Upper (North Fork) Coeur d'Alene River Subbasin Temperature Total Maximum Daily Loads

Addendum to the 2001 *Subbasin Assessment and Total Maximum Daily Loads of the North Fork Coeur d'Alene River*

Hydrologic Unit Code 17010301

Idaho Department of Environmental Quality

July 2013

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July 2013

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Acknowledgments

DEQ would like to acknowledge North Fork Coeur d'Alene Watershed Advisory Group members and participants for their generous contributions of time and energy to improve water quality.

- **Landowners and concerned citizens,** including Fred Brackebusch, Jamie Davis, Doug England, Roy Faler, Dave Funk, Dan Guy, George Hemphill, Del Kerr, Carol Lapan, Ed Lider, Ingrid Madsen, Craig Nelson, John Pickard, Larry Runkle, Bill Rust, and Sandy Schlepp.
- **Kingston Baptist Church:** Dale Helbig
- **Kootenai Environmental Alliance**: Mike Mihelich
- **North Idaho Fly Casters:** Bob Clark, Bob Bevins, and Earl Frizzell
- **Panhandle Lakes Resource Conservation and Development Council**: Nina Eckberg
- **University of Idaho:** Ashley McFarland, Tammi Laninga, and Nick Brown
- **Shoshone County:** Larry Yergler, Leslee Stanley, Jon Cantamessa, John Thomas
- **Kootenai-Shoshone Soil and Water Conservation District**: Bob Flagor
- **Benewah Soil and Water Conservation District**: Sherry Klaus
- **Idaho Soil and Water Conservation Commission**: Bill Lillibridge
- **Idaho Department of Lands:** Bob Burke, Mary Fritz, Diane Partridge, and Chris Tretter
- **Idaho Department of Fish and Game:** Melo Maiolie, Mary Terra-Berns, Jim Fredericks, Ryan Hardy, and Joe Dupont
- **USDA Forest Service:** Chris James, Claire Pitner, Aaron Prussian, Katherine (KK) Prussian, Matt Davis, Kim Johnson, Colter Smart, Tammy Maiolie, and Dan Scaife
- **US Environmental Protection Agency**: Don Martin and Leigh Woodruff

Cover photo: North Fork Coeur d'Alene River taken by DEQ, 2007.

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Abbreviations, Acronyms, and Symbols

§303(d)	refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section
AU	assessment unit
BLM	Bureau of Land Management
BMP	best management practice
BURP	Beneficial Use Reconnaissance Program
C	Celsius
CFR	Code of Federal Regulations
CGP	Stormwater Construction General Permit
cm	centimeter
CO_2	carbon dioxide
CWA	Clean Water Act
CWAL	cold water aquatic life
CWE	cumulative watershed effects
DEQ	Idaho Department of Environmental Quality
dbh	diameter at breast height
EPA	United States Environmental Protection Agency
FPA	Idaho Forest Practices Act
FSA	Farm Services Agency
FWS	United States Fish and Wildlife Service
GIS	geographic information systems
ha	hectare
HTG	habitat type group
HUC	hydrologic unit code
I.C.	Idaho Code
ICBEMP	Interior Columbia Basin Ecosystem Management Project
IDAPA	refers to citations of Idaho administrative rules
IDFG	Idaho Department of Fish and Game
IDL	Idaho Department of Lands
IDWR	Idaho Department of Water Resources
IPNF	Idaho Panhandle National Forests
km	kilometer
kWh/d	kilowatt-hour per day
LA	load allocation
LC	load capacity
LiDAR	light detection and ranging
m	meter
MDAT	maximum daily average temperature
MDMT	maximum daily maximum temperature
mi	mile
mi^2	square miles
MOS	margin of safety
MS4	Municipal Separate Storm Sewer System
MSGP	Industrial Stormwater Multi-Sector General Permit
MWMT	maximum weekly maximum temperature
n.a.	not applicable
NA	not assessed

NAIP	National Agriculture Imagery Program
NB	natural background
nd	no data (data not available)
NHD	National Hydrography Dataset
NPDES	National Pollutant Discharge Elimination System
PNV	potential natural vegetation
QAPP	quality assurance project plan
SAP	sampling and analysis plan
SBA	subbasin assessment
SS	salmonid spawning
STATSGO	State Soil Geographic Database
TIR	thermal infrared
TMDL	total maximum daily load
US	United States
USC	United States Code
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USFS	United States Forest Service
USGS	United States Geological Survey
VRU	vegetation response unit
WAG	watershed advisory group
WLA	wasteload allocation
WQLS	water quality limited segment

Executive Summary

This document addresses water temperature conditions in the streams and rivers of the Upper (North Fork) Coeur d'Alene River subbasin and is an addendum to the 2001 *Subbasin Assessment and Total Maximum Daily Loads of the North Fork Coeur d'Alene River*. The document includes background information about the subbasin and water temperature concerns, a pollutant source inventory, a summary of monitoring and the status of water quality improvements, and temperature total maximum daily loads (TMDLs). This TMDL analysis has been developed to comply with Idaho's TMDL requirements and quantifies pollutant sources, establishes load allocations, and assigns responsibility for load reductions needed to meet water quality standards and restore full support of beneficial uses.

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 §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 requires 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, also called the §303(d) list, of impaired waters. This list must be published every 2 years and is published in Idaho as the list of Category 5 waters in the Integrated Report. For waters identified on this list, states and tribes must develop a TMDL for the pollutant(s) causing impairment, set at a level to achieve water quality standards.

DEQ established temperature TMDLs for 54 assessment units (AUs) with water temperatures exceeding Idaho's water quality standards (Figure A; Table A). An AU is a segment of a water body that is treated as a single unit and given a unique alphanumeric identifier by DEQ. In the 2008 Integrated Report, 31 AUs were listed as impaired by temperature. An additional 23 AUs were listed as impaired by temperature in the 2010 Integrated Report. This document addresses the temperature conditions and TMDLs for all 54 of these AUs. For more information about the watersheds, other pollutants, and the subbasin as a whole, see the 2001 *Subbasin Assessment and Total Maximum Daily Loads of the North Fork Coeur d'Alene River*.

Subbasin at a Glance

The Upper (North Fork) Coeur d'Alene River subbasin (hydrologic unit code [HUC] 17010301) is located in northern Idaho at the headwaters of the Spokane River Basin. The 895-square mile subbasin spans three counties: Kootenai, Bonner, and Shoshone. Land use within the subbasin is diverse and includes agriculture, silviculture, recreation, residential use, and mining. The US Forest Service (USFS) is the major landowner in the subbasin and manages 540,033 acres (94%) of the subbasin's land area. Private landowners, the State of Idaho, and the US Bureau of Land Management (BLM) manage the remaining 6% of land area. The subbasin contains seven major watersheds and 1,121 stream miles divided into 79 assessment units. Beneficial uses of stream surface waters include cold water aquatic life and salmonid spawning throughout the subbasin. Criteria for protection of bull trout have been applied in applicable watersheds.

Subbasin	Upper (North Fork) Coeur d'Alene River Subbasin
Hydrologic Unit Code	17010301
Watershed Area	895 square miles
Land Uses	Forestry, Agriculture, Recreation, Mining, Rural Residential
Pollutant Addressed	Temperature
Beneficial Uses Affected	Cold Water Aquatic Life and Salmonid Spawning
Assessment Units with TMDLs	54

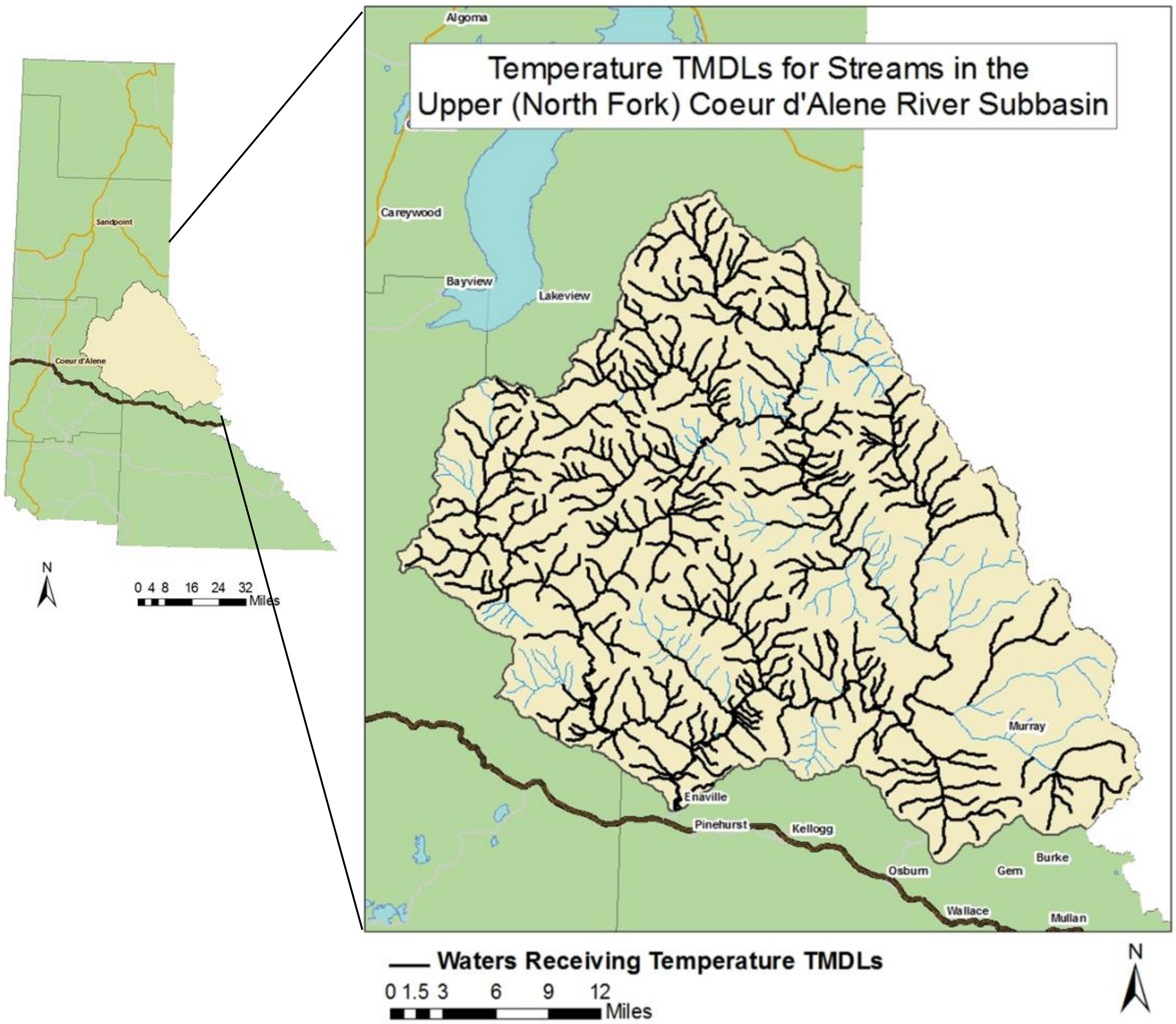

Figure A. Subbasin at a glance.

Table A. Stream assessment units for which temperature TMDLs were developed.

Assessment Unit Number	Assessment Unit Name
ID17010301PN001_02	North Fork Coeur d’Alene River tributaries below Prichard Creek
ID17010301PN001_05	North Fork Coeur d’Alene River below Prichard Creek
ID17010301PN001_05a	North Fork Coeur d’Alene River between Yellowdog and Prichard Creeks
ID17010301PN002_03	Graham Creek below Deceitful Gulch
ID17010301PN003_02	Beaver Creek headwaters and tributaries
ID17010301PN003_03	Beaver Creek below White Creek
ID17010301PN004_04	Prichard Creek below Eagle Creek
ID17010301PN005_02	Prichard Creek headwaters and tributaries above Butte Gulch
ID17010301PN008_02	West Fork Eagle Creek and tributaries
ID17010301PN009_03	Lost Creek below East Fork Lost Creek
ID17010301PN010_03	Shoshone Creek below Falls Creek
ID17010301PN011_02	Falls Creek and tributaries
ID17010301PN012_02	Shoshone Creek headwaters and tributaries above Falls Creek
ID17010301PN012_03	Shoshone Creek between Little Lost Fork and Falls Creek
ID17010301PN013_02	North Fork Coeur d’Alene River tributaries between Tepee and Yellowdog Creeks
ID17010301PN013_04	North Fork Coeur d’Alene River between Jordan and Tepee Creeks
ID17010301PN013_05	North Fork Coeur d’Alene River between Tepee and Yellowdog Creeks
ID17010301PN014_03	Jordan Creek and Lower Lost Fork
ID17010301PN015_02	North Fork Coeur d’Alene River, upper, headwaters, and tributaries
ID17010301PN015_03	North Fork Coeur d’Alene River, upper, and lower Buckskin Creek
ID17010301PN015_04	North Fork Coeur d’Alene River between Buckskin and Jordan Creeks
ID17010301PN016_02	West Elk Creek and Cataract Creek
ID17010301PN017_04	Tepee Creek between Trail Creek and Independence Creek
ID17010301PN017_05	Tepee Creek below Independence Creek
ID17010301PN018_02	Independence Creek headwaters and tributaries
ID17010301PN018_03a	Declaration Creek, lower
ID17010301PN018_03b	Snow Creek, lower
ID17010301PN018_04	Independence Creek below Declaration Creek
ID17010301PN019_02	Trail Creek headwaters and tributaries
ID17010301PN019_03	Trail Creek below Stewart Creek
ID17010301PN020_02	Tepee Creek headwaters and tributaries
ID17010301PN020_03	Tepee Creek between Short Creek and Trail Creek
ID17010301PN021_02	Brett Creek and tributaries
ID17010301PN022_02	Miners Creek and tributaries
ID17010301PN023_03	Flat Creek, lower
ID17010301PN024_02	Yellowdog Creek and tributaries
ID17010301PN026_02	Brown Creek and tributaries
ID17010301PN028_02	Steamboat Creek headwaters and tributaries
ID17010301PN028_03	Steamboat Creek and West Fork Steamboat Creek below Comfy Creek
ID17010301PN029_03	Cougar Gulch below East Fork Cougar Gulch
ID17010301PN030_02a	Little North Fork Coeur d’Alene River tributaries above Iron Creek
ID17010301PN030_02c	Little North Fork Coeur d’Alene River tributaries between Hudlow and Deception Creeks
ID17010301PN030_02d	Little North Fork Coeur d’Alene River tributaries below Skookum Creek
ID17010301PN030_03	Little North Fork Coeur d’Alene River between Solitaire and Skookum Creeks
ID17010301PN030_04	Little North Fork Coeur d’Alene River below Skookum Creek
ID17010301PN031_02	Bumblebee Creek and tributaries
ID17010301PN032_02	Laverne Creek and tributaries
ID17010301PN033_02	Leiberg Creek and tributaries
ID17010301PN034_02	Bootjack Creek and tributaries
ID17010301PN035_02	Iron Creek and tributaries
ID17010301PN036_02	Burnt Cabin Creek and tributaries
ID17010301PN037_02	Deception Creek and tributaries
ID17010301PN038_03	Skookum Creek, lower
ID17010301PN039_03	Copper Creek, lower

Water temperature strongly affects the life cycles of fish and other aquatic species, and different water temperature regimes determine whether a warm, cool, or coldwater aquatic community is present in a water body. Temperatures outside the natural range of variability can be harmful to fish at all life stages, especially if occurring in combination with other stressors. High water temperatures can have damaging chronic (long-term) and acute (short-term) effects to coldwater aquatic life. For adult fish, chronic exposure to high water temperatures can result in reduced body weight, reduced oxygen exchange, increased susceptibility to disease, and reduced reproductive capacity. Acute exposure to high water temperatures can be lethal if fish are unable to seek refuge in cooler water. Water temperatures also affect embryonic development of fish, juvenile growth and survival, and aquatic invertebrates, amphibians, and mollusks.

Key Findings

- Streams in the subbasin have high water temperatures in the summer that are harmful to fish and other aquatic life. The highest observed water temperatures are generally in the main stem North Fork Coeur d'Alene River and lower reaches of the largest tributaries. Smaller tributaries, springs, and side channel areas are often sources of cooler water and offer cool water refugia for fish.
- Stream temperature data from DEQ and the US Forest Service were available for 54 of the 79 stream AUs in the subbasin.
- Each of the 54 stream AUs analyzed exceeded one or more water quality criteria for temperature and were listed as impaired in the 2010 Integrated Report:
    - 6 stream AUs exceeded Idaho's water quality criteria for protection of cold water aquatic life.
    - All 54 stream AUs evaluated exceeded Idaho's water quality criteria for protection of salmonid spawning.
    - 3 stream AUs are included in the federal water quality criteria for protection of bull trout, and all 3 exceeded those criteria.
- Lack of riparian shade is the likely cause of excess water temperatures, and improvements in shade should reduce water temperatures and allow full support of cold water aquatic life.
- Temperature TMDLs were developed for 54 stream AUs using the potential natural vegetation method that establishes shade and solar load targets for the watersheds analyzed.

The 1998 §303(d) list of impaired waters originally included Prichard Creek from Barton Gulch to the North Fork Coeur d'Alene River as the only stream listed as impaired due to temperature, but Steamboat Creek was added to Idaho's 1998 §303(d) list by the Environmental Protection Agency (EPA) as exceeding Idaho's temperature criteria. As more data became available, many streams were added to the Idaho §303(d) list of impaired waters after 2000 due to temperature.

The 2008 Integrated Report included 31 AUs listed as temperature-impaired. In 2009, DEQ completed a full temperature assessment to analyze all water temperature data available in the subbasin. Of 79 total AUs in the subbasin, all 54 AUs with temperature data exceeded at least one portion of the Idaho water quality criteria for temperature. The 2009 assessment also found that three of the AUs listed as temperature-impaired in 2008 did not have any water temperature data available. For the 2010 Integrated Report, DEQ removed temperature as a pollutant causing impairment of these three units. The 54 AUs listed in the 2010 Integrated Report with temperature impairments received temperature TMDLs in this document. An additional 25 AUs that are not listed as temperature impaired have been included in this analysis for informational purposes only (Table B). This TMDL is built upon the results of the 2009 subbasin assessment for temperature and the 2010 Integrated Report.

Table B. Summary of temperature assessment outcomes for all 79 assessment units in the subbasin.

Assessment Unit Number	Assessment Unit Name	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
ID17010301PN001_02	North Fork Coeur d'Alene River tributaries below Prichard Creek	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN001_02a	North Fork Coeur d'Alene River tributaries between Yellowdog and Prichard Creeks	No	Temperature not assessed.	No temperature data available.
ID17010301PN001_05	North Fork Coeur d'Alene River below Prichard Creek	Yes	Move to Category 4a.	USFS data exceeded SS and CWAL criteria. Excess solar load from lack of shade.
ID17010301PN001_05a	North Fork Coeur d'Alene River between Yellowdog and Prichard Creeks	Yes	Move to Category 4a.	USFS data exceeded SS and CWAL criteria. Excess solar load from lack of shade.
ID17010301PN002_02	Graham Creek headwaters and tributaries	No	Temperature not assessed.	No temperature data available.
ID17010301PN002_03	Graham Creek below Deceitful Gulch	Yes	Move to Category 4a.	DEQ data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN003_02	Beaver Creek headwaters and tributaries	Yes	Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN003_03	Beaver Creek below White Creek	Yes	Move to Category 4a.	DEQ and USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN004_02	Prichard Creek tributaries between Butte Gulch and Eagle Creek	No	Temperature not assessed.	No temperature data available.
ID17010301PN004_03	Prichard Creek between Butte Gulch and Eagle Creek	No	Delisted in 2010. Temperature not assessed.	No temperature data available.
ID17010301PN004_04	Prichard Creek below Eagle Creek	Yes	Move to Category 4a.	DEQ and USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN005_02	Prichard Creek headwaters and tributaries above Butte Gulch	Yes	Move to Category 4a.	DEQ and USFS data exceeded SS criteria. Excess solar load from lack of shade.

Assessment Unit Number	Assessment Unit Name	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
ID17010301PN005_03	Prichard Creek between Barton Gulch and Butte Gulch	No	Delisted in 2010. Temperature not assessed.	No temperature data available.
ID17010301PN006_02	Butte Gulch	No	Temperature not assessed.	No temperature data available.
ID17010301PN007_02	East Fork Eagle Creek and tributaries	No	Temperature not assessed.	No temperature data available.
ID17010301PN007_03	Eagle Creek	No	Temperature not assessed.	No temperature data available.
ID17010301PN008_02	West Fork Eagle Creek and tributaries	Yes	Move to Category 4a.	DEQ and USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN009_02	Lost Creek headwaters and tributaries	No	Temperature not assessed.	No temperature data available.
ID17010301PN009_03	Lost Creek below East Fork Lost Creek	Yes	Move to Category 4a.	DEQ data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN010_02	Shoshone Creek tributaries below Falls Creek	No	Temperature not assessed.	No temperature data available.
ID17010301PN010_03	Shoshone Creek below Falls Creek	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS and CWAL criteria. Excess solar load from lack of shade.
ID17010301PN011_02	Falls Creek and tributaries	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS and EPA BT criteria. Excess solar load from lack of shade.
ID17010301PN012_02	Shoshone Creek headwaters and tributaries above Falls Creek	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN012_03	Shoshone Creek between Little Lost Fork and Falls Creek	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS and EPA BT criteria. Excess solar load from lack of shade.
ID17010301PN013_02	North Fork Coeur d'Alene River tributaries between Tepee and Yellowdog Creeks	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS and EPA BT criteria. Excess solar load from lack of shade.
ID17010301PN013_02a	North Fork Coeur d'Alene River tributaries between Jordan and Tepee Creeks	No	Temperature not assessed.	No temperature data available.
ID17010301PN013_04	North Fork Coeur d'Alene River between Jordan and Tepee Creeks	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS and EPA BT criteria. Excess solar load from lack of shade.
ID17010301PN013_05	North Fork Coeur d'Alene River between Tepee and Yellowdog Creeks	Yes	Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN014_02	Jordan Creek headwaters and tributaries	No	Temperature not assessed.	No temperature data available.

Assessment Unit Number	Assessment Unit Name	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
ID17010301PN014_02a	Cub Creek	No	Temperature not assessed.	No temperature data available.
ID17010301PN014_02b	Calamity Creek	No	Temperature not assessed.	No temperature data available.
ID17010301PN014_03	Jordan Creek and Lower Lost Fork	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN015_02	North Fork Coeur d'Alene River, upper, headwaters and tributaries	Yes	Move to Category 4a.	DEQ and USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN015_03	North Fork Coeur d'Alene River, upper, and lower Buckskin Creek	Yes	Move to Category 4a.	DEQ and USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN015_04	North Fork Coeur d'Alene River between Buckskin and Jordan Creeks	Yes	Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN016_02	West Elk Creek and Cataract Creek	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN017_02	Tepee Creek tributaries below Trail Creek	No	Temperature not assessed.	No temperature data available.
ID17010301PN017_04	Tepee Creek between Trail Creek and Independence Creek	Yes	Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN017_05	Tepee Creek below Independence Creek	Yes	Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN018_02	Independence Creek headwaters and tributaries	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN018_03	Independence Creek between Ellis and Declaration Creeks	No	Delisted in 2010. Temperature not assessed.	No temperature data available.
ID17010301PN018_03a	Declaration Creek, lower	Yes	Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN018_03b	Snow Creek, lower	Yes	Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN018_04	Independence Creek below Declaration Creek	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS and CWAL criteria. Excess solar load from lack of shade.
ID17010301PN019_02	Trail Creek headwaters and tributaries	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.

Assessment Unit Number	Assessment Unit Name	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
ID17010301PN019_03	Trail Creek below Stewart Creek	Yes	Move to Category 4a.	DEQ and USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN020_02	Tepee Creek headwaters and tributaries	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN020_03	Tepee Creek between Short Creek and Trail Creek	Yes	Move to Category 4a.	DEQ and USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN021_02	Brett Creek and tributaries	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN022_02	Miners Creek and tributaries	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN023_02	Flat Creek headwaters and tributaries	No	Temperature not assessed.	No temperature data available.
ID17010301PN023_03	Flat Creek, lower	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN024_02	Yellowdog Creek and tributaries	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN025_02	Downey Creek headwaters and tributaries	No	Temperature not assessed.	No temperature data available.
ID17010301PN025_03	Downey Creek, lower	No	Temperature not assessed.	No temperature data available.
ID17010301PN026_02	Brown Creek and tributaries	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS and EPA BT criteria. Excess solar load from lack of shade.
ID17010301PN027_03	Grizzly Creek, below Dewey Creek	No	Temperature not assessed.	No temperature data available.
ID17010301PN028_02	Steamboat Creek headwaters and tributaries	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN028_03	Steamboat Creek and West Fork Steamboat Creek below Comfy Creek	Yes	Move to Category 4a.	DEQ and USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN029_02	Cougar Gulch headwaters and tributaries	No	Temperature not assessed.	No temperature data available.
ID17010301PN029_03	Cougar Gulch below East Fork Cougar Gulch	Yes	List Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.

Assessment Unit Number	Assessment Unit Name	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
ID17010301PN030_02	Little North Fork Coeur d'Alene River tributaries to Solitaire Creek	No	Temperature not assessed.	No temperature data available.
ID17010301PN030_02a	Little North Fork Coeur d'Alene River tributaries above Iron Creek	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN030_02b	Hudlow Creek and tributaries	No	Temperature not assessed.	No temperature data available.
ID17010301PN030_02c	Little North Fork Coeur d'Alene River tributaries between Hudlow and Deception Creeks	Yes	Move to Category 4a.	DEQ data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN030_02d	Little North Fork Coeur d'Alene River tributaries below Skookum	Yes	Move to Category 4a.	DEQ data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN030_03	Little North Fork Coeur d'Alene River between Solitaire and Skookum Creeks	Yes	Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN030_04	Little North Fork Coeur d'Alene River below Skookum Creek	Yes	Move to Category 4a.	USFS data exceeded SS and CWAL criteria. Excess solar load from lack of shade.
ID17010301PN031_02	Bumblebee Creek and tributaries	Yes	Move to Category 4a.	DEQ data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN032_02	Laverne Creek and tributaries	Yes	Move to Category 4a.	DEQ and USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN033_02	Leiberg Creek and tributaries	Yes	Move to Category 4a.	DEQ data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN034_02	Bootjack Creek and tributaries	Yes	Move to Category 4a.	DEQ data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN035_02	Iron Creek and tributaries	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN036_02	Burnt Cabin Creek and tributaries	Yes	Move to Category 4a.	DEQ and USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN037_02	Deception Creek and tributaries	Yes	Move to Category 4a.	DEQ data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN038_02	Skookum Creek headwaters and tributaries	No	Temperature not assessed.	No temperature data available.

Assessment Unit Number	Assessment Unit Name	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
ID17010301PN038_03	Skookum Creek, lower	Yes	Listed Category 5 in 2010. Move to Category 4a.	DEQ data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN039_02	Copper Creek headwaters and tributaries	No	Temperature not assessed.	No temperature data available.
ID17010301PN039_03	Copper Creek, lower	Yes	Move to Category 4a.	DEQ data exceeded SS criteria. Excess solar load from lack of shade.

Note: US Forest Service (USFS); salmonid spawning (SS); cold water aquatic life (CWAL); US Environmental Protection Agency (EPA); bull trout (BT)

These temperature TMDLs were developed using the potential natural vegetation (PNV) method described by Shumar and De Varona (2009). Estimates were calculated for shade and solar loads under existing and target (potential) conditions in order to establish the temperature TMDL load allocations and the necessary load reductions to obtain temperatures at natural background conditions.

Estimated shade conditions and solar loads were variable among the streams evaluated. Most stream segments were within 20% of target shade conditions. Three assessment units had existing solar loads lower than the estimated target and load allocation: Graham Creek below Deceitful Gulch (ID17010301PN002_03), Lost Creek below East Fork Lost Creek (ID17010301PN009_03), and Steamboat Creek and West Fork Steamboat Creek below Comfy Creek (ID17010301PN028_03) The highest solar load reductions needed were in the lower portions of larger streams including the middle and lower North Fork Coeur d'Alene River, the lower Little North Fork Coeur d'Alene River, lower Trail Creek, and lower Tepee Creek. Areas with shade deficits over 50% include tributaries to the lower North Fork Coeur d'Alene River, stretches of upper Beaver Creek, portions of Falls Creek, lower Trail Creek (tributary to Tepee Creek), and portions of middle Tepee Creek. These areas should be considered priorities for TMDL implementation.

Introduction

The Clean Water Act (CWA) mandates that the chemical, physical, and biological integrity of the nation's waters be restored and maintained. In accordance with this mandate, the State of Idaho has adopted water quality standards to protect fish and wildlife while providing for recreation in and on the water, whenever attainable. As required by §303(d) of the CWA, the state must identify and prioritize water bodies that do not meet water quality standards and whose beneficial uses are not fully supported by water quality. This list of water bodies is called the §303(d) list and is published every 2 years as the list of Category 5 waters in DEQ's Integrated Report of statewide water quality status. The most recent US Environmental Protection Agency (EPA)-approved list of impaired water bodies is the Idaho Department of Environmental Quality's (DEQ's) 2010 Integrated Report (DEQ 2011). Waters identified as impaired must be addressed with total maximum daily loads (TMDLs) to bring them into compliance with water quality standards and full support of beneficial uses.

In 2001, DEQ completed a subbasin assessment and developed TMDLs to address sediment and metals (cadmium, lead, and zinc) impairments in the Upper (North Fork) Coeur d'Alene River subbasin (hydrologic unit code [HUC] 17010301). That document, the *Subbasin Assessment and Total Maximum Daily Loads of the North Fork Coeur d'Alene River* (DEQ 2001), contains a full subbasin assessment and details on water quality conditions focused on sediment and metals.

This addendum contains updated information on temperature conditions in streams of the subbasin. Once DEQ identified temperature impairments, loading analyses were performed to determine existing loads, load capacities, natural background conditions, and load allocations. In general, streams of this subbasin provide relatively high-quality habitat for trout and other coldwater species. However, water quality problems related to sediment and temperature continue to affect these organisms and prevent full support of the cold water aquatic life community. Through the implementation of the existing TMDLs for sediment and metals (DEQ 2001), and implementation of these TMDLs for temperature, water quality and habitat should improve and full support of coldwater aquatic life can be restored.

This document contains detailed information on the temperature TMDLs and loading analyses as well as information about the subbasin, beneficial uses and support status, pollutant sources, pollution control strategies, and recommendations for improving water temperatures and mitigating the effects of elevated temperatures in this subbasin. DEQ's primary goal with respect to these temperature TMDLs is to improve riparian conditions, thereby increasing shade and reducing stream temperatures for the benefit of coldwater organisms.

1 Subbasin Assessment—Watershed Characterization

The Upper (North Fork) Coeur d'Alene River subbasin is located in northern Idaho at the headwaters of the Spokane River Basin (Figure 1). The 895-square mile subbasin spans three counties: Kootenai, Bonner, and Shoshone.[1]

[1] See Appendix A for a unit conversion chart.

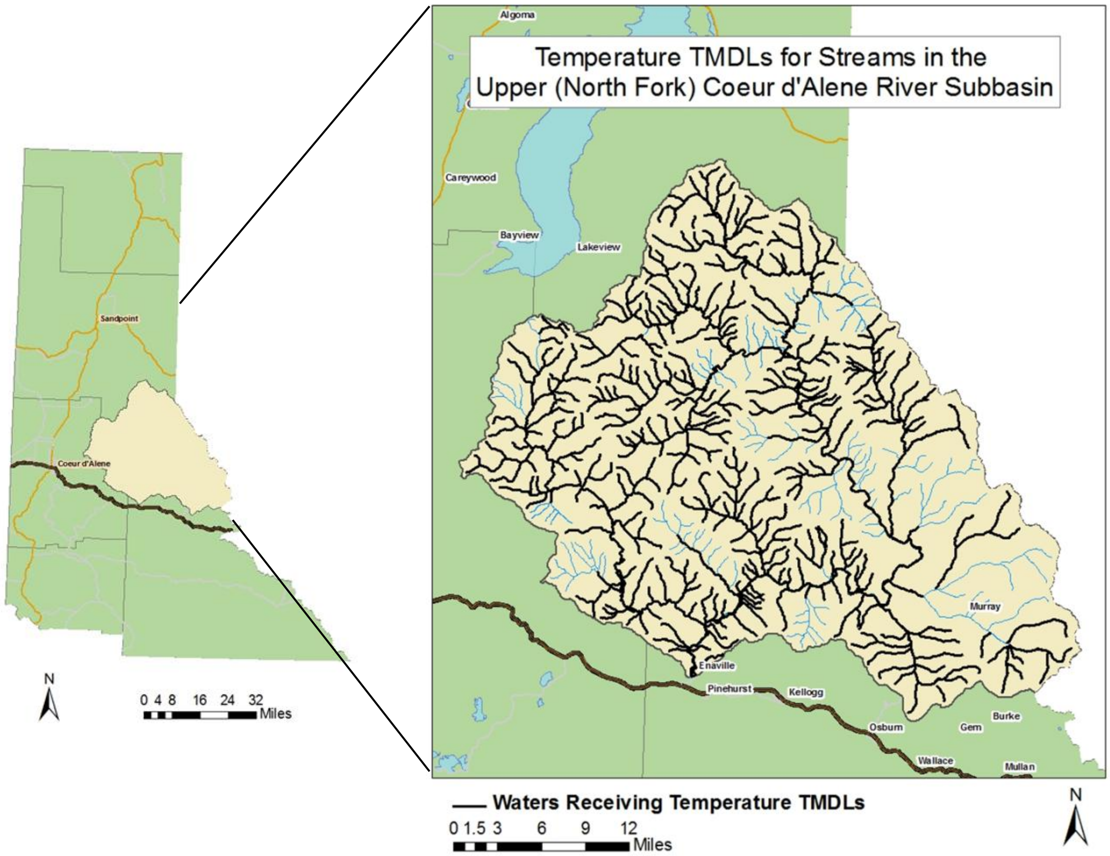

Figure 1. Upper (North Fork) Coeur d'Alene River subbasin in northern Idaho.

Currently, all streams in the subbasin that are part of the 1:100,000 national hydrography dataset (NHD) are divided by DEQ into 79 assessment units (AUs) for tracking, assessment, and management. Each AU receives an identification number (e.g., ID17010301PN003_02), and these are used to track and report the status of stream segments and lakes. AUs are groups of similar streams with similar land-use practices, ownership, or land management. Stream order and watershed boundaries are the main basis for determining AUs. Streams with similar stream orders are grouped together, and AUs are usually split when stream order changes or when crossing a major watershed boundary.

1.1 Physical and Biological Characteristics

A detailed discussion of the physical and biological characteristics of the Upper (North Fork) Coeur d'Alene River subbasin is provided in the *Subbasin Assessment and Total Maximum Daily Loads of the North Fork Coeur d'Alene River* (DEQ 2001).

Water temperature is an integral factor in determining the biological characteristics in a water body. Water temperature strongly influences the life cycles of fish and other aquatic species, and different water temperature regimes dictate whether a warm, cool, or coldwater aquatic community is present. Many factors, natural and anthropogenic, affect stream temperatures. Natural factors that affect water temperature include air temperature, elevation, aspect, climate, riparian vegetation, and channel morphology (e.g., width and depth). Humans influence water temperature through activities including heated discharges from point sources and alteration of riparian vegetation, stream channel dimensions, and flow.

Water temperatures outside the natural background range of variability can be harmful to fish at all life stages, especially if they occur in combination with other stressors like low dissolved oxygen, disease, or poor food supply. Fish vary in how well they tolerate temperature variations. Some species may tolerate wide ranges in temperature conditions and high water temperatures. Other species survive only in a relatively narrow range of temperatures and cannot tolerate high water temperatures. In Idaho, coldwater species like trout and salmon are the least tolerant of high water temperatures.

High water temperatures can be damaging to coldwater aquatic life as both a chronic (long-term) and an acute (short-term) stressor. For adult fish, chronic exposure to high water temperatures can result in reduced body weight, reduced oxygen exchange, increased susceptibility to disease, and reduced reproductive capacity. Acute exposure to high water temperatures can be lethal if fish are unable to seek refuge in cooler water. Water temperatures can create thermal migration barriers as fish avoid high temperatures. Juvenile fish are more sensitive to temperature variations than adult fish and can experience negative impacts, like lower growth rates, at lower temperatures than those that adversely affect adults. Water temperatures also affect embryonic development of fish and may affect aquatic invertebrates, amphibians, and mollusks.

The beneficial use of cold water aquatic life applies throughout the subbasin. The cold water aquatic life community consists of both native and nonnative coldwater species. The native complement of species includes westslope cutthroat trout (Figure 2), mountain whitefish, and bull trout (now thought to be extirpated in the subbasin). Nonnative coldwater species include rainbow trout, eastern brook trout, and Chinook salmon. Together, these species support a popular sport fishery. Other components of the coldwater aquatic community include amphibians, such as Pacific giant salamanders, and diverse invertebrates. High water temperatures can be harmful to coldwater aquatic life and may especially affect sensitive species.

Figure 2. Westslope cutthroat trout in the North Fork Coeur d'Alene River (Photo courtesy Ed Lider).

1.2 Cultural Characteristics

A detailed discussion of the cultural characteristics of the Upper (North Fork) Coeur d'Alene River subbasin is provided in the *Subbasin Assessment and Total Maximum Daily Loads of the North Fork Coeur d'Alene River* (DEQ 2001).

Land use within the subbasin is diverse and includes agriculture, silviculture, recreation (Figure 3), residential use, and mining.

Figure 3. Floating at the confluence of the North Fork Coeur d'Alene and Little North Fork Coeur d'Alene Rivers on a summer day.

The US Forest Service (USFS) is the major landowner in the subbasin, managing 540,033 acres (94%) of the subbasin's land area (Figure 4). Private landowners, the State of Idaho, and the US Bureau of Land Management (BLM) manage the remaining 6% of the land area. The subbasin contains seven major watersheds and 1,121 stream miles divided into 79 AUs.

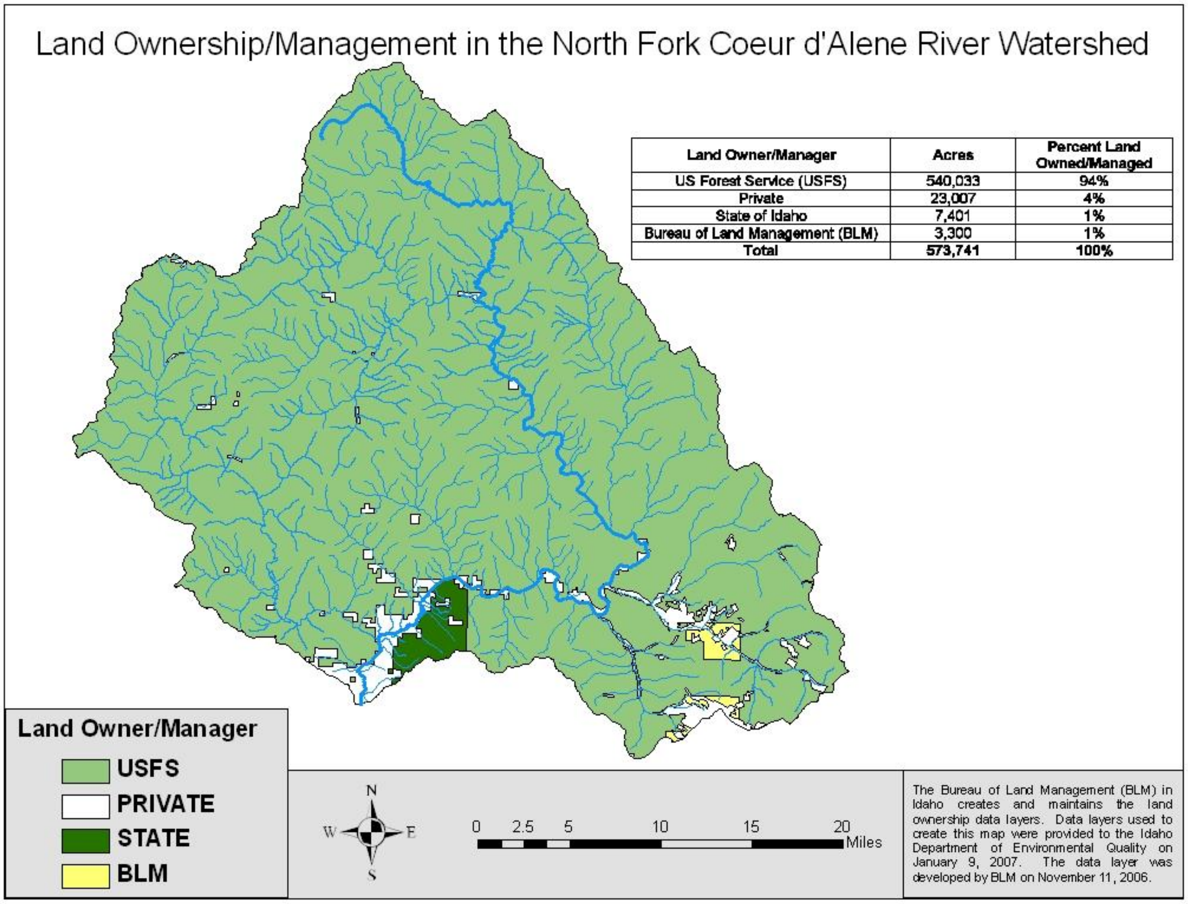

Figure 4. Patterns of landownership in the Upper (North Fork) Coeur d'Alene River subbasin.

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. Subsequently, these waters are required to have TMDLs developed to bring them into compliance with water quality standards.

In 1994, the US Environmental Protection Agency (EPA) identified Prichard Creek from Barton Gulch to the North Fork Coeur d'Alene River as impaired due to temperature. The full 1998 §303(d) list of impaired waters with additions from EPA included Prichard Creek and Steamboat Creek from its headwaters to the North Fork Coeur d'Alene River. These listings encompassed three current AUs for Prichard Creek (ID17010301PN004_03, ID17010301PN004_04, and ID17010301PN005_03) and two AUs for Steamboat Creek (ID17010301PN028_02 and ID17010301PN028_03). As more data became available, more streams were added to the Idaho §303(d) list of impaired waters in 2002, 2008, and 2010 related to water temperature.

The streams of the Upper (North Fork) Coeur d'Alene River subbasin were divided into 67 AUs for the 2002 Integrated Report (DEQ 2005b). In the 2002 Integrated Report, 27 AUs were considered water quality impaired due to excess water temperature. In the 2008 Integrated Report (DEQ 2009), the total stream length in the subbasin remained the same, but the total number of AUs increased from 67 to 76 due to AU splits. The 2008 Integrated Report included 31 AUs listed as temperature-impaired. The increasing number of identified temperature-related impairments more likely reflects a growing temperature data set rather than changes in water temperatures during that time.

In 2009, DEQ completed a full temperature assessment to analyze all water temperature data available in the subbasin. Data for 1997 and 1999 from 31 DEQ temperature recorders in 21 AUs indicated exceedances of Idaho's criteria for salmonid spawning. At the request of watershed advisory group (WAG) members, these data were supplemented by more extensive and current USFS temperature data sets. The USFS data included 252 temperature recorders from 44 AUs from 1998 to 2008. With these two data sources combined, only 25 of 79 AUs from the subbasin did not have any temperature data for evaluation. All 54 AUs with temperature data exceeded at least one portion of the Idaho water quality criteria for temperature.

The temperature assessment completed in 2009 found that 3 of the AUs listed as temperature-impaired in 2008 did not have any water temperature data available. For the 2010 Integrated Report, DEQ removed temperature as a pollutant causing impairment of these 3 AUs. The temperature assessment completed in 2009 also found exceedances of Idaho water quality criteria for temperature for another 23 AUs. These additional waters were listed in 2010 as temperature-impaired. In total, 54 assessment units were listed in 2010 with temperature impairments and received temperature TMDLs in this document (Figure 5; Table 1). This TMDL is built upon the results of the 2009 subbasin assessment for temperature and the 2010 Integrated Report (DEQ 2011).

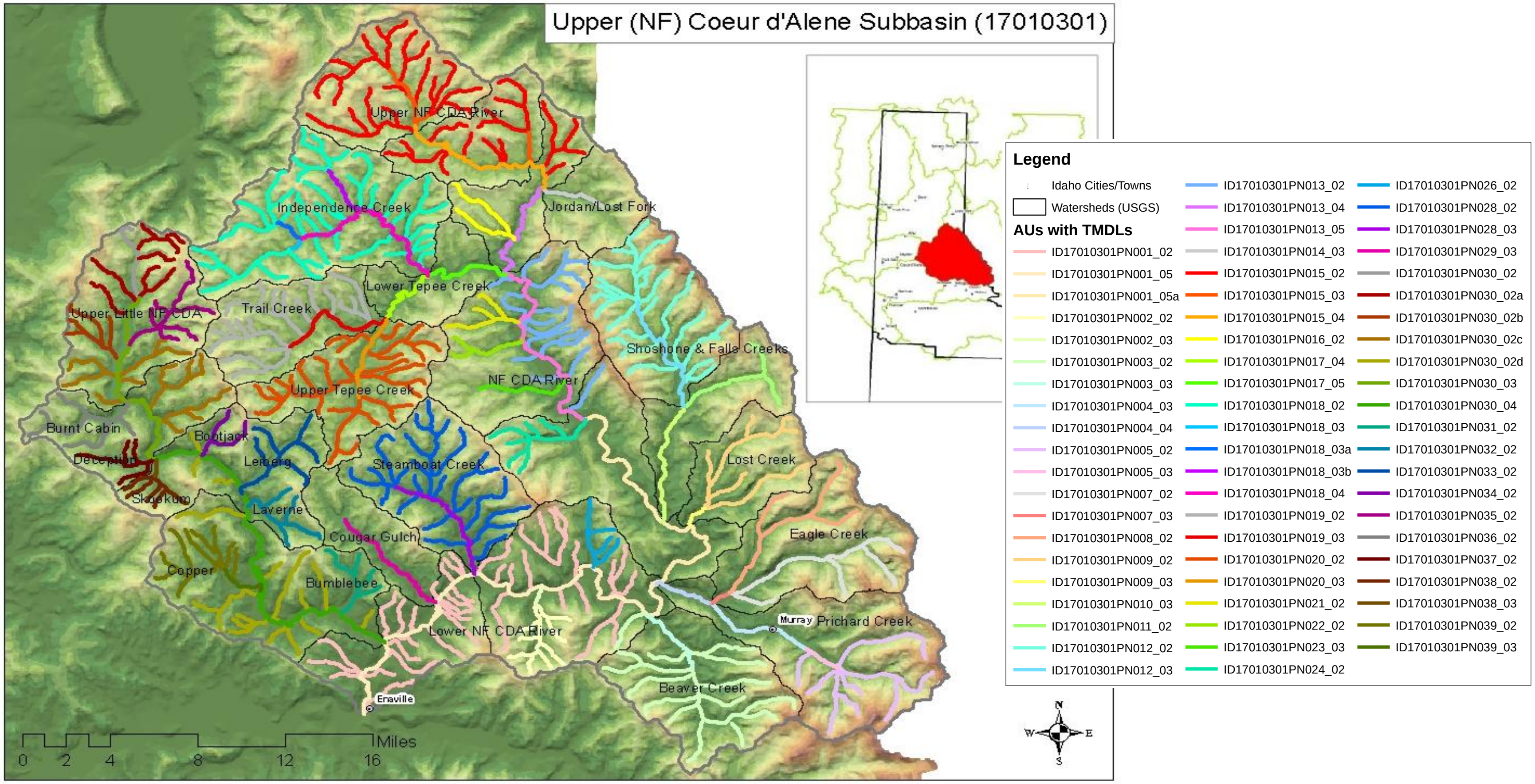

Figure 5. Upper (North Fork) Coeur d'Alene River subbasin streams included in temperature TMDL analysis with color-coded identification of stream assessment units.

Table 1. Stream assessment units listed as temperature impaired for which temperature TMDLs were developed.

Assessment Unit Number	Assessment Unit Name
ID17010301PN001_02	North Fork Coeur d'Alene River tributaries below Prichard Creek
ID17010301PN001_05	North Fork Coeur d'Alene River below Prichard Creek
ID17010301PN001_05a	North Fork Coeur d'Alene River between Yellowdog and Prichard Creeks
ID17010301PN002_03	Graham Creek below Deceitful Gulch
ID17010301PN003_02	Beaver Creek headwaters and tributaries
ID17010301PN003_03	Beaver Creek below White Creek
ID17010301PN004_04	Prichard Creek below Eagle Creek
ID17010301PN005_02	Prichard Creek headwaters and tributaries above Butte Gulch
ID17010301PN008_02	West Fork Eagle Creek and tributaries
ID17010301PN009_03	Lost Creek below East Fork Lost Creek
ID17010301PN010_03	Shoshone Creek below Falls Creek
ID17010301PN011_02	Falls Creek and tributaries
ID17010301PN012_02	Shoshone Creek headwaters and tributaries above Falls Creek
ID17010301PN012_03	Shoshone Creek between Little Lost Fork and Falls Creek
ID17010301PN013_02	North Fork Coeur d'Alene River tributaries between Tepee and Yellowdog Creeks
ID17010301PN013_04	North Fork Coeur d'Alene River between Jordan and Tepee Creeks
ID17010301PN013_05	North Fork Coeur d'Alene River between Tepee and Yellowdog Creeks
ID17010301PN014_03	Jordan Creek and Lower Lost Fork
ID17010301PN015_02	North Fork Coeur d'Alene River, upper, headwaters, and tributaries
ID17010301PN015_03	North Fork Coeur d'Alene River, upper, and lower Buckskin Creek
ID17010301PN015_04	North Fork Coeur d'Alene River between Buckskin and Jordan Creeks
ID17010301PN016_02	West Elk Creek and Cataract Creek
ID17010301PN017_04	Tepee Creek between Trail Creek and Independence Creek
ID17010301PN017_05	Tepee Creek below Independence Creek
ID17010301PN018_02	Independence Creek headwaters and tributaries
ID17010301PN018_03a	Declaration Creek, lower
ID17010301PN018_03b	Snow Creek, lower
ID17010301PN018_04	Independence Creek below Declaration Creek
ID17010301PN019_02	Trail Creek headwaters and tributaries
ID17010301PN019_03	Trail Creek below Stewart Creek
ID17010301PN020_02	Tepee Creek headwaters and tributaries
ID17010301PN020_03	Tepee Creek between Short Creek and Trail Creek
ID17010301PN021_02	Brett Creek and tributaries
ID17010301PN022_02	Miners Creek and tributaries
ID17010301PN023_03	Flat Creek, lower
ID17010301PN024_02	Yellowdog Creek and tributaries
ID17010301PN026_02	Brown Creek and tributaries
ID17010301PN028_02	Steamboat Creek headwaters and tributaries
ID17010301PN028_03	Steamboat Creek and West Fork Steamboat Creek below Comfy Creek
ID17010301PN029_03	Cougar Gulch below East Fork Cougar Gulch

Assessment Unit Number	Assessment Unit Name
ID17010301PN030_02a	Little North Fork Coeur d'Alene River tributaries above Iron Creek
ID17010301PN030_02c	Little North Fork Coeur d'Alene River tributaries between Hudlow and Deception Creeks
ID17010301PN030_02d	Little North Fork Coeur d'Alene River tributaries below Skookum Creek
ID17010301PN030_03	Little North Fork Coeur d'Alene River between Solitaire and Skookum Creeks
ID17010301PN030_04	Little North Fork Coeur d'Alene River below Skookum Creek
ID17010301PN031_02	Bumblebee Creek and tributaries
ID17010301PN032_02	Laverne Creek and tributaries
ID17010301PN033_02	Leiberg Creek and tributaries
ID17010301PN034_02	Bootjack Creek and tributaries
ID17010301PN035_02	Iron Creek and tributaries
ID17010301PN036_02	Burnt Cabin Creek and tributaries
ID17010301PN037_02	Deception Creek and tributaries
ID17010301PN038_03	Skookum Creek, lower
ID17010301PN039_03	Copper Creek, lower

Solar loading analyses were also completed for portions of some AUs without temperature data that are *not* §303(d) listed or known to be temperature impaired. This analysis is included to provide information about contributing loads and does not establish TMDLs for those streams (Table 2).

Table 2. Stream assessment units *not* listed as impaired by temperature but for which solar loading analyses were performed over at least portions of the water body. The information does not establish a TMDL and no load allocations are prescribed for these water bodies.

Assessment Unit Number	Assessment Unit Name
ID17010301PN001_02a	North Fork Coeur d'Alene River tributaries between Yellowdog and Prichard Creeks
ID17010301PN002_02	Graham Creek, headwaters and tributaries
ID17010301PN004_02	Prichard Creek tributaries between Butte Gulch and Eagle Creek
ID17010301PN004_03	Prichard Creek, between Butte Gulch and Eagle Creek
ID17010301PN005_03	Prichard Creek, between Barton Creek and Butte Gulch
ID17010301PN006_02	Butte Gulch
ID17010301PN007_02	East Fork Eagle Creek and tributaries
ID17010301PN007_03	Eagle Creek
ID17010301PN009_02	Lost Creek, headwaters and tributaries
ID17010301PN010_02	Shoshone Creek tributaries below Falls Creek
ID17010301PN013_02a	North Fork Coeur d'Alene River tributaries between Jordan Creek and Tepee Creek
ID17010301PN014_02	Jordan Creek, headwaters and tributaries
ID17010301PN014_02a	Cub Creek
ID17010301PN014_02b	Calamity Creek
ID17010301PN017_02	Tepee Creek tributaries, below Trail Creek
ID17010301PN018_03	Independence Creek, between Ellis Creek and Declaration Creek
ID17010301PN023_02	Flat Creek, headwaters and tributaries
ID17010301PN025_02	Downey Creek, headwaters and tributaries
ID17010301PN025_03	Downey Creek, lower

Assessment Unit Number	Assessment Unit Name
ID17010301PN027_03	Grizzly Creek, below Dewey Creek
ID17010301PN029_02	Cougar Gulch, headwaters and tributaries
ID17010301PN030_02	Little North Fork Coeur d'Alene River tributaries, headwaters to Solitaire Creek
ID17010301PN030_02b	Hudlow Creek, headwaters and tributaries
ID17010301PN038_02	Skookum Creek, headwaters and tributaries
ID17010301PN039_02	Copper Creek, headwaters and tributaries

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 fulfill CWA goals for "swimmable and fishable waters" and are categorized as existing uses, designated uses, and presumed uses. Refer to Idaho water quality standards, Section 3 of the *Water Body Assessment Guidance* (Grafe et al. 2002), and Appendix B of this document for additional detail regarding the identification of beneficial uses.

DEQ conducts water body assessments to determine if water quality is supporting beneficial uses of surface waters and whether water quality is exceeding water quality standards. The procedure to determine whether a water body fully supports its beneficial uses is outlined in IDAPA 58.01.02.054. The procedure relies heavily upon biological parameters and is detailed in the *Water Body Assessment Guidance* (Grafe et al. 2002). This guidance requires use of available relevant data to make beneficial use support status determinations. To complete water body assessments, beneficial uses must be determined, applicable water quality criteria must be identified, and data must be compiled and evaluated. The outcome of these assessments is used to develop the Integrated Report, which includes the CWA status of surface waters statewide.

Beneficial uses for waters in the North Fork Coeur d'Alene River subbasin include cold water aquatic life, salmonid spawning, primary contact recreation, secondary contact recreation, domestic water supply, special resource waters, agricultural water supply, industrial water supply, wildlife habitats, and aesthetics. Beneficial uses of stream surface waters relevant to these temperature TMDLs include cold water aquatic life and salmonid spawning throughout the subbasin and bull trout in designated watersheds.

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).

State and federal temperature criteria apply to waters in the Upper (North Fork) Coeur d'Alene River subbasin (Table 3). For these water body assessments and TMDLs, temperature criteria for protection of cold water aquatic life and salmonid spawning have been applied throughout the subbasin. Timing for the application of salmonid spawning criteria was determined based on recommendations from IDFG. For more information on water temperature criteria and their application in these TMDLs, refer to Appendix B. Criteria for protection of bull trout have been applied in applicable watersheds as defined by federal and state criteria (Table 3). Idaho water quality standards establish temperature criteria for bull trout in key watersheds (IDAPA

58.01.02.250.02.g), and federal criteria for bull trout protection have been promulgated by EPA in 40 CFR 131.33.

Table 3. Summary of applicable state and federal temperature criteria.

Type	Location	Criteria[a]	Dates	
Cold Water Aquatic Life Criteria	Applies to entire subbasin	22 ºC (71.6 ºF) Maximum Instantaneous (MDMT)	Applies entire year	
		19 ºC (66.2 ºF) Maximum Daily Average (MDAT)		
Salmonid Spawning Criteria	Applies to North Fork Coeur d'Alene River (headwaters to mouth), Prichard Creek (headwaters to mouth), and all other tributaries	13 ºC (55.4 ºF) Maximum Instantaneous (MDMT)	**Spring Spawning** >4,000 ft June 1–July 31 3,000–4,000 ft May 15–July 15 <3,000 ft May 1–July 1	**Fall Spawning** Aug 15–Nov 15
		9 ºC (48.2 ºF) Maximum Daily Average (MDAT)		
Current Idaho Bull Trout Criteria[b]	Applies to entire subbasin except 5th-order streams (Tepee Creek below Independence Creek, and North Fork Coeur d'Alene River below Tepee Creek)[c]	13 ºC (55.4 ºF) Maximum Weekly Maximum (MWMT)	**Rearing** June 1–Aug 31	n.a.
		9 ºC (48.2 ºF) Maximum Daily Average (MDAT)	n.a.	**Spawning** Sep 1–Oct 31
1998 Idaho Bull Trout Criteria	Applies to entire subbasin except 5th-order streams (Tepee Creek below Independence Creek, and North Fork Coeur d'Alene River below Tepee Creek)[c]	12 ºC (55.4 ºF) Maximum Daily Average (MDAT)	**Rearing** June 1–Aug 31	n.a.
		9 ºC (48.2 ºF) Maximum Daily Average (MDAT)	n.a.	**Spawning** Sep 1–Oct 31
EPA Bull Trout Criteria	Applies to Brown Creek, Falls Creek, and Graham Creek	10 ºC (50 ºF) Maximum Weekly Maximum (MWMT)	June 1–Sep 30	

[a] MDMT = Maximum Daily Maximum Temperature; MDAT = Maximum Daily Average Temperature; MWMT = Maximum Weekly Maximum Temperature
[b] Current Idaho temperature criteria for bull trout have not been approved or disapproved by EPA and therefore, the criteria adopted in 1998 are CWA-effective. See Appendix C for discussion.
[c] There are inconsistencies in the 1996 Bull Trout Conservation Plan (Batt 1996) identification of key watersheds referred to in IDAPA 58.01.02. See Appendix C for discussion.

2.4 Summary and Analysis of Existing Water Quality Data

A detailed summary and analysis of existing water quality data for the Upper (North Fork) Coeur d'Alene River subbasin is provided in the *Subbasin Assessment and Total Maximum Daily Loads of the North Fork Coeur d'Alene River* (DEQ 2001).

Numerous sources of water quality data were used in these water body assessments and temperature TMDLs (see Appendix D). DEQ monitoring data, primarily Beneficial Use Reconnaissance Program (BURP), were used as the baseline information about beneficial use support. Other data were obtained from multiple federal, state, and local entities. Watershed Professionals Network reports also include helpful compilations and analyses of water quality data in the subbasin.

In 2009, DEQ completed a full temperature assessment to analyze all water temperature data available in the subbasin. Data from 1997 and 1999 from 31 DEQ temperature recorders in 21 AUs exceeded Idaho’s criteria for salmonid spawning (Figure 6). At the request of North Fork Coeur d’Alene River WAG members, these data were supplemented by more extensive and current USFS temperature data sets. The USFS data sets included data collected by 252 temperature recorders from 44 AUs from 1998 to 2008. With DEQ and USFS data combined, only 25 of 79 AUs from the subbasin did not have any temperature data available for evaluation.

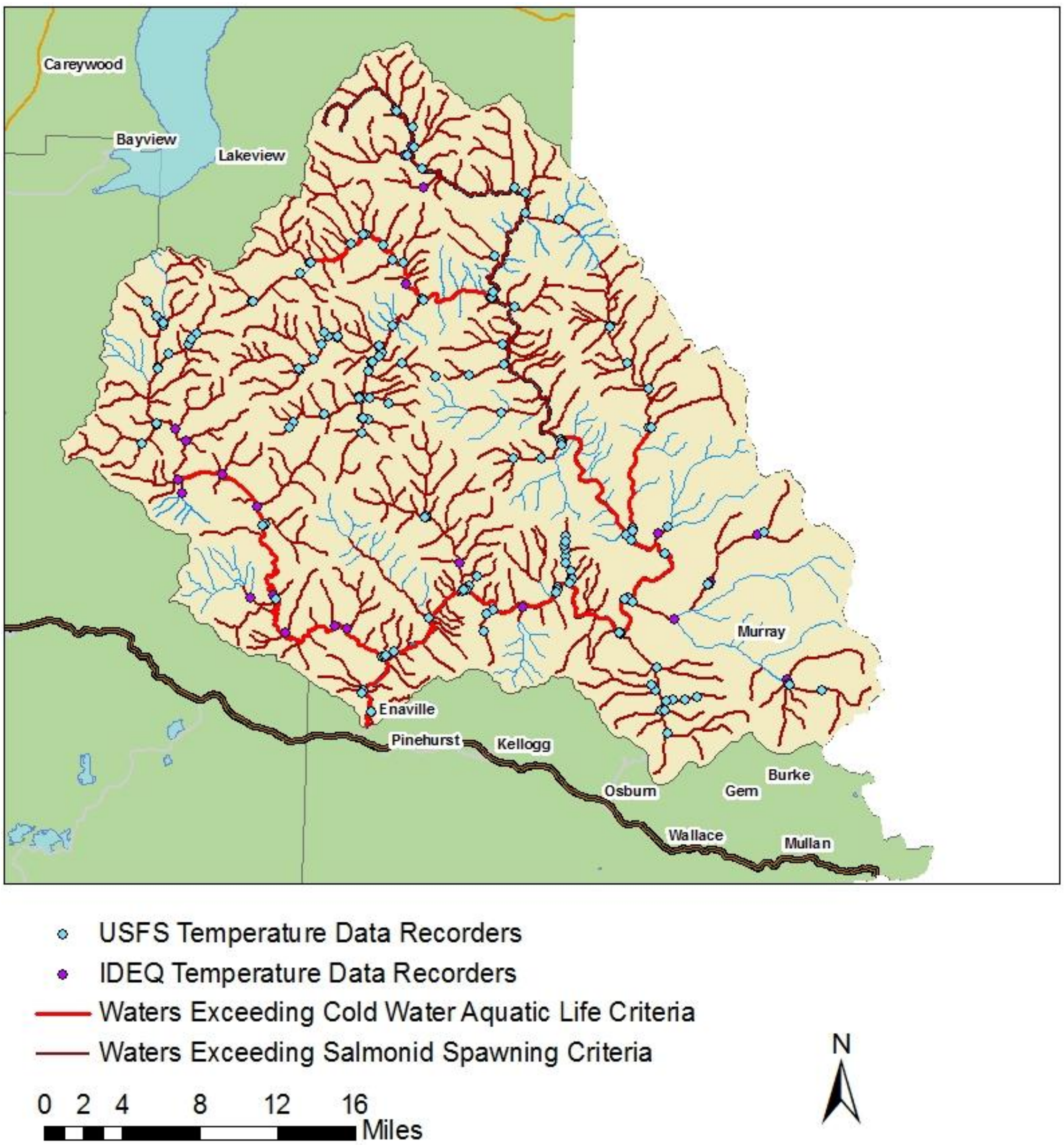

Figure 6. Temperature logger locations and assessment results for streams included in the DEQ temperature assessment for the Upper (North Fork) Coeur d’Alene River subbasin.

Assessments found widespread exceedances of Idaho numeric water temperature criteria, particularly for salmonid spawning. All of the 54 AUs with temperature data exceeded at least one portion of the Idaho water quality criteria for temperature (Table 3). All 54 AUs exceeded the salmonid spawning criteria in at least one portion of the year, 3 AUs exceeded the federal bull trout criteria (see Appendices B and C), and 6 AUs exceeded Idaho’s warmest criteria for cold water aquatic life (Table 3).

Water temperatures in the main stem North Fork Coeur d’Alene River and its larger tributaries reached temperatures greater than 22 degrees Celsius (°C), exceeded the numeric criteria for cold water aquatic life, and exhibited conditions that could be harmful to trout and other coldwater species (Table 4).

Table 4. Streams exceeding criteria for cold water aquatic life.

Assessment Unit Number	Assessment Unit Name
ID17010301PN001_05	North Fork Coeur d’Alene River below Prichard Creek
ID17010301PN001_05a	North Fork Coeur d’Alene River between Yellowdog and Prichard Creeks
ID17010301PN010_03	Shoshone Creek below Falls Creek
ID17010301PN017_05	Tepee Creek below Independence Creek
ID17010301PN018_04	Independence Creek below Declaration Creek
ID17010301PN030_04	Little North Fork Coeur d’Alene River below Skookum Creek

The spatial patterns observed during the temperature assessments for this TMDL were similar to patterns observed during IDFG and USFS cooperative studies (Dupont et al. 2008). In addition to ongoing fisheries studies in the subbasin, IDFG and USFS biologists studied stream temperatures, habitat quality, and cutthroat trout movement and mortality intensively during 2003 and 2004. They found that maximum water temperatures in the North Fork Coeur d’Alene River were warmer than 22 °C nearly the entire length from Tepee Creek to the mouth. They also found that the warmest water temperatures in the subbasin occurred in the middle reaches of the North Fork Coeur d’Alene River from approximately 5 kilometers (km) above Shoshone Creek to approximately 8 km below Prichard Creek (Figure 7). Downstream of this area, temperatures tend to cool. Temperatures are also cooler in tributaries.

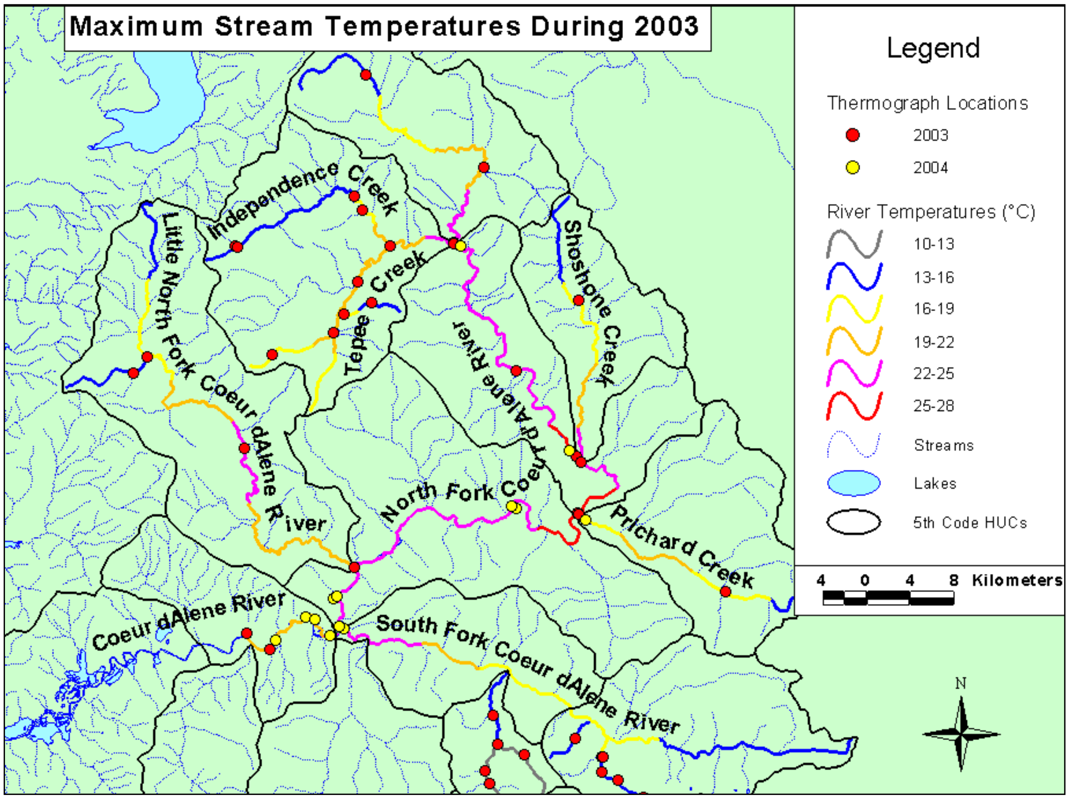

Figure 7. Stream temperature patterns observed during 2003 in Idaho Department of Fish and Game and US Forest Service cooperative study (Dupont et al. 2008).

The temporal patterns observed during the assessments for these TMDLs were also similar to patterns observed during other studies. For example, average maximum temperatures for the North Fork Coeur d'Alene River were highest in July and August (Figure 8). During these studies, biologists found summer afternoon temperatures in the North Fork Coeur d'Alene River above Shoshone Creek greater than 26 °C (Dupont et al. 2008). Trout located in these areas during snorkel surveys were observed lying on the river bottom and gasping. These signs of stress were attributed to the high water temperatures. They also found that trout utilizing these areas in the summer rather than migrating to cooler waters seemed to lose weight over the course of the summer and be in poorer condition than fish using cold water refugia. They also observed dead rainbow trout, mountain whitefish, and torrent sculpin believed to have died from temperature-related stress.

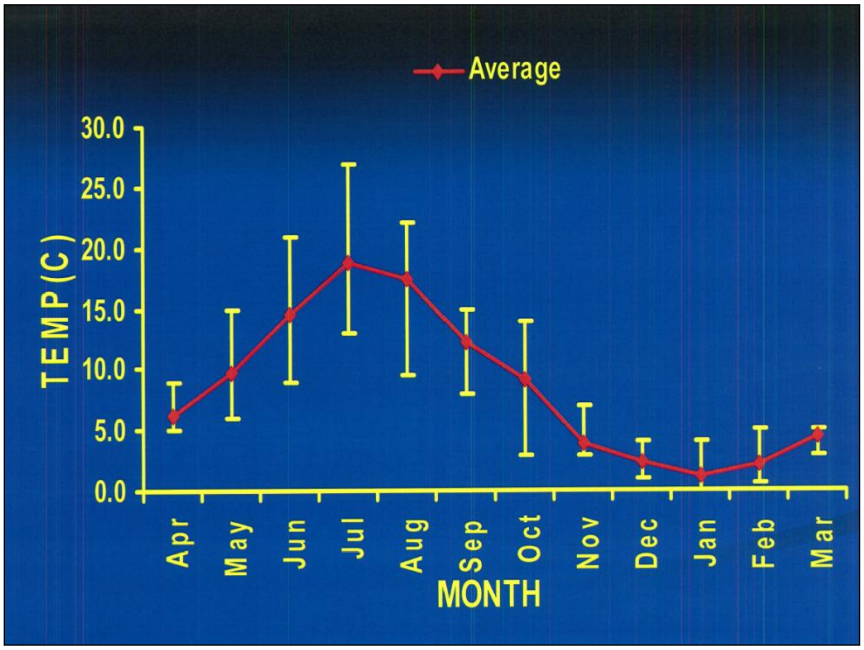

Figure 8. Average temperatures in North Fork Coeur d'Alene River in 2003 reflecting a typical pattern of warming for the river with peak temperatures in July and August. (Figure courtesy USFS.)

Cutthroat trout were thought to survive these high water temperatures due to the daily cycles of stream cooling and by moving into areas of cooler water when temperatures in the main river exceeded their thermal tolerance (Dupont et al. 2008). These areas of cooler water, known as refugia, were often associated with cooler tributaries of various sizes, springs, and side-channel habitats. Radio telemetry and snorkel surveys were paired with temperature studies and other data to evaluate these relationships.

In August 2007, an aerial thermal infrared survey of the North Fork Coeur d'Alene River was conducted. Funded by EPA and the USFS, this survey covered 31 miles from the confluence with the South Fork Coeur d'Alene River upstream to just above Shoshone Creek (Watershed Sciences 2007; Stevens and Dupont 2007). This survey identified temperatures of springs and tributary inflows and patterns in the main river temperature (Figure 9 and Figure 10). These studies identified biological effects of high water temperatures and suggested important activities that can mitigate these effects among coldwater aquatic life, particularly westslope cutthroat trout.

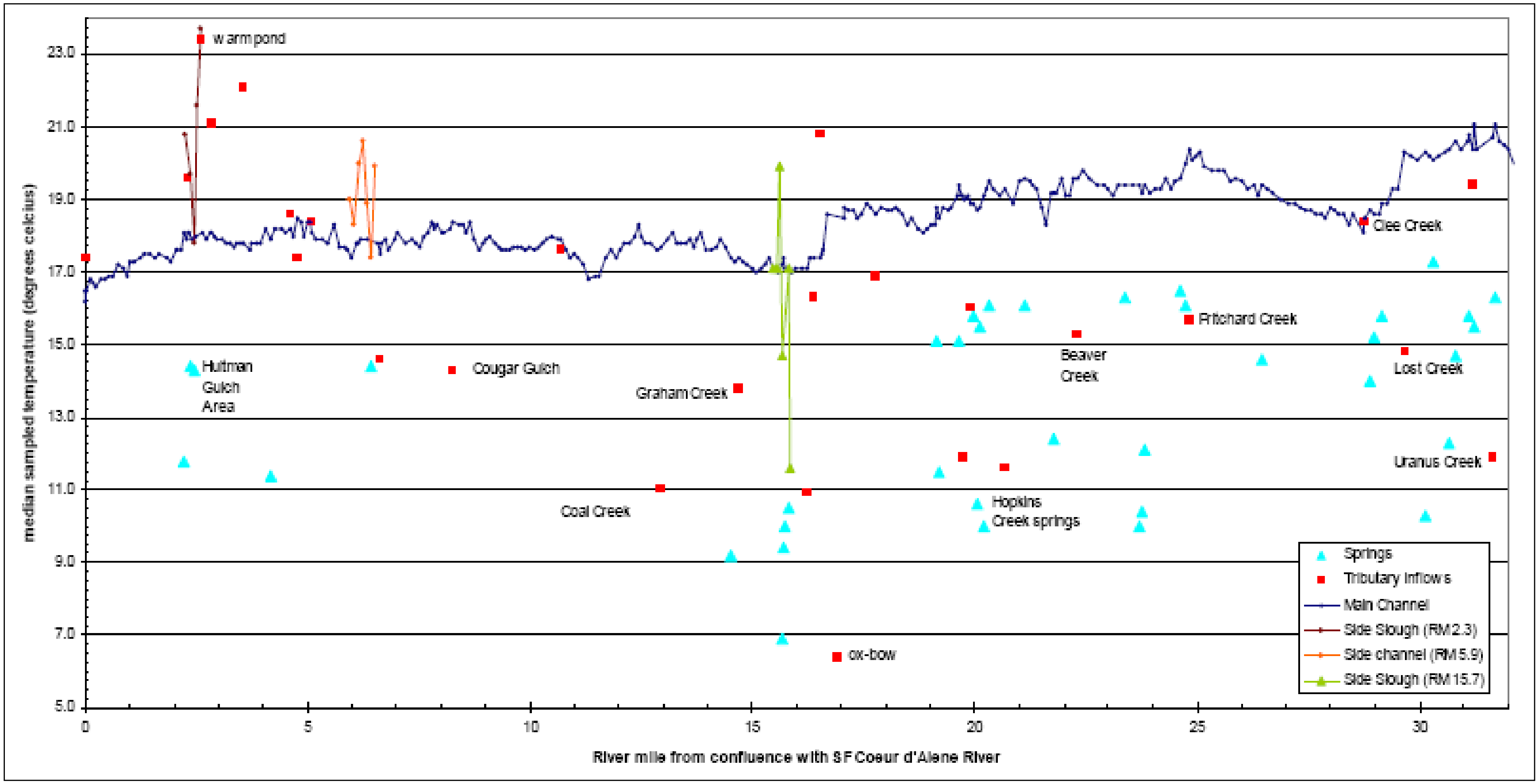

Figure 9. Median channel temperatures in the North Fork Coeur d'Alene River with locations of surface inflows (Watershed Sciences 2007).

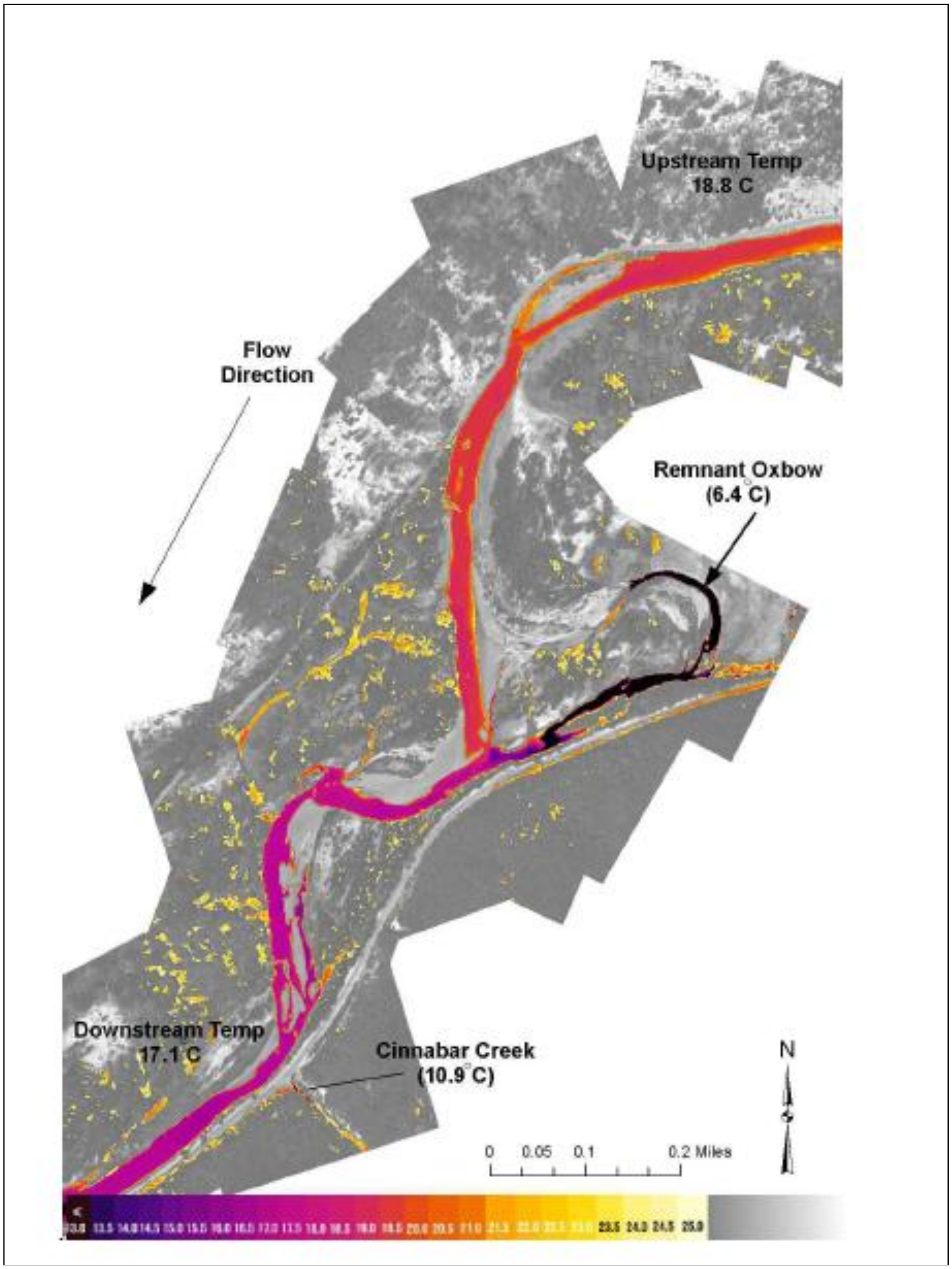

Figure 10. Example of coldwater side-channel habitat in a remnant oxbow of the North Fork Coeur d'Alene River showing the cooling effect of ground water influence (Watershed Sciences 2007).

The possible effects of climate change are also considered in this TMDL. Substantial scientific evidence indicates that air temperatures are rising across much of the earth, including the American West, and that most of this warming is due to increasing concentrations of carbon dioxide (CO_2) and other heat-trapping gases in the atmosphere (NRC 2010). While climate naturally varies in short-term and long-term patterns, research suggests that human activities are increasing greenhouse gases and causing air temperature changes far outside the natural range of variability (NRC 2010).

If predictions about the future climate are accurate, these changes pose economic and environmental threats to many parts of the world, including Idaho. Water resources and aquatic life are particularly at risk. Many possible impacts to water quality and aquatic life in the Pacific Northwest are presented by Hamlet et al. (2005); Karl et al. (2009); Mote and Salathé (2009); the National Research Council (2010); and Isaak, Luce, et al. (2010) and can be summarized as follows:

- Increasingly warm air temperatures—Average Pacific Northwest air temperatures have increased approximately 1.5 °F over the past century and are projected to rise another 3–10 °F during this century.
- Amplified precipitation variability with decreased summer precipitation and increased winter precipitation—Scientists expect more winter precipitation to fall as rain, resulting in decreased snowpack and increased winter flooding.
- Increased insect outbreaks, wildfire activity, and altered stream hydrologies—There may be more extensive seasonal dewatering, reduced summer streamflow, and increased channel disturbance from flooding, postfire landslides, and debris flows.
- Altered vegetation conditions—Forests are predicted to change in the future with altered species composition adapted to the most recent climate conditions. In some cases, forests may not return to their predisturbance condition following wildfire if the climate is dramatically different from historic conditions.
- Warming water temperatures in streams and rivers—Increasing air temperatures are already linked to warming water temperatures in the Columbia, Fraser, and Klamath Rivers.

The effects of water temperature on fish and other organisms have been described earlier in this document. Water temperature is a primary factor determining what types of aquatic life are present in a water body. The condition of aquatic life may be affected acutely and chronically by changes in temperature. Trout are particularly sensitive to water temperature, and temperature can be a limiting factor for the survival and distribution of various trout species. While trout may have the ability to adapt to changing water temperature conditions over time, rapid or extreme changes combined with multiple stressors may render some habitat unsuitable for these sensitive species.

Two native trout species are focal management species in this subbasin: westslope cutthroat trout and bull trout. Scientists evaluated the risk posed to westslope cutthroat trout by predicting increased summer temperatures, uncharacteristic winter flooding, and increased wildfires. They determined that 65% of habitat occupied by westslope cutthroat trout will be at high risk from one or more of these factors (Williams et al. 2009). Nearly all of the westslope cutthroat trout habitat within the North Fork Coeur d'Alene River subbasin was predicted to be at high risk from these factors, particularly winter flooding (Figure 11).

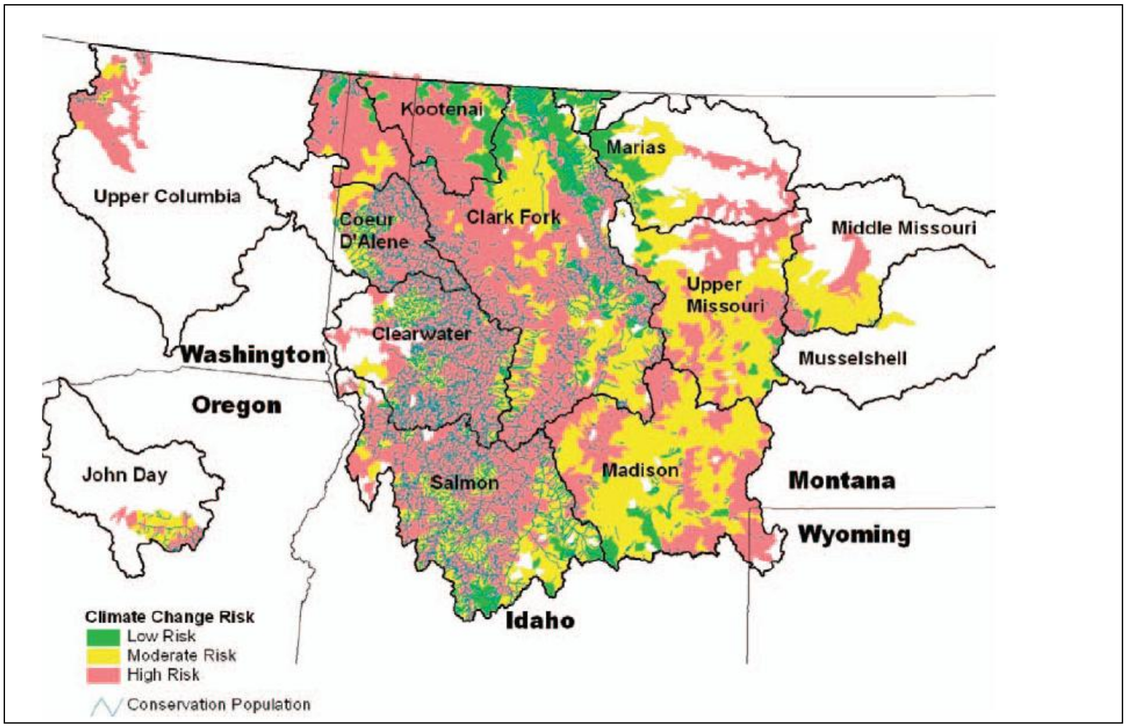

Figure 11. Composite climate change risk for watersheds within the historic range of westslope cutthroat trout. (Figure courtesy Williams et al. 2009.)

Other research has evaluated possible risk to bull trout from a changing climate. Researchers found that predicted warming could result in losses of 18–92% of thermally suitable spawning and rearing habitat areas and an even greater proportion of large (>10,000 hectares [ha]) habitat patches (Rieman et al. 2007). Rieman et al. modeled suitable habitat for bull trout in the North Fork Coeur d'Alene River subbasin under current conditions—though bull trout are thought to be locally extirpated—and found that current bull trout habitat is relatively vulnerable to even 100-meter (m) increases in the lower elevation limits for the species (Figure 12). In addition, stream temperature increases associated with a changing climate may allow nonnative species such as eastern brook trout, rainbow trout, and smallmouth bass to invade further upstream and potentially threaten the persistence of native trout (Fausch et al. 2006; Rieman et al. 2006; Rahel and Olden 2008; Isaak, Luce, et al. 2010).

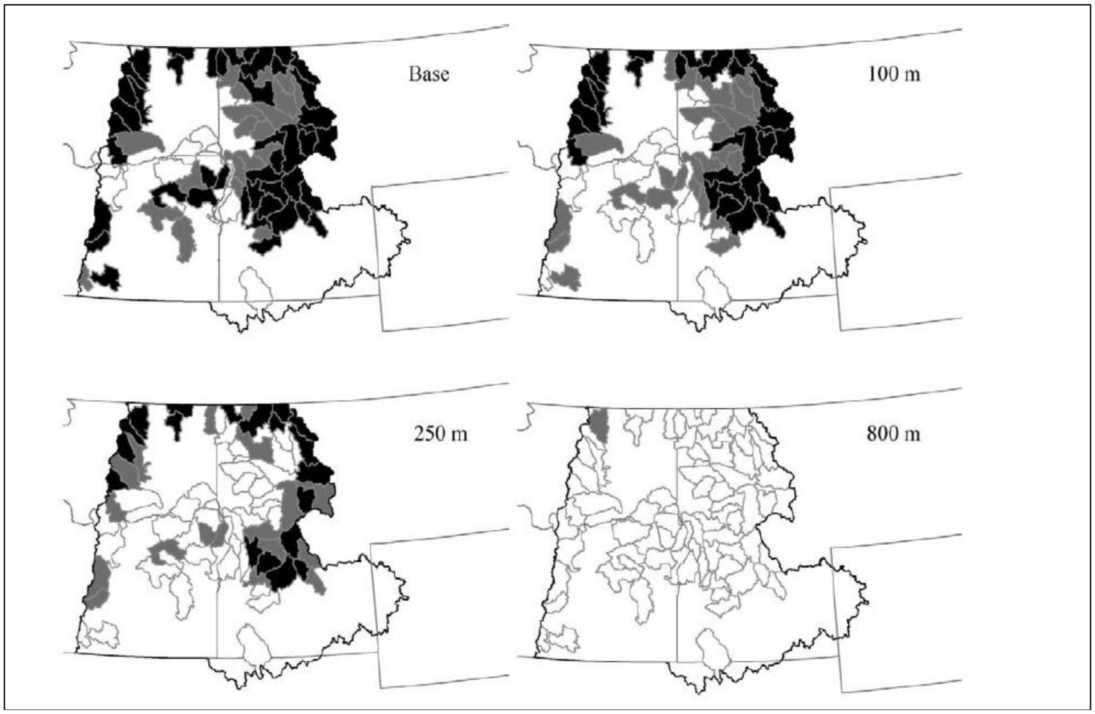

Figure 12. Risk of bull trout extirpation in interior Columbia River Basin subbasins assuming 100-, 250-, and 800-m increases in the lower elevation limits for this species as a result of climate warming. Risk was considered high (no shading), moderate (gray shading), or low (black shading) depending on the number of medium or large habitat patches remaining in each scenario. (Figure courtesy Rieman et al. 2007.)

These temperature TMDLs are designed to ensure water quality compliance with Idaho water quality standards based on current and historic climatic conditions. If predictions are correct, future changes in stream temperature related to warming air temperatures and changing climate may warrant further investigation. This information also suggests that efforts to protect and restore water quality are all the more important. Shade can provide cooling effects to the stream fairly independent of climate and can help to insulate the stream from increasing air temperatures. Considerations for climate change are incorporated into the TMDL implementation strategies portion of this document.

3 Subbasin Assessment—Pollutant Source Inventory

For a detailed discussion of pollutant sources in the subbasin, see the *Subbasin Assessment and Total Maximum Daily Loads of the North Fork Coeur d'Alene River* (DEQ 2001).

3.1 Point Sources

Point sources are sources of pollution from known discharge locations. There are no known National Pollutant Discharge Elimination System (NPDES)-permitted point sources in the subbasin.

3.2 Nonpoint Sources

Lack of riparian shade is the likely cause of excess water temperatures. Riparian shade loss has been caused by historic events and activities in the subbasin similar to those that have caused sediment loads. Roads, fires, and floods have affected riparian areas extensively. In addition, many riparian areas were heavily logged in the early days of timber harvest. Large cedar stumps are still clearly visible along the lower river corridor today, indicating the historic forest that once stood (Figure 13). Channel morphology changes have also affected solar loading, as many stream segments have become wider and shallower than they were under natural background conditions. Channels and shade conditions in most watersheds are recovering as management has changed over time to protect riparian zones.

Figure 13. Stumps can be observed along the North Fork Coeur d'Alene River where large trees were harvested during the early days of development in the subbasin.

Present-day anthropogenic riparian shade losses are caused primarily by roads and residential and recreational development along streams. Many riparian roads have been removed and reclaimed in recent decades. However, most of the main travel routes in the subbasin are located near streams and on floodplains (Figure 14), especially along the lower North Fork Coeur d'Alene River where riparian roads parallel both sides of the river. In this area, residential and recreational development has affected riparian shade, as many trees have been cleared to make space for trailers and reduce obstructed views of the river (Figure 15). Planting trees in riparian areas can help restore shade and other water quality benefits of healthy riparian vegetation (Figure 16).

Figure 14. Roads in riparian zones inhibit growth of healthy riparian vegetation and affect the solar load reaching streams.

Figure 15. Riparian vegetation has been largely removed along many recreational river lots, resulting in increased solar loads and erosion of unstable banks.

Figure 16. Planting trees along streams can help restore shade and other water quality benefits provided by healthy riparian vegetation.

4 Monitoring and Status of Water Quality Improvements

DEQ is currently completing a Five Year Review of the 2001 Subbasin Assessment and TMDLs of the North Fork Coeur d'Alene River. This report will summarize the monitoring and status of water quality improvements since the 2001 TMDL with a focus on improvements in sediment loads.

5 Total Maximum Daily Loads

A TMDL prescribes an upper limit (i.e., load capacity) on the discharge of a pollutant from all sources to ensure water quality standards are met. It 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 sources of the pollutant, when present, are considered part of the load allocation but may be identified separately 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 attaining water quality standards, the rules regarding TMDLs (40 CFR Part 130) require a margin of safety as part of the TMDL. Practically, the margin of safety is a reduction in the load capacity available for allocation to pollutant sources. The natural background load is also effectively a reduction in the load capacity available for allocation to anthropogenic pollutant sources. Load capacity can be summarized by the following equation:

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

Where:

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

The equation is written in this order because it represents the logical order in which a loading analysis is conducted. First, the load capacity is determined. Then, the load capacity is broken down into its components. The load capacity allocated to anthropogenic pollutant sources can be calculated by subtracting the margin of safety then the natural background. When the load analysis and allocation are complete, the TMDL must equal the load capacity.

Another step in a load analysis is quantifying current pollutant loads by sources. This step allows for the specification of load reductions as percentages of current conditions, considers equities in load reduction responsibility, and is necessary for pollutant trading to occur. The load capacity must be based on critical conditions (i.e., the conditions when water quality standards are most likely to be violated). Because both load capacity and pollutant loads can be highly variable, determining critical conditions can be quite complicated.

A pollutant load is fundamentally a quantity of pollutant discharged over some period of time and is generally the product of concentration and flow. Due to the diverse nature of various pollutants and the difficulty addressing pollutant loads, federal rules allow for "other appropriate measures" to be used when necessary. These "other measures" must be quantifiable and relate to water quality standards, but they allow flexibility to deal with pollutant loading in practical and tangible ways. The rules also recognize the particular difficulty of quantifying nonpoint source loads and allow "gross allotment" as a load allocation where available data or appropriate predictive techniques limit more accurate estimates. For certain pollutants with long-term effects, such as sediment and nutrients, EPA allows for seasonal or annual loads. This document analyzes solar loads measured as kilowatt-hours per day (kWh/d) during the 6-month period from April through September, the most critical period for temperature impairments.

5.1 Instream Water Quality Targets

The Upper (North Fork) Coeur d'Alene River subbasin temperature TMDLs were developed using a PNV approach. The Idaho water quality standards include a provision stating that if natural background conditions exceed numeric water quality criteria, this exceedance is not considered a violation of water quality standards (IDAPA 58.01.02.200.09). In these situations, natural background conditions become the water quality standard, and the natural background solar load (estimated from potential shade and natural bank-full width) becomes the target of the TMDL. The instream temperature that results from attaining natural background conditions is consistent with the water quality standards even if it exceeds numeric temperature criteria. Appendix B contains further discussion of water quality standards and the natural background provisions. The PNV approach for temperature TMDL development is summarized below and is described in detail in Shumar and De Varona (2009).

Potential Natural Vegetation for Temperature TMDLs

The PNV method is used when excess temperature loads to streams are due to solar radiation as a nonpoint source of pollution, solar radiation loads have increased as a result of riparian shade loss from human activities, and maximum shading under PNV will result in natural background stream temperatures. PNV along a stream is the riparian plant community that could grow to an overall mature state, although some level of natural disturbance within a historic range of variability is included in our development and use of shade targets. The riparian plant community is considered mature when the vegetation community is mature and undisturbed by anthropogenic sources and when vegetation height and density are at or near the potential expected for the given plant community.

Ground water temperature, air temperature, and direct solar radiation are all important heat contributors to streams (Poole and Berman 2001). Solar radiation is a primary factor in stream heat budgets (Johnson 2003; Caissie 2006) and is the source of heat most likely to be affected by land and resource management. Human activities causing excess solar loads include vegetation removal and road encroachment in riparian zones. The amount of solar radiation delivered to the stream is determined by factors including shade and stream morphology. Surrounding vegetation and other physical features such as hillsides, canyon walls, terraces, and high banks all provide shade. The prevailing aspect of the watershed is another important factor in determining shade levels. Stream morphology, including stream width and depth, affects the amount of solar radiation delivered to the stream and its effects on water temperature. Streamside vegetation and channel morphology are factors affecting shade and solar loading that may have been altered by human activities and may be most readily addressed by implementing a TMDL.

Riparian vegetation can be affected by natural events (e.g., wildlife grazing, disease, and wildfire) or by anthropogenic activities (e.g., livestock grazing, vegetation removal, and roads). Decreased shade could result in increased heating of the stream due to increased solar loads. Natural disturbances such as wildfires and floods are vitally important to maintaining biodiversity and forest health. Forest communities have evolved with adaptations to these natural disturbance patterns and continue to undergo succession towards PNV. Streams disturbed by natural disturbances are likely to have riparian vegetation less than PNV but would likely recover naturally over time without human intervention. Streams disturbed by human activity may require active restoration in addition to natural recovery.

Using the PNV approach, estimates are calculated for shade and solar loads under existing and potential (target) conditions in order to establish the temperature TMDL load allocations and the necessary load reductions to obtain temperatures at natural background conditions. Existing shade was estimated from visual evaluation of aerial photographs then partially field-verified with Solar Pathfinder data. Existing effective shade can be measured using a Solar Pathfinder or with other optical equipment similar to a fish-eye lens on a camera. The Solar Pathfinder is a device that can be used to estimate shade and solar loading to streams and is the recommended equipment for measuring riparian effective shade. Originally developed for solar power applications, the device consists of a convex lens and solar path chart mounted on a tripod. It is relatively affordable, lightweight, accurate, and simple to use. The device is placed in the middle of the stream at approximately bank-full water level, oriented to true south, and made level. Then a digital photograph is taken directly above the device to record the effective shade on the solar path chart. Once field sampling is completed, the photographs are analyzed using Solar Pathfinder software to quantify shade and solar loads over the 6-month critical time period (April through September).

Effective shade is the amount of shade provided by all objects that intercept solar radiation as the sun makes its way across the sky. Effective shade can be estimated from aerial photographs or by using a model with detailed information about riparian plants, topography, and stream aspect or measured using a Solar Pathfinder. Canopy cover is a measure related to shade and is the amount of vegetation directly over the stream. Canopy cover can be measured using a spherical densiometer and can be estimated visually on site or from aerial photographs. Canopy cover, or canopy closure, is the percentage of water covered by shade from the outermost perimeter of the natural spread of foliage from plants (Armantrout 1998). This measure is related to shade but is not synonymous, and several tools are available to determine canopy cover. The DEQ BURP program for wadeable streams measures canopy cover using a spherical concave densiometer modified with tape to show only 17 grid intersections (Bauer and Burton 1993; DEQ 2007b). This tool measures the vegetative canopy overhead in a view that is narrower than the Solar Pathfinder. The BURP protocol includes densiometer readings facing upstream and downstream from the stream center and facing the left and right banks at each location to characterize canopy cover. There are also other types of densiometers available including a spherical convex model.

We can estimate PNV, and therefore target shade, from models of plant community structure. Potential (target) shade was estimated using USFS vegetation information, bank-full width estimates, and shade curves for various vegetation types, aspects, and channel widths (discussed in more detail in Appendix E). The shade and solar loads observed at PNV result in natural background stream temperature and are the TMDL targets based on natural background provisions of the Idaho water quality standards (IDAPA 58.01.02.200.09) rather than numeric temperature criteria.

Comparing existing to potential shade reveals the shade deficit or amount of excess solar load received by the stream and the necessary solar load reduction. Existing and potential shade values were converted to solar load estimates. These conversions used solar load values supplied by the nearest National Renewable Energy Laboratory (NREL) in Missoula, Montana. At the NREL, solar load is recorded on flat-plate collectors.

Effective shade and solar loads at PNV conditions are assumed to be the natural background conditions of the water body. Assuming no point sources or other anthropogenic sources of heat exist in the watershed, stream temperatures under these conditions are assumed to be natural and consistent with Idaho water quality standards even if they exceed numeric criteria. The solar load at these conditions is established as the load capacity and the target of these TMDLs. When the existing solar load is greater than the potential solar load, the difference is the load reduction needed for the stream to meet water quality standards.

Design Conditions and Target Selection

Idaho water quality standards contain numeric water quality criteria for stream temperatures to support cold water aquatic life (Appendix B). Compliance with the numeric criteria for water temperature is one possible target for this TMDL. From a regulatory perspective, it would be ideal for stream temperatures in this subbasin to be below these numeric criteria; however, it is possible that natural background temperatures may exceed numeric criteria and still provide full support for cold water aquatic life. Natural background temperatures are not known for this subbasin, and this information is very difficult to obtain. Scientific evidence shows that solar radiation and shade are the primary determinants of stream thermal loading that are affected by human activities (Amaranthus et al. 1989; Cafferata 1990; Steedman et al. 1998; Poole and Berman 2001; Teti 2003; Rutherford et al. 2004; Thompson 2005). See also Shumar and De Varona (2009) for further discussion. Based on these relationships, this TMDL analysis asserts that natural background stream temperatures can be obtained under natural background riparian conditions with PNV. The shade provided by PNV and natural bank-full widths, and the associated solar load, is the primary target of this TMDL.

Determining Potential Solar Loads

To determine potential solar loads, the following components are required: solar radiation data, the estimated stream surface area under natural conditions, and estimates of shade under PNV.

The load analysis can be expressed as follows:

> potential solar load (kWh/d) = solar radiation (kWh/m^2/d) × natural background stream surface area (m^2) × potential shade factor (% of potential solar load not blocked by shade).

Each AU was divided into intervals based on estimated existing shade during aerial photo interpretation. Estimates of potential solar load were made for each stream interval, recorded in a load analysis table, and then summed for the entire AU. For detailed information on each parameter, refer to the load analysis tables in Appendix F.

Estimates of Solar Radiation

The data used to estimate the amount of solar radiation that could potentially be delivered to the stream surface under natural background conditions were the same data used to estimate existing solar loads. These data were obtained from the nearest NREL in Missoula, Montana. Flat-plate collectors are used to determine the amount of solar energy reaching the ground under full sun at these sites. This solar radiation information was used to calculate a 6-month average solar load of 5.5 kWh/m^2/d. The 6-month period of April through September is the critical time period when increasing air and water temperatures impact cold water aquatic life.

Estimates of Stream Surface Area under Natural Background Conditions

The stream surface area was estimated for each stream interval under natural background conditions. The length of the stream interval was estimated using geographic information system (GIS) software and aerial photos, and the same stream intervals were used for existing conditions. This information was combined with estimates of natural bank-full width to determine stream surface area.

Bank-full width is generally the width of the stream at the stage just before flooding begins and water overtops the banks into the floodplain. Bank-full width and discharge are common measures used to characterize streams, are associated with channel-forming flow events, and have a typical return interval of 1.5 years (Dunne and Leopold 1978; Rosgen 1996). Field indicators of bank-full width include perennial vegetation, changes in bank slope, and height of point bars. However, existing bank-full width may not be discernible from aerial photo interpretation and may not reflect natural bank-full widths. Bank-full width under natural conditions is estimated based on a regional curve relating the upstream drainage area to bank-full width. The curve was developed from US Geological Survey (USGS) gage discharge data compiled by Diane Hopster of the Idaho Department of Lands (IDL). For this TMDL, the Clearwater River Basin regional curve bank-full width estimate was applied with the following equation:

$$\text{Bank-full width} = 5.64 \times \text{Drainage area}^{0.52}.$$

The Clearwater River Basin curve (Figure 17) was selected because the basin is considered the least disturbed by human activities in northern Idaho and best approximates the natural background condition of the Upper (North Fork) Coeur d'Alene River subbasin. See Appendix D for more information on bank-full width.

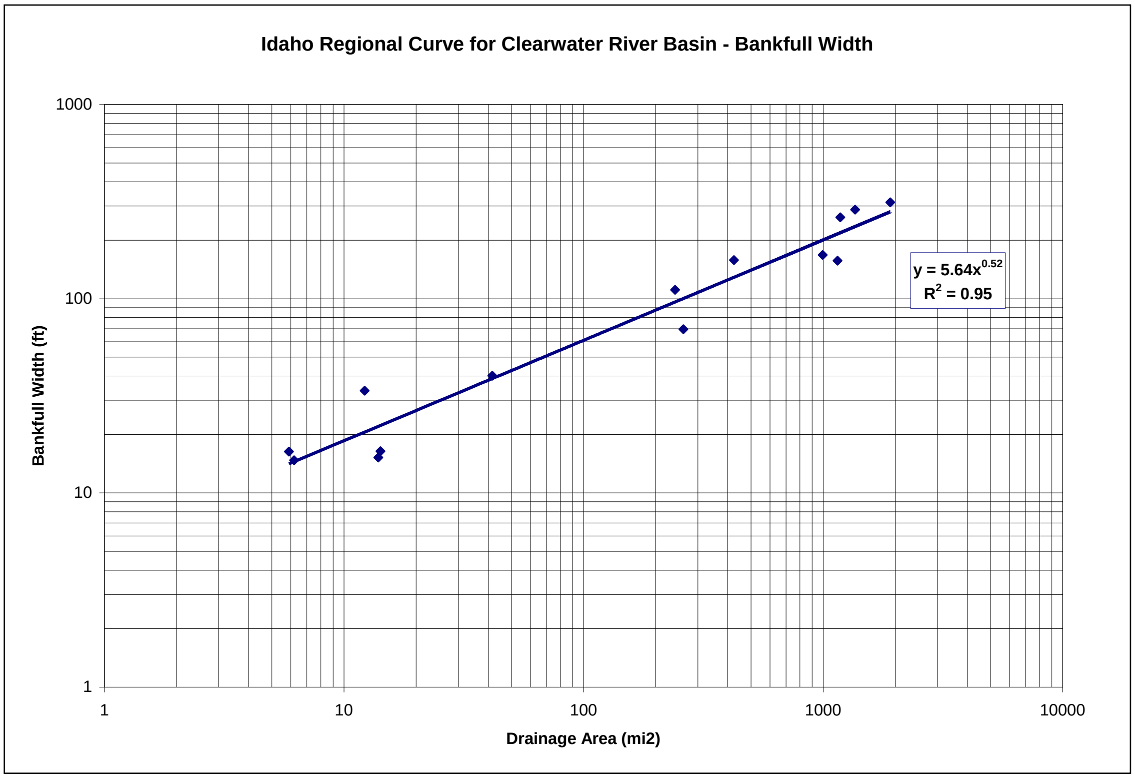

Figure 17. Bank-full width as a function of drainage area for the Clearwater River Basin.

Estimates of Shade under Potential Natural Vegetation

To estimate shade under PNV, riparian areas must first be classified based on stream order, gradient, and plant community characteristics. Determining stream order is a simple step based on the 1:100,000 NHD and the degree of branching. A 1st-order stream is not branched. Two 1st-order streams flow together to form a 2nd-order stream, two 2nd-order streams combine to make a 3rd-order stream, and so on. Streams in the Upper (North Fork) Coeur d'Alene River subbasin range from 1st to 5th order (Figure 18). Most streams are 3rd order or smaller, but sections of the larger streams are 4th and 5th order.

Stream gradient is a measure of the slope of the streambed and is determined from a digital elevation model from GIS programs. Streams in the Upper (North Fork) Coeur d'Alene River subbasin were classified into three categories: less than 3%, 3–10%, and greater than 10% (Figure 19).

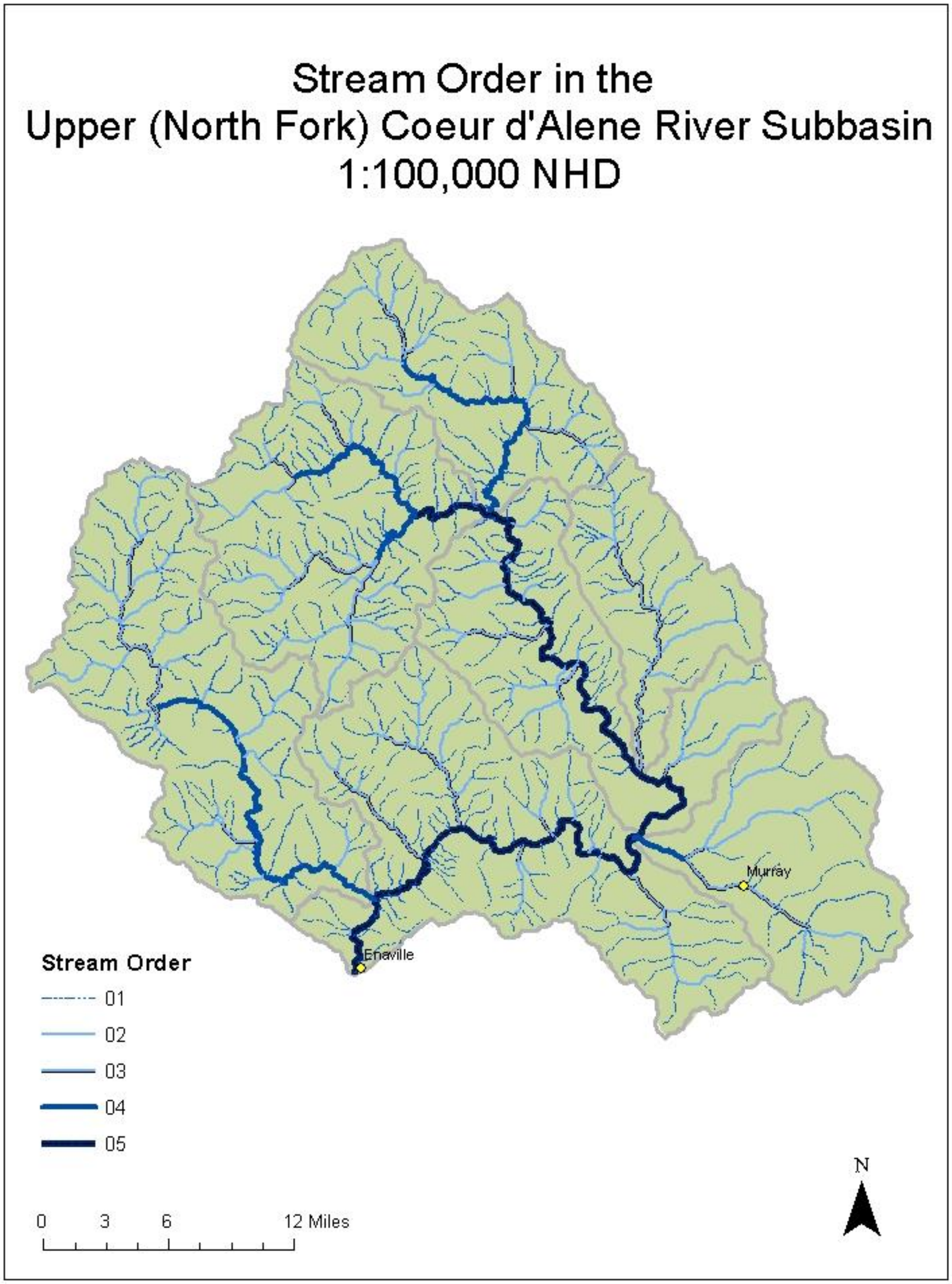

Figure 18. Stream order in the Upper (North Fork) Coeur d'Alene River subbasin.

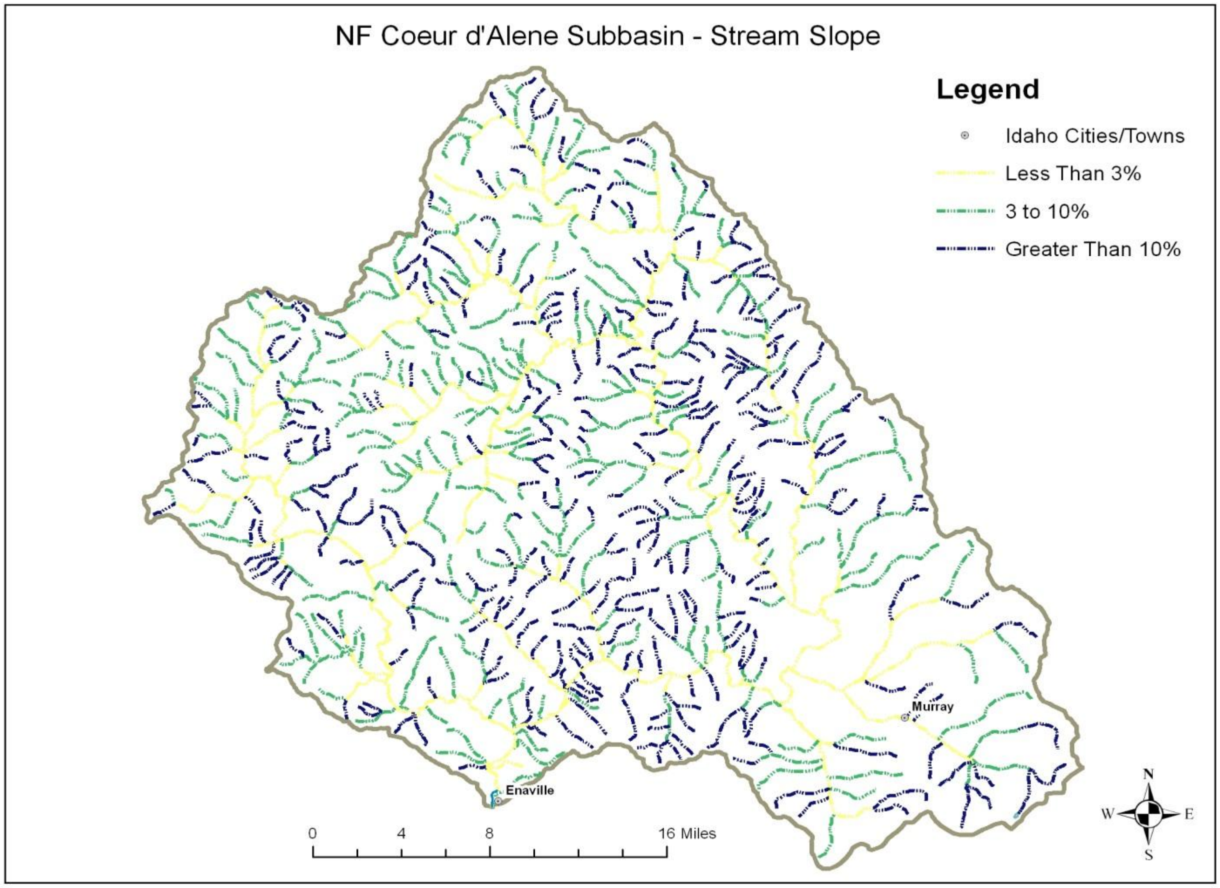

Figure 19. Stream gradient (slope) in the Upper (North Fork) Coeur d'Alene River subbasin.

The riparian plant community characteristics used to model shade at PNV were determined using a number of sources. Vegetation classifications and descriptions available from the Interior Columbia Basin Ecosystem Management Project (ICBEMP), USFS, and BLM were used to develop forest type classifications for this analysis. Additional information from EPA was used to develop "non-forest" type classifications applied to mixed hardwood and conifer forests found at lower elevations and wider floodplains.

The ICBEMP identified a number of PNV groups for the Columbia Basin that were mapped and included in the project's final environmental impact statement (USFS and BLM 2000). The ICBEMP identified the Upper (North Fork) Coeur d'Alene River subbasin as "moist forest." Many national forests further expanded on the ICBEMP vegetation classifications and now represent information as habitat type groups (HTGs) and vegetation response units (VRUs) for their planning areas. HTGs described by Cooper et al. (1991) summarize vegetation conditions and are based on potential climax vegetation. Though climax plant communities typically occupy a relatively small land area, these communities are considered the most meaningful index of environmental factors affecting vegetation and are used as a standard reference (Cooper et al. 1991).

Based on HTGs, national forests have also developed VRUs to describe and define the structure, composition, and function of forest ecosystems (USFS 1999, 2005). The VRUs are described as aggregations of land having similar capabilities and potentials for management. These ecological units have similar patterns in potential natural communities; soils; hydrologic function; landform and topography; lithology; climate; air quality; and natural processes (nutrient and biomass cycling, succession, productivity, and fire regimes). The Idaho Panhandle National Forests (IPNF) described approximately 11 VRUs based on 11 HTGs (Table 5).

In the BLM’s *Coeur d’Alene Resource Management Plan and Final Environmental Impact Statement*, there is a comparison of terms used by various agencies to describe vegetation groups. The “moist forest” of the ICBEMP corresponds with the “moist” VRU group of the IPNF and the “wet/warm conifer” cover type of the BLM Coeur d’Alene Field Office (BLM 2006). The Idaho Gap Analysis Program of USGS designates this area as containing western redcedar, western hemlock, western redcedar/grand fir, and western redcedar/western hemlock cover types (BLM 2006).

Table 5. Idaho Panhandle National Forests vegetation response units (VRUs) (USFS 1999, 2005).

VRU	Habitat Setting	Description
VRU 1	Warm and Dry	Generally, this VRU is characterized by large ponderosa pine with an open, grassy understory and occasional shrubs. Fire regime is an important determining factor.
VRU 2	Moderately Warm and Dry	This VRU is often a transitional setting that includes warm, dry grasslands and moderately cool and dry upland sites. Douglas-fir habitat types are common mixed with ponderosa pine, western larch, and lodgepole pine.
VRU 3	Moderately Warm and Moderately Dry	This is a transitional setting between the drier, warmer Douglas-fir dominated sites (VRU 1 and VRU 2) and the warmer, moister sites featuring western redcedar and hemlock (VRU 5).
VRU 4	Moderately Warm and Moist	This VRU occupies some lower slopes and valley bottoms. It contains diverse vegetation and may be dominated by grand fir, Douglas-fir, and western larch. Spruce, pine, and birch may also occur sparingly.
VRU 5	Moderately Cool and Moist	This VRU has a mixed severity fire regime that results in varied vegetation. Western redcedar and western hemlock are likely climax species. Western larch, Douglas-fir, and occasionally Engelmann spruce may be dominant. Understory vegetation is diverse and depends on canopy closure.
VRU 6 and VRU 8	Cool and Wet Riparian	These VRUs are described together due to ecological similarities and limited extent. These VRUs are less influenced by fire due to their wet nature and long fire return interval. VRU 6 generally occurs at lower elevations and is dominated by western redcedar with a diverse understory. A mix of conifers and hardwoods may also be found. VRU 8 is less dominated by western redcedar due to the temperature tolerance of the species. Engelmann spruce and subalpine fir are more common.
VRU 7	Cool and Moist	This VRU is typically found on mid to upper slopes but is also found within alluvial fans and stream floodplains. It occupies a broad subalpine zone with stands of western larch, lodgepole pine, and Douglas-fir with Engelmann spruce. Older stands are dominated by grand fir and subalpine fir.
VRU 9	Cool and Moderately Dry	This VRU is generally found on upper slopes and experiences moderate solar inputs, a short growing season, and early summer frosts. Lodgepole pine generally dominates.
VRU 10	Cold and Moderately Dry	This is a transition zone at high elevations between the forest and alpine tundra. Subalpine fir habitats dominate. Mountain hemlock, lodgepole pine, whitebark pine, and spruce may also occur.
VRU 11	Cold	These are high-elevation, cold sites near timberline. There is a short growing season, low solar input, and early summer frosts. Whitebark pine and subalpine fir habitat types dominate.

The IPNF VRUs were used as the basis for developing shade curves used to set target shade levels for these temperature TMDLs. For this analysis, the 11 IPNF VRUs for this subbasin have been combined into four PNV groups (Table 6). See Shumar and De Varona (2009 Appendix A.1) for detailed information on the development of these classifications and shade curves. Some streams examined in this analysis have headwaters in the warm/dry forests of Forest Group A (VRUs 1, 2, and 3); the cool, wet to moist forests of Forest Group C (VRUs 7 and 8); or the cold forests of Forest Group D (VRUs 9, 10, and 11). Most of the streams analyzed were in the moderately warm and moderately cool/moist assemblage of forests in Forest Group B (VRUs 4, 5, and 6). Streams were classified into PNV groups according to stream order, gradient, and applicable VRUs.

In addition to these forest groups, shade curves were developed for two hardwood-conifer mix forests that occur at lower elevations with wider floodplains. Although identified as Non-Forest Groups 1 and 2, the labels are perhaps misnomers because they are a mix of both coniferous and hardwood species and have a substantial tree component. Peter Leinenbach of EPA developed a process to use stream order and stream gradient to assign one of two hardwood shade curves for northern Idaho nonconiferous forest riparian areas (i.e., non-forest groups). This process is described in detail in Shumar and De Varona (2009) Appendix A.2.

In summary, streams less than 5th order with gradients 3% or greater were assigned to forest groups based on local VRUs. All streams smaller than 5th order and with gradients less than 3% were assigned to Non-Forest Group 1. All streams 5th order or larger were assigned to Non-Forest Group 2.

Table 6. Summary descriptions of potential natural vegetation (PNV) groups.

PNV Group	Streams Included	Description
Forest Group A	< 5th order Gradient ≥ 3% VRUs 1, 2, and 3	**Warm/Dry:** This setting includes the warmest and driest forest sites that support forest vegetation, usually at low elevations or mid-elevations on southerly aspects.
Forest Group B	< 5th order Gradient ≥ 3% VRUs 4, 5, and 6	**Moist:** This setting includes moist forest sites, usually low to mid-elevation, and includes stream bottoms and adjacent benches and toe slopes. This setting is the most productive, with favorable soil moisture and temperature regimes that favor abundant plant growth.
Forest Group C	< 5th order Gradient ≥ 3% VRUs 7 and 8	**Subalpine:** These settings include the moist, lower subalpine forest to the cool or cold dry sites between forest and alpine tundra. The moist end of this setting is common on northwest to east-facing slopes, riparian sites, and poorly drained subalpine sites. The cool to cold dry sites occur at higher elevations and typically have a short growing season.
Forest Group D	< 5th order Gradient ≥ 3% VRUs 9, 10, and 11	
Non-Forest Group 1	< 5th order Gradient < 3%	This group includes diverse plant communities, including late successional cedar-hemlock, black cottonwood, mixed conifer, and shrubs.
Non-Forest Group 2	≥ 5th order	In this group, black cottonwoods, shrubs, and grasses are common; conifers are rare.

The higher-elevation headwater portions of the streams in this subbasin are most often associated with coniferous forest types and were generally in VRUs 5 and 6 (Forest Group B) on north-facing slopes and VRU 2 (Forest Group A) on south-facing slopes. Vegetation on north-facing slopes was moderately cool and moist/wet forests. South-facing slopes were characterized by warm, dry forests of ponderosa pine, grand fir, Douglas-fir, and lodgepole pine. Only one stream interval, Spion Kop Creek, was classified as Forest Group D. As streams transitioned into lower elevations and larger floodplains, vegetation was classified as Forest Groups B and C (VRUs 6 and 8) or non-forest groups.

Once the PNV of the riparian area was classified, the associated shade was determined (Figure 20). This determination used the most current shade curves based on local information as developed by Peter Leinenbach of EPA (Appendix E). These curves relate effective shade to channel width at various aspects for each of the six PNV groups. In this analysis, the average shade value over all stream aspects was used.

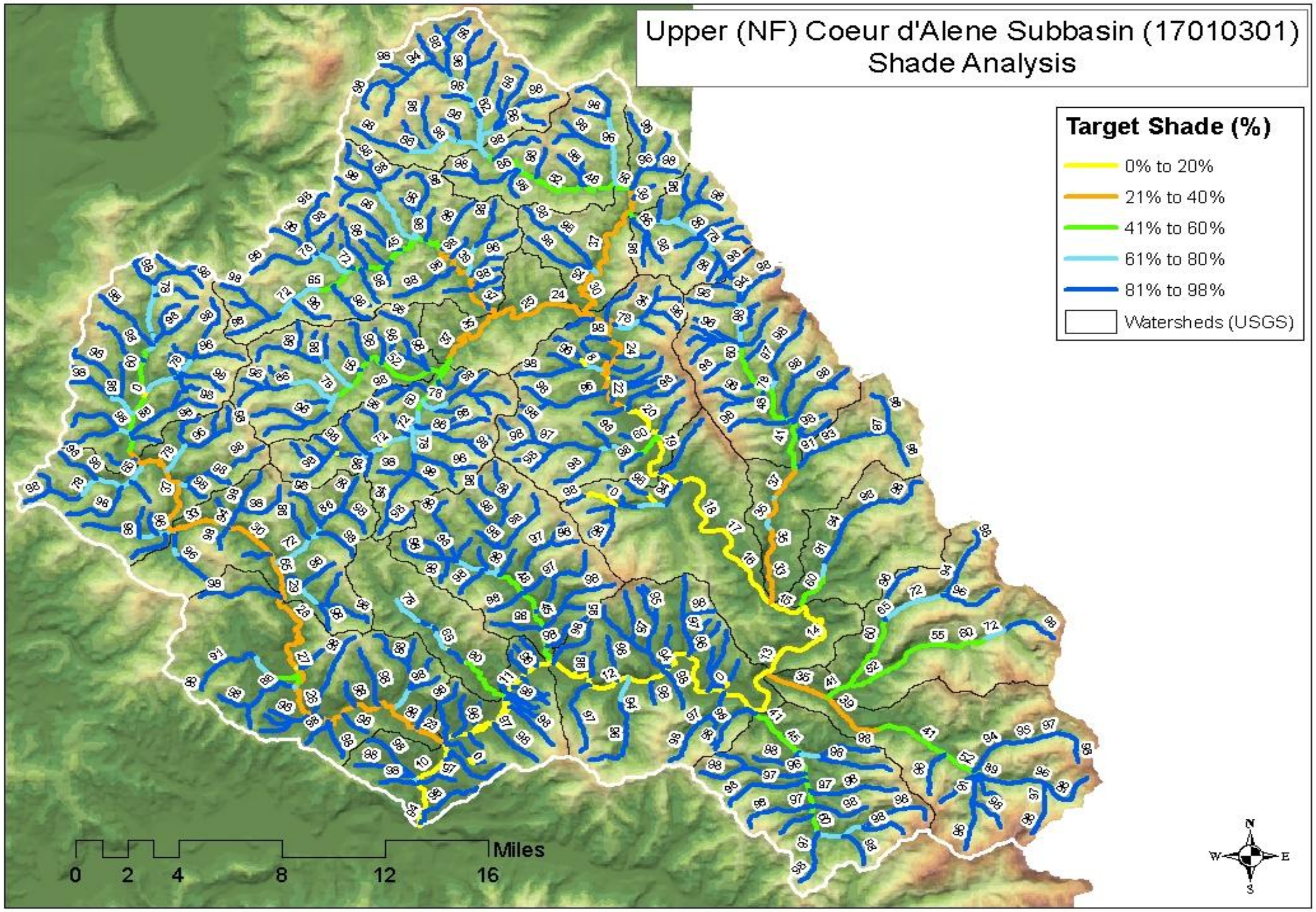

Figure 20. Target shade under potential natural vegetation conditions for the Upper (North Fork) Coeur d'Alene River subbasin.

Estimates of Potential Solar Loads

Once necessary data were compiled for solar radiation and stream surface area, vegetation was classified and shade estimates were developed for PNV. These data were used to calculate the estimated potential solar load using the following equation:

> potential solar load (kWh/d) = solar radiation (kWh/m^2/d) × natural background stream surface area (m^2) × potential shade factor (% of solar load not blocked at potential shade).

Estimated potential (target) shade for the subbasin is presented in Figure 20 and estimated potential solar loads are presented in tables in Appendix F. The shade provided by PNV is the primary target of this TMDL, and the associated solar loads are the load capacity. Estimates of potential solar load were made for each stream interval, recorded in a load analysis table, and then summed for the entire AU. For detailed information on each parameter, refer to the load analysis tables in Appendix F.

Monitoring Points

Monitoring for TMDL compliance should include measurements of stream temperature, bank-full width, and shade, along with biological monitoring through programs such as BURP. Since shade at PNV is the primary target of this TMDL, DEQ suggests that monitoring emphasize shade measurements using the Solar Pathfinder. The Solar Pathfinder can be used to verify estimates of existing shade and to determine progress toward meeting TMDL targets. Shade targets have been established for multiple stream intervals within each AU depending on vegetation. Monitoring recommendations include collecting Solar Pathfinder photographs at 10 equally spaced sites within each interval to adequately characterize shade for that interval and for the AU overall. These methods are described in further detail in section 5.5 under monitoring strategy.

5.2 Load Capacity

The load capacity of a water body is the upper limit on discharge of a pollutant from all sources allowable while ensuring the water body still meets water quality standards and supports beneficial uses. This PNV temperature TMDL analysis assumes that excess temperature loads to streams are due to solar radiation as a nonpoint source of pollution; that solar radiation loads have increased as a result of riparian shade loss; and that maximum shading under PNV results in natural background stream temperatures. Following this method, the natural background solar load is the load capacity (i.e., the upper limit of solar radiation to the stream that preserves natural background stream temperatures as the water quality criteria). In TMDLs using the PNV method, the load capacity, natural background load, potential solar load, and load allocation are all equivalent. Solar loads are measured as kilowatt-hours per day during the 6-month period from April through September, the most critical period for temperature impairments.

5.3 Estimates of Existing Pollutant Loads

The PNV method assesses excess temperature loads to streams due to solar radiation as a nonpoint source of pollution. Because there are no permitted point sources of thermal loading to streams in this subbasin, the estimates of existing pollutant loads focus on solar radiation as the source of excess thermal loading to the streams from nonpoint sources. Existing pollutant loads are expressed as solar radiation in kilowatt-hours reaching the stream surface on a daily basis (kilowatt-hours per day) during the 6-month critical time period, April–September.

Regulations allow for load estimates that "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading" (40 CFR 130.2(I)). An estimate must be made for existing pollutant loads from each point source, but no permitted point sources of thermal loading exist in this subbasin. Estimates of existing loads from nonpoint sources are typically based on land use and area. To the extent possible, natural background pollutant loads should be distinguished from human-caused nonpoint sources of pollution.

Existing solar loads are calculated from the following components: solar radiation information, the estimated existing stream surface area, and estimates of existing shade. The load analysis can be expressed as follows:

> existing solar load (kWh/d) = solar radiation (kWh/m^2/d) × existing stream surface area (m^2) × existing shade factor (% of solar load not blocked by existing shade).

Estimates of existing solar load were made for each stream interval, recorded in a load analysis table, and then summed for the entire AU. For detailed information on each parameter, refer to the load analysis tables in Appendix F.

Estimates of Existing Solar Radiation

The amount of solar radiation potentially delivered to the stream surface was obtained from the nearest NREL at Missoula, Montana. Flat-plate collectors are used to measure the amount of solar energy reaching the ground under full sun at these sites. This solar radiation information was obtained to calculate a 6-month average solar load of 5.5 kWh/m^2/d.

Estimates of Existing Stream Surface Area

The stream surface area was estimated for each stream interval. The length of the stream interval was determined using GIS software and varies depending on the land use or landscape that has affected shade in a particular area. This information was combined with estimates of existing bank-full width to determine stream surface area. Bank-full width is measured in the field during DEQ BURP monitoring, USFS surveys, and DEQ field monitoring of shade using Solar Pathfinders. Bank-full width is very difficult to estimate accurately from aerial photographs. For this TMDL analysis, data from DEQ and USFS were used to estimate existing bank-full width (Appendix D). When existing data were not available, the Clearwater River Basin regional curve bank-full width estimate was applied (see Figure 17).

Estimates of Existing Shade

Existing shade was determined from visual interpretation of aerial photographs using GIS analysis. Existing shade ranged from 0% to 90% with the greatest amount of shading observed in 1st- and 2nd-order streams (Figure 21). Visual estimates are made by a trained and experienced technician and some are field-verified using a Solar Pathfinder. The most recent digital orthophotography was obtained from the National Agriculture Imagery Program (NAIP) produced by the US Department of Agriculture (USDA) Farm Services Agency. The photographs are used as a base layer in a GIS program to reveal the landscape in the area of interest. For streams identified as temperature-impaired in the 2010 Integrated Report, the 2009 NAIP imagery was used for this analysis. For streams identified as temperature-impaired in the

2008 Integrated Report, the 2004 NAIP imagery was used. A stream map based on the 1:100,000 NHD and marked with DEQ AU numbers was used to identify stream segments on the aerial photographs.

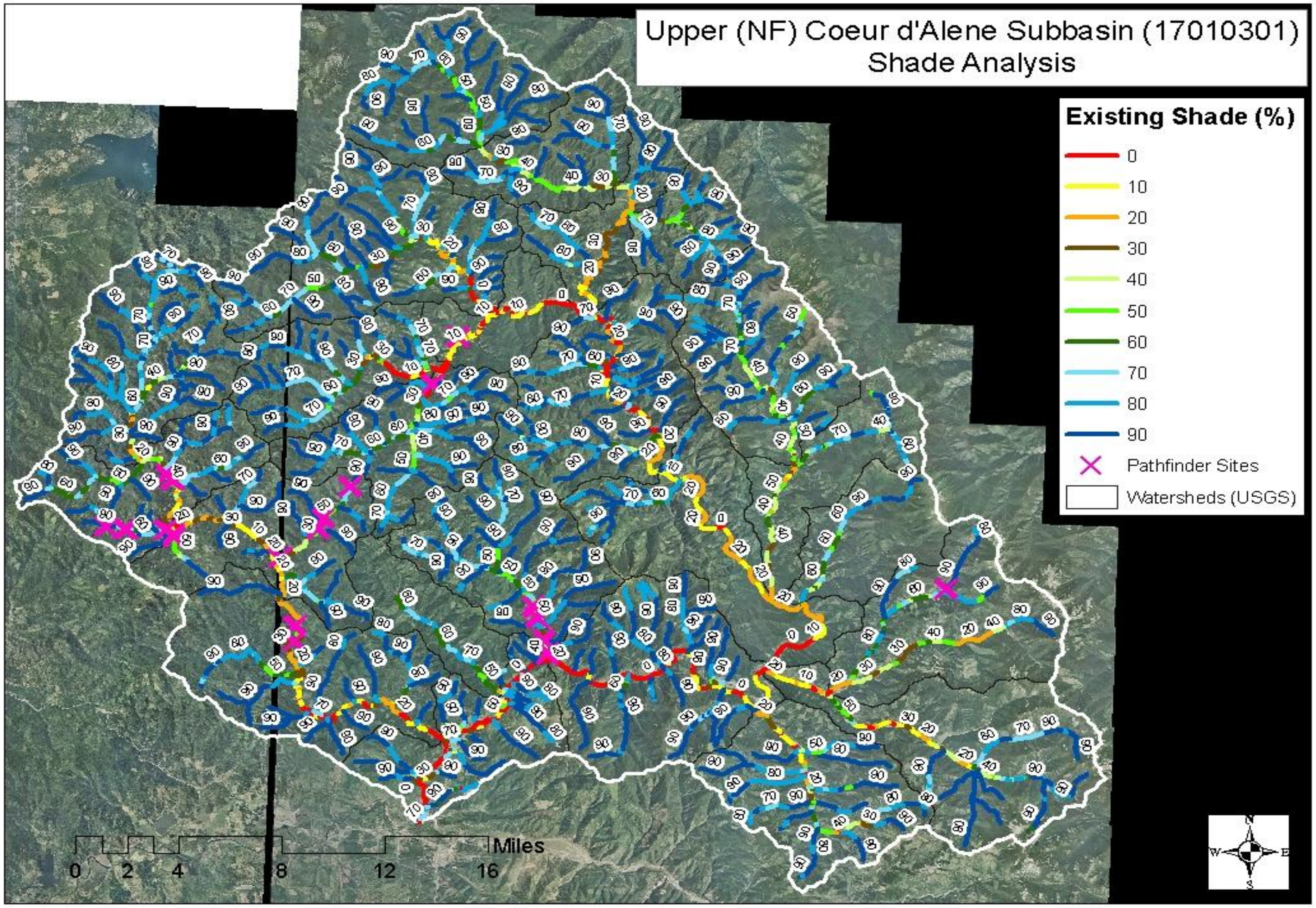

Figure 21. Estimated existing shade for streams of the Upper (North Fork) Coeur d'Alene River subbasin.

Streams were divided into intervals based on AU number and natural breaks in vegetation density. Intervals typically ranged from 50 to 2,200 m long. Estimates of existing shade were classified into 10% class intervals starting with shade class 0, representing shade levels from 0 to 9.9%, and proceeding through shade class 90 (i.e., shade levels from 90 to 100%). This method was adapted from the Idaho cumulative watershed effects (CWE) process (IDL 2000). For example, if the shade estimate for a stream interval was somewhere between 50% and 59.9% shade, the value of 50% shade was assigned to that interval. Shade estimates were based on general observations about the kind of vegetation present, vegetation density, and stream width and are an estimate of the amount of solar radiation blocked from reaching the stream surface. Streams with banks and water clearly visible in aerial photographs are usually in low shade classes of 10, 20, or 30% shade. Streams with dense forest or heavy brush with no portion of the water surface visible in aerial photographs are in high shade classes of 70, 80, or 90%.

Visual estimates of shade made from aerial photos can be strongly influenced by canopy cover and do not always accurately account for topography and landform. However, Oregon Department of Environmental Quality research concluded that shade and canopy cover measurements were remarkably similar (OWEB 2001). Solar Pathfinder field measurements of shade provide the most accurate estimates and are valuable as field verification. Methods for Solar Pathfinder measurements and field-verification are described in Shumar and De Varona (2009) and in the monitoring strategy discussion of this document. For this TMDL, the Solar Pathfinder was used at 20 sites on streams of varying shade classes to field-verify and calibrate the visual estimates of shade made from photographs. In 2007, Solar Pathfinder measurements were collected on Beaver Creek, Deception Creek, Leiberg Creek, Little North Fork Coeur d'Alene River, Skookum Creek, Steamboat Creek, Tepee Creek, and West Fork Eagle Creek (see Figure 21 for Solar Pathfinder sites). Differences between measured shade and visual estimates resulted in the visual estimates being adjusted. These data are included in Appendix G.

5.4 Load Allocation

The temperature TMDLs were developed using the potential natural vegetation (PNV) method described by Shumar and De Varona (2009). This method evaluated existing effective shade to the streams, potential effective shade, and the amount of shade needed to reach potential effective shade and thus, natural background water temperatures. The shade and solar loading observed at potential natural vegetation provide natural background stream temperature and are the TMDLs target rather than numeric temperature criteria based on natural background provisions of the Idaho water quality standards (IDAPA 58.01.02.200.09).

Because these TMDLs are based on PNV, which is equivalent to background conditions, the load allocation essentially expresses the desire to achieve background conditions. To reach that objective, load allocations are assigned to nonpoint source activities that have affected or may affect riparian vegetation and shade as a whole. Therefore, load allocations are reach specific and are dependent upon the target load for a given reach. The tables in Appendix F show the potential (target) shade levels and the associated potential summer load. The potential summer solar load 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 these TMDLs are dependent upon background conditions for achieving water quality standards, all tributaries to the waters examined here need to be in natural conditions to prevent excess heat loads to the system.

Estimated shade conditions and solar loads were variable among the streams evaluated (Figure 22; Table 7). Most stream segments were within 20% of target shade conditions. Three AUs had existing solar loads lower than the estimated target and load allocation: Graham Creek below Deceitful Gulch (ID17010301PN002_03), Lost Creek below East Fork Lost Creek (ID17010301PN009_03), and Steamboat Creek and West Fork Steamboat Creek below Comfy Creek (ID17010301PN028_03). While the overall existing solar loads of these AUs may be less than the estimated load allocation when added over the entire unit, there are reach-specific targets identified in Appendix F that should also be met to ensure water temperature protection. These streams should be evaluated as possibly attaining PNV shade targets and natural background temperatures.

The highest solar load reductions needed were in the lower portions of larger streams, including the middle and lower North Fork Coeur d'Alene River, the lower Little North Fork Coeur d'Alene River, lower Trail Creek, and lower Tepee Creek. Areas with shade deficits over 50% include tributaries to the lower North Fork Coeur d'Alene River, stretches of upper Beaver Creek, portions of Falls Creek, lower Trail Creek (tributary to Tepee Creek), and portions of middle Tepee Creek. These areas should be considered as priorities for TMDL implementation.

The highest stream temperature values were observed in the main stem North Fork Coeur d'Alene River and larger tributaries. The warmest locations were in the North Fork Coeur d'Alene River near Shoshone Creek during July. Coldwater refugia have been identified as important mitigation for these warm water temperatures by allowing trout to persist despite temperatures outside their normal tolerance range. These concepts should be considered when setting priorities for TMDL implementation.

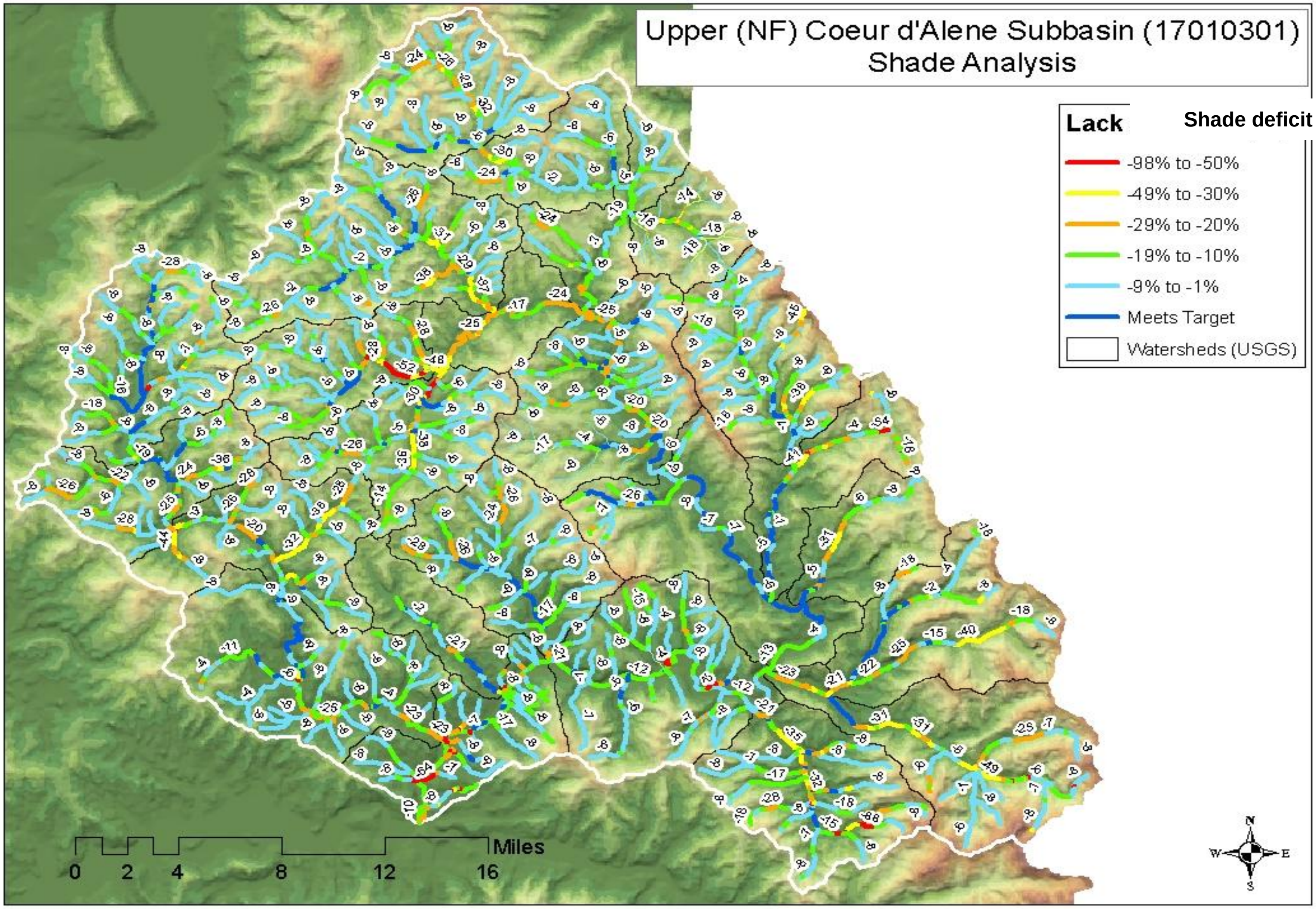

Figure 22. Shade deficits (difference between existing and potential shade) for the Upper (North Fork) Coeur d'Alene River subbasin.

Table 7. Summary of existing solar loads, temperature TMDL load allocations, and load reductions needed for the 54 assessment units (AUs) with temperature TMDLs. This table summarizes loads over entire assessment units. Within each assessment unit, there are reach-specific shade targets and solar load allocations provided in Appendix F.

Assessment Unit Number	Assessment Unit Name	Existing Load (kWh/day)	Load Allocation (kWh/day)	Load Reduction Needed (kWh/Day)	Percent Reduction Needed
ID17010301PN001_02	North Fork Coeur d'Alene River tributaries below Prichard Creek	192,643	37,263	155,380	81
ID17010301PN001_05	North Fork Coeur d'Alene River below Prichard Creek	10,739,949	9,746,358	993,591	9
ID17010301PN001_05a	North Fork Coeur d'Alene River between Yellowdog and Prichard Creeks	4,956,331	4,105,591	850,739	17
ID17010301PN002_03	Graham Creek below Deceitful Gulch	14,163	17,094	Existing shade > potential shade[a]	n/a
ID17010301PN003_02	Beaver Creek headwaters and tributaries	436,783	147,154	289,629	66
ID17010301PN003_03	Beaver Creek below White Creek	419,095	213,717	205,378	49
ID17010301PN004_04	Prichard Creek below Eagle Creek	342,320	239,642	102,678	30
ID17010301PN005_02	Prichard Creek headwaters and tributaries above Butte Gulch	173,492	30,495	142,997	82
ID17010301PN008_02	West Fork Eagle Creek and tributaries	169,438	143,683	25,755	15
ID17010301PN009_03	Lost Creek below East Fork Lost Creek	37,263	44,955	Existing shade > potential shade[a]	n/a
ID17010301PN010_03	Shoshone Creek below Falls Creek	571,857	561,789	10,068	2
ID17010301PN011_02	Falls Creek and tributaries	88,390	18,729	69,661	79
ID17010301PN012_02	Shoshone Creek headwaters and tributaries above Falls Creek	135,977	41,402	94,575	70
ID17010301PN012_03	Shoshone Creek between Little Lost Fork and Falls Creek	356,879	336,361	20,518	6
ID17010301PN013_02	North Fork Coeur d'Alene River tributaries between Tepee and Yellowdog Creeks	64,377	21,145	43,232	67
ID17010301PN013_04	North Fork Coeur d'Alene River between Jordan and Tepee Creeks	913,699	753,106	160,593	18
ID17010301PN013_05	North Fork Coeur d'Alene River between Tepee and Yellowdog Creeks	2,672,334	2,130,373	541,961	20
ID17010301PN014_03	Jordan Creek and Lower Lost Fork	93,545	64,147	29,398	31
ID17010301PN015_02	North Fork Coeur d'Alene River, upper, headwaters and tributaries	213,488	100,419	113,069	53
ID17010301PN015_03	North Fork Coeur d'Alene River, upper, and lower Buckskin Creek	111,408	80,684	30,724	28
ID17010301PN015_04	North Fork Coeur d'Alene River between Buckskin and Jordan Creeks	385,913	317,951	67,962	18
ID17010301PN016_02	West Elk Creek and Cataract Creek	30,838	6,390	24,448	79

Assessment Unit Number	Assessment Unit Name	Existing Load (kWh/day)	Load Allocation (kWh/day)	Load Reduction Needed (kWh/Day)	Percent Reduction Needed
ID17010301PN017_04	Tepee Creek between Trail Creek and Independence Creek	539,660	336,372	203,288	38
ID17010301PN017_05	Tepee Creek below Independence Creek	889,043	305,883	583,160	66
ID17010301PN018_02	Independence Creek headwaters and tributaries	227,436	87,944	139,492	61
ID17010301PN018_03a	Declaration Creek, lower	23,320	18,942	4,378	19
ID17010301PN018_03b	Snow Creek, lower	35,728	27,887	7,841	22
ID17010301PN018_04	Independence Creek below Declaration Creek	1,007,633	619,733	387,900	38
ID17010301PN019_02	Trail Creek headwaters and tributaries	123,189	49,699	73,490	60
ID17010301PN019_03	Trail Creek below Stewart Creek	664,576	221,495	443,081	67
ID17010301PN020_02	Tepee Creek headwaters and tributaries	170,149	76,257	93,892	55
ID17010301PN020_03	Tepee Creek between Short Creek and Trail Creek	301,477	138,916	162,561	54
ID17010301PN021_02	Brett Creek and tributaries	25,680	10,506	15,174	59
ID17010301PN022_02	Miners Creek and tributaries	17,781	3,621	14,160	80
ID17010301PN023_03	Flat Creek, lower	83,506	66,100	17,406	21
ID17010301PN024_02	Yellowdog Creek and tributaries	45,639	16,139	29,500	65
ID17010301PN026_02	Brown Creek and tributaries	19,767	3,605	16,162	82
ID17010301PN028_02	Steamboat Creek headwaters and tributaries	159,182	51,585	107,597	68
ID17010301PN028_03	Steamboat Creek and West Fork Steamboat Creek below Comfy Creek	307,522	310,253	Existing shade > potential shade[a]	n/a
ID17010301PN029_03	Cougar Gulch below East Fork Cougar Gulch	135,581	118,357	17,224	13
ID17010301PN030_02a	Little North Fork Coeur d'Alene River tributaries above Iron Creek	38,302	9,220	29,082	76
ID17010301PN030_02c	Little North Fork Coeur d'Alene River tributaries between Hudlow and Deception Creeks	84,260	34,125	50,135	60
ID17010301PN030_02d	Little North Fork Coeur d'Alene River tributaries below Skookum	38,626	8,527	30,099	78
ID17010301PN030_03	Little North Fork Coeur d'Alene River between Solitaire and Skookum Creeks	751,113	661,829	89,284	12
ID17010301PN030_04	Little North Fork Coeur d'Alene River below Skookum Creek	4,021,028	2,955,648	1,065,380	26
ID17010301PN031_02	Bumblebee Creek and tributaries	40,816	11,886	28,930	71
ID17010301PN032_02	Laverne Creek and tributaries	50,012	14,287	35,725	71
ID17010301PN033_02	Leiberg Creek and tributaries	178,189	42,119	136,070	76
ID17010301PN034_02	Bootjack Creek and tributaries	17,297	2,819	14,478	84

Assessment Unit Number	Assessment Unit Name	Existing Load (kWh/day)	Load Allocation (kWh/day)	Load Reduction Needed (kWh/Day)	Percent Reduction Needed
ID17010301PN035_02	Iron Creek and tributaries	73,744	37,936	35,808	49
ID17010301PN036_02	Burnt Cabin Creek and tributaries	113,075	54,206	58,869	52
ID17010301PN037_02	Deception Creek and tributaries	29,640	13,111	16,529	56
ID17010301PN038_03	Skookum Creek, lower	28,479	2,046	26,433	93
ID17010301PN039_03	Copper Creek, lower	89,584	60,676	28,908	32

[a] The loads included in this table are added over the entire stream assessment unit. While the assessment unit's overall existing solar load may be less than the estimated load allocation over the entire unit, there are reach-specific targets identified in Appendix F that should also be met to ensure water temperature protection.

PNV solar loading analysis was completed for portions of some stream AUs without temperature data that are not §303(d) listed or known to be temperature impaired. This analysis is included to provide information about contributing loads and does not establish TMDLs for those streams (Table 8).

Table 8. Summary of existing solar loads, estimated loads at potential natural vegetation (PNV) conditions, and load reductions recommended on tributaries *not* listed for excess temperature based on this analysis. Some load estimates may be for only portions of assessment units.

Assessment Unit Number	Assessment Unit Name	Existing Load (kWh/day)	Estimated Load at PNV (kWh/day)	Load Reduction Recommended (kWh/Day)
ID17010301PN001_02a	North Fork Coeur d'Alene River tributaries between Yellowdog and Prichard Creeks	nd[a]	nd	nd
ID17010301PN002_02	Graham Creek, headwaters and tributaries	9,235	3,247	5,988
ID17010301PN004_02	Prichard Creek tributaries between Butte Gulch and Eagle Creek	nd	nd	nd
ID17010301PN004_03	Prichard Creek, between Butte Gulch and Eagle Creek	507,975	364,472	143,503
ID17010301PN005_03	Prichard Creek, between Barton Creek and Butte Gulch	156,492	79,533	76,959
ID17010301PN006_02	Butte Gulch	nd	nd	nd
ID17010301PN007_02	East Fork Eagle Creek and tributaries	471,526	212,411	259,115
ID17010301PN007_03	Eagle Creek	158,928	63,862	95,066
ID17010301PN009_02	Lost Creek, headwaters and tributaries	67,155	32,693	34,462
ID17010301PN010_02	Shoshone Creek tributaries below Falls Creek	nd	nd	nd
ID17010301PN013_02a	North Fork Coeur d'Alene River tributaries between Jordan Creek and Tepee Creek	nd	nd	nd
ID17010301PN014_02	Jordan Creek, headwaters and tributaries	30,855	10,188	20,667
ID17010301PN014_02a	Cub Creek	nd	nd	nd
ID17010301PN014_02b	Calamity Creek	nd	nd	nd
ID17010301PN017_02	Tepee Creek tributaries, below Trail Cr.	nd	nd	nd
ID17010301PN018_03	Independence Creek, between Ellis Creek and Declaration Creek	61,380	42,966	18,414
ID17010301PN023_02	Flat Creek, headwaters and tributaries	28,083	4,430	23,653
ID17010301PN025_02	Downey Creek, headwaters and tributaries	nd	nd	nd
ID17010301PN025_03	Downey Creek, lower	nd	nd	nd
ID17010301PN027_03	Grizzly Creek, below Dewey Creek	7,288	2,987	4,301
ID17010301PN029_02	Cougar Gulch, headwaters and tributaries	nd	nd	nd
ID17010301PN030_02	Little North Fork Coeur d'Alene River tributaries, headwaters to Solitaire Cr.	24,332	26,487	Existing load < Potential load[b]
ID17010301PN030_02b	Hudlow Creek, headwaters and tributaries	42,268	20,015	22,253
ID17010301PN038_02	Skookum Creek, headwaters and tributaries	14,427	3,484	10,943
ID17010301PN039_02	Copper Creek, headwaters and tributaries	21,494	9,442	12,052

[a] No data (nd) are reported in this table for stream assessment units that are not identified as temperature impaired and did not have any PNV analysis performed during development of these TMDLs. There is a presumption that these streams are shaded under PNV conditions unless data show otherwise.
[b] The loads included in this table are added over the entire portion of stream assessment unit analyzed. While the assessment unit's overall existing solar load may be less than the estimated load allocation over the entire unit, there are reach-specific targets identified in Appendix F that should also be met to ensure water temperature protection.

Implementation of these temperature TMDLs should incorporate the needed solar load reductions and target shade conditions using strategies that maximize shade from riparian vegetation. Managers can utilize this analysis to identify locations with high excess solar loads and the largest differences between existing and target shade. Within the overall load allocation for each AU, these TMDLs establish reach-specific allocations for solar loading at PNV conditions. Some reaches are probably already reaching their target shade and solar loading rates. Other reaches have estimated shade deficits ranging from 2 to 88%. These locations can be prioritized for implementation activities including tree planting.

Implementation of these TMDLs should improve water quality conditions in streams of the Upper (North Fork) Coeur d'Alene River subbasin and enable full support of cold water aquatic life and salmonid spawning beneficial uses. The tables in Appendix F provide detailed reach-specific loading analyses, and maps in Appendix H identify locations with significant shade deficits and excess solar loads.

Wasteload Allocation

There are no known existing or proposed National Pollutant Discharge Elimination System (NPDES)-permitted point sources of temperature loading in this subbasin. Additionally, no excess thermal load is available for allocation since the load capacity is set at natural background for these TMDLs. Therefore, no wasteload allocations for temperature are provided in these TMDLs.

Stormwater Runoff as Wasteload Allocations

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

Municipal Separate Storm Sewer Systems

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

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

To prevent harmful pollutants from being washed or dumped into an MS4, operators must obtain an NPDES permit from EPA, implement a comprehensive municipal stormwater management program (SWMP), and use best management practices (BMPs) to control pollutants in stormwater discharges to the maximum extent practicable. There are no MS4 facilities within the Upper North Fork Coeur d'Alene subbasin, hence there is no wasteload allocation for such facilities.

Industrial Stormwater Requirements

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

Multi-Sector General Permit and Stormwater Pollution Prevention Plans

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

Industrial Facilities Discharging to Impaired Water Bodies

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

Also, because different industrial activities have sector-specific types of material that may be exposed to stormwater, EPA grouped the different regulated industries into 29 sectors, based on their typical activities. Part 8 of EPA's MSGP details the stormwater management practices and monitoring that are required for the different industrial sectors. EPA anticipates issuing a new MSGP in December 2013. DEQ anticipates including specific requirements for impaired waters as a condition of the 401 certification. The new MSGP will detail the specific monitoring requirements.

TMDL Industrial Stormwater Requirements

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

Construction Stormwater

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

Construction General Permit and Stormwater Pollution Prevention Plans

If a construction project disturbs more than 1 acre of land (or is part of a 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 SWPPP. The SWPPP must provide for the erosion, sediment, and pollution controls they intend to use; inspection of the controls periodically; and maintenance of BMPs throughout the life of the project. Operators are required to keep a current copy of their SWPPP on site or at an easily accessible location.

TMDL Construction Stormwater Requirements

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

Post-construction Stormwater Management

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

Margin of Safety

The margin of safety in these TMDLs is considered implicit in the design. The target of the TMDLs is natural background temperature conditions associated with PNV shading. It is unrealistic to set shade targets at higher or more conservative levels than the system PNV. Additionally, existing shade estimates are rounded down into 10% class intervals, which likely underestimates actual shade in the loading analysis. Although the load analysis used in these TMDLs involves gross estimations that are likely to have large variances, load allocations can be adjusted as more information is gathered.

Seasonal Variation

These temperature TMDLs are based on average spring/summer loads and consider seasonal variation in water temperature and the seasonal nature of temperature impacts to biota. All loads have been calculated for the 6-month critical time period from April through September. This period represents the time when the combination of increasing air and water temperatures coincides with increasing solar inputs and vegetative shade. The period also incorporates the timing of spring and fall salmonid spawning and the occurrence of maximum water temperatures. Water temperature is not known to exceed water quality standards or harm beneficial uses outside of this time period because of cooler weather and lower sun angle.

5.5 Implementation Strategies

Upon adoption of these TMDLs, implementation and evaluation should begin immediately using an adaptive management framework. The TMDL implementation timeline, strategic approach, responsible parties, and monitoring strategy are briefly summarized here. A discussion about pollutant trading is also included in this section. A TMDL implementation plan for this subbasin should be developed including more detailed recommendations for restoration and monitoring. Implementation strategies should be modified if monitoring shows that the TMDL goals are not being met or significant progress is not being made toward achieving the goals.

Implementation of these temperature TMDLs should incorporate the needed solar load reductions and target shade conditions using strategies that maximize shade from riparian vegetation. Land managers can utilize this analysis to identify stream segments with high excess solar loads and the largest shade deficits. Channel width also affects the amount of solar load that reaches the stream and could be addressed during TMDL implementation.

Within the overall load allocation for each AU, these TMDLs establish reach-specific allocations for solar loads at PNV condition. Some reaches are likely already reaching their target shade and solar loading rates. Other reaches have estimated shade deficits ranging from 2 to 88%. These locations can be prioritized for implementation activities including tree planting.

Lack of shade and excess solar loads can result from a variety of circumstances, including natural events, such as wildfire, and anthropogenic activities with varying degrees of permanency (e.g., paved roads compared to partial vegetation removal along recreational properties). Some of these conditions can be changed while others cannot, and implementation strategies must take these realities into account.

Water quality improvement projects for TMDL implementation should be combined with ongoing monitoring and evaluation to do the following:

- Verify assumptions and estimates used in the TMDL analysis. For example, estimates of existing shade made from aerial photographs should be field-verified using the Solar Pathfinder. Bank-full width estimates from regional curves can also be field-verified to refine estimates of existing solar loads.
- Monitor water quality trends including water temperature and overall support of beneficial uses. Water temperatures should be measured to evaluate trends and effects to aquatic life. Riparian vegetation, channel dimensions, and shade should be measured to detect trends and evaluate progress toward TMDL goals.
- Provide feedback on BMPs and water quality improvement projects to determine what practices are most effective and how they can best be employed to reach TMDL targets.
- Supply data for use in water body assessments during DEQ's preparation of the Integrated Report. Monitoring data meeting DEQ requirements can be used during this process to identify streams from this subbasin as either impaired due to excess water

temperatures or as fully supporting beneficial uses and attaining TMDL water quality goals.

- Provide information useful during development and possible revisions of water quality standards.
- Inform the 5-year review process for the TMDL. DEQ will work with the WAG to review and reevaluate each TMDL within 5 years of its completion to accomplish the following:
    - Assess the water quality status of water bodies
    - Evaluate the criteria, instream targets, pollutant allocations, assumptions, and analyses upon which the TMDL was based
    - Evaluate the attainability of water quality standards and TMDL goals

Time Frame

While some implementation strategies may exhibit immediate results in protecting and improving water temperatures, it may take decades for other strategies to take full effect. Planting vegetation and allowing vegetation to grow and mature are expected to be the primary approaches to implement these temperature TMDLs. It may take 10 years of plant growth to begin measuring significant increases in stream shade. The time it will take to meet the TMDL targets depends on the plant communities present and at PNV. The riparian plant communities along some streams are very close to achieving PNV shade targets and may attain water quality standards within the next 5 years. Other streams with a larger shade deficit may take 50 years to meet water quality standards. Progress will be evaluated during the 5-year review of the TMDL, and TMDL elements may be adjusted if necessary at that time.

Strategic Approach

A TMDL implementation plan for this subbasin should be developed including more detailed recommendations for restoration and monitoring. However, water quality protection and restoration activities are already being implemented and should continue to be carried out even before completion of a formal TMDL implementation plan. Monitoring and evaluation will be an integral part of the process and should begin with field verification of estimated existing shade conditions and bank-full widths. The parameters used to estimate PNV shade and natural bank-full widths can also be refined with more specific data.

In developing restoration priorities related to these TMDLs focused on shade targets, each stream reach needs to be examined for possible corrective action. Restoration activities should be prioritized based on the departure from target conditions (i.e., shade deficit) on a reach-by-reach basis. Reach-specific improvements can result in valuable shade increases, and potential shade conditions should be met in each stream reach to ensure water quality standards are met.

Perhaps the most valuable tools for identifying shade improvement opportunities are the maps included in Appendix H. These maps identify color-coded shade deficits for each reach of the stream system analyzed. As an example, the map for the Prichard, Eagle, and Beaver Creeks watersheds is included here (Figure 23). Stream reaches indicated with red have shade deficits of 50–98%. These reaches may be identified as key restoration priorities during TMDL implementation.

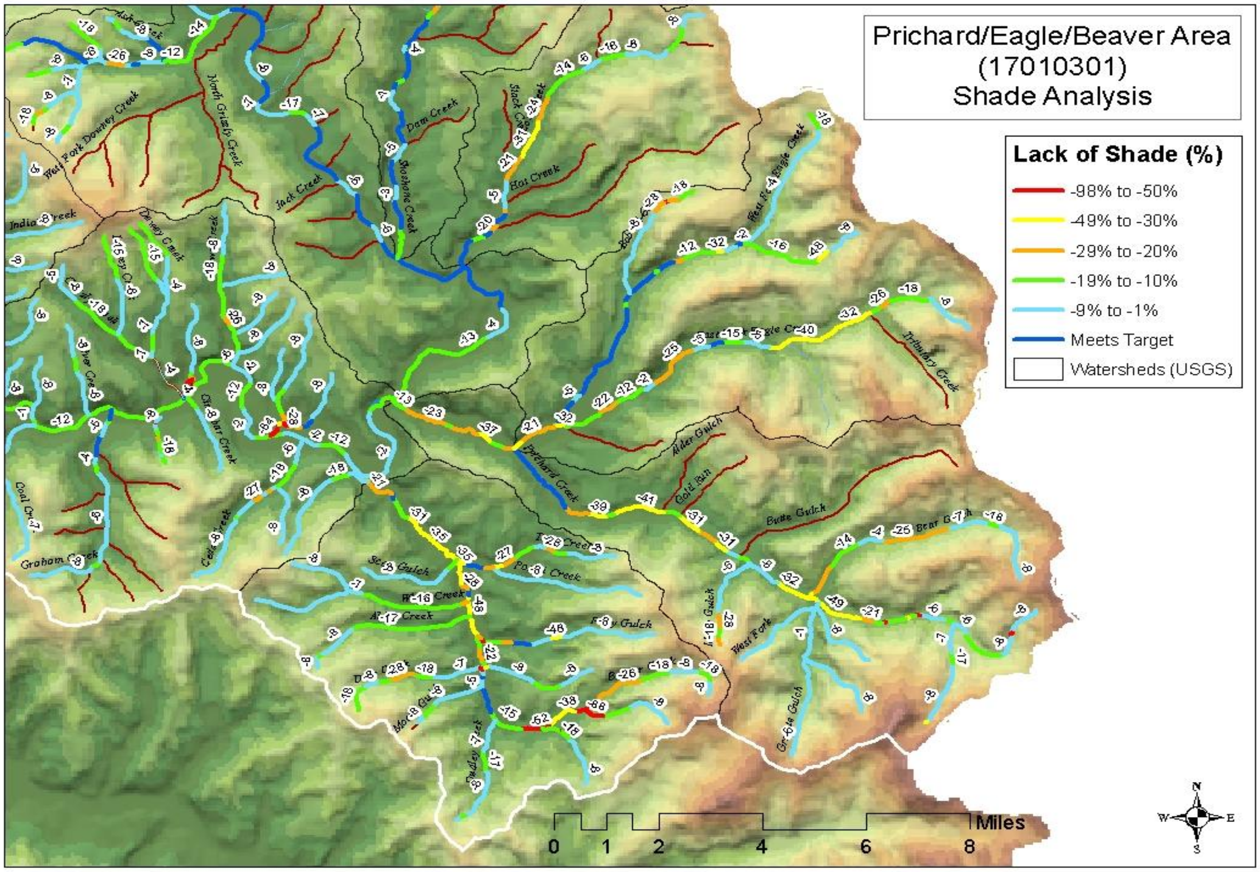

Figure 23. Shade deficits (percent lack of shade) in the Prichard Creek, Eagle Creek, and Beaver Creek drainages.

Approved state BMPs listed in the Idaho water quality standards include those in the "Rules Pertaining to the Idaho Forest Practices Act," "Rules Governing Exploration and Surface Mining in Idaho," and "Dredge and Placer Mining Operations in Idaho" administered by IDL and the "Stream Channel Alteration Rules" administered by the Idaho Department of Water Resources (IDWR). These temperature TMDLs and shade targets should be considered in these programs to prevent additional stream impairments.

For example, the Idaho Forest Practices Act (FPA) administered by IDL is recognized in the Idaho water quality standards as containing approved BMPs for limiting nonpoint sources of pollution including the excess thermal loading addressed in these TMDLs. These practices especially apply to forest management on private lands and state endowment lands managed by IDL. Within the Upper (North Fork) Coeur d'Alene River subbasin, IDL manages approximately 7,400 acres in the lower part of the watershed, and private landowners own 23,007 acres.

Under the FPA, riparian protections are applied to stream protection zones depending on whether streams are used for domestic water supply or are important for fish spawning, rearing, or migration. Streams used for domestic water supply or important for fisheries are called Class I streams, and the stream protection zone is the area within a slope distance of 75 feet from the ordinary high water mark on each side of the stream. Class II streams are usually headwater streams or minor drainages used for spawning or rearing by few, if any, fish. Class II streams that are not used for domestic water supply or used by fish for spawning and rearing and that contribute to Class I streams have a stream protection zone of 30 feet slope distance from the ordinary high water mark on each side of the stream. Class II streams that do not contribute to Class I streams must have undisturbed soils within at least a 5 feet slope distance from the ordinary high water mark on each side of the stream.

There are also a number of federal regulations and programs pertinent to these TMDLs. For example, the Inland Native Fish Strategy (INFISH) includes management directives for riparian areas designed to protect inland native fish species on lands managed by the USFS and BLM (USFS 1995). These directives include riparian management objectives (RMOs) that specify goals for riparian buffers and shade. Other pertinent federal programs include dredge and fill permitting by the Army Corps of Engineers and management plans associated with the Endangered Species Act by the US Fish and Wildlife Service. Waters from this subbasin are included in critical habitat designations for the threatened bull trout. Implementation of these TMDLs in coordination with recovery planning should help achieve water temperatures more suitable for bull trout.

Impoundments of water from beaver activity are considered a natural condition and are known to have many desired benefits for water quality and aquatic life. Although these areas can contribute to increased solar loads and increased temperature, they will be considered natural conditions for the purposes of this TMDL even if the resulting solar loading for a given interval does not match the load identified in the load analysis tables in Appendix F.

Increasing riparian shade and restoring natural channel widths are recommended as the primary activities for implementation of this temperature TMDL. However, the following additional strategies can be employed to maintain and improve coldwater habitats for fish and other aquatic organisms in the subbasin:

- Protect springs, headwaters, and other sources of cold water as well as cold water refugia in side-channel habitat. This strategy may be especially important in the larger streams of the system. In the lower North Fork Coeur d'Alene River mainstem, these areas were identified and illustrated by the thermal infrared imaging report (Watershed Sciences 2007).
- Consider enhancing cold water refugia and sources of cold water if needed and where appropriate.
- Retain and restore large wood and boulders in stream channels to encourage development of habitat complexity and deeper pools where aquatic life can access cooler water.
- Monitor the impacts of in-stream flows and water withdrawals on temperature.
- Remove barriers to aquatic organism passage where such reconnection does not pose unacceptable risks from nonnative species or genetic introgression. The removal of barriers may help
- Manage floodplains and wetlands to ensure hydrologic functions that protect cold water.
- Maintain existing shade and increase riparian shade by planting trees and shrubs.
- Follow Idaho water quality standards to minimize other sources of pollution and stressors to cold water aquatic life and salmonid spawning.
- Provide education about recommended practices to protect and restore water quality and cold water aquatic life.

Responsible Parties

The main responsible parties for implementing this TMDL are DEQ and the USFS. DEQ is the designated agency for implementing the CWA in Idaho, including establishing water quality standards and TMDLs, and leading programs to control and abate pollution sources. The USFS is the manager of greater than 90% of the land area and most of the streams in the subbasin. As the subbasin's major land manager, the USFS has the opportunity and responsibility to incorporate these TMDLs into resource decisions for protection of water quality.

Other responsible parties for TMDL implementation include those state agencies identified as designated management agencies in state plans as required by federal (CWA §303(e)) and state (Idaho Code 39-3601) laws and defined in the water quality standards:

- IDL for timber harvest activities, oil and gas exploration and development, and mining activities
- Idaho Soil and Water Conservation Commission for grazing and agricultural activities
- Idaho Transportation Department for public road construction
- Idaho State Department of Agriculture for aquaculture
- DEQ for all other activities

DEQ enters into many interagency agreements with these designated management agencies and other parties to ensure intergovernmental cooperation in Idaho's water quality management program. Important government agency partners in the Upper (North Fork) Coeur d'Alene River subbasin will also include the Bureau of Land Management, USFWS, ACOE, Natural Resources Conservation Service, EPA, IDWR, Idaho Department of Fish and Game, and Shoshone County.

The water quality concerns addressed in these TMDLs cannot be solved by government agencies alone. Efforts by private landowners, nongovernmental organizations, and public-private partnerships are crucial to successful water quality improvements. Environmental protection and water quality improvement projects by private landowners will contribute greatly to improved river conditions. Partnerships with educational institutions like the University of Idaho and organizations like the North Idaho Fly Casters will also be vital to implementing these TMDLs. Numerous opportunities are available for partnerships, funding, and other assistance for work on private lands or with a public-private partnership.

The North Fork Coeur d'Alene River WAG has been instrumental in developing these TMDLs and will continue to provide a vital forum during TMDL implementation. This group combines government agency representatives, nongovernmental organizations, and private landowners to make water quality related decisions in the subbasin. The WAG will lead development of the TMDL implementation plan and its execution.

Reasonable Assurance

All load allocations within this document are directed at nonpoint sources of pollution. On-the-ground actions designed to reduce pollutant loads will be completed through designated management agencies, agency partners, and citizen participation. DEQ's continued interaction with these groups will help ensure progress is made towards pollutant reductions. DEQ will inform these groups about water quality data, updated BMPs, and potential funding sources.

Monitoring Strategy

Monitoring associated with these TMDLs should include a range of strategies. Monitoring that incorporates the elements of these TMDLs is likely to provide the most important and useful data when evaluating TMDL goals and attainment. These monitoring elements include aerial photographs, bank-full width and Solar Pathfinder shade measurements, and other information about the riparian plant community. Aerial photographs from the NAIP are updated periodically, available online, and can be useful tools to evaluate changing riparian conditions over time.

For DEQ's recommendations on measuring shade and bank-full width associated with PNV temperature TMDLs, see Shumar and De Varona (2009, 6–14). These recommendations are similar to the methods used to field-verify aerial photograph interpretations for this TMDL.

To adequately characterize the effective shade on a stream reach, DEQ recommends 10 Solar Pathfinder traces (photos) taken over systematic intervals (e.g., every 50 m or every 50 paces) within a single shade class category. Random samples can also be useful. Solar Pathfinder photographs should be collected following Solar Pathfinder user manual specifications. The beginning point for Solar Pathfinder monitoring should be selected at a unique location, such as 50 m from a bridge or fence line. Then, monitoring should proceed upstream or downstream collecting photographs at fixed intervals.

DEQ recommends measuring bank-full width, photographing the riparian vegetation and stream landscape, and recording the conditions of riparian vegetation (e.g., species present and dominant) at each Solar Pathfinder site. It may also be helpful to collect densiometer measurements of canopy cover. These data can potentially be used to develop a relationship between canopy cover and shade that could enable TMDL compliance monitoring by densiometer.

There are many publications and resources available to help inform monitoring associated with shade and temperature TMDLs. The Oregon Watershed Enhancement Board's *Water Quality Monitoring: Technical Guide Book* contains a chapter on stream shade and canopy cover monitoring methods that includes a comparison of the various methods and the advantages of each (OWEB 1999). The Idaho *2004 Interagency Forest Practices Water Quality Audit* contains information on shade and a comparison of canopy cover to shade measurements (DEQ 2007a, Appendix F). Another review of stream shade measurement techniques was completed by Teti and Pike (2005) in British Columbia.

In addition to monitoring the elements included in this TMDL load analysis, direct measurements of stream temperature will be valuable to evaluate trends and associated biological impacts. Strategic deployment of digital temperature data recorders can be a simple and inexpensive way to measure stream temperatures over time. DEQ has published a protocol for placement and retrieval of temperature data loggers in Idaho streams (Zaroban 2000). A user's guide to measuring stream temperatures with digital data loggers was published by the USFS (Dunham et al. 2005). New recommendations include long-term, year-round deployment of digital temperature data loggers (Isaak, Horan, and Wollrab 2010). These types of stream temperature data can be very useful for analyzing stream temperatures and biological impacts of temperature changes, and for developing stream temperature models.

Stream temperature models for predicting temperature and habitat suitability in Idaho are being developed and refined. For example, USFS Rocky Mountain Research Station scientists in Boise have developed a multiple regression stream temperature model based on thermograph records and a simple set of geomorphic predictor variables (http://www.fs.fed.us/rm/boise/AWAE/projects/stream_temperature.shtml). Models like this one could be very useful in temperature-related water body assessments, TMDLs, and TMDL implementation.

Aerial remote sensing as a monitoring tool can also provide very useful information about stream temperatures. In 2007, this approach was used to collect thermal infrared (TIR) imagery and LiDAR (light detection and ranging) data to map stream temperatures in the North Fork Coeur d'Alene River from Shoshone Creek to the mouth (Watershed Sciences 2007). This project yielded important information about temperature patterns, including springs and coldwater refugia. Related ongoing cooperation between USFS and IDFG to monitor fish populations and water temperatures could be important in implementing and evaluating these TMDLs.

In addition to stream temperature and shade monitoring, biological monitoring will be helpful to evaluate the effects of changing thermal conditions and ensure full support of cold water aquatic life and salmonid spawning beneficial uses. The primary biological monitoring by DEQ is the annual BURP sampling at sites on wadeable streams. This program collects data on fish, habitat, and macroinvertebrates for water body assessment purposes. Other biological monitoring by USFS, IDFG, and others, particularly related to fisheries, will be valuable in the future.

Adequate planning is important to ensure data quality appropriate for water body assessments. For more information, refer to the discussion of data tiers in DEQ's *Water Body Assessment Guidance* (Grafe et al. 2002). A sampling and analysis plan and quality assurance project plan should be adopted for water quality monitoring efforts. These should follow current monitoring and analysis guidance from EPA to ensure accurate and reliable results. Stream temperature monitoring, Solar Pathfinder measurements, and bank-full width measurements are recommended for all AUs in these TMDLs.

Pollutant Trading

Pollutant trading, also known as water quality trading, is a voluntary contractual agreement to exchange pollutant load reductions between two parties. This formal trading program is included in Idaho water quality standards (IDAPA 58.01.02.055.06), and DEQ's policy is to allow pollutant trading as a means to meet TMDLs, thus restoring water quality limited water bodies to compliance with water quality standards. This policy is implemented through the *Water Quality Pollutant Trading Guidance* (DEQ 2010).

Pollutant trading can help solve surface water quality problems by focusing on cost-effective, local solutions. The practice is especially beneficial when pollutant sources face substantially different costs associated with pollutant load reduction. Typically, a party facing relatively high costs for pollutant load reduction compensates another party to achieve an equivalent, less-costly pollutant load reduction. Parties are likely to trade only if both benefit, and trading allows parties to decide how to best reduce pollutant loadings within the limits of certain requirements.

For pollutant trading to be authorized, it must be specifically mentioned within an EPA-approved TMDL document and a pollutant trading framework must be included in the TMDL implementation plan developed by DEQ and the WAG.

Pollutant trading is not likely to be applicable to these temperature TMDLs. The TMDLs are essentially set to natural background conditions. There are no NPDES-permitted point sources generating thermal loads, and no wasteload allocation is provided. In addition, pollutant trading for temperature is not currently considered feasible due to the time required for vegetation growth and the lengthy lag time between planting and the development of significant shade. However, pollutant trading should be considered a potential tool for these TMDLs in the future if it can be carried out in accordance with Idaho water quality standards.

5.6 Public Participation

Public participation was a vital component of completing these temperature TMDLs and was primarily accomplished by convening a North Fork Coeur d'Alene River WAG. The WAG first convened in 2007 and met every month or two to guide data collection and assessments, review and comment on TMDL development, plan and implement TMDLs, and work toward water quality improvements within the Upper (North Fork) Coeur d'Alene River subbasin. A total of 41 meetings were held from 2007 through 2012 during development of these TMDLs. All WAG meetings were open to the public and most were held in the USDA Forest Service office in Smelterville. Meeting agendas, meeting notes, and copies of handouts and presentations are available on the WAG website at http://www.deq.idaho.gov/north-fork-cda-river-subbasin-wag. A distribution list and response to public comments is provided in Appendices I and J, respectively.

5.7 Conclusions

This document addresses water temperature conditions in the streams and rivers of the Upper (North Fork) Coeur d'Alene River subbasin and establishes temperature TMDLs for 54 AUs with water temperatures in excess of Idaho's water quality standards.

The full assessment found 54 AUs exceeding Idaho's water quality standards and recommended changes to the Integrated Report based on these findings (Table 9). Of these AUs, 31 were listed as impaired by temperature in the 2008 Integrated Report (DEQ 2009). An additional 23 AUs were listed as impaired by temperature in the 2010 Integrated Report, and 3 were delisted due to lack of temperature data (DEQ 2011). Load allocations are established for 54 AUs, and no wasteload allocations are made.

Table 9. Summary of temperature assessment outcomes for all 79 assessment units.

Assessment Unit Number	Assessment Unit Name	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
ID17010301PN001_02	North Fork Coeur d'Alene River tributaries below Prichard Creek	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN001_02a	North Fork Coeur d'Alene River tributaries between Yellowdog and Prichard Creeks	No	Temperature not assessed.	No temperature data available.
ID17010301PN001_05	North Fork Coeur d'Alene River below Prichard Creek	Yes	Move to Category 4a.	USFS data exceeded SS and CWAL criteria. Excess solar load from lack of shade.
ID17010301PN001_05a	North Fork Coeur d'Alene River between Yellowdog and Prichard Creeks	Yes	Move to Category 4a.	USFS data exceeded SS and CWAL criteria. Excess solar load from lack of shade.
ID17010301PN002_02	Graham Creek headwaters and tributaries	No	Temperature not assessed.	No temperature data available.

Assessment Unit Number	Assessment Unit Name	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
ID17010301PN002_03	Graham Creek below Deceitful Gulch	Yes	Move to Category 4a.	DEQ data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN003_02	Beaver Creek headwaters and tributaries	Yes	Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN003_03	Beaver Creek below White Creek	Yes	Move to Category 4a.	DEQ and USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN004_02	Prichard Creek tributaries between Butte Gulch and Eagle Creek	No	Temperature not assessed.	No temperature data available.
ID17010301PN004_03	Prichard Creek between Butte Gulch and Eagle Creek	No	Delisted in 2010. Temperature not assessed.	No temperature data available.
ID17010301PN004_04	Prichard Creek below Eagle Creek	Yes	Move to Category 4a.	DEQ and USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN005_02	Prichard Creek headwaters and tributaries above Butte Gulch	Yes	Move to Category 4a.	DEQ and USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN005_03	Prichard Creek between Barton Gulch and Butte Gulch	No	Delisted in 2010. Temperature not assessed.	No temperature data available.
ID17010301PN006_02	Butte Gulch	No	Temperature not assessed.	No temperature data available.
ID17010301PN007_02	East Fork Eagle Creek and tributaries	No	Temperature not assessed.	No temperature data available.
ID17010301PN007_03	Eagle Creek	No	Temperature not assessed.	No temperature data available.
ID17010301PN008_02	West Fork Eagle Creek and tributaries	Yes	Move to Category 4a.	DEQ and USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN009_02	Lost Creek headwaters and tributaries	No	Temperature not assessed.	No temperature data available.
ID17010301PN009_03	Lost Creek below East Fork Lost Creek	Yes	Move to Category 4a.	DEQ data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN010_02	Shoshone Creek tributaries below Falls Creek	No	Temperature not assessed.	No temperature data available.
ID17010301PN010_03	Shoshone Creek below Falls Creek	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS and CWAL criteria. Excess solar load from lack of shade.
ID17010301PN011_02	Falls Creek and tributaries	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS and EPA BT criteria. Excess solar load from lack of shade.

Assessment Unit Number	Assessment Unit Name	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
ID17010301PN012_02	Shoshone Creek headwaters and tributaries above Falls Creek	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN012_03	Shoshone Creek between Little Lost Fork and Falls Creek	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS and EPA BT criteria. Excess solar load from lack of shade.
ID17010301PN013_02	North Fork Coeur d'Alene River tributaries between Tepee and Yellowdog Creeks	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS and EPA BT criteria. Excess solar load from lack of shade.
ID17010301PN013_02a	North Fork Coeur d'Alene River tributaries between Jordan and Tepee Creeks	No	Temperature not assessed.	No temperature data available.
ID17010301PN013_04	North Fork Coeur d'Alene River between Jordan and Tepee Creeks	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS and EPA BT criteria. Excess solar load from lack of shade.
ID17010301PN013_05	North Fork Coeur d'Alene River between Tepee and Yellowdog Creeks	Yes	Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN014_02	Jordan Creek headwaters and tributaries	No	Temperature not assessed.	No temperature data available.
ID17010301PN014_02a	Cub Creek	No	Temperature not assessed.	No temperature data available.
ID17010301PN014_02b	Calamity Creek	No	Temperature not assessed.	No temperature data available.
ID17010301PN014_03	Jordan Creek and Lower Lost Fork	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN015_02	North Fork Coeur d'Alene River, upper, headwaters and tributaries	Yes	Move to Category 4a.	DEQ and USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN015_03	North Fork Coeur d'Alene River, upper, and lower Buckskin Creek	Yes	Move to Category 4a.	DEQ and USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN015_04	North Fork Coeur d'Alene River between Buckskin and Jordan Creeks	Yes	Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN016_02	West Elk Creek and Cataract Creek	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN017_02	Tepee Creek tributaries below Trail Creek	No	Temperature not assessed.	No temperature data available.
ID17010301PN017_04	Tepee Creek between Trail Creek and Independence Creek	Yes	Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.

Assessment Unit Number	Assessment Unit Name	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
ID17010301PN017_05	Tepee Creek below Independence Creek	Yes	Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN018_02	Independence Creek headwaters and tributaries	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN018_03	Independence Creek between Ellis and Declaration Creeks	No	Delisted in 2010. Temperature not assessed.	No temperature data available.
ID17010301PN018_03a	Declaration Creek, lower	Yes	Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN018_03b	Snow Creek, lower	Yes	Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN018_04	Independence Creek below Declaration Creek	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS and CWAL criteria. Excess solar load from lack of shade.
ID17010301PN019_02	Trail Creek headwaters and tributaries	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN019_03	Trail Creek below Stewart Creek	Yes	Move to Category 4a.	DEQ and USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN020_02	Tepee Creek headwaters and tributaries	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN020_03	Tepee Creek between Short Creek and Trail Creek	Yes	Move to Category 4a.	DEQ and USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN021_02	Brett Creek and tributaries	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN022_02	Miners Creek and tributaries	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN023_02	Flat Creek headwaters and tributaries	No	Temperature not assessed.	No temperature data available.
ID17010301PN023_03	Flat Creek, lower	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN024_02	Yellowdog Creek and tributaries	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.

Assessment Unit Number	Assessment Unit Name	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
ID17010301PN025_02	Downey Creek headwaters and tributaries	No	Temperature not assessed.	No temperature data available.
ID17010301PN025_03	Downey Creek, lower	No	Temperature not assessed.	No temperature data available.
ID17010301PN026_02	Brown Creek and tributaries	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS and EPA BT criteria. Excess solar load from lack of shade.
ID17010301PN027_03	Grizzly Creek, below Dewey Creek	No	Temperature not assessed.	No temperature data available.
ID17010301PN028_02	Steamboat Creek headwaters and tributaries	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN028_03	Steamboat Creek and West Fork Steamboat Creek below Comfy Creek	Yes	Move to Category 4a.	DEQ and USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN029_02	Cougar Gulch headwaters and tributaries	No	Temperature not assessed.	No temperature data available.
ID17010301PN029_03	Cougar Gulch below East Fork Cougar Gulch	Yes	List Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN030_02	Little North Fork Coeur d'Alene River tributaries to Solitaire Creek	No	Temperature not assessed.	No temperature data available.
ID17010301PN030_02a	Little North Fork Coeur d'Alene River tributaries above Iron Creek	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN030_02b	Hudlow Creek and tributaries	No	Temperature not assessed.	No temperature data available.
ID17010301PN030_02c	Little North Fork Coeur d'Alene River tributaries between Hudlow and Deception Creeks	Yes	Move to Category 4a.	DEQ data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN030_02d	Little North Fork Coeur d'Alene River tributaries below Skookum	Yes	Move to Category 4a.	DEQ data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN030_03	Little North Fork Coeur d'Alene River between Solitaire and Skookum Creeks	Yes	Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN030_04	Little North Fork Coeur d'Alene River below Skookum Creek	Yes	Move to Category 4a.	USFS data exceeded SS and CWAL criteria. Excess solar load from lack of shade.
ID17010301PN031_02	Bumblebee Creek and tributaries	Yes	Move to Category 4a.	DEQ data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN032_02	Laverne Creek and tributaries	Yes	Move to Category 4a.	DEQ and USFS data exceeded SS criteria. Excess solar load from lack of shade.

Assessment Unit Number	Assessment Unit Name	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
ID17010301PN033_02	Leiberg Creek and tributaries	Yes	Move to Category 4a.	DEQ data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN034_02	Bootjack Creek and tributaries	Yes	Move to Category 4a.	DEQ data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN035_02	Iron Creek and tributaries	Yes	Listed Category 5 in 2010. Move to Category 4a.	USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN036_02	Burnt Cabin Creek and tributaries	Yes	Move to Category 4a.	DEQ and USFS data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN037_02	Deception Creek and tributaries	Yes	Move to Category 4a.	DEQ data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN038_02	Skookum Creek headwaters and tributaries	No	Temperature not assessed.	No temperature data available.
ID17010301PN038_03	Skookum Creek, lower	Yes	Listed Category 5 in 2010. Move to Category 4a.	DEQ data exceeded SS criteria. Excess solar load from lack of shade.
ID17010301PN039_02	Copper Creek headwaters and tributaries	No	Temperature not assessed.	No temperature data available.
ID17010301PN039_03	Copper Creek, lower	Yes	Move to Category 4a.	DEQ data exceeded SS criteria. Excess solar load from lack of shade.

Note: US Forest Service (USFS); salmonid spawning (SS); cold water aquatic life (CWAL); US Environmental Protection Agency (EPA); bull trout (BT)

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GIS Coverages

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Glossary

§305(b)

Refers to section 305 subsection "b" of the Clean Water Act. The term "305(b)" generally describes a report of each state's water quality and is the principle means by which the US Environmental Protection Agency, Congress, and the public evaluate whether US 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. Section 303(d) requires states to develop a list of water bodies that do not meet water quality standards. This section also requires total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and the TMDLs are subject to US Environmental Protection Agency approval.

Ambient

General conditions in the environment (Armantrout 1998). In the context of water quality, ambient waters are those representative of general conditions, not associated with episodic perturbations or specific disturbances such as a wastewater outfall (EPA 1996).

Anthropogenic

Relating to, or resulting from, the influence of human beings on nature.

Aquatic

Occurring, growing, or living in water.

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 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.

Beneficial Use

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

Beneficial Use Reconnaissance Program (BURP)

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

Benthic

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

Best Management Practices (BMPs)

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

Biological Integrity

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

Biota

The animal and plant life of a given region.

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 develop information on, and control the quality of, the nation's water resources.

Community

A group of interacting organisms living together in a given place.

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 US Environmental Protection Agency develops criteria guidance; states establish criteria.

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.

Ecosystem
The interacting system of a biological community and its nonliving (abiotic) environmental surroundings.

Endangered Species
Animals, birds, fish, plants, or other living organisms threatened with imminent extinction. Requirements for declaring a species as endangered are contained in the Endangered Species Act.

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

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

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

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

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 coldwater 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.

Growth Rate

A measure of how quickly something living will develop and grow, such as the amount of new plant or animal tissue produced per a given unit of time or number of individuals added to a population.

Habitat

The living place of an organism or community.

Headwater

The origin or beginning of a stream.

Hydrologic Basin

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

Hydrologic 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, 4th-field hydrologic units have been more commonly called subbasins; 5th- and 6th-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 4th-field hydrologic units.

Instantaneous

A condition or measurement at a moment (instant) in time.

Key Watershed

A watershed that has been designated in former Idaho Governor Phil Batt's State of Idaho Bull Trout Conservation Plan (1996) as critical to the long-term persistence of regionally important trout populations.

Limiting Factor

A chemical or physical condition that determines the growth potential of an organism. This can result in a complete inhibition of growth, but typically results in less than maximum growth rates.

Load Allocation (LA)

A portion of a water body's load capacity for a given pollutant that is given to a particular nonpoint source (by class, type, or geographic area).

Load(ing)

The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Loading is the product of flow (discharge) and concentration.

Load Capacity (LC)

How much pollutant a water body can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, a margin of safety, and natural background contributions, it becomes a total maximum daily load.

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 load capacity set aside to allow the uncertainty 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 (e.g., 4 is the median of 1, 2, 4, 14, 16). If there is an even number of numbers, the median is the average of the two middle numbers. For example, 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 discernable point or origin. They include, but are not limited to, irrigated and nonirrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.

Not Assessed (NA)

A concept and an assessment category describing water bodies that have been studied but are missing critical information needed to complete an assessment.

Not Fully Supporting

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

Not Fully Supporting Cold Water

At least one biological assemblage has been significantly modified beyond the natural range of its reference condition.

Parameter

A variable, measurable property whose value is a determinant of the characteristics of a system (e.g., temperature, dissolved oxygen, and fish populations are parameters of a stream or lake).

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 that 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.

Protocol

A series of formal steps for conducting a test or survey.

Quality Assurance (QA)

A program organized and designed to provide accurate and precise results. Included are the selection of proper technical methods, tests, or laboratory procedures; sample collection and preservation; the selection of limits; data evaluation; quality control; and personnel qualifications and training (Rand 1995). The goal of QA is to ensure the data provided are of the quality needed and claimed (EPA 1996).

Quality Control (QC)

Routine application of specific actions required to provide information for the quality assurance program. Included are standardization, calibration, and replicate samples (Rand 1995). QC is implemented at the field or bench level (EPA 1996).

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).
Reference Site	A specific locality on a water body that is minimally impaired and is representative of reference conditions for similar water bodies.
Resident	Describes fish that do not migrate.
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.
Spring	Ground water seeping out of the earth where the water table intersects the ground surface.
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 1st-order stream is an unforked or unbranched stream. Under Strahler's (1957) system, higher-order streams result from the joining of two streams of the same order.

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.

Stressors

Physical, chemical, or biological entities that can induce adverse effects on ecosystems or human health.

Subbasin

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

Subbasin Assessment (SBA)

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

Subwatershed

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

Surface Runoff

Precipitation, snowmelt, 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.

Threatened Species

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

Total Maximum Daily Load (TMDL)

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

Tributary

A stream feeding into a larger stream or lake.

Turbidity

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

Wasteload Allocation (WLA)

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

Water Body

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

Water 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 criteria are 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 US 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.

Watershed

1) All the land that 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 that contributes water to a point of interest in a water body.

Water Body Identification Number (WBID)

A number that uniquely identifies a water body in Idaho and ties in to the Idaho water quality standards and GIS information.

Wetland

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

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Appendix A. Unit Conversion Chart

Table A-1. Common conversions from metric to English units.

	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 = 35.31cfs	3 cfs = 0.09 m^3/sec 3 m^3/sec = 105.94 cfs
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 is equal to 1.55 cfs.

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Appendix B. Applicable Water Quality Standards and Criteria

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 fulfill Clean Water Act (CWA) goals for "swimmable and fishable waters" and may be categorized as existing uses, designated uses, and presumed uses. Refer to Idaho water quality standards and Section 3 of the *Water Body Assessment Guidance, Second Edition* (Grafe et al. 2002) for additional detail regarding the identification of beneficial uses.

Beneficial uses for waters in the Upper (North Fork) Coeur d'Alene River subbasin include cold water aquatic life, salmonid spawning, primary contact recreation, secondary contact recreation, domestic water supply, agricultural water supply, industrial water supply, wildlife habitats, and aesthetics (Table B-1). Waters with beneficial uses specifically designated in the water quality standards sections 110-160 are also listed separately in Table B-2. These are called designated beneficial uses. There may also be presumed beneficial uses based on background information and DEQ policy. Presumed use protections for all undesignated waters include cold water aquatic life and either primary or secondary contact recreation. Additionally, existing uses are also protected, even if not formally designated, and are those uses that occur now or have occurred since November 28, 1975. An existing use applied in the North Fork Coeur d'Alene River subbasin includes salmonid spawning for all stream segments based on available fisheries data (Wild Trout Enterprises 2009).

In this subbasin, most beneficial uses apply to the entire subbasin. These include cold water aquatic life, recreation, agricultural water supply, industrial water supply, wildlife habitats, and aesthetics. Primary contact recreation is designated for the entire length of the North Fork Coeur d'Alene River, from its headwaters in the upper North Fork Coeur d'Alene River watershed to the confluence with the South Fork Coeur d'Alene River. Prichard Creek, from its headwaters to the North Fork Coeur d'Alene River, is also designated for primary contact recreation. Secondary contact recreation is a presumed use for all other surface waters of the subbasin. Domestic water supply is a designated use for the North Fork Coeur d'Alene River and portions of Prichard Creek.

Table B-1. Selected beneficial uses defined.

Beneficial Use	Definition
Cold Water Aquatic Life	Water quality appropriate for the protection and maintenance of a viable aquatic life community for cold water species.
Salmonid Spawning	Waters which provide or could provide a habitat for active self-propagating populations of salmonid fishes.
Primary Contact Recreation	Water quality appropriate for prolonged and intimate contact by humans or for recreational activities when the ingestion of small quantities of water is likely to occur. Such activities include, but are not restricted to, those used for swimming, water skiing, or skin diving.
Secondary Contact Recreation	Water quality appropriate for recreational uses on or about the water and which are not included in the primary contact category. These activities may include fishing, boating, wading, infrequent swimming, and other activities where ingestion of raw water is not likely to occur.
Domestic Water Supply	Water quality appropriate for drinking water supplies.
Special Resource Water	Those specific segments or bodies of water which are recognized as needing intensive protection to: preserve outstanding or unique characteristics; or to maintain current beneficial use.
Agricultural Water Supply	Water quality appropriate for the irrigation of crops or as drinking water for livestock.
Industrial Water Supply	Water quality appropriate for industrial water supplies.
Wildlife Habitats	Water quality appropriate for wildlife habitats.
Aesthetics	Water quality appropriate for aesthetics.

Table B-2. Beneficial uses for North Fork Coeur d'Alene River subbasin waters.

Beneficial Use	Waters		Type
Cold Water Aquatic Life	North Fork Coeur d'Alene River (Yellow Dog Creek to mouth)	ID17010301PN001_05	Designated
	Prichard Creek (Butte Creek to mouth)	ID17010301PN004_03 ID17010301PN004_04	
	Prichard Creek (source to Butte Creek)	ID17010301PN005_02 ID17010301PN005_03	
	North Fork Coeur d'Alene River (Jordan Creek to Yellow Dog Creek)	ID17010301PN013_04 ID17010301PN013_05	
	North Fork Coeur d'Alene River (source to Jordan Creek)	ID17010301PN015_02 ID17010301PN015_03 ID17010301PN015_04	
	All additional streams and assessment units.		Existing
Salmonid Spawning	North Fork Coeur d'Alene River (Yellow Dog Creek to mouth)	ID17010301PN001_05	Designated
	Prichard Creek (Butte Creek to mouth)	ID17010301PN004_03 ID17010301PN004_04	
	Prichard Creek (source to Butte Creek)	ID17010301PN005_02 ID17010301PN005_03	

Beneficial Use	Waters		Type
	North Fork Coeur d'Alene River (Jordan Creek to Yellow Dog Creek)	ID17010301PN013_04 ID17010301PN013_05	
	North Fork Coeur d'Alene River (source to Jordan Creek)	ID17010301PN015_02 ID17010301PN015_03 ID17010301PN015_04	
	All additional streams and assessment units.		Existing
Primary Contact Recreation	North Fork Coeur d'Alene River (Yellow Dog Creek to mouth)	ID17010301PN001_05	Designated
	Prichard Creek (Butte Creek to mouth)	ID17010301PN004_03 ID17010301PN004_04	
	Prichard Creek (source to Butte Creek)	ID17010301PN005_02 ID17010301PN005_03	
	North Fork Coeur d'Alene River (Jordan Creek to Yellow Dog Creek)	ID17010301PN013_04 ID17010301PN013_05	
	North Fork Coeur d'Alene River (source to Jordan Creek)	ID17010301PN015_02 ID17010301PN015_03 ID17010301PN015_04	
Secondary Contact Recreation	All additional streams and assessment units not designated for primary contact recreation.		Presumed
Domestic Water Supply	North Fork Coeur d'Alene River (Yellow Dog Creek to mouth)	ID17010301PN001_05	Designated
	Prichard Creek (source to Butte Creek)	ID17010301PN005_02 ID17010301PN005_03	
	North Fork Coeur d'Alene River (Jordan Creek to Yellow Dog Creek)	ID17010301PN013_04 ID17010301PN013_05	
	North Fork Coeur d'Alene River (source to Jordan Creek)	ID17010301PN015_02 ID17010301PN015_03 ID17010301PN015_04	
Agricultural Water Supply	All subbasin waters and assessment units.		Designated
Industrial Water Supply	All subbasin waters and assessment units.		Designated
Wildlife Habitats	All subbasin waters and assessment units.		Designated
Aesthetics	All subbasin waters and assessment units.		Designated

Temperature Water Quality Criteria

These temperature TMDLs are based on Idaho water quality standards (IDAPA 58.01.02) adopted by the State of Idaho to protect public health and welfare, enhance the quality of water, and serve the purposes of the Clean Water Act, which states that water quality standards should do the following:

- provide, wherever attainable, water quality for the protection and propagation of fish, shellfish, and wildlife and protection of recreation in and on the water (fishable/swimmable conditions)
- consider the use and value of state waters for public water supplies, propagation of fish and wildlife, recreation, agriculture and industrial purposes, and navigation.

The Idaho water quality standards program is a joint effort between the Idaho Department of Environmental Quality (DEQ) and the U.S. Environmental Protection Agency (EPA). DEQ is responsible for developing and enforcing water quality standards that protect beneficial uses. The EPA develops regulations, policies, and guidance to help Idaho implement the program and to ensure that Idaho's adopted standards are consistent with the requirements of the Clean Water Act and relevant regulations. The EPA has authority to review and approve or disapprove state standards and to promulgate federal water quality rules.

Idaho water quality standards contain several provisions relevant to water temperature and these TMDLs, including descriptions of surface water beneficial uses and specific temperature criteria established to protect aquatic life uses. The main beneficial use addressed by these TMDLs is cold water aquatic life (CWAL), ensuring water quality appropriate for the protection and maintenance of a viable aquatic life community for cold water species (IDAPA 58.01.02.100.01.a). An associated beneficial use is salmonid spawning (SS), which ensures waters that provide or could provide a habitat for active self-propagating populations of salmonid fishes (IDAPA 58.01.02 100.01.b). Temperature criteria for these uses include daily maximum water temperatures and maximum daily average temperatures (Table B-3) (IDAPA 58.01.02 250.02.b).

Cold water aquatic life temperature criteria apply throughout the entire year, but are most likely to exceed standards in late summer and early fall in this subbasin. The application of salmonid spawning criteria is determined by DEQ on a water body specific basis, taking into account the best available scientific information on salmonid spawning and incubation periods. In the Panhandle Region of Idaho, time periods for application of salmonid spawning temperature criteria have been established based on consultation with Idaho Department of Fish and Game biologists and DEQ guidance (Table B-4).

Table B-3. Summary of state and federal temperature criteria applicable in the North Fork Coeur d'Alene River subbasin.

Type	Location	Criteria[a]	Dates	
Cold Water Aquatic Life	Applies to entire subbasin	22 ºC (71.6 ºF) Maximum Instantaneous (MDMT)	Applies entire year	
		19 ºC (66.2 ºF) Maximum Daily Average (MDAT)		
Salmonid Spawning	Applies to North Fork Coeur d'Alene River (headwaters to mouth) and Prichard Creek (headwaters to mouth) and all other tributaries	13 ºC (55.4 ºF) Maximum Instantaneous (MDMT)	Spring Spawning >4,000 ft Jun 1 – July 31 3,000 – 4,000 ft May 15 – July 15 <3,000 ft May 1 – July 1	Fall Spawning Aug 15 – Nov 15
		9 ºC (48.2 ºF) Maximum Daily Average (MDAT)		
Idaho Bull Trout Criteria [b]	Applies to entire subbasin except 5th order streams (Tepee Creek below Independence Creek, and North Fork Coeur d'Alene River below Tepee Creek) [c]	13 ºC (55.4 ºF) Maximum Weekly Maximum (MWMT)	Rearing Jun 1 – Aug 31	n.a.
		9 ºC (48.2 ºF) Maximum Daily Average (MDAT)	n.a.	Spawning Sep 1 – Oct 31
EPA Bull Trout Criteria	Brown Creek, Falls Creek, and Graham Creek	10 ºC (50 ºF) Maximum Weekly Maximum (MWMT)	Jun 1 – Sep 30	

[a] MDMT = Maximum Daily Maximum Temperature; MDAT = Maximum Daily Average Temperature; MWMT = Maximum Weekly Maximum Temperature

[b] Current Idaho temperature criteria for bull trout have not been approved or disapproved by EPA and are therefore, not effective for Clean Water Act (CWA) purposes. Instead, the criteria adopted in 1998 are CWA-effective.

[c] There are discrepancies in the *State of Idaho Bull Trout Conservation Plan* (Batt 1996) identification of key watersheds referred to in Idaho water quality standards. See Appendix C for more information.

Table B-4. Time periods for application of Idaho salmonid spawning temperature criteria in the Idaho Panhandle.

Species	Timing
Westslope cutthroat trout	Elevation ≥ 4,000 feet (1,219 meters) = June 1 – July 31 Elevation 3,000 – 4,000 feet (914 – 1,219 meters) = May 15 – July 15 Elevation < 3,000 feet (< 914 m) = May 1 – July 1
Rainbow trout	May 1 – July 1
Fall spawning salmonids	August 15 – November 15

There are additional provisions in Idaho water quality standards for protection of bull trout due to their temperature sensitivity and conservation status. During the 1990s, DEQ developed temperature water quality criteria for bull trout and submitted these criteria to EPA for approval. During this time period, petitions were made to the U.S. Fish and Wildlife Service to list bull trout under the Endangered Species Act. Idaho addressed these concerns by developing a *State of Idaho Bull Trout Conservation Plan* in 1996 (Batt 1996). In 1997, EPA did not act on Idaho's criteria for bull trout and instead promulgated federal temperature criteria for bull trout in Idaho (CFR §131.33)(Table B-3). The 1997 EPA criteria specified "temperatures not to exceed 10 °C expressed as an average of daily maximum temperatures over a seven day period during the months June through September," and applied to three streams in this subbasin: Brown Creek (AU = ID17010301PN026_02), Falls Creek (AU = ID17010301PN011_02), and Graham Creek (AUs = ID17010301PN002_02 and 002_03). The Columbia River bull trout population segments, including the Coeur d'Alene Basin, were ultimately listed as threatened under the ESA in 1998.

In 1998, State of Idaho temperature criteria for bull trout were incorporated into state rule. In 2001, Idaho revised portions of the temperature criteria for bull trout (IDAPA 58.01.02 250.02.g). In 2003, Idaho submitted revised water quality standards to EPA, including the revised temperature criteria for bull trout (Table B-5). As of this TMDL in 2013, EPA has taken no action to approve or disapprove these revised criteria. Although the 1998 criteria were not acted on by EPA, they were adopted prior to EPA's adoption of the "Alaska Rule" in 2000 which specified state water quality standards become applicable for CWA purposes only after they are approved by EPA. Thus, although subsequently changed, the 1998 Idaho temperature criteria to protect bull trout are effective for CWA purposes for water bodies not included in the federal rule.

The 1998 Idaho criteria for water temperature and bull trout and the 2003 Idaho criteria revisions apply to the same geographic area. These criteria apply to all tributary waters, not including 5th-order main stem rivers, located above 600 meters elevation in the key watersheds listed in Table 6 in Appendix F of the *State of Idaho Bull Trout Conservation Plan* (Batt 1996), which lists "the entire Coeur d'Alene River Drainage."

Table B-5. Idaho water quality criteria for bull trout in 1998 and 2003.

Year	Description
1998	Temperatures not to exceed 12 °C daily average during June, July and August for juvenile bull trout rearing and 9 °C daily average during September and October for bull trout spawning.
2003	Temperatures not to exceed 13 °C maximum weekly maximum temperature during June, July, and August for juvenile bull trout rearing and 9 °C daily average during September and October for bull trout spawning.

For assessment purposes, there are allowances applicable to the numeric temperature criteria including a provision for departures that are infrequent, brief and small.

Idaho water quality standards say:

> "In making use support determinations, the Department may give less weight to departures from criteria in Section 250 for pH, turbidity, dissolved oxygen, and temperature that are infrequent, brief, and small if aquatic habitat and biological data indicate to the assessor that aquatic life beneficial uses are otherwise supported. Unless otherwise determined by the Department, "infrequent" means less than ten percent (10%) of valid, applicable, representative measurements when continuous data are available; "brief" means two (2) hours or less; and "small" means conditions that avoid acute effects. Subsection 053.03 only applies to use of this data for determination of beneficial support status. Subsection 053.05 does not apply to or affect the application of criteria for any other regulatory purpose including, but not limited to, determining whether a particular discharge or activity violates water quality standards." (IDAPA 58.01.02.054.03)

As the rule states, this only applies when determining beneficial use support status ***and*** when aquatic habitat and biological data (e.g., Beneficial Use Reconnaissance Program (BURP) data) indicate that aquatic life beneficial uses are otherwise supported. If habitat and biological data do not show full support of aquatic life beneficial uses, DEQ cannot apply this allowance. The allowance is for assessment purposes and does not apply for other regulatory purpose. When evaluating whether this rule applies, departures from criteria must be infrequent, brief, and small. When calculating frequency, exceedances occurring less than 10% of the time period being evaluated were considered "infrequent." Calculating the frequency of exceedance is addressed in a technical memo from Don Essig (2007). There is no specific guidance for brief and small exceedances.

Once the time period to be evaluated is determined, complete data records for that time period are necessary to measure the frequency of exceedance for temperature criteria. If incomplete data records exist, they may be used to infer the frequency of exceedance (Essig 2007). Given these time periods for water temperature criteria, it is helpful to have water temperature data from May 15 to October 31.

To determine whether departures from temperature criteria are brief, the water temperature data being evaluated ideally must be recorded at hourly intervals or less. If water temperature data are recorded at a longer interval (e.g., daily), it may not be possible to determine whether exceedances of acute criteria were actually brief.

To determine whether departures from temperature criteria are small, the water temperature data being evaluated, must be measured at an appropriate resolution (ideally intervals of 1°C or less). The measurement accuracy of many data logger thermistors is ±0.2 to ±0.3 °C (Onset Computer Corporation www.onsetcomp.com; Essig and Mebane 2003).

The temperature data assessed for this TMDL were evaluated relative to this exemption for brief, infrequent, and small exceedances. This evaluation did not alter the outcome of any water body assessments. When water temperatures exceeded the numeric criteria, those exceedances were not brief, infrequent, and small.

There is also a provision in the Idaho water quality standards for days when the air temperature is extremely high (IDAPA 58.01.02.080.03). This exemption states that "exceeding the temperature criteria in Section 250 will not be considered a water quality standard violation when the air temperature of a given day exceeds the ninetieth percentile of a yearly series of the maximum weekly maximum air temperature (MWMT) calculated over the historic record measured at the nearest weather reporting station."

The maximum weekly maximum temperature (MWMT) is defined as the single highest weekly maximum temperature (WMT) that occurs during a given year or other period of interest (e.g., a spawning period). The WMT is "the mean of daily maximum temperatures measured over a consecutive seven (7) day period ending on the day of calculation" (IDAPA 58.01.02.010.59). In other words, the MWMT is "the mean of daily maximum water temperatures measured over the annual warmest consecutive seven (7) day period occurring during a given year" (IDAPA 58.01.02.250.02.g).

The temperature data assessed for this TMDL were evaluated relative to this exemption for extremely warm air temperatures. The exemption did not alter the outcome of any water body assessments. When water temperatures exceeded the numeric criteria, those exceedances did not occur only during times of extremely warm air temperatures.

Perhaps the most important water quality criteria relevant to this TMDL are the provisions related to natural background conditions in the Idaho water quality standards.
There are many water bodies in Idaho that have minimal human impacts (e.g., wilderness areas) but exceed Idaho's water quality criteria for temperature. It is possible that some waters are naturally warmer than Idaho water quality criteria and that beneficial uses may be supported at temperatures warmer than the numeric criteria. This subject has been studied by DEQ and Idaho water quality standards address the issue with a provision for natural conditions.

The natural conditions (IDAPA 58.01.02.054.03) provision reads as follows:

> "There is no impairment of beneficial uses or violation of water quality standards where natural background conditions exceed any applicable water quality criteria as determined by the Department, and such natural background conditions shall not, alone, be the basis for placing a water body on the list of water quality limited water bodies described in Section 054."

Natural background conditions are defined (IDAPA 58.01.02.010.63) as follows:

> "The physical, chemical, biological, or radiological conditions existing in a water body without human sources of pollution within the watershed. Natural disturbances including, but not limited to, wildfire, geologic disturbance, diseased

> vegetation, or flow extremes that affect the physical, chemical, and biological integrity of the water are part of natural background conditions. Natural background conditions should be described and evaluated taking into account this inherent variability with time and place."

Natural background conditions as criteria (IDAPA 58.01.02 200.09) are stated as follows:

> "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."

Applying the natural conditions provisions in Idaho water quality standards can be difficult, and DEQ has developed guidelines and resources that can be used to determine natural background conditions and how to apply water quality criteria (see Essig and Mebane 2003).

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Appendix C. Assessment of Compliance with EPA Bull Trout Temperature Criteria

Water quality criteria for temperature applicable in this subbasin include federally-promulgated water quality standards for bull trout (CFR §131.33). See Appendix B of this TMDL for further information on temperature criteria. Three streams within the North Fork Coeur d'Alene River subbasin are included in EPA's temperature criteria (Table C-1, Figure C-1). In the 2002 Integrated Report, only one of these streams, Graham Creek, had been assessed for temperature status and it was considered impaired. Upper Graham Creek, Brown Creek and Falls Creek were not assessed. In the 2008 Integrated Report, these assessments for temperature were unchanged from 2002.

Table C-1. Assessment status of the North Fork Coeur d'Alene River subbasin streams included in EPA's temperature criteria for bull trout.

Stream	Assessment Unit(s)	2002 Status (Pollutant)	2008 Status (Pollutant)
Brown Creek	ID17010301PN026_02	Not Assessed	Not Assessed
Falls Creek	ID17010301PN011_02	Impaired (Sediment)/ Temperature Not Assessed	Impaired (Sediment)/ Temperature Not Assessed
Graham Creek	ID17010301PN002_02	Not Assessed	Not Assessed
	ID17010301PN002_03	Impaired (Temperature)	Impaired (Temperature)

The U.S. Forest Service (USFS) Idaho Panhandle National Forests, Coeur d'Alene River Ranger District provided DEQ with a substantial temperature dataset covering the years 1998 to 2008. DEQ collected water temperature data on Graham Creek in 1999. These data were evaluated relevant to the EPA bull trout temperature criteria for this TMDL analysis.

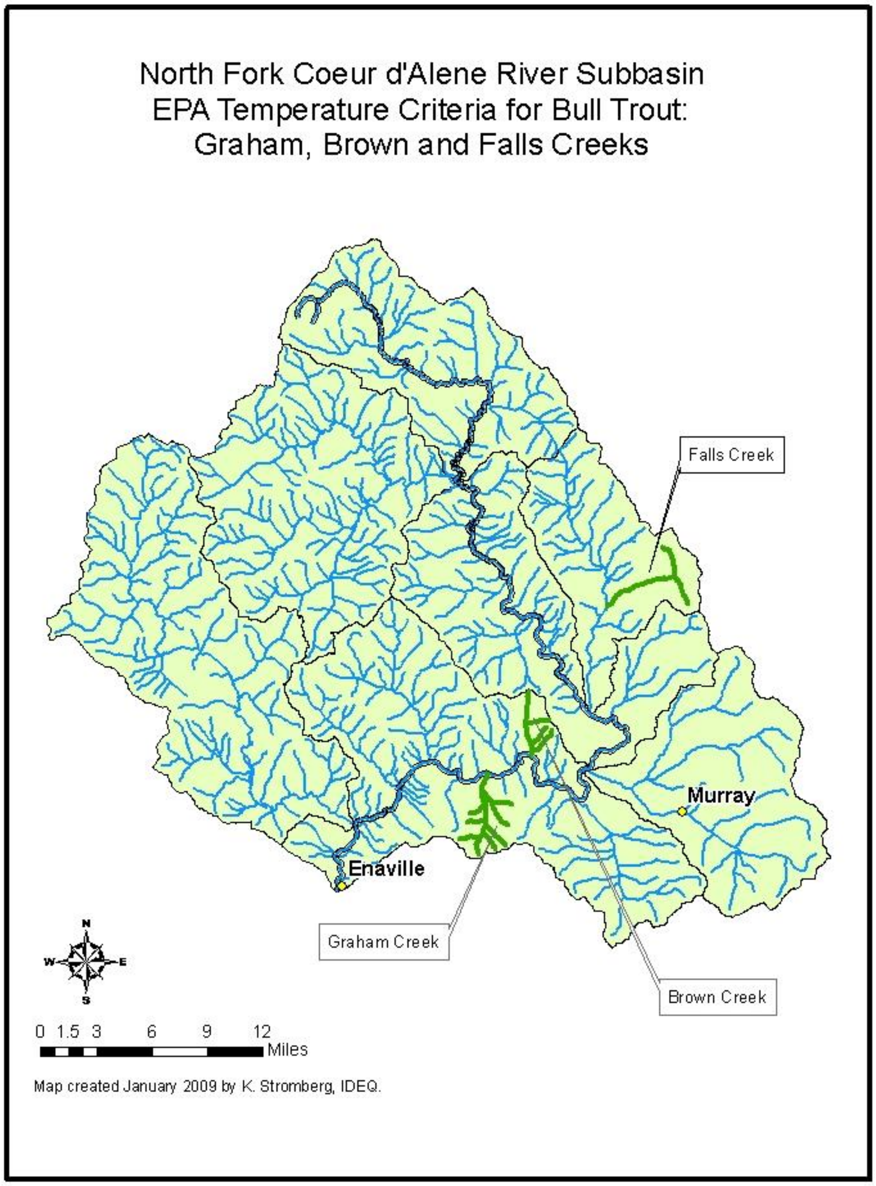


Figure C-1. EPA temperature criteria for bull trout apply in Graham Creek, Brown Creek, and Falls Creek within the North Fork Coeur d'Alene subbasin.

Brown Creek (ID17010301PN026_02)

Brown Creek was evaluated for EPA bull trout temperature criteria using USFS data from three sites over four years (four loggers total) during the criteria evaluation period of June through September (Table C-2). Rookie Creek, a tributary to Brown Creek, was also evaluated as part of this assessment unit. Results of the evaluation showed exceedances of the 10 °C weekly maximum temperature criteria approximately 81% of the evaluation time period. The highest maximum weekly maximum temperature (MWMT) was 13 °C. All sites exceeded criteria in every year evaluated.

Table C-2. Brown Creek temperature evaluation.

Site	Year(s)	Date Range Evaluated
Brown Creek, Upper	2000, 2001	July 18–Sept 4, 2000
		May 30–Sept 17, 2001
Brown Creek	2007	June 7–Sept 30, 2007
Rookie Creek	2005	May 24–Sept 20, 2005

Falls Creek (ID17010301PN011_02)

Falls Creek was evaluated for EPA bull trout temperature criteria using USFS data from two sites over two years (two loggers total) during the criteria evaluation period of June through September (Table 3). Results of the evaluation showed exceedances of the 10 °C weekly maximum temperature criteria approximately 83% of the evaluation time period. The highest MWMT was 14 °C. Both sites exceeded criteria in each year evaluated.

Table C-3. Falls Creek temperature evaluation.

Site	Year(s)	Date Range Evaluated
Falls Creek (2 sites)	2001, 2002	Aug 1–Sept 30, 2001
		Jun 8–Sept 30, 2002

Graham Creek (ID17010301PN002_03)

Lower Graham Creek was evaluated for EPA bull trout temperature criteria using DEQ data from one site in 1999 during the criteria evaluation period (Table C-4). Results from the evaluation showed exceedances of the 10 °C weekly maximum temperature criteria approximately 81% of the evaluation time period up to 14 °C MWMT. The site exceeded criteria in the year evaluated. Temperature data are not available for upper Graham Creek assessment unit number ID17010301PN002_02. That assessment unit remains unassessed with regards to temperature.

Table C-4. Graham Creek temperature evaluation.

Site	Year(s)	Date Range
Graham Creek	1999	July 2–Sept 30, 1999

Conclusions

In every year evaluated, all of the sites at Graham Creek, Brown Creek, and Falls Creek exceeded the EPA bull trout temperature criteria. Exceedances were not isolated events, and occurred during most of the spawning time period evaluated (June through September). Exceedances of the 10 °C weekly maximum temperature criteria were not small and were up to 4 °C above criteria. In this analysis, the three streams evaluated did not exceed Idaho water quality standards for cold water aquatic life, but all three did exceed Idaho water quality standards for salmonid spawning. Due to the identified exceedances of criteria, DEQ recommended that Brown Creek (ID17010301PN026_02), Falls Creek (ID17010301PN011_02), and Graham Creek (ID17010301PN002_03) be added to the 2010 Integrated Report as impaired by temperature for cold water aquatic life and salmonid spawning (Table C-5). These assessments were formalized with EPA's approval of the 2010 Integrated Report in September 2011.

Table C-5. Summary of EPA bull trout temperature criteria exceedances. Italics indicate status changes in the 2010 Integrated Report.

Stream	Assessment Unit(s)	Exceedance of EPA Criteria	2008 Integrated Report	2010 Integrated Report
Brown Creek	ID17010301PN026_02	Exceeds	Not Assessed	*Impaired (Temperature)*
Falls Creek	ID17010301PN011_02	Exceeds	Impaired (Sediment)/ Temperature Not Assessed	*Impaired (Sediment and Temperature)*
Graham Creek	ID17010301PN002_02	Not Assessed	Not Assessed	Not Assessed
	ID17010301PN002_03	Exceeds	Impaired (Temperature)	Impaired (Temperature)

Appendix D. Data Sources and Estimates of Bank-full Width

Table D-1. Data sources for Upper (North Fork) Coeur d'Alene River subbasin TMDLs.

Water Body/Assessment Unit	Data Source	Type of Data	When Collected
Beaver Creek, Deception Creek, Leiberg Creek, Little North Fork Coeur d'Alene River, Skookum Creek, Steamboat Creek, Tepee Creek, West Fork Eagle Creek	DEQ Regional Office	Solar Pathfinder effective shade and stream width	Summer 2007
All rivers and tributaries examined	DEQ State Technical Services Office	Aerial photo interpretation of existing shade and stream width estimation	2006–2007
Graham Creek, Beaver Creek, Prichard Creek, West Fork Eagle Creek, Lost Creek, North Fork Coeur d'Alene River, Independence Creek, Trail Creek (trib to Tepee Creek), Tepee Creek, Steamboat Creek, Little North Fork Coeur d'Alene River tributaries, Little North Fork Coeur d'Alene River, Bumblebee Creek, Laverne Creek, Leiberg Creek, Bootjack Creek, Burnt Cabin Creek, Deception Creek, Skookum Creek, Copper Creek	DEQ IDASA Database	Stream temperature	1997 and 1999
North Fork Coeur d'Alene River, Beaver Creek, Prichard Creek, West Fork Eagle Creek, Tepee Creek, Declaration Creek, Snow Creek, Trail Creek (trib to Tepee Creek), Steamboat Creek, Little North Fork Coeur d'Alene River tributaries, Little North Fork Coeur d'Alene River, Laverne Creek, Burnt Cabin Creek	USFS IPNF Datasets	Stream temperature	1998–2008

Table D-2. Regional curve estimates and existing measurements of bank-full width for major streams.

Location	area (sq mi)	Clearwater (m)	CDA USFS (m)	USFS power (m)	CDA WPN (m)	Average existing (m)
Beaver Creek @ mouth	42.3	12	10	13	13	
Beaver Creek bl Trail Creek	36	11	9	12	13	14.85
Beaver Creek bl Deer Creek	17.7	8	7	8	9	
Beaver Creek ab Dobson Gulch	4.9	4	6	4	5	7.95
Beaver Creek ab Carbon Creek	2.66	3	5	3	4	
Big Elk Creek @ mouth	11.6	6	6	6	8	6.8
Big Elk Creek ab First Creek	8.47	5	6	5	7	4.46
Big Elk Creek ab Boundary Creek	6.23	4	6	4	6	5.76
Bootjack Creek @ mouth	4.08	4	6	3	5	
Bootjack Creek ab Smith Creek	2.3	3	5	2	4	
Bumblebee Creek @ mouth	5.81	4	6	4	6	6
Bumblebee Creek ab 3rd tributary	1.62	2	5	2	3	
Burnt Cabin Creek @ mouth	11.3	6	6	6	8	8.25
Burnt Cabin Creek ab Lone Cabin Creek	7.24	5	6	5	6	
Burnt Cabin Creek ab Bottom Creek	4.24	4	6	3	5	
Burnt Cabin Creek bl Lost Mine Creek	1.9	2	5	2	4	
Copper Creek @ mouth	14	7	7	7	8	9
Copper Creek bl Mineral Creek	12.2	6	7	6	8	6.4
Copper Creek ab Mineral Creek	7.45	5	6	5	7	6.3
Copper Creek bl Fisher Creek	6.58	5	6	4	6	
Copper Creek ab Fisher Creek	3.99	4	6	3	5	
Deception Creek @ mouth	5.54	4	6	4	6	
Deception Creek ab Hoodoo Creek	2.96	3	5	3	4	
Graham Creek @ mouth	9.62	6	6	6	7	6.33
Graham Creek ab Deceitful Gulch	6.88	5	6	5	6	
Graham Creek ab East Fork	2.78	3	5	3	4	
Independence Creek @ mouth	59.8	14	12	16	16	17.76
Independence Creek bl North Creek	42	12	10	13	13	
Independence Creek bl Declaration Creek	21.7	9	8	9	10	12.4
Independence Creek ab Declaration Creek	12.6	6	7	6	8	8.1
Laverne Creek @ mouth	6.9	5	6	5	6	8.43
Laverne Creek ab 2nd tributary	3.37	3	5	3	5	
Leiberg Creek @ mouth	12.1	6	7	6	8	9.5
Leiberg Creek bl Lavin Creek	6.34	4	6	4	6	
Leiberg Creek ab Stull Creek	2.25	3	5	2	4	
Shoshone Cr @ mouth	69.2	16	13	17	17	
Shoshone Cr bl Falls Cr	55.7	14	12	15	15	
Shoshone Cr ab Falls Cr	41.7	12	10	13	13	
Shoshone Cr ab Cabin Cr	32.7	11	9	11	12	
Shoshone Cr ab Clinton Cr	21.9	9	8	9	10	
Shoshone Cr ab Ulm Cr	8.2	5	6	5	7	
Shoshone Cr ab Hemlock Cr	4.5	4	6	4	5	5.27
Shoshone Cr ab 1st tributary	1.43	2	5	2	3	
Lost Creek @ mouth	24.3	9	8	9	11	9
Lost Creek ab EF	13.7	7	7	7	8	
Lost Creek ab Stack Creek	8.51	5	6	5	7	
Lost Creek ab 4th tributary	3.69	3	5	3	5	
Prichard Creek @ mouth	97.8	19	17	21	19	15.65
Prichard Creek ab Eagle Creek	49.7	13	11	14	14	15.5
Prichard Creek bl Butte Gulch	39	12	10	12	13	12.2
Prichard Creek ab Granite Gulch	10.4	6	6	6	7	13.5
Skookum Creek @ mouth	6.35	4	6	4	6	7.05
Skookum Creek ab McCauley/Knight Creeks	4.04	4	6	3	5	
Skookum Creek ab Early Creek	2.07	3	5	2	4	
Steamboat Creek @ mouth	42	12	10	13	13	11.6
Steamboat Creek bl Barrymore Creek	34.6	11	9	11	12	11.6
Steamboat Creek bl EF/WF confluence	23.2	9	8	9	10	11.3
EF Steamboat Creek @ mouth	11	6	6	6	8	
EF Steamboat Creek ab Little EF Creek	6.95	5	6	5	6	
EF Steamboat Creek ab Cabin Creek	4.42	4	6	4	5	
EF Steamboat Creek ab Martin Creek	1.36	2	5	2	3	
WF Steamboat Creek @ mouth	11.5	6	6	6	8	
WF Steamboat Creek bl Comfy Creek	8.21	5	6	5	7	
WF Steamboat Creek ab Comfy Creek	4.04	4	6	3	5	
Tepee Creek @ mouth	144	23	23	26	22	
Tepee Creek ab Independence Creek	73.5	16	14	17	17	
Tepee Creek ab Trail Creek	35.6	11	9	12	13	12.95
Tepee Creek ab Big Elk Creek	14.1	7	7	7	9	3.5
Trail Creek @ mouth	29.7	10	9	10	12	
Trail Creek ab Bear Creek	26	9	8	10	11	
Trail Creek bl Callis Creek	18.5	8	7	8	10	16.25
Trail Creek bl Stewart/Potter confluence	11.5	6	6	6	8	
Eagle Creek @ mouth	44.5	12	10	13	14	20.65
WF Eagle Creek @ mouth	18.9	8	7	8	10	10.85
WF Eagle Creek ab Bobtail Creek	11.9	6	6	6	8	
WF Eagle Creek ab Cottonwood Creek	6.07	4	6	4	6	
EF Eagle Creek @ mouth	22.7	9	8	9	10	
EF Eagle Creek bl 2nd tributary	15	7	7	7	9	11.5
EF Eagle Creek ab Tributary Creek	4.97	4	6	4	6	
Coeur d'Alene River @ SF confluence	896	59	114	72	48	~60
Coeur d'Alene River ab NF CDA River	713	52	92	63	44	
Coeur d'Alene River bl Beaver Creek	581	47	76	56	40	46.03
Coeur d'Alene River ab Prichard Creek	439	41	58	48	36	33
Coeur d'Alene River ab Shoshone Creek	334	35	46	41	32	48.2
Coeur d'Alene River ab Tepee Creek	102	19	17	21	19	
Coeur d'Alene River ab Jordan Creek	70.2	16	14	17	17	13.3
Coeur d'Alene River ab Spruce Creek	26.5	9	8	10	11	6.4
NF Coeur d'Alene River @ mouth	170	25	26	28	24	~24
NF Coeur d'Alene River ab Copper Creek	125	21	20	24	21	
NF Coeur d'Alene River ab Leiberg Creek	95.4	18	17	20	19	22
NF Coeur d'Alene River ab Burnt Cabin Creek	44.5	12	10	13	14	13.2
NF Coeur d'Alene River ab Iron Creek	17.5	8	7	8	9	8.05
NF Coeur d'Alene River bl Honey Creek	4.37	4	6	4	5	

Table D-3. Regional curve estimates and existing measurements of bank-full width for Little North Fork Coeur d'Alene River tributaries.

Location	area (sq mi)	Clearwater (m)	CDA USFS (m)	USFS power (m)	CDA WPN (m)	
Honey Cr @ mouth	2.49	3	5	3	4	Tribs to Little NF CDA
Honey Cr bl Prospect Cr	1.82	2	5	2	4	030_02a
Honey Cr ab Unnamed Trib	0.5	1	5	1	2	
Prospect Cr @ mouth	0.41	1	5	1	2	
Unnamed Trib to Honey Cr	0.61	1	5	1	2	
Sob Cr @ mouth	1.25	2	5	2	3	
Solitaire Cr @ mouth	2.61	3	5	3	4	
Solitaire Cr bl EF/WF confl	2.29	3	5	2	4	
EF Solitaire Cr	1.42	2	5	2	3	
WF Solitaire Cr	0.87	2	5	1	3	
Tom Lavin Cr @ mouth	3.23	3	5	3	5	
Lewelling Cr @ mouth	2.17	3	5	2	4	
Iron Cr @ mouth	9.9	6	6	6	7	
Iron Cr ab Cataract Cr	5.6	4	6	4	6	
Iron Cr ab Rabiens Cr	2.74	3	5	3	4	
Rabiens Cr @ mouth	1.79	2	5	2	4	
Silver Run @ mouth	0.48	1	5	1	2	
Cataract Cr @ mouth	2.04	2	5	2	4	
Rusty Cr @ mouth	0.3	1	5	1	2	
Moose Cr @ mouth	0.59	1	5	1	2	
Hudlow Cr @ mouth	5.47	4	6	4	6	030_02b
Hudlow Cr ab EF	4.45	4	6	4	5	
EF Hudlow Cr @ mouth	0.72	1	5	1	2	
MF Hudlow Cr @ confluence	2.23	3	5	2	4	
WF Hudlow Cr @ confluence	1.92	2	5	2	4	
Trib to WF Hudlow Cr	0.53	1	5	1	2	
Hudlow Cr bl WF/MF confluence	4.15	4	6	3	5	
Gimlet Cr @ mouth	4.2	4	6	3	5	
Unnamed Trib to Gimlet Cr	0.71	1	5	1	2	
Gimlet Cr ab Trib	1.37	2	5	2	3	
Owl Cr (Little NF) @ mouth	2.35	3	5	2	4	
Owl Cr (Little NF) ab 1st Trib	0.83	2	5	1	3	
1st Trib to Owl Cr	0.59	1	5	1	2	
2nd Trib to Owl Cr	0.31	1	5	1	2	
Nicholas Cr @ mouth	4.2	4	6	3	5	030_02c
Nicholas Cr ab Canyon Fk	2.02	2	5	2	4	
Canyon Fork @ mouth	1.88	2	5	2	4	
Barney Cr @ mouth	3.59	3	5	3	5	
Barney Cr ab Argument Cr	1.17	2	5	2	3	
Argument Cr @ mouth	0.32	1	5	1	2	
Little Cr @ mouth	0.5	1	5	1	2	
Cathcart Cr @ mouth	1.07	2	5	2	3	
Cascade Cr @ mouth	6.11	4	6	4	6	
Cascade Cr ab Walker Cr	3.63	3	5	3	5	
Cascade Cr ab Unnamed Trib	1.86	2	5	2	4	
Unnamed Trib to Cascade Cr	0.53	1	5	1	2	
Walker Cr @ mouth	1.27	2	5	2	3	
Picnic Cr @ mouth	5.18	4	6	4	6	
Picnic Cr ab Thiesen Cr	4.44	4	6	4	5	
Picnic Cr ab Lunch Cr	3.23	3	5	3	5	
Lunch Cr @ mouth	0.52	1	5	1	2	
Thiesen Cr @ mouth	0.68	1	5	1	2	
Trestle Cr @ mouth	0.85	2	5	1	3	030_02d
Delaney Cr @ mouth	0.74	1	5	1	2	
Lindberg Cr @ mouth	0.82	2	5	1	3	
Breadwater Cr @ mouth	0.59	1	5	1	2	
Canyon Cr @ mouth	3.38	3	5	3	5	
Little Tepee Cr @ mouth	2.69	3	5	3	4	
Unnamed Trib ab Williams Draw	0.69	1	5	1	2	
Williams Draw @ mouth	1.46	2	5	2	3	
County Cr @ mouth	0.63	1	5	1	2	
Browns Gulch @ mouth	1	2	5	2	3	
Cannon Cr @ mouth	0.63	1	5	1	2	
Little Bumblebee Cr @ mouth	3.22	3	5	3	5	
Lost Mine Cr @ mouth	1.17	2	5	2	3	Tribs to Burnt Cabin Cr
Lone Cabin Cr @ mouth	2.38	3	5	3	4	036_02
Bottm Cr @ mouth	2.11	3	5	2	4	
George Cr @ mouth	0.73	1	5	1	2	
Hoodoo Cr @ mouth	0.47	1	5	1	2	Tribs to Deception Cr
Demorest Cr @ mouth	0.46	1	5	1	2	037_02
Sands Cr @ mouth	0.85	2	5	1	3	
Smith Cr @ mouth	1.4	2	5	2	3	Trib to Bootjack Cr 034_02
Stull Cr @ mouth	1.81	2	5	2	4	Tribs to Leiberg Cr
Lavin Cr @ mouth	1.51	2	5	2	3	033_02
Hemlock Cr @ mouth	1.81	2	5	2	4	
Tie Cr @ mouth	1.39	2	5	2	3	
Unnamed Trib #1 to Laverne Cr	0.76	1	5	1	3	Tribs to Laverne Cr
Unnamed Trib #2 to Laverne Cr	0.58	1	5	1	2	032_02
Unnamed Trib #3 to Laverne Cr	1.35	2	5	2	3	
Unnamed Trib #1 to Bumblebee Cr	0.62	1	5	1	2	Tribs to Bumblebee Cr
Unnamed Trib #2 to Bumblebee Cr	0.8	2	5	1	3	031_02
Unnamed Trib #3 to Bumblebee Cr	0.71	1	5	1	2	

Table D-4. Regional curve estimates and existing measurements of bank-full width for Upper North Fork Coeur d'Alene River tributaries.

Location	area (sq mi)	Clearwater (m)	CDA USFS (m)	USFS power (m)	CDA WPN (m)	
1st Trib to Upper NF CDA River	1.35	2	5	2	3	Tribs to Upper NF CDA
2nd Trib to Upper NF CDA River	0.78	2	5	1	3	015_02
3rd Trib to Upper NF CDA River	0.98	2	5	2	3	
4th Trib to Upper NF CDA River	3.18	3	5	3	5	
Trib to 4th Trib	0.68	1	5	1	2	
4th Trib ab its Trib	1.39	2	5	2	3	
Mosquito Cr @ mouth	2.67	3	5	3	4	
Trib to Mosquito Cr	1.35	2	5	2	3	
Mosquito Cr ab its Trib	0.82	2	5	1	3	
Trib bl Mosquito Cr	1.06	2	5	2	3	
Dahlman Cr @ mouth	1.6	2	5	2	3	
Buckskin Cr @ mouth	6.81	5	6	5	6	
1st Trib to Buckskin Cr	0.41	1	5	1	2	
2nd Trib to Buckskin Cr	3.6	3	5	3	5	
Trib to 2nd Trib to Buckskin	1.01	2	5	2	3	
Buckskin Cr ab 1st Trib	2.02	2	5	2	4	
Buckskin Cr ab 2nd Trib	2.66	3	5	3	4	
Spruce Cr @ mouth	10.06	6	6	6	7	
Spruce Cr ab Powder Cr	3.94	4	6	3	5	
Spruce Cr ab Larch Cr	5.73	4	6	4	6	
Spruce Cr ab Barren Cr	8.51	5	6	5	7	
Powder Cr @ mouth	0.83	2	5	1	3	
Larch Cr @ mouth	2.15	3	5	2	4	
Barren Cr @ mouth	0.78	2	5	1	3	
Martin Cr @ mouth	1.22	2	5	2	3	
Devil Cr @ mouth	4.56	4	6	4	5	
1st Trib to Devil Cr	0.48	1	5	1	2	
Imp Cr Trib to Devil Cr	0.99	2	5	2	3	
Devil Cr ab 1st Trib	1.02	2	5	2	3	
Devil Cr ab Imp Cr	3.56	3	5	3	5	
Wren Cr @ mouth	0.66	1	5	1	2	
Clark Cr @ mouth	0.82	2	5	1	3	
Sluice Cr @ mouth	0.81	2	5	1	3	
Deer Cr @ mouth	10.04	6	6	6	7	015_03
Deer Cr @ confl of Whitetail & Blacktail	8.54	5	6	5	7	
Whitetail Cr @ mouth	3.26	3	5	3	5	015_02
Trib to Whitetail Cr	1.02	2	5	2	3	
Whitetail Cr ab Trib	0.94	2	5	1	3	
Blacktail Cr @ mouth	5	4	6	4	6	
Trib to Blacktail Cr	1.18	2	5	2	3	
Blacktail Cr ab Trib	2.64	3	5	3	4	
Alden Cr @ mouth	5.63	4	6	4	6	
East Alden Cr @ mouth	2.66	3	5	3	4	
Alden Cr ab East Alden	2.44	3	5	3	4	
Sheep Run Cr @ mouth	1.03	2	5	2	3	
East Alden Cr ab Sheep Run Cr	1.36	2	5	2	3	
Jordan Cr @ mouth	17.4	8	7	8	9	
Jordan Cr ab Lost Fork	4.42	4	6	4	5	
Jordan Cr ab 1st tributary	0.73	1	5	1	2	
1st tributary to Jordan Cr	1.52	2	5	2	3	
2nd tributary to Jordan Cr	1.39	2	5	2	3	
3rd tributary to Jordan Cr	0.37	1	5	1	2	
Calamity Cr @ mouth	3.19	3	5	3	5	
Calmaity Cr ab 1st tributary	1.89	2	5	2	4	
1st tributary to Calamity Cr	0.9	2	5	1	3	
Lost Fork @ mouth	7.86	5	6	5	7	
Lost Fork ab Plant Cr	4.03	4	6	3	5	
Lost Fork ab 1st tributary	0.77	2	5	1	3	
1st tributary to Lost Fork	0.45	1	5	1	2	
Sho Cr @ mouth	1.81	2	5	2	4	
Plant Cr @ mouth	0.58	1	5	1	2	
Bluff Cr @ mouth	1.45	2	5	2	3	
1st tributary to Bluff Cr	0.48	1	5	1	2	
Cub Cr @ mouth	0.8	2	5	1	3	

Table D-4 (cont.). Regional curve estimates and existing measurements of bank-full width for Upper North Fork Tributaries.

Cataract Cr @ mouth	6.2	4	6	4	6
Cataract Cr ab W. Elk Cr	2.29	3	5	2	4
West Elk Cr @ mouth	3.83	3	6	3	5
Senator Cr @ mouth	0.83	2	5	1	3
Spion Kop Cr @ mouth	1.06	2	5	2	3
Cinnamon Cr @ mouth	5.46	4	6	4	6
Cinnamon Cr bl 2nd tributary	3.08	3	5	3	5
1st tributary to Cinnamon Cr	0.61	1	5	1	2
2nd tributary to Cinnamon Cr	1.14	2	5	2	3
3rd tributary to Cinnamon Cr	0.99	2	5	2	3
Lion Cr @ mouth	0.35	1	5	1	2
Taft Cr @ mouth	1.12	2	5	2	3
Presidents Cr @ mouth	0.53	1	5	1	2
Wilson Cr @ mouth	0.73	1	5	1	2
Brett Cr @ mouth	5.23	4	6	4	6
Brett Cr ab 1st tributary	2.35	3	5	2	4
1st tributary to Brett Cr	1.11	2	5	2	3
2nd tributary to Brett Cr	1.2	2	5	2	3
Gold Cr @ mouth	1.62	2	5	2	3
Miners Cr @ mouth	4.55	4	6	4	5
Miners Cr ab 1st tributary	0.77	2	5	1	3
1st tributary to Miners Cr	0.75	1	5	1	3
Debbs Cr @ mouth	0.65	1	5	1	2
Bennett Cr @ mouth	0.72	1	5	1	2
Big Hank Cr @ mouth	2.26	3	5	2	4
Big Hank Cr ab 1st tributary	1.21	2	5	2	3
1st tributary to Big Hank Cr	1.21	2	5	2	3
Un-named ab Little Canyon Cr	0.57	1	5	1	2
Little Canyon Cr @ mouth	1.91	2	5	2	4
Flat Cr @ mouth	14.1	7	7	7	9
Flat Cr bl Svee Cr	11.1	6	6	6	8
Flat Cr ab Svee Cr	8.09	5	6	5	7
Flat Cr bl 3rd tributary	5.6	4	6	4	6
Flat Cr ab 1st tributary	0.88	2	5	1	3
1st tributary to Flat Cr	1.07	2	5	2	3
2nd tributary to Flat Cr	0.63	1	5	1	2
3rd tributary to Flat Cr	2.22	3	5	2	4
1st tributary to 3rd tributary to Flat Cr	0.59	1	5	1	2
Svee Cr @ mouth	2.98	3	5	3	4
4th tributary to Flat Cr	0.85	2	5	1	3
5th tributary to Flat Cr	0.82	2	5	1	3
Teddy Cr @ mouth	2.31	3	5	2	4
Yellow Dog Cr @ mouth	7.77	5	6	5	7
Yellow Dog Cr bl 4th tributary	5.22	4	6	4	6
Yellow Dog Cr ab 1st tributary	0.97	2	5	2	3
1st tributary to Yellow Dog Cr	0.76	1	5	1	3
2nd tributary to Yellow Dog Cr	0.99	2	5	2	3
3rd tributary to Yellow Dog Cr	1.53	2	5	2	3
4th tributary to Yellow Dog Cr	0.5	1	5	1	2
Ash Cr @ mouth	0.81	2	5	1	3

Table D-5. Regional curve estimates and existing measurements of bank-full width for Independence Creek tributaries.

Location	area (sq mi)	Clearwater (m)	CDA USFS (m)	USFS power (m)	CDA WPN (m)	
Goose Cr @ mouth	3.18	3	5	3	5	Tribs to Independence Cr
Gosling Cr @ mouth	0.67	1	5	1	2	018_02
Goose Cr ab Gosling Cr	1.58	2	5	2	3	
Snowshoe Cr @ mouth	1.16	2	5	2	3	
Ellis Cr @ mouth	1.84	2	5	2	4	
Trib to Ellis Cr	0.44	1	5	1	2	
Ellis Cr ab Trib	0.82	2	5	1	3	
Declaration Cr @ mouth	9.06	5	6	5	7	018_02 & 018_03a
Declaration Cr ab 3rd Trib	7.69	5	6	5	7	018_02
Declaration Cr ab 2nd Trib	4.1	4	6	3	5	
Declaration Cr ab 1st Trib	2.69	3	5	3	4	
1st Trib to Declaration Cr	1.25	2	5	2	3	
2nd Trib to Declaration Cr	3.55	3	5	3	5	
3rd Trib to Declaration Cr	0.37	1	5	1	2	
Trib to 2nd Trib to Declaration	0.77	2	5	1	3	
2nd Trib ab its Trib	2.33	3	5	2	4	
Trib bl Declaration Cr	0.42	1	5	1	2	
Snowbird Cr @ mouth	1.32	2	5	2	3	
Surprise Cr @ mouth	1.56	2	5	2	3	
1st Trib bl Surprise Cr (North side)	0.39	1	5	1	2	
2nd Trib bl Surprise Cr (South side)	0.49	1	5	1	2	
Ermine Cr @ mouth	2.39	3	5	3	4	
Trib to Ermine Cr	0.62	1	5	1	2	
Ermine Cr ab Trib	1.63	2	5	2	3	
Snow Cr @ mouth	7.35	5	6	5	6	018_02 & 018_03b
Snow Cr ab 3rd Trib	3.35	3	5	3	5	018_02
Snow Cr ab 2nd Trib	2.27	3	5	2	4	
Snow Cr ab 1st Trib	1.27	2	5	2	3	
1st Trib to Snow Cr	0.71	1	5	1	2	
2nd Trib to Snow Cr	0.92	2	5	1	3	
3rd Trib to Snow Cr	1.82	2	5	2	4	
Trib to 3rd Snow Trib	0.62	1	5	1	2	
North Cr @ mouth	3.95	4	6	3	5	
Trib to North Cr	0.56	1	5	1	2	
North Cr ab Trib	2.12	3	5	2	4	
Griffith Cr @ mouth	0.75	1	5	1	3	
Green Cr @ mouth	2.23	3	5	2	4	
Trib bl Green Cr	0.37	1	5	1	2	
Emerson Cr @ mouth	4.69	4	6	4	5	
Trib to Emerson Cr	1.24	2	5	2	3	
Emerson Cr ab Trib	2.3	3	5	2	4	
Owl Cr @ mouth	3.67	3	5	3	5	
Minor Cr @ mouth	0.72	1	5	1	2	
Trident Cr @ mouth	0.84	2	5	1	3	
Trib to Trident Cr	0.39	1	5	1	2	
Trident Cr ab Trib	0.41	1	5	1	2	
1st Trib bl Trident Cr	0.25	1	5	1	2	
2nd Trib bl Trident Cr	0.29	1	5	1	2	

Table D-6. Regional curve estimates and existing measurements of bank-full width for Shoshone Creek tributaries.

Location	area (sq mi)	Clearwater (m)	CDA USFS (m)	USFS power (m)	CDA WPN (m)
1st Tributary to Shoshone Cr	0.28	1	5	1	2
2nd tributary to Shoshone Cr	2.03	2	5	2	4
Hemlock Cr @ mouth	2.04	2	5	2	4
3rd tributary to Shoshone Cr	0.31	1	5	1	2
Tent Cr @ mouth	0.42	1	5	1	2
Ulm Cr @ mouth	2.57	3	5	3	4
Little Lost Fork @ mouth	3.61	3	5	3	5
1st tributary to Little Lost Fork	0.88	2	5	1	3
2nd tributary to Little Lost Fork	0.32	1	5	1	2
3rd tributary to Little Lost Fork	0.95	2	5	1	3
Sentinel Cr @ mouth	2	2	5	2	4
Windfall Cr @ mouth	0.49	1	5	1	2
Camp Cr @ mouth	0.91	2	5	1	3
Hells Gulch @ mouth	2.6	3	5	3	4
SF Hells Gulch @ mouth	1.21	2	5	2	3
Clinton Cr @ mouth	4.5	4	6	4	5
Rampike Cr @ mouth	3.56	3	5	3	5
Pine Flat Cr @ mouth	1.82	2	5	2	4
Cabin Cr @ mouth	3.92	3	6	3	5
SF Cabin Cr @ mouth	1.25	2	5	2	3
Chute Cr @ mouth	0.9	2	5	1	3
Pipe Cr @ mouth	0.55	1	5	1	2
Falls Cr @ mouth	14	7	7	7	8
Falls Cr bl NF/SF confluence	7	5	6	5	6
NF Falls Cr @ mouth	3.64	3	5	3	5
SF Falls Cr @ mouth	3.37	3	5	3	5

Table D-7. Regional curve estimates and existing measurements of bank-full width for Lower North Fork Coeur d’Alene River tributaries.

Location	area (sq mi)	Clearwater (m)	CDA USFS (m)	USFS power (m)	CDA WPN (m)
Cedar Cr @ mouth	4.67	4	6	4	5
Cedar Cr ab Lansdale Cr	3.7	3	5	3	5
Lansdale Cr @ mouth	0.38	1	5	1	2
Hopkins Cr @ mouth	1.85	2	5	2	4
Hopkins Cr ab 1st tributary	1.09	2	5	2	3
1st tributary to Hopkins Cr	0.48	1	5	1	2
2nd tributary to Hopkins Cr	0.6	1	5	1	2
Brown Cr @ mouth	5.78	4	6	4	6
Brown Cr ab Hart Cr	4.15	4	6	3	5
Brown Cr ab 1st tributary	2.45	3	5	3	4
1st tributary to Brown Cr	0.66	1	5	1	2
Hart Cr @ mouth	0.38	1	5	1	2
Rookie Cr @ mouth	0.97	2	5	2	3
Little Grizzly Cr @ mouth	0.92	2	5	1	3
Cinnabar Cr @ mouth	1.11	2	5	2	3
Grizzly Cr @ mouth	7.17	5	6	5	6
Grizzly Cr ab Lindsey Cr	1.74	2	5	2	4
Lindsey Cr @ mouth	1.3	2	5	2	3
Dewey Cr @ mouth	2.94	3	5	3	4
Dewey Cr ab 1st tributary	0.99	2	5	2	3
1st tributary to Dewey Cr	0.83	2	5	1	3
Un-named (West of Grizzly Cr)	0.41	1	5	1	2
Silver Cr @ mouth	1.3	2	5	2	3
Coal Cr @ mouth	3.45	3	5	3	5
Tent Cr @ mouth	0.61	1	5	1	2
Pablo Cr @ mouth	0.33	1	5	1	2
Scott Cr @ mouth	1.81	2	5	2	4
Un-named (parallel Simmons Draw)	0.54	1	5	1	2
Simmons Draw @ mouth	0.32	1	5	1	2
Guard Cr @ mouth	0.42	1	5	1	2
Spring Cr @ mouth	0.79	2	5	1	3
Un-named (bl Spring Cr)	0.66	1	5	1	2
Un-named (ab McRae Cr)	0.48	1	5	1	2
McRae Cr @ mouth	0.21	1	5	1	1
Cougar Gulch @ mouth	19.4	8	7	8	10
Cougar Gulch ab Dennis Cr	12.6	6	7	6	8
Cougar Gulch bl Lone Cr	10.1	6	6	6	7
Cougar Gulch bl forks confluence	6	4	6	4	6
Smith Cr @ mouth	1.07	2	5	2	3
Fall Cr @ mouth	1.86	2	5	2	4
Thomas Cr @ mouth	2.96	3	5	3	4
Marsh Cr @ mouth	0.55	1	5	1	2
Un-named (bl Marsh Cr)	0.38	1	5	1	2
Studer Cr @ mouth	0.99	2	5	2	3
Lightner Draw @ mouth	1.78	2	5	2	4
Un-named (ab Little NF CDA R)	1.07	2	5	2	3
Hazendorf Cr @ mouth	1.94	2	5	2	4
Hullman Gulch @ mouth	0.9	2	5	1	3
Prado Cr @ mouth	4.34	4	6	4	5
1st tributary to Prado Cr	2.02	2	5	2	4
Un-named (bl Prado Cr)	1.11	2	5	2	3
McPhee Cr @ mouth	1.59	2	5	2	3

Tribs to Lower NF CDA R.
001_02

Table D-8. Regional curve estimates and existing measurements of bank-full width for Trail Creek and Tepee Creek tributaries.

Location	area (sq mi)	Clearwater (m)	CDA USFS (m)	USFS power (m)	CDA WPN (m)	
Potter Cr @ mouth	5.22	4	6	4	6	Tribs to Trail Creek
Potter Cr ab SF Potter Cr	1.91	2	5	2	4	019_02, _03
SF Potter Cr @ mouth	1.69	2	5	2	4	
Stewart Cr @ mouth	6.2	4	6	4	6	
Stewart Cr bl 3rd tributary	3.34	3	5	3	5	
1st tributary to Stewart Cr	0.69	1	5	1	2	
2nd tributary to Stewart Cr	0.49	1	5	1	2	
3rd tributary to Stewart Cr	0.41	1	5	1	2	
4th tributary to Stewart Cr	0.3	1	5	1	2	
5th tributary to Stewart Cr	0.46	1	5	1	2	
Callis Cr @ mouth	5.89	4	6	4	6	
Callis Cr bl NF Callis Cr	5	4	6	4	6	
Callis Cr ab NF Callis Cr	4.29	4	6	4	5	
Callis Cr ab 1st tributary	1.95	2	5	2	4	
1st tributary to Callis Cr	1.05	2	5	2	3	
2nd tributary to Callis Cr	0.6	1	5	1	2	
NF Callis Cr @ mouth	0.7	1	5	1	2	
Coon Gulch @ mouth	0.97	2	5	2	3	
Hamilton Cr @ mouth	1.71	2	5	2	4	
Dresser Cr @ mouth	1.39	2	5	2	3	
Bear Cr @ mouth	3.5	3	5	3	5	
Bear Cr ab West Bear Cr	2.54	3	5	3	4	
West Bear Cr @ mouth	0.82	2	5	1	3	
tributary to West Bear Cr	0.45	1	5	1	2	
US Cr @ mouth	1.77	2	5	2	4	
1st un-named to Big Elk Cr	0.44	1	5	1	2	
2nd un-named to Big Elk Cr	0.46	1	5	1	2	
3rd un-named to Big Elk Cr	0.44	1	5	1	2	
Boundary Cr @ mouth	1.24	2	5	2	3	
4th tributary to Big Elk Cr	0.42	1	5	1	2	
First Cr @ mouth	1.83	2	5	2	4	
New Cr @ mouth	0.42	1	5	1	2	
1st un-named to Tepee Cr	0.68	1	5	1	2	Tribs to Tepee Creek
Y Cr @ mouth	0.8	2	5	1	3	020_02
Riley Cr @ mouth	1.2	2	5	2	3	
Short Cr @ mouth	2.88	3	5	3	4	
1st tributary to Short Cr	0.5	1	5	1	2	
Little Elk Cr @ mouth	3.93	4	6	3	5	
1st tributary to Little Elk Cr	0.77	2	5	1	3	
2nd tributary to Little Elk Cr	0.87	2	5	1	3	
Drexall Cr @ mouth	0.7	1	5	1	2	
Halsey Cr @ mouth	4.87	4	6	4	5	
Halsey Cr ab 1st tributary	1.93	2	5	2	4	
1st tributary to Halsey Cr	0.5	1	5	1	2	
2nd tributary to Halsey Cr	0.65	1	5	1	2	
3rd tributary to Halsey Cr	0.59	1	5	1	2	
Van Hooster Cr @ mouth	1.54	2	5	2	3	
1st tributary to Van Hooster Cr	0.43	1	5	1	2	
Ryan Cr @ mouth	0.77	2	5	1	3	

Table D-9. Regional curve estimates and existing measurements of bank-full width for Prichard Creek and Eagle Creek tributaries.

Location	area (sq mi)	Clearwater (m)	CDA USFS (m)	USFS power (m)	CDA WPN (m)	
Falls Cr @ mouth	0.68	1	5	1	2	
Cascade Gulch @ mouth	1.76	2	5	2	4	Tribs to Prichard Cr
Granite Gulch @ mouth	9	5	6	5	7	005_02
Barton Gulch @ mouth	1.16	2	5	2	3	
West Fork @ mouth	1.25	2	5	2	3	
Moonshine Gulch @ mouth	1.62	2	5	2	3	
Granite Gulch ab Barton/West Fork	6.56	5	6	4	6	
Granite Gulch ab Moonshine Gulch	4.07	4	6	3	5	
Bear Gulch @ mouth	7.88	5	6	5	7	
Idaho Gulch @ mouth	2.35	3	5	2	4	
Cottonwood Cr @ mouth	2.46	3	5	3	4	Tribs to WF Eagle Cr
Bobtail Cr @ mouth	2.02	2	5	2	4	008_02

Table D-10. Regional curve estimates and existing measurements of bank-full width for Steamboat Creek tributaries.

Location	area (sq mi)	Clearwater (m)	CDA USFS (m)	USFS power (m)	CDA WPN (m)	
Martin Cr @ mouth	0.71	1	5	1	2	Tribs to Steamboat Cr
Clay Cr @ mouth	1.1	2	5	2	3	028_02
Cabin Cr @ mouth	1.99	2	5	2	4	
Little EF Cr @ mouth	2.75	3	5	3	4	
Long Tom Cr @ mouth	0.75	1	5	1	3	
Betty Cr @ mouth	0.58	1	5	1	2	
Un-named @ mouth	0.79	2	5	1	3	
Comfy Cr @ mouth	4.19	4	6	3	5	
Clark Gulch @ mouth	0.33	1	5	1	2	
Black Canyon Cr @ mouth	1.69	2	5	2	4	
Boston Brook @ mouth	0.41	1	5	1	2	
June Cr @ mouth	0.6	1	5	1	2	
Big Bob Cr @ mouth	1.04	2	5	2	3	
Can Cr @ mouth	4.39	4	6	4	5	
Can Cr ab Felder Cr	1.08	2	5	2	3	
Felder Cr @ mouth	0.78	2	5	1	3	
2nd tributary to Can Cr	0.48	1	5	1	2	
Barrymore Cr @ mouth	3.94	4	6	3	5	
Indian Cr @ mouth	3.42	3	5	3	5	
1st tributary to Indian Cr	0.78	2	5	1	3	
Omaha Cr @ mouth	1.75	2	5	2	4	
Eighty Day Cr @ mouth	0.67	1	5	1	2	

Table D-11. Regional curve estimates and existing measurements of bank-full width for Beaver Creek tributaries.

Location	area (sq mi)	Clearwater (m)	CDA USFS (m)	USFS power (m)	CDA WPN (m)	
Carbon Creek @ mouth	1.38	2	5	2	3	Tribs to Beaver Cr
Dobson Gulch @ mouth	2.02	2	5	2	4	003_02
Dudley Creek @ mouth	2.91	3	5	3	4	
Moore Gulch @ mouth	1.04	2	5	2	3	
Deer Creek @ mouth	2.62	3	5	3	4	
Unknown Gulch @ mouth	0.85	2	5	1	3	
Pony Gulch @ mouth	3.58	3	5	3	5	
Alder Creek @ mouth	2.69	3	5	3	4	
White Creek @ mouth	4.19	4	6	3	5	
White Creek ab tributary	2.25	3	5	2	4	
Tributary to White Creek	0.74	1	5	1	2	
Scott Gulch @ mouth	0.94	2	5	1	3	
Trail Creek @ mouth	5.7	4	6	4	6	
Trail Creek ab Potosi Gulch	2.54	3	5	3	4	
Potosi Gulch @ mouth	2.27	3	5	2	4	
Carpenter Gulch @ mouth	1.83	2	5	2	4	

Appendix E. Potential Natural Vegetation Descriptions and Shade Curves

Potential Natural Vegetation Groups

The Upper (North Fork) Coeur d'Alene River subbasin temperature TMDLs were based on effective shade estimates for six unique potential natural vegetation (PNV) groups:

- Warm/Dry Forest Group A
- Moist Forest Group B
- Cool/Moist Forest Group C
- Cool/Dry Forest Group D
- Non-Forest Group 1
- Non-Forest Group 2

A detailed description of these groups is available in Shumar and De Varona (2009) along with information on shade curve development. This appendix includes general descriptions, example photographs, and information on the composition and other vegetation characteristics of each PNV group.

The forest groups applied in these TMDLs were built on analyses by the U.S. Forest Service Idaho Panhandle National Forests (IPNF) and used USFS historic range of variability data and tree species information from the Coeur d'Alene National Forest (one of the three forests that make up the IPNF). The non-forest groups applied in these TMDLs were built upon analyses performed during development of Pend Oreille Lake subbasin temperature TMDLs. Detailed information is available in Shumar and De Varona (2009). The non-forest groups and shade curves were developed based on measurements in field plots using canopy cover, constancy, and tree height data.

Shade curves estimating percent effective shade depending on bank-full width were developed for each PNV group using a model called Shade.xls produced by the Washington Department of Ecology (Washington Department of Ecology 2010). Detailed information is available in Shumar and De Varona 2009. This model is based on work by Y.D. Chen and the Oregon Department of Environmental Quality (ODEQ) HeatSource model (Boyd 1996; Chen 1996; Chen et al.1998a; 1998b; Boyd and Kasper 2003; ODEQ 2006). For these shade curves, the Chen method was applied to the Shade.xls model using the following inputs for each PNV group: average height, average canopy cover, and average overhang (Table E-1).

Table E-1. Estimated average height and canopy cover data for shade model inputs.

PNV Group	Average Height (feet)	Average Canopy Cover (%)
Warm/Dry Forest Group A	71	57
Moist Forest Group B	84	81
Cool/Moist Forest Group C	73	78
Cool/Dry Forest Group D	68	70
Non-Forest Group 1	71	58
Non-Forest Group 2	82	50

Table E-2. Estimated average tree height for Idaho Panhandle National Forests, Coeur d'Alene National Forest.

Tree Species Common Name	Size Class and Average Tree Height (feet)				
	Sapling (3-inch dbh)[a]	Small (8-inch dbh)	Medium (13-inch dbh)	Large (19-inch dbh)	Oldest (24-inch dbh)
Ponderosa Pine	18	54	75	91	100
White Pine	22	69	98	119	130
Western Larch	31	73	94	108	115
Douglas Fir	24	59	78	90	97
Grand Fir/ Western Hemlock	24	64	87	103	112
Western Redcedar	21	57	78	92	100
Lodgepole Pine	31	61	74	82	87
Subalpine Fir	22	55	73	85	91
Whitebark Pine	31	73	94	108	115

a. diameter at breast height

Warm/Dry Forest Group A

The warm/dry forest group A was applied on streams less than 5th order with a gradient greater than or equal to 3% and vegetation from vegetation response units (VRUs) 1, 2, and 3. This group includes the warmest and driest forest sites that support forest vegetation, usually at low elevations or mid elevations on southerly aspects (Figure E-1, Figure E-2). Historical forest vegetation composition data for the IPNF Coeur d'Alene National Forest were used (Table E-3). Inputs to the shade model for this forest group included estimates of the overall average height (71 feet [ft]), weighted average canopy cover (57%), and average overhang (7.1 ft).

(Photos courtesy Dr. R.E. Rosiere)

Figure E-1. Forest group A is generally dominated by Douglas fir and Ponderosa pine.

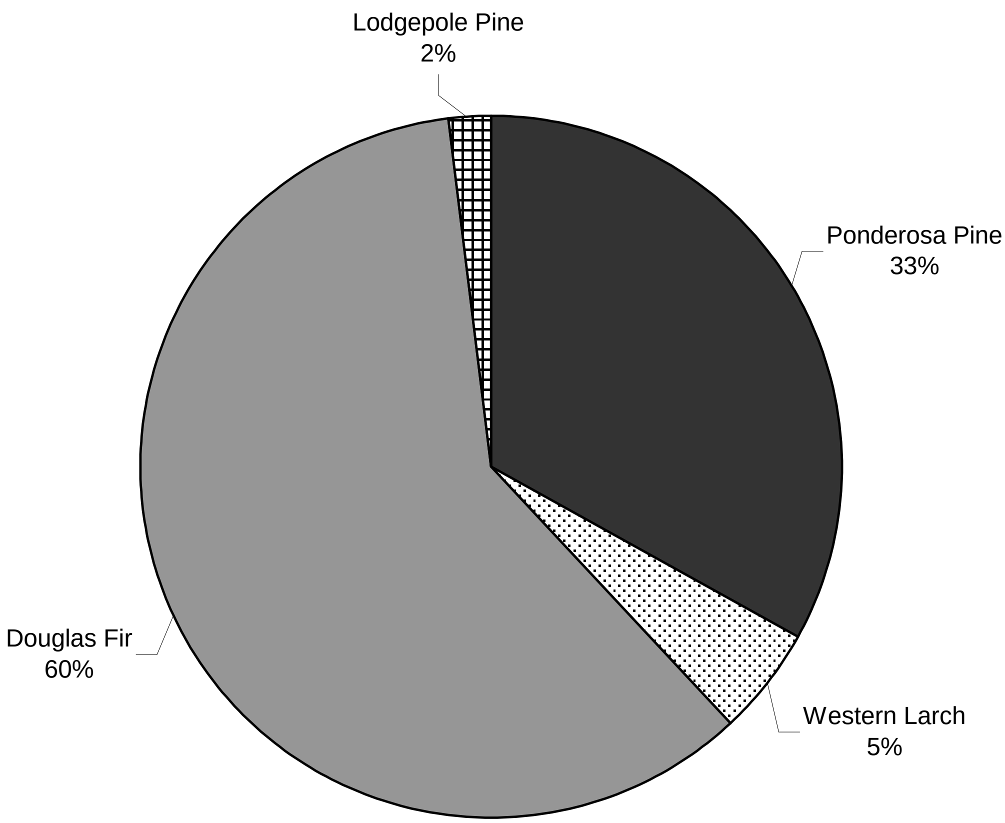


Figure E-2. Warm/dry forest group A species composition.

Table E-3. Warm/dry forest group A composition by species and size classes.

Tree Species Common Name	Size Class and Prevalence (%)					
	Sapling	Small	Medium	Large	Oldest	Total
Ponderosa Pine	6.9	5.3	5.3	7.3	8.3	33
White Pine	--	--	--	--	--	--
Western Larch	1.1	0.8	0.8	1.1	1.3	5
Douglas Fir	12.6	9.6	9.6	13.2	15.0	60
Grand Fir/ Western Hemlock	--	--	--	--	--	--
Western Redcedar	--	--	--	--	--	--
Lodgepole Pine	0.4	0.3	0.3	0.4	0.5	2
Subalpine Fir	--	--	--	--	--	--
Whitebark Pine	--	--	--	--	--	--
Total	21	16	16	22	25	100

Moist Forest Group B

The moist forest group B was applied on streams less than 5th order with a gradient greater than or equal to 3% and vegetation from VRUs 4, 5, and 6. This group includes moist forest sites, usually low to mid elevation, and includes stream bottoms and adjacent benches and toe slopes (Figure E-3, Figure E-4). This setting is the most productive, with favorable soil moisture and temperature regimes that favor abundant plant growth. Historical forest vegetation composition data for IPNF Coeur d'Alene National Forest were used (Table E-4). Abundance of white pine has been greatly reduced from historic conditions due to white pine blister rust and present-day forest communities are likely to demonstrate an altered species composition. Inputs to the shade model for this forest group included estimates of the overall average height (84 ft), weighted average canopy cover (81%), and average overhang (8.4 ft).

(Photos courtesy Dr. R.E. Rosiere)

Figure E-3. Forest group B is generally dominated by white pine and Douglas fir.

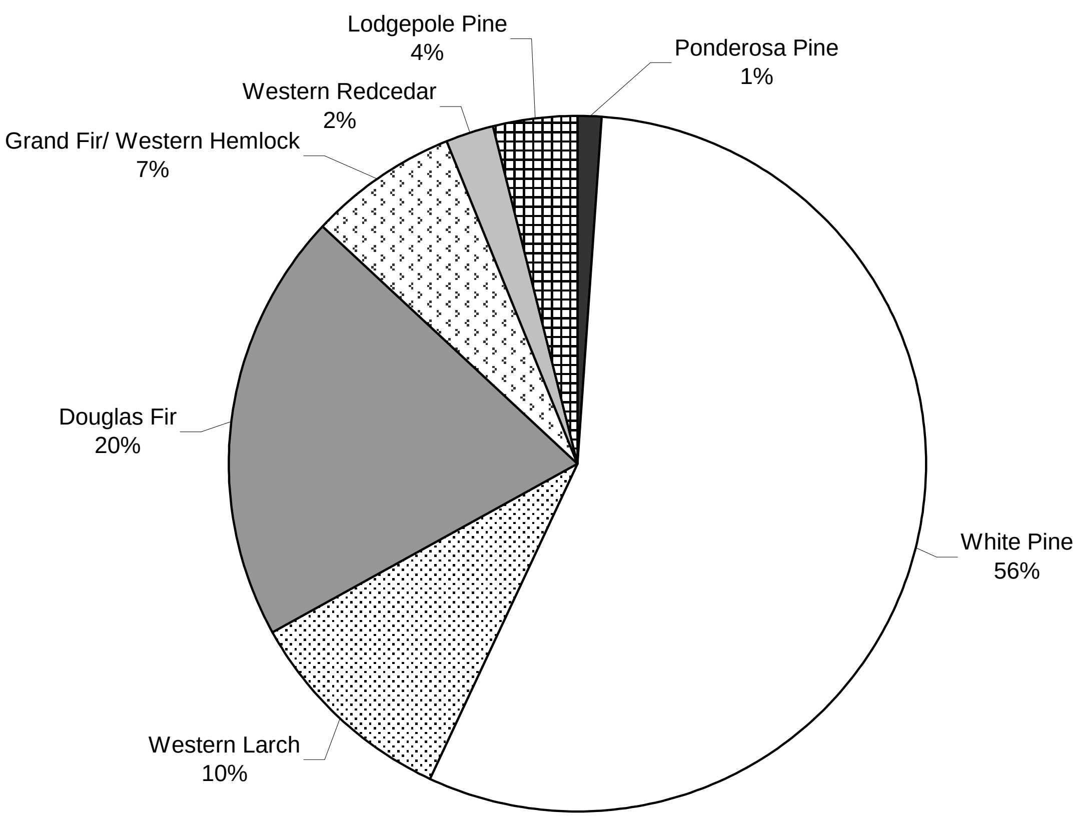


Figure E-4. Moist forest group B species composition.

Table E-4. Moist forest group B composition by species and size classes.

Tree Species Common Name	Size Class and Prevalence (%)					
	Sapling	Small	Medium	Large	Oldest	Total
Ponderosa Pine	0.2	0.1	0.2	0.3	0.2	1
White Pine	11.2	6.7	11.2	14.6	12.3	56
Western Larch	2.0	1.2	2.0	2.6	2.2	10
Douglas Fir	4.0	2.4	4.0	5.2	4.4	20
Grand Fir/ Western Hemlock	1.4	0.8	1.4	1.8	1.5	7
Western Redcedar	0.4	0.2	0.4	0.6	0.4	2
Lodgepole Pine	0.8	0.4	0.8	1.2	0.8	4
Subalpine Fir	--	--	--	--	--	--
Whitebark Pine	--	--	--	--	--	--
Total	20	12	20	26	22	100

Cool/Moist Forest Group C

The cool/moist forest group C was applied on streams less than 5th order with a gradient greater than or equal to 3% and vegetation from VRUs 7 and 8. This group is similar to cool/dry forest group D and includes the moist, lower subalpine forest (Figure E-5, Figure E-6). This group is more common on northwest to east-facing slopes, riparian and poorly drained subalpine sites. Historical forest vegetation composition data for IPNF Coeur d'Alene National Forest were used (Table E-5). Inputs to the shade model for this forest group included estimates of the overall average height (73 ft), weighted average canopy cover (78%) and average overhang (7.3 ft).

(Photo courtesy National Park Service)

(Photo courtesy Terry Glase)

Figure E-5. Forest Group C is generally dominated by subalpine fir and white pine.

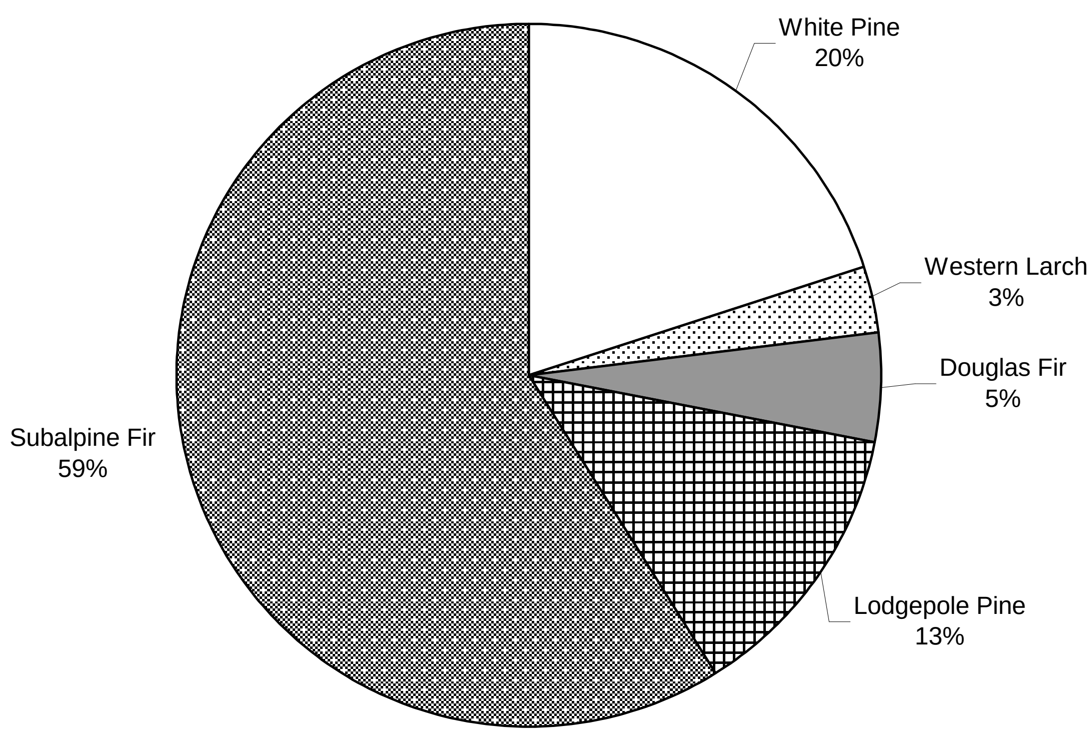


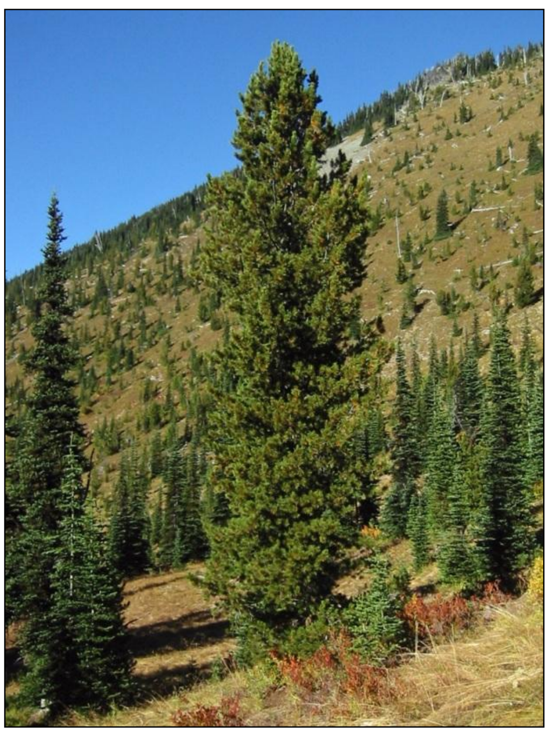
Figure E-6. Cool/moist forest group C species composition.

Table E-5. Cool/moist forest group C composition by species and size classes.

Tree Species Common Name	Size Class and Prevalence (%)					
	Sapling	Small	Medium	Large	Oldest	Total
Ponderosa Pine	--	--	--	--	--	--
White Pine	4.0	3.6	4.2	4.4	3.8	20
Western Larch	0.6	0.5	0.6	0.7	0.6	3
Douglas Fir	1.0	0.9	1.1	1.1	1.0	5
Grand Fir/ Western Hemlock	--	--	--	--	--	--
Western Redcedar	--	--	--	--	--	--
Lodgepole Pine	2.6	2.3	2.7	2.9	2.5	13
Subalpine Fir	11.8	10.6	12.4	13.0	11.2	59
Whitebark Pine	--	--	--	--	--	--
Total	20	18	21	22	19	100

Cool/Dry Forest Group D

The cool/dry forest group D was applied on streams less than 5th order with a gradient greater than or equal to 3% and vegetation from VRUs 9, 10 and 11. This group is similar to cool/moist forest group C and includes the subalpine forest and cool or cold dry sites between forest and alpine tundra (Figure E-7, Figure E-8). The cool to cold dry sites occur at higher elevations and typically have a short growing season. Historical forest vegetation composition data for IPNF Coeur d'Alene National Forest were used. Inputs to the shade model for this forest group included estimates of the overall average height (68 ft), weighted average canopy cover (70%) and average overhang (6.8 ft).



(Photo courtesy Walter Siegmund)

Figure E-7. Forest Group D is generally dominated by subalpine fir and whitebark pine.

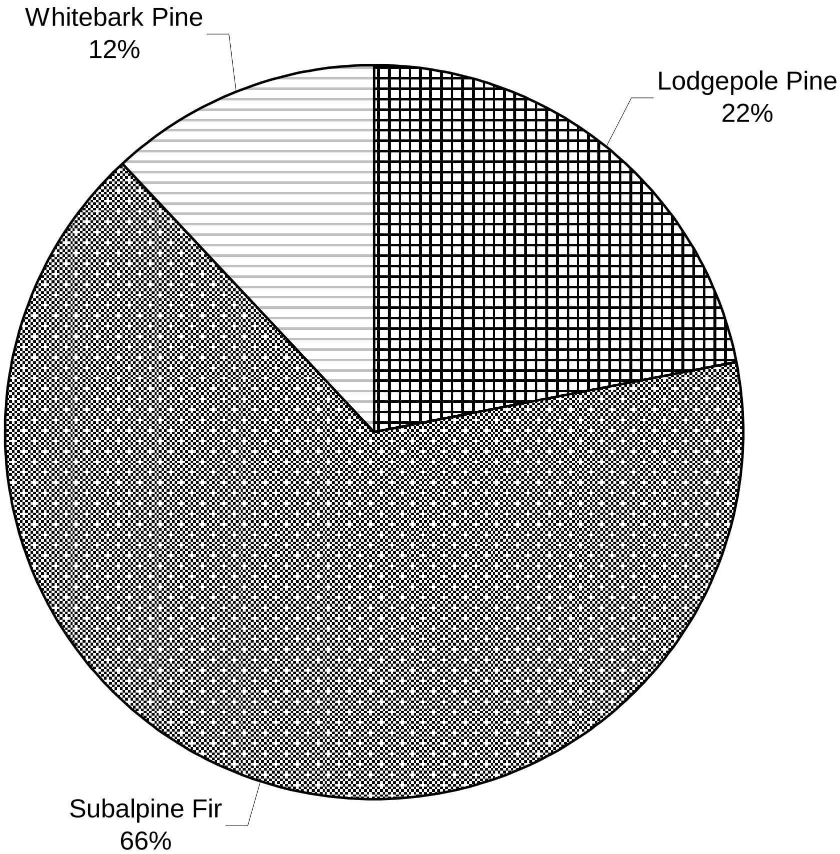


Figure E-8. Cool/dry forest group D species composition.

Table E-6. Cool/dry forest group D composition by species and size classes.

Tree Species Common Name	Size Class and Prevalence (%)					
	Sapling	Small	Medium	Large	Oldest	Total
Ponderosa Pine	--	--	--	--	--	--
White Pine	--	--	--	--	--	--
Western Larch	--	--	--	--	--	--
Douglas Fir	--	--	--	--	--	--
Grand Fir/ Western Hemlock	--	--	--	--	--	--
Western Redcedar	--	--	--	--	--	--
Lodgepole Pine	4.8	4.6	4.2	4.4	4.0	22
Subalpine Fir	14.5	13.9	12.5	13.2	11.9	66
Whitebark Pine	2.6	2.5	2.3	2.4	2.2	12
Total	22	21	19	20	18	100

Non-Forest Group 1

The non-forest group 1 was applied on streams less than 5th order with a gradient less than 3%. Vegetation inputs included VRUs 3C and 4C and measurements collected at sites in the Pend Oreille Lake subbasin. This group represents a diverse plant community including late successional cedar-hemlock, black cottonwood, mixed conifers and shrubs (Figure E-9, Figure E-10, Table E-7). Inputs to the shade model for this group included estimates of the overall average height (71 ft), weighted average canopy cover (58%) and average overhang (7.1 ft).

Figure E-9. Example of Non-Forest Group 1 vegetation with mixed shrub community and conifers.

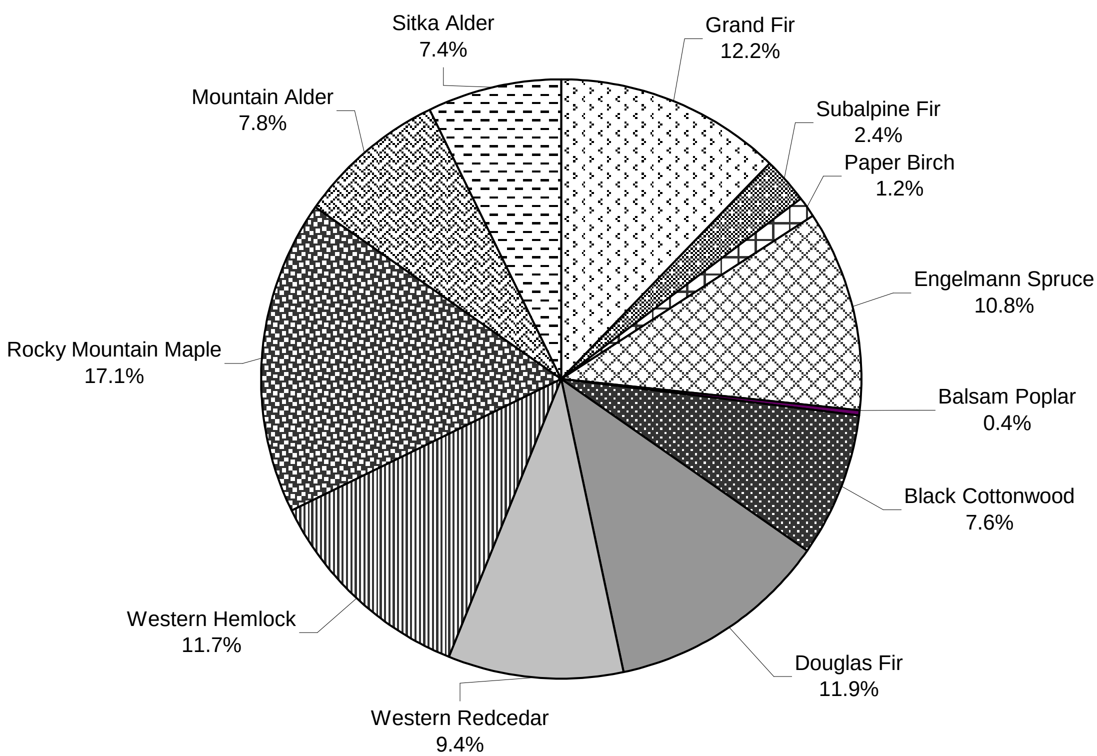


Figure E-10. Non-forest group 1 species composition based on constancy data.

Table E-7. Characteristics of non-forest group 1 used to develop shade curves.

Tree Species Common Name	Canopy Cover (%)	Constancy (%)	Weighted Canopy Cover (%)	System Potential Height (feet)	Weighting Factor (%)	Weighted System Potential Height (feet)
Grand Fir	13	43	6.38	100	12.22	12.22
Subalpine Fir	2	8	0.42	63	2.43	1.53
Paper Birch	19	4	1.70	70	1.21	0.85
Engelmann Spruce	15	38	5.49	90	10.79	9.71
Balsam Poplar	14	1	0.42	80	0.40	0.32
Black Cottonwood	15	27	4.19	100	7.65	7.65
Douglas Fir	12	42	5.25	91	11.89	10.82
Western Redcedar	31	33	10.26	87	9.39	8.17
Western Hemlock	12	42	6.23	85	11.74	9.98
Rocky Mountain Maple	9	61	5.65	30	17.11	5.13
Mountain Alder	27	28	7.95	30	7.81	2.34
Sitka Alder	16	26	4.01	30	7.35	2.21
Total			**58%**			**71 feet**

Non-Forest Group 2

The non-forest group 2 was applied on streams greater than 5th order with a gradient less than 3%. Vegetation inputs included VRU 5C and measurements collected at sites in the Pend Oreille Lake subbasin. This group is mainly comprised of black cottonwoods, shrubs and grasses while conifers are rare (Figure E-11, Figure E-12, Table E-8). Inputs to the shade model for this group included estimates of the overall average height (82 ft), weighted average canopy cover (50%) and average overhang (8.2 ft).

Figure E-11. Example of non-forest group 2 vegetation with black cottonwood common.

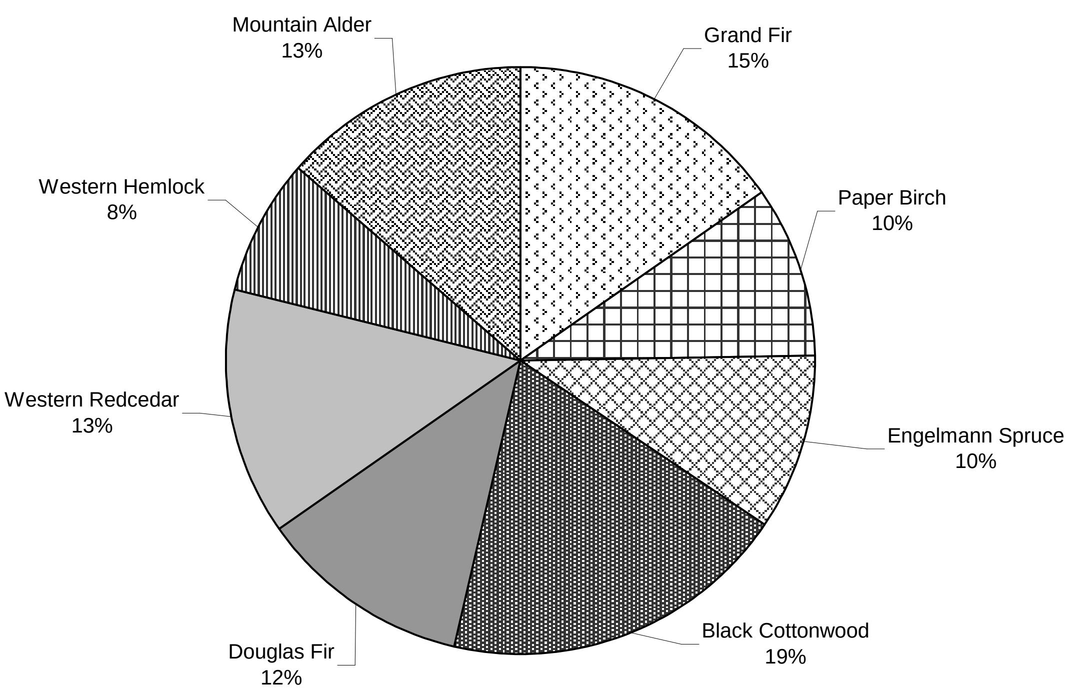


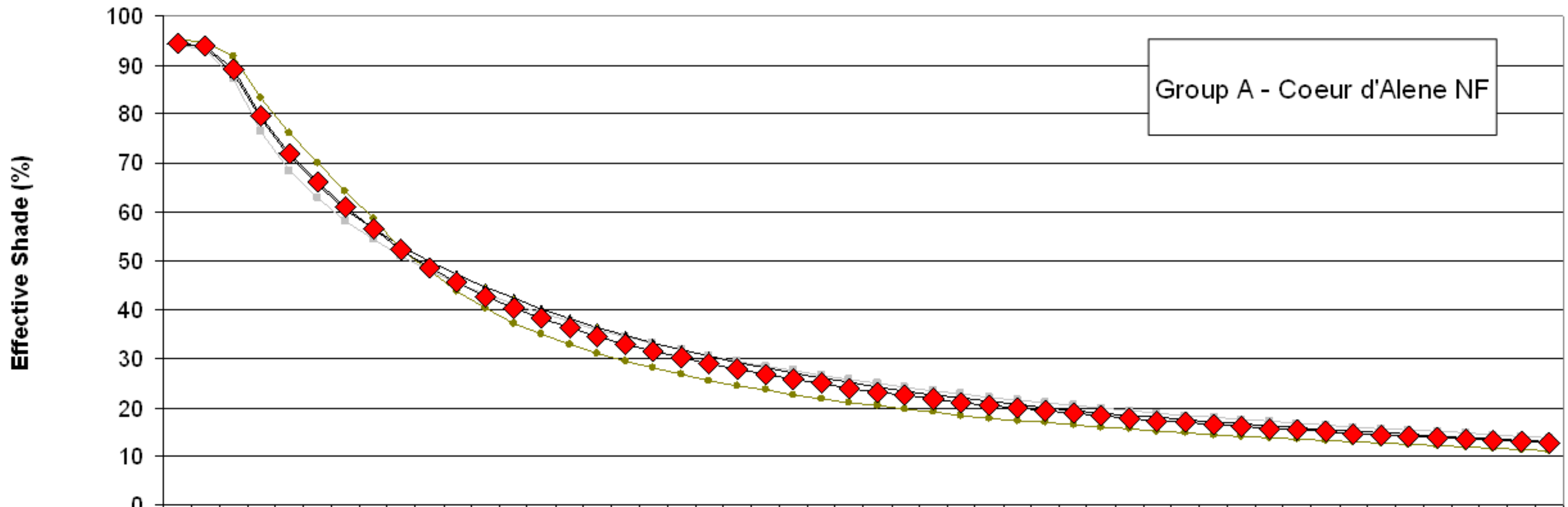
Figure E-12. Non-forest group 2 species composition based on constancy data.

Table E-8. Characteristics of non-forest group 2 used to develop shade curves.

Tree Species Common Name	Canopy Cover (%)	Constancy (%)	Weighted Canopy Cover (%)	System Potential Height (feet)	Weighting Factor (%)	Weighted System Potential Height (feet)
Grand Fir	16	50	8.00	100	15	15.34
Paper Birch	12	31	3.72	70	10	6.66
Engelmann Spruce	5	31	1.55	90	10	8.56
Black Cottonwood	28	63	17.64	100	19	19.33
Douglas Fir	2	38	0.76	91	12	10.61
Western Redcedar	18	44	7.92	87	13	11.74
Western Hemlock	6	25	1.50	85	8	6.52
Mountain Alder	20	44	8.80	25	13	3.37
Total			**50%**			**82 feet**

Effective Shade Curves

Figures E-13 through E-16 show the effective shade curves for forest groups A–D for the Coeur d'Alene National Forest. Figures E-17 and E-18 show the effective shade curves for the non-forest groups.

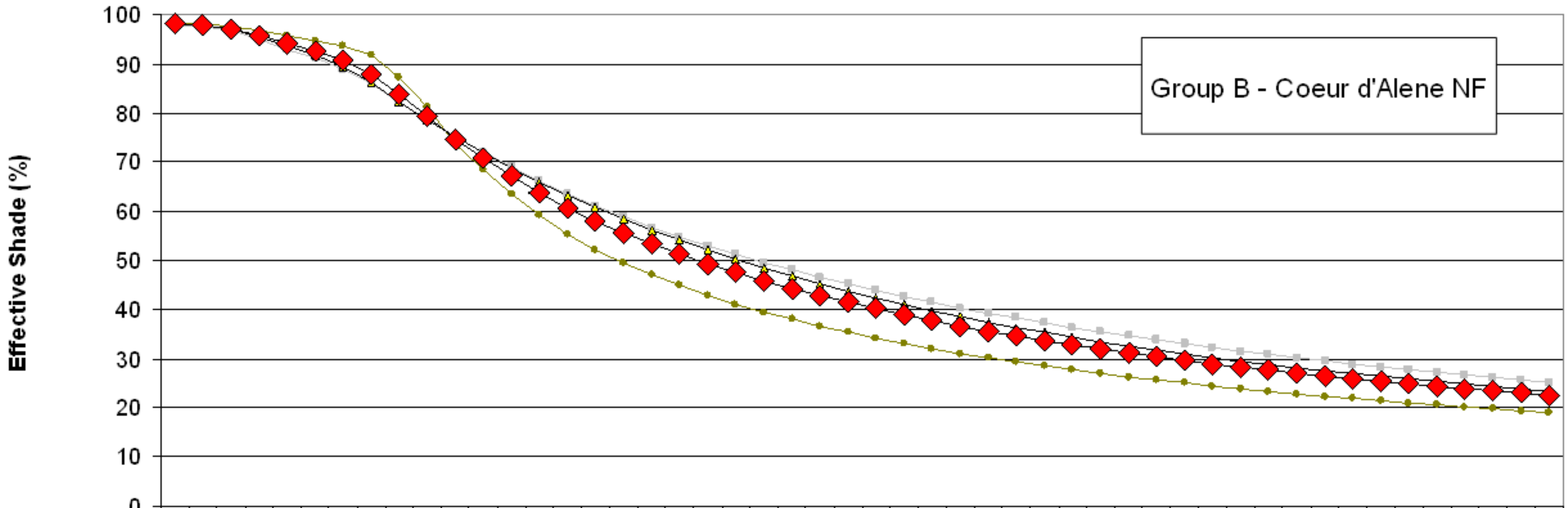


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
North - South	94	93	87	76	69	63	58	54	51	48	45	43	41	39	38	36	34	33	32	31	30	28	28	27	26
Northeast/Southwest	94	94	88	79	71	65	61	57	53	50	47	45	42	40	38	36	35	33	32	31	29	28	27	26	25
East - West	95	95	92	83	76	70	64	59	52	48	44	40	37	35	33	31	29	28	27	26	25	24	23	22	21
Average	95	94	89	80	72	66	61	56	52	49	45	43	40	38	36	34	33	31	30	29	28	27	26	25	24

	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North - South	25	24	23	23	22	22	21	20	20	19	19	18	18	18	17	17	16	16	16	15	15	15	14	14	14
Northeast/Southwest	24	23	23	22	21	21	20	19	19	18	18	17	17	17	16	16	15	15	15	14	14	14	14	13	13
East - West	20	20	19	18	18	17	17	16	16	16	15	15	14	14	14	13	13	13	13	12	12	12	12	11	11
Average	23	22	22	21	20	20	19	19	18	18	17	17	16	16	16	15	15	15	14	14	14	14	13	13	13

"Vegetation" Channel Width (meters) and Calculated Shade Conditions

Figure E-13. Target shade curves for forest group A for the Coeur d'Alene National Forest.

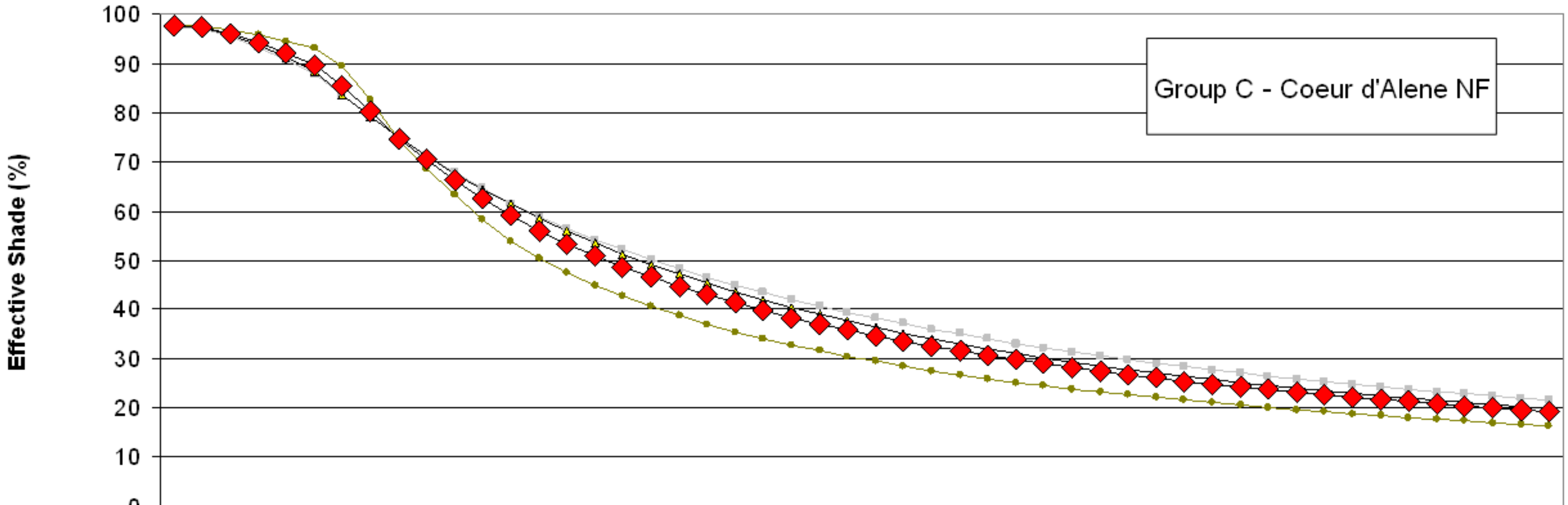


Channel width (m)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
North - South	98	98	97	95	93	91	89	86	82	79	75	72	69	66	64	61	59	57	55	53	51	50	48	47	45
Northeast/Southwest	98	98	97	95	94	92	89	86	82	78	75	72	69	66	63	61	58	56	54	52	50	48	47	45	44
East - West	98	98	98	97	96	95	94	92	87	81	74	68	64	59	55	52	49	47	45	43	41	40	38	37	35
Average	98	98	97	96	94	93	91	88	84	79	75	71	67	64	61	58	56	53	51	49	47	46	44	43	41

Channel width (m)	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North - South	44	43	41	40	39	38	37	36	35	35	34	33	32	32	31	30	30	29	28	28	27	27	26	26	25
Northeast/Southwest	42	41	40	39	37	36	35	34	33	33	32	31	30	29	29	28	28	27	26	26	25	25	24	24	23
East - West	34	33	32	31	30	29	28	28	27	26	26	25	24	24	23	23	22	22	21	21	21	20	20	19	19
Average	40	39	38	37	36	35	34	33	32	31	30	30	29	28	28	27	26	26	25	25	24	24	23	23	23

"Vegetation" Channel Width (meters) and Calculated Shade Conditions

Figure E-14. Target shade curves for forest group B for the Coeur d'Alene National Forest.

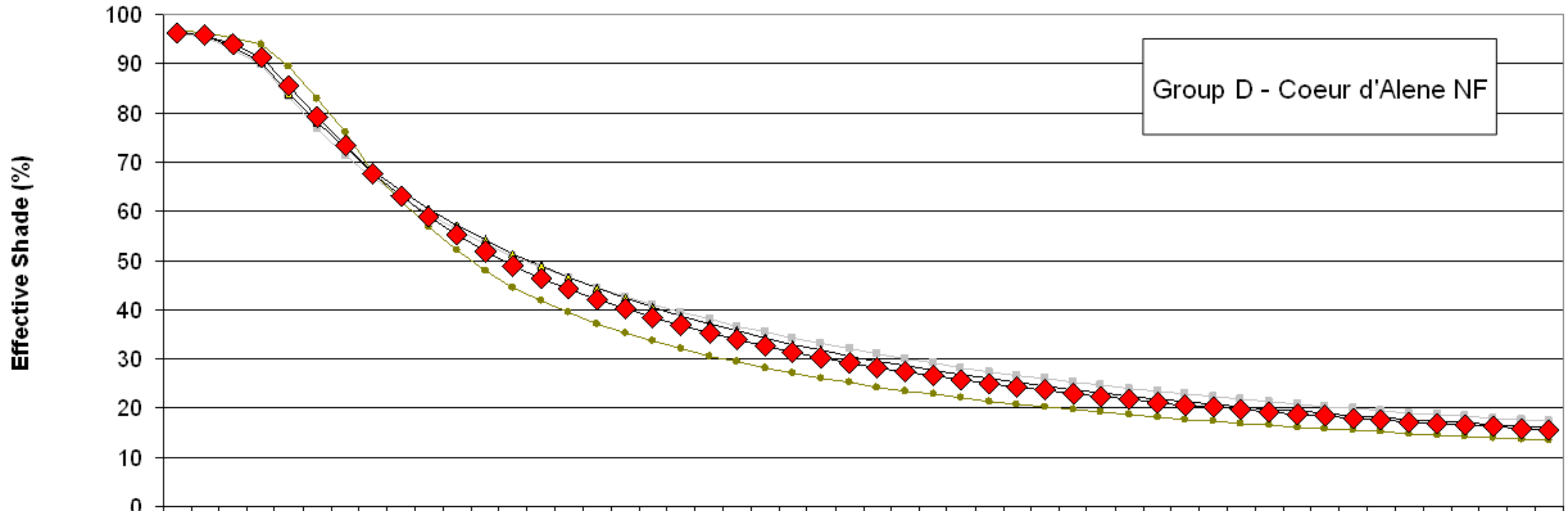


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
North - South	97	97	95	93	91	88	84	79	75	71	68	65	62	59	56	54	52	50	48	47	45	43	42	41	39
Northeast/Southwest	98	97	96	94	91	88	84	79	75	71	68	64	61	59	56	54	51	49	47	45	44	42	40	39	38
East - West	98	98	97	96	95	93	89	83	74	69	63	58	54	51	48	45	43	41	39	37	35	34	33	32	30
Average	98	97	96	94	92	90	86	80	75	70	66	62	59	56	53	51	49	47	45	43	41	40	38	37	36

	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North - South	38	37	36	35	34	33	32	31	31	30	29	28	28	27	26	26	25	25	24	24	23	23	22	22	22
Northeast/Southwest	36	35	34	33	32	31	30	29	29	28	27	26	26	25	25	24	23	23	22	22	22	21	21	20	20
East - West	29	28	28	27	26	25	24	24	23	23	22	22	21	21	20	20	19	19	18	18	18	17	17	17	16
Average	35	34	33	32	31	30	29	28	27	27	26	25	25	24	24	23	23	22	22	21	21	20	20	20	19

"Vegetation" Channel Width (meters) and Calculated Shade Conditions

Figure E-15. Target shade curves for forest group C for the Coeur d'Alene National Forest.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
North - South	96	95	93	90	83	77	71	67	63	59	56	53	51	49	47	45	43	41	39	38	37	35	34	33	32
Northeast/Southwest	96	96	93	90	84	78	73	68	64	60	57	54	51	49	47	44	42	40	39	37	36	34	33	32	31
East - West	97	96	95	94	89	83	76	68	62	57	52	48	45	42	39	37	35	34	32	31	29	28	27	26	25
Average	96	96	94	91	86	79	73	68	63	59	55	52	49	46	44	42	40	38	37	35	34	33	31	30	29

	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
North - South	31	30	29	28	27	27	26	25	25	24	23	23	22	22	21	21	20	20	19	19	19	18	18	18	17
Northeast/Southwest	30	29	28	27	26	25	24	24	23	22	22	21	21	20	20	19	19	19	18	18	17	17	17	16	16
East - West	24	24	23	22	21	21	20	20	19	19	18	18	17	17	17	16	16	15	15	15	15	14	14	14	13
Average	28	27	27	26	25	24	24	23	22	22	21	21	20	20	19	19	18	18	18	17	17	17	16	16	16

"Vegetation" Channel Width (meters) and Calculated Shade Conditions

Figure E-16. Target shade curves for forest group D for the Coeur d'Alene National Forest.

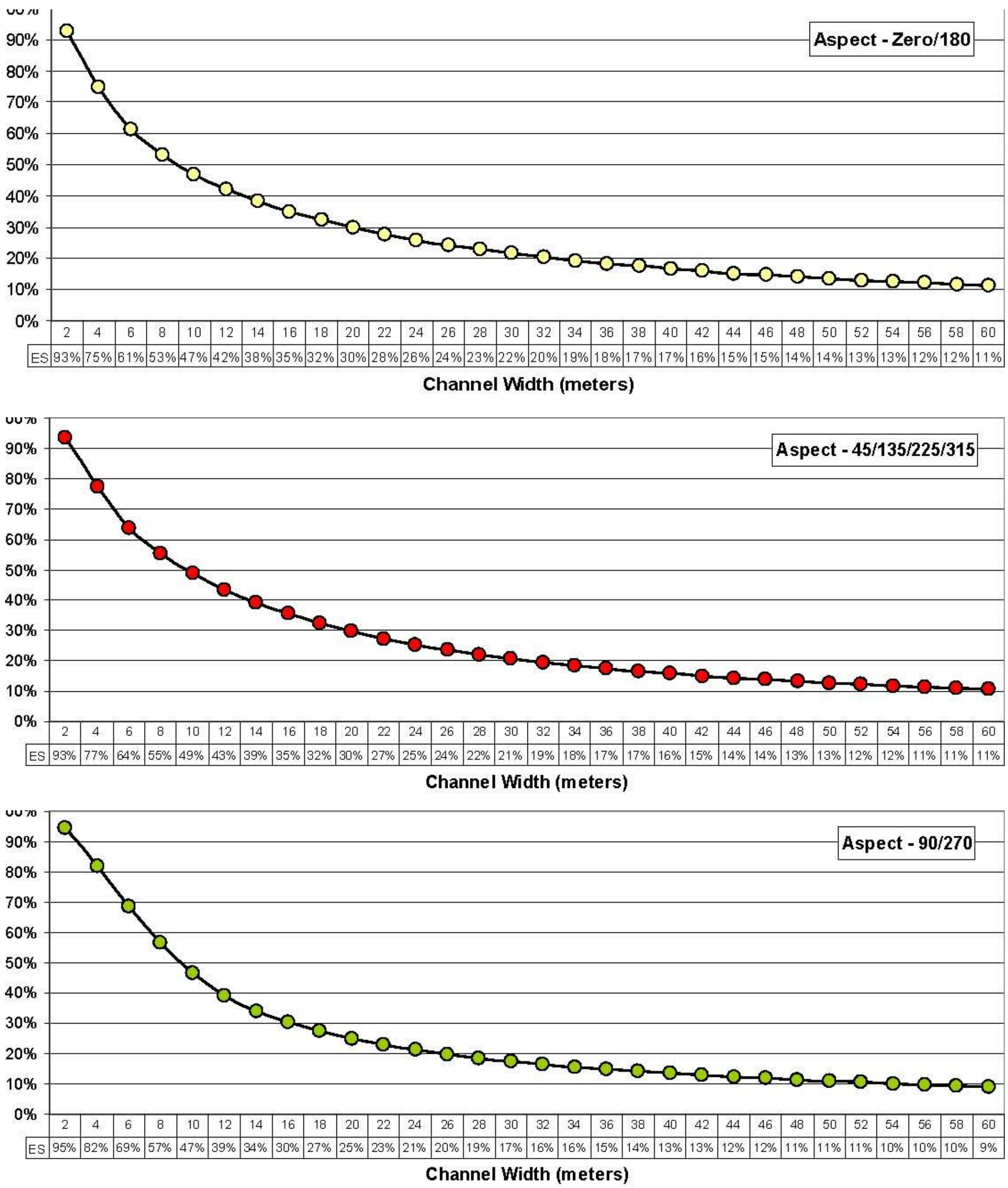


Figure E-17. Target shade curves for non-forest group 1 for the Idaho Panhandle Region.

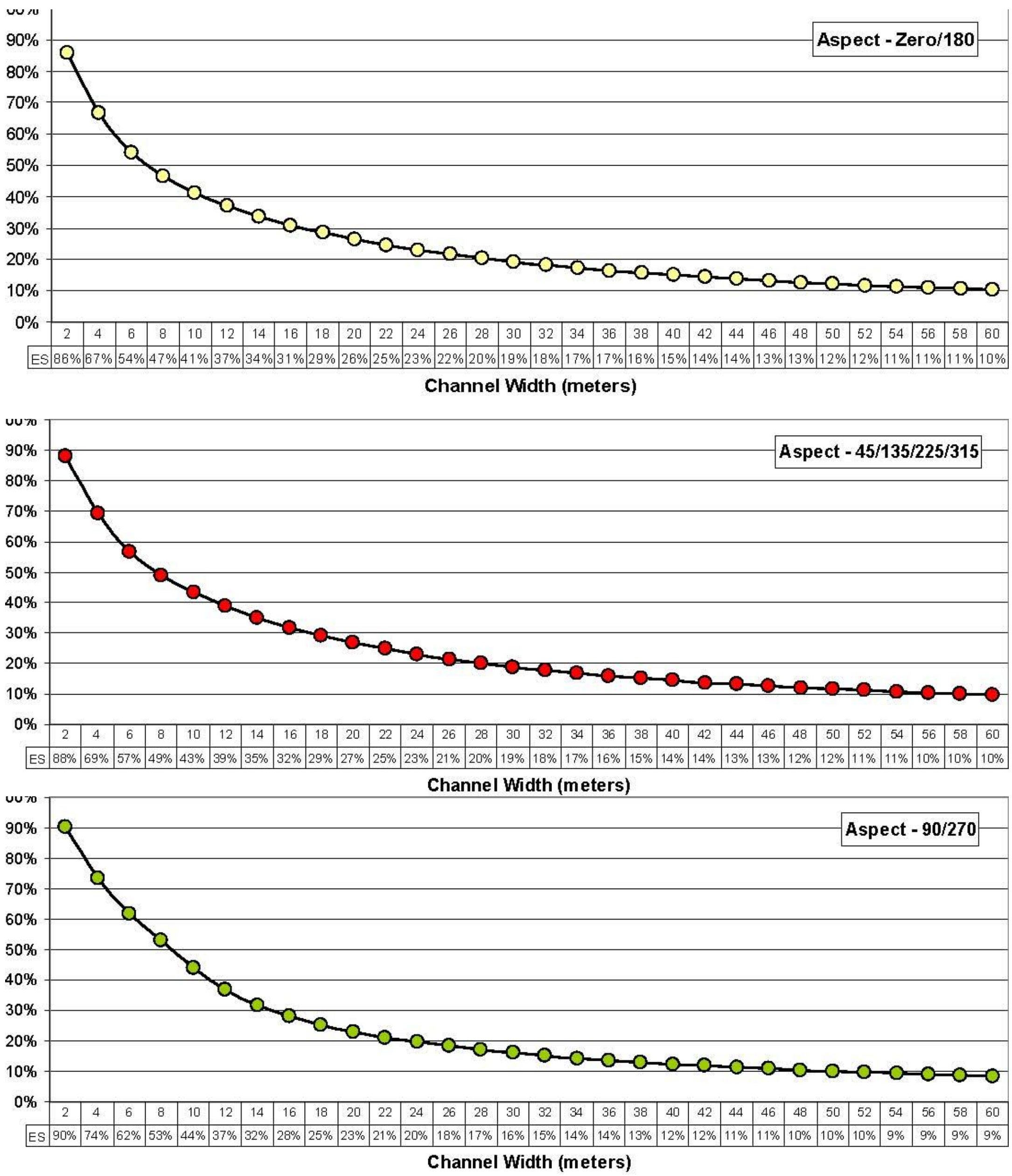


Figure E-18. Target shade curves for non-forest group 2 for the Idaho Panhandle Region.

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Appendix F. Existing and Potential Solar Load Calculations

Table F-1. Existing and potential solar loads for Beaver Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Beaver Creek**
Assessment Unit #ID17010301PN003_02														
520	0.9	0.55	0.98	0.11	-0.44	1	1	520	286	520	57.2	-228.8	-8	Forest
530	0.8	1.1	0.98	0.11	-0.99	1	1	530	583	530	58.3	-524.7	-18	Group C
950	0.9	0.55	0.98	0.11	-0.44	2	2	1900	1045	1900	209	-836	-8	Forest
950	0.8	1.1	0.98	0.11	-0.99	3	2	2850	3135	1900	209	-2926	-18	Group B
1990	0.7	1.65	0.96	0.22	-1.43	5	3	9950	16417.5	5970	1313.4	-15104.1	-26	
400	0.2	4.4	0.78	1.21	-3.19	7	4	2800	12320	1600	1936	-10384	-58	Nonforest
1010	0.4	3.3	0.78	1.21	-2.09	**8**	**4**	8080	26664	4040	4888.4	-21775.6	-38	Group 1
410	0.2	4.4	0.72	1.54	-2.86	9	5	3690	16236	2050	3157	-13079	-52	
130	0	5.5	0.72	1.54	-3.96	9	5	1170	6435	650	1001	-5434	-72	
370	0.2	4.4	0.72	1.54	-2.86	9	5	3330	14652	1850	2849	-11803	-52	
1190	0.5	2.75	0.65	1.925	-0.825	10	6	11900	32725	7140	13744.5	-18980.5	-15	
360	0.7	1.65	0.6	2.2	0.55	11	7	3960	6534	2520	5544	-990	0	
660	0.6	2.2	0.6	2.2	0	11	7	7260	15972	4620	10164	-5808	0	
300	0.5	2.75	0.55	2.475	-0.275	11	8	3300	9075	2400	5940	-3135	-5	
130	0.7	1.65	0.55	2.475	0.825	12	8	1560	2574	1040	2574	-9.09495E-13	0	
350	0.5	2.75	0.55	2.475	-0.275	12	8	4200	11550	2800	6930	-4620	-5	
230	0.4	3.3	0.55	2.475	-0.825	12	**8**	2760	9108	1840	4554	-4554	-15	
470	0.3	3.85	0.52	2.64	-1.21	12	9	5640	21714	4230	11167.2	-10546.8	-22	
460	0.4	3.3	0.52	2.64	-0.66	13	9	5980	19734	4140	10929.6	-8804.4	-12	
690	0.2	4.4	0.52	2.64	-1.76	13	9	8970	39468	6210	16394.4	-23073.6	-32	
780	0	5.5	0.48	2.86	-2.64	14	10	10920	60060	7800	22308	-37752	-48	
							Subtotal	**101,270**	**326,288**	**65,750**	**125,928**	**-200,360**	**-24**	
Assessment Unit #ID17010301PN003_03														
220	0.5	2.75	0.48	2.86	0.11	14	10	3080	8470	2200	6292	-2178	0	
320	0.2	4.4	0.48	2.86	-1.54	14	10	4480	19712	3200	9152	-10560	-28	
1070	0.1	4.95	0.45	3.025	-1.925	**15**	**11**	16050	79447.5	11770	35604.25	-43843.25	-35	
410	0	5.5	0.45	3.025	-2.475	15	11	6150	33825	4510	13642.75	-20182.25	-45	
1120	0.1	4.95	0.45	3.025	-1.925	15	11	16800	83160	12320	37268	-45892	-35	
180	0	5.5	0.41	3.245	-2.255	16	12	2880	15840	2160	7009.2	-8830.8	-41	
480	0.1	4.95	0.41	3.245	-1.705	16	12	7680	38016	5760	18691.2	-19324.8	-31	
780	0.3	3.85	0.41	3.245	-0.605	16	12	12480	48048	9360	30373.2	-17674.8	-11	
230	0.6	2.2	0.41	3.245	1.045	16	12	3680	8096	2760	8956.2	860.2	0	
1200	0.2	4.4	0.41	3.245	-1.155	16	**12**	19200	84480	14400	46728	-37752	-21	
							Subtotal	**92,480**	**419,095**	**68,440**	**213,717**	**-205,378**	**-25**	
							Total	**193,750**	**745,382**	**134,190**	**339,645**	**-405,737**		

Table F-2. Existing and potential solar loads for Beaver Creek tributaries.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Beaver Creek Tributaries	
Assessment Unit #ID17010301PN003_02															
770	0.9	0.55	0.98	0.11	-0.44	1	1	770	423.5	770	84.7	-338.8	-8	Group C	Carbon
810	0.9	0.55	0.98	0.11	-0.44	1	1	810	445.5	810	89.1	-356.4	-8	Group B	Creek
850	0.8	1.1	0.98	0.11	-0.99	2	2	1700	1870	1700	187	-1683	-18	Forest	
620	0.3	3.85	0.98	0.11	-3.74	2	2	1240	4774	1240	136.4	-4637.6	-68		
1800	0.9	0.55	0.98	0.11	-0.44	1	1	1800	990	1800	198	-792	-8		Dobson
410	0.8	1.1	0.98	0.11	-0.99	2	2	820	902	820	90.2	-811.8	-18		Gulch
40	0	5.5	0.98	0.11	-5.39	2	2	80	440	80	8.8	-431.2	-98		
510	0.8	1.1	0.98	0.11	-0.99	2	2	1020	1122	1020	112.2	-1009.8	-18		
160	0.9	0.55	0.98	0.11	-0.44	1	1	160	88	160	17.6	-70.4	-8		Dudley
130	0.8	1.1	0.98	0.11	-0.99	1	1	130	143	130	14.3	-128.7	-18		Creek
1900	0.9	0.55	0.98	0.11	-0.44	2	2	3800	2090	3800	418	-1672	-8		
650	0.8	1.1	0.97	0.165	-0.935	3	3	1950	2145	1950	321.75	-1823.25	-17		
1100	0.9	0.55	0.97	0.165	-0.385	3	3	3300	1815	3300	544.5	-1270.5	-7		
320	0.9	0.55	0.98	0.11	-0.44	1	1	320	176	320	35.2	-140.8	-8		Moore
450	0.8	1.1	0.98	0.11	-0.99	1	1	450	495	450	49.5	-445.5	-18		Gulch
1700	0.9	0.55	0.98	0.11	-0.44	2	2	3400	1870	3400	374	-1496	-8		
1000	0.8	1.1	0.98	0.11	-0.99	1	1	1000	1100	1000	110	-990	-18		Deer
480	0.9	0.55	0.98	0.11	-0.44	1	1	480	264	480	52.8	-211.2	-8		Creek
390	0.8	1.1	0.98	0.11	-0.99	2	2	780	858	780	85.8	-772.2	-18		
810	0.7	1.65	0.98	0.11	-1.54	2	2	1620	2673	1620	178.2	-2494.8	-28		
490	0.8	1.1	0.98	0.11	-0.99	2	2	980	1078	980	107.8	-970.2	-18		
1600	0.9	0.55	0.97	0.165	-0.385	3	3	4800	2640	4800	792	-1848	-7		
110	0.3	3.85	0.97	0.165	-3.685	3	3	330	1270.5	330	54.45	-1216.05	-67		
1200	0.9	0.55	0.98	0.11	-0.44	1	1	1200	660	1200	132	-528	-8		Unknown
800	0.8	1.1	0.98	0.11	-0.99	1	1	800	880	800	88	-792	-18		Gulch
1600	0.9	0.55	0.98	0.11	-0.44	2	2	3200	1760	3200	352	-1408	-8		
100	0.5	2.75	0.98	0.11	-2.64	2	2	200	550	200	22	-528	-48		
3000	0.9	0.55	0.98	0.11	-0.44	1	1	3000	1650	3000	330	-1320	-8		Pony
270	0.5	2.75	0.98	0.11	-2.64	2	2	540	1485	540	59.4	-1425.6	-48		Gulch
730	0.9	0.55	0.98	0.11	-0.44	2	2	1460	803	1460	160.6	-642.4	-8		
560	0.8	1.1	0.97	0.165	-0.935	3	3	1680	1848	1680	277.2	-1570.8	-17		
400	0.7	1.65	0.97	0.165	-1.485	3	3	1200	1980	1200	198	-1782	-27		
510	0.8	1.1	0.97	0.165	-0.935	3	3	1530	1683	1530	252.45	-1430.55	-17		
140	0.3	3.85	0.97	0.165	-3.685	3	3	420	1617	420	69.3	-1547.7	-67		
150	0.7	1.65	0.97	0.165	-1.485	3	3	450	742.5	450	74.25	-668.25	-27		
430	0.9	0.55	0.98	0.11	-0.44	1	1	430	236.5	430	47.3	-189.2	-8		Alder
160	0.8	1.1	0.98	0.11	-0.99	1	1	160	176	160	17.6	-158.4	-18		Creek
1300	0.9	0.55	0.98	0.11	-0.44	2	2	2600	1430	2600	286	-1144	-8		
3800	0.8	1.1	0.97	0.165	-0.935	3	3	11400	12540	11400	1881	-10659	-17		
3100	0.9	0.55	0.98	0.11	-0.44	2	2	6200	3410	6200	682	-2728	-8		White
450	0.9	0.55	0.97	0.165	-0.385	3	3	1350	742.5	1350	222.75	-519.75	-7		Creek
3200	0.8	1.1	0.96	0.22	-0.88	4	4	12800	14080	12800	2816	-11264	-16		
220	0.7	1.65	0.96	0.22	-1.43	4	4	880	1452	880	193.6	-1258.4	-26		
2200	0.9	0.55	0.98	0.11	-0.44	1	1	2200	1210	2200	242	-968	-8		trib to White
3100	0.9	0.55	0.98	0.11	-0.44	1	1	3100	1705	3100	341	-1364	-8		Scott
400	0.8	1.1	0.98	0.11	-0.99	2	2	800	880	800	88	-792	-18		Gulch
1600	0.9	0.55	0.98	0.11	-0.44	1	1	1600	880	1600	176	-704	-8		Trail
440	0.8	1.1	0.98	0.11	-0.99	2	2	880	968	880	96.8	-871.2	-18		Creek
260	0.7	1.65	0.98	0.11	-1.54	2	2	520	858	520	57.2	-800.8	-28		
410	0.9	0.55	0.98	0.11	-0.44	2	2	820	451	820	90.2	-360.8	-8		
610	0.8	1.1	0.97	0.165	-0.935	3	3	1830	2013	1830	301.95	-1711.05	-17		
520	0.7	1.65	0.97	0.165	-1.485	3	3	1560	2574	1560	257.4	-2316.6	-27		
260	0.5	2.75	0.97	0.165	-2.585	3	3	780	2145	780	128.7	-2016.3	-47		
280	0.5	2.75	0.78	1.21	-1.54	4	4	1120	3080	1120	1355.2	-1724.8	-28	Nonforest	
700	0.8	1.1	0.78	1.21	0.11	4	4	2800	3080	2800	3388	308	0	Group 1	
160	0.4	3.3	0.78	1.21	-2.09	4	4	640	2112	640	774.4	-1337.6	-38		
4900	0.9	0.55	0.98	0.11	-0.44	2	2	9800	5390	9800	1078	-4312	-8	Group B	Potosi Gulch
3200	0.9	0.55	0.98	0.11	-0.44	1	1	3200	1760	3200	352	-1408	-8		Carpenter
560	0.8	1.1	0.98	0.11	-0.99	2	2	1120	1232	1120	123.2	-1108.8	-18		Gulch
690	0.9	0.55	0.98	0.11	-0.44	2	2	1380	759	1380	151.8	-607.2	-8		
							Total	**117,390**	**110,495**	**117,390**	**21,226**	**-89,269**	**-20**		

Table F-3. Existing and potential solar loads for Big Elk Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Big Elk Creek**
Assessment Unit # ID17010301PN020_02														
1920	0.9	0.55	0.98	0.11	-0.44	1	1	1920	1056	1920	211.2	-844.8	-8	Forest Group G
890	0.8	1.1	0.98	0.11	-0.99	2	2	1780	1958	1780	195.8	-1762.2	-18	
680	0.8	1.1	0.94	0.33	-0.77	2	2	1360	1496	1360	448.8	-1047.2	-14	Nonforest Group 1
810	0.7	1.65	0.86	0.77	-0.88	3	3	2430	4009.5	2430	1871.1	-2138.4	-16	
1220	0.6	2.2	0.86	0.77	-1.43	3	3	3660	8052	3660	2818.2	-5233.8	-26	
690	0.7	1.65	0.78	1.21	-0.44	**6**	**4**	4140	6831	2760	3339.6	-3491.4	-8	
750	0.6	2.2	0.78	1.21	-0.99	4	4	3000	6600	3000	3630	-2970	-18	
230	0.7	1.65	0.72	1.54	-0.11	**4**	**5**	920	1518	1150	1771	253	-2	
530	0.6	2.2	0.72	1.54	-0.66	5	5	2650	5830	2650	4081	-1749	-12	
210	0.7	1.65	0.72	1.54	-0.11	5	5	1050	1732.5	1050	1617	-115.5	-2	
850	0.6	2.2	0.65	1.925	-0.28	6	6	5100	11220	5100	9817.5	-1402.5	-5	
320	0.5	2.75	0.65	1.925	-0.83	**7**	**6**	2240	6160	1920	3696	-2464	-15	
							Total	**30,250**	**56,463**	**28,780**	**33,497**	**-22,966**	**-12**	

Table F-4. Existing and potential solar loads for Big Elk Creek tributaries.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Big Elk Creek Tributaries**	
AU# ID17010301PN020_02															
2600	0.9	0.55	0.98	0.11	-0.44	2	2	5200	2860	5200	572	-2288	-8	Forest Group B	US Creek
1200	0.9	0.55	0.98	0.11	-0.44	1	1	1200	660	1200	132	-528	-8		1st un-named
330	0.8	1.1	0.98	0.11	-0.99	1	1	330	363	330	36.3	-326.7	-18		
1500	0.9	0.55	0.98	0.11	-0.44	1	1	1500	825	1500	165	-660	-8		2nd un-named
90	0.7	1.65	0.98	0.11	-1.54	1	1	90	148.5	90	9.9	-138.6	-28		
1600	0.9	0.55	0.98	0.11	-0.44	1	1	1600	880	1600	176	-704	-8		3rd un-named
40	0.8	1.1	0.98	0.11	-0.99	1	1	40	44	40	4.4	-39.6	-18		
1500	0.9	0.55	0.98	0.11	-0.44	1	1	1500	825	1500	165	-660	-8		Boundary Creek
1900	0.8	1.1	0.98	0.11	-0.99	2	2	3800	4180	3800	418	-3762	-18		
870	0.9	0.55	0.98	0.11	-0.44	1	1	870	478.5	870	95.7	-382.8	-8		4th un-named
570	0.8	1.1	0.98	0.11	-0.99	1	1	570	627	570	62.7	-564.3	-18		
170	0.9	0.55	0.98	0.11	-0.44	1	1	170	93.5	170	18.7	-74.8	-8		
1900	0.9	0.55	0.98	0.11	-0.44	1	1	1900	1045	1900	209	-836	-8		First Creek
1000	0.8	1.1	0.98	0.11	-0.99	2	2	2000	2200	2000	220	-1980	-18		
170	0.9	0.55	0.98	0.11	-0.44	2	2	340	187	340	37.4	-149.6	-8		
120	0.8	1.1	0.98	0.11	-0.99	2	2	240	264	240	26.4	-237.6	-18		
60	0.9	0.55	0.98	0.11	-0.44	2	2	120	66	120	13.2	-52.8	-8		
1800	0.9	0.55	0.98	0.11	-0.44	1	1	1800	990	1800	198	-792	-8		New Creek
40	0.7	1.65	0.98	0.11	-1.54	1	1	40	66	40	4.4	-61.6	-28		
							Total	**23,310**	**16,803**	**23,310**	**2,564**	**-14,238**	**-13**		

Table F-5. Existing and potential solar loads for Bootjack Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Bootjack Creek**	
Assessment Unit # ID17010301PN034_02															
3960	0.9	0.55	0.98	0.11	-0.44	2	2	7920	4356	7920	871.2	-3484.8	-8	Forest Group B	Smith Cr
730	0.9	0.55	0.98	0.11	-0.44	1	1	730	401.5	730	80.3	-321.2	-8		Bootjack Cr
720	0.7	1.65	0.98	0.11	-1.54	1	1	720	1188	720	79.2	-1108.8	-28		
1290	0.8	1.1	0.98	0.11	-0.99	2	2	2580	2838	2580	283.8	-2554.2	-18		
600	0.7	1.65	0.96	0.22	-1.43	3	**3**	1800	2970	1800	396	-2574	-26		
300	0.8	1.1	0.96	0.22	-0.88	3	3	900	990	900	198	-792	-16		
690	0.7	1.65	0.94	0.33	-1.32	4	**4**	2760	4554	2760	910.8	-3643.2	-24		
							Total	**17,410**	**17,298**	**17,410**	**2,819**	**-14,478**			

Table F-6. Existing and potential solar loads for Brett Creek and tributaries.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Brett Creek**	
AU# ID17010301PN021_02															
1000	0.9	0.55	0.98	0.11	-0.44	1	1	1000	550	1000	110	-440	-8	Forest	1st to Brett
760	0.8	1.1	0.98	0.11	-0.99	2	2	1520	1672	1520	167.2	-1504.8	-18	Group B	
60	0.7	1.65	0.94	0.33	-1.32	2	2	120	198	120	39.6	-158.4	-24	Group 1	
2100	0.9	0.55	0.98	0.11	-0.44	1	1	2100	1155	2100	231	-924	-8	Group B	2nd to Brett
300	0.8	1.1	0.98	0.11	-0.99	2	2	600	660	600	66	-594	-18		
530	0.9	0.55	0.98	0.11	-0.44	2	2	1060	583	1060	116.6	-466.4	-8		
90	0.7	1.65	0.97	0.165	-1.485	1	1	90	148.5	90	14.85	-133.65	-27	Group 1	
800	0.9	0.55	0.98	0.11	-0.44	1	1	800	440	800	88	-352	-8	Group B	Brett
650	0.8	1.1	0.98	0.11	-0.99	1	1	650	715	650	71.5	-643.5	-18		Creek
450	0.9	0.55	0.98	0.11	-0.44	2	2	900	495	900	99	-396	-8		
1100	0.8	1.1	0.94	0.33	-0.77	2	2	2200	2420	2200	726	-1694	-14	Nonforest	
820	0.7	1.65	0.86	0.77	-0.88	3	3	2460	4059	2460	1894.2	-2164.8	-16	Group 1	
800	0.7	1.65	0.86	0.77	-0.88	3	3	2400	3960	2400	1848	-2112	-16		
920	0.6	2.2	0.78	1.21	-0.99	4	4	3680	8096	3680	4452.8	-3643.2	-18		
120	0.8	1.1	0.78	1.21	0.11	4	4	480	528	480	580.8	52.8	0		
							Total	**20,060**	**25,680**	**20,060**	**10,506**	**-15,174**	**-14**		

Table F-7. Existing and potential solar loads for Brown Creek and tributaries.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Brown Creek**	
AU# ID17010301PN026_02															
2100	0.9	0.55	0.98	0.11	-0.44	1	1	2100	1155	2100	231	-924	-8	Forest	1st to Brown
1900	0.9	0.55	0.98	0.11	-0.44	1	1	1900	1045	1900	209	-836	-8	Group B	Hart Creek
2700	0.9	0.55	0.98	0.11	-0.44	2	2	5400	2970	5400	594	-2376	-8		Rookie Creek
1900	0.9	0.55	0.98	0.11	-0.44	1	1	1900	1045	1900	209	-836	-8		Brown
1100	0.8	1.1	0.98	0.11	-0.99	2	2	2200	2420	2200	242	-2178	-18		Creek
1100	0.8	1.1	0.97	0.165	-0.935	3	3	3300	3630	3300	544.5	-3085.5	-17		
280	0.7	1.65	0.96	0.22	-1.43	4	4	1120	1848	1120	246.4	-1601.6	-26		
350	0.8	1.1	0.96	0.22	-0.88	4	4	1400	1540	1400	308	-1232	-16		
710	0.8	1.1	0.96	0.22	-0.88	4	4	2840	3124	2840	624.8	-2499.2	-16		
450	0.9	0.55	0.96	0.22	-0.33	4	4	1800	990	1800	396	-594	-6		
							Total	**23,960**	**19,767**	**23,960**	**3,605**	**-16,162**	**-13**		

Table F-8. Existing and potential solar loads for Bumblebee Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Bumblebee Creek	
Assessment Unit # ID17010301PN031_02															
1790	0.9	0.55	0.98	0.11	-0.44	1	1	1790	984.5	1790	196.9	-787.6	-8	Forest Group B	Trib #1
1920	0.9	0.55	0.98	0.11	-0.44	2	2	3840	2112	3840	422.4	-1689.6	-8		Trib #2
2080	0.9	0.55	0.98	0.11	-0.44	1	1	2080	1144	2080	228.8	-915.2	-8		Trib #3
870	0.8	1.1	0.98	0.11	-0.99	1	1	870	957	870	95.7	-861.3	-18		Bumblebee Creek
1150	0.9	0.55	0.98	0.11	-0.44	2	1	2300	1265	1150	126.5	-1138.5	-8		
300	0.8	1.1	0.98	0.11	-0.99	3	2	900	990	600	66	-924	-18		
630	0.9	0.55	0.98	0.11	-0.44	3	**2**	1890	1039.5	1260	138.6	-900.9	-8		
1560	0.8	1.1	0.96	0.22	-0.88	4	3	6240	6864	4680	1029.6	-5834.4	-16		
270	0.9	0.55	0.96	0.22	-0.33	5	3	1350	742.5	810	178.2	-564.3	-6		
450	0.8	1.1	0.94	0.33	-0.77	5	4	2250	2475	1800	594	-1881	-14		
360	0.7	1.65	0.78	1.21	-0.44	5	4	1800	2970	1440	1742.4	-1227.6	-8	Nonforest Group 1	
570	0.6	2.2	0.78	1.21	-0.99	6	4	3420	7524	2280	2758.8	-4765.2	-18		
890	0.6	2.2	0.78	1.21	-0.99	**6**	**4**	5340	11748	3560	4307.6	-7440.4	-18		
							Total	**34,070**	**40,816**	**26,160**	**11,886**	**-28,930**	**-12**		

Table F-9. Existing and potential solar loads for Burnt Cabin Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Burnt Cabin Creek	
Assessment Unit # ID17010301PN036_02															
1590	0.9	0.55	0.98	0.11	-0.44	2	2	3180	1749	3180	349.8	-1399.2	-8	Forest Group B	Lost Mine Creek
310	0.7	1.65	0.98	0.11	-1.54	2	2	620	1023	620	68.2	-954.8	-28		
1540	0.9	0.55	0.98	0.11	-0.44	1	1	1540	847	1540	169.4	-677.6	-8		Lone Cabin Creek
420	0.8	1.1	0.98	0.11	-0.99	2	2	840	924	840	92.4	-831.6	-18		
250	0.7	1.65	0.98	0.11	-1.54	2	2	500	825	500	55	-770	-28		
600	0.8	1.1	0.98	0.11	-0.99	2	2	1200	1320	1200	132	-1188	-18		
2000	0.9	0.55	0.96	0.22	-0.33	3	3	6000	3300	6000	1320	-1980	-6		
150	0.8	1.1	0.96	0.22	-0.88	3	3	450	495	450	99	-396	-16		
870	0.9	0.55	0.98	0.11	-0.44	1	1	870	478.5	870	95.7	-382.8	-8		Bottom Creek
80	0.4	3.3	0.98	0.11	-3.19	1	1	80	264	80	8.8	-255.2	-58		
720	0.9	0.55	0.98	0.11	-0.44	2	2	1440	792	1440	158.4	-633.6	-8		
1360	0.8	1.1	0.96	0.22	-0.88	3	3	4080	4488	4080	897.6	-3590.4	-16		
120	0.7	1.65	0.96	0.22	-1.43	3	3	360	594	360	79.2	-514.8	-26		
1870	0.9	0.55	0.98	0.11	-0.44	1	1	1870	1028.5	1870	205.7	-822.8	-8		George Cr
580	0.8	1.1	0.98	0.11	-0.99	1	1	580	638	580	63.8	-574.2	-18		Burnt Cabin Creeek
740	0.9	0.55	0.98	0.11	-0.44	2	2	1480	814	1480	162.8	-651.2	-8		
200	0.8	1.1	0.98	0.11	-0.99	2	**2**	400	440	400	44	-396	-18		
1630	0.6	2.2	0.86	0.77	-1.43	3	3	4890	10758	4890	3765.3	-6992.7	-26	Nonforest Group 1	
570	0.7	1.65	0.86	0.77	-0.88	4	3	2280	3762	1710	1316.7	-2445.3	-16		
740	0.6	2.2	0.78	1.21	-0.99	5	**4**	3700	8140	2960	3581.6	-4558.4	-18		
660	0.7	1.65	0.78	1.21	-0.44	5	4	3300	5445	2640	3194.4	-2250.6	-8		
1010	0.6	2.2	0.72	1.54	-0.66	6	**5**	6060	13332	5050	7777	-5555	-12		
670	0.5	2.75	0.72	1.54	-1.21	7	5	4690	12897.5	3350	5159	-7738.5	-22		
2200	0.6	2.2	0.65	1.925	-0.28	**8**	**6**	17600	38720	13200	25410	-13310	-5		
							Total	**68,010**	**113,075**	**59,290**	**54,206**	**-58,869**	**-17**		

Table F-10. Existing and potential solar loads for Callis Creek and tributaries.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Callis Creek	
AU# ID17010301PN019_02															
2300	0.9	0.55	0.98	0.11	-0.44	2	2	4600	2530	4600	506	-2024	-8	Forest	1st to Callis
390	0.9	0.55	0.98	0.11	-0.44	1	1	390	214.5	390	42.9	-171.6	-8	Group B	2nd to Callis
190	0.8	1.1	0.98	0.11	-0.99	1	1	190	209	190	20.9	-188.1	-18		
1700	0.9	0.55	0.98	0.11	-0.44	1	1	1700	935	1700	187	-748	-8		
1900	0.9	0.55	0.98	0.11	-0.44	1	1	1900	1045	1900	209	-836	-8		NF Callis Cr
850	0.9	0.55	0.98	0.11	-0.44	1	1	850	467.5	850	93.5	-374	-8		Callis
700	0.8	1.1	0.98	0.11	-0.99	1	1	700	770	700	77	-693	-18		Creek
800	0.9	0.55	0.98	0.11	-0.44	2	2	1600	880	1600	176	-704	-8		
850	0.8	1.1	0.98	0.11	-0.99	2	2	1700	1870	1700	187	-1683	-18		
690	0.8	1.1	0.86	0.77	-0.33	3	3	2070	2277	2070	1593.9	-683.1	-6	Nonforest	
320	0.7	1.65	0.86	0.77	-0.88	3	3	960	1584	960	739.2	-844.8	-16	Group 1	
550	0.8	1.1	0.86	0.77	-0.33	3	3	1650	1815	1650	1270.5	-544.5	-6		
570	0.8	1.1	0.78	1.21	0.11	4	4	2280	2508	2280	2758.8	250.8	0		
900	0.7	1.65	0.78	1.21	-0.44	4	4	3600	5940	3600	4356	-1584	-8		
410	0.6	2.2	0.78	1.21	-0.99	4	4	1640	3608	1640	1984.4	-1623.6	-18		
640	0.7	1.65	0.78	1.21	-0.44	4	4	2560	4224	2560	3097.6	-1126.4	-8		
360	0.8	1.1	0.78	1.21	0.11	4	4	1440	1584	1440	1742.4	158.4	0		
							Total	**29,830**	**32,461**	**29,830**	**19,042**	**-13,419**	**-10**		

Table F-11. Existing and potential solar loads for Cataract Creek and West Elk Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Cataract Creek	
AU# ID17010301PN016_02															
810	0.9	0.55	0.98	0.11	-0.44	1	1	810	445.5	810	89.1	-356.4	-8	Forest	West Elk
640	0.8	1.1	0.98	0.11	-0.99	1	1	640	704	640	70.4	-633.6	-18	Group B	Creek
810	0.7	1.65	0.94	0.33	-1.32	1	1	810	1336.5	810	267.3	-1069.2	-24	Group 1	
2800	0.8	1.1	0.98	0.11	-0.99	2	2	5600	6160	5600	616	-5544	-18	Group B	
1100	0.9	0.55	0.97	0.165	-0.385	3	3	3300	1815	3300	544.5	-1270.5	-7		
270	0.8	1.1	0.97	0.165	-0.935	3	3	810	891	810	133.65	-757.35	-17		
2000	0.9	0.55	0.98	0.11	-0.44	1	1	2000	1100	2000	220	-880	-8		Cataract
1200	0.8	1.1	0.98	0.11	-0.99	2	2	2400	2640	2400	264	-2376	-18		Creek
160	0.7	1.65	0.86	0.77	-0.88	3	3	480	792	480	369.6	-422.4	-16	Nonforest	
150	0.4	3.3	0.86	0.77	-2.53	3	3	450	1485	450	346.5	-1138.5	-46	Group 1	
690	0.8	1.1	0.97	0.165	-0.935	3	3	2070	2277	2070	341.55	-1935.45	-17	Group B	
550	0.9	0.55	0.97	0.165	-0.385	3	3	1650	907.5	1650	272.25	-635.25	-7		
590	0.7	1.65	0.78	1.21	-0.44	4	4	2360	3894	2360	2855.6	-1038.4	-8	Group 1	
							Total	**23,380**	**24,448**	**23,380**	**6,390**	**-18,057**	**-16**		

Table F-12. Existing and potential solar loads for Copper Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Copper Creek**
Assessment Unit # ID17010301PN039_02														
330	0.9	0.55	0.98	0.11	-0.44	1	1	330	181.5	330	36.3	-145.2	-8	Forest
400	0.7	1.65	0.98	0.11	-1.54	2	2	800	1320	800	88	-1232	-28	Group B
220	0.8	1.1	0.96	0.22	-0.88	3	3	660	726	660	145.2	-580.8	-16	
990	0.9	0.55	0.94	0.33	-0.22	4	4	3960	2178	3960	1306.8	-871.2	-4	
90	0.7	1.65	0.94	0.33	-1.32	4	4	360	594	360	118.8	-475.2	-24	
470	0.9	0.55	0.91	0.495	-0.06	5	5	2350	1292.5	2350	1163.25	-129.25	-1	
2530	0.8	1.1	0.91	0.495	-0.61	5	5	12650	13915	12650	6261.75	-7653.25	-11	
130	0.7	1.65	0.91	0.495	-1.155	6	5	780	1287	650	321.75	-965.25	-21	
							Subtotal	**21,890**	**21,494**	**21,760**	**9,442**	**-12,052**	**-14**	
Assessment Unit # ID17010301PN039_03														
650	0.8	1.1	0.65	1.925	0.825	6	6	3900	4290	3900	7507.5	3217.5	0	Nonforest
520	0.6	2.2	0.65	1.925	-0.275	7	6	3640	8008	3120	6006	-2002	-5	Group 1
710	0.5	2.75	0.65	1.925	-0.825	8	6	5680	15620	4260	8200.5	-7419.5	-15	
770	0.6	2.2	0.6	2.2	0	8	7	6160	13552	5390	11858	-1694	0	
300	0.5	2.75	0.6	2.2	-0.55	9	7	2700	7425	2100	4620	-2805	-10	
840	0.6	2.2	0.6	2.2	0	9	7	7560	16632	5880	12936	-3696	0	
360	0.3	3.85	0.6	2.2	-1.65	9	7	3240	12474	2520	5544	-6930	-30	
260	0.1	4.95	0.6	2.2	-2.75	9	7	2340	11583	1820	4004	-7579	-50	
							Subtotal	**35,220**	**89,584**	**28,990**	**60,676**	**-28,908**	**-14**	
							Total	**57,110**	**111,078**	**50,750**	**70,118**	**-40,960**		

Table F-13. Existing and potential solar loads for Cougar Gulch.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Cougar Gulch**
AU# ID17010301PN029_03														
880	0.6	2.2	0.78	1.21	-0.99	4	4	3520	7744	3520	4259.2	-3484.8	-18	Nonforest
180	0.8	1.1	0.78	1.21	0.11	4	4	720	792	720	871.2	79.2	0	Group 1
1100	0.7	1.65	0.72	1.54	-0.11	5	5	5500	9075	5500	8470	-605	-2	
750	0.8	1.1	0.93	0.385	-0.715	6	6	4500	4950	4500	1732.5	-3217.5	-13	Group B
360	0.7	1.65	0.65	1.925	0.275	6	6	2160	3564	2160	4158	594	0	Group 1
140	0.8	1.1	0.93	0.385	-0.715	6	6	840	924	840	323.4	-600.6	-13	Group B
330	0.8	1.1	0.93	0.385	-0.715	6	6	1980	2178	1980	762.3	-1415.7	-13	Forest
1400	0.6	2.2	0.65	1.925	-0.275	6	6	8400	18480	8400	16170	-2310	-5	Group 1
650	0.7	1.65	0.91	0.495	-1.155	7	7	4550	7507.5	4550	2252.25	-5255.25	-21	Group B
890	0.8	1.1	0.91	0.495	-0.605	7	7	6230	6853	6230	3083.85	-3769.15	-11	
400	0.7	1.65	0.6	2.2	0.55	7	7	2800	4620	2800	6160	1540	0	Group 1
130	0.8	1.1	0.6	2.2	1.1	7	7	910	1001	910	2002	1001	0	
1100	0.6	2.2	0.55	2.475	0.275	8	8	8800	19360	8800	21780	2420	0	
690	0.5	2.75	0.55	2.475	-0.275	8	8	5520	15180	5520	13662	-1518	-5	
500	0.6	2.2	0.55	2.475	0.275	8	8	4000	8800	4000	9900	1100	0	
790	0.6	2.2	0.55	2.475	0.275	8	8	6320	13904	6320	15642	1738	0	
130	0.2	4.4	0.55	2.475	-1.925	8	8	1040	4576	1040	2574	-2002	-35	
230	0.4	3.3	0.55	2.475	-0.825	8	8	1840	6072	1840	4554	-1518	-15	
							Total	**69,630**	**135,581**	**69,630**	**118,357**	**-17,224**	**-8**	

Table F-14. Existing and potential solar loads for Deception Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Deception Creek**	
Assessment Unit # ID17010301PN037_02															
2170	0.9	0.55	0.98	0.11	-0.44	1	1	2170	1193.5	2170	238.7	-954.8	-8	Forest	Hoodoo Cr
1650	0.9	0.55	0.98	0.11	-0.44	1	1	1650	907.5	1650	181.5	-726	-8	Group B	Demorest Cr
3130	0.9	0.55	0.98	0.11	-0.44	2	2	6260	3443	6260	688.6	-2754.4	-8		Sands Cr
710	0.9	0.55	0.98	0.11	-0.44	1	1	710	390.5	710	78.1	-312.4	-8		Deception Cr
1540	0.9	0.55	0.98	0.11	-0.44	2	2	3080	1694	3080	338.8	-1355.2	-8		
950	0.7	1.65	0.98	0.11	-1.54	2	2	1900	3135	1900	209	-2926	-28		
590	0.6	2.2	0.96	0.22	-1.98	3	**3**	1770	3894	1770	389.4	-3504.6	-36		
2270	0.7	1.65	0.78	1.21	-0.44	4	**4**	9080	14982	9080	10986.8	-3995.2	-8	Nonforest 1	
							Total	**26,620**	**29,640**	**26,620**	**13,111**	**-16,529**	**-14**		

Table F-15. Existing and potential solar loads for WF Eagle Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**WF Eagle Creek**	
Assessment Unit # ID17010301PN008_02															
1200	0.9	0.55	0.98	0.11	-0.44	1	1	1200	660	1200	132	-528	-8	Forest Group B	Cottonwood Creek
410	0.5	2.75	0.98	0.11	-2.64	2	2	820	2255	820	90.2	-2164.8	-48		
2470	0.8	1.1	0.96	0.22	-0.88	3	3	7410	8151	7410	1630.2	-6520.8	-16		
580	0.8	1.1	0.98	0.11	-0.99	1	1	580	638	580	63.8	-574.2	-18		Bobtail Creek
290	0.7	1.65	0.98	0.11	-1.54	1	1	290	478.5	290	31.9	-446.6	-28		
160	0.4	3.3	0.98	0.11	-3.19	1	1	160	528	160	17.6	-510.4	-58		
450	0.7	1.65	0.98	0.11	-1.54	1	1	450	742.5	450	49.5	-693	-28		
3130	0.9	0.55	0.98	0.11	-0.44	2	2	6260	3443	6260	688.6	-2754.4	-8		
680	0.8	1.1	0.98	0.11	-0.99	1	1	680	748	680	74.8	-673.2	-18		WF Eagle Creek
4550	0.9	0.55	0.94	0.33	-0.22	4	**4**	18200	10010	18200	6006	-4004	-4		
230	0.7	1.65	0.72	1.54	-0.11	5	5	1150	1897.5	1150	1771	-126.5	-2	Nonforest Group 1	
230	0.8	1.1	0.72	1.54	0.44	5	5	1150	1265	1150	1771	506	0		
460	0.7	1.65	0.72	1.54	-0.11	5	5	2300	3795	2300	3542	-253	-2		
280	0.4	3.3	0.72	1.54	-1.76	5	5	1400	4620	1400	2156	-2464	-32		
1050	0.6	2.2	0.72	1.54	-0.66	6	5	6300	13860	5250	8085	-5775	-12		
250	0.4	3.3	0.65	1.925	-1.375	6	6	1500	4950	1500	2887.5	-2062.5	-25		
590	0.7	1.65	0.65	1.925	0.275	6	6	3540	5841	3540	6814.5	973.5	0		
130	0.5	2.75	0.65	1.925	-0.825	7	6	910	2502.5	780	1501.5	-1001	-15		
1040	0.8	1.1	0.65	1.925	0.825	7	**6**	7280	8008	6240	12012	4004	15		
390	0.6	2.2	0.6	2.2	0	7	7	2730	6006	2730	6006	0	0		
160	0.5	2.75	0.6	2.2	-0.55	7	7	1120	3080	1120	2464	-616	-10		
200	0.7	1.65	0.6	2.2	0.55	8	7	1600	2640	1400	3080	440	0		
270	0.6	2.2	0.6	2.2	0	8	7	2160	4752	1890	4158	-594	0		
250	0.9	0.55	0.6	2.2	1.65	8	7	2000	1100	1750	3850	2750	0		
780	0.8	1.1	0.6	2.2	1.1	8	7	6240	6864	5460	12012	5148	0		
400	0.6	2.2	0.6	2.2	0	9	7	3600	7920	2800	6160	-1760	0		
180	0.8	1.1	0.6	2.2	1.1	9	7	1620	1782	1260	2772	990	0		
250	0.6	2.2	0.6	2.2	0	9	7	2250	4950	1750	3850	-1100	0		
380	0.8	1.1	0.6	2.2	1.1	9	7	3420	3762	2660	5852	2090	0		
870	0.6	2.2	0.55	2.475	0.275	10	8	8700	19140	6960	17226	-1914	0		
360	0.5	2.75	0.55	2.475	-0.275	10	8	3600	9900	2880	7128	-2772	-5		
450	0.6	2.2	0.55	2.475	0.275	10	8	4500	9900	3600	8910	-990	0		
270	0.5	2.75	0.55	2.475	-0.275	11	8	2970	8167.5	2160	5346	-2821.5	-5		
280	0.7	1.65	0.55	2.475	0.825	11	**8**	3080	5082	2240	5544	462	0		
							Total	**111,170**	**169,439**	**100,020**	**143,683**	**-25,755**	**-10**		

Table F-16. Existing and potential solar loads for EF Eagle Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**EF Eagle Creek**
Assessment Unit # ID17010301PN007_02														
450	0.9	0.55	0.98	0.11	-0.44	2	1	900	495	450	49.5	-445.5	-8	Group C
1330	0.9	0.55	0.98	0.11	-0.44	2	1	2660	1463	1330	146.3	-1316.7	-8	Group A
1300	0.8	1.1	0.98	0.11	-0.99	3	2	3900	4290	2600	286	-4004	-18	Forest
270	0.7	1.65	0.96	0.22	-1.43	4	3	1080	1782	810	178.2	-1603.8	-26	Group B
410	0.8	1.1	0.94	0.33	-0.77	5	**4**	2050	2255	1640	541.2	-1713.8	-14	
340	0.4	3.3	0.78	1.21	-2.09	6	4	2040	6732	1360	1645.6	-5086.4	-38	Nonforest
580	0.4	3.3	0.72	1.54	-1.76	7	5	4060	13398	2900	4466	-8932	-32	Group 1
570	0.2	4.4	0.65	1.925	-2.475	8	6	4560	20064	3420	6583.5	-13480.5	-45	
2070	0.2	4.4	0.6	2.2	-2.2	**11**	**7**	22770	100188	14490	31878	-68310	-40	
840	0.5	2.75	0.55	2.475	-0.275	12	8	10080	27720	6720	16632	-11088	-5	
640	0.4	3.3	0.55	2.475	-0.825	12	8	7680	25344	5120	12672	-12672	-15	
420	0.6	2.2	0.55	2.475	0.275	12	8	5040	11088	3360	8316	-2772	0	
540	0.5	2.75	0.55	2.475	-0.275	12	8	6480	17820	4320	10692	-7128	-5	
1800	0.3	3.85	0.55	2.475	-1.375	12	8	21600	83160	14400	35640	-47520	-25	
400	0.5	2.75	0.52	2.64	-0.11	13	9	5200	14300	3600	9504	-4796	-2	
980	0.4	3.3	0.52	2.64	-0.66	13	9	12740	42042	8820	23284.8	-18757.2	-12	
620	0.3	3.85	0.52	2.64	-1.21	13	9	8060	31031	5580	14731.2	-16299.8	-22	
1140	0.4	3.3	0.52	2.64	-0.66	13	9	14820	48906	10260	27086.4	-21819.6	-12	
340	0.2	4.4	0.52	2.64	-1.76	13	**9**	4420	19448	3060	8078.4	-11369.6	-32	
							Total	**140,140**	**471,526**	**94,240**	**212,411**	**-259,115**	**-19**	

Table F-17. Existing and potential solar loads for Eagle Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Eagle Creek**
Assessment Unit # ID17010301PN007_03														
1320	0.2	4.4	0.41	3.245	-1.155	21	12	27720	121968	15840	51400.8	-70567.2	-21	Nonforest Group 1
320	0	5.5	0.41	3.245	-2.255	**21**	**12**	6720	36960	3840	12460.8	-24499.2	-41	
							Total	**34,440**	**158,928**	**19,680**	**63,862**	**-95,066**		

Table F-18. Existing and potential solar loads for Falls Creek and tributaries.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Falls Creek**	
AU# ID17010301PN011_02															
220	0.5	2.75	0.98	0.11	-2.64	1	1	220	605	220	24.2	-580.8	-48	Forest Group B	NF Falls Creek
1500	0.9	0.55	0.98	0.11	-0.44	1	1	1500	825	1500	165	-660	-8		
90	0.7	1.65	0.98	0.11	-1.54	2	2	180	297	180	19.8	-277.2	-28		
180	0.9	0.55	0.98	0.11	-0.44	2	2	360	198	360	39.6	-158.4	-8		
80	0.8	1.1	0.98	0.11	-0.99	2	2	160	176	160	17.6	-158.4	-18		
440	0.9	0.55	0.97	0.165	-0.385	3	3	1320	726	1320	217.8	-508.2	-7		
100	0.5	2.75	0.97	0.165	-2.585	3	3	300	825	300	49.5	-775.5	-47		
220	0.9	0.55	0.97	0.165	-0.385	3	3	660	363	660	108.9	-254.1	-7		
220	0.7	1.65	0.97	0.165	-1.485	3	3	660	1089	660	108.9	-980.1	-27		
230	0.8	1.1	0.97	0.165	-0.935	3	3	690	759	690	113.85	-645.15	-17		
370	0.7	1.65	0.98	0.11	-1.54	1	1	370	610.5	370	40.7	-569.8	-28		SF Falls Creek
560	0.8	1.1	0.98	0.11	-0.99	1	1	560	616	560	61.6	-554.4	-18		
80	0.3	3.85	0.98	0.11	-3.74	2	2	160	616	160	17.6	-598.4	-68		
570	0.8	1.1	0.98	0.11	-0.99	2	2	1140	1254	1140	125.4	-1128.6	-18		
180	0.7	1.65	0.98	0.11	-1.54	2	2	360	594	360	39.6	-554.4	-28		
280	0.8	1.1	0.97	0.165	-0.935	3	3	840	924	840	138.6	-785.4	-17		
380	0.7	1.65	0.97	0.165	-1.485	3	3	1140	1881	1140	188.1	-1692.9	-27		
310	0.9	0.55	0.97	0.165	-0.385	3	3	930	511.5	930	153.45	-358.05	-7		
760	0.4	3.3	0.94	0.33	-2.97	5	5	3800	12540	3800	1254	-11286	-54		Falls Creek
930	0.8	1.1	0.94	0.33	-0.77	5	5	4650	5115	4650	1534.5	-3580.5	-14		
910	0.9	0.55	0.94	0.33	-0.22	5	5	4550	2502.5	4550	1501.5	-1001	-4		
550	0.7	1.65	0.93	0.385	-1.265	6	6	3300	5445	3300	1270.5	-4174.5	-23		
850	0.8	1.1	0.93	0.385	-0.715	6	6	5100	5610	5100	1963.5	-3646.5	-13		
310	0.7	1.65	0.93	0.385	-1.265	6	6	1860	3069	1860	716.1	-2352.9	-23		
230	0.5	2.75	0.93	0.385	-2.365	6	6	1380	3795	1380	531.3	-3263.7	-43		
140	0.6	2.2	0.93	0.385	-1.815	6	6	840	1848	840	323.4	-1524.6	-33		
90	0.5	2.75	0.93	0.385	-2.365	6	6	540	1485	540	207.9	-1277.1	-43		
360	0.8	1.1	0.91	0.495	-0.605	7	7	2520	2772	2520	1247.4	-1524.6	-11		
520	0.7	1.65	0.91	0.495	-1.155	7	7	3640	6006	3640	1801.8	-4204.2	-21		
220	0.4	3.3	0.91	0.495	-2.805	7	7	1540	5082	1540	762.3	-4319.7	-51		
490	0.6	2.2	0.91	0.495	-1.705	7	7	3430	7546	3430	1697.85	-5848.15	-31		
660	0.5	2.75	0.91	0.495	-2.255	7	7	4620	12705	4620	2286.9	-10418.1	-41		
							Total	**53,320**	**88,391**	**53,320**	**18,729**	**-69,661**	**-26**		

Table F-19. Existing and potential solar loads for Flat Creek and tributaries.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Flat Creek**	
AU# ID17010301PN023_02															
1300	0.9	0.55	0.98	0.11	-0.44	2	2	2600	1430	2600	286	-1144	-8	Forest	1st to Flat
1100	0.9	0.55	0.98	0.11	-0.44	1	1	1100	605	1100	121	-484	-8	Group B	2nd to Flat
100	0.8	1.1	0.98	0.11	-0.99	1	1	100	110	100	11	-99	-18		
660	0.9	0.55	0.98	0.11	-0.44	1	1	660	363	660	72.6	-290.4	-8		
100	0.8	1.1	0.98	0.11	-0.99	1	1	100	110	100	11	-99	-18		
240	0.9	0.55	0.98	0.11	-0.44	1	1	240	132	240	26.4	-105.6	-8		
420	0.8	1.1	0.98	0.11	-0.99	1	1	420	462	420	46.2	-415.8	-18		3rd to Flat
910	0.9	0.55	0.98	0.11	-0.44	2	2	1820	1001	1820	200.2	-800.8	-8		
870	0.8	1.1	0.97	0.165	-0.935	3	3	2610	2871	2610	430.65	-2440.35	-17		
1000	0.8	1.1	0.98	0.11	-0.99	1	1	1000	1100	1000	110	-990	-18		1st to 3rd
1000	0.9	0.55	0.98	0.11	-0.44	1	1	1000	550	1000	110	-440	-8		
3300	0.9	0.55	0.98	0.11	-0.44	2	2	6600	3630	6600	726	-2904	-8		Svee Creek
460	0.8	1.1	0.97	0.165	-0.935	3	3	1380	1518	1380	227.7	-1290.3	-17		
140	0.9	0.55	0.97	0.165	-0.385	3	3	420	231	420	69.3	-161.7	-7		
2400	0.9	0.55	0.98	0.11	-0.44	2	2	4800	2640	4800	528	-2112	-8		4th to Flat
1300	0.9	0.55	0.98	0.11	-0.44	1	1	1300	715	1300	143	-572	-8		5th to Flat
330	0.8	1.1	0.98	0.11	-0.99	2	2	660	726	660	72.6	-653.4	-18		
200	0.9	0.55	0.98	0.11	-0.44	2	2	400	220	400	44	-176	-8		
1100	0.9	0.55	0.98	0.11	-0.44	1	1	1100	605	1100	121	-484	-8		Flat Creek
140	0.8	1.1	0.98	0.11	-0.99	1	1	140	154	140	15.4	-138.6	-18		
780	0.9	0.55	0.98	0.11	-0.44	2	2	1560	858	1560	171.6	-686.4	-8		
190	0.4	3.3	0.98	0.11	-3.19	2	2	380	1254	380	41.8	-1212.2	-58		
120	0.8	1.1	0.98	0.11	-0.99	2	2	240	264	240	26.4	-237.6	-18		
480	0.9	0.55	0.98	0.11	-0.44	2	2	960	528	960	105.6	-422.4	-8		
220	0.8	1.1	0.97	0.165	-0.935	3	3	660	726	660	108.9	-617.1	-17		
460	0.8	1.1	0.97	0.165	-0.935	3	3	1380	1518	1380	227.7	-1290.3	-17		
760	0.7	1.65	0.97	0.165	-1.485	3	3	2280	3762	2280	376.2	-3385.8	-27		
							Subtotal	**35,910**	**28,083**	**35,910**	**4,430**	**-23,653**	**-14**		
AU# ID17010301PN023_03															
500	0.9	0.55	0.96	0.22	-0.33	4	4	2000	1100	2000	440	-660	-6		
520	0.8	1.1	0.96	0.22	-0.88	4	4	2080	2288	2080	457.6	-1830.4	-16		
1000	0.9	0.55	0.94	0.33	-0.22	5	5	5000	2750	5000	1650	-1100	-4		
950	0.8	1.1	0.94	0.33	-0.77	5	5	4750	5225	4750	1567.5	-3657.5	-14		
700	0.7	1.65	0.65	1.925	0.275	6	6	4200	6930	4200	8085	1155	0	Nonforest	
210	0.7	1.65	0.65	1.925	0.275	6	6	1260	2079	1260	2425.5	346.5	0	Group 1	
550	0.6	2.2	0.65	1.925	-0.275	6	6	3300	7260	3300	6352.5	-907.5	-5		
600	0.7	1.65	0.65	1.925	0.275	6	6	3600	5940	3600	6930	990	0		
820	0.4	3.3	0.6	2.2	-1.1	7	7	5740	18942	5740	12628	-6314	-20		
370	0.4	3.3	0.6	2.2	-1.1	7	7	2590	8547	2590	5698	-2849	-20		
670	0.5	2.75	0.6	2.2	-0.55	7	7	4690	12897.5	4690	10318	-2579.5	-10		
620	0.6	2.2	0.6	2.2	0	7	7	4340	9548	4340	9548	0	0		
							Subtotal	**43,550**	**83,507**	**43,550**	**66,100**	**-17,406**	**-8**		
							Total	**79,460**	**111,590**	**79,460**	**70,530**	**-41,059**	**-12**		

Table F-20. Existing and potential solar loads for Graham Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Graham Creek**
Assessment Unit # ID17010301PN002_02														
2140	0.9	0.55	0.98	0.11	-0.44	1	1	2140	1177	2140	235.4	-941.6	-8	Forest
280	0.8	1.1	0.98	0.11	-0.99	2	2	560	616	560	61.6	-554.4	-18	Group B
3270	0.9	0.55	0.96	0.22	-0.33	3	**3**	9810	5395.5	9810	2158.2	-3237.3	-6	
330	0.8	1.1	0.94	0.33	-0.77	4	4	1320	1452	1320	435.6	-1016.4	-14	
270	0.9	0.55	0.94	0.33	-0.22	4	4	1080	594	1080	356.4	-237.6	-4	
							Subtotal	**14,910**	**9,235**	**14,910**	**3,247**	**-5,987**	**-10**	
Assessment Unit # ID17010301PN002_03														
440	0.8	1.1	0.72	1.54	0.44	5	**5**	2200	2420	2200	3388	968	0	Nonforest
310	0.9	0.55	0.72	1.54	0.99	5	5	1550	852.5	1550	2387	1534.5	0	Group 1
490	0.6	2.2	0.65	1.925	-0.275	6	6	2940	6468	2940	5659.5	-808.5	-5	
120	0.5	2.75	0.65	1.925	-0.825	6	6	720	1980	720	1386	-594	-15	
370	0.8	1.1	0.65	1.925	0.825	**6**	**6**	2220	2442	2220	4273.5	1831.5	0	
							Subtotal	**9,630**	**14,163**	**9,630**	**17,094**	**2,932**	**-4**	
							Total	**24,540**	**23,397**	**24,540**	**20,341**	**-3,056**		

Table F-21. Existing and potential solar loads for Grizzly Creek and tributaries.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Grizzly Creek**	
AU# ID17010301PN001_02															
1600	0.8	1.1	0.95	0.275	-0.825	1	1	1600	1760	1600	440	-1320	-15	Forest	Lindsey
2000	0.9	0.55	0.98	0.11	-0.44	2	2	4000	2200	4000	440	-1760	-8	Group B	Creek
1400	0.8	1.1	0.95	0.275	-0.825	1	1	1400	1540	1400	385	-1155	-15	Group A	Dewey
1300	0.9	0.55	0.94	0.33	-0.22	2	2	2600	1430	2600	858	-572	-4		Creek
1500	0.9	0.55	0.97	0.165	-0.385	3	3	4500	2475	4500	742.5	-1732.5	-7	Group B	
570	0.8	1.1	0.97	0.165	-0.935	3	3	1710	1881	1710	282.15	-1598.85	-17		
190	0.9	0.55	0.97	0.165	-0.385	3	3	570	313.5	570	94.05	-219.45	-7		
2100	0.8	1.1	0.95	0.275	-0.825	1	1	2100	2310	2100	577.5	-1732.5	-15	Group A	1st to Dewey
570	0.9	0.55	0.98	0.11	-0.44	2	2	1140	627	1140	125.4	-501.6	-8	Group B	
710	0.9	0.55	0.95	0.275	-0.275	1	1	710	390.5	710	195.25	-195.25	-5	Group A	Grizzly
660	0.9	0.55	0.98	0.11	-0.44	1	1	660	363	660	72.6	-290.4	-8	Group B	Creek
1800	0.8	1.1	0.98	0.11	-0.99	2	2	3600	3960	3600	396	-3564	-18		
1400	0.8	1.1	0.97	0.165	-0.935	3	3	4200	4620	4200	693	-3927	-17		
							Subtotal	**28,790**	**23,870**	**28,790**	**5,301**	**-18,569**	**-11**		
AU# ID17010301PN027_03															
310	0.8	1.1	0.94	0.33	-0.77	5	5	1550	1705	1550	511.5	-1193.5	-14		
620	0.9	0.55	0.94	0.33	-0.22	5	5	3100	1705	3100	1023	-682	-4		
530	0.8	1.1	0.94	0.33	-0.77	5	5	2650	2915	2650	874.5	-2040.5	-14		
350	0.9	0.55	0.94	0.33	-0.22	5	5	1750	962.5	1750	577.5	-385	-4		
							Subtotal	**9,050**	**7,288**	**9,050**	**2,987**	**-4,301**	**-9**		
							Total	**37,840**	**31,158**	**37,840**	**8,288**	**-22,870**	**-11**		

Table F-22. Existing and potential solar loads for Independence Creek and tributaries.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Independence Creek & Tributaries**	
Assessment Unit # ID17010301PN018_02															
1910	0.9	0.55	0.98	0.11	-0.44	1	1	1910	1050.5	1910	210.1	-840.4	-8	Forest	Goose
230	0.8	1.1	0.98	0.11	-0.99	2	2	460	506	460	50.6	-455.4	-18	Group B	Creek
310	0.9	0.55	0.98	0.11	-0.44	2	2	620	341	620	68.2	-272.8	-8		
900	0.7	1.65	0.86	0.77	-0.88	3	3	2700	4455	2700	2079	-2376	-16	Nonforest	
420	0.9	0.55	0.86	0.77	0.22	3	3	1260	693	1260	970.2	277.2	0	Group 1	
270	0.7	1.65	0.86	0.77	-0.88	3	3	810	1336.5	810	623.7	-712.8	-16		
530	0.8	1.1	0.98	0.11	-0.99	1	1	530	583	530	58.3	-524.7	-18	Forest	Gosling
850	0.9	0.55	0.98	0.11	-0.44	1	1	850	467.5	850	93.5	-374	-8	Group B	Creek
2850	0.9	0.55	0.98	0.11	-0.44	2	2	5700	3135	5700	627	-2508	-8		Snowshoe Cr
2180	0.9	0.55	0.98	0.11	-0.44	2	2	4360	2398	4360	479.6	-1918.4	-8		Ellis
480	0.9	0.55	0.98	0.11	-0.44	2	2	960	528	960	105.6	-422.4	-8		Creek
680	0.8	1.1	0.98	0.11	-0.99	2	2	1360	1496	1360	149.6	-1346.4	-18		
260	0.9	0.55	0.98	0.11	-0.44	2	2	520	286	520	57.2	-228.8	-8		
300	0.7	1.65	0.98	0.11	-1.54	1	1	300	495	300	33	-462	-28		Trib to Ellis
1360	0.9	0.55	0.98	0.11	-0.44	1	1	1360	748	1360	149.6	-598.4	-8		Creek
3510	0.9	0.55	0.98	0.11	-0.44	2	2	7020	3861	7020	772.2	-3088.8	-8		Declaration
490	0.8	1.1	0.96	0.22	-0.88	3	3	1470	1617	1470	323.4	-1293.6	-16		Creek
310	0.9	0.55	0.96	0.22	-0.33	3	3	930	511.5	930	204.6	-306.9	-6		
160	0.8	1.1	0.96	0.22	-0.88	3	3	480	528	480	105.6	-422.4	-16		
560	0.7	1.65	0.78	1.21	-0.44	4	4	2240	3696	2240	2710.4	-985.6	-8	Nonforest	
							Subtotal	**35,840**	**28,732**	**35,840**	**9,871**	**-18,861**	**-12**	Group 1	
Assessment Unit # ID17010301PN018_03a															
340	0.7	1.65	0.72	1.54	-0.11	5	5	1700	2805	1700	2618	-187	-2		
1000	0.6	2.2	0.72	1.54	-0.66	5	5	5000	11000	5000	7700	-3300	-12		
1020	0.7	1.65	0.72	1.54	-0.11	5	5	5100	8415	5100	7854	-561	-2		
100	0.6	2.2	0.72	1.54	-0.66	5	5	500	1100	500	770	-330	-12		
							Subtotal	**12,300**	**23,320**	**12,300**	**18,942**	**-4,378**	**-7**		
Assessment Unit # ID17010301PN018_02															
2730	0.9	0.55	0.98	0.11	-0.44	2	2	5460	3003	5460	600.6	-2402.4	-8	Forest	1st Trib to
770	0.8	1.1	0.98	0.11	-0.99	2	2	1540	1694	1540	169.4	-1524.6	-18	Group B	Declaration
2300	0.9	0.55	0.98	0.11	-0.44	2	2	4600	2530	4600	506	-2024	-8		2nd Trib to
990	0.8	1.1	0.96	0.22	-0.88	3	3	2970	3267	2970	653.4	-2613.6	-16		Declaration
230	0.7	1.65	0.96	0.22	-1.43	3	3	690	1138.5	690	151.8	-986.7	-26		
1480	0.7	1.65	0.86	0.77	-0.88	3	3	4440	7326	4440	3418.8	-3907.2	-16	Group 1	
2370	0.9	0.55	0.98	0.11	-0.44	2	2	4740	2607	4740	521.4	-2085.6	-8	Forest	Trib to 2nd Trib
1370	0.9	0.55	0.98	0.11	-0.44	1	1	1370	753.5	1370	150.7	-602.8	-8	Group B	3rd Trib
2030	0.9	0.55	0.98	0.11	-0.44	1	1	2030	1116.5	2030	223.3	-893.2	-8		Trib bl Declaration
1590	0.9	0.55	0.98	0.11	-0.44	1	1	1590	874.5	1590	174.9	-699.6	-8		Snowbird
1180	0.8	1.1	0.98	0.11	-0.99	2	2	2360	2596	2360	259.6	-2336.4	-18		Creek
4050	0.9	0.55	0.98	0.11	-0.44	2	2	8100	4455	8100	891	-3564	-8		Surprise Cr
2310	0.9	0.55	0.98	0.11	-0.44	1	1	2310	1270.5	2310	254.1	-1016.4	-8		1st Trib bl Surprise
1770	0.9	0.55	0.98	0.11	-0.44	1	1	1770	973.5	1770	194.7	-778.8	-8		2nd Trib bl Surprise
4300	0.9	0.55	0.98	0.11	-0.44	2	2	8600	4730	8600	946	-3784	-8		Ermine
410	0.8	1.1	0.86	0.77	-0.33	3	3	1230	1353	1230	947.1	-405.9	-6	Group 1	Creek
2430	0.9	0.55	0.98	0.11	-0.44	1	1	2430	1336.5	2430	267.3	-1069.2	-8	Forest	Trib to Ermine
1870	0.9	0.55	0.98	0.11	-0.44	1	1	1870	1028.5	1870	205.7	-822.8	-8	Group B	Snow
200	0.8	1.1	0.98	0.11	-0.99	2	2	400	440	400	44	-396	-18		Creek
710	0.9	0.55	0.98	0.11	-0.44	2	2	1420	781	1420	156.2	-624.8	-8		
1160	0.8	1.1	0.86	0.77	-0.33	3	3	3480	3828	3480	2679.6	-1148.4	-6	Group 1	
300	0.8	1.1	0.96	0.22	-0.88	3	3	900	990	900	198	-792	-16	Forest	
370	0.9	0.55	0.96	0.22	-0.33	3	3	1110	610.5	1110	244.2	-366.3	-6	Group B	
							Subtotal	**65,410**	**48,703**	**65,410**	**13,858**	**-34,845**	**-11**		
Assessment Unit # ID17010301PN018_03b															
330	0.7	1.65	0.78	1.21	-0.44	4	4	1320	2178	1320	1597.2	-580.8	0	Nonforest	
1710	0.8	1.1	0.78	1.21	0.11	4	4	6840	7524	6840	8276.4	752.4	0	Group 1	
190	0.8	1.1	0.78	1.21	0.11	4	4	760	836	760	919.6	83.6	0		
220	0.7	1.65	0.72	1.54	-0.11	5	5	1100	1815	1100	1694	-121	-2		
390	0.6	2.2	0.72	1.54	-0.66	5	5	1950	4290	1950	3003	-1287	-12		
890	0.5	2.75	0.72	1.54	-1.21	5	5	4450	12237.5	4450	6853	-5384.5	-22		
330	0.6	2.2	0.72	1.54	-0.66	5	5	1650	3630	1650	2541	-1089	-12		
390	0.7	1.65	0.72	1.54	-0.11	5	5	1950	3217.5	1950	3003	-214.5	-2		
							Subtotal	**20,020**	**35,728**	**20,020**	**27,887**	**-7,841**	**-6**		

Table F-22 (cont.). Existing and potential solar loads for Independence Creek (cont.).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Independence Creek & Tributaries	
Assessment Unit # ID17010301PN018_02															
1700	0.9	0.55	0.98	0.11	-0.44	1	1	1700	935	1700	187	-748	-8	Forest	1st Trib to Snow
1870	0.9	0.55	0.98	0.11	-0.44	2	2	3740	2057	3740	411.4	-1645.6	-8	Group B	2nd Trib to Snow
1590	0.9	0.55	0.98	0.11	-0.44	1	1	1590	874.5	1590	174.9	-699.6	-8		3rd Trib to Snow
1450	0.8	1.1	0.98	0.11	-0.99	2	2	2900	3190	2900	319	-2871	-18		
1410	0.9	0.55	0.98	0.11	-0.44	1	1	1410	775.5	1410	155.1	-620.4	-8		Trib to 3rd Trib
1780	0.9	0.55	0.98	0.11	-0.44	1	1	1780	979	1780	195.8	-783.2	-8		North
440	0.8	1.1	0.98	0.11	-0.99	2	2	880	968	880	96.8	-871.2	-18		Creek
1660	0.7	1.65	0.96	0.22	-1.43	3	3	4980	8217	4980	1095.6	-7121.4	-26		
620	0.7	1.65	0.78	1.21	-0.44	4	4	2480	4092	2480	3000.8	-1091.2	-8	Nonforest	
1050	0.8	1.1	0.78	1.21	0.11	4	4	4200	4620	4200	5082	462	0	Group 1	
210	0.7	1.65	0.78	1.21	-0.44	4	4	840	1386	840	1016.4	-369.6	-8		
1460	0.9	0.55	0.98	0.11	-0.44	1	1	1460	803	1460	160.6	-642.4	-8	Group B	Trib to North Cr
1220	0.9	0.55	0.98	0.11	-0.44	1	1	1220	671	1220	134.2	-536.8	-8	Group A	Griffith
1220	0.8	1.1	0.98	0.11	-0.99	1	1	1220	1342	1220	134.2	-1207.8	-18	Group B	Creek
1070	0.9	0.55	0.98	0.11	-0.44	1	1	1070	588.5	1070	117.7	-470.8	-8	Forest	Green
1320	0.8	1.1	0.98	0.11	-0.99	2	2	2640	2904	2640	290.4	-2613.6	-18	Group A	Creek
1350	0.7	1.65	0.96	0.22	-1.43	3	3	4050	6682.5	4050	891	-5791.5	-26		
290	0.8	1.1	0.96	0.22	-0.88	3	3	870	957	870	191.4	-765.6	-16		
1810	0.9	0.55	0.98	0.11	-0.44	1	1	1810	995.5	1810	199.1	-796.4	-8	Forest	Trib bl Green
1630	0.9	0.55	0.98	0.11	-0.44	2	2	3260	1793	3260	358.6	-1434.4	-8	Group B	Emerson
2050	0.8	1.1	0.86	0.77	-0.33	3	3	6150	6765	6150	4735.5	-2029.5	-6	Nonforest	Creek
1220	0.7	1.65	0.78	1.21	-0.44	4	4	4880	8052	4880	5904.8	-2147.2	-8	Group 1	
790	0.8	1.1	0.78	1.21	0.11	4	4	3160	3476	3160	3823.6	347.6	0		
2400	0.9	0.55	0.98	0.11	-0.44	2	2	4800	2640	4800	528	-2112	-8	Forest	Trib to Emerson
1480	0.9	0.55	0.98	0.11	-0.44	1	1	1480	814	1480	162.8	-651.2	-8	Group B	Owl Creek
330	0.8	1.1	0.98	0.11	-0.99	2	2	660	726	660	72.6	-653.4	-18		
400	0.7	1.65	0.98	0.11	-1.54	2	2	800	1320	800	88	-1232	-28		
590	0.6	2.2	0.98	0.11	-2.09	2	2	1180	2596	1180	129.8	-2466.2	-38		
1750	0.7	1.65	0.96	0.22	-1.43	3	3	5250	8662.5	5250	1155	-7507.5	-26		
2610	0.9	0.55	0.98	0.11	-0.44	1	1	2610	1435.5	2610	287.1	-1148.4	-8		Minor Cr
1750	0.9	0.55	0.98	0.11	-0.44	1	1	1750	962.5	1750	192.5	-770	-8		Trident
280	0.8	1.1	0.98	0.11	-0.99	1	1	280	308	280	30.8	-277.2	-18	Group A	Creek
360	0.8	1.1	0.98	0.11	-0.99	2	2	720	792	720	79.2	-712.8	-18	Forest	
1590	0.9	0.55	0.98	0.11	-0.44	1	1	1590	874.5	1590	174.9	-699.6	-8	Group B	Trib to Trident
700	0.9	0.55	0.98	0.11	-0.44	1	1	700	385	700	77	-308	-8		1st Trib bl Trident
930	0.8	1.1	0.98	0.11	-0.99	1	1	930	1023	930	102.3	-920.7	-18		
110	0.6	2.2	0.98	0.11	-2.09	1	1	110	242	110	12.1	-229.9	-38		
1220	0.9	0.55	0.98	0.11	-0.44	1	1	1220	671	1220	134.2	-536.8	-8		2nd Trib bl Trident
600	0.8	1.1	0.98	0.11	-0.99	1	1	600	660	600	66	-594	-18		
370	0.7	1.65	0.98	0.11	-1.54	1	1	370	610.5	370	40.7	-569.8	-28		
1250	0.9	0.55	0.98	0.11	-0.44	1	1	1250	687.5	1250	137.5	-550	-8		Independence
330	0.8	1.1	0.98	0.11	-0.99	2	2	660	726	660	72.6	-653.4	-18		Creek
370	0.9	0.55	0.98	0.11	-0.44	3	2	1110	610.5	740	81.4	-529.1	-8		
770	0.8	1.1	0.96	0.22	-0.88	4	3	3080	3388	2310	508.2	-2879.8	-16		
300	0.9	0.55	0.96	0.22	-0.33	5	3	1500	825	900	198	-627	-6		
620	0.6	2.2	0.86	0.77	-1.43	6	4	3720	8184	2480	1909.6	-6274.4	-26	Nonforest	
2590	0.7	1.65	0.72	1.54	-0.11	7	5	18130	29914.5	12950	19943	-9971.5	-2	Group 1	
810	0.5	2.75	0.65	1.925	-0.83	**8**	**6**	6480	17820	4860	9355.5	-8464.5	-15		
							Subtotal	**119,270**	**150,002**	**109,490**	**64,215**	**-85,787**	**-14**		
Assessment Unit # ID17010301PN018_03															
2790	0.6	2.2	0.6	2.2	0.00	10	7	27,900	61,380	19,530	42,966	-18,414	0		
Assessment Unit # ID17010301PN018_02															
950	0.5	2.75	0.52	2.64	-0.11	**12**	**9**	11400	31350	8550	22572	-8778	-2		
360	0.6	2.2	0.52	2.64	0.44	12	9	4320	9504	3240	8553.6	-950.4	0		
1700	0.3	3.85	0.48	2.86	-0.99	12	10	20400	78540	17000	48620	-29920	-18		
2020	0.6	2.2	0.45	3.025	0.83	13	11	26260	57772	22220	67215.5	9443.5	0		
530	0.4	3.3	0.41	3.245	-0.05	14	12	7420	24486	6360	20638.2	-3847.8	-1		
760	0.3	3.85	0.41	3.245	-0.60	14	12	10640	40964	9120	29594.4	-11369.6	-11		
1680	0.1	4.95	0.41	3.245	-1.71	14	**12**	23520	116424	20160	65419.2	-51004.8	-31		
1290	0.2	4.4	0.39	3.355	-1.05	15	13	19350	85140	16770	56263.35	-28876.65	-19		
440	0.1	4.95	0.39	3.355	-1.60	15	13	6600	32670	5720	19190.6	-13479.4	-29		
310	0.2	4.4	0.39	3.355	-1.05	15	13	4650	20460	4030	13520.65	-6939.35	-19		
790	0.1	4.95	0.39	3.355	-1.60	16	13	12640	62568	10270	34455.85	-28112.15	-29		
500	0.2	4.4	0.39	3.355	-1.05	16	13	8000	35200	6500	21807.5	-13392.5	-19		
220	0.1	4.95	0.39	3.355	-1.60	16	13	3520	17424	2860	9595.3	-7828.7	-29		
2300	0	5.5	0.37	3.465	-2.04	17	14	39100	215050	32200	111573	-103477	-37		
340	0.1	4.95	0.37	3.465	-1.49	18	14	6120	30294	4760	16493.4	-13800.6	-27		
730	0	5.5	0.37	3.465	-2.04	18	14	13140	72270	10220	35412.3	-36857.7	-37		
170	0.1	4.95	0.37	3.465	-1.49	18	14	3060	15147	2380	8246.7	-6900.3	-27		
630	0	5.5	0.37	3.465	-2.04	**18**	**14**	11340	62370	8820	30561.3	-31808.7	-37		
							Subtotal	**231,480**	**1,007,633**	**191,180**	**619,733**	**-387,900**	**-21**		
Assessment Unit # ID17010301PN018_02							**Total**	**452,000**	**1,235,069**	**401,920**	**707,677**	**-527,392**	**-14**		
Assessment Unit # ID17010301PN018_03 & 03a & 03b							**Total**	**60,220**	**120,428**	**51,850**	**89,795**	**-30,633**	**-6**		

Table F-23. Existing and potential solar loads for Iron Creek and tributaries.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Iron Creek**	
AU# ID17010301PN035_02															
1500	0.9	0.55	0.98	0.11	-0.44	1	1	1500	825	1500	165	-660	-8	Forest Group B	Rabiens Fork
160	0.8	1.1	0.98	0.11	-0.99	2	2	320	352	320	35.2	-316.8	-18		
1600	0.9	0.55	0.98	0.11	-0.44	2	2	3200	1760	3200	352	-1408	-8		
1800	0.9	0.55	0.98	0.11	-0.44	1	1	1800	990	1800	198	-792	-8		Silver Run
3400	0.9	0.55	0.98	0.11	-0.44	1	1	3400	1870	3400	374	-1496	-8		Cataract Cr
1600	0.9	0.55	0.98	0.11	-0.44	1	1	1600	880	1600	176	-704	-8		Rusty Creek
1800	0.9	0.55	0.98	0.11	-0.44	1	1	1800	990	1800	198	-792	-8		Moose Creek
210	0.8	1.1	0.98	0.11	-0.99	1	1	210	231	210	23.1	-207.9	-18		
290	0.9	0.55	0.98	0.11	-0.44	1	1	290	159.5	290	31.9	-127.6	-8		
550	0.8	1.1	0.98	0.11	-0.99	1	1	550	605	550	60.5	-544.5	-18		Iron Creek
1200	0.9	0.55	0.98	0.11	-0.44	1	1	1200	660	1200	132	-528	-8		
180	0.9	0.55	0.98	0.11	-0.44	2	2	360	198	360	39.6	-158.4	-8		
320	0.8	1.1	0.98	0.11	-0.99	2	2	640	704	640	70.4	-633.6	-18		
1500	0.9	0.55	0.98	0.11	-0.44	2	2	3000	1650	3000	330	-1320	-8		
520	0.7	1.65	0.97	0.165	-1.485	3	3	1560	2574	1560	257.4	-2316.6	-27		
260	0.8	1.1	0.97	0.165	-0.935	3	3	780	858	780	128.7	-729.3	-17		
450	0.9	0.55	0.97	0.165	-0.385	3	3	1350	742.5	1350	222.75	-519.75	-7		
210	0.8	1.1	0.96	0.22	-0.88	4	4	840	924	840	184.8	-739.2	-16		
150	0.7	1.65	0.96	0.22	-1.43	4	4	600	990	600	132	-858	-26		
110	0.8	1.1	0.96	0.22	-0.88	4	4	440	484	440	96.8	-387.2	-16		
330	0.5	2.75	0.78	1.21	-1.54	4	4	1320	3630	1320	1597.2	-2032.8	-28	Nonforest Group 1	
120	0.6	2.2	0.78	1.21	-0.99	4	4	480	1056	480	580.8	-475.2	-18		
410	0.4	3.3	0.78	1.21	-2.09	4	4	1640	5412	1640	1984.4	-3427.6	-38		
230	0.5	2.75	0.78	1.21	-1.54	4	4	920	2530	920	1113.2	-1416.8	-28		
420	0.5	2.75	0.72	1.54	-1.21	5	5	2100	5775	2100	3234	-2541	-22		
780	0.7	1.65	0.72	1.54	-0.11	5	5	3900	6435	3900	6006	-429	-2		
540	0.4	3.3	0.65	1.925	-1.375	6	6	3240	10692	3240	6237	-4455	-25		
540	0.6	2.2	0.65	1.925	-0.275	6	6	3240	7128	3240	6237	-891	-5		
230	0.1	4.95	0.65	1.925	-3.025	6	6	1380	6831	1380	2656.5	-4174.5	-55		
440	0.6	2.2	0.65	1.925	-0.275	6	6	2640	5808	2640	5082	-726	-5		
							Total	**46,300**	**73,744**	**46,300**	**37,936**	**-35,808**	**-16**		

Table F-24. Existing and potential solar loads for Jordan Creek and tributaries.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Jordan Creek	
AU# ID17010301PN014_02															
1400	0.9	0.55	0.98	0.11	-0.44	1	1	1400	770	1400	154	-616	-8	Group B	1st to Jordan
240	0.8	1.1	0.94	0.33	-0.77	2	2	480	528	480	158.4	-369.6	-14	Group A	
1300	0.9	0.55	0.98	0.11	-0.44	1	1	1300	715	1300	143	-572	-8	Forest	2nd to Jordan
510	0.8	1.1	0.98	0.11	-0.99	2	2	1020	1122	1020	112.2	-1009.8	-18	Group B	
580	0.8	1.1	0.94	0.33	-0.77	2	2	1160	1276	1160	382.8	-893.2	-14	Group 1	
750	0.9	0.55	0.98	0.11	-0.44	1	1	750	412.5	750	82.5	-330	-8		3rd to Jordan
780	0.9	0.55	0.95	0.275	-0.275	1	1	780	429	780	214.5	-214.5	-5	Group A	
1800	0.9	0.55	0.98	0.11	-0.44	1	1	1800	990	1800	198	-792	-8	Group B	Calamity Creek
150	0.8	1.1	0.98	0.11	-0.99	2	2	300	330	300	33	-297	-18		
350	0.7	1.65	0.94	0.33	-1.32	2	2	700	1155	700	231	-924	-24	Nonforest	
1500	0.7	1.65	0.86	0.77	-0.88	3	3	4500	7425	4500	3465	-3960	-16	Group 1	
2200	0.9	0.55	0.98	0.11	-0.44	1	1	2200	1210	2200	242	-968	-8		1st to Calamity
110	0.7	1.65	0.94	0.33	-1.32	2	2	220	363	220	72.6	-290.4	-24	Group 1	
300	0.8	1.1	0.98	0.11	-0.99	1	1	300	330	300	33	-297	-18		Jordan Creek
990	0.9	0.55	0.98	0.11	-0.44	1	1	990	544.5	990	108.9	-435.6	-8		
660	0.8	1.1	0.98	0.11	-0.99	1	1	660	726	660	72.6	-653.4	-18		
250	0.8	1.1	0.98	0.11	-0.99	2	2	500	550	500	55	-495	-18		
600	0.8	1.1	0.94	0.33	-0.77	2	2	1200	1320	1200	396	-924	-14	Group 1	
370	0.6	2.2	0.86	0.77	-1.43	3	3	1110	2442	1110	854.7	-1587.3	-26		
580	0.5	2.75	0.86	0.77	-1.98	3	3	1740	4785	1740	1339.8	-3445.2	-36		
170	0.7	1.65	0.78	1.21	-0.44	4	4	680	1122	680	822.8	-299.2	-8		
210	0.5	2.75	0.78	1.21	-1.54	4	4	840	2310	840	1016.4	-1293.6	-28		
							Subtotal	**24,630**	**30,855**	**24,630**	**10,188**	**-20,667**	**-16**		
AU# ID17010301PN014_03															
510	0.5	2.75	0.65	1.925	-0.825	6	6	3060	8415	3060	5890.5	-2524.5	-15		
640	0.3	3.85	0.65	1.925	-1.925	6	6	3840	14784	3840	7392	-7392	-35		
400	0.3	3.85	0.6	2.2	-1.65	7	7	2800	10780	2800	6160	-4620	-30		
1200	0.5	2.75	0.6	2.2	-0.55	7	7	8400	23100	8400	18480	-4620	-10		
430	0.5	2.75	0.55	2.475	-0.275	8	8	3440	9460	3440	8514	-946	-5		
							Subtotal	**21,540**	**66,539**	**21,540**	**46,437**	**-20,103**	**-19**		
							Total	**46,170**	**97,394**	**46,170**	**56,625**	**-40,769**	**-16**		

Table F-25. Existing and potential solar loads for Laverne Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Laverne Creek**	
Assessment Unit # ID17010301PN032_02															
2250	0.9	0.55	0.98	0.11	-0.44	1	1	2250	1237.5	2250	247.5	-990	-8	Forest Group B	Trib #1
320	0.8	1.1	0.98	0.11	-0.99	1	1	320	352	320	35.2	-316.8	-18		
1800	0.9	0.55	0.98	0.11	-0.44	1	1	1800	990	1800	198	-792	-8		Trib #2
1650	0.9	0.55	0.98	0.11	-0.44	1	1	1650	907.5	1650	181.5	-726	-8		Trib #3
660	0.8	1.1	0.98	0.11	-0.99	2	2	1320	1452	1320	145.2	-1306.8	-18		
370	0.7	1.65	0.98	0.11	-1.54	2	2	740	1221	740	81.4	-1139.6	-28		
2120	0.9	0.55	0.98	0.11	-0.44	1	1	2120	1166	2120	233.2	-932.8	-8		Laverne Creek
1090	0.8	1.1	0.98	0.11	-0.99	3	2	3270	3597	2180	239.8	-3357.2	-18		
290	0.7	1.65	0.96	0.22	-1.43	4	3	1160	1914	870	191.4	-1722.6	-26		
250	0.5	2.75	0.86	0.77	-1.98	4	3	1000	2750	750	577.5	-2172.5	-36	Nonforest Group 1	
1270	0.7	1.65	0.78	1.21	-0.44	5	4	6350	10477.5	5080	6146.8	-4330.7	-8		
270	0.8	1.1	0.78	1.21	0.11	6	4	1620	1782	1080	1306.8	-475.2	0		
310	0.7	1.65	0.91	0.495	-1.16	6	5	1860	3069	1550	767.25	-2301.75	-21	Forest Group B	
520	0.8	1.1	0.91	0.495	-0.605	7	5	3640	4004	2600	1287	-2717	-11		
620	0.6	2.2	0.91	0.495	-1.705	7	5	4340	9548	3100	1534.5	-8013.5	-31		
360	0.8	1.1	0.91	0.495	-0.605	8	5	2880	3168	1800	891	-2277	-11		
90	0.4	3.3	0.91	0.495	-2.805	8	5	720	2376	450	222.75	-2153.25	-51		
							Total	**37,040**	**50,012**	**29,660**	**14,287**	**-35,725**	**-18**		

Table F-26. Existing and potential solar loads for Leiberg Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Leiberg Creek**	
Assessment Unit # ID17010301PN033_02															
680	0.9	0.55	0.98	0.11	-0.44	1	1	680	374	680	74.8	-299.2	-8	Forest Group B	Stull Creek
1090	0.8	1.1	0.98	0.11	-0.99	2	2	2180	2398	2180	239.8	-2158.2	-18		
650	0.9	0.55	0.98	0.11	-0.44	2	2	1300	715	1300	143	-572	-8		
3170	0.9	0.55	0.98	0.11	-0.44	2	2	6340	3487	6340	697.4	-2789.6	-8		Lavin Cr
2580	0.9	0.55	0.98	0.11	-0.44	2	2	5160	2838	5160	567.6	-2270.4	-8		Hemlock Creek
420	0.8	1.1	0.98	0.11	-0.99	2	2	840	924	840	92.4	-831.6	-18		
2250	0.9	0.55	0.98	0.11	-0.44	2	2	4500	2475	4500	495	-1980	-8		Tie Creek
620	0.8	1.1	0.98	0.11	-0.99	2	2	1240	1364	1240	136.4	-1227.6	-18		
510	0.9	0.55	0.98	0.11	-0.44	1	1	510	280.5	510	56.1	-224.4	-8		Leiberg Creek
570	0.7	1.65	0.98	0.11	-1.54	1	1	570	940.5	570	62.7	-877.8	-28		
1020	0.7	1.65	0.98	0.11	-1.54	2	2	2040	3366	2040	224.4	-3141.6	-28		
430	0.6	2.2	0.96	0.22	-1.98	3	3	1290	2838	1290	283.8	-2554.2	-36		
360	0.6	2.2	0.86	0.77	-1.43	3	3	1080	2376	1080	831.6	-1544.4	-26	Nonforest Group 1	
1490	0.5	2.75	0.86	0.77	-1.98	4	3	5960	16390	4470	3441.9	-12948.1	-36		
500	0.3	3.85	0.78	1.21	-2.64	5	4	2500	9625	2000	2420	-7205	-48		
750	0.5	2.75	0.78	1.21	-1.54	6	4	4500	12375	3000	3630	-8745	-28		
390	0.3	3.85	0.78	1.21	-2.64	7	4	2730	10510.5	1560	1887.6	-8622.9	-48		
1350	0.4	3.3	0.72	1.54	-1.76	8	5	10800	35640	6750	10395	-25245	-32		
1250	0.3	3.85	0.72	1.54	-2.31	9	5	11250	43312.5	6250	9625	-33687.5	-42		
590	0.2	4.4	0.65	1.925	-2.475	10	6	5900	25960	3540	6814.5	-19145.5	-45		
							Total	**71,370**	**178,189**	**55,300**	**42,119**	**-136,070**	**-25**		

Table F-27. Existing and potential solar loads for Lost Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Lost Creek**
Assessment Unit # ID17010301PN009_02														
480	0.9	0.55	0.98	0.11	-0.44	1	1	480	264	480	52.8	-211.2	-8	Group C
520	0.9	0.55	0.98	0.11	-0.44	1	1	520	286	520	57.2	-228.8	-8	Forest
980	0.8	1.1	0.98	0.11	-0.99	1	1	980	1078	980	107.8	-970.2	-18	Group B
1420	0.9	0.55	0.98	0.11	-0.44	2	2	2840	1562	2840	312.4	-1249.6	-8	
890	0.8	1.1	0.96	0.22	-0.88	3	3	2670	2937	2670	587.4	-2349.6	-16	
670	0.9	0.55	0.96	0.22	-0.33	3	**3**	2010	1105.5	2010	442.2	-663.3	-6	
1530	0.8	1.1	0.94	0.33	-0.77	4	4	6120	6732	6120	2019.6	-4712.4	-14	
860	0.7	1.65	0.94	0.33	-1.32	4	4	3440	5676	3440	1135.2	-4540.8	-24	
350	0.5	2.75	0.91	0.495	-2.255	5	5	1750	4812.5	1750	866.25	-3946.25	-41	
840	0.6	2.2	0.91	0.495	-1.705	5	5	4200	9240	4200	2079	-7161	-31	
150	0.5	2.75	0.91	0.495	-2.255	5	5	750	2062.5	750	371.25	-1691.25	-41	
1020	0.7	1.65	0.91	0.495	-1.155	5	**5**	5100	8415	5100	2524.5	-5890.5	-21	
1050	0.6	2.2	0.65	1.925	-0.275	6	6	6300	13860	6300	12127.5	-1732.5	-5	Nonforest
140	0.4	3.3	0.6	2.2	-1.1	7	7	980	3234	980	2156	-1078	-20	Group 1
510	0.7	1.65	0.6	2.2	0.55	7	7	3570	5890.5	3570	7854	1963.5	0	
							Subtotal	**41,710**	**67,155**	**41,710**	**32,693**	**-34,462**	**-17**	
Assessment Unit # ID17010301PN009_03														
340	0.4	3.3	0.6	2.2	-1.1	7	**7**	2380	7854	2380	5236	-2618	-20	
290	0.6	2.2	0.55	2.475	0.275	8	8	2320	5104	2320	5742	638	0	
420	0.4	3.3	0.55	2.475	-0.825	8	8	3360	11088	3360	8316	-2772	-15	
700	0.8	1.1	0.52	2.64	1.54	9	9	6300	6930	6300	16632	9702	0	
250	0.7	1.65	0.52	2.64	0.99	9	9	2250	3712.5	2250	5940	2227.5	0	
130	0.6	2.2	0.52	2.64	0.44	**9**	**9**	1170	2574	1170	3088.8	514.8	0	
							Subtotal	**17,780**	**37,263**	**17,780**	**44,955**	**7,692**	**-6**	
							Total	**59,490**	**104,418**	**59,490**	**77,648**	**-26,770**	**-14**	

Table F-28. Existing and potential solar loads for Lost Fork and tributaries.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Lost Fork**	
					AU# ID17010301PN014_02										
1600	0.9	0.55	0.98	0.11	-0.44	1	1	1600	880	1600	176	-704	-8	Forest	1st to Lost Fork
1300	0.9	0.55	0.98	0.11	-0.44	1	1	1300	715	1300	143	-572	-8	Group B	Sho Creek
1400	0.8	1.1	0.98	0.11	-0.99	2	2	2800	3080	2800	308	-2772	-18		
420	0.8	1.1	0.94	0.33	-0.77	2	2	840	924	840	277.2	-646.8	-14	Group 1	
1800	0.9	0.55	0.98	0.11	-0.44	1	1	1800	990	1800	198	-792	-8	Group B	Plant Creek
770	0.9	0.55	0.98	0.11	-0.44	1	1	770	423.5	770	84.7	-338.8	-8	Group C	Bluff Creek
840	0.8	1.1	0.98	0.11	-0.99	1	1	840	924	840	92.4	-831.6	-18	Group B	
170	0.8	1.1	0.98	0.11	-0.99	1	1	170	187	170	18.7	-168.3	-18		
1200	0.8	1.1	0.98	0.11	-0.99	2	2	2400	2640	2400	264	-2376	-18		
230	0.8	1.1	0.94	0.33	-0.77	2	2	460	506	460	151.8	-354.2	-14	Group 1	
520	0.9	0.55	0.98	0.11	-0.44	1	1	520	286	520	57.2	-228.8	-8	Group B	1st to Bluff Cr
980	0.8	1.1	0.98	0.11	-0.99	1	1	980	1078	980	107.8	-970.2	-18		
1700	0.9	0.55	0.98	0.11	-0.44	1	1	1700	935	1700	187	-748	-8		Cub Creek
600	0.8	1.1	0.98	0.11	-0.99	2	2	1200	1320	1200	132	-1188	-18		
110	0.8	1.1	0.94	0.33	-0.77	2	2	220	242	220	72.6	-169.4	-14	Group 1	
1300	0.9	0.55	0.98	0.11	-0.44	1	1	1300	715	1300	143	-572	-8	Group B	Lost Fork
260	0.8	1.1	0.98	0.11	-0.99	2	2	520	572	520	57.2	-514.8	-18		
240	0.9	0.55	0.98	0.11	-0.44	2	2	480	264	480	52.8	-211.2	-8		
830	0.8	1.1	0.86	0.77	-0.33	3	3	2490	2739	2490	1917.3	-821.7	-6	Nonforest	
490	0.7	1.65	0.78	1.21	-0.44	4	4	1960	3234	1960	2371.6	-862.4	-8	Group 1	
140	0.8	1.1	0.78	1.21	0.11	4	4	560	616	560	677.6	61.6	0		
510	0.6	2.2	0.78	1.21	-0.99	4	4	2040	4488	2040	2468.4	-2019.6	-18		
							Subtotal	**26,950**	**27,759**	**26,950**	**9,958**	**-17,800**	**-12**		
					AU# ID17010301PN014_03										
80	0.8	1.1	0.72	1.54	0.44	5	5	400	440	400	616	176	0		
290	0.7	1.65	0.72	1.54	-0.11	5	5	1450	2392.5	1450	2233	-159.5	-2		
170	0.7	1.65	0.72	1.54	-0.11	5	5	850	1402.5	850	1309	-93.5	-2		
510	0.6	2.2	0.72	1.54	-0.66	5	5	2550	5610	2550	3927	-1683	-12		
190	0.4	3.3	0.72	1.54	-1.76	5	5	950	3135	950	1463	-1672	-32		
410	0.6	2.2	0.72	1.54	-0.66	5	5	2050	4510	2050	3157	-1353	-12		
440	0.5	2.75	0.72	1.54	-1.21	5	5	2200	6050	2200	3388	-2662	-22		
210	0.4	3.3	0.72	1.54	-1.76	5	5	1050	3465	1050	1617	-1848	-32		
							Subtotal	**11,500**	**27,005**	**11,500**	**17,710**	**-9,295**	**-14**		
							Total	**38,450**	**54,764**	**38,450**	**27,668**	**-27,095**	**-13**		

Table F-29. Existing and potential solar loads for Miners Creek and tributaries.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Miners Creek**	
AU# ID17010301PN022_02															
400	0.9	0.55	0.98	0.11	-0.44	1	1	400	220	400	44	-176	-8	Forest Group B	1st to Miners
190	0.8	1.1	0.98	0.11	-0.99	1	1	190	209	190	20.9	-188.1	-18		
170	0.9	0.55	0.98	0.11	-0.44	1	1	170	93.5	170	18.7	-74.8	-8		
490	0.8	1.1	0.98	0.11	-0.99	1	1	490	539	490	53.9	-485.1	-18		
690	0.9	0.55	0.98	0.11	-0.44	1	1	690	379.5	690	75.9	-303.6	-8		
60	0.8	1.1	0.98	0.11	-0.99	1	1	60	66	60	6.6	-59.4	-18		
2000	0.9	0.55	0.98	0.11	-0.44	2	2	4000	2200	4000	440	-1760	-8		Miners Creek
490	0.7	1.65	0.97	0.165	-1.485	3	3	1470	2425.5	1470	242.55	-2182.95	-27		
350	0.8	1.1	0.97	0.165	-0.935	3	3	1050	1155	1050	173.25	-981.75	-17		
520	0.7	1.65	0.97	0.165	-1.485	3	3	1560	2574	1560	257.4	-2316.6	-27		
1600	0.9	0.55	0.96	0.22	-0.33	4	4	6400	3520	6400	1408	-2112	-6		
1000	0.8	1.1	0.96	0.22	-0.88	4	4	4000	4400	4000	880	-3520	-16		
							Total	**20,480**	**17,782**	**20,480**	**3,621**	**-14,160**	**-15**		

Table F-30. Existing and potential solar loads for Potter Creek and tributaries.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Potter Creek**	
AU# ID17010301PN019_02															
1600	0.9	0.55	0.98	0.11	-0.44	1	1	1600	880	1600	176	-704	-8	Forest Group B	SF Potter Creek
1400	0.8	1.1	0.98	0.11	-0.99	2	2	2800	3080	2800	308	-2772	-18		
1800	0.9	0.55	0.98	0.11	-0.44	1	1	1800	990	1800	198	-792	-8		Potter Creek
280	0.8	1.1	0.98	0.11	-0.99	2	2	560	616	560	61.6	-554.4	-18		
330	0.9	0.55	0.98	0.11	-0.44	2	2	660	363	660	72.6	-290.4	-8		
1300	0.8	1.1	0.98	0.11	-0.99	2	2	2600	2860	2600	286	-2574	-18		
270	0.7	1.65	0.98	0.11	-1.54	2	2	540	891	540	59.4	-831.6	-28		
1700	0.7	1.65	0.86	0.77	-0.88	3	3	5100	8415	5100	3927	-4488	-16	Nonforest Group 1	
320	0.5	2.75	0.78	1.21	-1.54	4	4	1280	3520	1280	1548.8	-1971.2	-28		
320	0.8	1.1	0.78	1.21	0.11	4	4	1280	1408	1280	1548.8	140.8	0		
220	0.7	1.65	0.78	1.21	-0.44	4	4	880	1452	880	1064.8	-387.2	-8		
							Total	**19,100**	**24,475**	**19,100**	**9,251**	**-15,224**	**-14**		

Table F-31. Existing and potential solar loads for Prichard Creek headwaters (AU# 005_02).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Prichard Creek**	
Assessment Unit # ID17010301PN005_02															
110	0.6	2.2	0.98	0.11	-2.09	1	1	110	242	110	12.1	-229.9	-38	Forest	Cascade
2200	0.9	0.55	0.98	0.11	-0.44	1	1	2200	1210	2200	242	-968	-8	Group C	Gulch
370	0.8	1.1	0.97	0.165	-0.93	2	2	740	814	740	122.1	-691.9	-17		
990	0.9	0.55	0.97	0.165	-0.39	2	2	1980	1089	1980	326.7	-762.3	-7		
3540	0.9	0.55	0.96	0.22	-0.33	3	3	10620	5841	10620	2336.4	-3504.6	-6	Forest	Granite
1840	0.9	0.55	0.91	0.495	-0.06	5	5	9200	5060	9200	4554	-506	-1	Group B	Gulch
240	0.9	0.55	0.91	0.495	-0.06	5	5	1200	660	1200	594	-66	-1		
2760	0.9	0.55	0.98	0.11	-0.44	2	2	5520	3036	5520	607.2	-2428.8	-8		Barton Gulch
3150	0.9	0.55	0.98	0.11	-0.44	2	2	6300	3465	6300	693	-2772	-8		West Fork
580	0.9	0.55	0.98	0.11	-0.44	1	1	580	319	580	63.8	-255.2	-8	Group C	Moonshine
2250	0.9	0.55	0.98	0.11	-0.44	2	2	4500	2475	4500	495	-1980	-8	Group B	Gulch
740	0.9	0.55	0.98	0.11	-0.44	1	1	740	407	740	81.4	-325.6	-8	Group C	Bear
1510	0.9	0.55	0.98	0.11	-0.44	1	1	1510	830.5	1510	166.1	-664.4	-8	Forest	Gulch
370	0.8	1.1	0.98	0.11	-0.99	2	2	740	814	740	81.4	-732.6	-18	Group B	
1240	0.9	0.55	0.97	0.165	-0.39	2	2	2480	1364	2480	409.2	-954.8	-7	Forest	
2080	0.7	1.65	0.95	0.275	-1.38	3	3	6240	10296	6240	1716	-8580	-25	Group C	
850	0.9	0.55	0.94	0.33	-0.22	4	4	3400	1870	3400	1122	-748	-4	Forest	
1070	0.8	1.1	0.94	0.33	-0.77	4	4	4280	4708	4280	1412.4	-3295.6	-14	Group B	
1170	0.7	1.65	0.91	0.495	-1.16	5	5	5850	9652.5	5850	2895.75	-6756.75	-21		
190	0.6	2.2	0.91	0.495	-1.71	5	5	950	2090	950	470.25	-1619.75	-31		
300	0.7	1.65	0.98	0.11	-1.54	1	1	300	495	300	33	-462	-28		Idaho
280	0.8	1.1	0.98	0.11	-0.99	1	1	280	308	280	30.8	-277.2	-18		Gulch
460	0.7	1.65	0.98	0.11	-1.54	1	1	460	759	460	50.6	-708.4	-28		
2270	0.9	0.55	0.96	0.22	-0.33	3	3	6810	3745.5	6810	1498.2	-2247.3	-6		
1160	0.9	0.55	0.98	0.11	-0.44	1	1	1160	638	1160	127.6	-510.4	-8		Prichard
150	0.3	3.85	0.98	0.11	-3.74	2	1	300	1155	150	16.5	-1138.5	-68		Creek
770	0.9	0.55	0.98	0.11	-0.44	3	1	2310	1270.5	770	84.7	-1185.8	-8		
1500	0.8	1.1	0.98	0.11	-0.99	5	2	7500	8250	3000	330	-7920	-18		
530	0.9	0.55	0.96	0.22	-0.33	6	3	3180	1749	1590	349.8	-1399.2	-6		
370	0.8	1.1	0.96	0.22	-0.88	6	3	2220	2442	1110	244.2	-2197.8	-16		
790	0.9	0.55	0.96	0.22	-0.33	7	3	5530	3041.5	2370	521.4	-2520.1	-6		
160	0.3	3.85	0.94	0.33	-3.52	8	4	1280	4928	640	211.2	-4716.8	-64		
210	0.8	1.1	0.94	0.33	-0.77	8	4	1680	1848	840	277.2	-1570.8	-14		
100	0.5	2.75	0.94	0.33	-2.42	8	4	800	2200	400	132	-2068	-44		
630	0.8	1.1	0.94	0.33	-0.77	9	4	5670	6237	2520	831.6	-5405.4	-14		
120	0.4	3.3	0.91	0.495	-2.805	10	5	1200	3960	600	297	-3663	-51		
190	0.8	1.1	0.91	0.495	-0.605	10	5	1900	2090	950	470.25	-1619.75	-11		
550	0.7	1.65	0.91	0.495	-1.155	11	5	6050	9982.5	2750	1361.25	-8621.25	-21		
410	0.4	3.3	0.89	0.605	-2.695	12	6	4920	16236	2460	1488.3	-14747.7	-49		
160	0.5	2.75	0.89	0.605	-2.145	13	6	2080	5720	960	580.8	-5139.2	-39		
870	0.4	3.3	0.89	0.605	-2.695	**14**	**6**	12180	40194	5220	3158.1	-37035.9	-49		
							Total	**136,950**	**173,492**	**104,480**	**30,495**	**-142,997**	**-20**		

Table F-32. Existing and potential solar loads for Prichard Creek (AU# 005_03).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Prichard Creek**
Assessment Unit # ID17010301PN005_03														
440	0.3	3.85	0.6	2.2	-1.65	13	7	5720	22022	3080	6776	-15246	-30	Nonforest Group 1
530	0.1	4.95	0.55	2.475	-2.475	13	8	6890	34105.5	4240	10494	-23611.5	-45	
580	0.2	4.4	0.52	2.64	-1.76	13	9	7540	33176	5220	13780.8	-19395.2	-32	
1160	0.4	3.3	0.48	2.86	-0.44	12	10	13920	45936	11600	33176	-12760	-8	
460	0.3	3.85	0.45	3.025	-0.825	12	11	5520	21252	5060	15306.5	-5945.5	-15	
							Total	**39,590**	**156,492**	**29,200**	**79,533**	**-76,958**	**-26**	

Table F-33. Existing and potential solar loads for Prichard Creek (AU# 004_03).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Prichard Creek**
Assessment Unit # ID17010301PN004_03														
410	0.4	3.3	0.41	3.245	-0.055	**12**	**12**	4920	16236	4920	15965.4	-270.6	-1	Nonforest Group 1
500	0.1	4.95	0.41	3.245	-1.705	13	12	6500	32175	6000	19470	-12705	-31	
620	0.2	4.4	0.41	3.245	-1.155	13	12	8060	35464	7440	24142.8	-11321.2	-21	
800	0.1	4.95	0.41	3.245	-1.705	13	12	10400	51480	9600	31152	-20328	-31	
530	0.3	3.85	0.41	3.245	-0.605	14	12	7420	28567	6360	20638.2	-7928.8	-11	
440	0.1	4.95	0.41	3.245	-1.705	14	12	6160	30492	5280	17133.6	-13358.4	-31	
380	0	5.5	0.41	3.245	-2.255	14	12	5320	29260	4560	14797.2	-14462.8	-41	
830	0.1	4.95	0.41	3.245	-1.705	14	12	11620	57519	9960	32320.2	-25198.8	-31	
280	0.2	4.4	0.39	3.355	-1.045	15	13	4200	18480	3640	12212.2	-6267.8	-19	
540	0	5.5	0.39	3.355	-2.145	15	13	8100	44550	7020	23552.1	-20997.9	-39	
810	0.1	4.95	0.39	3.355	-1.595	15	13	12150	60142.5	10530	35328.15	-24814.35	-29	
300	0.7	1.65	0.39	3.355	1.705	15	13	4500	7425	3900	13084.5	5659.5	0	
360	0.6	2.2	0.39	3.355	1.155	15	13	5400	11880	4680	15701.4	3821.4	0	
720	0.5	2.75	0.39	3.355	0.605	16	13	11520	31680	9360	31402.8	-277.2	0	
400	0.6	2.2	0.39	3.355	1.155	16	13	6400	14080	5200	17446	3366	0	
160	0.5	2.75	0.39	3.355	0.605	16	13	2560	7040	2080	6978.4	-61.6	0	
490	0.6	2.2	0.39	3.355	1.155	16	13	7840	17248	6370	21371.35	4123.35	0	
270	0.4	3.3	0.39	3.355	0.055	**16**	**13**	4320	14256	3510	11776.05	-2479.95	0	
							Total	**127,390**	**507,975**	**110,410**	**364,472**	**-143,502**	**-16**	

Table F-34. Existing and potential solar loads for Prichard Creek (AU# 004_04).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Prichard Creek**
Assessment Unit # ID17010301PN004_04														
390	0.1	4.95	0.37	3.465	-1.485	16	14	6240	30888	5460	18918.9	-11969.1	-27	Nonforest Group 1
430	0.2	4.4	0.37	3.465	-0.935	16	14	6880	30272	6020	20859.3	-9412.7	-17	
440	0	5.5	0.37	3.465	-2.035	16	14	7040	38720	6160	21344.4	-17375.6	-37	
1020	0.1	4.95	0.35	3.575	-1.375	16	15	16320	80784	15300	54697.5	-26086.5	-25	
220	0.2	4.4	0.35	3.575	-0.825	16	15	3520	15488	3300	11797.5	-3690.5	-15	
1410	0.1	4.95	0.33	3.685	-1.265	16	16	22560	111672	22560	83133.6	-28538.4	-23	
490	0.2	4.4	0.33	3.685	-0.715	**16**	16	7840	34496	7840	28890.4	-5605.6	-13	
							Total	**70,400**	**342,320**	**66,640**	**239,642**	**-102,678**	**-22**	

Table F-35. Existing and potential solar loads for Shoshone Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Shoshone Creek**
AU# ID17010301PN012_02														
240	0.9	0.55	0.96	0.22	-0.33	1	1	240	132	240	52.8	-79.2	-6	Group D
1040	0.9	0.55	0.98	0.11	-0.44	1	1	1040	572	1040	114.4	-457.6	-8	Group C
820	0.9	0.55	0.98	0.11	-0.44	2	2	1640	902	1640	180.4	-721.6	-8	Group B
270	0.8	1.1	0.98	0.11	-0.99	2	2	540	594	540	59.4	-534.6	-18	Forest
330	0.9	0.55	0.98	0.11	-0.44	2	2	660	363	660	72.6	-290.4	-8	
710	0.8	1.1	0.98	0.11	-0.99	2	2	1420	1562	1420	156.2	-1405.8	-18	
660	0.8	1.1	0.97	0.165	-0.935	3	3	1980	2178	1980	326.7	-1851.3	-17	
270	0.9	0.55	0.97	0.165	-0.385	3	3	810	445.5	810	133.65	-311.85	-7	
540	0.7	1.65	0.78	1.21	-0.44	4	4	2160	3564	2160	2613.6	-950.4	-8	Nonforest
100	0.8	1.1	0.78	1.21	0.11	4	4	400	440	400	484	44	0	Group 1
60	0.8	1.1	0.78	1.21	0.11	4	4	240	264	240	290.4	26.4	0	
510	0.7	1.65	0.78	1.21	-0.44	4	4	2040	3366	2040	2468.4	-897.6	-8	
190	0.5	2.75	0.78	1.21	-1.54	4	4	760	2090	760	919.6	-1170.4	-28	
120	0.8	1.1	0.78	1.21	0.11	4	4	480	528	480	580.8	52.8	0	
140	0.7	1.65	0.78	1.21	-0.44	4	4	560	924	560	677.6	-246.4	-8	
1160	0.6	2.2	0.72	1.54	-0.66	5	5	5800	12760	5800	8932	-3828	-12	
270	0.5	2.75	0.72	1.54	-1.21	5	5	1350	3712.5	1350	2079	-1633.5	-22	
290	0.7	1.65	0.72	1.54	-0.11	5	5	1450	2392.5	1450	2233	-159.5	-2	
							Subtotal	**23,570**	**36,790**	**23,570**	**22,375**	**-14,415**	**-10**	
AU# ID17010301PN012_03														
180	0.7	1.65	0.6	2.2	0.55	7	7	1260	2079	1260	2772	693	0	
420	0.6	2.2	0.6	2.2	0	7	7	2940	6468	2940	6468	0	0	
720	0.5	2.75	0.6	2.2	-0.55	7	7	5040	13860	5040	11088	-2772	-10	
1400	0.4	3.3	0.55	2.475	-0.825	8	8	11200	36960	11200	27720	-9240	-15	
300	0.5	2.75	0.55	2.475	-0.275	8	8	2400	6600	2400	5940	-660	-5	
180	0.4	3.3	0.52	2.64	-0.66	9	9	1620	5346	1620	4276.8	-1069.2	-12	
530	0.5	2.75	0.52	2.64	-0.11	9	9	4770	13117.5	4770	12592.8	-524.7	-2	
520	0.4	3.3	0.52	2.64	-0.66	9	9	4680	15444	4680	12355.2	-3088.8	-12	
390	0.3	3.85	0.48	2.86	-0.99	10	10	3900	15015	3900	11154	-3861	-18	
240	0.6	2.2	0.48	2.86	0.66	10	10	2400	5280	2400	6864	1584	0	
390	0.5	2.75	0.48	2.86	0.11	10	10	3900	10725	3900	11154	429	0	
790	0.4	3.3	0.48	2.86	-0.44	10	10	7900	26070	7900	22594	-3476	-8	
230	0.5	2.75	0.45	3.025	0.275	11	11	2530	6957.5	2530	7653.25	695.75	0	
330	0.6	2.2	0.45	3.025	0.825	11	11	3630	7986	3630	10980.75	2994.75	0	
510	0.5	2.75	0.45	3.025	0.275	11	11	5610	15427.5	5610	16970.25	1542.75	0	
50	0.3	3.85	0.45	3.025	-0.825	11	11	550	2117.5	550	1663.75	-453.75	-15	
260	0.3	3.85	0.45	3.025	-0.825	11	11	2860	11011	2860	8651.5	-2359.5	-15	
190	0.3	3.85	0.45	3.025	-0.825	11	11	2090	8046.5	2090	6322.25	-1724.25	-15	
750	0.4	3.3	0.41	3.245	-0.055	12	12	9000	29700	9000	29205	-495	-1	
300	0.5	2.75	0.41	3.245	0.495	12	12	3600	9900	3600	11682	1782	0	
320	0.5	2.75	0.41	3.245	0.495	12	12	3840	10560	3840	12460.8	1900.8	0	
1100	0.4	3.3	0.41	3.245	-0.055	12	12	13200	43560	13200	42834	-726	-1	
280	0.5	2.75	0.41	3.245	0.495	12	12	3360	9240	3360	10903.2	1663.2	0	
260	0.4	3.3	0.41	3.245	-0.055	12	12	3120	10296	3120	10124.4	-171.6	-1	
170	0.3	3.85	0.41	3.245	-0.605	12	12	2040	7854	2040	6619.8	-1234.2	-11	
210	0.5	2.75	0.41	3.245	0.495	12	12	2520	6930	2520	8177.4	1247.4	0	
440	0.3	3.85	0.41	3.245	-0.605	12	12	5280	20328	5280	17133.6	-3194.4	-11	
							Subtotal	**115,240**	**356,879**	**115,240**	**336,361**	**-20,518**	**-6**	
AU# ID17010301PN010_03														
600	0.2	4.4	0.37	3.465	-0.935	14	14	8400	36960	8400	29106	-7854	-17	
270	0.3	3.85	0.37	3.465	-0.385	14	14	3780	14553	3780	13097.7	-1455.3	-7	
320	0.1	4.95	0.37	3.465	-1.485	14	14	4480	22176	4480	15523.2	-6652.8	-27	
210	0.2	4.4	0.37	3.465	-0.935	14	14	2940	12936	2940	10187.1	-2748.9	-17	
800	0.5	2.75	0.37	3.465	0.715	14	14	11200	30800	11200	38808	8008	0	
420	0.4	3.3	0.37	3.465	0.165	14	14	5880	19404	5880	20374.2	970.2	0	
260	0.6	2.2	0.64	1.98	-0.22	14	14	3640	8008	3640	7207.2	-800.8	-4	Group B
1000	0.4	3.3	0.37	3.465	0.165	14	14	14000	46200	14000	48510	2310	0	Group 1
240	0.2	4.4	0.35	3.575	-0.825	15	15	3600	15840	3600	12870	-2970	-15	
170	0.5	2.75	0.35	3.575	0.825	15	15	2550	7012.5	2550	9116.25	2103.75	0	
120	0.4	3.3	0.35	3.575	0.275	15	15	1800	5940	1800	6435	495	0	
730	0.6	2.2	0.61	2.145	-0.055	15	15	10950	24090	10950	23487.75	-602.25	-1	Group B
1400	0.4	3.3	0.35	3.575	0.275	15	15	21000	69300	21000	75075	5775	0	Group 1
730	0.3	3.85	0.35	3.575	-0.275	15	15	10950	42157.5	10950	39146.25	-3011.25	-5	
880	0.4	3.3	0.33	3.685	0.385	16	16	14080	46464	14080	51884.8	5420.8	0	
540	0.3	3.85	0.33	3.685	-0.165	16	16	8640	33264	8640	31838.4	-1425.6	-3	
990	0.4	3.3	0.33	3.685	0.385	16	16	15840	52272	15840	58370.4	6098.4	0	
1200	0.2	4.4	0.33	3.685	-0.715	16	16	19200	84480	19200	70752	-13728	-13	
							Subtotal	**162,930**	**571,857**	**162,930**	**561,789**	**-10,068**	**-6**	
							Total	**301,740**	**965,525**	**301,740**	**920,525**	**-45,000**	**-7**	

Table F-36. Existing and potential solar loads for Shoshone Creek tributaries.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Shoshone Creek Tributaries	
AU# ID17010301PN012_02															
650	0.9	0.55	0.98	0.11	-0.44	1	1	650	357.5	650	71.5	-286	-8	Forest	1st Tributary
610	0.8	1.1	0.98	0.11	-0.99	1	1	610	671	610	67.1	-603.9	-18	Group B	
460	0.9	0.55	0.98	0.11	-0.44	1	1	460	253	460	50.6	-202.4	-8		
500	0.9	0.55	0.98	0.11	-0.44	1	1	500	275	500	55	-220	-8	Group C	2nd Tributary
970	0.9	0.55	0.98	0.11	-0.44	1	1	970	533.5	970	106.7	-426.8	-8	Group B	
1600	0.9	0.55	0.94	0.33	-0.22	2	2	3200	1760	3200	1056	-704	-4	Group A	
400	0.9	0.55	0.98	0.11	-0.44	2	2	800	440	800	88	-352	-8	Group B	
1300	0.8	1.1	0.98	0.11	-0.99	1	1	1300	1430	1300	143	-1287	-18		Hemlock Creek
760	0.9	0.55	0.98	0.11	-0.44	1	1	760	418	760	83.6	-334.4	-8		
460	0.8	1.1	0.98	0.11	-0.99	2	2	920	1012	920	101.2	-910.8	-18		
220	0.9	0.55	0.98	0.11	-0.44	2	2	440	242	440	48.4	-193.6	-8		
470	0.8	1.1	0.98	0.11	-0.99	2	2	940	1034	940	103.4	-930.6	-18		
220	0.9	0.55	0.98	0.11	-0.44	2	2	440	242	440	48.4	-193.6	-8		
1500	0.9	0.55	0.98	0.11	-0.44	1	1	1500	825	1500	165	-660	-8		3rd Tributary
1700	0.9	0.55	0.98	0.11	-0.44	1	1	1700	935	1700	187	-748	-8		Tent Creek
2200	0.9	0.55	0.98	0.11	-0.44	1	1	2200	1210	2200	242	-968	-8		Ulm Creek
1100	0.8	1.1	0.98	0.11	-0.99	2	2	2200	2420	2200	242	-2178	-18		
270	0.9	0.55	0.97	0.165	-0.385	3	3	810	445.5	810	133.65	-311.85	-7		
2000	0.9	0.55	0.98	0.11	-0.44	1	1	2000	1100	2000	220	-880	-8		Little Lost Fork
320	0.8	1.1	0.98	0.11	-0.99	2	2	640	704	640	70.4	-633.6	-18		
700	0.8	1.1	0.97	0.165	-0.935	3	3	2100	2310	2100	346.5	-1963.5	-17		
590	0.8	1.1	0.97	0.165	-0.935	3	3	1770	1947	1770	292.05	-1654.95	-17		
290	0.9	0.55	0.97	0.165	-0.385	3	3	870	478.5	870	143.55	-334.95	-7		
900	0.9	0.55	0.98	0.11	-0.44	1	1	900	495	900	99	-396	-8	Group C	1st to Little Lost
1300	0.9	0.55	0.98	0.11	-0.44	2	2	2600	1430	2600	286	-1144	-8	Group B	
910	0.8	1.1	0.98	0.11	-0.99	1	1	910	1001	910	100.1	-900.9	-18		2nd to Little Lost Fork
1100	0.9	0.55	0.98	0.11	-0.44	1	1	1100	605	1100	121	-484	-8		
780	0.8	1.1	0.95	0.275	-0.825	1	1	780	858	780	214.5	-643.5	-15	Group A	3rd to Little Lost Fork
2000	0.9	0.55	0.98	0.11	-0.44	2	2	4000	2200	4000	440	-1760	-8	Group B	
400	0.9	0.55	0.98	0.11	-0.44	1	1	400	220	400	44	-176	-8	Group C	Sentinel Creek
2800	0.9	0.55	0.98	0.11	-0.44	2	2	5600	3080	5600	616	-2464	-8	Group B	
2000	0.9	0.55	0.98	0.11	-0.44	1	1	2000	1100	2000	220	-880	-8		Windfall Creek
2100	0.9	0.55	0.98	0.11	-0.44	2	2	4200	2310	4200	462	-1848	-8		Camp Creek
900	0.9	0.55	0.98	0.11	-0.44	1	1	900	495	900	99	-396	-8	Group C	Hells Gulch
1700	0.9	0.55	0.98	0.11	-0.44	1	1	1700	935	1700	187	-748	-8	Group B	
800	0.9	0.55	0.98	0.11	-0.44	2	2	1600	880	1600	176	-704	-8		
610	0.8	1.1	0.97	0.165	-0.935	3	3	1830	2013	1830	301.95	-1711.05	-17		
280	0.9	0.55	0.97	0.165	-0.385	3	3	840	462	840	138.6	-323.4	-7		

Table F-36 (cont). Existing and potential solar loads for Shoshone Creek tributaries.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Shoshone Creek Tributaries**	
300	0.9	0.55	0.97	0.165	-0.385	2	2	600	330	600	99	-231	-7	Group C	SF Hells Gulch
1300	0.9	0.55	0.98	0.11	-0.44	2	2	2600	1430	2600	286	-1144	-8	Group B	
860	0.5	2.75	0.95	0.275	-2.475	1	1	860	2365	860	236.5	-2128.5	-45	Group A	Clinton Creek
460	0.7	1.65	0.95	0.275	-1.375	1	1	460	759	460	126.5	-632.5	-25		
330	0.9	0.55	0.98	0.11	-0.44	1	1	330	181.5	330	36.3	-145.2	-8	Group B	
470	0.7	1.65	0.98	0.11	-1.54	2	2	940	1551	940	103.4	-1447.6	-28		
820	0.9	0.55	0.98	0.11	-0.44	2	2	1640	902	1640	180.4	-721.6	-8		
370	0.5	2.75	0.98	0.11	-2.64	2	2	740	2035	740	81.4	-1953.6	-48		
1600	0.9	0.55	0.97	0.165	-0.385	3	3	4800	2640	4800	792	-1848	-7		
600	0.8	1.1	0.96	0.22	-0.88	4	4	2400	2640	2400	528	-2112	-16		
910	0.7	1.65	0.78	1.21	-0.44	4	4	3640	6006	3640	4404.4	-1601.6	-8	Nonforest 1	
2000	0.9	0.55	0.98	0.11	-0.44	1	1	2000	1100	2000	220	-880	-8	Group B	Rampike Creek
1700	0.8	1.1	0.98	0.11	-0.99	2	2	3400	3740	3400	374	-3366	-18		
540	0.7	1.65	0.97	0.165	-1.485	3	3	1620	2673	1620	267.3	-2405.7	-27		
690	0.6	2.2	0.97	0.165	-2.035	3	3	2070	4554	2070	341.55	-4212.45	-37		
210	0.7	1.65	0.97	0.165	-1.485	3	3	630	1039.5	630	103.95	-935.55	-27		
200	0.8	1.1	0.97	0.165	-0.935	3	3	600	660	600	99	-561	-17		
60	0.4	3.3	0.86	0.77	-2.53	3	3	180	594	180	138.6	-455.4	-46	Nonforest 1	
610	0.8	1.1	0.98	0.11	-0.99	1	1	610	671	610	67.1	-603.9	-18	Group C	Pine Flat Creek
2000	0.9	0.55	0.98	0.11	-0.44	1	1	2000	1100	2000	220	-880	-8	Group B	
1100	0.8	1.1	0.98	0.11	-0.99	2	2	2200	2420	2200	242	-2178	-18		
550	0.9	0.55	0.98	0.11	-0.44	2	2	1100	605	1100	121	-484	-8		
140	0.7	1.65	0.94	0.33	-1.32	2	2	280	462	280	92.4	-369.6	-24	Nonforest 1	
450	0.8	1.1	0.98	0.11	-0.99	1	1	450	495	450	49.5	-445.5	-18	Group B	Cabin Creek
1500	0.9	0.55	0.98	0.11	-0.44	1	1	1500	825	1500	165	-660	-8		
810	0.8	1.1	0.98	0.11	-0.99	2	2	1620	1782	1620	178.2	-1603.8	-18		
1500	0.6	2.2	0.98	0.11	-2.09	2	2	3000	6600	3000	330	-6270	-38		
510	0.7	1.65	0.97	0.165	-1.485	3	3	1530	2524.5	1530	252.45	-2272.05	-27		
250	0.8	1.1	0.97	0.165	-0.935	3	3	750	825	750	123.75	-701.25	-17		
110	0.9	0.55	0.97	0.165	-0.385	3	3	330	181.5	330	54.45	-127.05	-7		
310	0.8	1.1	0.97	0.165	-0.935	3	3	930	1023	930	153.45	-869.55	-17		
580	0.9	0.55	0.98	0.11	-0.44	2	2	1160	638	1160	127.6	-510.4	-8		SF Cabin Creek
2500	0.9	0.55	0.98	0.11	-0.44	2	2	5000	2750	5000	550	-2200	-8		Chute Creek
730	0.8	1.1	0.98	0.11	-0.99	1	1	730	803	730	80.3	-722.7	-18		Pipe Creek
2100	0.9	0.55	0.98	0.11	-0.44	1	1	2100	1155	2100	231	-924	-8		
							Total	**111,940**	**99,187**	**111,940**	**19,027**	**-80,160**	**-14**		

Table F-37. Existing and potential solar loads for Skookum Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Skookum Creek**
Assessment Unit # ID17010301PN038_02														
2040	0.9	0.55	0.98	0.11	-0.44	1	1	2040	1122	2040	224.4	-897.6	-8	Forest
560	0.7	1.65	0.96	0.22	-1.43	3	**3**	1680	2772	1680	369.6	-2402.4	-26	Group B
350	0.4	3.3	0.86	0.77	-2.53	4	3	1400	4620	1050	808.5	-3811.5	-46	Nonforest
430	0.5	2.75	0.78	1.21	-1.54	5	**4**	2150	5912.5	1720	2081.2	-3831.3	-28	Group 1
							Subtotal	**7,270**	**14,427**	**6,490**	**3,484**	**-10,943**	**-27**	
Assessment Unit # ID17010301PN038_03														
1110	0.5	2.75	0.94	0.33	-2.42	6	4	6660	18315	4440	1465.2	-16849.8	-44	Forest
440	0.4	3.3	0.94	0.33	-2.97	**7**	**4**	3080	10164	1760	580.8	-9583.2	-54	Group B
							Subtotal	**9,740**	**28,479**	**6,200**	**2,046**	**-26,433**	**-49**	
							Total	**17,010**	**42,906**	**12,690**	**5,530**	**-37,376**	**-34**	

Table F-38. Existing and potential solar loads for Steamboat Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Steamboat Creek**
Assessment Unit # ID17010301PN028_03														
930	0.5	2.75	0.52	2.64	-0.11	**11**	**9**	10230	28132.5	8370	22096.8	-6035.7	-2	Nonforest
200	0.5	2.75	0.48	2.86	0.11	11	10	2200	6050	2000	5720	-330	0	Group 1
280	0.7	1.65	0.48	2.86	1.21	11	10	3080	5082	2800	8008	2926	0	
510	0.6	2.2	0.48	2.86	0.66	11	10	5610	12342	5100	14586	2244	0	
930	0.5	2.75	0.45	3.025	0.275	11	11	10230	28132.5	10230	30945.75	2813.25	0	
430	0.7	1.65	0.45	3.025	1.375	11	11	4730	7804.5	4730	14308.25	6503.75	0	
1220	0.5	2.75	0.45	3.025	0.275	**12**	**11**	14640	40260	13420	40595.5	335.5	0	
540	0.7	1.65	0.45	3.025	1.375	**12**	**11**	6480	10692	5940	17968.5	7276.5	0	
520	0.5	2.75	0.41	3.245	0.495	12	12	6240	17160	6240	20248.8	3088.8	0	
300	0.4	3.3	0.41	3.245	-0.055	12	12	3600	11880	3600	11682	-198	-1	
1040	0.3	3.85	0.41	3.245	-0.605	12	12	12480	48048	12480	40497.6	-7550.4	-11	
570	0.4	3.3	0.41	3.245	-0.055	12	12	6840	22572	6840	22195.8	-376.2	-1	
770	0.2	4.4	0.41	3.245	-1.155	**12**	**12**	9240	40656	9240	29983.8	-10672.2	-21	
							Total	**95,600**	**278,812**	**90,990**	**278,837**	**25**	**-3**	

Table F-39. Existing and potential solar loads for EF Steamboat Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**EF Steamboat Creek**
Assessment Unit # ID17010301PN028_02														
680	0.9	0.55	0.98	0.11	-0.44	1	1	680	374	680	74.8	-299.2	-8	Forest Group B
980	0.9	0.55	0.98	0.11	-0.44	2	2	1960	1078	1960	215.6	-862.4	-8	
290	0.8	1.1	0.98	0.11	-0.99	2	**2**	580	638	580	63.8	-574.2	-18	
1760	0.7	1.65	0.96	0.22	-1.43	3	3	5280	8712	5280	1161.6	-7550.4	-26	
1460	0.7	1.65	0.94	0.33	-1.32	4	**4**	5840	9636	5840	1927.2	-7708.8	-24	
270	0.9	0.55	0.91	0.495	-0.055	5	5	1350	742.5	1350	668.25	-74.25	-1	
370	0.8	1.1	0.91	0.495	-0.605	5	5	1850	2035	1850	915.75	-1119.25	-11	
780	0.9	0.55	0.91	0.495	-0.055	5	**5**	3900	2145	3900	1930.5	-214.5	-1	
360	0.7	1.65	0.65	1.925	0.275	6	6	2160	3564	2160	4158	594	0	Nonforest Group 1
1010	0.5	2.75	0.65	1.925	-0.825	6	6	6060	16665	6060	11665.5	-4999.5	-15	
780	0.6	2.2	0.65	1.925	-0.275	6	**6**	4680	10296	4680	9009	-1287	-5	
							Total	**34,340**	**55,886**	**34,340**	**31,790**	**-24,096**	**-11**	

Table F-40. Existing and potential solar loads for WF Steamboat Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**WF Steamboat Creek**
Assessment Unit # ID17010301PN028_02														
530	0.9	0.55	0.98	0.11	-0.44	1	1	530	291.5	530	58.3	-233.2	-8	Forest Group B
1070	0.7	1.65	0.98	0.11	-1.54	2	2	2140	3531	2140	235.4	-3295.6	-28	
340	0.8	1.1	0.96	0.22	-0.88	3	3	1020	1122	1020	224.4	-897.6	-16	
720	0.7	1.65	0.96	0.22	-1.43	3	3	2160	3564	2160	475.2	-3088.8	-26	
1430	0.9	0.55	0.94	0.33	-0.22	**4**	**4**	5720	3146	5720	1887.6	-1258.4	-4	
							Subtotal	**11,570**	**11,655**	**11,570**	**2,881**	**-8,774**	**-16**	
Assessment Unit # ID17010301PN028_03														
390	0.8	1.1	0.72	1.54	0.44	**5**	**5**	1950	2145	1950	3003	858	0	Nonforest Group 1
1790	0.7	1.65	0.65	1.925	0.275	6	6	10740	17721	10740	20674.5	2953.5	0	
670	0.6	2.2	0.65	1.925	-0.275	**6**	**6**	4020	8844	4020	7738.5	-1105.5	-5	
							Subtotal	**16,710**	**28,710**	**16,710**	**31,416**	**2,706**	**-2**	
							Total	**28,280**	**40,365**	**28,280**	**34,297**	**-6,068**	**-11**	

Table F-41. Existing and potential solar loads for Steamboat Creek tributaries.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Steamboat Creek Tributaries**	
AU# ID17010301PN028_02															
1500	0.9	0.55	0.98	0.11	-0.44	1	1	1500	825	1500	165	-660	-8	Forest Group B	Martin Creek
440	0.8	1.1	0.98	0.11	-0.99	1	1	440	484	440	48.4	-435.6	-18		
1600	0.9	0.55	0.98	0.11	-0.44	2	2	3200	1760	3200	352	-1408	-8		Clay Creek
2800	0.9	0.55	0.98	0.11	-0.44	2	2	5600	3080	5600	616	-2464	-8		Cabin Creek
3900	0.9	0.55	0.98	0.11	-0.44	2	2	7800	4290	7800	858	-3432	-8		Little EF Steamboat
1000	0.8	1.1	0.97	0.165	-0.935	3	3	3000	3300	3000	495	-2805	-17		
1800	0.9	0.55	0.98	0.11	-0.44	1	1	1800	990	1800	198	-792	-8		Long Tom Creek
350	0.8	1.1	0.98	0.11	-0.99	1	1	350	385	350	38.5	-346.5	-18		Betty Creek
680	0.9	0.55	0.98	0.11	-0.44	1	1	680	374	680	74.8	-299.2	-8		
380	0.8	1.1	0.98	0.11	-0.99	1	1	380	418	380	41.8	-376.2	-18		
380	0.9	0.55	0.98	0.11	-0.44	1	1	380	209	380	41.8	-167.2	-8		
1100	0.9	0.55	0.98	0.11	-0.44	1	1	1100	605	1100	121	-484	-8		Un-named
110	0.8	1.1	0.98	0.11	-0.99	2	2	220	242	220	24.2	-217.8	-18		
680	0.9	0.55	0.98	0.11	-0.44	2	2	1360	748	1360	149.6	-598.4	-8		
590	0.9	0.55	0.98	0.11	-0.44	1	1	590	324.5	590	64.9	-259.6	-8		Comfy Creek
250	0.8	1.1	0.98	0.11	-0.99	1	1	250	275	250	27.5	-247.5	-18		
180	0.7	1.65	0.98	0.11	-1.54	1	1	180	297	180	19.8	-277.2	-28		
340	0.8	1.1	0.98	0.11	-0.99	2	2	680	748	680	74.8	-673.2	-18		
540	0.9	0.55	0.98	0.11	-0.44	2	2	1080	594	1080	118.8	-475.2	-8		
1600	0.8	1.1	0.97	0.165	-0.935	3	3	4800	5280	4800	792	-4488	-17		
1200	0.7	1.65	0.96	0.22	-1.43	4	4	4800	7920	4800	1056	-6864	-26		
230	0.7	1.65	0.96	0.22	-1.43	4	4	920	1518	920	202.4	-1315.6	-26		
1700	0.9	0.55	0.98	0.11	-0.44	1	1	1700	935	1700	187	-748	-8		Clark Gulch
1800	0.9	0.55	0.98	0.11	-0.44	1	1	1800	990	1800	198	-792	-8		Black Canyon
490	0.8	1.1	0.98	0.11	-0.99	2	2	980	1078	980	107.8	-970.2	-18		
490	0.9	0.55	0.98	0.11	-0.44	1	1	490	269.5	490	53.9	-215.6	-8		Boston Brook
310	0.8	1.1	0.98	0.11	-0.99	1	1	310	341	310	34.1	-306.9	-18		
860	0.9	0.55	0.98	0.11	-0.44	1	1	860	473	860	94.6	-378.4	-8		
2100	0.9	0.55	0.98	0.11	-0.44	1	1	2100	1155	2100	231	-924	-8		June Creek
750	0.8	1.1	0.98	0.11	-0.99	1	1	750	825	750	82.5	-742.5	-18	Group C	Big Bob Creek
1800	0.9	0.55	0.98	0.11	-0.44	2	2	3600	1980	3600	396	-1584	-8	Group B	
1600	0.9	0.55	0.98	0.11	-0.44	2	2	3200	1760	3200	352	-1408	-8		Can Creek
3200	0.9	0.55	0.97	0.165	-0.385	3	3	9600	5280	9600	1584	-3696	-7		
960	0.8	1.1	0.96	0.22	-0.88	4	4	3840	4224	3840	844.8	-3379.2	-16		
250	0.8	1.1	0.96	0.22	-0.88	4	4	1000	1100	1000	220	-880	-16		
1500	0.9	0.55	0.98	0.11	-0.44	1	1	1500	825	1500	165	-660	-8		Felder Creek
310	0.8	1.1	0.98	0.11	-0.99	2	2	620	682	620	68.2	-613.8	-18		
1700	0.9	0.55	0.98	0.11	-0.44	1	1	1700	935	1700	187	-748	-8		2nd to Can
1100	0.9	0.55	0.95	0.275	-0.275	1	1	1100	605	1100	302.5	-302.5	-5	Group A	Barrymore Creek
1800	0.9	0.55	0.98	0.11	-0.44	2	2	3600	1980	3600	396	-1584	-8	Group B	
240	0.8	1.1	0.97	0.165	-0.935	3	3	720	792	720	118.8	-673.2	-17		
600	0.9	0.55	0.97	0.165	-0.385	3	3	1800	990	1800	297	-693	-7		
2600	0.8	1.1	0.96	0.22	-0.88	4	4	10400	11440	10400	2288	-9152	-16		
600	0.9	0.55	0.98	0.11	-0.44	1	1	600	330	600	66	-264	-8	Group C	Indian Creek
3200	0.9	0.55	0.98	0.11	-0.44	2	2	6400	3520	6400	704	-2816	-8	Group B	
210	0.8	1.1	0.97	0.165	-0.935	3	3	630	693	630	103.95	-589.05	-17		
1900	0.8	1.1	0.97	0.165	-0.935	3	3	5700	6270	5700	940.5	-5329.5	-17		
2100	0.9	0.55	0.98	0.11	-0.44	2	2	4200	2310	4200	462	-1848	-8		1st to Indian
2600	0.9	0.55	0.98	0.11	-0.44	1	1	2600	1430	2600	286	-1144	-8		Omaha Creek
860	0.8	1.1	0.98	0.11	-0.99	2	2	1720	1892	1720	189.2	-1702.8	-18		
3400	0.9	0.55	0.98	0.11	-0.44	1	1	3400	1870	3400	374	-1496	-8		Eighty Day Cr
							Total	**118,030**	**91,641**	**118,030**	**16,914**	**-74,727**	**-13**		

Table F-42. Existing and potential solar loads for Stewart Creek and tributaries.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Stewart Creek	
AU# ID17010301PN019_02															
1600	0.9	0.55	0.98	0.11	-0.44	1	1	1600	880	1600	176	-704	-8	Forest Group B	1st to Stewart
1800	0.9	0.55	0.98	0.11	-0.44	1	1	1800	990	1800	198	-792	-8		2nd to Stewart
1700	0.9	0.55	0.98	0.11	-0.44	1	1	1700	935	1700	187	-748	-8		3rd to Stewart
1600	0.9	0.55	0.98	0.11	-0.44	1	1	1600	880	1600	176	-704	-8		4th to Stewart
1800	0.9	0.55	0.98	0.11	-0.44	1	1	1800	990	1800	198	-792	-8		5th to Stewart
2100	0.9	0.55	0.98	0.11	-0.44	1	1	2100	1155	2100	231	-924	-8		Stewart Creek
350	0.8	1.1	0.98	0.11	-0.99	2	2	700	770	700	77	-693	-18		
1100	0.8	1.1	0.97	0.165	-0.935	3	3	3300	3630	3300	544.5	-3085.5	-17		
540	0.7	1.65	0.86	0.77	-0.88	3	3	1620	2673	1620	1247.4	-1425.6	-16	Nonforest Group 1	
3000	0.7	1.65	0.78	1.21	-0.44	4	4	12000	19800	12000	14520	-5280	-8		
AU# ID17010301PN019_03															
40	0.7	1.65	0.78	1.21	-0.44	4	4	160	264	160	193.6	-70.4	-8		
							Total	**28,380**	**32,967**	**28,380**	**17,749**	**-15,219**	**-10**		

Table F-43. Existing and potential solar loads for Upper Tepee Creek (AU# 020_02).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Tepee Creek
Assessment Unit # ID17010301PN020_02														
540	0.9	0.55	0.98	0.11	-0.44	1	1	540	297	540	59.4	-237.6	-8	Nonforest Group 1
740	0.8	1.1	0.98	0.11	-0.99	1	1	740	814	740	81.4	-732.6	-18	
520	0.7	1.65	0.98	0.11	-1.54	1	1	520	858	520	57.2	-800.8	-28	
1870	0.8	1.1	0.94	0.33	-0.77	2	2	3740	4114	3740	1234.2	-2879.8	-14	
1360	0.7	1.65	0.86	0.77	-0.88	3	3	4080	6732	4080	3141.6	-3590.4	-16	
1520	0.5	2.75	0.86	0.77	-1.98	3	3	4560	12540	4560	3511.2	-9028.8	-36	
							Total	**14,180**	**25,355**	**14,180**	**8,085**	**-17,270**	**-20**	

Table F-44. Existing and potential solar loads for Tepee Creek (AU# 020_03).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Tepee Creek
Assessment Unit # ID17010301PN020_03														
1450	0.4	3.3	0.78	1.21	-2.09	**4**	4	5800	19140	5800	7018	-12122	-38	Nonforest Group 1
280	0.6	2.2	0.72	1.54	-0.66	5	5	1400	3080	1400	2156	-924	-12	
250	0.5	2.75	0.72	1.54	-1.21	5	5	1250	3437.5	1250	1925	-1512.5	-22	
300	0.6	2.2	0.72	1.54	-0.66	6	5	1800	3960	1500	2310	-1650	-12	
580	0.4	3.3	0.65	1.925	-1.38	7	6	4060	13398	3480	6699	-6699	-25	
380	0.5	2.75	0.65	1.925	-0.83	8	6	3040	8360	2280	4389	-3971	-15	
280	0.6	2.2	0.6	2.2	0.00	8	7	2240	4928	1960	4312	-616	0	
630	0.3	3.85	0.6	2.2	-1.65	9	7	5670	21829.5	4410	9702	-12127.5	-30	
1850	0	5.5	0.52	2.64	-2.86	11	9	20350	111925	16650	43956	-67969	-52	
140	0.1	4.95	0.45	3.025	-1.93	**13**	**11**	1820	9009	1540	4658.5	-4350.5	-35	
1330	0	5.5	0.41	3.245	-2.26	14	12	18620	102410	15960	51790.2	-50619.8	-41	
							Total	**66,050**	**301,477**	**56,230**	**138,916**	**-162,561**	**-26**	

Table F-45. Existing and potential solar loads for Tepee Creek (AU# 017_04).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Tepee Creek**
Assessment Unit # ID17010301PN017_04														
190	0.1	4.95	0.41	3.245	-1.71	14	12	2660	13167	2280	7398.6	-5768.4	-31	Nonforest Group 1
2950	0.1	4.95	0.37	3.465	-1.49	16	14	47200	233640	41300	143104.5	-90535.5	-27	
1060	0.1	4.95	0.35	3.575	-1.38	17	15	18020	89199	15900	56842.5	-32356.5	-25	
160	0	5.5	0.35	3.575	-1.93	17	15	2720	14960	2400	8580	-6380	-35	
300	0.1	4.95	0.35	3.575	-1.38	17	15	5100	25245	4500	16087.5	-9157.5	-25	
140	0	5.5	0.33	3.685	-1.82	18	16	2520	13860	2240	8254.4	-5605.6	-33	
180	0.1	4.95	0.33	3.685	-1.27	18	16	3240	16038	2880	10612.8	-5425.2	-23	
440	0	5.5	0.33	3.685	-1.82	18	16	7920	43560	7040	25942.4	-17617.6	-33	
1010	0.1	4.95	0.33	3.685	-1.27	18	**16**	18180	89991	16160	59549.6	-30441.4	-23	
							Total	**107,560**	**539,660**	**94,700**	**336,372**	**-203,288**	**-28**	

Table F-46. Existing and potential solar loads for Lower Tepee Creek (AU# 017_05).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Tepee Creek**
Assessment Unit # ID17010301PN017_05														
320	0	5.5	0.29	3.905	-1.60	19	17	6080	33440	5440	21243.2	-12196.8	-29	Nonforest Group 2
290	0.1	4.95	0.29	3.905	-1.05	19	17	5510	27274.5	4930	19251.65	-8022.85	-19	
500	0	5.5	0.29	3.905	-1.60	19	17	9500	52250	8500	33192.5	-19057.5	-29	
480	0.1	4.95	0.28	3.96	-0.99	20	18	9600	47520	8640	34214.4	-13305.6	-18	
240	0	5.5	0.28	3.96	-1.54	20	18	4800	26400	4320	17107.2	-9292.8	-28	
1030	0.1	4.95	0.27	4.015	-0.94	21	19	21630	107068.5	19570	78573.55	-28494.95	-17	
180	0	5.5	0.25	4.125	-1.38	22	20	3960	21780	3600	14850	-6930	-25	
1060	0.1	4.95	0.25	4.125	-0.83	22	20	23320	115434	21200	87450	-27984	-15	
3330	0	5.5	0.24			25	**23**	83250	457875	76590	0	-457875	-24	
							Total	**167,650**	**889,042**	**152,790**	**305,883**	**-583,160**	**-23**	

Table F-47. Existing and potential solar loads for Tepee Creek tributaries.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Tepee Creek Tributaries**	
AU# ID17010301PN020_02															
1200	0.9	0.55	0.98	0.11	-0.44	1	1	1200	660	1200	132	-528	-8	Forest	1st un-named
750	0.8	1.1	0.98	0.11	-0.99	1	1	750	825	750	82.5	-742.5	-18	Group B	
2100	0.9	0.55	0.98	0.11	-0.44	2	2	4200	2310	4200	462	-1848	-8		Y Creek
1700	0.9	0.55	0.98	0.11	-0.44	1	1	1700	935	1700	187	-748	-8		Riley Creek
330	0.8	1.1	0.98	0.11	-0.99	2	2	660	726	660	72.6	-653.4	-18		
1700	0.9	0.55	0.98	0.11	-0.44	1	1	1700	935	1700	187	-748	-8		1st to Short
940	0.9	0.55	0.98	0.11	-0.44	1	1	940	517	940	103.4	-413.6	-8		Short Creek
250	0.8	1.1	0.98	0.11	-0.99	2	2	500	550	500	55	-495	-18		
2000	0.8	1.1	0.86	0.77	-0.33	3	3	6000	6600	6000	4620	-1980	-6	Nonforest	
490	0.7	1.65	0.86	0.77	-0.88	3	3	1470	2425.5	1470	1131.9	-1293.6	-16	Group 1	
1600	0.9	0.55	0.98	0.11	-0.44	2	2	3200	1760	3200	352	-1408	-8	Group B	1st to Little Elk
1100	0.9	0.55	0.98	0.11	-0.44	1	1	1100	605	1100	121	-484	-8		2nd to Little Elk
310	0.8	1.1	0.98	0.11	-0.99	1	1	310	341	310	34.1	-306.9	-18		
1800	0.9	0.55	0.98	0.11	-0.44	2	2	3600	1980	3600	396	-1584	-8		
160	0.8	1.1	0.94	0.33	-0.77	2	2	320	352	320	105.6	-246.4	-14	Group 1	
1500	0.9	0.55	0.98	0.11	-0.44	1	1	1500	825	1500	165	-660	-8	Group B	Little Elk
1200	0.9	0.55	0.98	0.11	-0.44	2	2	2400	1320	2400	264	-1056	-8		Creek
740	0.8	1.1	0.97	0.165	-0.935	3	3	2220	2442	2220	366.3	-2075.7	-17		
470	0.8	1.1	0.86	0.77	-0.33	3	3	1410	1551	1410	1085.7	-465.3	-6	Group 1	
1000	0.7	1.65	0.78	1.21	-0.44	4	4	4000	6600	4000	4840	-1760	-8		
360	0.8	1.1	0.78	1.21	0.11	4	4	1440	1584	1440	1742.4	158.4	0		
1600	0.9	0.55	0.98	0.11	-0.44	1	1	1600	880	1600	176	-704	-8	Group B	Drexall Creek
2000	0.8	1.1	0.98	0.11	-0.99	1	1	2000	2200	2000	220	-1980	-18		
190	0.9	0.55	0.98	0.11	-0.44	1	1	190	104.5	190	20.9	-83.6	-8		
1600	0.9	0.55	0.98	0.11	-0.44	1	1	1600	880	1600	176	-704	-8		1st to Halsey
1900	0.9	0.55	0.98	0.11	-0.44	1	1	1900	1045	1900	209	-836	-8		2nd to Halsey
2100	0.9	0.55	0.98	0.11	-0.44	1	1	2100	1155	2100	231	-924	-8		3rd to Halsey
2300	0.9	0.55	0.98	0.11	-0.44	2	2	4600	2530	4600	506	-2024	-8		Halsey
700	0.8	1.1	0.98	0.11	-0.99	2	2	1400	1540	1400	154	-1386	-18		Creek
690	0.8	1.1	0.86	0.77	-0.33	3	3	2070	2277	2070	1593.9	-683.1	-6	Group 1	
610	0.7	1.65	0.86	0.77	-0.88	3	3	1830	3019.5	1830	1409.1	-1610.4	-16		
340	0.5	2.75	0.86	0.77	-1.98	3	3	1020	2805	1020	785.4	-2019.6	-36	beaver pond	
280	0.7	1.65	0.78	1.21	-0.44	4	4	1120	1848	1120	1355.2	-492.8	-8		
550	0.8	1.1	0.78	1.21	0.11	4	4	2200	2420	2200	2662	242	0		
1010	0.8	1.1	0.78	1.21	0.11	4	4	4040	4444	4040	4888.4	444.4	0		
2100	0.9	0.55	0.98	0.11	-0.44	1	1	2100	1155	2100	231	-924	-8	Group B	1st to Van Hooster
1300	0.9	0.55	0.98	0.11	-0.44	1	1	1300	715	1300	143	-572	-8		Van Hooster
1800	0.8	1.1	0.98	0.11	-0.99	2	2	3600	3960	3600	396	-3564	-18		Creek
90	0.9	0.55	0.94	0.33	-0.22	2	2	180	99	180	59.4	-39.6	-4	Group 1	
1400	0.9	0.55	0.98	0.11	-0.44	1	1	1400	770	1400	154	-616	-8	Group B	Ryan
600	0.8	1.1	0.98	0.11	-0.99	2	2	1200	1320	1200	132	-1188	-18		Creek
470	0.9	0.55	0.98	0.11	-0.44	2	2	940	517	940	103.4	-413.6	-8		
170	0.7	1.65	0.94	0.33	-1.32	2	2	340	561	340	112.2	-448.8	-24	Group 1	
							Total	**79,010**	**71,528**	**79,010**	**32,111**	**-39,416**	**-11**		

Table F-48. Existing and potential solar loads for Trail Creek.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Trail Creek**
Assessment Unit # ID17010301PN019_03														
590	0.6	2.2	0.65	1.925	-0.28	14	**6**	8260	18172	3540	6814.5	-11357.5	-5	Nonforest
240	0.7	1.65	0.6	2.2	0.55	15	7	3600	5940	1680	3696	-2244	0	Group 1
1900	0.6	2.2	0.55	2.475	0.27	**16**	**8**	30400	66880	15200	37620	-29260	0	
1160	0.3	3.85	0.55	2.475	-1.38	16	8	18560	71456	9280	22968	-48488	-25	
280	0.4	3.3	0.55	2.475	-0.83	16	8	4480	14784	2240	5544	-9240	-15	
700	0.3	3.85	0.55	2.475	-1.38	16	8	11200	43120	5600	13860	-29260	-25	
470	0.2	4.4	0.52	2.64	-1.76	16	9	7520	33088	4230	11167.2	-21920.8	-32	
2130	0	5.5	0.52	2.64	-2.86	16	9	34080	187440	19170	50608.8	-136831.2	-52	
680	0.1	4.95	0.52	2.64	-2.31	16	9	10880	53856	6120	16156.8	-37699.2	-42	
370	0	5.5	0.52	2.64	-2.86	16	**9**	5920	32560	3330	8791.2	-23768.8	-52	
230	0.1	4.95	0.52	2.64	-2.31	16	9	3680	18216	2070	5464.8	-12751.2	-42	
1350	0	5.5	0.48	2.86	-2.64	16	**10**	21600	118800	13500	38610	-80190	-48	
							Total	**160,180**	**664,312**	**85,960**	**221,301**	**-443,011**	**-28**	

Table F-49. Existing and potential solar loads for Trail Creek tributaries.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Trail Creek Tributaries**	
AU# ID17010301PN019_02															
1800	0.9	0.55	0.98	0.11	-0.44	1	1	1800	990	1800	198	-792	-8	Forest Group B	Coon Gulch
700	0.8	1.1	0.98	0.11	-0.99	2	2	1400	1540	1400	154	-1386	-18		
1700	0.9	0.55	0.98	0.11	-0.44	1	1	1700	935	1700	187	-748	-8		Hamilton Creek
1000	0.7	1.65	0.98	0.11	-1.54	2	2	2000	3300	2000	220	-3080	-28		
230	0.8	1.1	0.98	0.11	-0.99	2	2	460	506	460	50.6	-455.4	-18		
170	0.2	4.4	0.98	0.11	-4.29	2	2	340	1496	340	37.4	-1458.6	-78		
840	0.9	0.55	0.98	0.11	-0.44	1	1	840	462	840	92.4	-369.6	-8		Dresser Creek
590	0.8	1.1	0.98	0.11	-0.99	1	1	590	649	590	64.9	-584.1	-18		
910	0.7	1.65	0.98	0.11	-1.54	2	2	1820	3003	1820	200.2	-2802.8	-28		
290	0.8	1.1	0.98	0.11	-0.99	2	2	580	638	580	63.8	-574.2	-18		
60	0.5	2.75	0.98	0.11	-2.64	2	2	120	330	120	13.2	-316.8	-48		
1300	0.9	0.55	0.98	0.11	-0.44	1	1	1300	715	1300	143	-572	-8		West Bear Creek
230	0.9	0.55	0.98	0.11	-0.44	2	2	460	253	460	50.6	-202.4	-8		
760	0.8	1.1	0.98	0.11	-0.99	2	2	1520	1672	1520	167.2	-1504.8	-18		
230	0.7	1.65	0.98	0.11	-1.54	2	2	460	759	460	50.6	-708.4	-28		
1700	0.9	0.55	0.98	0.11	-0.44	1	1	1700	935	1700	187	-748	-8		1st to W. Bear
1200	0.9	0.55	0.98	0.11	-0.44	1	1	1200	660	1200	132	-528	-8		Bear Creek
490	0.8	1.1	0.98	0.11	-0.99	1	1	490	539	490	53.9	-485.1	-18		
180	0.9	0.55	0.98	0.11	-0.44	1	1	180	99	180	19.8	-79.2	-8		
390	0.8	1.1	0.98	0.11	-0.99	2	2	780	858	780	85.8	-772.2	-18		
770	0.7	1.65	0.98	0.11	-1.54	2	2	1540	2541	1540	169.4	-2371.6	-28		
270	0.6	2.2	0.98	0.11	-2.09	2	2	540	1188	540	59.4	-1128.6	-38		
590	0.8	1.1	0.98	0.11	-0.99	2	2	1180	1298	1180	129.8	-1168.2	-18		
620	0.7	1.65	0.98	0.11	-1.54	2	2	1240	2046	1240	136.4	-1909.6	-28		
450	0.6	2.2	0.97	0.165	-2.035	3	3	1350	2970	1350	222.75	-2747.25	-37		
170	0.7	1.65	0.97	0.165	-1.485	3	3	510	841.5	510	84.15	-757.35	-27		
90	0.5	2.75	0.86	0.77	-1.98	3	3	270	742.5	270	207.9	-534.6	-36	Nonforest Group 1	
80	0.7	1.65	0.86	0.77	-0.88	3	3	240	396	240	184.8	-211.2	-16		
100	0.5	2.75	0.86	0.77	-1.98	3	3	300	825	300	231	-594	-36		
110	0.8	1.1	0.86	0.77	-0.33	3	3	330	363	330	254.1	-108.9	-6		
							Total	**27,240**	**33,550**	**27,240**	**3,851**	**-29,699**	**-22**		

Table F-50. Existing and Potential solar loads for Yellow Dog Creek and tributaries.

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Yellow Dog Creek**	
AU# ID17010301PN024_02															
1300	0.9	0.55	0.98	0.11	-0.44	1	1	1300	715	1300	143	-572	-8	Forest Group B	1st to Yellow Dog
290	0.8	1.1	0.98	0.11	-0.99	1	1	290	319	290	31.9	-287.1	-18		
410	0.9	0.55	0.98	0.11	-0.44	1	1	410	225.5	410	45.1	-180.4	-8		
1000	0.9	0.55	0.98	0.11	-0.44	1	1	1000	550	1000	110	-440	-8		2nd to Yellow Dog
670	0.8	1.1	0.98	0.11	-0.99	2	2	1340	1474	1340	147.4	-1326.6	-18		
1200	0.8	1.1	0.98	0.11	-0.99	1	1	1200	1320	1200	132	-1188	-18		3rd to Yellow Dog
2300	0.9	0.55	0.98	0.11	-0.44	2	2	4600	2530	4600	506	-2024	-8		
1300	0.8	1.1	0.98	0.11	-0.99	1	1	1300	1430	1300	143	-1287	-18		4th to Yellow Dog
370	0.9	0.55	0.98	0.11	-0.44	1	1	370	203.5	370	40.7	-162.8	-8		
310	0.9	0.55	0.98	0.11	-0.44	1	1	310	170.5	310	34.1	-136.4	-8		Ash Creek
310	0.8	1.1	0.98	0.11	-0.99	1	1	310	341	310	34.1	-306.9	-18		
910	0.9	0.55	0.98	0.11	-0.44	2	2	1820	1001	1820	200.2	-800.8	-8		
1000	0.8	1.1	0.98	0.11	-0.99	2	2	2000	2200	2000	220	-1980	-18		
390	0.8	1.1	0.98	0.11	-0.99	1	1	390	429	390	42.9	-386.1	-18		Yellow Dog Creek
190	0.7	1.65	0.98	0.11	-1.54	1	1	190	313.5	190	20.9	-292.6	-28		
180	0.8	1.1	0.98	0.11	-0.99	1	1	180	198	180	19.8	-178.2	-18		
1100	0.9	0.55	0.98	0.11	-0.44	2	2	2200	1210	2200	242	-968	-8		
890	0.9	0.55	0.97	0.165	-0.385	3	3	2670	1468.5	2670	440.55	-1027.95	-7		
210	0.9	0.55	0.97	0.165	-0.385	3	3	630	346.5	630	103.95	-242.55	-7		
500	0.9	0.55	0.96	0.22	-0.33	4	4	2000	1100	2000	440	-660	-6		
240	0.9	0.55	0.96	0.22	-0.33	4	4	960	528	960	211.2	-316.8	-6		
600	0.7	1.65	0.96	0.22	-1.43	4	4	2400	3960	2400	528	-3432	-26		
200	0.9	0.55	0.96	0.22	-0.33	4	4	800	440	800	176	-264	-6		
200	0.8	1.1	0.78	1.21	0.11	4	4	800	880	800	968	88	0	Nonforest Group 1	
810	0.7	1.65	0.78	1.21	-0.44	4	4	3240	5346	3240	3920.4	-1425.6	-8		
490	0.6	2.2	0.72	1.54	-0.66	5	5	2450	5390	2450	3773	-1617	-12		
2100	0.8	1.1	0.94	0.33	-0.77	5	5	10500	11550	10500	3465	-8085	-14	Group B	
							Total	**45,660**	**45,639**	**45,660**	**16,139**	**-29,500**	**-12**		

Table F-51. Existing and potential solar loads for Little North Fork Coeur d'Alene River headwaters (AU# 030_02).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Little NF Coeur d'Alene River**	
Assessment Unit # ID17010301PN030_02															
2210	0.9	0.55	0.98	0.11	-0.44	1	1	2210	1215.5	2210	243.1	-972.4	-8	Forest Group B	Headwaters Little NF
710	0.8	1.1	0.96	0.22	-0.88	3	3	2130	2343	2130	468.6	-1874.4	-16		
190	0.9	0.55	0.96	0.22	-0.33	3	3	570	313.5	570	125.4	-188.1	-6		
2070	0.8	1.1	0.78	1.21	0.11	4	**4**	8280	9108	8280	10018.8	910.8	0	Nonforest Group 1	
730	0.7	1.65	0.72	1.54	-0.11	5	5	3650	6022.5	3650	5621	-401.5	-2		
420	0.9	0.55	0.72	1.54	0.99	5	5	2100	1155	2100	3234	2079	0		
370	0.7	1.65	0.72	1.54	-0.11	5	5	1850	3052.5	1850	2849	-203.5	-2		
340	0.9	0.55	0.65	1.925	1.38	6	6	2040	1122	2040	3927	2805	0		
							Total	**22,830**	**24,332**	**22,830**	**26,487**	**2,155**	**-4**		

Table F-52. Existing and potential solar loads for Little North Fork Coeur d'Alene River tributaries (AU# 030_02a).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Little NF Coeur d'Alene River Tributaries	
Assessment Unit # ID17010301PN030_02a															
1760	0.9	0.55	0.98	0.11	-0.44	1	1	1760	968	1760	193.6	-774.4	-8	Forest Group B	Honey Creek
420	0.8	1.1	0.98	0.11	-0.99	2	2	840	924	840	92.4	-831.6	-18		
450	0.7	1.65	0.98	0.11	-1.54	2	2	900	1485	900	99	-1386	-28		
630	0.7	1.65	0.98	0.11	-1.54	2	2	1260	2079	1260	138.6	-1940.4	-28		
970	0.8	1.1	0.86	0.77	-0.33	3	3	2910	3201	2910	2240.7	-960.3	-6	Nonforest 1	
960	0.9	0.55	0.98	0.11	-0.44	1	1	960	528	960	105.6	-422.4	-8	Forest Group B	1st Trib to Honey
240	0.8	1.1	0.98	0.11	-0.99	1	1	240	264	240	26.4	-237.6	-18		
220	0.9	0.55	0.98	0.11	-0.44	1	1	220	121	220	24.2	-96.8	-8		
360	0.9	0.55	0.98	0.11	-0.44	1	1	360	198	360	39.6	-158.4	-8		Prospect Creek
520	0.7	1.65	0.98	0.11	-1.54	1	1	520	858	520	57.2	-800.8	-28		
190	0.9	0.55	0.98	0.11	-0.44	1	1	190	104.5	190	20.9	-83.6	-8		
160	0.7	1.65	0.98	0.11	-1.54	1	1	160	264	160	17.6	-246.4	-28		
460	0.9	0.55	0.98	0.11	-0.44	1	1	460	253	460	50.6	-202.4	-8		
560	0.9	0.55	0.98	0.11	-0.44	1	1	560	308	560	61.6	-246.4	-8		Sob Creek
710	0.8	1.1	0.98	0.11	-0.99	1	1	710	781	710	78.1	-702.9	-18		
1410	0.9	0.55	0.98	0.11	-0.44	2	2	2820	1551	2820	310.2	-1240.8	-8		
280	0.8	1.1	0.98	0.11	-0.99	2	2	560	616	560	61.6	-554.4	-18		
140	0.7	1.65	0.86	0.77	-0.88	3	3	420	693	420	323.4	-369.6	-16	Nonforest Group 1	Solitaire Creek
470	0.8	1.1	0.86	0.77	-0.33	3	3	1410	1551	1410	1085.7	-465.3	-6		
110	0.7	1.65	0.86	0.77	-0.88	3	3	330	544.5	330	254.1	-290.4	-16		
470	0.8	1.1	0.98	0.11	-0.99	1	1	470	517	470	51.7	-465.3	-18	Forest Group B	EF Solitaire
1720	0.9	0.55	0.98	0.11	-0.44	2	2	3440	1892	3440	378.4	-1513.6	-8		
800	0.8	1.1	0.98	0.11	-0.99	2	2	1600	1760	1600	176	-1584	-18		
2230	0.9	0.55	0.98	0.11	-0.44	1	1	2230	1226.5	2230	245.3	-981.2	-8		WF Solitaire
440	0.8	1.1	0.98	0.11	-0.99	2	2	880	968	880	96.8	-871.2	-18		
1670	0.9	0.55	0.98	0.11	-0.44	1	1	1670	918.5	1670	183.7	-734.8	-8	Group C	Tom Lavin Creek
1100	0.8	1.1	0.98	0.11	-0.99	2	2	2200	2420	2200	242	-2178	-18	Forest Group B	
1140	0.9	0.55	0.98	0.11	-0.44	2	2	2280	1254	2280	250.8	-1003.2	-8		
420	0.8	1.1	0.96	0.22	-0.88	3	3	1260	1386	1260	277.2	-1108.8	-16		
700	0.9	0.55	0.96	0.22	-0.33	3	3	2100	1155	2100	462	-693	-6		
2990	0.9	0.55	0.98	0.11	-0.44	2	2	5980	3289	5980	657.8	-2631.2	-8		Lewelling Creek
1170	0.8	1.1	0.96	0.22	-0.88	3	3	3510	3861	3510	772.2	-3088.8	-16		
220	0.9	0.55	0.96	0.22	-0.33	3	3	660	363	660	145.2	-217.8	-6		
							Total	**45,870**	**38,302**	**45,870**	**9,220**	**-29,082**	**-14**		

Table F-53. Existing and potential solar loads for Little North Fork Coeur d’Alene River tributaries (AU# 030_02b).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Little NF Coeur d'Alene River Tributaries**	
Assessment Unit # ID17010301PN030_02b															
1420	0.9	0.55	0.98	0.11	-0.44	1	1	1420	781	1420	156.2	-624.8	-8	Forest	Trib to WF Hudlow
1720	0.9	0.55	0.98	0.11	-0.44	1	1	1720	946	1720	189.2	-756.8	-8	Group B	WF Hudlow
170	0.9	0.55	0.98	0.11	-0.44	2	2	340	187	340	37.4	-149.6	-8		Creek
1430	0.8	1.1	0.98	0.11	-0.99	2	2	2860	3146	2860	314.6	-2831.4	-18		
460	0.9	0.55	0.98	0.11	-0.44	1	1	460	253	460	50.6	-202.4	-8		MF Hudlow
170	0.8	1.1	0.98	0.11	-0.99	1	1	170	187	170	18.7	-168.3	-18		Creek
890	0.9	0.55	0.98	0.11	-0.44	1	1	890	489.5	890	97.9	-391.6	-8		
680	0.8	1.1	0.98	0.11	-0.99	2	2	1360	1496	1360	149.6	-1346.4	-18		
160	0.9	0.55	0.98	0.11	-0.44	2	2	320	176	320	35.2	-140.8	-8		
850	0.8	1.1	0.98	0.11	-0.99	2	2	1700	1870	1700	187	-1683	-18		
300	0.9	0.55	0.96	0.22	-0.33	3	3	900	495	900	198	-297	-6		
1190	0.8	1.1	0.96	0.22	-0.88	3	3	3570	3927	3570	785.4	-3141.6	-16		
730	0.9	0.55	0.98	0.11	-0.44	1	1	730	401.5	730	80.3	-321.2	-8		EF Hudlow
1930	0.8	1.1	0.98	0.11	-0.99	1	1	1930	2123	1930	212.3	-1910.7	-18		Creek
670	0.8	1.1	0.78	1.21	0.11	4	4	2680	2948	2680	3242.8	294.8	0	Nonforest	Hudlow
1200	0.8	1.1	0.78	1.21	0.11	4	4	4800	5280	4800	5808	528	0	Group 1	Creek
1480	0.9	0.55	0.98	0.11	-0.44	1	1	1480	814	1480	162.8	-651.2	-8	Forest	Trib to Gimlet Cr
2220	0.9	0.55	0.98	0.11	-0.44	1	1	2220	1221	2220	244.2	-976.8	-8	Group B	Gimlet
2050	0.9	0.55	0.94	0.33	-0.22	2	2	4100	2255	4100	1353	-902	-4	Nonforest	Creek
1740	0.8	1.1	0.86	0.77	-0.33	3	3	5220	5742	5220	4019.4	-1722.6	-6	Group 1	
140	0.7	1.65	0.78	1.21	-0.44	4	4	560	924	560	677.6	-246.4	-8		
2030	0.9	0.55	0.98	0.11	-0.44	2	2	4060	2233	4060	446.6	-1786.4	-8	Forest	Owl
200	0.9	0.55	0.96	0.22	-0.33	3	3	600	330	600	132	-198	-6	Group B	Creek
940	0.9	0.55	0.96	0.22	-0.33	3	3	2820	1551	2820	620.4	-930.6	-6		
180	0.8	1.1	0.86	0.77	-0.33	3	3	540	594	540	415.8	-178.2	-6	Nonforest	
1830	0.9	0.55	0.98	0.11	-0.44	1	1	1830	1006.5	1830	201.3	-805.2	-8	Forest	1st Trib to Owl
1620	0.9	0.55	0.98	0.11	-0.44	1	1	1620	891	1620	178.2	-712.8	-8	Group B	2nd Trib to Owl
							Total	**50,900**	**42,268**	**50,900**	**20,015**	**-22,253**	**-9**		

Table F-54. Existing and potential solar loads for Little North Fork Coeur d'Alene River tributaries (AU# 030_02c).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Little NF Coeur d'Alene River Tributaries	
Assessment Unit # ID17010301PN030_02c															
1340	0.9	0.55	0.98	0.11	-0.44	1	1	1340	737	1340	147.4	-589.6	-8	Forest	Nicholas
2060	0.8	1.1	0.98	0.11	-0.99	2	2	4120	4532	4120	453.2	-4078.8	-18	Group B	Creek
200	0.7	1.65	0.98	0.11	-1.54	2	2	400	660	400	44	-616	-28		
380	0.8	1.1	0.98	0.11	-0.99	2	2	760	836	760	83.6	-752.4	-18		
870	0.7	1.65	0.78	1.21	-0.44	4	4	3480	5742	3480	4210.8	-1531.2	-8	Nonforest	
2630	0.9	0.55	0.98	0.11	-0.44	2	2	5260	2893	5260	578.6	-2314.4	-8	Forest	Canyon Fork
970	0.8	1.1	0.98	0.11	-0.99	2	2	1940	2134	1940	213.4	-1920.6	-18	Group B	
2710	0.9	0.55	0.98	0.11	-0.44	2	2	5420	2981	5420	596.2	-2384.8	-8		Barney
170	0.8	1.1	0.98	0.11	-0.99	2	2	340	374	340	37.4	-336.6	-18		Creek
2180	0.8	1.1	0.86	0.77	-0.33	3	3	6540	7194	6540	5035.8	-2158.2	-6	Nonforest	
1160	0.9	0.55	0.86	0.77	0.22	3	3	3480	1914	3480	2679.6	765.6	0	Group 1	
1320	0.9	0.55	0.98	0.11	-0.44	1	1	1320	726	1320	145.2	-580.8	-8	Forest	Argument
300	0.8	1.1	0.98	0.11	-0.99	1	1	300	330	300	33	-297	-18	Group B	Creek
1820	0.9	0.55	0.98	0.11	-0.44	1	1	1820	1001	1820	200.2	-800.8	-8		Little Cr
650	0.9	0.55	0.98	0.11	-0.44	1	1	650	357.5	650	71.5	-286	-8		Cathcart
710	0.8	1.1	0.98	0.11	-0.99	1	1	710	781	710	78.1	-702.9	-18		Creek
910	0.9	0.55	0.98	0.11	-0.44	2	2	1820	1001	1820	200.2	-800.8	-8		
110	0.5	2.75	0.94	0.33	-2.42	2	2	220	605	220	72.6	-532.4	-44	Nonforest	
220	0.9	0.55	0.98	0.11	-0.44	1	1	220	121	220	24.2	-96.8	-8	Forest	Cascade
1050	0.8	1.1	0.98	0.11	-0.99	1	1	1050	1155	1050	115.5	-1039.5	-18	Group B	Creek
140	0.7	1.65	0.98	0.11	-1.54	2	2	280	462	280	30.8	-431.2	-28		
1360	0.9	0.55	0.98	0.11	-0.44	2	2	2720	1496	2720	299.2	-1196.8	-8		
1060	0.9	0.55	0.96	0.22	-0.33	3	3	3180	1749	3180	699.6	-1049.4	-6		
960	0.8	1.1	0.96	0.22	-0.88	3	3	2880	3168	2880	633.6	-2534.4	-16		
660	0.9	0.55	0.78	1.21	0.66	4	4	2640	1452	2640	3194.4	1742.4	0	Nonforest	
440	0.8	1.1	0.78	1.21	0.11	4	4	1760	1936	1760	2129.6	193.6	0	Group 1	
1110	0.7	1.65	0.78	1.21	-0.44	4	4	4440	7326	4440	5372.4	-1953.6	-8		
470	0.8	1.1	0.98	0.11	-0.99	1	1	470	517	470	51.7	-465.3	-18	Forest	1st Trib to
810	0.9	0.55	0.98	0.11	-0.44	1	1	810	445.5	810	89.1	-356.4	-8	Group B	Cascade
430	0.8	1.1	0.98	0.11	-0.99	1	1	430	473	430	47.3	-425.7	-18		
2650	0.9	0.55	0.98	0.11	-0.44	2	2	5300	2915	5300	583	-2332	-8		Walker
150	0.8	1.1	0.98	0.11	-0.99	2	2	300	330	300	33	-297	-18		Creek
1790	0.9	0.55	0.98	0.11	-0.44	1	1	1790	984.5	1790	196.9	-787.6	-8		Picnic
180	0.8	1.1	0.98	0.11	-0.99	2	2	360	396	360	39.6	-356.4	-18		Creek
270	0.7	1.65	0.98	0.11	-1.54	2	2	540	891	540	59.4	-831.6	-28		
580	0.8	1.1	0.98	0.11	-0.99	2	2	1160	1276	1160	127.6	-1148.4	-18		
260	0.7	1.65	0.98	0.11	-1.54	2	2	520	858	520	57.2	-800.8	-28		
650	0.6	2.2	0.96	0.22	-1.98	3	3	1950	4290	1950	429	-3861	-36		
270	0.7	1.65	0.96	0.22	-1.43	3	3	810	1336.5	810	178.2	-1158.3	-26		
340	0.8	1.1	0.96	0.22	-0.88	3	3	1020	1122	1020	224.4	-897.6	-16		
610	0.8	1.1	0.94	0.33	-0.77	4	4	2440	2684	2440	805.2	-1878.8	-14		
1150	0.7	1.65	0.94	0.33	-1.32	4	4	4600	7590	4600	1518	-6072	-24		
400	0.7	1.65	0.78	1.21	-0.44	4	4	1600	2640	1600	1936	-704	-8	Nonforest	
1700	0.9	0.55	0.98	0.11	-0.44	1	1	1700	935	1700	187	-748	-8	Forest	Thiesen Cr
1660	0.9	0.55	0.98	0.11	-0.44	1	1	1660	913	1660	182.6	-730.4	-8	Group B	Larch Cr
							Total	**86,550**	**84,260**	**86,550**	**34,125**	**-50,135**	**-14**		

Table F-55. Existing and potential solar loads for Little North Fork Coeur d'Alene River tributaries (AU# 030_02d).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Little NF Coeur d'Alene River Tributaries**	
Assessment Unit # ID17010301PN030_02d															
1820	0.9	0.55	0.98	0.11	-0.44	2	2	3640	2002	3640	400.4	-1601.6	-8	Forest	Trestle Cr
1790	0.9	0.55	0.98	0.11	-0.44	1	1	1790	984.5	1790	196.9	-787.6	-8	Group B	Delaney Cr
400	0.9	0.55	0.98	0.11	-0.44	1	1	400	220	400	44	-176	-8		Lindberg
240	0.8	1.1	0.98	0.11	-0.99	1	1	240	264	240	26.4	-237.6	-18		Creek
1310	0.9	0.55	0.98	0.11	-0.44	2	2	2620	1441	2620	288.2	-1152.8	-8		
810	0.9	0.55	0.98	0.11	-0.44	1	1	810	445.5	810	89.1	-356.4	-8		Breadwater
260	0.8	1.1	0.98	0.11	-0.99	1	1	260	286	260	28.6	-257.4	-18		Creek
760	0.9	0.55	0.98	0.11	-0.44	1	1	760	418	760	83.6	-334.4	-8		
360	0.8	1.1	0.98	0.11	-0.99	1	1	360	396	360	39.6	-356.4	-18	Nonforest Group1	
5860	0.9	0.55	0.98	0.11	-0.44	2	2	11720	6446	11720	1289.2	-5156.8	-8	Forest	Canyon Cr
730	0.9	0.55	0.98	0.11	-0.44	1	1	730	401.5	730	80.3	-321.2	-8	Group B	Little Tepee
600	0.8	1.1	0.98	0.11	-0.99	1	1	600	660	600	66	-594	-18		Creek
3910	0.9	0.55	0.98	0.11	-0.44	2	2	7820	4301	7820	860.2	-3440.8	-8		
310	0.8	1.1	0.96	0.22	-0.88	3	3	930	1023	930	204.6	-818.4	-16		
500	0.9	0.55	0.96	0.22	-0.33	3	3	1500	825	1500	330	-495	-6		
150	0.8	1.1	0.96	0.22	-0.88	3	3	450	495	450	99	-396	-16		
660	0.7	1.65	0.86	0.77	-0.88	3	3	1980	3267	1980	1524.6	-1742.4	-16	Nonforest Group1	
2060	0.9	0.55	0.98	0.11	-0.44	1	1	2060	1133	2060	226.6	-906.4	-8	Group B	Unnamed ab
230	0.8	1.1	0.98	0.11	-0.99	1	1	230	253	230	25.3	-227.7	-18	Nonforest Group1	Williams
2640	0.9	0.55	0.98	0.11	-0.44	2	2	5280	2904	5280	580.8	-2323.2	-8	Forest	Williams Draw
1650	0.9	0.55	0.98	0.11	-0.44	1	1	1650	907.5	1650	181.5	-726	-8	Group B	County
150	0.8	1.1	0.98	0.11	-0.99	1	1	150	165	150	16.5	-148.5	-18		Creek
2060	0.9	0.55	0.98	0.11	-0.44	2	2	4120	2266	4120	453.2	-1812.8	-8		Browns Gulch
3790	0.9	0.55	0.98	0.11	-0.44	2	2	7580	4169	7580	833.8	-3335.2	-8		Little
550	0.8	1.1	0.96	0.22	-0.88	3	3	1650	1815	1650	363	-1452	-16		Bumblebee Cr
1490	0.9	0.55	0.98	0.11	-0.44	1	1	1490	819.5	1490	163.9	-655.6	-8		Cannon
290	0.8	1.1	0.98	0.11	-0.99	1	1	290	319	290	31.9	-287.1	-18	Nonforest Group1	Creek
							Total	**61,110**	**38,627**	**61,110**	**8,527**	**-30,099**	**-12**		

Table F-56. Existing and potential solar loads for Little North Fork Coeur d'Alene River (AU# 030_03).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Little NF Coeur d'Alene River**
Assessment Unit # ID17010301PN030_03														
690	0.7	1.65	0.65	1.925	0.27	6	6	4140	6831	4140	7969.5	1138.5	0	Nonforest Group 1
600	0.8	1.1	0.65	1.925	0.83	6	6	3600	3960	3600	6930	2970	0	
360	0.7	1.65	0.6	2.2	0.55	7	7	2520	4158	2520	5544	1386	0	
270	0.8	1.1	0.6	2.2	1.10	7	7	1890	2079	1890	4158	2079	0	
180	0.7	1.65	0.6	2.2	0.55	7	7	1260	2079	1260	2772	693	0	
180	0.8	1.1	0.6	2.2	1.10	7	7	1260	1386	1260	2772	1386	0	
660	0.7	1.65	0.6	2.2	0.55	7	7	4620	7623	4620	10164	2541	0	
580	0.8	1.1	0.55	2.475	1.38	8	8	4640	5104	4640	11484	6380	0	
920	0.7	1.65	0.55	2.475	0.82	**8**	**8**	7360	12144	7360	18216	6072	0	
690	0.6	2.2	0.52	2.64	0.44	9	9	6210	13662	6210	16394.4	2732.4	0	
180	0.7	1.65	0.52	2.64	0.99	9	9	1620	2673	1620	4276.8	1603.8	0	
160	0.6	2.2	0.52	2.64	0.44	9	9	1440	3168	1440	3801.6	633.6	0	
600	0.7	1.65	0.48	2.86	1.21	10	10	6000	9900	6000	17160	7260	0	
300	0.4	3.3	0.48	2.86	-0.44	10	10	3000	9900	3000	8580	-1320	-8	
140	0.2	4.4	0.48	2.86	-1.54	10	10	1400	6160	1400	4004	-2156	-28	
160	0.3	3.85	0.48	2.86	-0.99	10	10	1600	6160	1600	4576	-1584	-18	
330	0.2	4.4	0.45	3.025	-1.38	11	11	3630	15972	3630	10980.75	-4991.25	-25	
940	0.3	3.85	0.45	3.025	-0.82	11	11	10340	39809	10340	31278.5	-8530.5	-15	
360	0.3	3.85	0.41	3.245	-0.60	12	12	4320	16632	4320	14018.4	-2613.6	-11	
410	0.4	3.3	0.41	3.245	-0.05	12	12	4920	16236	4920	15965.4	-270.6	-1	
440	0.3	3.85	0.41	3.245	-0.60	**13**	**12**	5720	22022	5280	17133.6	-4888.4	-11	
1100	0.2	4.4	0.39	3.355	-1.05	13	13	14300	62920	14300	47976.5	-14943.5	-19	
700	0.4	3.3	0.39	3.355	0.06	13	13	9100	30030	9100	30530.5	500.5	0	
370	0.5	2.75	0.39	3.355	0.61	13	13	4810	13227.5	4810	16137.55	2910.05	0	
260	0.2	4.4	0.39	3.355	-1.05	14	13	3640	16016	3380	11339.9	-4676.1	-19	
230	0.4	3.3	0.39	3.355	0.06	14	13	3220	10626	2990	10031.45	-594.55	0	
290	0.5	2.75	0.39	3.355	0.61	14	13	4060	11165	3770	12648.35	1483.35	0	
440	0.3	3.85	0.37	3.465	-0.39	14	14	6160	23716	6160	21344.4	-2371.6	-7	
830	0.4	3.3	0.37	3.465	0.17	15	14	12450	41085	11620	40263.3	-821.7	0	
530	0.6	2.2	0.37	3.465	1.27	15	14	7950	17490	7420	25710.3	8220.3	0	
180	0	5.5	0.37	3.465	-2.04	15	14	2700	14850	2520	8731.8	-6118.2	-37	
500	0.2	4.4	0.37	3.465	-0.94	15	14	7500	33000	7000	24255	-8745	-17	
370	0.1	4.95	0.37	3.465	-1.49	16	14	5920	29304	5180	17948.7	-11355.3	-27	
230	0.2	4.4	0.35	3.575	-0.83	16	15	3680	16192	3450	12333.75	-3858.25	-15	
350	0.4	3.3	0.35	3.575	0.28	16	15	5600	18480	5250	18768.75	288.75	0	
330	0.2	4.4	0.35	3.575	-0.83	16	15	5280	23232	4950	17696.25	-5535.75	-15	
830	0.1	4.95	0.35	3.575	-1.38	17	15	14110	69844.5	12450	44508.75	-25335.75	-25	
330	0.2	4.4	0.35	3.575	-0.83	17	15	5610	24684	4950	17696.25	-6987.75	-15	
610	0.3	3.85	0.35	3.575	-0.27	17	15	10370	39924.5	9150	32711.25	-7213.25	-5	
450	0.1	4.95	0.33	3.685	-1.27	17	16	7650	37867.5	7200	26532	-11335.5	-23	
110	0.1	4.95	0.33	3.685	-1.27	18	16	1980	9801	1760	6485.6	-3315.4	-23	
							Total	**217,580**	**751,113**	**208,460**	**661,829**	**-89,284**	**-9**	

Table F-57. Existing and potential solar loads for Little North Fork Coeur d'Alene River (AU# 030_04).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Little NF Coeur d'Alene River**
Assessment Unit # ID17010301PN030_04														
1020	0	5.5	0.33	3.685	-1.82	18	16	18360	100980	16320	60139.2	-40840.8	-33	Nonforest
480	0.2	4.4	0.33	3.685	-0.72	18	16	8640	38016	7680	28300.8	-9715.2	-13	Group 1
190	0.1	4.95	0.33	3.685	-1.27	18	16	3420	16929	3040	11202.4	-5726.6	-23	
530	0.3	3.85	0.33	3.685	-0.17	19	16	10070	38769.5	8480	31248.8	-7520.7	-3	
390	0.2	4.4	0.33	3.685	-0.72	19	16	7410	32604	6240	22994.4	-9609.6	-13	
360	0.3	3.85	0.32	3.74	-0.11	19	17	6840	26334	6120	22888.8	-3445.2	-2	
270	0.2	4.4	0.32	3.74	-0.66	19	17	5130	22572	4590	17166.6	-5405.4	-12	
180	0.3	3.85	0.32	3.74	-0.11	19	17	3420	13167	3060	11444.4	-1722.6	-2	
590	0.1	4.95	0.32	3.74	-1.21	20	17	11800	58410	10030	37512.2	-20897.8	-22	
240	0.2	4.4	0.32	3.74	-0.66	20	17	4800	21120	4080	15259.2	-5860.8	-12	
580	0.3	3.85	0.32	3.74	-0.11	20	17	11600	44660	9860	36876.4	-7783.6	-2	
1610	0.1	4.95	0.3	3.85	-1.10	21	18	33810	167359.5	28980	111573	-55786.5	-20	
620	0.3	3.85	0.3	3.85	0.00	22	18	13640	52514	11160	42966	-9548	0	
580	0.2	4.4	0.3	3.85	-0.55	22	18	12760	56144	10440	40194	-15950	-10	
940	0.1	4.95	0.3	3.85	-1.10	**22**	**18**	20680	102366	16920	65142	-37224	-20	
470	0.2	4.4	0.29	3.905	-0.50	23	19	10810	47564	8930	34871.65	-12692.35	-9	
270	0.1	4.95	0.29	3.905	-1.05	23	19	6210	30739.5	5130	20032.65	-10706.85	-19	
190	0.2	4.4	0.29	3.905	-0.50	23	19	4370	19228	3610	14097.05	-5130.95	-9	
510	0.1	4.95	0.29	3.905	-1.05	23	19	11730	58063.5	9690	37839.45	-20224.05	-19	
1140	0.2	4.4	0.29	3.905	-0.50	23	19	26220	115368	21660	84582.3	-30785.7	-9	
360	0.3	3.85	0.29	3.905	0.06	23	19	8280	31878	6840	26710.2	-5167.8	0	
1220	0.2	4.4	0.29	3.905	-0.50	23	19	28060	123464	23180	90517.9	-32946.1	-9	
890	0.2	4.4	0.28	3.96	-0.44	24	20	21360	93984	17800	70488	-23496	-8	
1410	0.5	2.75	0.28	3.96	1.21	24	20	33840	93060	28200	111672	18612	0	
2170	0.3	3.85	0.28	3.96	0.11	24	20	52080	200508	43400	171864	-28644	0	
1920	0.2	4.4	0.27	4.015	-0.39	25	21	48000	211200	40320	161884.8	-49315.2	-7	
720	0.3	3.85	0.26	4.07	0.22	26	22	18720	72072	15840	64468.8	-7603.2	0	
1050	0.1	4.95	0.26	4.07	-0.88	26	22	27300	135135	23100	94017	-41118	-16	
190	0.2	4.4	0.26	4.07	-0.33	26	22	4940	21736	4180	17012.6	-4723.4	-6	
490	0.1	4.95	0.26	4.07	-0.88	26	22	12740	63063	10780	43874.6	-19188.4	-16	
280	0	5.5	0.26	4.07	-1.43	26	22	7280	40040	6160	25071.2	-14968.8	-26	
300	0.1	4.95	0.26	4.07	-0.88	26	22	7800	38610	6600	26862	-11748	-16	
1310	0	5.5	0.25	4.125	-1.38	27	23	35370	194535	30130	124286.25	-70248.75	-25	
540	0.1	4.95	0.25	4.125	-0.83	27	23	14580	72171	12420	51232.5	-20938.5	-15	
1950	0	5.5	0.25	4.125	-1.38	27	23	52650	289575	44850	185006.25	-104568.75	-25	
250	0.1	4.95	0.25	4.125	-0.83	27	23	6750	33412.5	5750	23718.75	-9693.75	-15	
440	0.2	4.4	0.24	4.18	-0.22	28	24	12320	54208	10560	44140.8	-10067.2	-4	
470	0.1	4.95	0.24	4.18	-0.77	28	24	13160	65142	11280	47150.4	-17991.6	-14	
170	0.2	4.4	0.24	4.18	-0.22	28	24	4760	20944	4080	17054.4	-3889.6	-4	
750	0.1	4.95	0.24	4.18	-0.77	28	24	21000	103950	18000	75240	-28710	-14	
480	0	5.5	0.24	4.18	-1.32	28	24	13440	73920	11520	48153.6	-25766.4	-24	
370	0.3	3.85	0.24	4.18	0.33	28	24	10360	39886	8880	37118.4	-2767.6	0	
190	0.1	4.95	0.24	4.18	-0.77	28	24	5320	26334	4560	19060.8	-7273.2	-14	
380	0.3	3.85	0.24	4.18	0.33	28	24	10640	40964	9120	38121.6	-2842.4	0	
1030	0.2	4.4	0.24	4.18	-0.22	28	24	28840	126896	24720	103329.6	-23566.4	-4	
220	0.1	4.95	0.23	4.235	-0.72	29	25	6380	31581	5500	23292.5	-8288.5	-13	
940	0.2	4.4	0.23	4.235	-0.17	29	25	27260	119944	23500	99522.5	-20421.5	-3	
780	0	5.5	0.23	4.235	-1.27	29	25	22620	124410	19500	82582.5	-41827.5	-23	
420	0.1	4.95	0.23	4.235	-0.72	29	25	12180	60291	10500	44467.5	-15823.5	-13	
400	0	5.5	0.23	4.235	-1.27	29	25	11600	63800	10000	42350	-21450	-23	
530	0.1	4.95	0.23	4.235	-0.72	29	25	15370	76081.5	13250	56113.75	-19967.75	-13	
1350	0	5.5	0.23	4.235	-1.27	29	**25**	39150	215325	33750	142931.25	-72393.75	-23	
							Total	**865,870**	**4,021,028**	**734,290**	**2,955,648**	**-1,065,380**	**-12**	

Table F-58. Existing and potential solar loads for the Upper North Fork Coeur d'Alene River (AU# 015_02).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	NF Coeur d'Alene River Tributaries	
Assessment Unit # ID17010301PN015_02															
2270	0.9	0.55	0.98	0.11	-0.44	2	2	4540	2497	4540	499.4	-1997.6	-8	Forest Group B	1st Trib to NF
800	0.9	0.55	0.98	0.11	-0.44	1	1	800	440	800	88	-352	-8	Forest Group C	2nd Trib to NF
400	0.8	1.1	0.98	0.11	-0.99	2	2	800	880	800	88	-792	-18	Forest Group B	
780	0.9	0.55	0.98	0.11	-0.44	2	2	1560	858	1560	171.6	-686.4	-8		
1400	0.9	0.55	0.98	0.11	-0.44	1	1	1400	770	1400	154	-616	-8		3rd Trib to NF
520	0.8	1.1	0.98	0.11	-0.99	2	2	1040	1144	1040	114.4	-1029.6	-18		
460	0.9	0.55	0.98	0.11	-0.44	2	2	920	506	920	101.2	-404.8	-8	Forest Group A	
2180	0.9	0.55	0.98	0.11	-0.44	1	1	2180	1199	2180	239.8	-959.2	-8	Forest Group B	4th Trib to NF
1230	0.8	1.1	0.98	0.11	-0.99	2	2	2460	2706	2460	270.6	-2435.4	-18		
630	0.9	0.55	0.96	0.22	-0.33	3	3	1890	1039.5	1890	415.8	-623.7	-6		
730	0.8	1.1	0.96	0.22	-0.88	3	3	2190	2409	2190	481.8	-1927.2	-16		
1320	0.9	0.55	0.98	0.11	-0.44	1	1	1320	726	1320	145.2	-580.8	-8		Trib to 4th Trib
2720	0.9	0.55	0.98	0.11	-0.44	2	2	5440	2992	5440	598.4	-2393.6	-8		Mosquito Cr
1740	0.9	0.55	0.96	0.22	-0.33	3	3	5220	2871	5220	1148.4	-1722.6	-6		
310	0.8	1.1	0.96	0.22	-0.88	3	3	930	1023	930	204.6	-818.4	-16		
2350	0.9	0.55	0.98	0.11	-0.44	2	2	4700	2585	4700	517	-2068	-8		Trib to Mosquito
1870	0.9	0.55	0.98	0.11	-0.44	2	2	3740	2057	3740	411.4	-1645.6	-8	Forest Group A	Trib bl Mosquito
3700	0.9	0.55	0.98	0.11	-0.44	2	2	7400	4070	7400	814	-3256	-8	Forest Group B	Dahlman Cr
370	0.8	1.1	0.98	0.11	-0.99	2	2	740	814	740	81.4	-732.6	-18		
4280	0.9	0.55	0.98	0.11	-0.44	2	2	8560	4708	8560	941.6	-3766.4	-8		Buckskin Cr
1190	0.8	1.1	0.86	0.77	-0.33	3	3	3570	3927	3570	2748.9	-1178.1	-6	Nonforest	
960	0.8	1.1	0.78	1.21	0.11	4	4	3840	4224	3840	4646.4	422.4	2	Group 1	
430	0.7	1.65	0.72	1.54	-0.11	5	5	2150	3547.5	2150	3311	-236.5	-2		
2130	0.9	0.55	0.98	0.11	-0.44	1	1	2130	1171.5	2130	234.3	-937.2	-8	Forest Group B	1st Trib to Buckskin
3220	0.9	0.55	0.98	0.11	-0.44	2	2	6440	3542	6440	708.4	-2833.6	-8		2nd Trib to Buckskin
850	0.9	0.55	0.96	0.22	-0.33	3	3	2550	1402.5	2550	561	-841.5	-6		
810	0.8	1.1	0.86	0.77	-0.33	3	3	2430	2673	2430	1871.1	-801.9	-6	Nonforest	
2280	0.9	0.55	0.98	0.11	-0.44	2	2	4560	2508	4560	501.6	-2006.4	-8	Forest Group B	Trib to 2nd Trib
1510	0.9	0.55	0.98	0.11	-0.44	1	1	1510	830.5	1510	166.1	-664.4	-8	Nonforest	Spruce Cr
1690	0.8	1.1	0.94	0.33	-0.77	2	2	3380	3718	3380	1115.4	-2602.6	-14	Group 1	
660	0.9	0.55	0.86	0.77	0.22	3	3	1980	1089	1980	1524.6	435.6	4		
1160	0.8	1.1	0.78	1.21	0.11	4	4	4640	5104	4640	5614.4	510.4	2		
740	0.6	2.2	0.78	1.21	-0.99	4	4	2960	6512	2960	3581.6	-2930.4	-18		
360	0.8	1.1	0.78	1.21	0.11	4	4	1440	1584	1440	1742.4	158.4	2		
800	0.7	1.65	0.72	1.54	-0.11	5	5	4000	6600	4000	6160	-440	-2		
510	0.6	2.2	0.72	1.54	-0.66	5	5	2550	5610	2550	3927	-1683	-12		
360	0.7	1.65	0.72	1.54	-0.11	5	5	1800	2970	1800	2772	-198	-2		
540	0.7	1.65	0.65	1.925	0.27	6	6	3240	5346	3240	6237	891	5		
880	0.6	2.2	0.65	1.925	-0.28	6	6	5280	11616	5280	10164	-1452	-5		
2680	0.9	0.55	0.98	0.11	-0.44	2	2	5360	2948	5360	589.6	-2358.4	-8	Forest Group B	Powder Cr
3740	0.9	0.55	0.98	0.11	-0.44	2	2	7480	4114	7480	822.8	-3291.2	-8		Larch Cr
2040	0.9	0.55	0.98	0.11	-0.44	2	2	4080	2244	4080	448.8	-1795.2	-8		Barren Cr
120	0.7	1.65	0.98	0.11	-1.54	2	2	240	396	240	26.4	-369.6	-28		
3520	0.9	0.55	0.98	0.11	-0.44	2	2	7040	3872	7040	774.4	-3097.6	-8		Martin Cr
140	0.8	1.1	0.98	0.11	-0.99	2	2	280	308	280	30.8	-277.2	-18		

Table F-58 (cont.). Existing and potential solar loads for the Upper North Fork Coeur d'Alene River (AU# 015_02).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	NF Coeur d'Alene River Tributaries	
1540	0.9	0.55	0.98	0.11	-0.44	1	1	1540	847	1540	169.4	-677.6	-8		Devil Cr
710	0.8	1.1	0.98	0.11	-0.99	2	2	1420	1562	1420	156.2	-1405.8	-18		
1800	0.7	1.65	0.94	0.33	-1.32	2	2	3600	5940	3600	1188	-4752	-24	Nonforest Group 1	
150	0.8	1.1	0.86	0.77	-0.33	3	3	450	495	450	346.5	-148.5	-6		
620	0.9	0.55	0.86	0.77	0.22	3	3	1860	1023	1860	1432.2	409.2	4		
560	0.8	1.1	0.86	0.77	-0.33	3	3	1680	1848	1680	1293.6	-554.4	-6		
140	0.7	1.65	0.78	1.21	-0.44	4	4	560	924	560	677.6	-246.4	-8		
1800	0.9	0.55	0.98	0.11	-0.44	1	1	1800	990	1800	198	-792	-8	Forest Group B	1st Trib to Devil
570	0.9	0.55	0.98	0.11	-0.44	1	1	570	313.5	570	62.7	-250.8	-8		Imp Cr
910	0.8	1.1	0.98	0.11	-0.99	1	1	910	1001	910	100.1	-900.9	-18		
740	0.9	0.55	0.98	0.11	-0.44	2	2	1480	814	1480	162.8	-651.2	-8		
2100	0.9	0.55	0.98	0.11	-0.44	1	1	2100	1155	2100	231	-924	-8		Wren Cr
2590	0.9	0.55	0.98	0.11	-0.44	2	2	5180	2849	5180	569.8	-2279.2	-8		Clark Cr
2170	0.9	0.55	0.98	0.11	-0.44	2	2	4340	2387	4340	477.4	-1909.6	-8		Sluice Cr
1830	0.9	0.55	0.98	0.11	-0.44	1	1	1830	1006.5	1830	201.3	-805.2	-8	Forest Group C	Whitetail Cr
240	0.9	0.55	0.98	0.11	-0.44	2	2	480	264	480	52.8	-211.2	-8	Forest Group B	
1440	0.8	1.1	0.98	0.11	-0.99	2	2	2880	3168	2880	316.8	-2851.2	-18		
610	0.9	0.55	0.96	0.22	-0.33	3	3	1830	1006.5	1830	402.6	-603.9	-6		
1540	0.9	0.55	0.98	0.11	-0.44	2	2	3080	1694	3080	338.8	-1355.2	-8		Trib to Whitetail
3670	0.9	0.55	0.98	0.11	-0.44	2	2	7340	4037	7340	807.4	-3229.6	-8		Blacktail Cr
1070	0.7	1.65	0.78	1.21	-0.44	4	4	4280	7062	4280	5178.8	-1883.2	-8	Nonforest Group 1	
1010	0.8	1.1	0.72	1.54	0.44	5	5	5050	5555	5050	7777	2222	8		
2290	0.9	0.55	0.98	0.11	-0.44	2	2	4580	2519	4580	503.8	-2015.2	-8	Forest Group B	Trib to Blacktail
4940	0.9	0.55	0.98	0.11	-0.44	2	2	9880	5434	9880	1086.8	-4347.2	-8		Alden Cr
180	0.8	1.1	0.96	0.22	-0.88	3	3	540	594	540	118.8	-475.2	-16		
380	0.8	1.1	0.94	0.33	-0.77	4	4	1520	1672	1520	501.6	-1170.4	-14		
340	0.9	0.55	0.95	0.275	-0.28	4	4	1360	748	1360	374	-374	-5	Forest Group A	
760	0.8	1.1	0.95	0.275	-0.82	4	4	3040	3344	3040	836	-2508	-15		
1700	0.9	0.55	0.98	0.11	-0.44	2	2	3400	1870	3400	374	-1496	-8	Forest Group B	East Alden Cr
770	0.8	1.1	0.96	0.22	-0.88	3	3	2310	2541	2310	508.2	-2032.8	-16		
2840	0.9	0.55	0.98	0.11	-0.44	2	2	5680	3124	5680	624.8	-2499.2	-8		Sheep Run Cr
1520	0.9	0.55	0.98	0.11	-0.44	1	1	1520	836	1520	167.2	-668.8	-8		Falls Cr
210	0.8	1.1	0.98	0.11	-0.99	1	1	210	231	210	23.1	-207.9	-18	Forest Group A	
1060	0.9	0.55	0.98	0.11	-0.44	1	1	1060	583	1060	116.6	-466.4	-8	Forest Group B	NF CDA River
2290	0.8	1.1	0.98	0.11	-0.99	2	2	4580	5038	4580	503.8	-4534.2	-18		
1630	0.7	1.65	0.94	0.33	-1.32	2	2	3260	5379	3260	1075.8	-4303.2	-24	Nonforest Group 1	
610	0.6	2.2	0.86	0.77	-1.43	3	3	1830	4026	1830	1409.1	-2616.9	-26		
320	0.5	2.75	0.86	0.77	-1.98	3	3	960	2640	960	739.2	-1900.8	-36		
320	0.6	2.2	0.78	1.21	-0.99	4	4	1280	2816	1280	1548.8	-1267.2	-18		
							Total	**244,030**	**213,488**	**244,030**	**100,419**	**-113,069**	**-10**		

Table F-59. Existing and potential solar loads for the Upper North Fork Coeur d'Alene River (AU# 015_03).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**NF Coeur d'Alene River**	
Assessment Unit # ID17010301PN015_03															
280	0.7	1.65	0.72	1.54	-0.11	5	5	1400	2310	1400	2156	-154	-2	Nonforest Group 1	Deer Cr
310	0.6	2.2	0.72	1.54	-0.66	5	5	1550	3410	1550	2387	-1023	-12		
1240	0.7	1.65	0.65	1.925	0.27	6	6	7440	12276	7440	14322	2046	5		
850	0.6	2.2	0.65	1.925	-0.28	6	6	5100	11220	5100	9817.5	-1402.5	-5		
210	0.5	2.75	0.78	1.21	-1.54	4	4	840	2310	840	1016.4	-1293.6	-28		NF CDA River
270	0.6	2.2	0.78	1.21	-0.99	4	4	1080	2376	1080	1306.8	-1069.2	-18		
810	0.5	2.75	0.78	1.21	-1.54	4	4	3240	8910	3240	3920.4	-4989.6	-28		
370	0.7	1.65	0.78	1.21	-0.44	4	4	1480	2442	1480	1790.8	-651.2	-8		
2440	0.5	2.75	0.72	1.54	-1.21	5	5	12200	33550	12200	18788	-14762	-22		
1020	0.6	2.2	0.65	1.925	-0.28	6	6	6120	13464	6120	11781	-1683	-5		
1160	0.5	2.75	0.65	1.925	-0.83	6	6	6960	19140	6960	13398	-5742	-15		
							Total	**47,410**	**111,408**	**47,410**	**80,684**	**-30,724**	**-13**		

Table F-60. Existing and potential solar loads for the North Fork Coeur d'Alene River (AU# 015_04).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**NF Coeur d'Alene River**
Assessment Unit # ID17010301PN015_04														
950	0.4	3.3	0.65	1.925	-1.38	**6**	6	5700	18810	5700	10972.5	-7837.5	-25	Nonforest Group 1
380	0.2	4.4	0.6	2.2	-2.20	7	7	2660	11704	2660	5852	-5852	-40	
960	0.3	3.85	0.6	2.2	-1.65	7	7	6720	25872	6720	14784	-11088	-30	
1140	0.5	2.75	0.6	2.2	-0.55	7	7	7980	21945	7980	17556	-4389	-10	
1480	0.4	3.3	0.55	2.475	-0.83	8	8	11840	39072	11840	29304	-9768	-15	
2620	0.5	2.75	0.52	2.64	-0.11	9	9	23580	64845	23580	62251.2	-2593.8	-2	
2500	0.4	3.3	0.48	2.86	-0.44	10	10	25000	82500	25000	71500	-11000	-8	
920	0.3	3.85	0.45	3.025	-0.82	11	11	10120	38962	10120	30613	-8349	-15	
350	0.4	3.3	0.45	3.025	-0.27	11	11	3850	12705	3850	11646.25	-1058.75	-5	
750	0.3	3.85	0.41	3.245	-0.60	12	12	9000	34650	9000	29205	-5445	-11	
880	0.4	3.3	0.41	3.245	-0.05	12	12	10560	34848	10560	34267.2	-580.8	-1	
							Total	**117,010**	**385,913**	**117,010**	**317,951**	**-67,962**	**-15**	

Table F-61. Existing and potential solar loads for the North Fork Coeur d'Alene River tributaries (AU# 013_02).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	NF CDA River Tributaries	
AU# ID17010301PN013_02															
1500	0.9	0.55	0.98	0.11	-0.44	1	1	1500	825	1500	165	-660	-8	Forest	Senator
610	0.7	1.65	0.94	0.33	-1.32	2	2	1220	2013	1220	402.6	-1610.4	-24	Group 1	Creek
1150	0.9	0.55	0.96	0.22	-0.33	2	2	2300	1265	2300	506	-759	-6	Group D	Spion Kop Creek
2250	0.9	0.55	0.98	0.11	-0.44	2	2	4500	2475	4500	495	-1980	-8	Group B	
1200	0.8	1.1	0.98	0.11	-0.99	1	1	1200	1320	1200	132	-1188	-18	Group C	1st to Cinnamon
520	0.9	0.55	0.98	0.11	-0.44	1	1	520	286	520	57.2	-228.8	-8	Group B	
1000	0.9	0.55	0.98	0.11	-0.44	1	1	1000	550	1000	110	-440	-8	Group C	2nd to Cinnamon
1500	0.9	0.55	0.98	0.11	-0.44	2	2	3000	1650	3000	330	-1320	-8	Group B	
1800	0.9	0.55	0.98	0.11	-0.44	2	2	3600	1980	3600	396	-1584	-8		3rd to Cinnamon
880	0.9	0.55	0.95	0.275	-0.275	1	1	880	484	880	242	-242	-5	Group A	Cinnamon
880	0.9	0.55	0.94	0.33	-0.22	2	2	1760	968	1760	580.8	-387.2	-4		Creek
1100	0.8	1.1	0.86	0.77	-0.33	3	3	3300	3630	3300	2541	-1089	-6	Nonforest	
410	0.8	1.1	0.78	1.21	0.11	4	4	1640	1804	1640	1984.4	180.4	0	Group 1	
1200	0.7	1.65	0.78	1.21	-0.44	4	4	4800	7920	4800	5808	-2112	-8		
170	0.8	1.1	0.96	0.22	-0.88	4	4	680	748	680	149.6	-598.4	-16	Group B	
1500	0.9	0.55	0.98	0.11	-0.44	1	1	1500	825	1500	165	-660	-8		Lion Creek
2500	0.9	0.55	0.98	0.11	-0.44	2	2	5000	2750	5000	550	-2200	-8		Taft Creek
2400	0.9	0.55	0.98	0.11	-0.44	1	1	2400	1320	2400	264	-1056	-8		Presidents
220	0.8	1.1	0.97	0.165	-0.935	1	1	220	242	220	36.3	-205.7	-17	Group 1	Creek
1100	0.9	0.55	0.98	0.11	-0.44	1	1	1100	605	1100	121	-484	-8	Group B	Wilson
110	0.8	1.1	0.98	0.11	-0.99	1	1	110	121	110	12.1	-108.9	-18		Creek
110	0.9	0.55	0.98	0.11	-0.44	1	1	110	60.5	110	12.1	-48.4	-8		
240	0.8	1.1	0.98	0.11	-0.99	1	1	240	264	240	26.4	-237.6	-18		
930	0.9	0.55	0.98	0.11	-0.44	1	1	930	511.5	930	102.3	-409.2	-8		
120	0.8	1.1	0.95	0.275	-0.825	1	1	120	132	120	33	-99	-15	Group A	Gold
2200	0.9	0.55	0.98	0.11	-0.44	1	1	2200	1210	2200	242	-968	-8	Group B	Creek
110	0.8	1.1	0.98	0.11	-0.99	2	2	220	242	220	24.2	-217.8	-18		
60	0.9	0.55	0.98	0.11	-0.44	2	2	120	66	120	13.2	-52.8	-8		
460	0.8	1.1	0.98	0.11	-0.99	2	2	920	1012	920	101.2	-910.8	-18		
190	0.9	0.55	0.98	0.11	-0.44	2	2	380	209	380	41.8	-167.2	-8		
850	0.8	1.1	0.98	0.11	-0.99	2	2	1700	1870	1700	187	-1683	-18		
410	0.9	0.55	0.98	0.11	-0.44	2	2	820	451	820	90.2	-360.8	-8		
1800	0.9	0.55	0.98	0.11	-0.44	1	1	1800	990	1800	198	-792	-8		Debbs
430	0.8	1.1	0.98	0.11	-0.99	1	1	430	473	430	47.3	-425.7	-18		Creek
1800	0.9	0.55	0.98	0.11	-0.44	1	1	1800	990	1800	198	-792	-8		
2000	0.9	0.55	0.98	0.11	-0.44	1	1	2000	1100	2000	220	-880	-8		Bennett Creek
750	0.9	0.55	0.98	0.11	-0.44	1	1	750	412.5	750	82.5	-330	-8	Group C	1st to Big Hank
1650	0.9	0.55	0.98	0.11	-0.44	1	1	1650	907.5	1650	181.5	-726	-8	Group B	
160	0.8	1.1	0.98	0.11	-0.99	2	2	320	352	320	35.2	-316.8	-18		
80	0.9	0.55	0.98	0.11	-0.44	2	2	160	88	160	17.6	-70.4	-8		
120	0.8	1.1	0.98	0.11	-0.99	2	2	240	264	240	26.4	-237.6	-18		
2300	0.9	0.55	0.98	0.11	-0.44	2	2	4600	2530	4600	506	-2024	-8		Big Hank
90	0.8	1.1	0.97	0.165	-0.935	3	3	270	297	270	44.55	-252.45	-17		Creek
540	0.9	0.55	0.97	0.165	-0.385	3	3	1620	891	1620	267.3	-623.7	-7		
230	0.8	1.1	0.97	0.165	-0.935	3	3	690	759	690	113.85	-645.15	-17		
760	0.9	0.55	0.97	0.165	-0.385	3	3	2280	1254	2280	376.2	-877.8	-7		
290	0.7	1.65	0.86	0.77	-0.88	3	3	870	1435.5	870	669.9	-765.6	-16	Group 1	
2000	0.9	0.55	0.98	0.11	-0.44	1	1	2000	1100	2000	220	-880	-8	Group B	Un-named
3000	0.9	0.55	0.98	0.11	-0.44	2	2	6000	3300	6000	660	-2640	-8		Little Canyon Cr
1300	0.9	0.55	0.98	0.11	-0.44	1	1	1300	715	1300	143	-572	-8		Teddy
540	0.8	1.1	0.98	0.11	-0.99	2	2	1080	1188	1080	118.8	-1069.2	-18		Creek
1300	0.9	0.55	0.98	0.11	-0.44	2	2	2600	1430	2600	286	-1144	-8		
570	0.8	1.1	0.97	0.165	-0.935	3	3	1710	1881	1710	282.15	-1598.85	-17		
350	0.9	0.55	0.97	0.165	-0.385	3	3	1050	577.5	1050	173.25	-404.25	-7		
270	0.8	1.1	0.97	0.165	-0.935	3	3	810	891	810	133.65	-757.35	-17		
450	0.9	0.55	0.97	0.165	-0.385	3	3	1350	742.5	1350	222.75	-519.75	-7		
							Total	**87,370**	**64,378**	**87,370**	**21,145**	**-43,232**	**-11**		

Table F-62. Existing and potential solar loads for the North Fork Coeur d'Alene River (AU# 013_04).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**NF Coeur d'Alene River**
Assessment Unit # ID17010301PN013_04														
3440	0.2	4.4	0.39	3.355	-1.05	**13**	13	44720	196768	44720	150035.6	-46732.4	-19	Nonforest
2480	0.3	3.85	0.37	3.465	-0.39	14	14	34720	133672	34720	120304.8	-13367.2	-7	Group 1
470	0.2	4.4	0.35	3.575	-0.83	15	15	7050	31020	7050	25203.75	-5816.25	-15	
800	0.3	3.85	0.35	3.575	-0.27	15	15	12000	46200	12000	42900	-3300	-5	
630	0.2	4.4	0.33	3.685	-0.72	16	16	10080	44352	10080	37144.8	-7207.2	-13	
450	0.3	3.85	0.33	3.685	-0.17	16	16	7200	27720	7200	26532	-1188	-3	
1690	0.2	4.4	0.32	3.74	-0.66	17	17	28730	126412	28730	107450.2	-18961.8	-12	
1150	0.1	4.95	0.3	3.85	-1.10	18	18	20700	102465	20700	79695	-22770	-20	
330	0.2	4.4	0.3	3.85	-0.55	18	18	5940	26136	5940	22869	-3267	-10	
1070	0.1	4.95	0.29	3.905	-1.05	19	19	20330	100633.5	20330	79388.65	-21244.85	-19	
250	0.2	4.4	0.29	3.905	-0.50	19	19	4750	20900	4750	18548.75	-2351.25	-9	
580	0.1	4.95	0.29	3.905	-1.05	20	**19**	11600	57420	11020	43033.1	-14386.9	-19	
							Total	**207,820**	**913,699**	**207,240**	**753,106**	**-160,593**	**-13**	

Table F-63. Existing and potential solar loads for the Lower North Fork Coeur d'Alene River (AU# 013_05).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**NF Coeur d'Alene River**
Assessment Unit # ID17010301PN013_05														
630	0	5.5	0.25	4.125	-1.38	20	20	12600	69300	12600	51975	-17325	-25	Nonforest
220	0.1	4.95	0.25	4.125	-0.83	20	20	4400	21780	4400	18150	-3630	-15	Group 2
1400	0	5.5	0.25	4.125	-1.38	21	20	29400	161700	28000	115500	-46200	-25	
380	0.1	4.95	0.25	4.125	-0.83	22	21	8360	41382	7980	32917.5	-8464.5	-15	
430	0	5.5	0.25	4.125	-1.38	22	21	9460	52030	9030	37248.75	-14781.25	-25	
1000	0.2	4.4	0.25	4.125	-0.28	22	21	22000	96800	21000	86625	-10175	-5	
490	0	5.5	0.24	4.18	-1.32	23	22	11270	61985	10780	45060.4	-16924.6	-24	
440	0.2	4.4	0.24	4.18	-0.22	23	22	10120	44528	9680	40462.4	-4065.6	-4	
360	0.1	4.95	0.24	4.18	-0.77	23	22	8280	40986	7920	33105.6	-7880.4	-14	
1490	0	5.5	0.23	4.235	-1.27	24	23	35760	196680	34270	145133.45	-51546.55	-23	
170	0.1	4.95	0.23	4.235	-0.72	25	23	4250	21037.5	3910	16558.85	-4478.65	-13	
700	0	5.5	0.23	4.235	-1.27	25	23	17500	96250	16100	68183.5	-28066.5	-23	
1500	0.1	4.95	0.22	4.29	-0.66	26	24	39000	193050	36000	154440	-38610	-12	
1010	0.2	4.4	0.21	4.345	-0.05	27	25	27270	119988	25250	109711.25	-10276.75	-1	
1270	0	5.5	0.2	4.4	-1.10	28	26	35560	195580	33020	145288	-50292	-20	
590	0.1	4.95	0.2	4.4	-0.55	28	26	16520	81774	15340	67496	-14278	-10	
280	0	5.5	0.2	4.4	-1.10	29	27	8120	44660	7560	33264	-11396	-20	
200	0.1	4.95	0.2	4.4	-0.55	29	27	5800	28710	5400	23760	-4950	-10	
1130	0	5.5	0.2	4.4	-1.10	29	27	32770	180235	30510	134244	-45991	-20	
690	0.2	4.4	0.19	4.455	0.05	30	28	20700	91080	19320	86070.6	-5009.4	0	
630	0.1	4.95	0.19	4.455	-0.50	30	28	18900	93555	17640	78586.2	-14968.8	-9	
1300	0.2	4.4	0.19	4.455	0.05	31	28	40300	177320	36400	162162	-15158	0	
3440	0.1	4.95	0.19	4.455	-0.50	33	29	113520	561924	99760	444430.8	-117493.2	-9	
							Total	**531,860**	**2,672,335**	**491,870**	**2,130,373**	**-541,961**	**-14**	

Table F-64. Existing and potential solar loads for the Lower North Fork Coeur d'Alene River (AU# 001_05a).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**NF Coeur d'Alene River**
Assessment Unit # ID17010301PN001_05a														
2290	0.2	4.4	0.18	4.51	0.11	35	30	80150	352660	68700	309837	-42823	0	Nonforest
1210	0.1	4.95	0.18	4.51	-0.44	36	31	43560	215622	37510	169170.1	-46451.9	-8	Group 2
860	0.2	4.4	0.18	4.51	0.11	37	31	31820	140008	26660	120236.6	-19771.4	0	
1260	0.1	4.95	0.17	4.565	-0.39	38	32	47880	237006	40320	184060.8	-52945.2	-7	
610	0	5.5	0.17	4.565	-0.94	39	32	23790	130845	19520	89108.8	-41736.2	-17	
470	0.1	4.95	0.17	4.565	-0.39	39	33	18330	90733.5	15510	70803.15	-19930.35	-7	
2590	0.2	4.4	0.16	4.62	0.22	40	34	103600	455840	88060	406837.2	-49002.8	0	
840	0.1	4.95	0.16	4.62	-0.33	41	35	34440	170478	29400	135828	-34650	-6	
1230	0.2	4.4	0.16	4.62	0.22	42	35	51660	227304	43050	198891	-28413	0	
630	0.1	4.95	0.16	4.62	-0.33	43	**35**	27090	134095.5	22050	101871	-32224.5	-6	
5490	0.2	4.4	0.15	4.675	0.27	**48**	38	263520	1159488	208620	975298.5	-184189.5	0	
1370	0.1	4.95	0.14	4.73	-0.22	47	**41**	64390	318730.5	56170	265684.1	-53046.4	-4	
5120	0	5.5	0.13	4.785	-0.72	**47**	44	240640	1323520	225280	1077964.8	-245555.2	-13	
							Total	**1,030,870**	**4,956,331**	**880,850**	**4,105,591**	**-850,739**	**-5**	

Table F-65. Existing and potential solar loads for the Lower North Fork Coeur d'Alene River (AU# 001_05).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m²/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m²/day)	Potential Load minus Existing load (kWh/m²/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m²)	Existing Summer Load (kWh/day)	Natural Segment Area (m²)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**NF Coeur d'Alene River**
Assessment Unit # ID17010301PN001_05														
4140	0.1	4.95	0.12	4.84	-0.11	**46**	46	190440	942678	190440	921729.6	-20948.4	-2	
880	0	5.5	0.12	4.84	-0.66	47	47	41360	227480	41360	200182.4	-27297.6	-12	
1280	0.1	4.95	0.12	4.84	-0.11	47	47	60160	297792	60160	291174.4	-6617.6	-2	
960	0	5.5	0.12	4.84	-0.66	47	47	45120	248160	45120	218380.8	-29779.2	-12	
1260	0.1	4.95	0.12	4.84	-0.11	47	47	59220	293139	59220	286624.8	-6514.2	-2	
980	0	5.5	0.12	4.84	-0.66	48	48	47040	258720	47040	227673.6	-31046.4	-12	
830	0.1	4.95	0.12	4.84	-0.11	48	48	39840	197208	39840	192825.6	-4382.4	-2	
8020	0	5.5	0.12	4.84	-0.66	49	49	392980	2161390	392980	1902023	-259367	-12	
420	0.1	4.95	0.11	4.895	-0.05	50	50	21000	103950	21000	102795	-1155	-1	
8030	0	5.5	0.11	4.895	-0.61	51	51	409530	2252415	409530	2004649	-247766	-11	
660	0.1	4.95	0.11	4.895	-0.05	51	51	33660	166617	33660	164765.7	-1851.3	-1	
1480	0	5.5	0.11	4.895	-0.61	52	52	76960	423280	76960	376719.2	-46560.8	-11	
550	0.1	4.95	0.11	4.895	-0.05	52	52	28600	141570	28600	139997	-1573	-1	
2160	0	5.5	0.11	4.895	-0.61	52	**52**	112320	617760	112320	549806.4	-67953.6	-11	
7420	0	5.5	0.1	4.95	-0.55	59	**59**	437780	2407790	437780	2167011	-240779	-10	
							Total	**1,996,010**	**10,739,949**	**1,996,010**	**9,746,358**	**-993,591**	**-7**	

Table F-66. Existing and potential solar loads for the Lower North Fork Coeur d'Alene River tributaries (AU# 001_02).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Lower CDA River Tributaries**	
AU# ID17010301PN001_02															
2600	0.9	0.55	0.98	0.11	-0.44	2	2	5200	2860	5200	572	-2288	-8	Forest Group B	Cedar Creek
160	0.8	1.1	0.98	0.11	-0.99	2	2	320	352	320	35.2	-316.8	-18		
690	0.9	0.55	0.97	0.165	-0.385	3	3	2070	1138.5	2070	341.55	-796.95	-7		
310	0.7	1.65	0.97	0.165	-1.485	3	3	930	1534.5	930	153.45	-1381.05	-27		
200	0.9	0.55	0.97	0.165	-0.385	3	3	600	330	600	99	-231	-7		
200	0.7	1.65	0.97	0.165	-1.485	3	3	600	990	600	99	-891	-27		
160	0.9	0.55	0.97	0.165	-0.385	3	3	480	264	480	79.2	-184.8	-7		
900	0.8	1.1	0.96	0.22	-0.88	4	4	3600	3960	3600	792	-3168	-16		
960	0.9	0.55	0.96	0.22	-0.33	4	4	3840	2112	3840	844.8	-1267.2	-6		
2200	0.9	0.55	0.98	0.11	-0.44	1	1	2200	1210	2200	242	-968	-8		Lansdale Creek
2900	0.9	0.55	0.98	0.11	-0.44	1	1	2900	1595	2900	319	-1276	-8		Hopkins Creek
440	0.8	1.1	0.98	0.11	-0.99	2	2	880	968	880	96.8	-871.2	-18		
500	0.8	1.1	0.98	0.11	-0.99	2	2	1000	1100	1000	110	-990	-18		
300	0.7	1.65	0.98	0.11	-1.54	2	2	600	990	600	66	-924	-28		
190	0.5	2.75	0.94	0.33	-2.42	2	2	380	1045	380	125.4	-919.6	-44	Nonforest Group 1	
450	0.3	3.85	0.94	0.33	-3.52	2	2	900	3465	900	297	-3168	-64		
1900	0.9	0.55	0.98	0.11	-0.44	1	1	1900	1045	1900	209	-836	-8	Group B	1st to Hopkins
1800	0.9	0.55	0.98	0.11	-0.44	1	1	1800	990	1800	198	-792	-8		2nd to Hopkins
470	0	5.5	0	5.5	0	1	1	470	2585	470	2585	0	0		
490	0.7	1.65	0.98	0.11	-1.54	1	1	490	808.5	490	53.9	-754.6	-28		
190	0.3	3.85	0.98	0.11	-3.74	1	1	190	731.5	190	20.9	-710.6	-68		
2600	0.9	0.55	0.98	0.11	-0.44	1	1	2600	1430	2600	286	-1144	-8		Little Grizzly Creek
130	0.8	1.1	0.98	0.11	-0.99	2	2	260	286	260	28.6	-257.4	-18		
110	0.7	1.65	0.94	0.33	-1.32	2	2	220	363	220	72.6	-290.4	-24	Group 1	
510	0.4	3.3	0.94	0.33	-2.97	2	2	1020	3366	1020	336.6	-3029.4	-54		
2400	0.9	0.55	0.98	0.11	-0.44	2	2	4800	2640	4800	528	-2112	-8	Group B	Cinnabar Creek
450	0.8	1.1	0.98	0.11	-0.99	2	2	900	990	900	99	-891	-18		
260	0.8	1.1	0.98	0.11	-0.99	1	1	260	286	260	28.6	-257.4	-18		Un-named (E of Graham)
120	0.9	0.55	0.98	0.11	-0.44	1	1	120	66	120	13.2	-52.8	-8		
390	0.8	1.1	0.98	0.11	-0.99	1	1	390	429	390	42.9	-386.1	-18		
140	0.7	1.65	0.98	0.11	-1.54	1	1	140	231	140	15.4	-215.6	-28		
90	0.3	3.85	0.98	0.11	-3.74	1	1	90	346.5	90	9.9	-336.6	-68		
240	0.8	1.1	0.98	0.11	-0.99	1	1	240	264	240	26.4	-237.6	-18		
170	0.9	0.55	0.98	0.11	-0.44	1	1	170	93.5	170	18.7	-74.8	-8		
50	0.1	4.95	0.98	0.11	-4.84	1	1	50	247.5	50	5.5	-242	-88		
200	0.9	0.55	0.98	0.11	-0.44	1	1	200	110	200	22	-88	-8		
1200	0.9	0.55	0.98	0.11	-0.44	1	1	1200	660	1200	132	-528	-8		Silver Creek
420	0.8	1.1	0.98	0.11	-0.99	2	2	840	924	840	92.4	-831.6	-18		
1600	0.9	0.55	0.98	0.11	-0.44	2	2	3200	1760	3200	352	-1408	-8		
5800	0.9	0.55	0.97	0.165	-0.385	3	3	17400	9570	17400	2871	-6699	-7		Coal Creek
1900	0.9	0.55	0.98	0.11	-0.44	1	1	1900	1045	1900	209	-836	-8		Tent Creek
1600	0.9	0.55	0.98	0.11	-0.44	1	1	1600	880	1600	176	-704	-8		Pablo Creek

Table F-66 (cont.). Existing and potential solar loads for the Lower North Fork Coeur d'Alene River tributaries (AU# 001_02).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	Lower CDA River Tributaries	
2400	0.9	0.55	0.98	0.11	-0.44	1	1	2400	1320	2400	264	-1056	-8		Scott
520	0.8	1.1	0.98	0.11	-0.99	2	2	1040	1144	1040	114.4	-1029.6	-18		Creek
1300	0.9	0.55	0.98	0.11	-0.44	2	2	2600	1430	2600	286	-1144	-8		
2300	0.9	0.55	0.98	0.11	-0.44	1	1	2300	1265	2300	253	-1012	-8		Un-named
2100	0.9	0.55	0.98	0.11	-0.44	1	1	2100	1155	2100	231	-924	-8		Simmons Draw
450	0.9	0.55	0.98	0.11	-0.44	1	1	450	247.5	450	49.5	-198	-8		Guard
150	0.8	1.1	0.98	0.11	-0.99	1	1	150	165	150	16.5	-148.5	-18		Creek
760	0.9	0.55	0.98	0.11	-0.44	1	1	760	418	760	83.6	-334.4	-8		
390	0.7	1.65	0.98	0.11	-1.54	1	1	390	643.5	390	42.9	-600.6	-28		
160	0.9	0.55	0.98	0.11	-0.44	1	1	160	88	160	17.6	-70.4	-8		
720	0.8	1.1	0.98	0.11	-0.99	1	1	720	792	720	79.2	-712.8	-18		Spring
200	0.9	0.55	0.98	0.11	-0.44	1	1	200	110	200	22	-88	-8		Creek
440	0.8	1.1	0.98	0.11	-0.99	2	2	880	968	880	96.8	-871.2	-18		
660	0.9	0.55	0.98	0.11	-0.44	2	2	1320	726	1320	145.2	-580.8	-8		
270	0.7	1.65	0.94	0.33	-1.32	2	2	540	891	540	178.2	-712.8	-24	Group 1	
1600	0.8	1.1	0.98	0.11	-0.99	1	1	1600	1760	1600	176	-1584	-18	Group B	Un-named
810	0.9	0.55	0.98	0.11	-0.44	1	1	810	445.5	810	89.1	-356.4	-8		(W of Spring)
360	0.8	1.1	0.97	0.165	-0.935	1	1	360	396	360	59.4	-336.6	-17	Group 1	
500	0.8	1.1	0.98	0.11	-0.99	1	1	500	550	500	55	-495	-18	Group B	Un-named
1400	0.9	0.55	0.98	0.11	-0.44	1	1	1400	770	1400	154	-616	-8		(E of Smith)
380	0.8	1.1	0.98	0.11	-0.99	1	1	380	418	380	41.8	-376.2	-18		
100	0.7	1.65	0.97	0.165	-1.485	1	1	100	165	100	16.5	-148.5	-27	Group 1	
140	0.7	1.65	0.98	0.11	-1.54	1	1	140	231	140	15.4	-215.6	-28	Group B	McRae
210	0.8	1.1	0.98	0.11	-0.99	1	1	210	231	210	23.1	-207.9	-18		Creek
980	0.9	0.55	0.98	0.11	-0.44	1	1	980	539	980	107.8	-431.2	-8		
300	0.3	3.85	0.97	0.165	-3.685	1	1	300	1155	300	49.5	-1105.5	-67	Group 1	
170	0.7	1.65	0.97	0.165	-1.485	1	1	170	280.5	170	28.05	-252.45	-27		
1300	0.8	1.1	0.98	0.11	-0.99	1	1	1300	1430	1300	143	-1287	-18	Group B	Smith
1100	0.9	0.55	0.98	0.11	-0.44	2	2	2200	1210	2200	242	-968	-8		Creek
500	0.8	1.1	0.98	0.11	-0.99	2	2	1000	1100	1000	110	-990	-18		
820	0.8	1.1	0.98	0.11	-0.99	1	1	820	902	820	90.2	-811.8	-18		Fall
2900	0.9	0.55	0.98	0.11	-0.44	2	2	5800	3190	5800	638	-2552	-8		Creek
140	0.8	1.1	0.94	0.33	-0.77	2	2	280	308	280	92.4	-215.6	-14	Group 1	
3300	0.9	0.55	0.98	0.11	-0.44	2	2	6600	3630	6600	726	-2904	-8	Group B	Thomas
570	0.8	1.1	0.97	0.165	-0.935	3	3	1710	1881	1710	282.15	-1598.85	-17		Creek
1400	0.9	0.55	0.98	0.11	-0.44	1	1	1400	770	1400	154	-616	-8		Marsh
500	0.8	1.1	0.98	0.11	-0.99	1	1	500	550	500	55	-495	-18		Creek
1000	0.9	0.55	0.98	0.11	-0.44	1	1	1000	550	1000	110	-440	-8		Un-named
110	0.8	1.1	0.98	0.11	-0.99	1	1	110	121	110	12.1	-108.9	-18		(W of Thomas)
170	0.3	3.85	0.97	0.165	-3.685	1	1	170	654.5	170	28.05	-626.45	-67	Group 1	
2300	0.9	0.55	0.98	0.11	-0.44	1	1	2300	1265	2300	253	-1012	-8	Group B	Studer
400	0.7	1.65	0.98	0.11	-1.54	2	2	800	1320	800	88	-1232	-28		Creek
170	0.5	2.75	0.94	0.33	-2.42	2	2	340	935	340	112.2	-822.8	-44	Group 1	
130	0.1	4.95	0.94	0.33	-4.62	2	2	260	1287	260	85.8	-1201.2	-84		
330	0.7	1.65	0.94	0.33	-1.32	2	2	660	1089	660	217.8	-871.2	-24		

Table F-66 (cont.). Existing and potential solar loads for the Lower North Fork Coeur d'Alene River tributaries (AU# 001_02).

Segment Length (meters)	Existing Shade (fraction)	Existing Summer Load (kWh/m^2/day)	Potential Shade (fraction)	Potential Summer Load (kWh/m^2/day)	Potential Load minus Existing load (kWh/m^2/day)	Existing Stream Width (m)	Natural Stream Width (m)	Existing Segment Area (m^2)	Existing Summer Load (kWh/day)	Natural Segment Area (m^2)	Potential Summer Load (kWh/day)	Potential Load minus Existing Load (kWh/day)	Lack of Shade (%)	**Lower CDA River Tributaries**	
170	0.8	1.1	0.98	0.11	-0.99	1	1	170	187	170	18.7	-168.3	-18	Group B	Lightner Draw
1000	0.9	0.55	0.98	0.11	-0.44	1	1	1000	550	1000	110	-440	-8		
820	0.8	1.1	0.98	0.11	-0.99	1	1	820	902	820	90.2	-811.8	-18		
1800	0.9	0.55	0.98	0.11	-0.44	2	2	3600	1980	3600	396	-1584	-8		
60	0.1	4.95	0.94	0.33	-4.62	2	2	120	594	120	39.6	-554.4	-84	Group 1	
550	0.6	2.2	0.94	0.33	-1.87	2	2	1100	2420	1100	363	-2057	-34		
230	0.1	4.95	0.94	0.33	-4.62	2	2	460	2277	460	151.8	-2125.2	-84		
700	0.9	0.55	0.98	0.11	-0.44	1	1	700	385	700	77	-308	-8	Group B	Un-named (E of Hazendorf)
390	0	5.5	0	5.5	0	1	1	390	2145	390	2145	0	0	dry	
1400	0.9	0.55	0.98	0.11	-0.44	2	2	2800	1540	2800	308	-1232	-8		
800	0.7	1.65	0.98	0.11	-1.54	2	2	1600	2640	1600	176	-2464	-28		
230	0.3	3.85	0.94	0.33	-3.52	2	2	460	1771	460	151.8	-1619.2	-64	Group 1	
3100	0.9	0.55	0.98	0.11	-0.44	1	1	3100	1705	3100	341	-1364	-8	Group B	Hazendorf Creek
1000	0.8	1.1	0.98	0.11	-0.99	2	2	2000	2200	2000	220	-1980	-18		
150	0.1	4.95	0.94	0.33	-4.62	2	2	300	1485	300	99	-1386	-84	Group 1	
360	0.7	1.65	0.94	0.33	-1.32	2	2	720	1188	720	237.6	-950.4	-24		
220	0.3	3.85	0.94	0.33	-3.52	2	2	440	1694	440	145.2	-1548.8	-64		
470	0.7	1.65	0.94	0.33	-1.32	2	2	940	1551	940	310.2	-1240.8	-24		
1200	0.9	0.55	0.97	0.165	-0.385	1	1	1200	660	1200	198	-462	-7		Hullman Gulch
310	0.7	1.65	0.94	0.33	-1.32	2	2	620	1023	620	204.6	-818.4	-24		
610	0.3	3.85	0.94	0.33	-3.52	2	2	1220	4697	1220	402.6	-4294.4	-64		
320	0.1	4.95	0.94	0.33	-4.62	2	2	640	3168	640	211.2	-2956.8	-84		
160	0.3	3.85	0.94	0.33	-3.52	2	2	320	1232	320	105.6	-1126.4	-64		
180	0	5.5	0.94	0.33	-5.17	2	2	360	1980	360	118.8	-1861.2	-94		
1500	0.9	0.55	0.98	0.11	-0.44	1	1	1500	825	1500	165	-660	-8	Group B	Prado Creek
1500	0.8	1.1	0.98	0.11	-0.99	2	2	3000	3300	3000	330	-2970	-18		
970	0.9	0.55	0.97	0.165	-0.385	3	3	2910	1600.5	2910	480.15	-1120.35	-7		
120	0.8	1.1	0.96	0.22	-0.88	4	4	480	528	480	105.6	-422.4	-16		
100	0.8	1.1	0.96	0.22	-0.88	4	4	400	440	400	88	-352	-16		
250	0.1	4.95	0.78	1.21	-3.74	4	4	1000	4950	1000	1210	-3740	-68	Group 1	
260	0.7	1.65	0.78	1.21	-0.44	4	4	1040	1716	1040	1258.4	-457.6	-8		
3900	0.9	0.55	0.98	0.11	-0.44	2	2	7800	4290	7800	858	-3432	-8	Group B	1st to Prado
890	0.9	0.55	0.98	0.11	-0.44	1	1	890	489.5	890	97.9	-391.6	-8		Un-named (S of Prado)
660	0.8	1.1	0.98	0.11	-0.99	2	2	1320	1452	1320	145.2	-1306.8	-18		
440	0.9	0.55	0.98	0.11	-0.44	2	2	880	484	880	96.8	-387.2	-8		
280	0.3	3.85	0.94	0.33	-3.52	2	2	560	2156	560	184.8	-1971.2	-64	Group 1	
1270	0.8	1.1	0.98	0.11	-0.99	1	1	1270	1397	1270	139.7	-1257.3	-18	Group B	McPhee Creek
180	0	5.5	0.98	0.11	-5.39	1	1	180	990	180	19.8	-970.2	-98		
140	0.8	1.1	0.98	0.11	-0.99	1	1	140	154	140	15.4	-138.6	-18		
240	0.6	2.2	0.98	0.11	-2.09	1	1	240	528	240	26.4	-501.6	-38		
110	0.4	3.3	0.98	0.11	-3.19	1	1	110	363	110	12.1	-350.9	-58		
1200	0.9	0.55	0.98	0.11	-0.44	2	2	2400	1320	2400	264	-1056	-8		
170	0.6	2.2	0.98	0.11	-2.09	2	2	340	748	340	37.4	-710.6	-38		
550	0.9	0.55	0.98	0.11	-0.44	2	2	1100	605	1100	121	-484	-8		
330	0.7	1.65	0.94	0.33	-1.32	2	2	660	1089	660	217.8	-871.2	-24	Group 1	
290	0.8	1.1	0.94	0.33	-0.77	2	2	580	638	580	191.4	-446.6	-14		
660	0.7	1.65	0.94	0.33	-1.32	2	2	1320	2178	1320	435.6	-1742.4	-24		
							Total	**174,360**	**168,773**	**174,360**	**31,962**	**-136,811**	**-24**		

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Appendix G. Relationship between Solar Pathfinder Measurements and Original Aerial Photograph Interpretation Estimates of Existing Shade

Site	Aerial Photo Estimated Shade Class (%)	Solar Pathfinder Measured Shade (%)	Solar Pathfinder Estimated Shade Class (%)	Difference in Shade Class (%)
Little North Fork Coeur d'Alene River 1	30	45	40	-10
Little North Fork Coeur d'Alene River 2	30	67	60	-30
Little North Fork Coeur d'Alene River 3	10	58	50	-40
Little North Fork Coeur d'Alene River 4	10	39	40	-30
Deception Creek 1	70	77	70	0
Deception Creek 2	80	70	70	10
Deception Creek 3	80	95	90	-10
Steamboat Creek 1	20	24	20	0
Steamboat Creek 2	20	36	30	-10
Steamboat Creek 3	40	73	70	-30
Steamboat Creek 4	40	56	50	-10
Leiberg Creek 1	90	68	60	30
Leiberg Creek 2	60	55	50	10
Leiberg Creek 3	50	36	30	20
Leiberg Creek 4	60	34	30	30
Beaver Creek	50	58	50	0
West Fork Eagle Creek	90	90	90	0
Tepee Creek 1	0	12	10	-10
Tepee Creek 2	0	4	0	0
			Average	-4
			Standard Deviation	20
			95% Confidence Interval	10

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Appendix H. Shade Deficit Maps

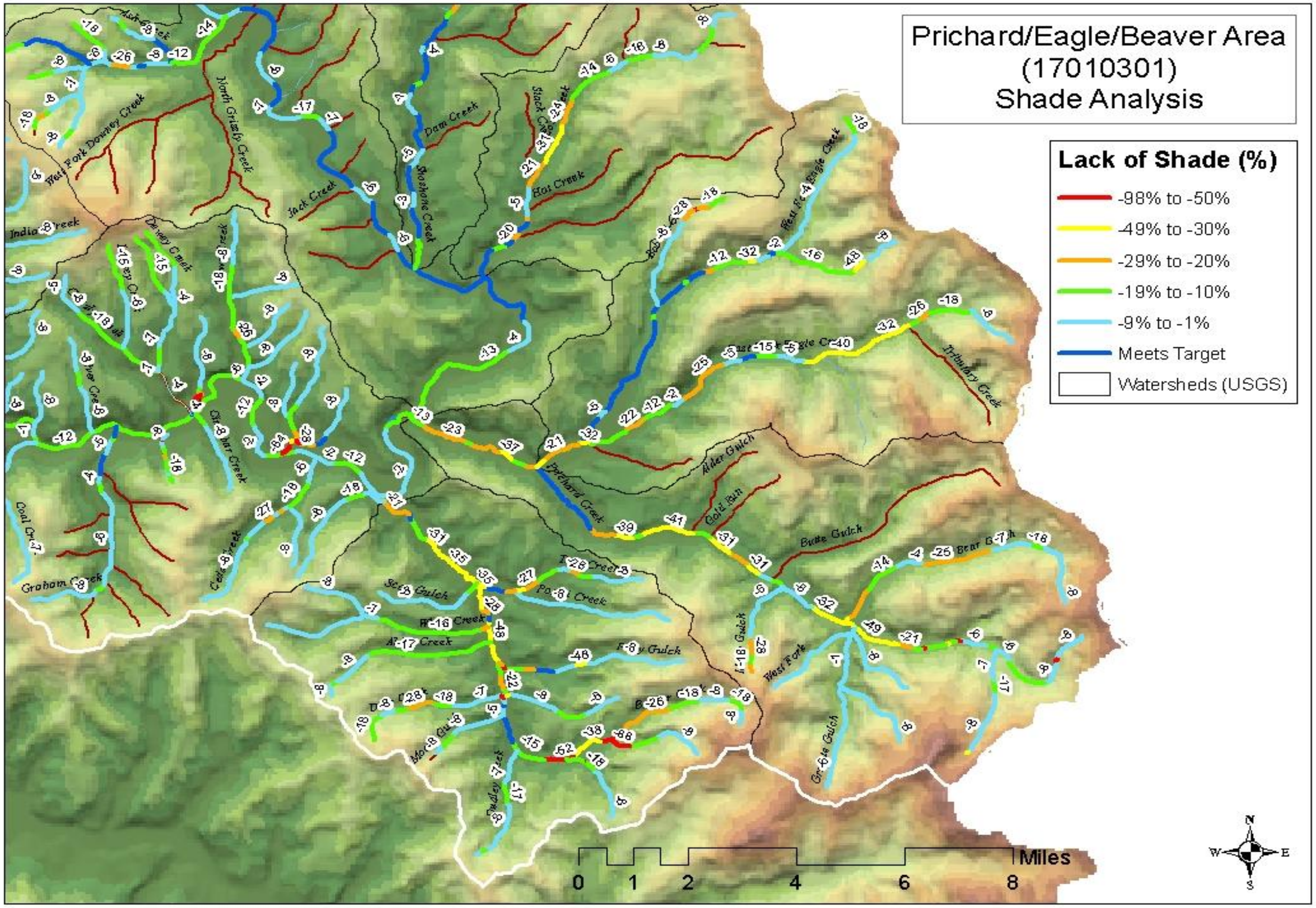

Figure H-1. Shade deficit for the Lost Creek to Beaver Creek area.

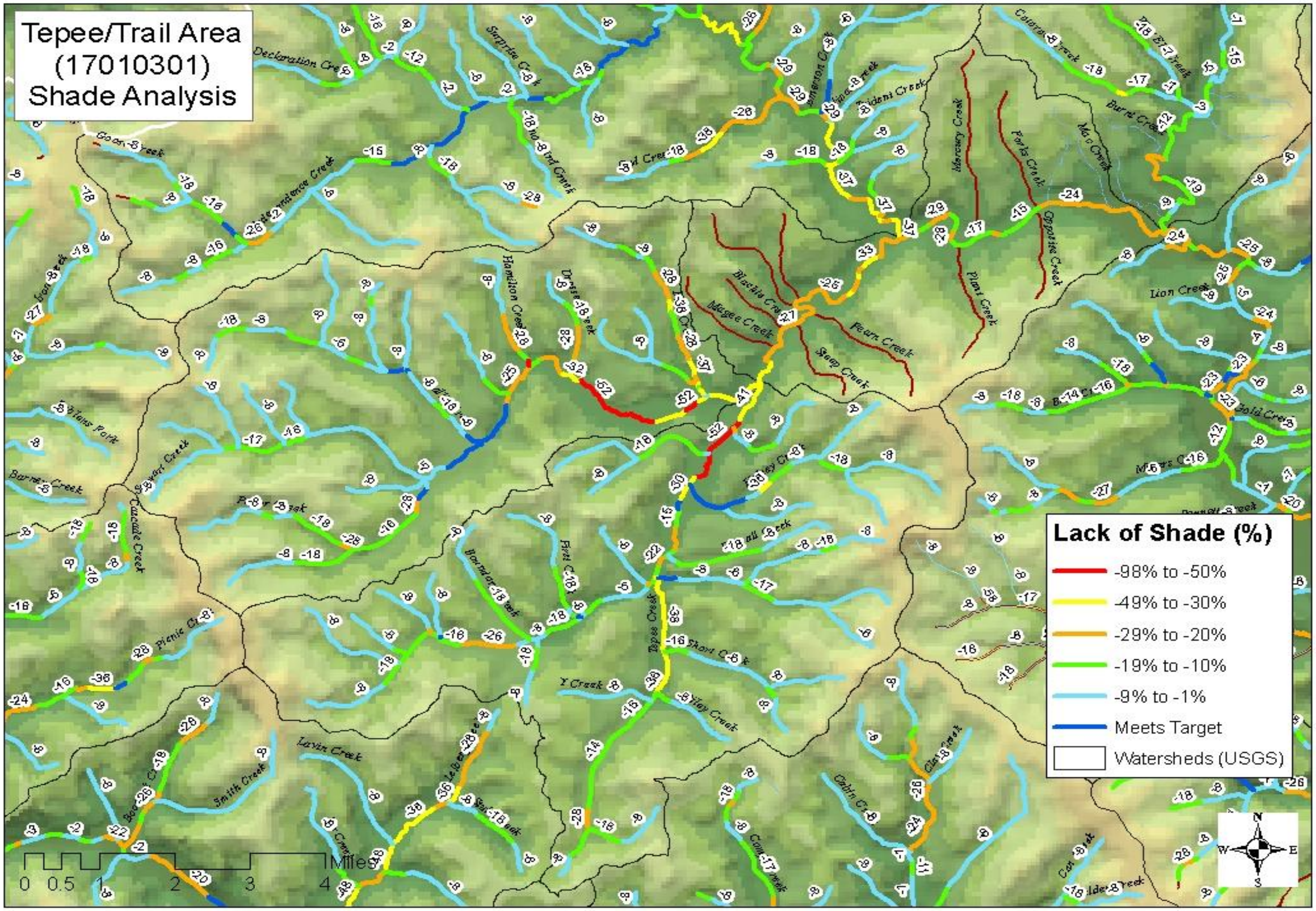

Figure H-2. Shade deficit for the Tepee Creek area.

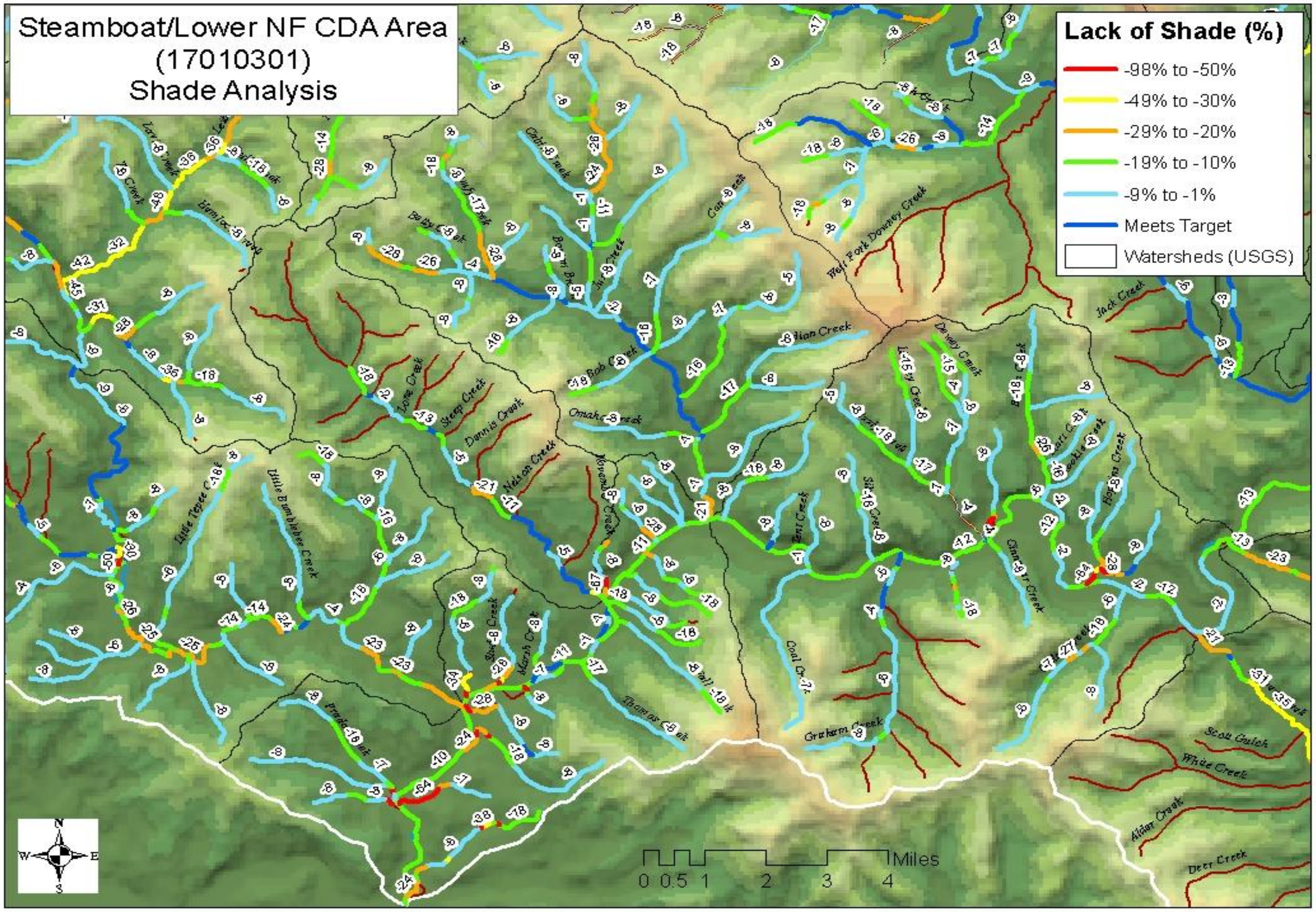

Figure H-3. Shade deficit for the Lower North Fork Coeur d'Alene River area.

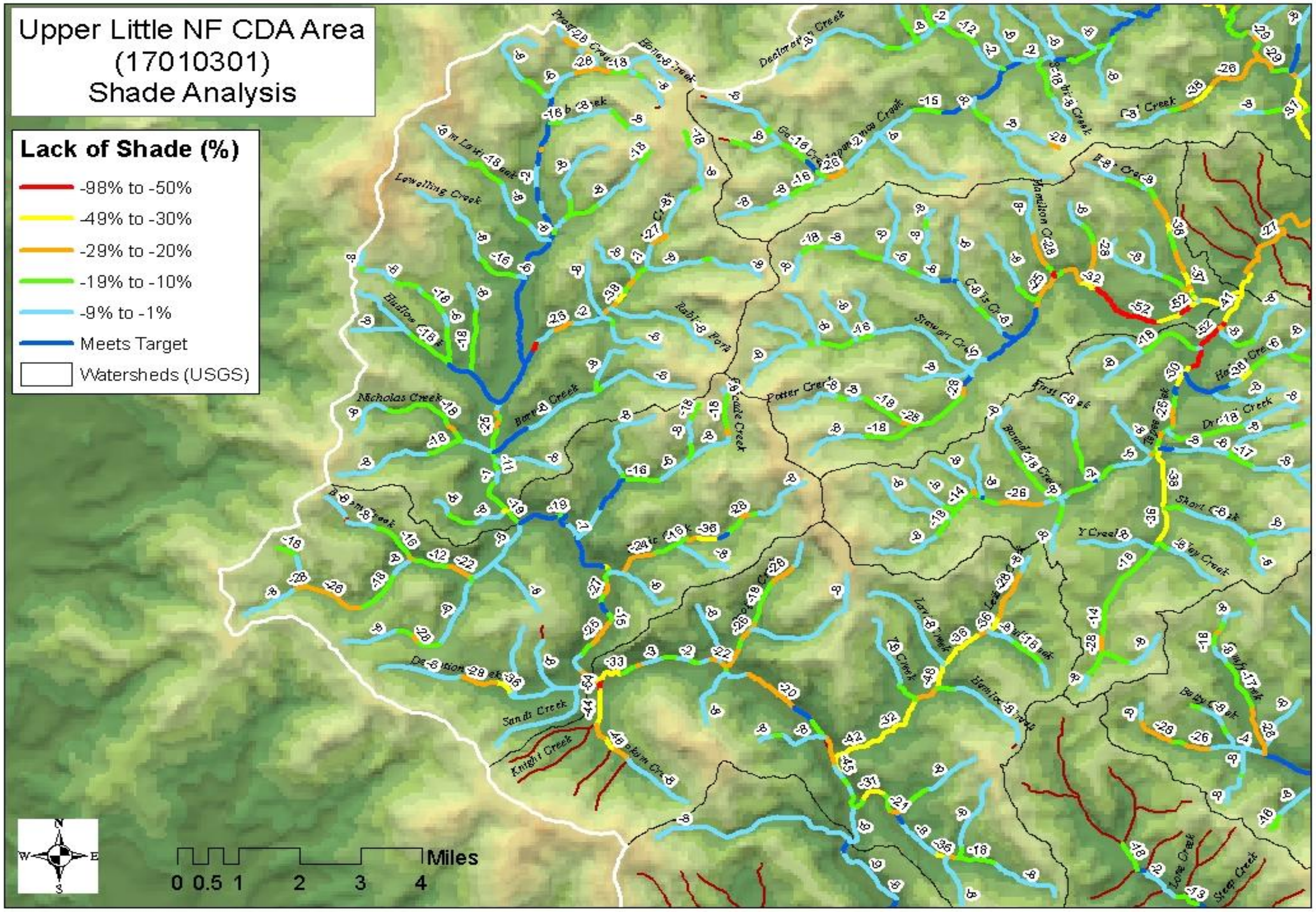

Figure H-4. Shade deficit for the Upper Little North Fork Coeur d'Alene River area.

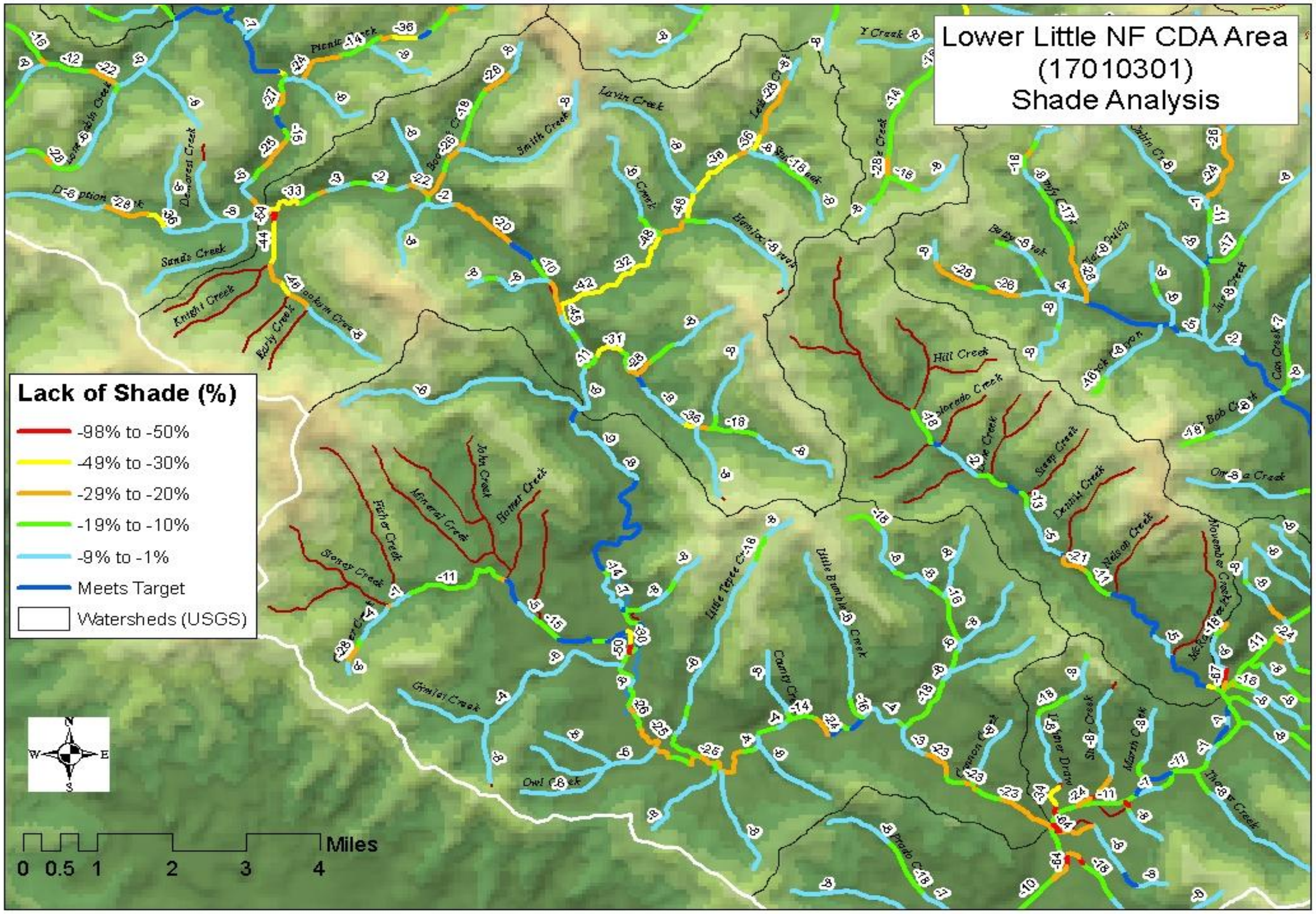

Figure H-5. Shade deficit for the Lower Little North Fork Coeur d’Alene River area.

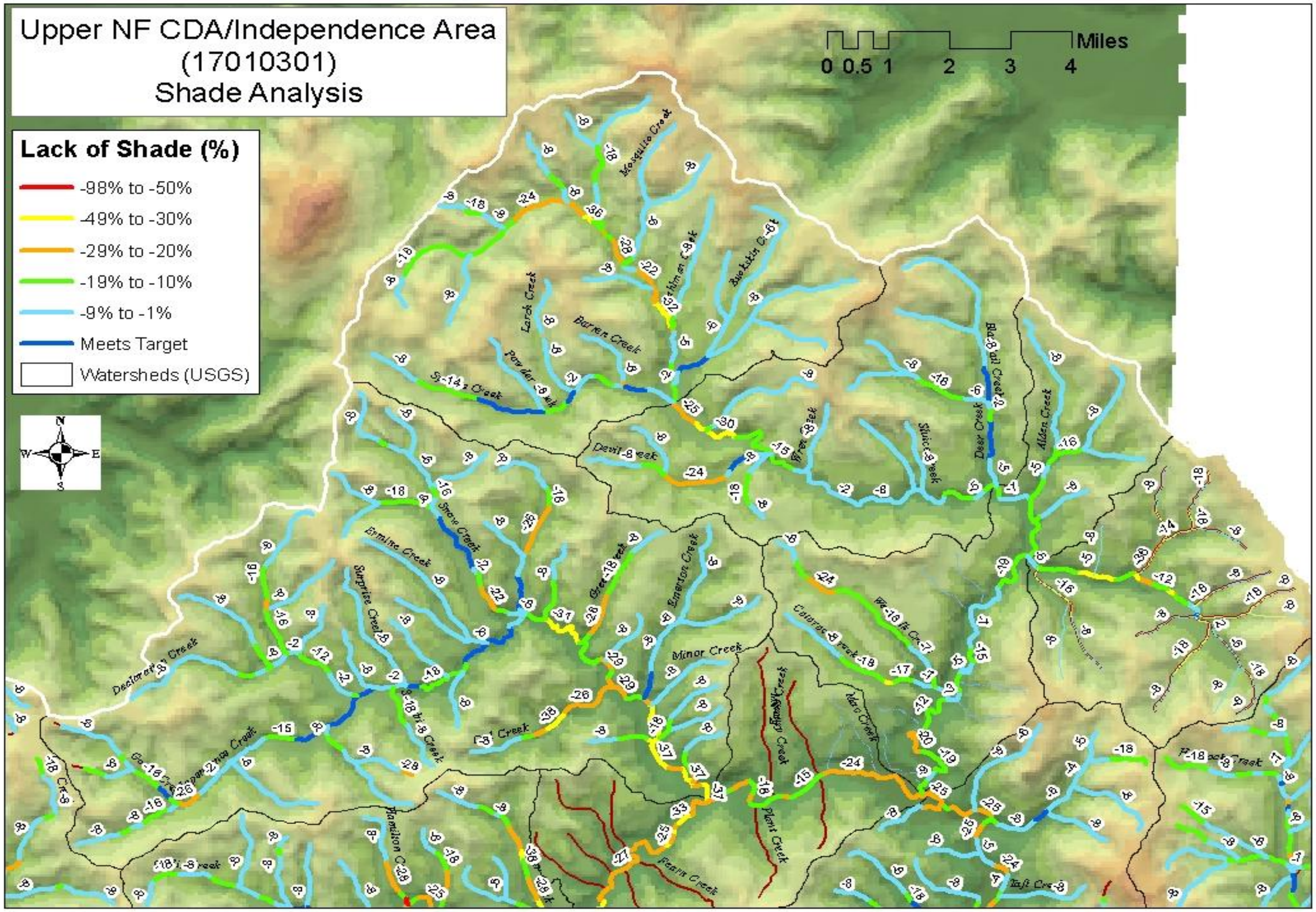

Figure H-6. Shade deficit for the Upper North Fork Coeur d'Alene River area.

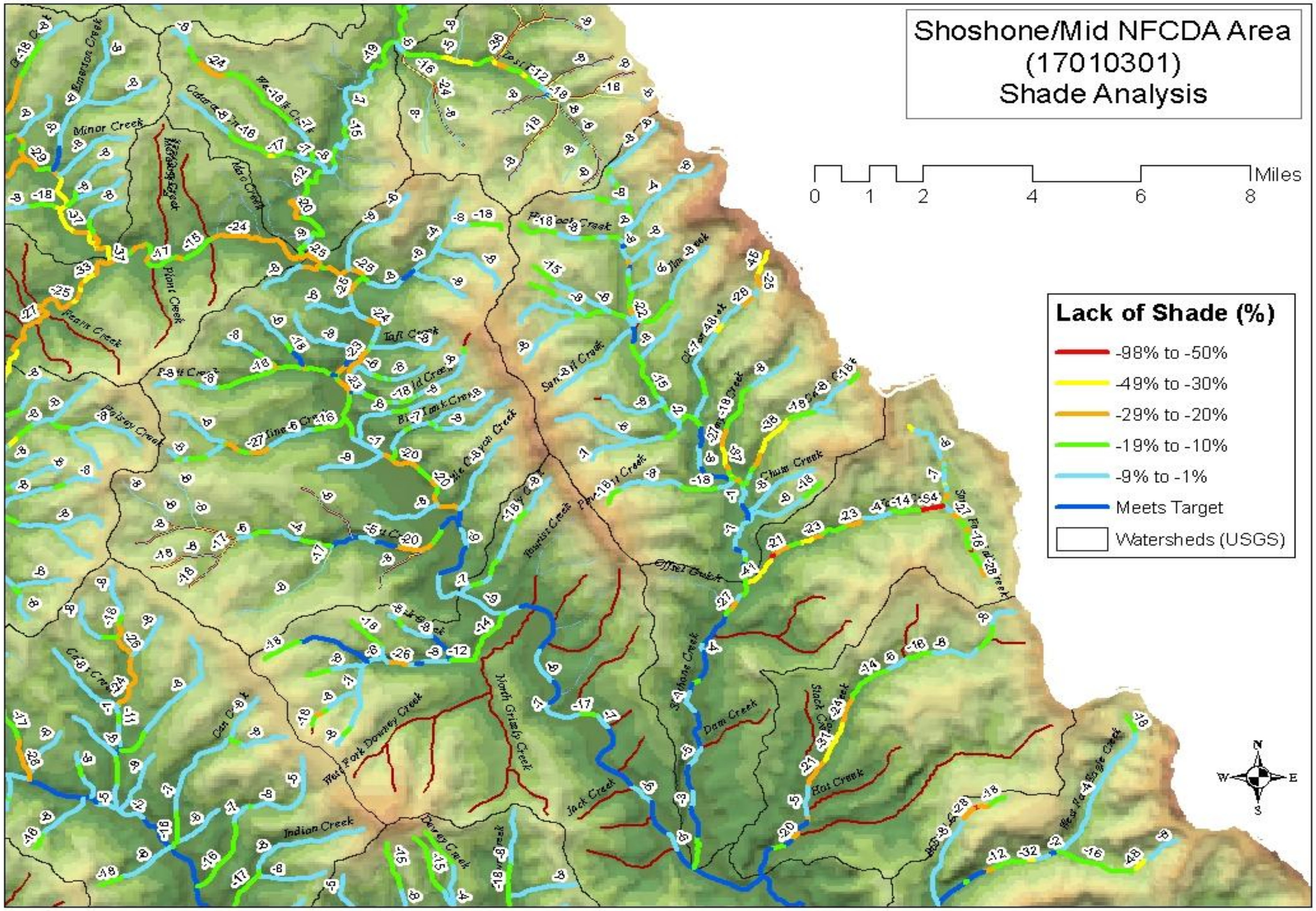

Figure H-7. Shade deficit for the Middle North Fork Coeur d'Alene River area.

Appendix I. Distribution List

Copies of the final report will be provided to the Idaho Department of Environmental Quality State Office, US Environmental Protection Agency, and North Fork Coeur d'Alene River Watershed Advisory Group participants (Table I-1).

Table I-1. North Fork Coeur d'Alene Watershed Advisory Group participants.

Name	Representing	Stakeholder Category
Roy Faler	Livestock/Hay Farmer	Agriculture
Fred Brackebusch	New Jersey Mining Company	Mining
Bill Rust	Mining, Panhandle Basin Advisory Group	
Sandy Schlepp	Independent Logger	Forestry
Larry Yergler Leslee Stanley Jim Best	Shoshone County Commissioners	Local Government
Bob Clark Bob Bevins	North Idaho Fly Casters	Water-Based Recreation
Mike Mihelich	Kootenai Environmental Alliance	Environmental Interests
Jim Ekins	University of Idaho Extension	Universities/Education
Carol Lapan	Private Landowner, Beaver Cr	Private Landowners/ Concerned Citizens
Ingrid Madsen	Private Landowner, Beaver Cr	
George Hemphill	Private Landowner, Beaver Cr	
Larry Runkle	Private Landowner, Beaver Cr	
Doug England	Private Landowner, Beaver Cr	
Brice Shoemaker	Private Landowner	
John Pickard	Private Landowner, Cataldo	
Dan Guy	Private Landowner	
Ed Lider	Concerned Citizen	
Wade Jerome Claire Pitner	Idaho Panhandle National Forests (USFS)	Resource Management Agencies
Jeremy Brandt	Idaho Department of Lands (IDL)	
Mike Stevenson	Bureau of Land Management (BLM)	
Mary Terra-Berns	Idaho Department of Fish and Game (IDFG)	
Aubrey Woodcock	Natural Resources Conservation Service (NRCS)	
Bob Flagor	Kootenai-Shoshone Soil and Water Conservation District (KSSWCD)	
Sandra Raskell	Coeur d'Alene Tribe	Tribal Representative

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Appendix J. Public Comments

Comments were received from the following individuals:

1. Fred Brackebusch—2008, via e-mail
2. Melvin Baillie—April 24, 2013, via e-mail
3. Herb Zanetti—April 24, 2013, via e-mail
4. Anonymous—April 9, 2013, via e-mail
5. Jerry Hanson—March 12, 2013, via e-mail
6. Dale Morris—March 12, 2013, via e-mail
7. Marv Satuloff, interested citizen—March 11, 2013, via e-mail
8. Fred Manthey—March 12, 2013, via e-mail
9. Ross Stout, South Fork Coeur d'Alene River Sewer District—April 9, 2013, letter
10. Gene Turbak—April 4, 2013, letter
11. Ed Anderson—May 13, 2013, letter
12. Fred Brackebusch, WAG member—May 2013, letter
13. Leigh Woodruff, EPA—June 10, 2013, letter
14. Shoshone County Commissioners—June 10, 2013, letter

Comments and responses are included in Table J-1 on the following pages.

Table J-1. Public comments on draft temperature TMDLs and responses.

Comment 1	Kajsa:
Fred Brackebusch, WAG member, March 27, 2008, via e-mail Mr. Brackebusch requested these comments be applied during the 2013 public comment period. Mr. Brackebusch also provided Comment 12 during May 2013.	Following are my comments plus see 3 attached documents: 1. The optimum temperature for cutthroat growth according to Bear et al is 13.6 deg C with 90% upper confidence limit of 17 deg C. The optimum growth temp for rainbow is 15 deg C according to the trout farming guide attached. 2. At constant temps above 20 deg C, according to Bear et al, cutthroat start to die. Bear et al recommend 20 deg C as the standard: "whereas maximum daily stream temperatures below 20 deg C would be adequate to maintain survival of westslope cutthroat trout." The work by Bear et al appears to be correct with respect to the North Fork since we have a good cutthroat trout population and have higher temps than the 13 deg standard now being used. 3. If we used the 20 deg C as the standard upper limit for temp, it looks like a lot of "impaired" streams would be removed from the list. The 20 deg upper limit would be protective because temps decrease at night and there are cold water refugia that fish take advantage of in the river environment. 4. Fish spawn before water warms up in the summer so temp does not appear to be an issue for spawning in the North Fork. 5. See attached photo of Merganser duck choking on a 13 inch cutthroat. Photo was taken on Ferguson ranch near Big Hank. Control of Merganser duck population looks like a good method to increase trout population. 6. The predominant beneficial use of the North Fork in the summer from Shoshone creek downstream is floating [swimming]. Since warm water is necessary for this beneficial use, it should be considered in the temp TMDL process and it appears to be improperly ignored. 7. There are other, more abundant, fish in the North Fork including northern pike minnow, whitefish, and shiner which undoubtedly need higher temps than cutthroat for optimum growth. 8. Cutthroat grow very slowly because of cold water much of the year and because of a limited food supply.

	Attachments  Bear, E.A., T.E. McMahon, and A.V. Zale. 2005. Thermal requirements of westslope cutthroat trout. Final report to the Wild Fish Habitat Initiative, Montana Water Center, Bozeman, MT. Klontz, G.W. 1991. Manual for rainbow trout production on the family-owned farm. Manual prepared for Nelson and Sons, Inc., 118 West 4800 South, Murray, Utah.
Response 1	Mr. Brackebusch, Thank you for your comments. Your comments regarding numeric criteria and standards for temperature are addressed below. Idaho water quality standards for natural background temperatures are perhaps most important in these TMDLs. These are discussed near the end of Appendix B. There is no impairment of beneficial uses or violation of water quality standards where natural background conditions exceed any applicable water quality criteria. The PNV TMDLs for temperature are currently the best tool available in Idaho to document natural background conditions even if they

	exceed the numeric criteria. In addition to referencing your attachments, we have added the peer-reviewed publication associated with the Bear et al. 2005 report. That article is listed below. Bear, E.A., T.E. McMahon, and A.V. Zale. 2007. "Comparative thermal requirements of westslope cutthroat trout and rainbow trout: Implications for species interactions and development of thermal protection standards." *Transactions of the American Fisheries Society* 136:1113-1121. The following responses address your numbered comments: 1 and 2. Bear et al. reported optimum growth temperatures for westslope cutthroat trout of 13.6 °C in both the 2005 report and the 2007 article. Bear et al. (2007) state that fish become lethargic and cease feeding as temperatures approached the species upper lethal limit (20 °C for westslope cutthroat trout and 24 °C for rainbow trout). The 2007 peer-reviewed article goes on to suggest that "maximum daily temperatures near the optimum growth temperatures of 13–15 °C would ensure suitable thermal habitat for westslope cutthroat trout populations." This is because "the optimum growth temperature can be used as an indicator of the **upper range** of suitable habitat for the long-term persistence of salmonids" (emphasis added). Idaho water quality standards include maximum daily temperatures as the maximum instantaneous value or MDMT (see Appendix B, Table B-3). For cold water aquatic life, MDMT must be 22 °C or less. For salmonid spawning, MDMT must be 13 °C or less. Both standards are supported by Bear et al.'s results, particularly since spawning salmonids may be especially sensitive to heat stress. With regard to rainbow trout, Klontz (1991) reported an optimum growth rate for farmed rainbow trout of 15 °C. Bear et al. (2007) reported optimum growth for rainbow trout at 13.1 °C. Again, science suggests the maximum daily temperature should be near the optimum growth temperature. With a mix of salmonids, temperature criteria must be protective for the most sensitive species in order to protect both. In this case, the more sensitive species is westslope cutthroat trout. Idaho's water quality standards for maximum instantaneous stream temperature are supported by these studies rather than contradicted. 3. If an MDMT of 20 °C were used as the upper limit for stream temperature, many streams in the North Fork Coeur d'Alene drainage would not exceed this value and would not be listed as impaired.

	Idaho's standards do include an MDMT of 22 °C for protection of cold water aquatic life. Only the largest streams exceeded this value. However, salmonids are more sensitive to heat stress during spawning, and a salmonid spawning criteria with MDMT of 13 °C applies in those cases. We have data to illustrate widespread use of streams in this subbasin by salmonids, and assessments must utilize the appropriate criteria. You are correct that streams cool overnight and there are cold water refugia that fish can take advantage of in the river environment. It is difficult to set numeric standards that account for all of the variation in the natural environment. For this reason, the MDMT and maximum daily average temperature (MDAT) values are used, and we strive to set these at values that are conservative enough to protect the aquatic life without being overprotective. 4. Salmonid spawning temperature criteria apply at different times depending on elevations in the spring and in a single window for the fall. These windows have been set at the regional level based on Idaho Department of Fish and Game recommendations. They can be found in Appendix B, Table B-3. Some streams exceed the spring criteria, others exceed the fall criteria, and still others exceed both. 5. While mergansers can be predators of trout, they are not within DEQ's jurisdiction. Mergansers are only one of the natural predators; others include otters, eagles, ospreys, and other fish. It's natural that many trout do not survive to adulthood. We have no indication that these natural predators are causing undue harm to cutthroat populations. Instead, trout densities are increasing. On a more humorous note, the photo you provided suggests that cutthroat trout are controlling mergansers just fine. 6. DEQ does not have any temperature criteria related to recreational uses of water bodies. 7. There are many fish species abundant in the North Fork Coeur d'Alene River subbasin. The existing complement is comprised of cold water species. Criteria must be protective of the most sensitive species to ensure long-term survival of this aquatic life community. 8. Growth and survival of cutthroat trout is very dependent on water temperature. At extremely low temperatures, the trout may grow slowly. However, stream temperatures in the North Fork Coeur d'Alene River subbasin are either at or above the optimum temperature for growth during much of the year. Low water temperature is not considered a limiting factor for cutthroat trout.

Comment 2 Melvin Baillie, April 24, 2013, via e-mail	I read the local paper a month ago. It said the river was running 80 degrees. HA HA, what kind of nonsense is that? Where you tested must have a thermal vent, so leave. The people of Shoshone county do not need your help. Your help would most likely mean high tax restrictions to the river and less camping along it so go away.
Response 2	Mr. Baillie, Thank you for your e-mail. Unfortunately, the article was somewhat misleading. There are only small areas in the North Fork Coeur d’Alene River that can get up to 80 degrees Fahrenheit during the hot parts of the year. The water is only this warm in *some areas*, *sometimes*. Most of the streams are quite cold most of the time, as anyone swimming or wading can testify. Stream temperature data confirm our assessment, and there are no thermal vents that we know of. We compiled temperature data and reports from DEQ, the US Forest Service, and the Idaho Department of Fish and Game for the time period 1997–2008. The assessment is described in the draft TMDL in section 2.4 (pages 11–17). Figure 6 on page 12 shows the locations of temperature data recorders and stream segments exceeding Idaho water quality standards. DEQ is made up of Idahoans working for the people of Idaho and is the state agency tasked to ensure clean air, water, and land in the state and protect Idaho citizens from the adverse health impacts of pollution. We do this while working with landowners and managers to maintain access, recreation, and economic opportunities. DEQ’s intentions with these TMDLs are not to increase taxes or reduce camping opportunities on the river. In fact, DEQ staff are working with the watershed advisory group to promote and improve recreational opportunities in the river corridor.
Comment 3 Herb Zanetti, April 24, 2013, via e-mail	DEQ. I would like to comment on the rock bed load that the CDA river has, and a possible solution that could work in lowering the bottom of the river. Zanetti Brothers in the past has used the pine creek stream bed load for their concrete business. ZBI has taken the rock from the creek in late fall when the water table is low and off to one side or the other not disturbing the water flow. The next year the spring high water level replaces the rock that we have removed the year before. Just a thought.

Response 3	Mr. Zanetti, Thank you very much for your suggestions. Dredging is frequently suggested as a tool to reduce sedimentation and temperatures in the river. There are times and places where dredging might be appropriate. However, the long-term effectiveness and consequences often make dredging less desirable than other techniques. Dredging is often a short-term solution to excessive bedload or sedimentation since dredged areas often fill in quickly. Dredging can also have unintended consequences such as the following: – Destabilizing channels and streambed sediments by disturbing natural bed armor and altering bed elevations – Initiating increased erosion of streambanks and streambeds – Reducing habitat complexity by decreasing large woody debris, pools, and other important structures Alternatives may include stream channel reconstruction, which can be accomplished through excavation of banks and channels combined with careful design and installation of stabilizing features. The ultimate goal is generally to maintain a stream channel that can transport sediment effectively in a self-sustaining way. For these temperature TMDLs, the recommendations in section 5.5 apply. In locations where that is not possible, dredging might be needed. Thank you again for your comments.
Comment 4 Anonymous, April 9, 2013, via e-mail	I find it disturbing that you plan to play god and waste more money on your liberal efforts to prevent climate change. You at the DEQ already want to close our forest access. I despise your agency and the threat you make to the public and their lands. It is our land and stop trying to close our roads, dirt bike trails and access. DEQ says that dirt bikes create erosion problems, but you don't bat an eye when a timber company is turned loose on 100 acres due to be clear cut. I support logging but I despise your agency and their efforts to lock me out of my forest by saying a dirt bike will destroy the environment. Go to California. They need your liberal al gore thinking. DEQ (division to eradicate quality of life)
Response 4	Sir/Madam, Thank you for your feedback. It's unfortunate you are distressed by these draft temperature TMDLs, and there seems to be misunderstandings about what these TMDLs mean. DEQ is the State of Idaho's Department of

	Environmental Quality. We are Idahoans working for the people of Idaho and are the state agency tasked by the governor and legislature to ensure clean air, water, and land in the state and protect Idaho citizens from the adverse health impacts of pollution. We do this while working with landowners and managers to maintain access, recreation, and economic opportunities. We strive to do that work efficiently with limited funds. There are times when trails, roads, and logging practices do contribute to impaired water quality and management changes are needed; however, dirt bikes and logging can coexist with a healthy environment on private and public lands.
Comment 5 Jerry Hanson, March 12, 2013, via e-mail	I would encourage that follow-up be required on all plantings. Many projects that I have seen require a minimum for planting then, no follow up to see if additional plantings are needed. Monies should be held back on projects to supplement replanting and maintenance that could be useful in establishing creek banks. I would like to know if Mica creek is included in the Sub basin plan? I noticed Cougar Creek is listed but not other creeks that I recognized on the west side of the lake. Maybe it is another Cougar creek. I know Maximum total Loads have been done on Mica creek and a lot of effort has been put into controlling erosion but I am not sure much effort has been place on stream bank shade.
Response 5	Mr. Hanson, We agree that follow-up monitoring for plantings is very important for successful projects. Many funding sources require this type of monitoring, and we always encourage this practice. Mica Creek and Cougar Creek, tributaries to Coeur d'Alene Lake, are not included in these TMDLs. These TMDLs cover the North Fork Coeur d'Alene River and its tributaries upstream of the Kingston/Enaville area. Mica Creek and Cougar Creek, tributaries to the lake, are included in the Coeur d'Alene Lake tributaries TMDL available for download here: http://www.deq.idaho.gov/water-quality/surface-water/tmdls/table-of-sbas-tmdls/coeur-dalene-lake-and-river-subbasin.aspx. We appreciate your comments and questions.

Comment 6 Dale Morris, March 12, 2013, via e-mail	After reading the article in the CDA Press about warm water in the CDA river area causing bad situations for trout, makes me wonder if the same things has happened to the Spokane River, as the trout in there, have almost disappeared in the past few years. Only seem to catch a lot of Bass and Sucker fish. Many years ago, this was excellent Trout fishing, and now only later in the summer, will you even ever see one. Plenty of small mouth bass there the past few years, but trout almost nonexistent.
Response 6	Mr. Morris, Thank you for your interest and comments. The Spokane River in Idaho is currently listed as impaired by phosphorus, cadmium, lead, and zinc. Water temperatures are sometimes higher than optimal temperatures for trout. However, modeling has demonstrated that the Spokane River in Idaho has naturally warmer water temperatures than other parts of the region. Modeling showed that, because of increased depth, current conditions are actually cooler now than they would be without impacts of human development. Because Spokane River water temperatures are higher than the Coeur d'Alene River or St. Joe River systems, introduced bass and other warm water-tolerant fish may have an advantage. Actions to provide good water quality and habitat can help provide angling opportunities into the future. Please contact the Idaho Department of Fish and Game if you would like further information.

Comment 7 Marv Satuloff, interested citizen, March 11, 2013, via e-mail	My goodness, over 200 pages to tell us that we need to plant trees and bushes along the north fork waterways. No wonder our government needs so much money. And an unproven theory-global warming is cited. Are you people nuts or just trying to justify your jobs? 2-3 pages would have done the job & saved the taxpayers thousands if not millions of dollars. What a joke!
Response 7	Mr. Satuloff, We understand your frustration with the document's length. We have been trying to reduce the length of TMDLs while maintaining consistency statewide with a TMDL template. The template is intended to make information in TMDLs easier for users to find and to help DEQ ensure all of the federally required components of a TMDL are included. We have reason to believe elevated stream temperatures are caused by increased solar radiation due to wider, shallower channels and removal of streamside vegetation that would have provided shade. Global warming is not cited as a cause for elevated stream temperatures in the Upper (North

	Fork) Coeur d'Alene River subbasin. Rather, climate change is mentioned as something to consider for future management decisions and TMDL implementation. We strive to do the work that's required to meet Idaho's laws and the needs of Idaho's people, and to do that work efficiently with limited funds. Thank you for your interest and comments.
Comment 8 Fred Manthey, March 12, 2013, via e-mail	I read with interest the March 12th article in the Coeur d'Alene Press reporting hot streams in Kootenai and Shoshone Counties. Frankly, I had to check the date of the paper, to make sure it was not April 1st. "900 miles of stream in Kootenai and Shoshone counties are heating up to as high as 80 degrees Fahrenheit, confirmed Kajsa Stromberg, DEQ spokesperson." I have been talking to people who have lived here most or all of their lives, and cannot find anyone who can support your statements about 80 degree water temperatures, or 900 miles of overly warm waters. We can agree that trout are sensitive to water temperatures. And 80 degree water over a period of time would most likely be detrimental to the trout population. However, we have also heard for years that the fish in southern Idaho grow faster and larger, because the warmer water supports more food sources. It would seem logical that the streams here are much colder than those in southern Idaho. Please mail or email a map showing the locations of these extreme temperatures, and the data that has been collected to support that claim. Also, please furnish the report showing the dates and respective temperatures when this data was collected. How was this information collected? Do you have infrared aerial photos that accurately show the extent of these conditions? I have examined the 217 page Draft Upper Coeur d'Alene River Sub Basin Temperature Total Maximum Daily Loads Addendum. It seems like a lot of paperwork in a effort to support your statement in the CDA Press. Kajsa, could you just tell me where to look in that 217 page document to confirm the locations of 900 miles of hot streams, and the dates and methods used to collect that data? I would like to find those streams. In 50 years, I have never found a stream around here that would be comfortable to stand in for any length of time.
Response 8	Mr. Manthey, Unfortunately, there were a few misquotes and misleading statements in the *Coeur d'Alene Press* article. As you stated, there are not 900 miles of

	80 degree Fahrenheit water in the North Fork Coeur d'Alene River subbasin. That was confusing for many readers. Some areas in the North Fork Coeur d'Alene River can get up to 80 degrees Fahrenheit during the hot parts of the year. So the water is only this warm in *some areas, sometimes*. Most of the streams are quite cold most of the time, as anyone swimming or wading can testify. Stream temperature data confirm our assessment. Stream temperature data were collected by deploying sensors with data loggers in streams, usually for several months. The assessment is described in the draft TMDL in section 2.4 (pages 11–17). Figure 6 on page 12 shows the locations of temperature data recorders and stream segments exceeding Idaho water quality standards. It can be difficult to sort through 217 pages. It is a lot of paperwork and I often wish these documents could be shorter as well. The Idaho Department of Fish and Game/US Forest Service report "Movement, Mortality, and Habitat Use of Coeur d'Alene River Cutthroat Trout, Panhandle Region 2004" found the warmest water temperatures in the North Fork Coeur d'Alene River near Shoshone Creek that were 25–28 degrees Celsius (77–82 degrees Fahrenheit) (page 79). This pattern has been consistently found in several studies over time. The warmest temperatures are near Shoshone Creek, and the river gets cooler as it gets closer to Enaville. We also have aerial thermal infrared imaging for the lower 35 miles of the North Fork Coeur d'Alene River (Watershed Sciences, Inc. 2007). [Note: Stream temperature data and supporting documentation were provided to Mr. Manthey on DEQ's ftp site.]
Comment 9 Ross Stout, South Fork Coeur d'Alene River Sewer District, April 9, 2013, letter	As you know the South Fork Cd'A River Sewer District's treatment facilities discharge to a major tributary of the Cd'A river system. The primary reason for the deficiencies in the South Fork reach is due to one hundred years of unregulated mining activity. I am also sure that you are aware the District has been targeted to collect river temperature data, at no cost to the regulatory agencies, in the upcoming discharge permit. This is in addition to the beleaguering metals issues. The demographics of this are indicate that our citizens are facing ever increasing difficulties with a declining population that has a higher than average age and lower than average income. The most recent Superfund Record of Decision (ROD) appears to indicate that it may not be possible to meet water quality criteria in the South Fork Cd'A River. The District patrons need your help working with USEPA and IDEQ to determine the appropriate water quality standards for this unique

	watershed. I urge you to take these facts into consideration. Thank you for the opportunity to provide comment.
Response 9	Mr. Stout, Thank you for your interest and comments. These temperature TMDLs apply only to the North Fork Coeur d'Alene River and its tributaries upstream of the confluence with the South Fork Coeur d'Alene River. As such, the South Fork Coeur d'Alene River will not be affected by these TMDLs. We recognize the difficulties faced by the South Fork Coeur d'Alene River Sewer District and DEQ is committed to working with you to resolve these issues to the best of our ability.
Comment 10 Gene Turbak, April 4, 2013, letter	I read your article and comments regarding the temperature of water and fish. I appreciate your concern of the trout. That is thoughtful of you and DEQ. I do not think you are going to help the trout by adding more material to the river – CDA North Fork. I think it would help the problem if you could get a "backhoe" and remove the dirt, silt, sand, etc. that has filled in the channels and holes. Dig a hole on shore and bury it. I love to fish the N.F.C.D.A. River – from Beaver Creek to Cataldo, and I have never witnessed any fish floating from spring to fall. I am sure there has had many changes in water temperatures over the years. The cutthroat trout are native fish of the rivers. They know how to survive. They will find the water temp. they like. If the water is 80° - I do not see any swimmers. You stated we like our fish cooked but not before we catch them. How are we going to cook them when you cannot keep them? They should change the limit to keep 5 cutthroat "I" rainbow. There are plenty of cutthroat. Plant some good rainbows – not the tank hatchery fish. I used to catch some nice rainbows in the 50s, 60s, 70s and 80s, but now there are hardly none. God says to enjoy the wonders of nature, but don't disturb it. So just deepen the riffles and holes by removing the silt, sand, etc. Do not add more material. High water will wash it out. I would like to attend the meeting but I do not like to drive to C.D.A. when you think the problem is in Kellogg. Good luck and thank you again for your concern.

<table>
<tr><td>Response 10</td><td>Mr. Turbak,

Thank you for your comments and observations. Dredging is frequently suggested as a tool to reduce sedimentation and temperatures in the river. There are times and places where dredging might be appropriate. However, the long-term effectiveness and consequences often make dredging less desirable than other techniques.

Dredging is often a short-term solution to excessive bedload or sedimentation since dredged areas often fill in quickly. Dredging can also have unintended consequences such as the following:
– Destabilizing channels and streambed sediments by disturbing natural bed armor and altering bed elevations
– Initiating increased erosion of streambanks and streambeds
– Reducing habitat complexity by decreasing large woody debris, pools, and other important structures

Alternatives may include stream channel reconstruction, which can be accomplished through excavation of banks and channels combined with careful design and installation of stabilizing features. The ultimate goal is generally to maintain a stream channel that can transport sediment effectively in a self-sustaining way. For these temperature TMDLs, the recommendations in section 5.5 apply.

In locations where that is not possible, dredging might be needed.

Regarding fishing regulations and fish stocking, those issues are not within DEQ's jurisdiction. The Idaho Department of Fish and Game manages fishing regulations and fish stocking within Idaho. I have forwarded your comments to them.

Thank you again for your comments.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Comment 11

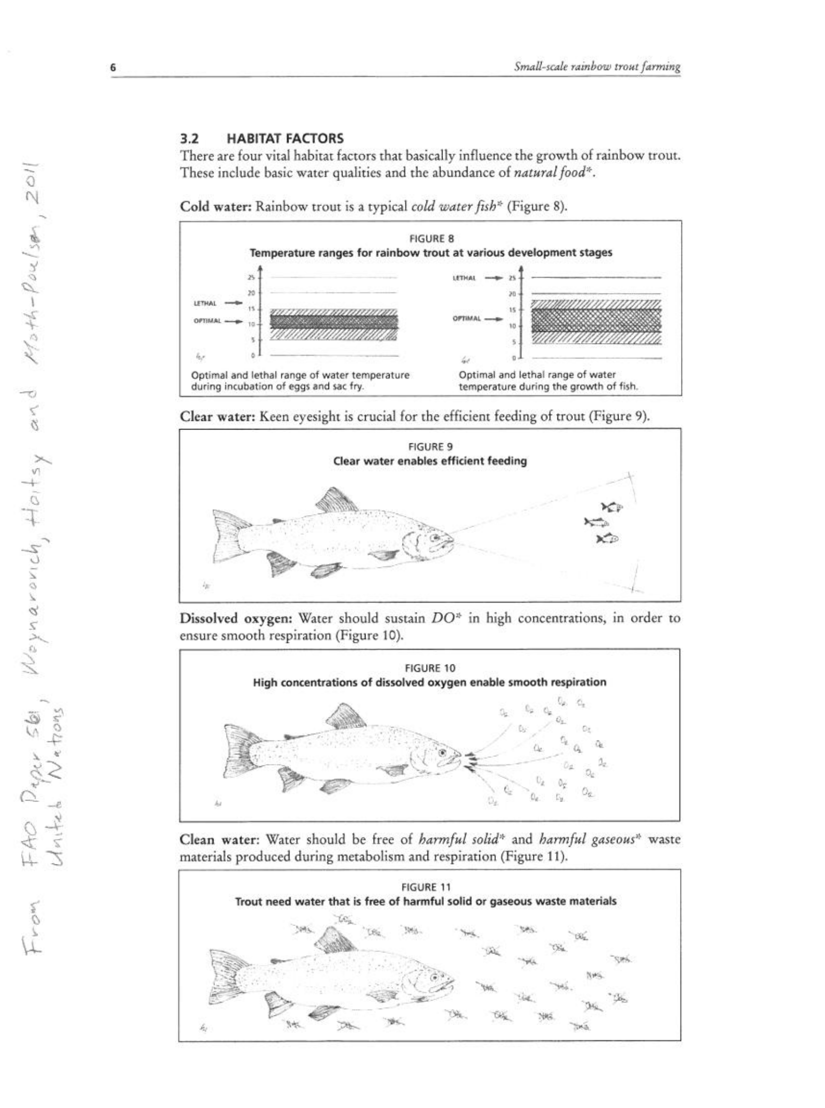
Ed Anderson, May 13, 2013, letter</td><td>1. I am suspicious that this matter is another ploy to involve the EPA in the regulation of our property rights. This makes me very reluctant to buy into the problem.
2. I would like the state to be more independent of the EPA, and take a strict stand on the protection of private property
3. Back in the early 1900's the river was a main log floating stream and was dredged on a regular basis to create a deep channel to float logs. Since the "college graduates" were hired in the 60's and 70's and to date they did not want any equipment in the river, now the bed is full of gravel and has to flatten out because of the bed loading.
4. I do like the idea of dredging a deep channel in the river. The gravel would be a valuable resource.</td></tr>
</table>

Response 11	Mr. Anderson, Thank you for your comments and concerns. These temperature TMDLs are to address elevated water temperatures and meet the State of Idaho's water quality standards. DEQ must follow Idaho's laws to ensure protection of our environment and public health. Private property rights are an important consideration. Streams in the North Fork Coeur d'Alene River subbasin were historically used for transport of logs through a series of splash dams. This was important for Idaho's economic development, but the full effects of this system were not known at that time. Now, it's clear that transporting logs this way does significant damage to river systems. That history is part of the reason stream channels are still repairing today. Dredging is frequently suggested as a tool to reduce sedimentation and temperatures in the river. There are times and places where dredging might be appropriate. However, the long-term effectiveness and consequences often make dredging less desirable than other techniques. Dredging is often a short-term solution to excessive bedload or sedimentation since dredged areas often fill in quickly. Dredging can also have unintended consequences such as the following: – Destabilizing channels and streambed sediments by disturbing natural bed armor and altering bed elevations – Initiating increased erosion of streambanks and streambeds – Reducing habitat complexity by decreasing large woody debris, pools, and other important structures Alternatives may include stream channel reconstruction, which can be accomplished through excavation of banks and channels combined with careful design and installation of stabilizing features. In a location where that is not possible, dredging might be needed. The ultimate goal is generally to maintain a stream channel that can transport sediment effectively in a self-sustaining way. For these temperature TMDLs, the recommendations in section 5.5 apply.

Comment 12

Fred Brackebusch, WAG member, May 2013, letter

1. It is no surprise that larger streams have the most lack of shade because trees and shrubs are not large enough to shade these areas. Page xiii.
2. Because the trout fishery is one of the best in the State of Idaho according to Idaho Fish and Game, it follows that the temperature standards must be incorrect. Idaho DEQ refuses to change the standards so we are stuck with a real stupid situation. Rainbow trout farmers have different and higher temperature standards than the State. Who do you suppose is correct: 1) a trout farmer with his investment at stake or 2) the State DEQ who has something to gain from an inventory of "impaired streams" to spend taxpayers' money on. Following is another example of trout farmers' standards showing higher temperatures for both spawning and adult fish.



From FAO Paper 561, Woynarovich, Hoitsy and Moth-Poulsen, 2011 United Nations

6 — *Small-scale rainbow trout farming*

3.2 HABITAT FACTORS

There are four vital habitat factors that basically influence the growth of rainbow trout. These include basic water qualities and the abundance of *natural food**.

Cold water: Rainbow trout is a typical *cold water fish** (Figure 8).

FIGURE 8
Temperature ranges for rainbow trout at various development stages

Optimal and lethal range of water temperature during incubation of eggs and sac fry.

Optimal and lethal range of water temperature during the growth of fish.

Clear water: Keen eyesight is crucial for the efficient feeding of trout (Figure 9).

FIGURE 9
Clear water enables efficient feeding

Dissolved oxygen: Water should sustain *DO** in high concentrations, in order to ensure smooth respiration (Figure 10).

FIGURE 10
High concentrations of dissolved oxygen enable smooth respiration

Clean water: Water should be free of *harmful solid** and *harmful gaseous** waste materials produced during metabolism and respiration (Figure 11).

FIGURE 11
Trout need water that is free of harmful solid or gaseous waste materials

3. Page 14. Dupont study speculates that trout were suffering from heat

	stress and also speculates that fish "seemed to lose weight." 4. Page 17. There is no climatological data presented for the North Fork, yet warming climate is postulated. Weather records for Spokane show a cooling trend over a 130 year period based on daily extreme temperatures (see attached discussion). Obviously, warming (or cooling) at some other location on the earth does not affect the North Fork. Following is a discussion of climatological data from stations at Spokane, Missoula, and Boise which have the nearest long term data for comparison to the North Fork. See PDF file "Record Temps Discussion May 2013"
Response 12	Mr. Brackebusch, Thank you for your comments. You raise good questions about management of temperature. 1. The larger streams don't necessarily have the most lack of shade. Shade deficits are highest in areas such as Tepee and Trail Creeks just upstream of their confluence, stretches of upper Beaver Creek, portions of Falls Creek, and some tributaries to the lower North Fork Coeur d'Alene River. These are small to moderate-sized streams with shade deficits greater than 50%. Larger streams may have lower shade deficits but higher excess solar loads. The highest excess solar loads don't always occur where shade deficits are highest. Solar loads are calculated from a combination of shade and channel width. They are the amount of solar radiation reaching the stream's surface area. Excess solar loads are high when there is a combination of high surface area and high shade deficit. We are only treating the excess solar load and recognize that larger, wider streams are often naturally less shaded. For example, the largest stream assessment unit is the Lower North Fork Coeur d'Alene River (AU#001_05) (Table F-65). Its channel width was estimated as 46–59 meters. Shade targets for larger streams are determined based on stream order, nearby forest vegetation, and channel width. Targets take into account the type of vegetation that can be found along these larger, low-gradient streams as well as the fraction of shade the vegetation would provide. In this case, Nonforest Group 2 would be expected to provide only 10–12% shade at target conditions. The estimated existing shade was 0–10%. The shade deficits are low (1–12%), the necessary load reductions percentage is low (9%), but the absolute solar load reduction needed is high (993,591 kWh/day). Compare that to tributaries to the lower North Fork Coeur d'Alene

	River (AU#001_02). These tributaries are 1–4 meters wide and in Forest Group B or Nonforest Group 1. Shade targets are 78–98% on these narrow streams. The estimated existing shade was 0–10%. Shade deficits were wide ranging (8–98%), the necessary load reduction percentage was high (81%), and the absolute solar load reduction needed was 155,380 kWh/day. TMDL implementation strategies should take into account these variations. Strategies should focus on doing the most good for aquatic life rather than simply focusing on areas with high shade deficits or high excess solar loads. 2. The cutthroat trout fishery is considered one of the best in Idaho by the Idaho Department of Fish and Game (IDFG). According to recent reports, cutthroat trout densities have increased in the North Fork Coeur d'Alene River since the 1970s, and this is attributed to changes in regulations and improving habitat. In tributaries, the link between improved habitats and improved aquatic life communities has also been documented by DEQ and the US Forest Service. However, IDFG also notes that cutthroat trout densities in the North Fork Coeur d'Alene River remain at about two-thirds that of the St. Joe River. There remains room for improvement to provide temperature, sediment, and metals conditions fully protective of aquatic life to support management goals for the species. For example, IDFG's draft management plan for cutthroat trout states that water temperatures need to be reduced in much of the Coeur d'Alene River system. Setting numeric temperature criteria is very difficult. As stated above, it is difficult to account for all the variation in the natural environment. For this reason, the maximum daily maximum temperature (MDMT) and maximum daily average temperature (MDAT) values are used, and we strive to set these at values that are conservative enough to protect the aquatic life without being over-protective. Additionally, Idaho's criteria must be approved by EPA for Clean Water Act purposes. If EPA disapproves Idaho's standards, they may promulgate federal standards for us. EPA's current recommended criteria are even colder than our current temperature criteria. DEQ has investigated rulemaking for temperature on several occasions and has conducted research throughout the state to assess the situation. Given EPA's recommended stream temperature criteria, DEQ has concluded that the best course is to use the current standards with an emphasis on natural background conditions. Furthermore, it makes sense that rainbow trout farmers may have different water temperature recommendations than Idaho standards set for wild fish. The fish encounter very different conditions in

	aquaculture settings compared to natural conditions. Even then, the FAO paper you cite states that "the best growth out of the consumed feed varies from 13 °C to 15 °C. Hence, the optimal utilization of feed and the maximum appetite of rainbow trout also fall within this range of water temperature." This range is near or below Idaho's water quality standards for stream temperature. 3. Dupont's study did speculate that trout were suffering from heat stress and that fish seemed to lose weight at higher temperatures. This is consistent with many peer-reviewed scientific studies that found trout condition declines at high temperatures. 4. Climatological data for the North Fork Coeur d'Alene River subbasin was not discussed in detail. However, several studies and reports are referenced that suggest a changing climate across the American West and Pacific Northwest (NRC 2010; Hamlet et al. 2005; Karl et al. 2009; Mote and Salathe 2009; Isaak and Luce et al. 2010; Williams et al. 2009; and Rieman et al. 2007). Large-scale discussions of climate can be appropriate. Warming or cooling at other locations on earth can affect climate conditions in the North Fork Coeur d'Alene River subbasin. For example, conditions in the Pacific Ocean are extremely important to local and regional weather patterns. The Pacific Decadal Oscillation and El Nino/Southern Oscillation are two Pacific Ocean patterns that influence atmospheric conditions as well as our local weather. We believe elevated stream temperatures are caused by increased solar radiation due to wider, shallower channels and removal of streamside vegetation that would have provided shade. Global warming is not cited as a cause for elevated stream temperatures in the Upper (North Fork) Coeur d'Alene River subbasin. Rather, climate change is mentioned as something to consider for future management decisions and TMDL implementation.
Comment 13 Leigh Woodruff, EPA, June 10, 2013, letter	Thank you for the opportunity to review the draft Upper (North Fork) Coeur d'Alene River Subbasin Temperature TMDL Maximum Daily Loads. The draft TMDL is thorough and very well written, and we have no major concerns. The following comments are provided primarily as suggestions to improve the document. P.10. Criteria to support beneficial uses. This section would be more complete if a brief discussion of the Idaho water quality standards natural conditions provisions were included.

	P.26. PNV temperature TMDL discussion. Suggested wording revision in 4th full paragraph: *Effective shade and solar loads at PNV conditions are assumed to be the natural background conditions of the water body. Assuming no point sources or other anthropogenic sources of heat exist in the watershed, stream temperatures under these conditions are assumed to be natural...* P.27. Natural bankfull width is an assumption/target in the TMDL which is needed to achieve natural temperatures. The existing width of several streams (Beaver, Prichard, Trail, etc.) is considerably wider than natural, especially in the lower reaches. Because these widths will need to be reduced in order to meet the TMDL objectives, we recommend that the natural bankfull width targets be more prominently displayed and discussed as part of the load allocation (Section 5.4), in order to highlight the issue for stakeholders, and make it easier for them to see where the major channel problems are located. P.39. Estimates of Existing Shade. In some cases there are significant differences between estimated and measured shade. The document indicates that visual estimates were adjusted based on measured data. Were these adjustments specific to each reach in which the discrepancy was noted? This would be preferable, given the wide range of differences in some cases. P.26. Stormwater and NPDES permitting. We recommend that wording in this section be replaces with standard wording for MS4, construction and industrial stormwater which was worked out with Marti Bridges, IDEQ TMDL program manager for another TMDL (see attached). P.51. Strategic Approach. We support the strong language included about the importance of protecting areas of cold water refugia, restoring large wood and boulders, and managing floodplains to ensure hydrologic connectivity. While shade and channel width are the primary targets of the TMDL, stream temperature problems are dynamic and complex. We appreciate that you have drawn attention to the need to address other very important aspects of stream temperature in order to ensure full support of fisheries and other beneficial uses. Appendix D, Table D-2. It is not clear how the different types of channel width information in the header to this table were used to derive target and existing channel widths. Perhaps this could be more fully explained in the text (p.28). If you have any questions about these comments, please contact me at (208) 378-5774, or woodruff.leigh@epa.gov.

Response 13	Mr. Woodruff, Thank you for your comments. P.10. Detailed information on natural background conditions is included in Appendix B and is referred to on page 10. P.26. This statement has been revised with the suggested wording. "Effective shade and solar loads at PNV conditions are assumed to be the natural background conditions of the water body. Assuming no point sources or other anthropogenic sources of heat exist in the watershed, stream temperatures under these conditions are assumed to be natural and consistent with Idaho water quality standards even if they exceed the numeric criteria." P. 27. Restoring natural channel width should be an important consideration for streams in the North Fork Coeur d'Alene River subbasin. This is emphasized in the implementation discussion of section 5.5. P. 39. If there were differences in estimated and measured existing shade, adjustments were made to the reaches where such differences were observed. P. 46. The wording in this section for stormwater and NPDES permitting was replaced with standard template language recently negotiated between DEQ and EPA. P. 51. Thank you for your support of the TMDL implementation strategic approach. These are some of the most important components of the TMDL document and the future of cold water aquatic life. Stream temperature is a complex issue, particularly in larger river systems. Appendix D, Table D-2. The Clearwater curve was selected as the model for natural channel width. This selection is described on page 28. The other information included in Table D-2 compares additional channel width information from other data sources.

Comment 14 Shoshone County Commissioners, June 10, 2013, letter	Shoshone County respectfully submits the following comments in response to the Upper (North Fork) Coeur d'Alene River Subbasin Temperature TMDL Draft further referred to as the (DRAFT). Shoshone County along with its Resource Committee of citizens and in cooperation with WAG members Bill Rust and Fred Brackebusch is pleased to provide the following comments intended to provide guidance in the implementation of the DRAFT. The County along with our Resource committee and other Shoshone County citizens have a strong interest in management of waters and lands within County borders to provide robust levels of economic, ecologic and social benefits. We appreciate the opportunity to provide comment on the DRAFT and request that you carefully consider our comments in your revisions of the DRAFT. As elected officials Shoshone County Commissioners take an oath to uphold the constitutions and the laws of the United States and the State of Idaho. We are charged with protecting and ensuring that the customs, culture and socio-economic viability of Shoshone County are protected for present and future generations of residents. Federal and State statutes require agencies to coordinate with local government in developing and implementing plans, policies and management actions. Shoshone County has evoked coordination in Resolution 2009-07 and looks forward to coordinating with IDEQ. We have several primary concerns with the DRAFT and hope the final version is responsive to these suggestions for improvement. 1) **Climate change.** There is mention of future climate change from trapping of green house gases and warming Pacific air temperatures and future warming from 3-10 degrees F in the next century. While there are documents supporting global warming, there are just as many supporting global cooling and in Fred Brackebusch's study (see attachment) of Spokane, Missoula, and Boise weather data for the last century and beyond, the exact opposite is true for the Inland Empire region showing a global cooling trend. There is no mention of solar spots and their consideration to rise of temperatures which may have a more pronounced effect on short term temperature increases and is not controlled by earthly factors. Common sense should be considered when considering the climate change issue. Factories in the mid twentieth century contributed to pollution, belching smoke into the atmosphere. Technological improvements and greater environmental

	awareness have created, in America, greatly refined air quality and pollution controls which must be considered for industry to exist. 2) **The Endangered Species Act (ESA).** The ESA was not ill-conceived in the beginning, but misuse by land developers, greedy conservation interests and the EPA.s Orwellian reverse speak, has transformed ESA into the most misused, unjust and unconstitutional abrogation of our civil liberties in US history. When considering a river for bull trout habitat and considering the numbers of this species now inhabiting streams throughout Idaho and other states, a strong effort to delist this species as recovered by State and federal agencies should not only be considered but the attempt should be in full process at this time. If not one bull trout ever swims up the Coeur d'Alene River it will certainly not endanger them in the most miniscule amount. Sadly though, great expectations of protecting are environment, has morphed into an enormous runaway government train dragging out rights, economy… and species with it. It is Shoshone County's position that any consideration of ecological emphasis must consider that the socio-economic and cultural impacts on Shoshone County through the coordination process. Even Governor Butch Otter in his comments on the 2012 National Forest Planning Rule explicitly emphasized the importance of economic factors of local communities when considering ecological factors such as "bull trout habitat. 3) **Temperature Readings.** Temperature readings have been discussed of reaching as high as 80 deg. Far. The County has to question whether this reading is accurate or relevant. With the normal cool night temperature readings mostly in the 40-45 deg. Far. Range, this high temperature is not a constant and when the temperature does exceed the allowable temperature for salmonid sustainability three things must be considered: 1) this temperature does not last for any duration of time, mostly because there is a small timeframe for direct sun, usually mid-day, 2) these warm, dog days happen for usually a 10 day to two week period in late July or August, 3) when this warming phenomenon occurs experience suggests that fish move to deeper, cooler water. In fact Shoshone County supports a management plan that would call for sediment removal (river rock) to create deeper pools for warm temperature conditions.

	4) **Idaho Fish and Game classification of the North Fork of the Coeur d'Alene.** Idaho Fish and Game rates the North Fork as "one of the best cutthroat fishing streams in the Panhandle" and on their website note double the amount of cutthroat over 13" in just the last few years of statistics. Shoshone County believes that consideration for present fishing quality on the river is evidence that stream quality is improving. 5) **Clean Water Act (CWA).** Shoshone County believes that the water quality criteria for temperature and the TMDL process that EPA, Region 10 has forced Idaho to adopt is not in accordance with the intent of the Clean Water Act. In the development of the Temperature TMDL for the North Fork of the CD'A River it has become obvious that the numeric water quality criteria for salmonid spawning and cold water aquatic life are lower than the naturally occurring conditions in the watershed. EPA, Region 10 needs to coordinate their plan with Idaho DEQ and Shoshone County and contribute monetarily along with other resources to work toward a solution of the temperature TMDL problem which naturally occurs in this watershed. 6) **Statewide problem.** Although these comments apply to the North Fork Temperature TMDL, the problem is state wide. According to the Idaho Water Quality Assessment Report for 2010 from the EPA website, Idaho has 61,926 miles of assessed streams and 33,984 are impaired. TMDLs have been completed on 16,247 miles and TMDLs are needed on 17,208. Another table says the causes of impairment are mostly temperature and sediment. These studies being about half done will cost Idaho nearly $200 million to complete. Shoshone County believes the State of Idaho would be better served to use these funds on projects that will actually improve water quality in state private lands. We also feel the State of Idaho along with Shoshone County need to work toward "coordinating" with USFS, BLM, EPA, and other federal agencies as mandated by Federal Land Policy and Management Act (FLPMA), National Forest Management Act (NFMA), National Environmental Policy Act (NEPA) and other acts to the betterment of the citizens of Idaho. Shoshone County appreciates the opportunity to provide comments on this DRAFT. The ultimate measure of success of this DRAFT will be on-the –ground accomplishments that improve this

	watershed while enhancing the health, prosperity, and the sustainability of our local communities. We look forward to meeting with staff and discussing any of our concerns in more detail. Shoshone County Commissioners s/Larry Yergler Larry Yergler, Chairman s/Leslee Stanley Leslee Stanley, Commissioner s/Jim Best Jim Best, Commissioner
Response 14	Dear Commissioners, Thank you very much for your involvement and comments. 1. We have reason to believe elevated stream temperatures are caused by increased solar radiation due to wider, shallower channels and removal of streamside vegetation that would have provided shade. Global warming is not cited as a cause for elevated stream temperatures in the Upper (North Fork) Coeur d'Alene River subbasin. Rather, climate change is mentioned as something to consider for future management decisions and TMDL implementation. Despite the public controversy, there is a wide body of scientific evidence suggesting that climate change should be considered as a possibility for future management decisions. 2. Decisions about Endangered Species Act status are not within DEQ's jurisdiction. This TMDL addresses water quality standards. Bull trout are among the many aquatic organisms protected by those standards. 3. The highest water temperature measurements were from 75–80 °F in portions of the North Fork Coeur d'Alene River near Shoshone Creek. These data are both accurate and relevant. The temperatures do cool during the night, may be cooler in other parts of the river, and cool eventually in the fall. However, they are higher than the acute temperature criteria for cold water aquatic life. The temperatures exceed the water quality standards. Even short-term exposures to temperatures this high can be harmful. 4. The North Fork Coeur d'Alene River is probably one of the best cutthroat trout fishing streams in the Panhandle. Cutthroat trout have been increasing in number and size. We agree that there is evidence of improving water quality. Water quality has been improving; however,

	there are still water quality impairments and further improvement is needed. 5. Idaho's water quality standards include a provision for natural background conditions. Water temperatures at natural background conditions do not exceed the standards, even if they exceed the numeric criteria. Documenting natural background conditions can be very challenging, especially in watersheds with significant human impacts. The best tool that we currently have to address this situation is the PNV methodology employed in this TMDL. 6. Idaho's most current assessment of water quality is contained in the draft 2012 Integrated Report. This report includes a total of 95,119 miles of stream statewide. There are TMDLs in place for 23,068 miles of stream. TMDLs are needed for another 12,649 miles of stream. Water bodies can be included in multiple categories of the Integrated Report. For that reason, stream mile figures from the different categories can't be simply added together. Shoshone County Commissioners and Shoshone County citizens have been involved with the North Fork Coeur d'Alene River Watershed Advisory Group since its beginning. Coordination with local government and local citizens is very important and we will continue to make ample opportunities available to participate in TMDL development and implementation. We agree that the ultimate measure of success will be on-the-ground accomplishments that improve this watershed while enhancing the health, prosperity, and sustainability of our local communities. We look forward to working with you to make that happen.

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