); Severe (9+)	5
Recession Rate	**0.06**



STREAMBANK EROSION INVENTORY WORKSHEET

Stream:	Eighteenmile Creek	**Stream Segment Location (DD)**		
Section:	Upper BURP Site #1	*Upstream:*	N 44.502277	W 113.18414
Date:	7/8/2008	*Downstream:*	N 44.50021	W 113.195958
Field Crew:		**Landuse and Notes:**		State, BLM

AU ID17060204SL045_02
Eighteenmile Creek - Upper

Streambank Erosion Calculations

Average Bank Height	2.24	ft
Total Inventoried Bank Length	1800	ft
Inventoried Bank Length	3600	ft
Erosive Bank Length	251	ft
Bank Eroding Segment Length	502	ft
Percent Eroding Bank	0.14	%
Eroding Area	1124.48	ft^2
Recession Rate	0.09	
Bulk Density*	110	lb/ft^2
Bank Erosion over Sampled Reach	5.57	tons/year/sample reach
Erosion Rate	16.33	tons/mile/year
Feet of similar stream type*	2510	ft
Eroding Bank Extrapolation	1202.01111	ft
Total Streambank Erosion	13.33	tons/year

Streambank Erosion Reduction Calculations

Eroding Area With Load Reductions	1612.8	ft^2
Erosion over sampled reach (with 20% load reduction)	7.98	tons/yr/sample
Erosion Rate	23.42	tons/mile/year
Feet of Similar Stream Type	2510	ft
Eroding Bank Extrapoltation (with reduction)	1724	ft
Total Streambank Erosion	19.12	tons/year

Summary for Load Reductions

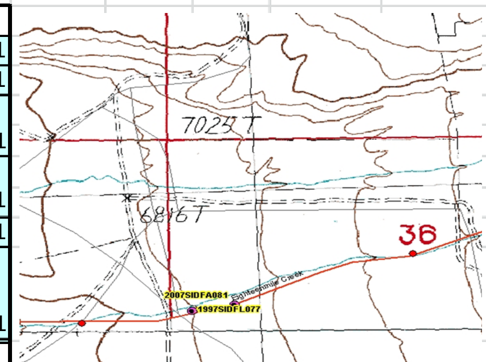
Current Load		Load Capacity		
Erosion Rate (t/mi/yr)	Current Load (t/y)	Erosion Rate (ton/mi/yr)	Load Capacity (t/yr)	% reduction
16.33	13.33	23.42	19.12	-43.43

Load Allocation = -5.79

*ID752: 33, 150
gravelly loam

Recession Rate Calculation Worksheet

Slope Factor	Rating
Bank Stability (0-3)	1
Bank Condition (0-3)	1
Vegetative/cover on Banks (0-3)	1
Bank/Channel Shape - downcutting (0-3)	1
Channel Bottom (0-2)	1
Deposition (0-1)	1
Total = Slight (0-4); Moderate (5-8); Severe (9+)	6
Recession Rate	**0.09**



STREAMBANK EROSION INVENTORY WORKSHEET

Stream:	Eighteenmile Creek	**Stream Segment Location (DD)**		
Section:	Middle site #2	*Upstream:*	N 44.555013	W 113.255037
Date:	7/8/2008	*Downstream:*	N 44.558957	W 113.257119
Field Crew:		**Landuse and Notes:**		State, BLM

AU ID17060204SL043_03
Eighteenmile Creek--Middle

Streambank Erosion Calculations

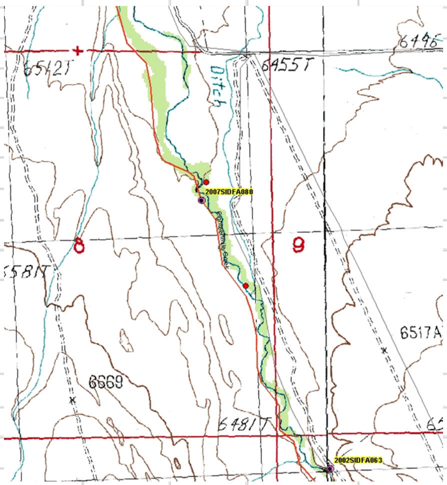
Average Bank Height	1.1	ft
Total Inventoried Bank Length	1851	ft
Inventoried Bank Length	3702	ft
Erosive Bank Length	105	ft
Bank Eroding Segment Length	210	ft
Percent Eroding Bank	0.06	%
Eroding Area	231	ft^2
Recession Rate	0.04	
Bulk Density*	110	lb/ft^2
Bank Erosion over Sampled Reach	0.51	tons/year/sample reach
Erosion Rate	1.45	tons/mile/year
Feet of similar stream type*	18510	ft
Eroding Bank Extrapolation	2310	ft
Total Streambank Erosion	5.59	tons/year

Streambank Erosion Reduction Calculations

Eroding Area With Load Reductions	814.44	ft^2
Erosion over sampled reach (with 20% load reduction)	1.79	tons/yr/sample
Erosion Rate	5.11	tons/mile/year
Feet of Similar Stream Type	18510	ft
Eroding Bank Extrapoltation (with reduction)	8144.4	ft
Total Streambank Erosion	19.71	tons/year

Recession Rate Calculation Worksheet

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



Summary for Load Reductions

Current Load		Load Capacity		
Erosion Rate (t/mi/yr)	Current Load (t/y)	Erosion Rate (ton/mi/yr)	Load Capacity (t/yr)	% reduction
1.45	5.59	5.11	19.71	-252.57

Load Allocation = -14.12

*ID752: 217, 14, 63, 157
gravelly loam

STREAMBANK EROSION INVENTORY WORKSHEET

Stream:	Eighteenmile Creek	**Stream Segment Location (DD)**		
Section:	Lower Site	*Upstream:*	N 44.633964	W 113.282901
Date:	7/8/2008	*Downstream:*	N 44.636074	W 113.284276
Field Crew:		**Landuse and Notes:**		BLM

AU ID17060204SL042_03
Eighteenmile Creek -- Lower

Streambank Erosion Calculations

Average Bank Height	1	ft
Total Inventoried Bank Length	2900	ft
Inventoried Bank Length	5800	ft
Erosive Bank Length	582	ft
Bank Eroding Segment Length	1164	ft
Percent Eroding Bank	0.20	%
Eroding Area	1164	ft^2
Recession Rate	0.5	
Bulk Density*	110	lb/ft^2
Bank Erosion over Sampled Reach	32.01	tons/year/sample reach
Erosion Rate	58.28	tons/mile/year
Feet of similar stream type*	29000	ft
Eroding Bank Extrapolation	12804	ft
Total Streambank Erosion	352.11	tons/year

Streambank Erosion Reduction Calculations

Eroding Area With Load Reductions	1160	ft^2
Erosion over sampled reach (with 20% load reduction)	31.90	tons/yr/sample
Erosion Rate	58.08	tons/mile/year
Feet of Similar Stream Type	29000	ft
Eroding Bank Extrapoltation (with reduction)	12760	ft
Total Streambank Erosion	350.90	tons/year

Summary for Load Reductions

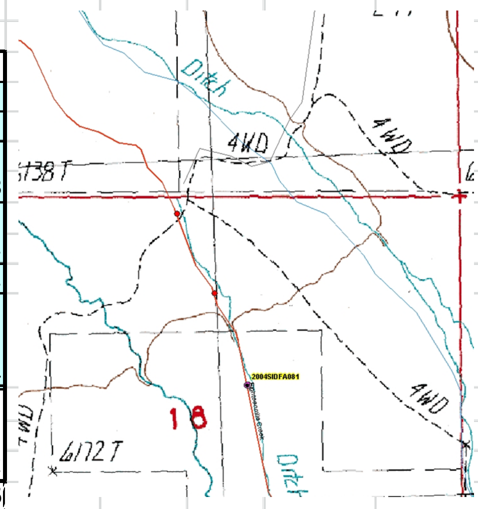
Current Load		Load Capacity		
Erosion Rate (t/mi/yr)	**Current Load (t/y)**	**Erosion Rate (ton/mi/yr)**	**Load Capacity (t/yr)**	**% reduction**
58.28	352.11	58.08	350.90	0.34

Load Allocation = 1.21

*ID752: 6, 230
gravelly loam

Recession Rate Calculation Worksheet

Slope Factor	Rating
Bank Stability (0-3)	3
Bank Condition (0-3)	3
Vegetative/cover on Banks (0-3)	3
Bank/Channel Shape - downcutting (0-3)	1
Channel Bottom (0-2)	1
Deposition (0-1)	1
Total = Slight (0-4); Moderate (5-8); Severe (9+)	12
Recession Rate	**0.5**



STREAMBANK EROSION INVENTORY WORKSHEET

Stream:	McDevitt Creek	**Stream Segment Location (DD)**			
Section:	Lower Site #1	*Upstream:*	N 44.931023	W 113.68279	
Date:	6/30/2008	*Downstream:*	N 44.93051667	W 113.68565	
Field Crew:		**Landuse and Notes:**		State	

AU ID17060204SL007b_03
McDevitt Creek Lower

Streambank Erosion Calculations

Average Bank Height	3.3	ft
Total Inventoried Bank Length	924	ft
Inventoried Bank Length	1848	ft
Erosive Bank Length	148	ft
Bank Eroding Segment Length	296	ft
Percent Eroding Bank	0.16	%
Eroding Area	976.8	ft^2
Recession Rate	0.03	
Bulk Density*	110	lb/ft^2
Bank Erosion over Sampled Reach	1.61	tons/year/sample reach
Erosion Rate	9.21	tons/mile/year
Feet of similar stream type*	9240	ft
Eroding Bank Extrapolation	3256	ft
Total Streambank Erosion	17.73	tons/year

Streambank Erosion Reduction Calculations

Eroding Area With Load Reductions	1219.68	ft^2
Erosion over sampled reach (with 20% load reduction)	2.01	tons/yr/sample
Erosion Rate	11.50	tons/mile/year
Feet of Similar Stream Type	9240	ft
Eroding Bank Extrapoltation (with reduction)	4065.6	ft
Total Streambank Erosion	22.14	tons/year

Summary for Load Reductions

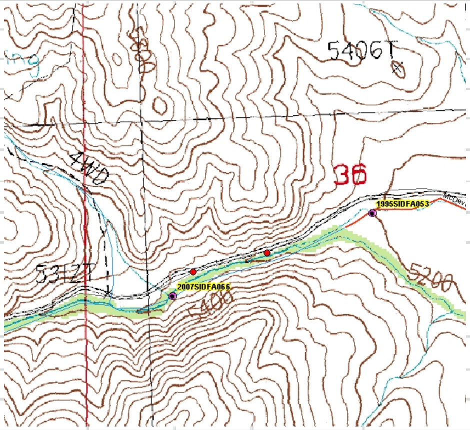
Current Load		Load Capacity		
Erosion Rate (t/mi/yr)	Current Load (t/y)	Erosion Rate (ton/mi/yr)	Load Capacity (t/yr)	% reduction
9.21	17.73	11.50	22.14	-24.86

Load Allocation = -4.41

*ID752: 31, 38, 41, 46
cobbly, stony, and gravelly loam

Recession Rate Calculation Worksheet

Slope Factor	Rating
Bank Stability (0-3)	1
Bank Condition (0-3)	1
Vegetative/cover on Banks (0-3)	1
Bank/Channel Shape - downcutting (0-3)	0
Channel Bottom (0-2)	0
Deposition (0-1)	-1
Total = Slight (0-4); Moderate (5-8); Severe (9+)	2
Recession Rate	**0.03**



STREAMBANK EROSION INVENTORY WORKSHEET

Stream:	McDevitt Creek	**Stream Segment Location (DD)**			
Section:	Lower Middle Site #2	*Upstream:*	N 44.927133	W 113.705267	
Date:	6/30/2008	*Downstream:*	N 44.92758333	W 113.70265	
Field Crew:		**Landuse and Notes:**		BLM	

AU ID17060204SL007b_03
McDevitt Creek -- Lower Middle

Streambank Erosion Calculations

Average Bank Height	1.2	ft
Total Inventoried Bank Length	612	ft
Inventoried Bank Length	1224	ft
Erosive Bank Length	74	ft
Bank Eroding Segment Length	148	ft
Percent Eroding Bank	0.12	%
Eroding Area	177.6	ft^2
Recession Rate	0.05	
Bulk Density*	110	lb/ft^2
Bank Erosion over Sampled Reach	0.49	tons/year/sample reach
Erosion Rate	4.21	tons/mile/year
Feet of similar stream type*	6120	ft
Eroding Bank Extrapolation	1628	ft
Total Streambank Erosion	5.37	tons/year

Streambank Erosion Reduction Calculations

Eroding Area With Load Reductions	293.76	ft^2
Erosion over sampled reach (with 20% load reduction)	0.81	tons/yr/sample
Erosion Rate	6.97	tons/mile/year
Feet of Similar Stream Type	6120	ft
Eroding Bank Extrapoltation (with reduction)	2692.8	ft
Total Streambank Erosion	8.89	tons/year

Summary for Load Reductions

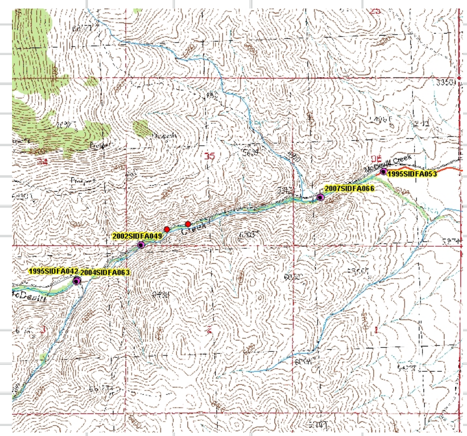
Current Load		Load Capacity		
Erosion Rate (t/mi/yr)	**Current Load (t/y)**	**Erosion Rate (ton/mi/yr)**	**Load Capacity (t/yr)**	**% reduction**
4.21	5.37	6.97	8.89	-65.41

Load Allocation = -3.51

*ID752: 38, 46
cobbly, stony, and gravelly loam

Recession Rate Calculation Worksheet

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



STREAMBANK EROSION INVENTORY WORKSHEET

Stream:	McDevitt Creek	**Stream Segment Location (DD)**		
Section:	Upper Middle Site #3	*Upstream:*	N 44.922819	W 113.728194
Date:	7/1/2008	*Downstream:*	N 44.92223333	W 113.7222833
Field Crew:		**Landuse and Notes:**		BLM

AU ID17060204SL007b_03
McDevitt Creek -- Upper Middle

Streambank Erosion Calculations

Average Bank Height	1.2	ft
Total Inventoried Bank Length	1578	ft
Inventoried Bank Length	3156	ft
Erosive Bank Length	81	ft
Bank Eroding Segment Length	162	ft
Percent Eroding Bank	0.05	%
Eroding Area	194.4	ft^2
Recession Rate	0.03	
Bulk Density*	110	lb/ft^2
Bank Erosion over Sampled Reach	0.32	tons/year/sample reach
Erosion Rate	1.07	tons/mile/year
Feet of similar stream type*	15780	ft
Eroding Bank Extrapolation	1782	ft
Total Streambank Erosion	3.53	tons/year

Streambank Erosion Reduction Calculations

Eroding Area With Load Reductions	757.44	ft^2
Erosion over sampled reach (with 20% load reduction)	1.25	tons/yr/sample
Erosion Rate	4.18	tons/mile/year
Feet of Similar Stream Type	15780	ft
Eroding Bank Extrapoltation (with reduction)	6943.2	ft
Total Streambank Erosion	13.75	tons/year

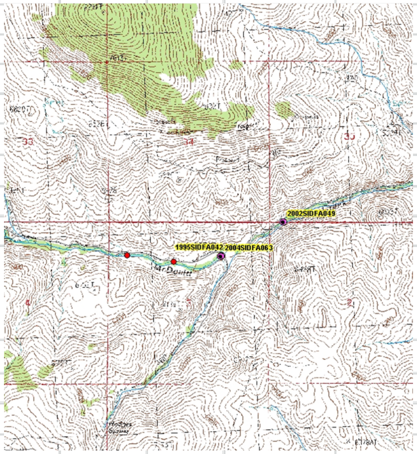
Summary for Load Reductions

Current Load		Load Capacity		
Erosion Rate (t/mi/yr)	Current Load (t/y)	Erosion Rate (ton/mi/yr)	Load Capacity (t/yr)	% reduction
1.07	3.53	4.18	13.75	-289.63

Load Allocation = -10.22
*ID752: 46
gravelly loam

Recession Rate Calculation Worksheet

Slope Factor	Rating
Bank Stability (0-3)	1
Bank Condition (0-3)	0
Vegetative/cover on Banks (0-3)	1
Bank/Channel Shape - downcutting (0-3)	0
Channel Bottom (0-2)	0
Deposition (0-1)	0
Total = Slight (0-4); Moderate (5-8); Severe (9+)	2
Recession Rate	**0.03**



STREAMBANK EROSION INVENTORY WORKSHEET

Stream:	McDevitt Creek	**Stream Segment Location (DD)**		
Section:	Upper Site #4	*Upstream:*	N 44.93981667	W 113.7778833
Date:	7/1/2008	*Downstream:*	N 44.94256667	W 113.7781667
Field Crew:		**Landuse and Notes:**		BLM

AU ID17060204SL007b_02
McDevitt Creek -- Upper

Streambank Erosion Calculations

Average Bank Height	3.3	ft
Total Inventoried Bank Length	936	ft
Inventoried Bank Length	1872	ft
Erosive Bank Length	36	ft
Bank Eroding Segment Length	72	ft
Percent Eroding Bank	0.04	%
Eroding Area	237.6	ft^2
Recession Rate	0.02	
Bulk Density*	110	lb/ft^2
Bank Erosion over Sampled Reach	0.26	tons/year/sample reach
Erosion Rate	1.47	tons/mile/year
Feet of similar stream type*	9360	ft
Eroding Bank Extrapolation	792	ft
Total Streambank Erosion	2.87	tons/year

Summary for Load Reductions

Current Load		Load Capacity		
Erosion Rate (t/mi/yr)	**Current Load (t/y)**	**Erosion Rate (ton/mi/yr)**	**Load Capacity (t/yr)**	**% reduction**
1.47	2.87	7.67	14.95	-420.00

Load Allocation = -12.07

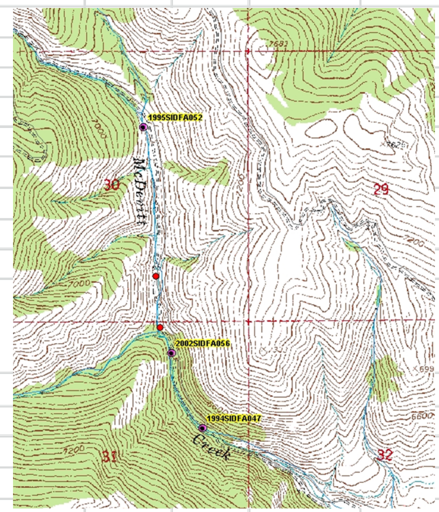
*ID752: 106
gravelly loam

Streambank Erosion Reduction Calculations

Eroding Area With Load Reductions	1235.52	ft^2
Erosion over sampled reach (with 20% load reduction)	1.36	tons/yr/sample
Erosion Rate	7.67	tons/mile/year
Feet of Similar Stream Type	9360	ft
Eroding Bank Extrapoltation (with reduction)	4118.4	ft
Total Streambank Erosion	14.95	tons/year

Recession Rate Calculation Worksheet

Slope Factor	Rating
Bank Stability (0-3)	1
Bank Condition (0-3)	0
Vegetative/cover on Banks (0-3)	0
Bank/Channel Shape - downcutting (0-3)	0
Channel Bottom (0-2)	0
Deposition (0-1)	0
Total = Slight (0-4); Moderate (5-8); Severe (9+)	1
Recession Rate	**0.02**



STREAMBANK EROSION INVENTORY WORKSHEET

Stream:	Geertson Creek	**Stream Segment Location (DD)**		
Section:	Jeffries Property	*Upstream:*	N 45.1884	W 113.7292167
Date:	7/10/2008	*Downstream:*	N 45.183937	W 113.729579
Field Crew:		**Landuse and Notes:**		Private

AU ID17060204SL065b_02
Geertson Creek

Streambank Erosion Calculations

Average Bank Height	1.2	ft
Total Inventoried Bank Length	1200	ft
Inventoried Bank Length	2400	ft
Erosive Bank Length	93	ft
Bank Eroding Segment Length	186	ft
Percent Eroding Bank	0.08	%
Eroding Area	223.2	ft^2
Recession Rate	0.03	
Bulk Density*	85	lb/ft^2
Bank Erosion over Sampled Reach	0.28	tons/year/sample reach
Erosion Rate	1.25	tons/mile/year
Feet of similar stream type*	12000	ft
Eroding Bank Extrapolation	2046	ft
Total Streambank Erosion	3.13	tons/year

Streambank Erosion Reduction Calculations

Eroding Area With Load Reductions	576	ft^2
Erosion over sampled reach (with 20% load reduction)	0.73	tons/yr/sample
Erosion Rate	3.23	tons/mile/year
Feet of Similar Stream Type	12000	ft
Eroding Bank Extrapoltation (with reduction)	5280	ft
Total Streambank Erosion	8.08	tons/year

Summary for Load Reductions

Current Load		Load Capacity		
Erosion Rate (t/mi/yr)	**Current Load (t/y)**	**Erosion Rate (ton/mi/yr)**	**Load Capacity (t/yr)**	**% reduction**
1.25	3.13	3.23	8.08	-158.06

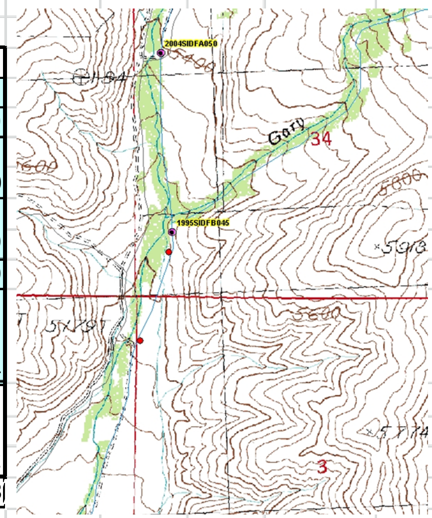
Load Allocation = -4.95

*ID752: 241, 169

silt loam

Recession Rate Calculation Worksheet

Slope Factor	**Rating**
Bank Stability (0-3)	1
Bank Condition (0-3)	0
Vegetative/cover on Banks (0-3)	0
Bank/Channel Shape - downcutting (0-3)	0
Channel Bottom (0-2)	0
Deposition (0-1)	1
Total = Slight (0-4); Moderate (5-8); Severe (9+)	2
Recession Rate	**0.03**



STREAMBANK EROSION INVENTORY WORKSHEET

Stream:	Wimpy Creek	**Stream Segment Location (DD)**		
Section:	Skinner Property	*Upstream:*	N 45.1046	W 113.70535
Date:	8/21//2008	*Downstream:*	N 45.10478333	W 113.7027
Field Crew:		**Landuse and Notes:**		Private

AU ID17060204SL063_02
Wimpey Creek

Streambank Erosion Calculations

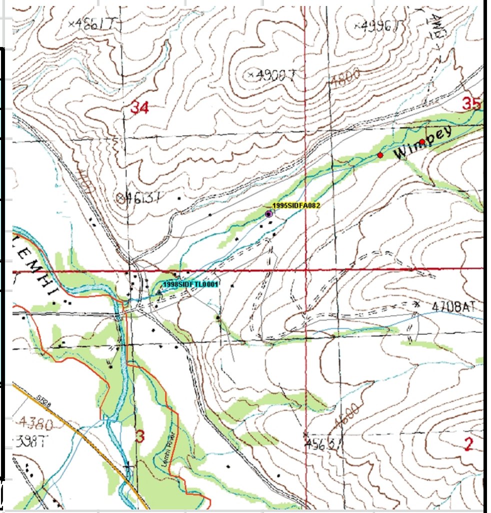
Average Bank Height	2.1	ft
Total Inventoried Bank Length	1049	ft
Inventoried Bank Length	2098	ft
Erosive Bank Length	1049	ft
Bank Eroding Segment Length	2098	ft
Percent Eroding Bank	1.00	%
Eroding Area	4405.8	ft^2
Recession Rate	0.5	
Bulk Density*	85	lb/ft^2
Bank Erosion over Sampled Reach	93.62	tons/year/sample reach
Erosion Rate	471.24	tons/mile/year
Feet of similar stream type*	10490	ft
Eroding Bank Extrapolation	23078	ft
Total Streambank Erosion	1029.86	tons/year

Streambank Erosion Reduction Calculations

Eroding Area With Load Reductions	881.16	ft^2
Erosion over sampled reach (with 20% load reduction)	18.72	tons/yr/sample
Erosion Rate	94.25	tons/mile/year
Feet of Similar Stream Type	10490	ft
Eroding Bank Extrapoltation (with reduction)	4615.6	ft
Total Streambank Erosion	205.97	tons/year

Recession Rate Calculation Worksheet

Slope Factor	**Rating**
Bank Stability (0-3)	3
Bank Condition (0-3)	3
Vegetative/cover on Banks (0-3)	2
Bank/Channel Shape - downcutting (0-3)	1
Channel Bottom (0-2)	2
Deposition (0-1)	1
Total = Slight (0-4); Moderate (5-8); Severe (9+)	12
Recession Rate	**0.5**



Summary for Load Reductions

Current Load		**Load Capacity**		
Erosion Rate (t/mi/yr)	**Current Load (t/y)**	**Erosion Rate (ton/mi/yr)**	**Load Capacity (t/yr)**	**% reduction**
471.24	1029.86	94.25	205.97	80.00

Load Allocation = 823.88

*ID752: 241
silt loam

STREAMBANK EROSION INVENTORY WORKSHEET

Stream:	Mill Creek	**Stream Segment Location (DD)**		
Section:	Skinner Property	*Upstream:*	N 44.7076	W 113.5952333
Date:	8/20//2008	*Downstream:*	N 44.70543333	W 113.5934333
Field Crew:		**Landuse and Notes:**		USFS

AU ID17060204SL026a_02
Mill Creek

Streambank Erosion Calculations

Average Bank Height	1.4	ft
Total Inventoried Bank Length	900	ft
Inventoried Bank Length	1800	ft
Erosive Bank Length	98	ft
Bank Eroding Segment Length	196	ft
Percent Eroding Bank	0.11	%
Eroding Area	274.4	ft^2
Recession Rate	0.01	
Bulk Density*	85	lb/ft^2
Bank Erosion over Sampled Reach	0.12	tons/year/sample reach
Erosion Rate	0.68	tons/mile/year
Feet of similar stream type*	8000	ft
Eroding Bank Extrapolation	1938.22222	ft
Total Streambank Erosion	1.15	tons/year

Streambank Erosion Reduction Calculations

Eroding Area With Load Reductions	504	ft^2
Erosion over sampled reach (with 20% load reduction)	0.21	tons/yr/sample
Erosion Rate	1.26	tons/mile/year
Feet of Similar Stream Type	8000	ft
Eroding Bank Extrapoltation (with reduction)	3560	ft
Total Streambank Erosion	2.12	tons/year

Summary for Load Reductions

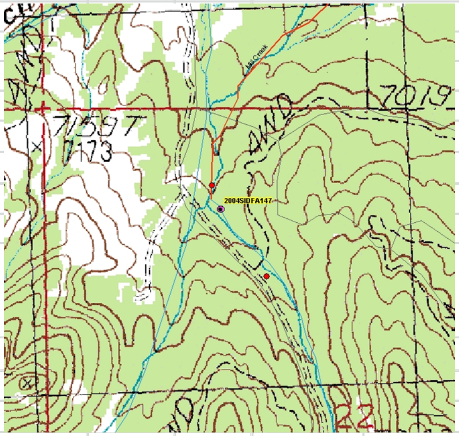
Existing		Proposed		
Erosion Rate (t/mi/yr)	Current Load (t/y)	Erosion Rate (ton/mi/yr)	Load Capacity (t/yr)	% reduction
0.68	1.15	1.26	2.12	-83.67

Load Allocation = -0.96

*ID752: 117
silt loam

Recession Rate Calculation Worksheet

Slope Factor	Rating
Bank Stability (0-3)	0
Bank Condition (0-3)	0
Vegetative/cover on Banks (0-3)	0
Bank/Channel Shape - downcutting (0-3)	0
Channel Bottom (0-2)	0
Deposition (0-1)	0
Total = Slight (0-4); Moderate (5-8); Severe (9+)	0
Recession Rate	**0.01**



STREAMBANK EROSION INVENTORY WORKSHEET

Stream:	Sandy Creek	**Stream Segment Location (DD)**		
Section:	McConnaghy Property	*Upstream:*	N 45.07655	W 113.6103
Date:	8/21//2008	*Downstream:*	N 44.07743333	W 113.6076
Field Crew:		**Landuse and Notes:**		Private

AU ID17060204SL062b_02
Sandy Creek

Streambank Erosion Calculations

Average Bank Height	1.2	ft
Total Inventoried Bank Length	834	ft
Inventoried Bank Length	1668	ft
Erosive Bank Length	261	ft
Bank Eroding Segment Length	522	ft
Percent Eroding Bank	0.31	%
Eroding Area	626.4	ft^2
Recession Rate	0.05	
Bulk Density*	105	lb/ft^2
Bank Erosion over Sampled Reach	1.64	tons/year/sample reach
Erosion Rate	10.41	tons/mile/year
Feet of similar stream type*	8340	ft
Eroding Bank Extrapolation	5742	ft
Total Streambank Erosion	18.09	tons/year

Streambank Erosion Reduction Calculations

Eroding Area With Load Reductions	400.32	ft^2
Erosion over sampled reach (with 20% load reduction)	1.05	tons/yr/sample
Erosion Rate	6.65	tons/mile/year
Feet of Similar Stream Type	8340	ft
Eroding Bank Extrapoltation (with reduction)	3669.6	ft
Total Streambank Erosion	11.56	tons/year

Summary for Load Reductions

Existing		Proposed		
Erosion Rate (t/mi/yr)	**Current Load (t/y)**	**Erosion Rate (ton/mi/yr)**	**Load Capacity (t/yr)**	**% reduction**
10.41	18.09	6.65	11.56	36.09

Load Allocation = 6.53

*ID752: 241
stony loam

Recession Rate Calculation Worksheet

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

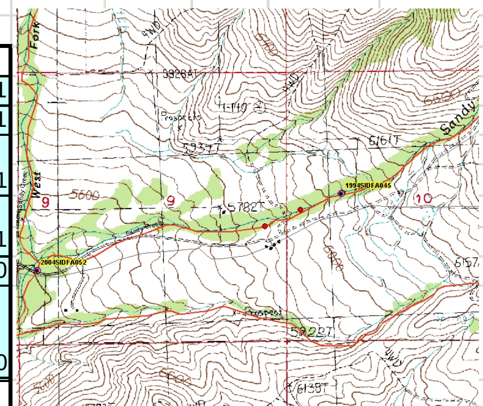


Table 2 McNeil sediment core results summary.

Assessment Unit	Mean Percentage Fine Sediment
ID17060204SL007b_03 McDevitt Creek—Lower	36
ID17060204SL007b_03 McDevitt Creek—Lower Middle	59
ID17060204SL007b_03 McDevitt Creek—Upper Middle	40
ID17060204SL009_05 Hayden Creek	15
ID17060204SL026a_02 Mill Creek	23
ID17060204SL043_03 Eighteenmile Creek—Middle	42
ID17060204SL043_03 Eighteenmile Creek—Lower	36
ID17060204SL045_02 Eighteenmile Creek—Upper	33
ID17060204SL063_02 Wimpey Creek	36
ID17060204SL064b_02 Bohannon Creek—Middle	24
ID17060204SL064a_02 Bohannon Creek—Lower	25
ID17060204SL065b_02 Geertson Creek	39

The detailed subsurface fine sediment data are provided below:

McNeil Sediment Core Sampling Form

Stream	McDevitt Creek Site #1					
Date	6/30/2008					
Location:	Lower BURP site					
Lat/Lon:	N:	44 55.875				
	W:	113 40.933				
Site Desc:						
Personnel:						
Rosgen Channel:						
Reach Gradient:						
Geology: (Q G V S)						
Target Species						
Sample Number		1	2	3		
Seive Size (inches)		ML	ML	ML		
2.5		2290	420	150		
1		1400	2240	930		
0.5		1050	1090	660		
0.25		920	1840	690		
1.0 - 0.25" Subtotal		3370	5170	2280		
#4		320	220	240		
#8		530	760	440		
#20		440	920	610		
#70		350	1000	480		
#270		65	1000	100		
<0.25" Subtotal		1705	3900	1870		
Sample Total						
W/O 2.5"		5075	9070	4150	Mean	Std. Dev.
% Fines W/O 2.5"		**0.335961**	**0.429989**	**0.450602**	**0.405517**	**0.061113**
Sample Total						
W 2.5"		7365	9490	4300	Mean	Std. Dev.
% Fines W 2.5"		0.2315	0.410959	0.434884	0.359114	0.111162

McNeil Sediment Core Sampling Form

Stream	McDevitt Creek Site #2					
Date	7/1/2008					
Location:	Lower Middle BURP site					
Lat/Lon:	N:	44 55.834				
	W:	113 42.157				
Site Desc:						
Personnel:						
Rosgen Channel:						
Reach Gradient:						
Geology: (Q G V S)						
Target Species						
Sample Number		1	2	3		
Seive Size (inches)		ML	ML	ML		
2.5		22	40	0		
1		80	180	25		
0.5		980	1200	1305		
0.25		1520	1940	1860		
1.0 - 0.25" Subtotal		2580	3320	3190		
#4		500	440	420		
#8		560	640	860		
#20		1300	1460	870		
#70		905	1880	3185		
#270		220	150	110		
<0.25" Subtotal		3485	4570	5445		
Sample Total						
W/O 2.5"		6065	7890	8635	Mean	Std. Dev.
% Fines W/O 2.5"		**0.574608**	**0.579214**	**0.630573**	**0.594799**	**0.031067**
Sample Total						
W 2.5"		6087	7930	8635	Mean	Std. Dev.
% Fines W 2.5"		0.572532	0.576293	0.630573	0.593132	0.032479

McNeil Sediment Core Sampling Form

Stream	McDevitt Creek Site #3					
Date	7/1/2008					
Location:	Upper Middle BURP site					
Lat/Lon:	N:	44 55.380				
	W:	113 43.042				
Site Desc:						
Personnel:						
Rosgen Channel:						
Reach Gradient:						
Geology: (Q G V S)						
Target Species						
Sample Number		**1**	**2**	**3**		
Seive Size (inches)		ML	ML	ML		
2.5		0	0	0		
1		2355	2125	1780		
0.5		1500	1830	1640		
0.25		2080	1420	1310		
1.0 - 0.25" Subtotal		5935	5375	4730		
#4		460	425	230		
#8		440	730	700		
#20		550	1780	1380		
#70		1300	1065	1250		
#270		41	220	280		
<0.25" Subtotal		2791	4220	3840		
Sample Total						
W/O 2.5"		8726	9595	8570	Mean	Std. Dev.
% Fines W/O 2.5"		**0.319849**	**0.439812**	**0.448075**	**0.402579**	**0.071765**
Sample Total						
W 2.5"		8726	9595	8570	Mean	Std. Dev.
% Fines W 2.5"		0.319849	0.439812	0.448075	0.402579	0.071765

McNeil Sediment Core Sampling Form

Stream	18 Mile Creek					
Date	7/8/2008					
Location:	Middle reach					
Lat/Lon:	N:	44 33.534				
	W:	113 15.426				
Site Desc:						
Personnel:						
Rosgen Channel:						
Reach Gradient:						
Geology: (Q G V S)						
Target Species						
Sample Number		**1**	**2**	**3**		
Seive Size (inches)		ML	ML	ML		
2.5		150	390	500		
1		2225	1610	1480		
0.5		810	490	1000		
0.25		580	925	1075		
1.0 - 0.25" Subtotal		3615	3025	3555		
#4		230	290	425		
#8		400	635	1000		
#20		620	835	1025		
#70		960	680	740		
#270		210	55	105		
<0.25" Subtotal		2420	2495	3295		
Sample Total						
W/O 2.5"		6035	5520	6850	Mean	Std. Dev.
% Fines W/O 2.5"		**0.400994**	**0.451993**	**0.481022**	**0.44467**	**0.040513**
Sample Total						
W 2.5"		6185	5910	7350	Mean	Std. Dev.
% Fines W 2.5"		0.391269	0.422166	0.448299	0.420578	0.028548

McNeil Sediment Core Sampling Form

Stream	18 Mile Creek					
Date	7/8/2008					
Location:	Upper reach					
Lat/Lon:	N:					
	W:					
Site Desc:						
Personnel:						
Rosgen Channel:						
Reach Gradient:						
Geology: (Q G V S)						
Target Species						
Sample Number		**1**	**2**	**3**		
Seive Size (inches)		ML	ML	ML		
2.5		130	780	150		
1		4340	4140	3025		
0.5		2190	1420	1920		
0.25		1420	1200	100		
1.0 - 0.25" Subtotal		7950	6760	5045		
#4		480	440	440		
#8		1320	360	980		
#20		1860	1040	1420		
#70		600	370	620		
#270		100	21	120		
<0.25" Subtotal		4360	2231	3580		
Sample Total						
W/O 2.5"		12310	8991	8625	Mean	Std. Dev.
% Fines W/O 2.5"		**0.354184**	**0.248137**	**0.415072**	**0.339131**	**0.08448**
Sample Total						
W 2.5"		12440	9771	8775	Mean	Std. Dev.
% Fines W 2.5"		0.350482	0.228329	0.407977	0.328929	0.091743

McNeil Sediment Core Sampling Form

Stream	18 Mile Creek					
Date	7/8/2008					
Location:	Lower reach					
Lat/Lon:	N:					
	W:					
Site Desc:						
Personnel:						
Rosgen Channel:						
Reach Gradient:						
Geology: (Q G V S)						
Target Species						
Sample Number		**1**	**2**	**3**		
Seive Size (inches)		ML	ML	ML		
2.5		410	950	1540		
1		1200	2100	2540		
0.5		1225	1280	1050		
0.25		770	980	750		
1.0 - 0.25" Subtotal		3195	4360	4340		
#4		275	345	285		
#8		475	590	700		
#20		1780	800	650		
#70		440	450	760		
#270		175	100	150		
<0.25" Subtotal		3145	2285	2545		
Sample Total						
W/O 2.5"		6340	6645	6885	Mean	Std. Dev.
% Fines W/O 2.5"		**0.496057**	**0.343868**	**0.369644**	**0.40319**	**0.081452**
Sample Total						
W 2.5"		6750	7595	8425	Mean	Std. Dev.
% Fines W 2.5"		0.465926	0.300856	0.302077	0.356286	0.094953

McNeil Sediment Core Sampling Form

Stream	Geertson Creek					
Date	7/10/2008					
Location:						
Lat/Lon:	N:	45 11.304				
	W:	113 43.753				
Site Desc:						
Personnel:						
Rosgen Channel:						
Reach Gradient:						
Geology: (Q G V S)						
Target Species						
Sample Number		**1**	**2**	**3**		
Seive Size (inches)		ML	ML	ML		
2.5		1080	0	0		
1		1175	2640	1320		
0.5		1425	1510	600		
0.25		940	680	1220		
1.0 - 0.25" Subtotal		3540	4830	3140		
#4		350	140	340		
#8		800	220	760		
#20		680	480	2200		
#70		435	640	820		
#270		40	170	227		
<0.25" Subtotal		2305	1650	4347		
Sample Total						
W/O 2.5"		5845	6480	7487	Mean	Std. Dev.
% Fines W/O 2.5"		**0.394354**	**0.25463**	**0.580606**	**0.409863**	**0.163541**
Sample Total						
W 2.5"		6925	6480	7487	Mean	Std. Dev.
% Fines W 2.5"		0.332852	0.25463	0.580606	0.389363	0.170177

McNeil Sediment Core Sampling Form

Stream	Mill Creek					
Date	8/20/2008					
Location:						
Lat/Lon:	N:	44 42.456				
	W:	113 35.714				
Site Desc:						
Personnel:						
Rosgen Channel:						
Reach Gradient:						
Geology: (Q G V S)						
Target Species						
Sample Number		**1**	**2**	**3**		
Seive Size (inches)		ML	ML	ML		
2.5		980	1020	5420		
1		2340	2300	2120		
0.5		2250	2110	760		
0.25		1510	920	600		
1.0 - 0.25" Subtotal		6100	5330	3480		
#4		520	380	280		
#8		1300	660	350		
#20		1050	620	150		
#70		700	345	100		
#270		25	90	25		
<0.25" Subtotal		3595	2095	905		
Sample Total						
W/O 2.5"		9695	7425	4385	Mean	Std. Dev.
% Fines W/O 2.5"		**0.37081**	**0.282155**	**0.206385**	**0.28645**	**0.082296**
Sample Total						
W 2.5"		10675	8445	9805	Mean	Std. Dev.
% Fines W 2.5"		0.336768	0.248076	0.0923	0.225715	0.123759

McNeil Sediment Core Sampling Form

Stream	Wimpy Creek					
Date	8/21/2008					
Location:						
Lat/Lon:	N:	44 06.276				
	W:	113 42.321				
Site Desc:						
Personnel:						
Rosgen Channel:						
Reach Gradient:						
Geology: (Q G V S)						
Target Species						
Sample Number		**1**	**2**	**3**		
Seive Size (inches)		ML	ML	ML		
2.5		1410	200	425		
1		1760	2450	1350		
0.5		860	1080	720		
0.25		700	980	680		
1.0 - 0.25" Subtotal		3320	4510	2750		
#4		200	380	210		
#8		500	860	540		
#20		600	1050	830		
#70		240	780	750		
#270		30	200	60		
<0.25" Subtotal		1570	3270	2390		
Sample Total						
W/O 2.5"		4890	7780	5140	Mean	Std. Dev.
% Fines W/O 2.5"		**0.321063**	**0.420308**	**0.464981**	**0.402117**	**0.073663**
Sample Total						
W 2.5"		6300	7980	5565	Mean	Std. Dev.
% Fines W 2.5"		0.249206	0.409774	0.42947	0.362817	0.098881

McNeil Sediment Core Sampling Form

Stream	Bohannon Creek					
Date	7/9/2008					
Location:	Middle Reach					
Lat/Lon:	N:					
	W:					
Site Desc:						
Personnel:						
Rosgen Channel:						
Reach Gradient:						
Geology: (Q G V S)						
Target Species						
Sample Number		**1**	**2**	**3**		
Seive Size (inches)		ML	ML	ML		
2.5		2650	2095	640		
1		2690	3520	2960		
0.5		1050	1420	1200		
0.25		675	1180	750		
1.0 - 0.25" Subtotal		4415	6120	4910		
#4		220	380	215		
#8		500	800	530		
#20		935	755	950		
#70		265	360	540		
#270		80	40	40		
<0.25" Subtotal		2000	2335	2275		
Sample Total						
W/O 2.5"		6415	8455	7185	Mean	Std. Dev.
% Fines W/O 2.5"		**0.311769**	**0.276168**	**0.316632**	**0.301523**	**0.022092**
Sample Total						
W 2.5"		9065	10550	7825	Mean	Std. Dev.
% Fines W 2.5"		0.220629	0.221327	0.290735	0.24423	0.040276

McNeil Sediment Core Sampling Form

Stream	Bohannon Creek					
Date	7/9/2008					
Location:	Lower Reach					
Lat/Lon:	N:					
	W:					
Site Desc:						
Personnel:						
Rosgen Channel:						
Reach Gradient:						
Geology: (Q G V S)						
Target Species						
Sample Number		1	2	3		
Seive Size (inches)		ML	ML	ML		
2.5		3750	3220	5800		
1		1800	2000	1400		
0.5		760	660	530		
0.25		755	780	550		
1.0 - 0.25" Subtotal		3315	3440	2480		
#4		240	360	270		
#8		640	1000	675		
#20		930	990	635		
#70		275	710	365		
#270		40	45	55		
<0.25" Subtotal		2125	3105	2000		
Sample Total						
W/O 2.5"		5440	6545	4480	Mean	Std. Dev.
% Fines W/O 2.5"		**0.390625**	**0.474408**	**0.446429**	**0.437154**	**0.042655**
Sample Total						
W 2.5"		9190	9765	10280	Mean	Std. Dev.
% Fines W 2.5"		0.23123	0.317972	0.194553	0.247918	0.06338

McNeil Sediment Core Sampling Form

Stream	Hayden Creek					
Date	9/9/2008					
Location:	Middle Reach					
Lat/Lon:	N:	44 50.122				
	W:	113 40.263				
Site Desc:						
Personnel:						
Rosgen Channel:						
Reach Gradient:						
Geology: (Q G V S)						
Target Species						
Sample Number		1	2	3		
Seive Size (inches)		ML	ML	ML		
2.5		1200	300	240		
1		1840	1940	1060		
0.5		1100	980	1230		
0.25		680	400	760		
1.0 - 0.25" Subtotal		3620	3320	3050		
#4		220	170	260		
#8		90	100	540		
#20		40	160	340		
#70		29	30	15		
#270		20	10	42		
<0.25" Subtotal		399	470	1197		
Sample Total						
W/O 2.5"		4019	3790	4247	Mean	Std. Dev.
% Fines W/O 2.5"		**0.099278**	**0.124011**	**0.281846**	**0.168378**	**0.099041**
Sample Total						
W 2.5"		5219	4090	4487	Mean	Std. Dev.
% Fines W 2.5"		0.076451	0.114914	0.266771	0.152712	0.100632

Appendix E. Bacteria Data—Idaho Falls Regional DEQ Office and Lemhi Soil and Water Conservation District

The Lemhi Soil and Water Conservation District has monitored extensively throughout the subbasin for *Escherichia coli* (*E. coli*) and fecal coliform since 1994. The original Lemhi River subbasin total maximum daily load (TMDL) (DEQ 1999) approved in 2000 presented data for both *E. coli* and fecal coliform and produced extensive comparisons in their populations during the range of existent streamflow regimes. Since then, the Idaho water quality standard was revised from using fecal coliform to *E. coli*, which should not exceed a geometric mean of 126 *E. coli* organisms per 100 milliliters (mL) based on a minimum of five samples taken every three to seven days over a 30-day period (IDAPA 58.01.02.251.01.a.), which supports both primary and secondary contact recreation. Single *E. coli* sample values should not exceed 576 *E. coli* organisms per 100 mL for waters designated as secondary contact recreation or 406 *E. coli* organisms per 100 mL for waters designated as primary contact recreation. If the single sample value exceeds these limits, the geometric mean shall be determined.

Table 1 presents a summary of conservation district sampling for *E. coli* from 2002 through 2006 throughout the Lemhi River subbasin.

Table 1. Lemhi Soil and Water Conservation District *E. coli* sampling, 2002–2006.

	median geomean	% exceedance	median instantaneous	% exceedance
LEMHI R BELOW LITTLE 8MI CK	181	74	180	17
Lemhi River at Lemhi	217	100	220	24
LEMHI RIVER NEAR LEMHI	134	58	140	3
Agency Creek at Mouth	427	100	400	47
LEMHI @ BARRACKS LN BRIDGE	377	100	400	47
Hayden Creek at Mouth	179	63	188	47
LEMHI RIVER@SALMON ST.CHARLES BR	433	100	460	10
Return Flow 300 Yds N of S&R Br	1490	100	2000	52
Return Flow 500 yds N of S&R Br	1829	100	2300	94
Agency Creek at Tendoy School	384	100	380	98
Agency Creek at Campground	225	95	266	47
Wimpy Creek at Back Road	605	100	790	27
Ditch by #9 Green at Golf Course	587	95	600	67

Table 2 presents a summary of DEQ sampling for *E. coli* from 1999 through 2006 throughout the Lemhi River subbasin.

Table 2. Idaho Department of Environmental Quality *E. coli* sampling, 1999–2006.

SiteID	Stream Name	Date 1	Ecoli Sample Result 1	Date 2	Ecoli Sample Result 2	Date 3	Ecoli Sample Result 3	Date 4	Ecoli Sample Result 4	Date 5	Ecoli Sample Result 5
1994SIDFA053	EIGHTEEN MILE CREEK (UPPER)	7/27/1999	<10								
1995SIDFA090	CHALLIS CREEK (LOWER)	6/29/1999	20								
1995SIDFB026	EIGHTEENMILE CREEK (UPPER)	7/27/1999	<10								
1996SIDFZ013	SHORT CREEK	7/20/1999	20								
1996SIDFZ084	CRUIKSHANK CREEK	7/26/1999	7200	8/3/1999	570	8/4/1999	1300	8/5/1999	750	8/9/1999	640
1997SIDFL077	EIGHTEENMILE CREEK	7/27/1999	10								
1997SIDFL078	MIDDLE FORK LITTLE TIMBER CREEK	7/27/1999	10								
1997SIDFL079	NORTH FORK LITTLE TIMBER CREEK	7/27/1999	10								
1997SIDFL080	TENMILE CREEK	7/27/1999	<10								
1997SIDFL081	CLEAR CREEK	7/27/1999	<10								
1997SIDFL082	BALDY CREEK	7/20/1999	10								
1997SIDFL083	HAYNES CREEK	7/20/1999	<10								
1997SIDFL084	HAYNES CREEK	7/20/1999	<10								
1997SIDFL085	WARM SPRING CREEK	7/20/1999	<10								
1997SIDFL086	PRATT CREEK	7/20/1999	10								
1997SIDFL089	LITTLE TIMBER CREEK	7/27/1999	<10								
1997SIDFL090	BASIN CREEK	7/27/1999	400								
1997SIDFL098	WITHINGTON CREEK	7/19/1999	<10								
1997SIDFL099	WITHINGTON CREEK	7/19/1999	<10								
1997SIDFM125	LEMHI RIVER	7/26/1999	710	8/3/1999	110	8/4/1999	910	8/5/1999	990	8/9/1999	860
1997SIDFM126	LEMHI RIVER	7/19/1999	1100	7/26/1999	190	7/29/1999	190	8/3/1999	150	8/4/1999	1000
1997SIDFM127	LEMHI RIVER	7/19/1999	1000	7/26/1999	130	7/29/1999	290	8/3/1999	180	8/4/1999	790
1997SIDFM129	BIG SPRING CREEK	7/27/1999	240								
1997SIDFM130	LEMHI RIVER	7/27/1999	180								
1997SIDFM131	LEMHI RIVER	7/27/1999	130								
1997SIDFM133	LEMHI RIVER	7/19/1999	1200	7/26/1999	98	7/29/1999	160	8/3/1999	160	8/4/1999	1400
1998SIDFB080	PRATT CREEK	7/20/1999	<10								
2002SIDFA054	AGENCY CREEK	9/18/2002	140								
2002SIDFA059	HAWLEY CREEK	9/18/2002	30								
2002SIDFA060	HAYDEN CREEK	9/18/2002	31								
2002SIDFA061	BIG EIGHTMILE CREEK	9/18/2002	200								
2002SIDFA062	BIG TIMBER CREEK	9/18/2002	20								
2002SIDFA063	EIGHTEENMILE CREEK	9/18/2002	22								
2004SIDFA058	WITHINGTON CREEK	9/14/2004	184								
2004SIDFA059	HAYNES CREEK	9/15/2004	45								
2004SIDFA060	PATTEE CREEK	10/13/2004	17								
2004SIDFA067	WRIGHT CREEK	9/15/2004	<2								
2004SIDFA068	YEARIAN CREEK	9/15/2004	65								
2004SIDFA078	CLEAR CREEK	9/15/2004	91								
2004SIDFA079	TENMILE CREEK	9/15/2004	172								
2004SIDFA081	EIGHTEEN MILE CREEK	9/15/2004	42								
2004SIDFA144	BEAR VALLEY CREEK	9/15/2004	3								
2004SIDFA145	BEAR VALLEY CREEK	9/15/2004	10								
2004SIDFA146	HAYDEN CREEK	9/15/2004	48								
2004SIDFA147	MILL CREEK	9/15/2004	<2								
2004SIDFA148	HAWLEY CREEK	9/15/2004	66								
2004SIDFA149	BIG TIMBER CREEK	9/15/2004	46								
2004SIDFA150	BIG EIGHTMILE CREEK	9/15/2004	32								
2004SIDFA151	CANYON CREEK	9/15/2004	73								
2006SIDFA048	BIG EIGHTMILE CREEK	8/24/2006	38								
2006SIDFA049	BEAR VALLEY CREEK	8/24/2006	91								

In 2008, DEQ sampled six locations along the main stem Lemhi River without any exceedances of the water quality standards. The laboratory analytical reports for those six samples are provided below.

Teton Microbiology Lab

258 N. Water Ave Suite #2 - Idaho Falls, ID 83402
phone(208)-529-0077 fax(208)-522-3797
email: tetonmicrolab@gmail.com www.tetonmicro.com

Laboratory Analytical Report

Client: DEQ
Project: E. coli by quanti-tray, Nitrogen, Phosphorus
Work Order No: 08090091
Sampling Location: Lemhi - L1

Report Date: 09-12-2008
Collection Date: 09-10-2008
Date Received: 09-10-2008
Sample Number: T08090091001

Analysis	Result	Units	Method	Analysis Date	Analyst
E.coli Quant.	370.0	CFU/100mL	Quantitray	09-11-2008	AF

Teton Microbiology Lab

258 N. Water Ave Suite #2 - Idaho Falls, ID 83402
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Laboratory Analytical Report

Client: DEQ
Project: E. coli by quanti-tray, Nitrogen, Phosphorus
Work Order No: 08090091
Sampling Location: Lemhi - L2

Report Date: 09-12-2008
Collection Date: 09-10-2008
Date Received: 09-10-2008
Sample Number: T08090091002

Analysis	Result	Units	Method	Analysis Date	Analyst
E.coli Quant.	210.0	CFU/100mL	Quantitray	09-11-2008	AF

Teton Microbiology Lab
258 N. Water Ave Suite #2 - Idaho Falls, ID 83402
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Laboratory Analytical Report

Client: DEQ
Project: E. coli by quanti-tray, Nitrogen, Phosphorus
Work Order No: 08090091
Sampling Location: Lemhi - L3

Report Date: 09-12-2008
Collection Date: 09-10-2008
Date Received: 09-10-2008
Sample Number: T08090091003

Analysis	Result	Units	Method	Analysis Date	Analyst
E.coli Quant.	266.8	CFU/100mL	Quantitray	09-11-2008	AF

Teton Microbiology Lab
258 N. Water Ave Suite #2 - Idaho Falls, ID 83402
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email: tetonmicrolab@gmail.com www.tetonmicro.com

Laboratory Analytical Report

Client: DEQ
Project: E. coli by quanti-tray, Nitrogen, Phosphorus
Work Order No: 08090091
Sampling Location: Lemhi - L4

Report Date: 09-12-2008
Collection Date: 09-10-2008
Date Received: 09-10-2008
Sample Number: T08090091004

Analysis	Result	Units	Method	Analysis Date	Analyst
E.coli Quant.	155.2	CFU/100mL	Quantitray	09-11-2008	AF

Teton Microbiology Lab
258 N. Water Ave Suite #2 - Idaho Falls, ID 83402
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email: tetonmicrolab@gmail.com www.tetonmicro.com

Laboratory Analytical Report

Client: DEQ
Project: E. coli by quanti-tray, Nitrogen, Phosphorus
Work Order No: 08090091
Sampling Location: Lemhi - L5

Report Date: 09-12-2008
Collection Date: 09-10-2008
Date Received: 09-10-2008
Sample Number: T08090091005

Analysis	Result	Units	Method	Analysis Date	Analyst
E.coli Quant.	124.8	CFU/100mL	Quantitray	09-11-2008	AF

Teton Microbiology Lab

258 N. Water Ave Suite #2 - Idaho Falls, ID 83402
phone(208)-529-0077 fax(208)-522-3797
email: tetonmicrolab@gmail.com www.tetonmicro.com

Laboratory Analytical Report

Client: DEQ
Project: E. coli by quanti-tray, Nitrogen, Phosphorus
Work Order No: 08090091
Sampling Location: Lemhi - L6

Report Date: 09-12-2008
Collection Date: 09-10-2008
Date Received: 09-10-2008
Sample Number: T08090091006

Analysis	Result	Units	Method	Analysis Date	Analyst
E.coli Quant.	237.4	CFU/100mL	Quantitray	09-11-2008	AF

The following laboratory report forms for DEQ sampling in 2011 show a Lemhi River geometric mean value of 444 *E. coli* organisms per 100 mL and an instantaneous value of 59.4 for Texas Creek.

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
Aaron Swift
900 N. Skyline, Suite B
Idaho Falls, ID 83402

Date Submitted: 05/05/2011
Date Reported: 05/06/2011

Certificate of Analysis

Sample Description: Lemhi River
Lab Tracking #: I105037-01
Sampling Date/Time: 05/05/11 11:30

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	461.1	MPN/100 mL	SM9223B	05/05/2011	MPH

Sample Description: Texas Ct.
Lab Tracking #: I105037-02
Sampling Date/Time: 05/05/11 10:00

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	59.4	MPN/100 mL	SM9223B	05/05/2011	MPH

ND = Not Detected

G. Ryan Pattie
Laboratory Director

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IAS EnviroChem
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Phone: (208) 237-3300 • Fax: (208) 237-3336
email: iasec3308@iasenvirochem.com • www.iasenvirochem.com

Idaho Falls DEQ
Aaron Swift
900 N. Skyline, Suite B
Idaho Falls, ID 83402

Date Submitted: 05/11/2011
Date Reported: 05/17/2011

Certificate of Analysis

Sample Description: Lemhi River
Lab Tracking #: I105062-01
Sampling Date/Time: 05/11/11 9:30

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	290.9	MPN/100 mL	SM9223B	05/11/2011	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
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email: iasec3308@iasenvirochem.com • www.iasenvirochem.com

Idaho Falls DEQ
Aaron Swift
900 N. Skyline, Suite B
Idaho Falls, ID 83402

Date Submitted: 05/19/2011
Date Reported: 05/20/2011

Certificate of Analysis

Sample Description: Lemhi River
Lab Tracking #: I105111-01
Sampling Date/Time: 05/18/11 15:05

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	387.3	MPN/100 mL	SM9223B	05/19/2011	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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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
Aaron Swift
900 N. Skyline, Suite B
Idaho Falls, ID 83402

Date Submitted: 05/25/2011
Date Reported: 05/26/2011

Certificate of Analysis

Sample Description: Lemhi River
Lab Tracking #: I105146-01
Sampling Date/Time: 05/25/11 10:40

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	1203.3	MPN/100 mL	SM9223B	05/25/2011	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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email: iasec3308@iasenvirochem.com • www.iasenvirochem.com

Idaho Falls DEQ
Aaron Swift
900 N. Skyline, Suite B
Idaho Falls, ID 83402

Date Submitted: 06/01/2011
Date Reported: 06/02/2011

Certificate of Analysis

Sample Description: Lemhi River
Lab Tracking #: I106015-01
Sampling Date/Time: 06/01/11 12:00

Analyte	Result	Units	Method	Analyzed	Analyst
E. coli	275.5	MPN/100 mL	SM9223B	06/01/2011	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 F. Upper Salmon Basin Watershed Program Conservation Actions in the Lemhi River Subbasin

The Upper Salmon Basin Watershed Program (USBWP) was formed in 1992 to protect and restore the condition of streams in the Upper Salmon Basin, which includes the following subbasins:

- Lemhi subbasin
- Middle Salmon-Panther subbasin
- Pahsimeroi subbasin
- East Fork Salmon subbasin
- Upper Salmon subbasin minus East Fork Salmon

The following tables detail projects with direct USBWP involvement in the Lemhi River subbasin.

Conservation Benefit	Conservation Actions	Lemhi Watershed 17060204
		1994-2008
Fish Habitat Improvement	Instream Habitat Enhancement	20.0
	Riparian Habitat Enhancement	31.0
Fish Migration Enhancement	Migration Barrier Removed	17.0
	Screen or Backdoor Barrier	4.0
Water Quality / Quantity	Instream Flow Enhancement	6.0
	Water Quality Improvement	11.0
Metrics	CFS of Flow Restored	46.7
	Aquatic Habitat Access	17.1
	Stream Miles Treated	3.0
	River Miles Fenced	31.3
	Total Fence Installed	40.5
	Acres Treated	1,081.7
Totals	Total Projects	63.0
	Conservation Actions	89.0
	updated	7/22/2010

A. Fish habitat improvement:	Fish habitat improvement projects are primarily of two types; *riparian habitat improvement* , and *instream habitat improvement* .
1. Riparian habitat improvement (fencing)	Examples of riparian habitat improvement include protecting stream side vegetation by excluding livestock from stream banks with fences, changing grazing management systems, removing structures such as roads from near streams, riparian plantings.
2. Instream habitat improvement (structures)	Examples of *instream habitat improvement* includes (both hard and soft solutions) restoring natural stream channel features and increasing stream channel complexity – and therefore fish habitat quality - by reintroducing large woody debris, adding rock structures to facilitate development of pools, removing stream bank armoring such as “rip-rap”, facilitating the natural stream channel meander, diversion dam improvements, water management improvements, side channel habitat creation, and diversion consolidation.
B. Fish migration enhancement:	Fish migration enhancement projects are primarily of two types; *fish migration barrier removal* , and *irrigation diversion screening* .
3. Fish migration barrier removal (diversion dams)	Examples of *fish migration barrier removal* may include redesigning irrigation diversion dams to allow fish passage, installation of siphons where canals cross streams, and removing impassable culverts under roads crossing streams.
4. Irrigation diversion fish screening (screens)	Examples of *irrigation diversion screening* include installation of any of a number of fish screen designs generally near the head of an irrigation diversion that allows water to flow through the screen mesh and down the diversion, but effectively returns even the smallest fish back to the river. Screening actions also often include an effort to redesign the water intake structure so that is less likely to entrain fish into the diversion in the first place. Also, the creation of barriers in irrigation ditches to prevent fish from entering into irrigation facilities and becoming entrained (backdoor barriers).
C. Water quality and quantity improvement:	Water quality and quanity enhancement efforts are primarily of two types; *instream flow enhancement* , and *water quality improvement* .
5. Instream flow enhancement (water purchases, donations)	Examples of *instream flow enhancement* include working with irrigators to improve their water use efficiency (i.e. divert less water from the stream) which may include: conversion to sprinkler irrigation systems, consolidation of irrigation diversions, decreasing water loss in ditches with pipelines, so that less water is lost to the ground in transmission, and buying or renting water from irrigators to leave in-stream for fish.
6. Water quality improvement (CAFO’s plus)	Examples of *water quality improvement* include reducing sediment and animal waste movement from confined animal feeding operations (CAFO’s), installation of off-stream stockwater systems, protecting eroding stream banks to reduce sediment delivery, and improving road design to reduce sediment delivery.
* Stream dewatering can be considered a fish migration barrier, but efforts to address stream dewatering were captured in the projects database under the *instream flow enhancement* action category.	
1. Riparian Habitat Improvement-	XX stream miles (XX miles fenced)
2. Instream Habitat Improvement-	XX stream miles
3. Fish Migration Barrier Removal-	XX barriers (XXX miles of habitat)
4. Irrigation Diversion Screening-	XXX screens (XXX cfs of flow)
5. Instream Flow Enhancement-	XXX cfs of flow restored (ann. avg?)
6. Water Quality Improvements-	XX projects (XX miles/acres)

The total number of projects tallied under each conservation action is XXX projects. This exceeds the XXX total number of projects because many projects include more than one type of conservation action. In fact, any one habitat conservation project could theoretically include all six types of conservation actions. For example, work at an irrigation diversion site could result in the installation of a fish screen (4), removal of a diversion dam fish migration barrier (3), improvement of instream habitat conditions (2), restoration of riparian vegetation (1), an enhancement in stream flow (5) because less water is diverted to meet irrigation needs, and an improvement in water quality (6) because of increased stream bank stabilization and elimination of the need to plow up a stream gravel diversion dam every spring season.

Many more projects in the database included only one conservation action. For example, most fencing projects included only riparian habitat improvement (1) as the conservation action for that project. In the database tracking these projects, from one to three conservation actions were identified for each of the XXX projects.

More than one habitat improvement project may be implemented in the same reach of stream over time. For example, a fish screening project may be implemented at an irrigation diversion one year, and then in another year a riparian fence may be constructed to protect riparian vegetation. Therefore, the total amount of stream miles affected by conservation actions may exceed the total miles for that stream if multiple projects are implemented to address multiple, overlapping habitat protection needs over a period of years.

Because water diverted for irrigation - but not consumed by plants or evaporated - often returns to the river from which it was diverted, the amount of cubic feet per second (cfs) of water flow that is treated (screened or restored to the stream channel) can be more than the average flow for that stream. For example, the average summer flow for a stream may be 5 cfs, but three irrigation diversions on that stream each remove 2 cfs – for a total of 6 cfs - because return flow from the first irrigator reaches the stream before the third irrigator removes it again. In addition, high springtime flows in excess of summer flows are often diverted by irrigators, and these high flows are screened to protect fish. Finally, some instream flow enhancement projects occur on an annual basis and are tallied as such annually, and not just once. Therefore, the amount of water documented as screened in a stream or returned to the stream channel can, and often does, exceed the average amount of summer flow in that stream.

								Fish Habitat Improvement		Fish Migration Enhancement		Water Quality / Quantity Improvement		Metrics					Funding				
Primary Year	Project Name	Descriptive Name	Reach	Stream	HUC Name	Sponsor	Planning Lead	Instream Habitat Enhancement (Structures)	Riparian Habitat Enhancement (Fence)	Migration Barrier Removed	Screen or Backdoor Barrier	Instream Flow Enhancement	Water Quality Improvement	CFS of Flow Restored	Stream Miles Treated	River Miles Fenced	Total Fence Installed	Acres Treated	Funding 1	Funding 2	Funding 3	Funding 4	Habitat Access
1995	L 5 BoR Demo	Lemhi River Diversion Elimination, L5 and Side Channel Rearing Enhancement	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Bureau of Reclamation/LSWCD/ Nature Conservancy	USBWP-BoR	1		1				15	0	0	0	0	BoR	Priv. Land Owner	Nature Conservancy		0.25
1995	L 4 BoR Demo	Lemhi River Diversion Elimination, L4	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Bureau of Reclamation	USBWP-BoR			1				0	0	0	0	0	BoR	Priv. Land Owner			1
1995	L 6,L7, L7a BoR Demo	Lemhi River Diversion Elimination and Enhancement, L6/L7/7a	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Bureau of Reclamation	USBWP-BoR			3		1		0	0	0	0	0	BoR	WD 74 and LID (in-kind)	FSA/NRCS		3
1996	L 3a Diversion	Lemhi River Diversion Enhancement, L3a 1	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP-NRCS			1		1		0	0	0	0	0	BoR	IDFG Screen Shop	NRCS	Priv. Land Owner	0.57
1997	Muleshoe Fence	Lemhi River Riparian Enhancement Project, Muleshoe	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP		1					0	0	1	1	0	USFWS (PFW)	Priv. Land Owner (in kind)	Priv. Land Owner (Cash)		0
1997	Snook Fencing	Lemhi River Riparian Enhancement Project, Snook	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP		1					0	0	0.9	0.9	0	BPA-H	MWP			0
1997	Sager barbs I	Lemhi River Riparian Enhancement Project, Sager 1	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP-NRCS	1	1				1	0	0.05	0.125	0.125	0	Priv. Land Owner	Priv. Land Owner	BoR	MWP	0
1997	Sager 2	Lemhi River Riparian Enhancement Project, Sager 2	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP-NRCS	1					1	0	0.05	0	0	0	BoR				0
1997	Nelson / Stokes L3, L2b, L2c	Lemhi River Diversion Elimination and Enhancement, Nelson/Stokes	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP-NRCS	3						0	0	0	0	0	BPA - IDFG	MWP	IDFG Screen Shop	NRCS	0
1998	L 8a Diversion	Lemhi River Diversion Modification, L8a	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP-NRCS	1						0	0	0	0	0	BPA-H	Priv. Land Owner	NRCS	MWP	0.2
1999	Merritt Streambank Project	Lemhi River Erosion Reduction, Merritt	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP-NRCS	1					1	0	0.5	0	0	0	BPA	Priv. Land Owner			0
1999	Skinner	Wimpy Creek, Lemhi River Flow Enhancement	Lemhi River, mouth to Agency Creek	Wimpy Creek - Tributary to Lemhi River	Lemhi	Lemhi Soil and Water Conservation District	NRCS		1					0	0	0.5	0.5	0	BPA	NRCS			0
2000	Bitterroot Ranch Structures	Lemhi River Instream Habitat Enhancement	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Idaho Transportation Department	USBWP-NRCS-ITD	1						0	0.5	0	0	0	ITD	IDFG			0
2001	Snook Feedlot	Lemhi River Water Quality Improvement, Snook	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP-NRCS		1				1	0	0	0.265	1.1	0	NRCS	BPA	Priv. Land Owner (Cash)	Priv. Land Owner (in kind)	0
2001	Merritt Fencing	Lemhi River Riparian Enhancement, Merritt	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP		1					0	0	0.33	0.33	0	BPA				0
2001	Goddard Habitat Project - Riparian Fencing	Lemhi River Riparian Enhancement, Goddard	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP		1					0	0	1	1	0	BPA				0
2001	Herbst Stockwater Pipeline	Lemhi River Riparian Enhancement, Herbst	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	NRCS						1	0	0	0	0	0	BPA	WQPA			0
2002	L-11 Diversion Elimination Stephenson	Lemhi River Diversion Elimination and Enhancement, L11	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP-NRCS	1						12.5	0	0	0	0	BPA-Screen Shop	Priv. Land Owner (in kind)			0.5
2003	L3a Upgrade	Lemhi River Diversion Enhancement, L3a 2	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	BoR	1						0	0	0	0	0	BPA	BoR			0
2003	L3 Diversion Dam	Lemhi River Diversion Enhancement, L3 2	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	BoR	1						0	0	0	0	0	BPA	BoR			0.6
2004	L9 Diversion Replacement	Lemhi River Diversion Enhancement, L9	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	BoR	1						0	0	0	0	0	BPA	BoR			1.9
2004	Lemhi River Bank Restoration-Cockrell	Lemhi River Streambank Enhancement, Cockrell	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USFWS	1						0	0.25	0.5	0.5	0.26	USFWS-PFW	Priv. Land Owner (in kind)			0
2004	Goddard Habitat Project-Streambank	Lemhi River Streambank Enhancement, Bar-13	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP	1					1	0	0.05	0	0	0	BPA				0

2005	L3AO Diversion Replacement	Lemhi River, L3AO Diversion Replacement	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	BoR	1						0	0	0	0	0	BPA	BoR				1.3
2005	L-3 Wasteway	L-3 Wasteway	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	BoR	1			1			0	0	0	0	0	BPA	BoR				0
2005	Goddard Habitat Project - Stockwater	Lemhi River Watergap Closure and Stockwater System, Bar-13	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP						1	0	1	0	0	0	BPA					0
2006	Surface to Groundwater Conversion - SV Golf Course	Surface to Groundwater Conversion - SV Golf Course	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP-NRCS					1		3.56	0	0	0	0	BPA	OSC-PCSRF	City of Salmon (Cash and In Kind)			0
2006	L-13 Diversion Modification	L-13 Diversion Modification	Lemhi River, mouth to Agency Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP-BoR	1						0	0	0	0	0	BPA					0.3
								18	7	6	1	3	7	31.06	2.4	4.62	5.455	0.26						9.62
2005	Lemhi River Riparian Enhancement, Knight Fence	Lemhi River Riparian Enhancement, Knight Fence	Lemhi River, Agency Creek to Hayden Creek	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP-NRCS		1					0	0	0.62	0.61	6	OSC-PCSRF	Priv. Land Owner (in kind)				0
								0	1	0	0	0	0	0	0	0.62	0.61	6						0
2003	Basin Creek AFO	Basin Creek, Lemhi River Water Quality Enhancement	Lemhi River, Hayden Creek	Basin Creek - Tributary to Hayden Creek	Lemhi	Lemhi Soil and Water Conservation District	SCC		1				1	0	0	0.14	0.14	0	BPA					0
2005	Hayden Fence Crossing	Hayden Creek, Lemhi River Passage Enhancement, Fence Crossing	Lemhi River, Hayden Creek	Hayden Creek - Tributary to Lemhi River	Lemhi	Lemhi Soil and Water Conservation District	USBWP			1				0	0	0	0	0	BPA	Priv. Land Owner (in kind)	Volunteer Labor			0
2010	Hayden Creek 1A Diversion Elimination and Riparian Fence	Hayden Creek 1A Diversion Elimination and Riparian Fence	Lemhi River, Hayden Creek	Hayden Creek - Tributary to Lemhi River	Lemhi	Lemhi Soil and Water Conservation District	USBWP-SCC		1	1	1			0.2	0.6	0.6	0.66	3	BPA	Priv. Land Owner				0.1
								0	2	2	1	0	1	0.2	0.6	0.74	0.8	3						0.1
1995	Beyeler Ranch 1	Upper Lemhi Riparian Enhancement Project, Beyeler 1	Lemhi River, Hayden Creek to Leadore	Lemhi River - Tributary to Salmon River	Lemhi	Idaho Fish and Game Department	USBWP-IDFG-NRCS		1					0	0	1.4	1.6	279	BLM	IDFG	NRCS			0
1996	Neibaur Riparian Pasture	Lemhi Riparian Enhancement Project, Neibaur Riparian Pasture	Lemhi River, Hayden Creek to Leadore	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP-NRCS		1					0	0	3	3.3	159	BLM	BPA	Priv. Land Owner			0
1996	Thomas Riparian Pasture	Lemhi Riparian Enhancement Project, Thomas Riparian Pasture	Lemhi River, Hayden Creek to Leadore	Lemhi River - Tributary to Salmon River	Lemhi	Idaho Fish and Game Department	USBWP-IDFG-NRCS		1					0	0	1	2.3	315	IDFG	BLM	NRCS			0
1997	Amonson (Kesl) Riparian Grazing System	Lemhi River Riparian Enhancement Project, Amonsen	Lemhi River, Hayden Creek to Leadore	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP-BLM-NRCS		1					0	0	0.83	1.3	150	BPA	BLM	NRCS	Priv. Land Owner (in kind)		0
1997	Tyler/Noranda Riparian Fence	Lemhi River Riparian Enhancement Project, Tyler	Lemhi River, Hayden Creek to Leadore	Lemhi River - Tributary to Salmon River	Lemhi	NMFS, USFS, and IDEQ	USBWP		1					0	0	7.75	11.5	80	Noranda Mine	Noranda (o and m)				0
1998	Ellsworth Fencing 2	Lemhi River Riparian Enhancement, Ellsworth	Lemhi River, Hayden Creek to Leadore	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP		1					0	0	0.38	0.38	0	BPA-H	Priv. Land Owner				0
1999	McFarland Livestock (Kauer)	Lemhi River Riparian Enhancement, McFarland 1	Lemhi River, Hayden Creek to Leadore	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP		1					0	0	1.07	0.73	10	BPA-H	Priv. Land Owner (in kind)	BLM	MWP		0
2000	McFarland Fence II	Lemhi River Riparian Enhancement, McFarland 2	Lemhi River, Hayden Creek to Leadore	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP		1					0	0	0.5	0.5	2.5	BPA					0
2002	Bowman Riparian Fence	Lemhi River Riparian Enhancement, Bowman	Lemhi River, Hayden Creek to Leadore	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP		1					0	0	0.24	0.24	0.5	BPA					0
2005	Cottom Lane Fence	Lemhi River Riparian Enhancement, Cottom Lane Fence	Lemhi River, Hayden Creek to Leadore	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP		1					0	0	0.33	0.33	1.2	OSC-PCSRF	Priv. Land Owner (in kind)	BPA			0
2005	L 44 Diversion Modification	L 44 Diversion Modification	Lemhi River, Hayden Creek to Leadore	Lemhi River - Tributary to Salmon River	Lemhi	Lemhi Soil and Water Conservation District	USBWP-BoR			1				0	0	0	0	0	BPA	BoR				0.1
2008	Amonson Watergap Closure and Stockwater System	Lemhi Watergap Closure and Stockwater System, Amonson	Lemhi River, Hayden Creek to Leadore	Lemhi River - Tributary to Salmon River	Lemhi	Idaho Soil Conservation Commission	USBWP		1				1	0	0	0.2	0.19	0	BPA	Landowner				0
								0	11	1	0	0	1	0	0	16.7	22.37	997.2						0.1
1998	L 31/Herbst	Agency Creek, Lemhi River Barrier Removal	Lemhi River, Other Tribs and Lemhi Headwaters	Agency Creek - Tributary to Lemhi River	Lemhi	Lemhi Soil and Water Conservation District	USBWP-NRCS	1		1				0	0	0	0	0	BoR	NRCS	IDFG	MWP		0.7

								Fish Habitat Improvement		Fish Migration Enhancement		Water Quality / Quantity Improvement		Metrics						Funding			
Year	Project Name	Descriptive Name	Reach	Stream	HUC-4 Name	Sponsor	Planning Lead	Instream Habitat Enhancement (Structures)	Riparian Habitat Enhancement (Fence)	Migration Barrier Removed	Screen or Backdoor Barrier	Instream Flow Enhancement	Water Quality Improvement	CFS of Flow Restored	Habitat Access (Miles)	Stream Miles Treated	Stream Miles Fenced	Total Fence Installed	Riparian Protected	Funding 1	Funding 2	Funding 3	Funding 4
2011	Upper Carmen Creek Grazing Study	Photopoints and permanent transects were established to monitor riparian grazing plan.	Mainstem Salmon River tribs, North Fork to Pahsimeroi	Carmen Creek - Tributary to Salmon River	Salmon-Panther	Lemhi Soil and Water Conservation District	USBWP-OSC		1						0					BPA EXP UPPER SALMON SCREEN TRIBUTARY PASSAGE-OSC			
2011	Little Springs Creek Diversion Closure & Pivot Sprinkler Installation	Eliminate 3 diversions & transfer POD to L48/49, install 10-tower & 5-tower pivot, pumping station, mainline, bore under Hwy 28	Lemhi River, Hayden Creek to Leadore	Lemhi River	Lemhi	Lemhi Soil and Water Conservation District	USBWP-OSC	1		1		1		3.94	0.36	5.1				BPA EXP LEMHI RIVER RESTORATION -OSC			
2011	Lemhi River L-52 Lateral Removal Project	Removed fish migration barriers at Mill Creek, Little Springs, the Lemhi River and improve stream flow in Lemhi Little Springs Creek by 3.5 cfs. The 7-mile long L-52 irrigation canal was abandoned in exchange for 3 pivot sprinkler systems and associated pumps and pipeline.	Lemhi River, Hayden Creek to Leadore	Lemhi River	Lemhi	Lemhi Soil and Water Conservation District	USBWP-OSC	3		1		1		3.5	4.56	11.1				BPA CAP UPPER SALMON TRIBUTARY PASSAGE	TNC		
2011	Wallace Creek Culvert Replacement	Reestablish upstream passage to rearing habitat and coldwater refugia for all life stages of ESA-listed and resident fish species by removing the perched, undersized culvert and replacing it with a prefabricated, modular steel bridge.	Mainstem Salmon River tribs, North Fork to Pahsimeroi	Wallace Creek - Tributary to Salmon River	Salmon-Panther	Lemhi Soil and Water Conservation District	USBWP-OSC			1					1					PCSRF-OSC	Lemhi County Road & Bridge		
2011	Archie Lane Culvert Replacement	Improve fish passage on Carmen Creek by replacing two undersized culverts on a private road that pose velocity barriers to certain life stages of ESA and resident fish at high flows and replacing them with a prefabricated, modular steel bridge.	Mainstem Salmon River tribs, North Fork to Pahsimeroi	Carmen Creek - Tributary to Salmon River	Salmon-Panther	Lemhi Soil and Water Conservation District	USBWP-OSC			1					0.65					BPA EXP LEMHI RIVER RESTORATION -OSC			
2011	Parmenter Road Culvert Replacement	Improve fish passage on Carmen Creek by replacing two undersized culverts on a county road that pose velocity barriers to certain life stages of ESA and resident fish at high flows and replacing them with a prefabricated, modular steel bridge.	Mainstem Salmon River tribs, North Fork to Pahsimeroi	Carmen Creek - Tributary to Salmon River	Salmon-Panther	Lemhi Soil and Water Conservation District	USBWP-OSC			1					0.6					BPA EXP LEMHI RIVER RESTORATION -OSC	Lemhi County Road & Bridge		
2011	Lower Little Springs Creek Fence	Installed 5,400 feet of 4-pole jack to manage domestic livestock access to the riparian area of the Lemhi Little Springs Creek.	Lemhi River, Hayden Creek to Leadore	Lemhi River	Lemhi	Lemhi Soil and Water Conservation District	USBWP-OSC		1						0		1	1.02	21	BPA EXP LEMHI RIVER RESTORATION -OSC			
2011	Salmon River, Dahle Slough Fence (Salmon River Mile 263)	Installed 4,937 feet of 4-pole jack to manage domestic livestock access to the riparian area of the slough channel with a minimum 35 foot setback.	Mainstem Salmon River, North Fork to Pahsimeroi	Slough Channel Tributary to Salmon River	Salmon-Panther	Lemhi Soil and Water Conservation District	USBWP-OSC		1						0		0.48	0.94	7.8				

Appendix G. Distribution List

Both the draft and final version of this document are distributed to the following groups:

- Upper Salmon Basin Watershed Program
- Salmon Basin Advisory Group

These groups represent local landowners, producers, federal and state agencies tasked with water quality improvements. In addition, the DEQ webpage makes all finalized TMDL Addendum and Five-Year Reviews here: http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls.aspx

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Appendix H. Public Comments/Public Participation

No public comments were received during the comment period. EPA did provide pre public comment written comments and their comments/suggestions are reflected in this final document. Additionally, verbal suggestions from meetings with the Upper Salmon Basin Watershed Program, the Office of Species Conservation and the Salmon BAG were also considered and reflected in the final TMDL.

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Appendix I. BLM Lemhi River TMDL Implementation Plan Update

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Lemhi River TMDL
Implementation Plan Update

Bureau of Land Management
Salmon Field Office

May 2012

Overview

In 1999, the Idaho Department of Environmental Quality published the Lemhi River Watershed TMDL. The TMDL was developed to address water quality concerns on the Lemhi River and seven (7) tributary streams.. These surface waters within the subbasin have been identified as having a beneficial support status less than Full Support. Two additional stream reaches which have been identified as unable to meet State water quality standards due to dewatering for irrigation purposes were not included in the TMDL, and thus will not be included in this document.

This document serves as a summary of BLM activities that have benefitted water quality concerns in the Lemhi River Watershed as they relate to the Lemhi TMDL.

Water Quality Concerns

This document describes the issues, concerns and sediment reductions identified in the TMDL as well projects that have been implemented to address the water quality issues.

The Lemhi River TMDL identified three stream reaches encompassing BLM-managed lands as not meeting state water quality standards: Bohannon, Eighteenmile, and Wimpey Creeks. Of these, BLM manages significant portions of the listed reach only on Eighteenmile Creek. BLM managed lands were identified as impacting water quality on the portions of McDevitt, Geertson and Kirtley Creeks downstream of public lands.

The following narrative identifies the grazing management and road sediment reduction projects that have been implemented to address water quality concerns on BLM-administered lands in each of the stream drainages identified as not meeting State water quality standards. Over 42 miles of roads were treated between 2007 and 2011. The roads were surfaced with pit run and/or crushed gravel aggregate. Water bars, drainage culverts or drainage dips were added to improve surface drainage from the roadway and allow the least amount of sediment runoff from the road. Fish passable culverts were added in six locations. Hardened wet crossings were established in two locations. The roads were compacted and graded to harden the surface of the roadway. The surfacing and drainage improvements are expected to significantly reduce the amount of sedimentation that is delivered to waterways near these roads.

Drainage Updates

Bohannon Creek

West Fork of Wimpey Road (#30101): Approximately four miles were upgraded with compacted gravel surfacing, improved water drainage on approximately six miles of road and the installation of new culverts as necessary to improve drainage. A new fish-passable culvert was also installed on the Bohannon Creek crossing.

Grazing Management: The Bohannon Creek Allotment management was changed to mostly fall use with dry cows. This has improved the East Fork substantially and is now in PFC condition.

Kirtley Creek

Grazing Management: Projects included the construction of a short fence on the State/BLM boundary in the East Fork of Kirtley Creek to exclude livestock amounting to about two miles of stream in the headwaters of the East Fork (Whitehorse Canyon). The fragile headwater meadows are now excluded and improving.

Eighteenmile Creek

Road system improvements completed in 2005- 2010:

- Eighteenmile Road (#3016): Approximately 11 miles of gravel surfacing. Replaced or install new drainage culverts as necessary. Installed two fish-passable culverts on Clear and Tenmile Creeks to prevent further erosion of the road surface.

- McGinty Ridge Road (#3045): Approximately 6 miles of gravel surfacing from the junction with MacFarland Blvd and Eighteenmile road to the Wilderness Study Area (WSA) boundary. A new section of road approximately .33 miles long was constructed starting in T13N, R28E, Section 3 NESE and ending in T13N, R28E, Section 2 SWSW. An old section of road approximately .37 miles long was obliterated and rehabilitated starting in T13N, R28E, Section 3 SESE and ending in T13N, R28E, Section 2 SWSW. This section of road was replaced because of a steep grade and persistent erosion. The McGinty Ridge Road ends at the WSA boundary, eliminating approximately .26 miles of the existing road to use, further reducing erosion.

- Upper Eighteenmile Road (#3016): Gravel surfacing on approximately 5.75 miles of road from the junction of McFarland Blvd to the junction with the Wildhorse Spring A road.

- Wildhorse Spring A Road (#30120): Approximately 6.25 miles of road were improved with gravel surfacing and improved water drainage by adding cutouts and drainage culverts.

Grazing Management: Improvements continue on the Powderhorn, Center Ridge and Chamberlain Creek Allotments on Eighteenmile and Clear Creeks. Additionally, new riparian grazing standards were implemented in 2011 as a result of litigation with Western Watersheds Project and coordinated with USFWS and NMFS for fish and water quality benefits. The new "Watershed Level" assessment, EA and proposed 10-year grazing permits expected in 2012 will substantially improve stream/riparian conditions on Eighteenmile and Clear Creeks. We also maintained two livestock grazing exclosures on Eighteenmile Creek to continue riparian area improvement.

Geertson Creek

Grazing Management: Gary Creek MIM evaluation was completed in 2011 with the stream being documented as very stable and in PFC in the Geertson Creek Allotment. The exclosure fence continues to allow for substantial improvements on both the short segment at the mouth of the canyon and the larger Canyon Pasture. Conditions are good to excellent in these reaches.

McDevitt Creek

Road system improvements completed in 2009- 2011:

- McDevitt Road (#3001): Approximately three miles of gravel surfacing, improved water drainage and replacement or installation new culverts. BLM installed a new culvert on Burton Gulch and reconstructed approximately ½ mile of road to reduce sediment to main McDevitt Creek; cleaned out and reset the Upper McDevitt cattleguard to provide for proper drainage and reduce road gullying and sedimentation; replaced four stream crossing culverts with new fish-passable culverts on McDevitt Creek and installed two wet-crossing fords with geotextile fabric and angled rock for stability.

- Baldy Basin Road (#3004): Approximately 1 ½ miles of gravel surfacing, improved water drainage by adding rolling dips and replacing or installing new culverts.

- Dipping Vat Road (#3008): Improve drainage on approximately 1 ½ miles of road by adding water bars and installing two culverts to reduce sediment to McDevitt Creek.

Grazing Management:

- McDevitt Creek Allotment: BLM and permittee implemented a three-pasture rotation and continued light grazing use on main McDevitt Creek in the riparian pasture. Additionally, one exclosure was constructed in Dipping Vat Gulch (about 3.5 acres), and another on a small unnamed tributary opposite Mormon Canyon (about 55 acres). Overall, riparian conditions on the allotment have improved dramatically. The entire length of McDevitt Creek is now in PFC, Dipping Vat, Mormon Canyon and Sawmill Canyon are in FAR with upward trends, especially with increases in aspen, willows and deep-rooted herbaceous plants.

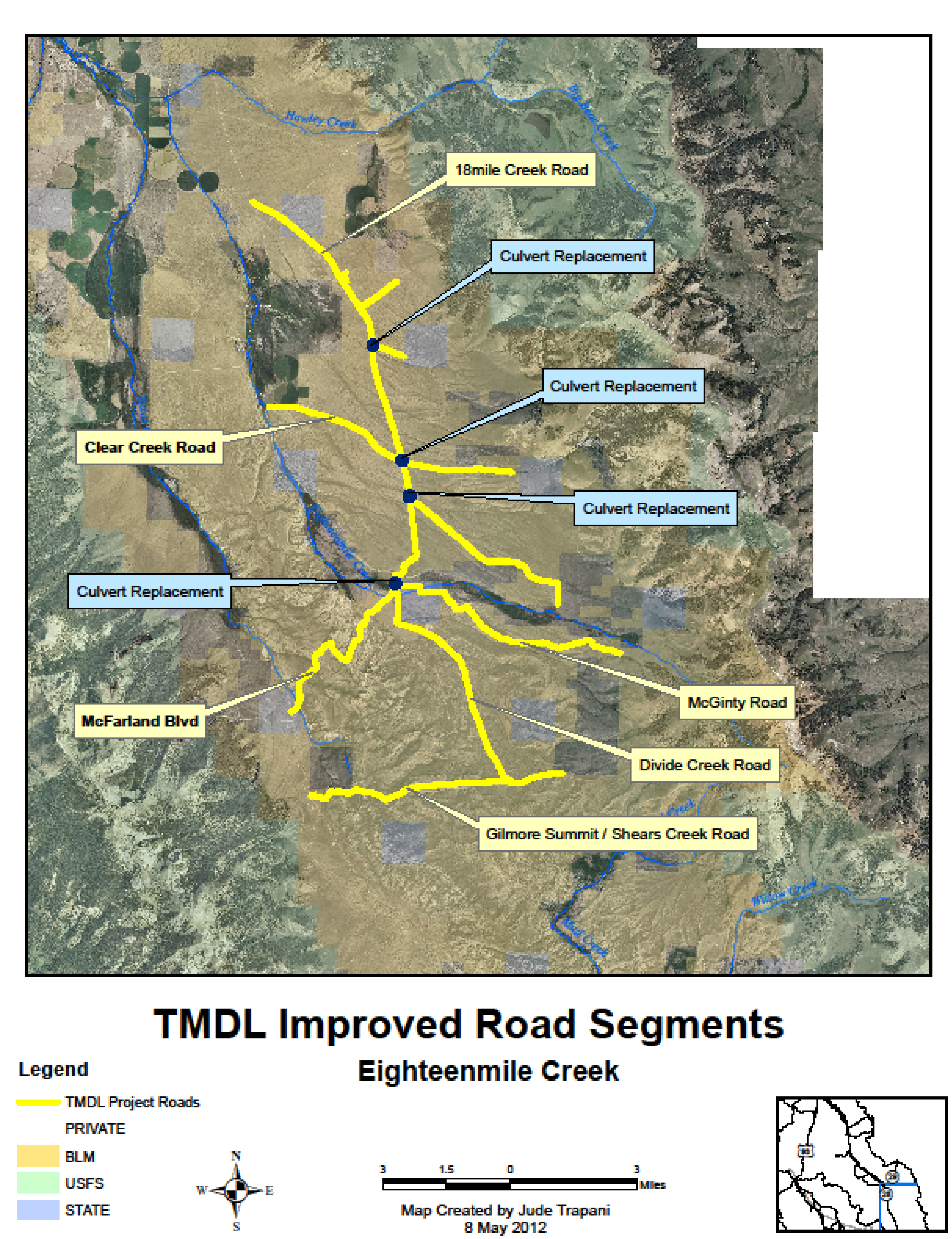
- Baldy Basin Allotment: Exclosures on main McDevitt Creek and an unnamed tributary have been maintained and improving quickly (135 acres and 1¼ miles of stream habitat) and further protecting the stream and enhance woody species regeneration.

Hayden Creek

Road system improvements completed in 2008- 2010: Approximately three miles of Basin Creek Road (#3071) was surfaced with gravel and Geotextile fabric was added to approximately 1 ½ miles of road before gravel surfacing to stabilize the roadbed. We also stabilized 200 yards of an existing irrigation ditch, which is located above road, with a liner to prevent failure and subsequent damage to the road prism. Additionally, the Trail Creek road crossing culvert was replaced with a new fish-passable culvert.

Grazing Management:

Improvements continue on the Grouse Creek and Rye Grass Creek Allotments. New riparian grazing standards were implemented in 2009 as a result of a new 10-year permit and further new riparian grazing standards implemented in 2011 as a result of litigation with Western Watersheds Project and coordinated with USFWS and NMFS for fish and water quality benefits. Specific improvements include an increase of bank stability on the Grouse Creek DMA (key area) from 33% in 2008 to 66% in 2011. Bull, Grouse and Trail Creeks receive a maximum of two-weeks of grazing during the "hot-season" which has shown an upward trend.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Culvert Replacement
Culvert Replacement
Clear Creek Road
Culvert Replacement
Culvert Replacement
McGinty Road
McFarland Blvd
Divide Creek Road
Gilmore Summit / Shears Creek Road
TMDL Improved Road Segments
Eighteenmile Creek
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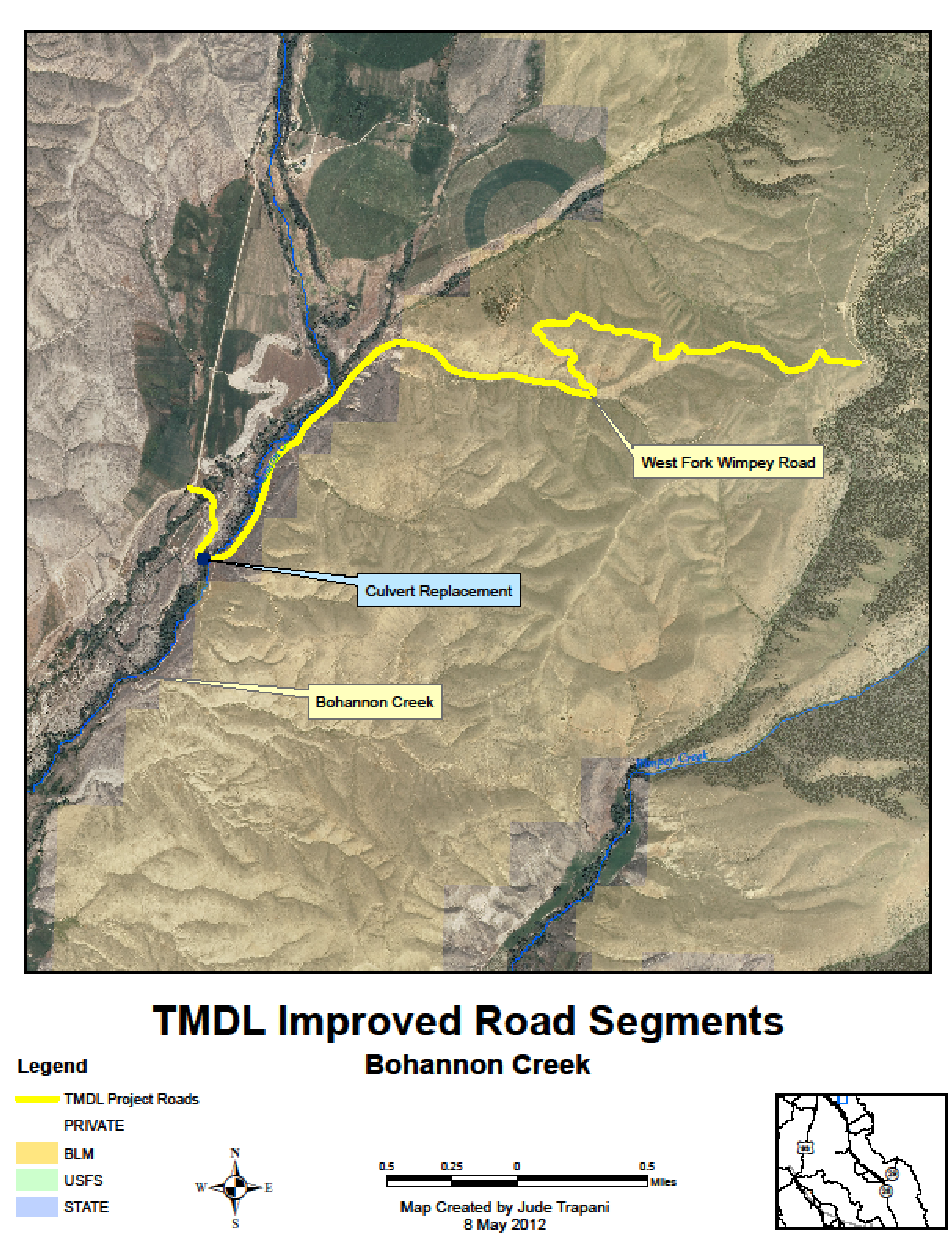
Map Created by Jude Trapani
8 May 2012


West Fork Wimpey Road
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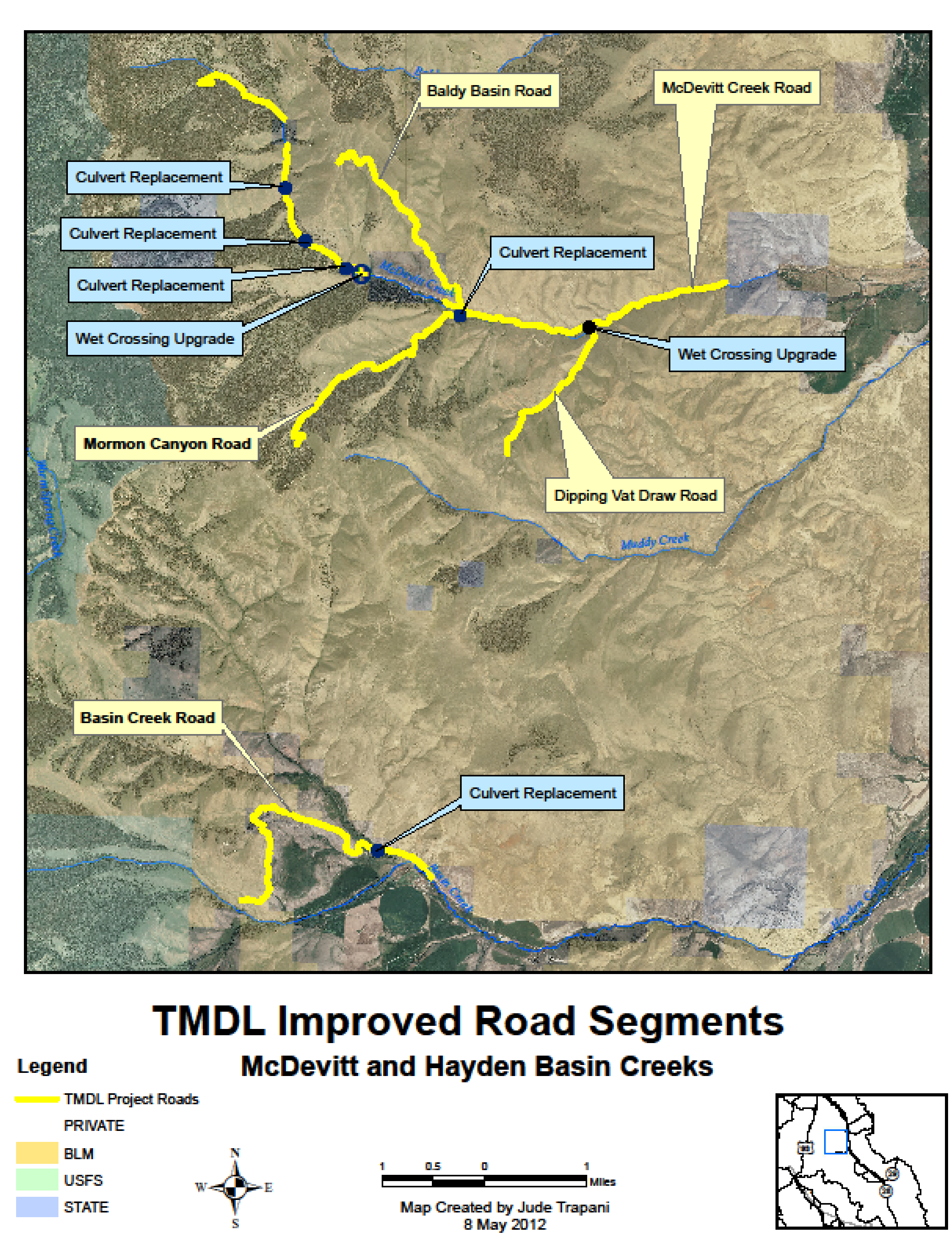
Baldy Basin Road
McDevitt Creek Road
Culvert Replacement
Culvert Replacement
Culvert Replacement
Culvert Replacement
Wet Crossing Upgrade
Wet Crossing Upgrade
Mormon Canyon Road
Dipping Vat Draw Road
Muddy Creek
Basin Creek Road
Culvert Replacement
TMDL Improved Road Segments
McDevitt and Hayden Basin Creeks
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TMDL Project Roads
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Map Created by Jude Trapani
8 May 2012

Success Stories
Culvert Replacements for Aquatic Species Benefits
Idaho Falls District, Salmon Field Office 2006

Bohannon Creek: This stream is a tributary to the Lemhi River and contains habitat for bull trout and steelhead and is designated critical habitat for chinook salmon and historic spawning habitat. It is a cold-water stream coming off the high peaks on the continental divide at 10,000 feet elevation. Numerous partial barriers from irrigation withdrawal/headgates and road crossing culverts are found in the lower end. The BLM culvert replacement on the WF Wimpey Road was part of this barrier removal and irrigation diversion consolidation program as part of the cooperative Upper Salmon Basin Watershed Program (USBWP) and the Idaho Department of Fish and Game (IDFG) Screen Program. This group is a very successful multi-agency and group stream habitat restoration program especially focused on anadromous fish. The WF Wimpey Road culvert was most likely a complete barrier at most flows and was a great candidate for replacement. The other barriers are being addressed through diversion consolidations with the landowner and help from the IDFG Screen Program and the Bureau of Reclamation.

BEFORE: Swash culvert with one foot drop.

AFTER: Open-bottom arch culvert.

Canyon Creek: This stream is a tributary to the upper Lemhi River. It has good populations of cutthroat and rainbow trout and is historic chinook and steelhead spawning and rearing habitat. It has been a location for a series of restoration projects with the USBWP and the IDFG Screen Program to restore flow and reconnect the lower end which was often completely dewatered from April – November from irrigation withdrawal.

The USBWP is continuing restoring passage and flow in Canyon Creek with the culvert replacements and irrigation diversion barrier elimination. We hope to have the Whitefish Ditch consolidated into another diversion downstream and thus eliminate the ditch and the associated barrier in Canyon Creek. Once completed, Canyon Creek will be available for fish migration along its full extent. Additionally, the ranch at the lowest reach is proposing to fence off cattle from Canyon Creek and restore the willow community on the last impacted segment on Canyon Creek proper.

BEFORE: Swash culvert with velocity barrier.

AFTER: Round culvert buried half way – full passage

Basin Creek (Hayden Creek watershed) Grouse Creek culvert replacement

Road Improvements

Eighteenmile Road example

McDevitt wet-crossing

Eighteenmile Road example

Eighteenmile Road example

WF Wimpey Road erosion