5. Total Maximum Daily Loads

A TMDL prescribes an upper limit on discharge of a pollutant from all sources so as to assure water quality standards are met. It further allocates this load capacity (LC) among the various sources of the pollutant. Pollutant sources fall into two broad classes: point sources, each of which receives a wasteload allocation (WLA); and nonpoint sources, each of which receives a load allocation (LA). Natural background (NB), when present, is considered part of the LA, but is often broken out on its own because it represents a part of the load not subject to control. Because of uncertainties regarding quantification of loads and the relation of specific loads to attainment of water quality standards, the rules regarding TMDLs (Water quality planning and management, 40 CFR Part 130) require that a margin of safety (MOS) be a part of the TMDL.

Practically, the margin of safety is a reduction in the load capacity that is 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. This can be summarized symbolically as the equation: LC = MOS + NB + LA + WLA = TMDL. 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 necessary margin of safety is determined and subtracted; then natural background, if relevant, is quantified and subtracted; and then the remainder is allocated among pollutant sources. When the breakdown and allocation are completed the result is a TMDL, which must equal the load capacity.

Another step in a loading analysis is the quantification of current pollutant loads by source. This allows the specification of load reductions as percentages from current conditions, considers equities in load reduction responsibility, and is necessary in order for pollutant trading to occur. The load capacity must be based on critical conditions – the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. Because both load capacity and pollutant source loads vary, and not necessarily in concert, determination of critical conditions can be more complicated than it may appear on the surface.

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

5.1 In-stream Water Quality Targets

The goal of a TMDL is to restore "full support of designated beneficial uses" (Idaho Code 39.3611, 3615). In order to do so, appropriate water quality targets for pollutants must be used. These targets must be quantifiable in order to determine the loading capacity of a water body. For example, the narrative water quality standard for sediment is translated into a measurable water quality target designed to support beneficial uses.

The goal of this TMDL is to establish a declining trend in sediment and temperature loading in the appropriate water bodies. Monitoring of pollutant loads and beneficial use support will occur as part of the implementation phase of the TMDL. Improvement to water quality in the case of sediment and temperature impairment can be attained by many methods including increased vegetative buffers and improved stream bank stability.

Sediment

Current scientific techniques do not provide specific methods for identification of streambank stability, sediment load, or load capacity that would meet the narrative criteria for sediment and determine full support of beneficial uses. We must presume that load capacity lies somewhere between the current loading and the levels that relate to natural background streambank erosion levels. We presume that beneficial uses were, or would be, fully supported at natural background sediment loading levels.

To improve the quality of spawning substrate and rearing habitat in the South Fork Boise River subbasin, it is necessary to reduce the percentage of subsurface fine sediment (sediment materials less than 6.35 mm in diameter) to a 5-year mean below 27% for improved survival of salmonid eggs and fry. A 5-year mean no more than 27% subsurface fine sediment will be the sediment target for this TMDL. The percentage of subsurface fines in a stream was determined using the McNeil core sampling method described in section 2 of this document. Where core samples could not be taken, data from Wolman Pebble Counts taken using BURP protocol was used to estimate percent fine sediment. This was the case with Moores Creek.

Temperature

For the South Fork Boise River subbasin temperature TMDLs DEQ utilized a potential natural vegetation (PNV) approach. For potential natural vegetation temperature TMDLs, it is assumed that natural temperatures may exceed numeric water quality criteria. If potential natural vegetation (PNV) targets are achieved yet stream temperatures are warmer than numeric criteria, it is assumed that the stream's temperature is natural (provided there are no point sources or human induced ground water sources of heat) and natural background provisions of Idaho water quality standards apply. As per IDAPA 58.01.02.200.09:

> *"When natural background conditions exceed any applicable water quality criteria set forth in Sections 210, 250, 251, 252, or 253, the applicable water quality criteria shall not apply; instead, pollutant levels shall not exceed the natural background conditions, except that temperature levels may be increase above natural background conditions when allowed under Section 401."*

See Appendix B for further discussion of water quality standards and background provisions. The PNV approach and the procedures and methodologies to develop PNV target shade levels and to estimate existing shade levels are described in this section. For a more complete discussion of shade and its effects on stream water temperature, refer to the South Fork Clearwater Subbasin Assessment and TMDL (IDEQ, 2004).

Potential Natural Vegetation for Temperature TMDLs

There are several important contributors of heat to a stream including ground water discharge, air temperature, and direct solar radiation (Poole and Berman 2001). Of these, direct solar radiation is the source of heat that has the most potential to be controlled or manipulated. The parameters that affect or control the amount of solar radiation hitting a stream throughout its length are shade and stream morphology. Shade is provided by the surrounding vegetation and other physical features such as hillsides, canyon walls, terraces, and high banks. Stream morphology affects how closely riparian vegetation grows together and water storage in the fluvial aquifer. Streamside vegetation and channel morphology are factors influencing shade which are most likely to have been influenced by anthropogenic activities, and which can be most readily corrected and addressed by a TMDL.

Depending on how much vertical elevation surrounds the stream, vegetation farther away from the riparian corridor can provide shade. However, riparian vegetation provides a substantial amount of shade on a stream by virtue of its proximity. We can measure the amount of shade that a stream experiences in a number of ways. Effective shade, that shade provided by all objects that intercept the sun as it makes its way across the sky, can be measured in a given spot with a solar pathfinder or with optical equipment similar to a fish-eye lens on a camera. Effective shade can also be modeled using detailed information about riparian plants and their communities, topography, and the stream's aspect. In addition to shade, canopy cover is a similar parameter that affects solar radiation. Canopy cover is the vegetation that hangs directly over the stream, and can be measured using a densiometer, or estimated visually either on site or on aerial photography. All of these methods tell us information about how covered the stream is and how much of it is exposed to direct solar radiation.

Potential natural vegetation (PNV) along a stream is that riparian plant community that has grown to an overall mature state, although some level of natural disturbance is usually included in our development and use of shade targets. The PNV can be removed by disturbance either naturally (wildfire, disease/old age, wind-blown, wildlife grazing) or anthropogenically (domestic livestock grazing, vegetation removal, erosion). The idea behind PNV as targets for temperature TMDLs is that PNV provides a natural level of solar loading to the stream without any anthropogenic removal of shade producing vegetation. Anything less than PNV results in the stream heating up from anthropogenically created additional solar inputs. We can estimate PNV from models of plant community structure (shade curves for specific riparian plant communities), and we can measure existing vegetative cover or shade. Comparing the two allows us to calculate how much excess solar load the stream is receiving, and what potential there is to decrease solar gain. Streams disturbed by wildfire require their own time to recover.

Streams that have been disturbed by human activity may require additional restoration above and beyond natural recovery.

Existing shade, or cover, was estimated for two waterbodies in the South Fork Boise River Subbasin from visual observations of aerial photos. These estimates were field verified by measuring shade with a solar pathfinder at systematically located points along the streams (see below for methodology). PNV targets were determined from an analysis of probable vegetation at the streams and comparing that to shade curves developed for similar vegetation communities in other TMDLs. A shade curve shows the relationship between effective shade and stream width. As a stream gets wider, the shade decreases as the vegetation has less ability to shade the center of wide streams. As the vegetation gets taller, the plant community is able to provide more shade at any given channel width. Existing and PNV shade was converted to solar load from data collected on flat plate collectors at the nearest National Renewable Energy Laboratory (NREL) weather station collecting these data. In this case, the Boise station was used. The difference between existing and potential solar load, assuming existing load is higher, is the load reduction necessary to bring the stream back into compliance with water quality standards (see Appendix B). PNV shade and loads are assumed to be the natural condition, thus stream temperatures under PNV conditions are assumed to be natural (so long as there are no point sources or any other anthropogenic sources of heat in the subbasin), and are thus considered to be consistent with the Idaho water quality standards, even though they may exceed numeric criteria.

Pathfinder Methodology

The solar pathfinder is a device that allows one to trace the outline of shade-producing objects on monthly solar path charts. The percentage of the sun's path covered by these objects is the effective shade on the stream at the spot that the tracing is made. In order to adequately characterize the effective shade on a reach of stream, ten traces should be taken at systematic or random intervals along the length of the stream in question.

At each sampling location the solar pathfinder should be placed in the middle of the stream at about the bankfull water level. Follow the manufacturer's instructions (orient to true south and level) for taking traces. Systematic sampling is easiest to accomplish and does not bias the location of sampling. Start at a unique location, such as 100 m from a bridge or fence line, and then proceed upstream or downstream, stopping to take additional traces at fixed intervals (e.g. every 50m, every 50 paces, etc.). One can also randomly locate points of measurement by generating random numbers to be used as interval distances.

Bankfull widths should be measured and notes and photographs documenting the presence/absence of shade-producing species should be taken. Pay special attention to changes in riparian plant communities and what kinds of plant species (the large, dominant, shade producing ones) are present. Densiometer readings at solar pathfinder trace locations may also be recorded. This provides the opportunity to develop relationships between canopy cover and effective shade for a stream.

Aerial Photo Interpretation

Canopy coverage estimates or expectations of shade based on plant type and density are provided for natural breaks in vegetation density, marked out on a 1:100K or 1:250K hydrography. Each interval is assigned a single value representing the bottom of a 10%-canopy coverage or shade class as described below (*adapted from the CWE process, IDL, 2000)*. For example, if estimated canopy cover for a particular stretch of stream is between 50% and 59%, we assign the value of 50% to that segment of stream. The estimate is based on a general intuitive observation about the kind of vegetation present, its density, and the width of the stream. The typical vegetation type (below) shows the kind of landscape a particular cover class usually falls into for a stream 5m wide or less. For example, if a segment of a 5m wide stream is identified as 20% cover class, it is usually because it is in agricultural land, meadows, open areas, or clearcuts. However, that does not mean that the 20% cover class cannot occur in shrublands and forests, because it does on wider streams.

Cover class	Typical vegetation type on 5m wide stream
0 = 0 – 9% cover	agricultural land, denuded areas
10 = 10 –19%	agricultural land, meadows, open areas, clear-cut
20 = 20 – 29%	agricultural land, meadows, open areas, clear-cut
30 = 30 – 39%	agricultural land, meadows, open areas, clear-cut
40 = 40 – 49%	shrubland/meadows
50 = 50 – 59%	shrubland/meadows, open forests
60 = 60 – 69%	shrubland/meadows, open forests
70 = 70 – 79%	forested
80 = 80 – 89%	forested
90 = 90 –100%	forested

It is important to note that visual estimates made from the aerial photos are strongly influenced by canopy cover. It is not always possible to visualize or anticipate shade characteristics resulting from topography and landform. We assume that canopy coverage and shade are similar based on research conducted by Oregon DEQ (2003). The visual estimates of 'shade' in this TMDL were field verified with a solar pathfinder. The pathfinder measures effective shade and takes into consideration other physical features that block the sun from hitting the stream surface (e.g. hillsides, canyon walls, terraces, man-made structures). The estimate of 'shade' made visually from an aerial photo does not always take into account topography or any shading that may occur from physical features other than vegetation. However, research has shown that shade and cover measurements are remarkably similar (OWEB, 2001), reinforcing the idea that riparian vegetation and objects proximal to the stream provide the most shade.

Stream Morphology

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

The only factor not developed from the aerial photo work described previously is channel width. Accordingly, this parameter must be estimated from available information. We use regional curves for the major basins in Idaho, data compiled by Diane Hopster of Idaho Department of Lands (Figure 15), to estimate natural bankfull width.

For each stream evaluated in the loading analysis, bankfull width was estimated based on drainage area of the Upper Snake curve from Figure 15. Additionally, existing width was evaluated from available data. If the stream's existing width is wider than that predicted by the Upper Snake curve in Figure 15, then the Figure estimate of bankfull width is used in the loading analysis for natural width. If existing width is smaller, then existing width is used in the loading analysis for natural width. In most cases, existing widths are about the same as the predicted widths so existing data are used for natural widths in these areas.

Table 21. Estimates of bankfull width based on upper Snake River Basin regional curve and existing measurements.

Location	Area (square miles)	US (m)	Existing (m)
Lime Creek at mouth	133.4	13	13.5
Lime Creek Below Trail Creek	96.66	12	11.8
Lime Creek above Trail Creek	94.7	12	12.2
Lime Creek above Slickear Creek	87.91	11	
Lime Creek below Sprout Creek	37.6	8	
NF Lime Creek at mouth	17.2	5	
MF Lime Creek at mouth	17.15	5	5.5
SF Lime Creek at mouth	45.85	8	
SF Lime Creek above Hunter Creek	36.2	8	8.8
Smith Creek at mouth	51.64	9	6.5
Smith Creek below Graves Creek	51.64	9	6.5
Smith Creek above Spring Creek	43.58	8	8
Smith Creek above Aden Creek	25.94	7	6.7
Smith Creek below Washboard Creek	21.95	6	7.6
Smith Creek above Tiger Creek	17.18	5	4.5
Smith Creek above Mule Gulch	8.37	4	5

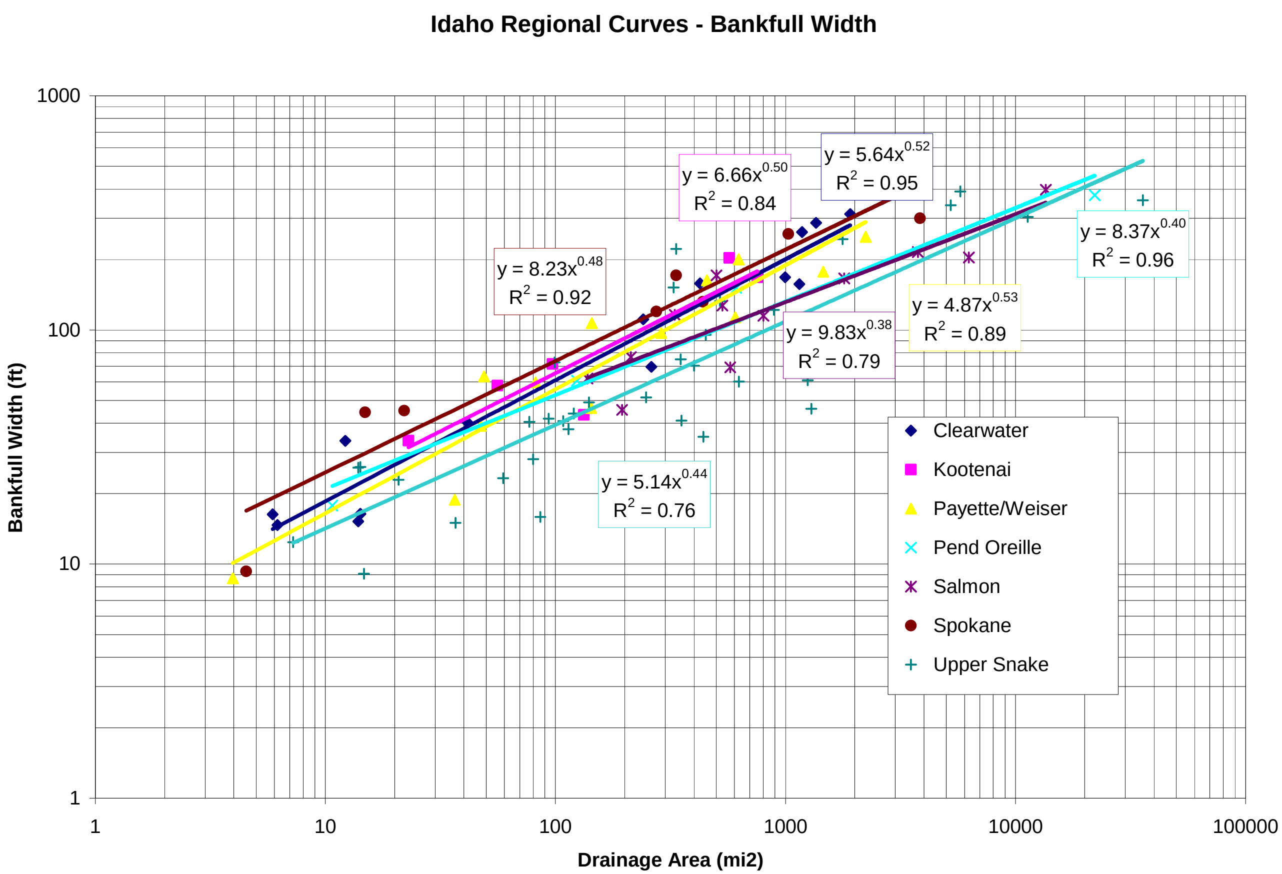

Figure 15 Bankfull Width as a Function of Drainage Area

Design Conditions

Sediment

Critical periods are not proposed for sediment. Effects of sediment in aquatic systems are not limited to a particular time of year, whether they are water column effects from abrasion or decreasing visibility, or sediment accumulation filling interstitial substrate spaces, degrading the area for salmonid spawning use.

Annual erosion and sediment delivery rates are dependant upon climatic variability where above average water years typically produce higher erosion and subsequently higher sediment loads from unstable streambanks. Stable banks that provide access of peak flow to the flood plain are better able to withstand extreme hydrologic events without becoming unstable. Additionally, the annual average sediment load is not distributed equally throughout the year. To quantify the seasonal and annual variability and critical timing of sediment loading, climate and hydrology must be considered. Most erosion typically occurs during a few critical months during spring runoff when bankfull flow occurs.

Temperature

The South Fork Boise Subbasin lies in the Southern Forested Mountains Ecoregion (McGrath et al., 2001). This region is characterized by droughty soils resulting from the granite rocks common in the region. Open Douglas fir is common with grand fir and subalpine fir being found at higher elevations and ponderosa pine in the canyons. Mountain sagebrush is also present in the southern parts of the ecoregion.

Smith Creek originates in the Trinity Mountain Range and Lime Creek originates from the Soldier Mountains just west of Smokey Dome. Smith Creek begins in a conifer/meadow vegetation type with a few grass dominated areas. The three forks of Lime Creek begin in meadows near the tree line and go into a conifer/meadow type soon after. The lower portions of the three forks all alternate between conifer/shrub and deciduous shrub types. Lime Creek, North Fork Lime Creek and Middle Fork Lime Creek all have several segments that pass through conifer dominated areas, mainly on the upper portions of the streams. Lime Creek begins where the North and Middle Fork Lime Creek meet in an area dominated by alternating and mixed patches of shrub and conifer forests. South Fork Lime Creek empties into Lime Creek at a point below the conjunction of the north and middle forks. The majority of Lime Creek is within the deciduous shrub vegetation type.

The mixed conifer vegetation type is largely comprised of ponderosa pine and Douglas fir forests. Willow, alder, dogwood and aspen are also present. The meadow vegetation type, occurring at higher elevations near the tops of the watersheds, consists of various grasses along with lower statured willows and graminoids. The deciduous shrub mix type is mainly willows and mountain alder. The conifer/shrub and conifer/meadow types are similar forest species at lower gradient, broader valley locations where a shrub or grass understory flanks the stream with conifers a short distance from or lightly dispersed around the stream.

Target Selection

Sediment

Target selection of sediment is supported by existing narrative criteria of [IDAPA 58.01.02.200.08].

The sediment target for this subbasin is based on subsurface fine sediment 5-year mean of 27% based on core samples and/or Wolman Pebble Counts. Reduction in streambank erosion prescribed in this TMDL is directly linked to the improvement of streambank stability related to riparian vegetation vigor and density adequate to protect streambanks, thus reducing lateral recession. Over time, stream channels are expected to regain equilibrium and provide natural mechanisms for trapping sediment and reducing stream energy which in turn reduces stream erosion and instream sediment loading. It is presumed that methods used to reduce chronic sediment loading will simultaneously decrease ambient stream temperatures. Also, improved streambank stability will reduce fine sediment loading and improve instream habitat features which are likely to result in attainment of designated beneficial uses.

Salmonid spawning success, egg survival to emergence, rearing habitat, benthic macroinvertebrate populations, and fish escapement can all be impacted by stream substrate size composition. Fine sediment can fill in gaps between larger substrate material, impairing designated beneficial uses for CWAL and SS by sediment pollution. It is necessary to reduce the percentage of depth fine sediments (materials less than 6.35 mm in diameter) as determined by McNeil core samples to a 5-year mean no greater than 27%.

Temperature

To determine PNV shade targets for the South Fork Boise River Subbasin, effective shade curves from several existing temperature TMDLs, as described earlier in this section. Because no two landscapes are exactly the same, shade targets were derived using an average of the various shade curves available to represent the range of shade conditions of the riparian community specific to this TMDL.

Shade Curves

To develop shade targets for the Conifer vegetation type (Table 22) shade curves for a Ponderosa pine and Douglas fir type were averaged. The shade curves for Ponderosa pine and Douglas fir came from the Salmon-Chamberlain (Crooked Creek) TMDL (IDEQ, 2002). The Ponderosa pine shade curve has an average canopy density of 58% and an average height of 59 feet and includes green ash and common chokecherry. The Douglas fir shade curve has an average canopy density of 64% and an average height of 83 feet and includes red-osier dogwood, common chokecherry, quaking aspen, and narrowleaf and black cottonwood. Based on the Boise National Forest potential vegetation groups (BNF, 2003) Ponderosa pine and Douglas fir are found in mixed patches along specific stream segments, none of which are separable into segments dominated by either conifer type.

Table 22. Shade targets for the conifer vegetation type at various stream widths.

Mixed Conifer	1m	2m	3m	4m	5m	6m	7m	8m	9m
ponderosa pine (IDEQ, 2002)	84	80	77	75	73	72	69	65	62
Douglas fir (IDEQ, 2002)	91	89	86	85	84	82	80	79	77
Average	87.5	84.5	81.5	80.0	78.5	77.0	74.5	72.0	69.5
Target (%)	**88**	**85**	**82**	**80**	**79**	**77**	**75**	**72**	**70**

To create shade targets for the conifer/shrub vegetation type the same Douglas fir shade curve used in the conifer type is blended with a mid-elevation (4,500' to 6,500') willow/alder shade curve from the Trout Creek Mountains Ecological Provence of the Alvord Lake TMDL (ODEQ, 2003). The willow/alder shade curve has an average canopy density of 75% and an average height of 24 feet.

Table 23. Shade targets for the conifer/shrub vegetation type at various stream widths

Conifer/Shrub	1m	2m	3m	4m	5m	6m	7m	8m	9m	10m	11m	12m
willow/alder - Trout (ODEQ, 2003)	90	86	79	70	65	57	51	50	44	40	36	33
Douglas fir (IDEQ, 2002)	91	89	86	85	84	82	80	79	77	75	73	71
Average	90.5	87.5	82.5	77.5	74.5	69.5	65.5	64.5	60.5	57.5	54.5	52.0
Target (%)	**91**	**88**	**83**	**78**	**75**	**70**	**66**	**65**	**61**	**58**	**55**	**52**

To create shade targets for the conifer/meadow vegetation type the same Douglas fir shade curve used in the conifer vegetation type is blended with a tufted hairgrass shade curve from the Salmon-Chamberlain (Crooked Creek) TMDL (IDEQ, 2002). The tufted hairgrass shade curve has an average canopy density of 42% and an average height of 2 feet.

Table 24. Shade targets for the conifer/meadow vegetation type at various stream widths.

Conifer/Meadow	1m	2m	3m	4m	5m
tufted hairgrass (IDEQ, 2002)	43	30	17	15	12
Douglas fir (IDEQ, 2002)	91	89	86	85	84
Average	67	59.5	51.5	50.0	48
Target (%)	**67**	**60**	**52**	**50**	**48**

For the meadow vegetation type, a shade curve for graminoid/willow from the Trout Creek Mountains Ecological Provence of the Alvord Lake TMDL (ODEQ, 2003) and the same shade curve for tufted hairgrass used to describe the conifer/meadow vegetation type were averaged together. The graminoid/willow shade curve has an average canopy density of 10% and an average height of 8.5 feet.

Table 25. Shade Targets for the Meadow Vegetation Type at Various Stream Widths

Meadow	1m	2m	3m	4m	5m
tufted hairgrass (IDEQ, 2002)	43	30	17	15	12
graminoid/willow-Trout (ODEQ, 2003)	39	26	18	14	10
Average	41	28.00	17.5	14.5	11.00
Target (%)	**41**	**28**	**18**	**15**	**11**

The shade curve used to create the shade targets for the shrub vegetation type is the same willow/alder shade curve used for the conifer/shrub vegetation type described in Table 26.

Table 26. Shade targets for the shrub vegetation type at various stream widths.

Deciduous Shrub Mix	1m	2m	3m	4m	5m	6m	7m	8m	9m	10m	11m	12m	13m
willow/alder - Trout (ODEQ, 2003)	90	86	79	70	65	57	51	50	44	40	36	33	30
Target (%)	**90**	**86**	**79**	**70**	**65**	**57**	**51**	**50**	**44**	**40**	**36**	**33**	**30**

Monitoring Points

Percent Depth Fine Sediment

Subsurface and/or surface sediment monitoring sites are established in spawning habitat determined suitable for salmonid spawning within listed stream segments using the McNeil core sediment sampling method and/or the BURP protocol for Wolman Pebble Counts. Those sites should continue to be monitored and the results used to refine management practices to protect water quality, coldwater aquatic life and salmonid spawning.

Temperature Monitoring

The accuracy of the aerial photo interpretations were field verified with a solar pathfinder at 6 locations on Smith Creek. (see Figures 16, 17, 18). Of the six pathfinder sites, five matched the 10% class interval of the stream segment they were verifying. The average of the remaining pathfinder site was only one 10% class interval above that of the stream segment it was verifying. Effective shade monitoring can take place on any reach throughout the South Fork Boise River Subbasin and be compared to estimates of existing shade displayed on Figures 17 and 20 and described in Tables 29 through 33. Areas with the greatest disparity between existing shade estimates and shade targets should be monitored with solar pathfinders to verify existing shade levels and measure progress toward meeting shade targets. It is important to note that many existing shade estimates have not been field verified, and may require adjustment during the implementation process. Stream segments for each change in existing shade vary in length depending on land use or landscape that has affected that natural shade level. It is appropriate to monitor any existing stream segment to see if that segment has achieved target levels. Ten equally spaced solar pathfinder measurements within that segment averaged together should suffice to determine new shade levels in the future.

Comment [s1]: What % of total stream miles?—to assist with determining error margins.

5.2 Load Capacity

The load capacity is the “greatest loading a waterbody can receive without violating water quality standards” [40 CFR $130.2]. This must be at a level to meet “…water quality standards with season variations and a margin of safety which takes into account any lack of knowledge…” (Clean Water Act $ §303(d)(c)). Likely sources of uncertainty include the lack of knowledge of assimilative capacity, uncertain relation of selected target(s) to beneficial use(s), lack of data regarding natural background conditions, and variability in target measurement.

Sediment

Load capacity for subsurface fine sediment (diameter <6.35mm) shall be based on assumed natural subsurface fine sediment less than or equal to 27%. It is presumed that beneficial uses were or would be supported at natural background sediment loading rates and presumed that loading capacity lies somewhere between the current loading level and sediment loading from natural streambank erosion.

Note that natural background loading rates are not necessarily the loading capacities. An adaptive management approach will be used to provide reductions in sediment loading based on best management practice implementation coupled with data collected from future monitoring to determine the loading rate at which beneficial uses are supported.

Estimated capacity is directly related to the improvement of riparian vegetation characteristics and stream channel conditions within the range of natural variability for desirable potential channel types. Increased vegetation cover provides a protective covering of streambanks, reduces lateral recession, traps sediment, and reduces the erosive energy of the stream.

Keeping other nonpoint sources of sediment in enhance effectiveness of streamside restoration efforts. This includes proper maintenance of roads and stream crossings. Evaluation of land management practices to minimize erosion and sediment transport into the streams must also occur.

Temperature

The loading capacity for a stream under PNV is essentially the solar loading allowed under the shade targets specified for the reaches within that stream. These loads are determined by multiplying the solar load to a flat plate collector (under full sun) for a given period of time by the fraction of the solar radiation that is not blocked by shade (i.e. the percent open or 1-percent shade). In other words, if a shade target is 60% (or 0.6), then the maximum solar load hitting the stream under that target is 40% of the load hitting the flat plate collector under full sun.

Late July and early August typically represent a period of highest stream temperatures. Solar gains can begin early in the spring and affect the highest temperatures reached later on in the summer and salmonids spawning temperatures in spring and fall. Therefore, solar loading in these streams is evaluated from spring (April) to early fall (September). DEQ obtained solar load data for flat plate collectors from the National Renewable Energy Laboratory (NREL) weather station in Boise, ID. The solar loads used in this TMDL are spring/summer averages, thus, we use an average load for the six month period from April through September. These months coincide with time of year that stream temperatures are increasing and when deciduous vegetation is in leaf. Tables 29 through 33 show the PNV shade targets (identified as Target or Potential Shade) and their corresponding potential summer load (in kWh/m^2/day and kWh/day) that serve as the loading capacities for the streams.

The effective shade calculations are based on the same time period as solar load data, for the same reasons as previously mentioned. Total target loads for the streams evaluated in the South Fork Boise River Subbasin range from 55,739 kWh/day for the Middle Fork of Lime Creek to 830,364 kWh/day for Lime Creek. Smith Creek’s total target load is less than Lime Creek at 626,911 kWh/day.

5.3 Estimates of Existing Pollutant Loads

Regulations allow that loadings “...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading,” (Water quality planning and management, 40 CFR §130.2(I)). An estimate must be made for each point source. Nonpoint sources are typically estimated based on the type of sources (land use) and area (such as a subwatershed), but may be aggregated by type of source or land area. To the extent possible, background loads should be distinguished from human-caused increases in nonpoint loads. Table 27 summarizes the point source permitted discharge in the South Fork Boise River subbasin. Note that while there is one permitted point source, it does not discharge into a 303(d) listed stream. The Elk Valley Subdivision Wastewater Treatment facility discharges into the Boise River above Anderson Ranch Reservoir. This source will not be included in load calculations for 303(d) listed AUs.

Table 27. Current wasteloads from point sources in the South Fork Boise River Subbasin.

Wasteload Type	Load	NPDES[a] Permit Number
Elk Valley Subdivision Wastewater Treatment	• BOD (30 mg/L 30 day average, 45 mg/L 7 day average) • TSS (30 mg/L 30 day average, 45 mg/L 7 day average) • E. coli (126 CFU/100 ml 30 day average, 406 CFU/100 ml instantaneous maximum)	ID-0027970-9

[a] National Pollutant Discharge Elimination System

The following table shows the estimated subsurface fine sediment loads for listed waters in the South Fork Boise River subbasin.

Table 28. Current loads from nonpoint sources in the South Fork Boise River Subbasin.

Stream/AU	Target Load (% Subsurface Fines)	Existing Load (% Subsurface Fines)	Estimation Method
South Fork Boise River- Dixie Creek (ID17050113SW004_03)	27%	81%	Core Sampling
Smith Creek (ID17050113SW032_03)	27%	24%	Core Sampling
Lower Willow Creek (ID17050113SW002b_03)	27%	17%	Core Sampling

Temperature

Existing loads in this temperature TMDL come from estimates of existing shade as determined from aerial photo interpretations. Like target shade, existing shade was converted to a solar load by multiplying the fraction of open stream by the solar radiation measured on a flat plate collector at the NREL weather station in Boise. Existing shade data (by proportion and kWh/m2/day) and existing loads (by proportion and kWh/m2/day) are presented in Tables 29 through 33 by stream area.

Existing and potential loads in kWh/day can be summed for the entire stream or by the portion of stream examined in a single loading table. These total loads are shown at the bottom of their respective columns in each table. The difference between potential load and existing load is also summed for the entire table. Should existing load exceed potential load, this difference becomes the excess load to be discussed next in the load allocation section. The percent reduction shown in the lower right corner of each table represents how much total excess load there is in relation to total existing load.

Total existing loads for the streams evaluated in the South Fork Boise River Subbasin range from 90,251 kWh/day for the Middle Fork of Lime Creek to 986,833 kWh/day for Lime Creek. Smith Creek's total existing load is less than that of Lime Creek at 911,900 kWh/day.

Table 29. Existing and Potential Solar Loads for Smith 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)	Excess Load/Linear Meter	Smith Creek
220	0.5	3.19	0.67	2.1054	-1.08	1	1	220	701.8	220	463.188	-238.612	-1.08	Conifer/Meadow
340	0.4	3.828	0.67	2.1054	-1.7226	1	1	340	1301.52	340	715.836	-585.684	-1.72	
240	0.5	3.19	0.67	2.1054	-1.0846	1	1	240	765.6	240	505.296	-260.304	-1.08	
180	0.3	4.466	0.41	3.7642	-0.7018	1	1	180	803.88	180	677.556	-126.324	-0.70	Meadow
800	0.5	3.19	0.67	2.1054	-1.0846	1	1	800	2552	800	1684.32	-867.68	-1.08	Conifer/Meadow
290	0.4	3.828	0.67	2.1054	-1.7226	1	1	290	1110.12	290	610.566	-499.554	-1.72	
860	0.5	3.19	0.67	2.1054	-1.0846	1	1	860	2743.4	860	1810.644	-932.756	-1.08	
320	0.4	3.828	0.28	4.5936	0.7656	2	2	640	2449.92	640	2939.904	489.984	1.53	Meadow
250	0.6	2.552	0.6	2.552	0	2	2	500	1276	500	1276	0	0.00	Conifer/Meadow
410	0.4	3.828	0.28	4.5936	0.7656	2	2	820	3138.96	820	3766.752	627.792	1.53	Meadow
770	0.6	2.552	0.88	0.7656	-1.7864	2	2	1540	3930.08	1540	1179.024	-2751.056	-3.57	Conifer/Shrub
2640	0.7	1.914	0.83	1.0846	-0.8294	3	3	7920	15158.88	7920	8590.032	-6568.848	-2.49	
2140	0.6	2.552	0.78	1.4036	-1.1484	4	4	8560	21845.12	8560	12014.816	-9830.304	-4.59	
430	0.3	4.466	0.65	2.233	-2.233	5	5	2150	9601.9	2150	4800.95	-4800.95	-11.17	Shrub
510	0.4	3.828	0.65	2.233	-1.595	5	5	2550	9761.4	2550	5694.15	-4067.25	-7.98	
300	0.6	2.552	0.75	1.595	-0.957	5	5	1500	3828	1500	2392.5	-1435.5	-4.79	Conifer/Shrub
670	0.4	3.828	0.65	2.233	-1.595	5	5	3350	12823.8	3350	7480.55	-5343.25	-7.98	Shrub
1490	0.3	4.466	0.57	2.7434	-1.7226	6	6	8940	39926.04	8940	24525.996	-15400.044	-10.34	
980	0.2	5.104	0.51	3.1262	-1.9778	7	7	6860	35013.44	6860	21445.732	-13567.708	-13.84	
150	0	6.38	0.51	3.1262	-3.2538	7	7	1050	6699	1050	3282.51	-3416.49	-22.78	
3870	0.1	5.742	0.51	3.1262	-2.6158	7	7	27090	155550.78	27090	84688.758	-70862.022	-18.31	
830	0.3	4.466	0.51	3.1262	-1.3398	7	7	5810	25947.46	5810	18163.222	-7784.238	-9.38	
1710	0.2	5.104	0.51	3.1262	-1.9778	7	7	11970	61094.88	11970	37420.614	-23674.266	-13.84	
420	0	6.38	0.5	3.19	-3.19	8	8	3360	21436.8	3360	10718.4	-10718.4	-25.52	
1010	0.3	4.466	0.5	3.19	-1.276	8	8	8080	36085.28	8080	25775.2	-10310.08	-10.21	
1720	0.2	5.104	0.5	3.19	-1.914	8	8	13760	70231.04	13760	43894.4	-26336.64	-15.31	
270	0.6	2.552	0.5	3.19	0.638	8	8	2160	5512.32	2160	6890.4	1378.08	5.10	
1280	0.4	3.828	0.5	3.19	-0.638	8	8	10240	39198.72	10240	32665.6	-6533.12	-5.10	
280	0	6.38	0.5	3.19	-3.19	8	8	2240	14291.2	2240	7145.6	-7145.6	-25.52	
1440	0.2	5.104	0.5	3.19	-1.914	8	8	11520	58798.08	11520	36748.8	-22049.28	-15.31	
290	0.4	3.828	0.5	3.19	-0.638	8	8	2320	8880.96	2320	7400.8	-1480.16	-5.10	
1910	0.6	2.552	0.61	2.4882	-0.0638	9	9	17190	43868.88	17190	42772.158	-1096.722	-0.57	Conifer/Shrub
160	0.5	3.19	0.61	2.4882	-0.7018	9	9	1440	4593.6	1440	3583.008	-1010.592	-6.32	
430	0.6	2.552	0.61	2.4882	-0.0638	9	9	3870	9876.24	3870	9629.334	-246.906	-0.57	
210	0.5	3.19	0.61	2.4882	-0.7018	9	9	1890	6029.1	1890	4702.698	-1326.402	-6.32	
760	0.6	2.552	0.61	2.4882	-0.0638	9	9	6840	17455.68	6840	17019.288	-436.392	-0.57	
1250	0.4	3.828	0.44	3.5728	-0.2552	9	9	11250	43065	11250	40194	-2871	-2.30	Shrub
2850	0.3	4.466	0.44	3.5728	-0.8932	9	9	25650	114552.9	25650	91642.32	-22910.58	-8.04	
							Total	**215,990**	**911,900**	**215,990**	**626,911**	**-284,989**		**-31**
														% Reduction

Table 30. Existing and Potential Solar Loads for Lime 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)	Excess Load/Linear Meter	Lime Creek
200	0.5	3.19	0.5	3.19	0.00	8	8	1600	5104	1600	5104	0	0.00	Shrub
350	0.6	2.552	0.65	2.233	-0.319	8	8	2800	7145.6	2800	6252.4	-893.2	-2.55	Conifer/Shrub
200	0.7	1.914	0.72	1.7864	-0.1276	8	8	1600	3062.4	1600	2858.24	-204.16	-1.02	Conifer
110	0.5	3.19	0.5	3.19	0	8	8	880	2807.2	880	2807.2	0	0.00	Shrub
550	0.7	1.914	0.72	1.7864	-0.1276	8	8	4400	8421.6	4400	7860.16	-561.44	-1.02	Conifer
60	0.5	3.19	0.5	3.19	0	8	8	480	1531.2	480	1531.2	0	0.00	Shrub
720	0.7	1.914	0.7	1.914	0	9	9	6480	12402.72	6480	12402.72	0	0.00	Conifer
250	0.5	3.19	0.44	3.5728	0.3828	9	9	2250	7177.5	2250	8038.8	861.3	3.45	Shrub
200	0.2	5.104	0.44	3.5728	-1.5312	9	9	1800	9187.2	1800	6431.04	-2756.16	-13.78	
160	0.3	4.466	0.44	3.5728	-0.8932	9	9	1440	6431.04	1440	5144.832	-1286.208	-8.04	
470	0.2	5.104	0.44	3.5728	-1.5312	9	9	4230	21589.92	4230	15112.944	-6476.976	-13.78	
180	0.1	5.742	0.4	3.828	-1.914	10	10	1800	10335.6	1800	6890.4	-3445.2	-19.14	
170	0.2	5.104	0.4	3.828	-1.276	10	10	1700	8676.8	1700	6507.6	-2169.2	-12.76	
160	0.1	5.742	0.4	3.828	-1.914	10	10	1600	9187.2	1600	6124.8	-3062.4	-19.14	
170	0.2	5.104	0.4	3.828	-1.276	10	10	1700	8676.8	1700	6507.6	-2169.2	-12.76	
370	0	6.38	0.4	3.828	-2.552	10	10	3700	23606	3700	14163.6	-9442.4	-25.52	
120	0.2	5.104	0.4	3.828	-1.276	10	10	1200	6124.8	1200	4593.6	-1531.2	-12.76	
320	0.5	3.19	0.55	2.871	-0.319	11	11	3520	11228.8	3520	10105.92	-1122.88	-3.51	Conifer/Shrub
990	0.4	3.828	0.55	2.871	-0.957	11	11	10890	41686.92	10890	31265.19	-10421.73	-10.53	
250	0.3	4.466	0.36	4.0832	-0.3828	11	11	2750	12281.5	2750	11228.8	-1052.7	-4.21	Shrub
260	0.1	5.742	0.36	4.0832	-1.6588	11	11	2860	16422.12	2860	11677.952	-4744.168	-18.25	
630	0.4	3.828	0.52	3.0624	-0.7656	12	12	7560	28939.68	7560	23151.744	-5787.936	-9.19	Conifer/Shrub
110	0.2	5.104	0.33	4.2746	-0.8294	12	12	1320	6737.28	1320	5642.472	-1094.808	-9.95	Shrub
200	0.1	5.742	0.33	4.2746	-1.4674	12	12	2400	13780.8	2400	10259.04	-3521.76	-17.61	
410	0.2	5.104	0.33	4.2746	-0.8294	12	12	4920	25111.68	4920	21031.032	-4080.648	-9.95	
2900	0.3	4.466	0.33	4.2746	-0.1914	12	12	34800	155416.8	34800	148756.08	-6660.72	-2.30	
170	0.1	5.742	0.33	4.2746	-1.4674	12	12	2040	11713.68	2040	8720.184	-2993.496	-17.61	
280	0.3	4.466	0.33	4.2746	-0.1914	12	12	3360	15005.76	3360	14362.656	-643.104	-2.30	
630	0.2	5.104	0.33	4.2746	-0.8294	12	12	7560	38586.24	7560	32315.976	-6270.264	-9.95	
270	0.1	5.742	0.33	4.2746	-1.4674	12	12	3240	18604.08	3240	13849.704	-4754.376	-17.61	
110	0.2	5.104	0.33	4.2746	-0.8294	12	12	1320	6737.28	1320	5642.472	-1094.808	-9.95	
650	0.2	5.104	0.3	4.466	-0.638	13	13	8450	43128.8	8450	37737.7	-5391.1	-8.29	
170	0.3	4.466	0.3	4.466	0	13	13	2210	9869.86	2210	9869.86	0	0.00	
90	0.2	5.104	0.3	4.466	-0.638	13	13	1170	5971.68	1170	5225.22	-746.46	-8.29	
50	0.3	4.466	0.3	4.466	0	13	13	650	2902.9	650	2902.9	0	0.00	
720	0.1	5.742	0.3	4.466	-1.276	13	13	9360	53745.12	9360	41801.76	-11943.36	-16.59	
240	0.2	5.104	0.3	4.466	-0.638	13	13	3120	15924.48	3120	13933.92	-1990.56	-8.29	
180	0.1	5.742	0.3	4.466	-1.276	13	13	2340	13436.28	2340	10450.44	-2985.84	-16.59	
850	0.2	5.104	0.3	4.466	-0.638	13	13	11050	56399.2	11050	49349.3	-7049.9	-8.29	
310	0.1	5.742	0.3	4.466	-1.276	13	13	4030	23140.26	4030	17997.98	-5142.28	-16.59	
540	0.2	5.104	0.3	4.466	-0.638	13	13	7020	35830.08	7020	31351.32	-4478.76	-8.29	
710	0.1	5.742	0.3	4.466	-1.276	13	13	9230	52998.66	9230	41221.18	-11777.48	-16.59	
160	0.2	5.104	0.3	4.466	-0.638	13	13	2080	10616.32	2080	9289.28	-1327.04	-8.29	
330	0.1	5.742	0.3	4.466	-1.276	13	13	4290	24633.18	4290	19159.14	-5474.04	-16.59	
540	0.3	4.466	0.3	4.466	0	13	13	7020	31351.32	7020	31351.32	0	0.00	
80	0.1	5.742	0.3	4.466	-1.276	13	13	1040	5971.68	1040	4644.64	-1327.04	-16.59	
270	0.3	4.466	0.3	4.466	0	13	13	3510	15675.66	3510	15675.66	0	0.00	
380	0	6.38	0.3	4.466	-1.914	13	13	4940	31517.2	4940	22062.04	-9455.16	-24.88	
							Total	**209,710**	**986,833**	**209,710**	**830,364**	**-156,469**		**-16**
														% Reduction

Table 31. Existing and Potential Solar Loads for North Fork Lime 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)	Excess Load/Linear Meter	NF Lime Creek
230	0.5	3.19	0.41	3.7642	0.57	1	1	230	733.7	230	865.766	132.066	0.57	Meadow
260	0.7	1.914	0.67	2.1054	0.1914	1	1	260	497.64	260	547.404	49.764	0.19	Conifer/Meadow
430	0.6	2.552	0.67	2.1054	-0.4466	1	1	430	1097.36	430	905.322	-192.038	-0.45	
190	0.7	1.914	0.67	2.1054	0.1914	1	1	190	363.66	190	400.026	36.366	0.19	
90	0.6	2.552	0.67	2.1054	-0.4466	1	1	90	229.68	90	189.486	-40.194	-0.45	
450	0.8	1.276	0.88	0.7656	-0.5104	1	1	450	574.2	450	344.52	-229.68	-0.51	Conifer
160	0.7	1.914	0.67	2.1054	0.1914	1	1	160	306.24	160	336.864	30.624	0.19	Conifer/Meadow
180	0.8	1.276	0.88	0.7656	-0.5104	1	1	180	229.68	180	137.808	-91.872	-0.51	Conifer
1740	0.6	2.552	0.6	2.552	0	2	2	3480	8880.96	3480	8880.96	0	0.00	Conifer/Meadow
640	0.7	1.914	0.85	0.957	-0.957	2	2	1280	2449.92	1280	1224.96	-1224.96	-1.91	Conifer
240	0.6	2.552	0.6	2.552	0	2	2	480	1224.96	480	1224.96	0	0.00	Conifer/Meadow
2350	0.8	1.276	0.83	1.0846	-0.1914	3	3	7050	8995.8	7050	7646.43	-1349.37	-0.57	Conifer/Shrub
190	0.6	2.552	0.79	1.3398	-1.2122	3	3	570	1454.64	570	763.686	-690.954	-3.64	Shrub
290	0.7	1.914	0.78	1.4036	-0.5104	4	4	1160	2220.24	1160	1628.176	-592.064	-2.04	Conifer/Shrub
220	0.4	3.828	0.7	1.914	-1.914	4	4	880	3368.64	880	1684.32	-1684.32	-7.66	Shrub
210	0.6	2.552	0.7	1.914	-0.638	4	4	840	2143.68	840	1607.76	-535.92	-2.55	
460	0.7	1.914	0.7	1.914	0	4	4	1840	3521.76	1840	3521.76	0	0.00	
450	0.6	2.552	0.7	1.914	-0.638	4	4	1800	4593.6	1800	3445.2	-1148.4	-2.55	Shrub
120	0.6	2.552	0.78	1.4036	-1.1484	4	4	480	1224.96	480	673.728	-551.232	-4.59	Conifer/Shrub
550	0.6	2.552	0.7	1.914	-0.638	4	4	2200	5614.4	2200	4210.8	-1403.6	-2.55	Shrub
230	0.6	2.552	0.78	1.4036	-1.1484	4	4	920	2347.84	920	1291.312	-1056.528	-4.59	Conifer/Shrub
360	0.5	3.19	0.7	1.914	-1.276	4	4	1440	4593.6	1440	2756.16	-1837.44	-5.10	Shrub
130	0.6	2.552	0.65	2.233	-0.319	5	5	650	1658.8	650	1451.45	-207.35	-1.60	
330	0.5	3.19	0.65	2.233	-0.957	5	5	1650	5263.5	1650	3684.45	-1579.05	-4.79	
530	0.6	2.552	0.75	1.595	-0.957	5	5	2650	6762.8	2650	4226.75	-2536.05	-4.79	Conifer/Shrub
150	0.5	3.19	0.65	2.233	-0.957	5	5	750	2392.5	750	1674.75	-717.75	-4.79	Shrub
470	0.6	2.552	0.75	1.595	-0.957	5	5	2350	5997.2	2350	3748.25	-2248.95	-4.79	Conifer/Shrub
130	0.7	1.914	0.75	1.595	-0.319	5	5	650	1244.1	650	1036.75	-207.35	-1.60	
1000	0.5	3.19	0.65	2.233	-0.957	5	5	5000	15950	5000	11165	-4785	-4.79	Shrub
							Total	**40,110**	**95,936**	**40,110**	**71,275**	**-24,661**		**-26**
														% Reduction

Table 32. Existing and Potential Solar Loads for Middle Fork Lime 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)	Excess Load/Linear Meter	MF Lime Creek
220	0.4	3.828	0.41	3.7642	-0.06	1	1	220	842.16	220	828.124	-14.036	-0.06	Meadow
680	0.5	3.19	0.67	2.1054	-1.0846	1	1	680	2169.2	680	1431.672	-737.528	-1.08	Conifer/Meadow
2640	0.9	0.638	0.88	0.7656	0.1276	1	1	2640	1684.32	2640	2021.184	336.864	0.13	Conifer
2600	0.8	1.276	0.88	0.7656	-0.5104	2	2	5200	6635.2	5200	3981.12	-2654.08	-1.02	Conifer/Shrub
1760	0.7	1.914	0.83	1.0846	-0.8294	3	3	5280	10105.92	5280	5726.688	-4379.232	-2.49	
1450	0.6	2.552	0.78	1.4036	-1.1484	4	4	5800	14801.6	5800	8140.88	-6660.72	-4.59	
1830	0.7	1.914	0.78	1.4036	-0.5104	4	4	7320	14010.48	7320	10274.352	-3736.128	-2.04	
2090	0.4	3.828	0.65	2.233	-1.595	5	5	10450	40002.6	10450	23334.85	-16667.75	-7.98	Shrub
							Total	**37,590**	**90,251**	**37,590**	**55,739**	**-34,513**		**-38**
														% Reduction

Table 33. Existing and Potential Solar Loads for South Fork Lime 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)	Excess Load/Linear Meter	SF Lime Creek
120	0.4	3.828	0.41	3.7642	-0.06	1	1	120	459.36	120	451.704	-7.656	-0.06	Meadow
240	0.7	1.914	0.67	2.1054	0.1914	1	1	240	459.36	240	505.296	45.936	0.19	Conifer/Meadow
1110	0.4	3.828	0.41	3.7642	-0.0638	1	1	1110	4249.08	1110	4178.262	-70.818	-0.06	Meadow
320	0.6	2.552	0.67	2.1054	-0.4466	1	1	320	816.64	320	673.728	-142.912	-0.45	Conifer/Meadow
270	0.7	1.914	0.67	2.1054	0.1914	1	1	270	516.78	270	568.458	51.678	0.19	
1540	0.8	1.276	0.86	0.8932	-0.3828	2	2	3080	3930.08	3080	2751.056	-1179.024	-0.77	Shrub
1110	0.9	0.638	0.88	0.7656	0.1276	2	2	2220	1416.36	2220	1699.632	283.272	0.26	Conifer/Shrub
4200	0.8	1.276	0.83	1.0846	-0.1914	3	3	12600	16077.6	12600	13665.96	-2411.64	-0.57	
2180	0.6	2.552	0.75	1.595	-0.957	5	5	10900	27816.8	10900	17385.5	-10431.3	-4.79	
350	0.4	3.828	0.65	2.233	-1.595	5	5	1750	6699	1750	3907.75	-2791.25	-7.98	Shrub
240	0.6	2.552	0.75	1.595	-0.957	5	5	1200	3062.4	1200	1914	-1148.4	-4.79	Conifer/Shrub
420	0.4	3.828	0.57	2.7434	-1.0846	6	6	2520	9646.56	2520	6913.368	-2733.192	-6.51	Shrub
490	0.5	3.19	0.7	1.914	-1.276	6	6	2940	9378.6	2940	5627.16	-3751.44	-7.66	Conifer/Shrub
1920	0.4	3.828	0.57	2.7434	-1.0846	6	6	11520	44098.56	11520	31603.968	-12494.592	-6.51	Shrub
1110	0.5	3.19	0.66	2.1692	-1.0208	7	7	7770	24786.3	7770	16854.684	-7931.616	-7.15	Conifer/Shrub
400	0.3	4.466	0.51	3.1262	-1.3398	7	7	2800	12504.8	2800	8753.36	-3751.44	-9.38	Shrub
340	0.6	2.552	0.66	2.1692	-0.3828	7	7	2380	6073.76	2380	5162.696	-911.064	-2.68	Conifer/Shrub
300	0.4	3.828	0.51	3.1262	-0.7018	7	7	2100	8038.8	2100	6565.02	-1473.78	-4.91	Shrub
1530	0.5	3.19	0.66	2.1692	-1.0208	7	7	10710	34164.9	10710	23232.132	-10932.768	-7.15	Conifer/Shrub
710	0.4	3.828	0.5	3.19	-0.638	8	8	5680	21743.04	5680	18119.2	-3623.84	-5.10	Shrub
540	0.6	2.552	0.65	2.233	-0.319	8	8	4320	11024.64	4320	9646.56	-1378.08	-2.55	Conifer/Shrub
720	0.4	3.828	0.5	3.19	-0.638	8	8	5760	22049.28	5760	18374.4	-3674.88	-5.10	Shrub
380	0.5	3.19	0.5	3.19	0	8	8	3040	9697.6	3040	9697.6	0	0.00	
470	0.6	2.552	0.65	2.233	-0.319	8	8	3760	9595.52	3760	8396.08	-1199.44	-2.55	Conifer/Shrub
							Total	**99,110**	**288,306**	**99,110**	**216,648**	**-71,658**		**-25**
														% Reduction

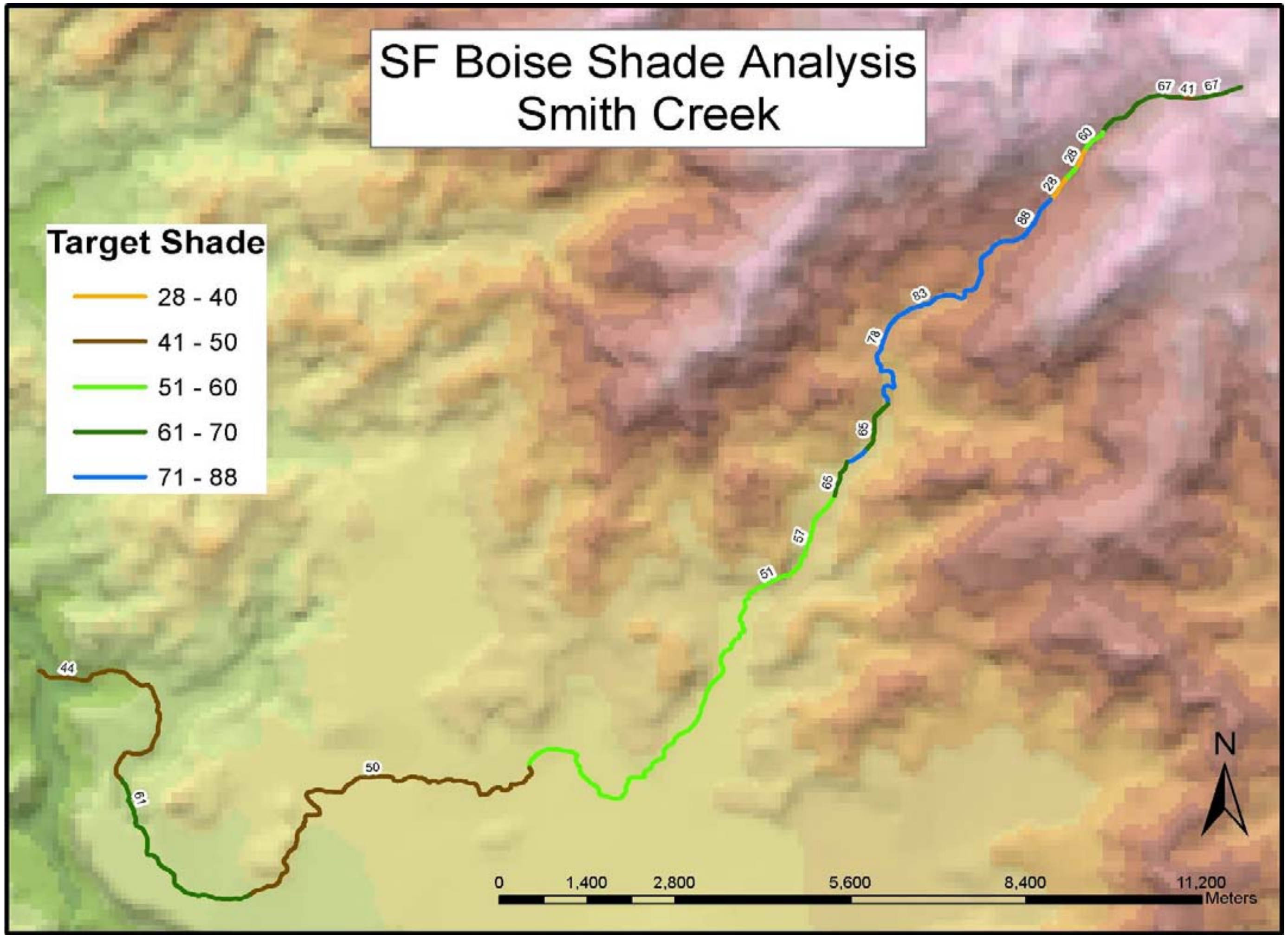

Figure 16. Target Shade for Smith Creek.

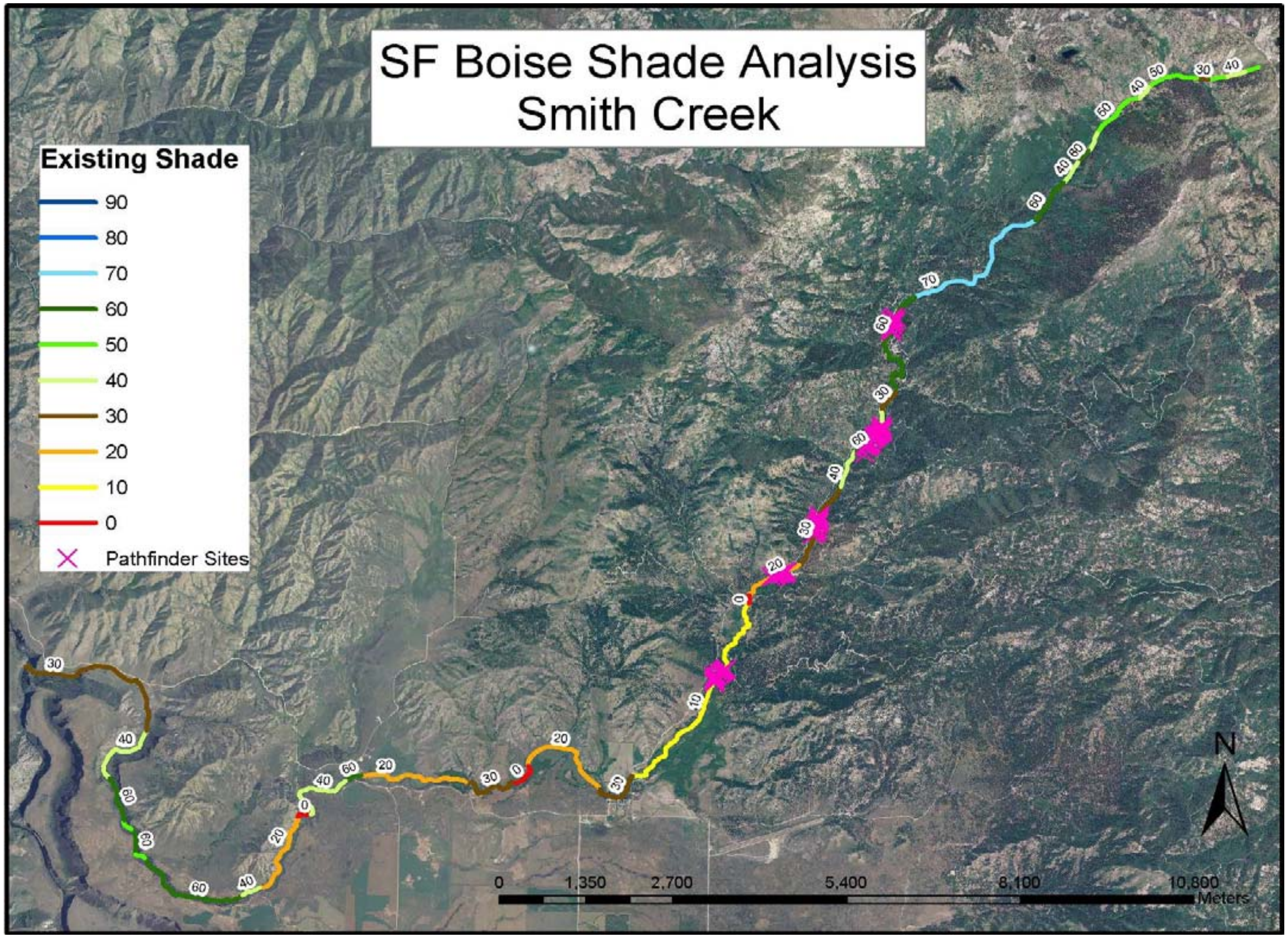

Figure 17. Existing Cover Estimated for Smith Creek by Aerial Photo Interpretation.

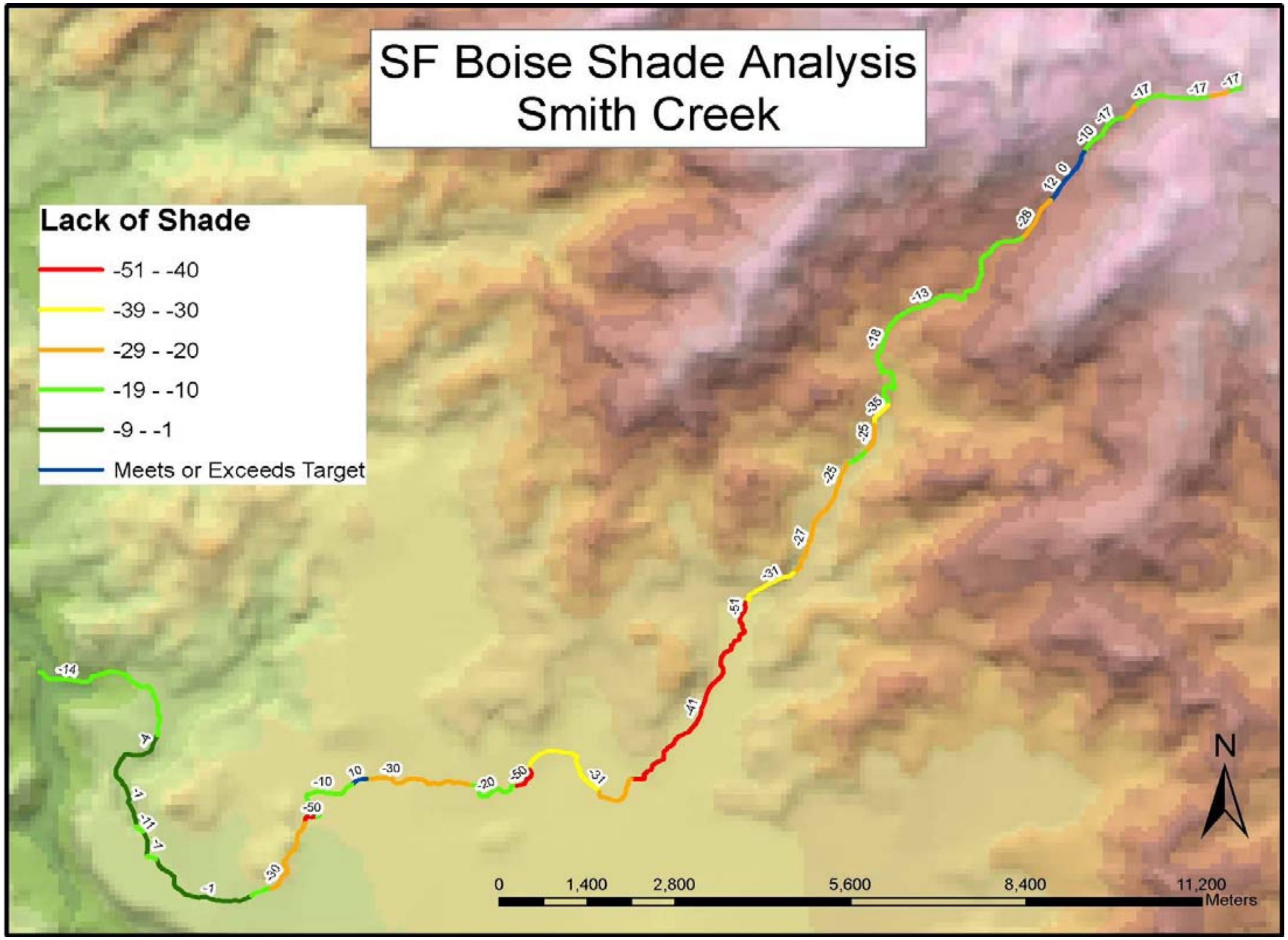

Figure 18. Lack of Shade (Difference Between Existing and Target) for Smith Creek.

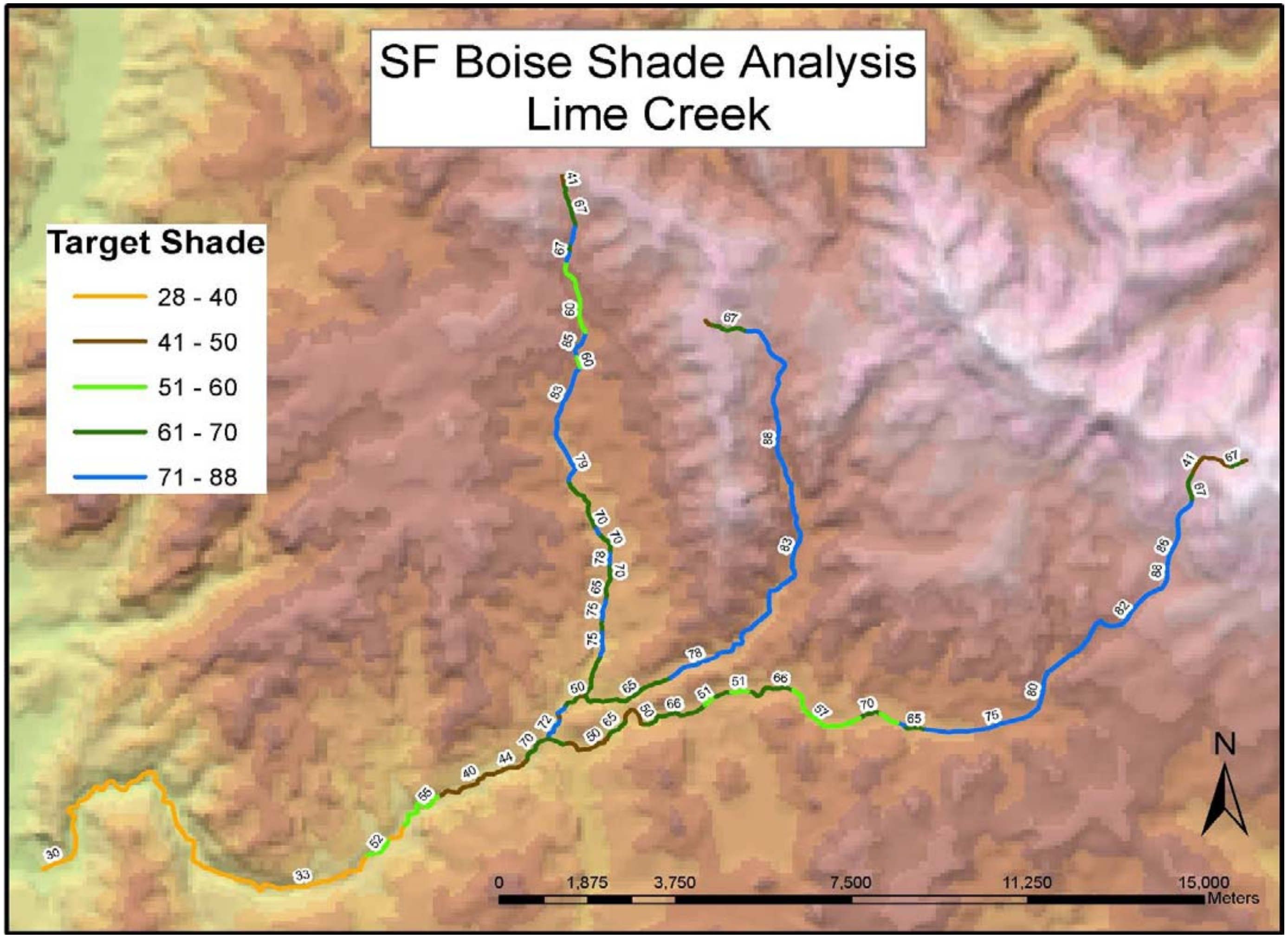

Figure 19. Target Shade for Lime Creek.

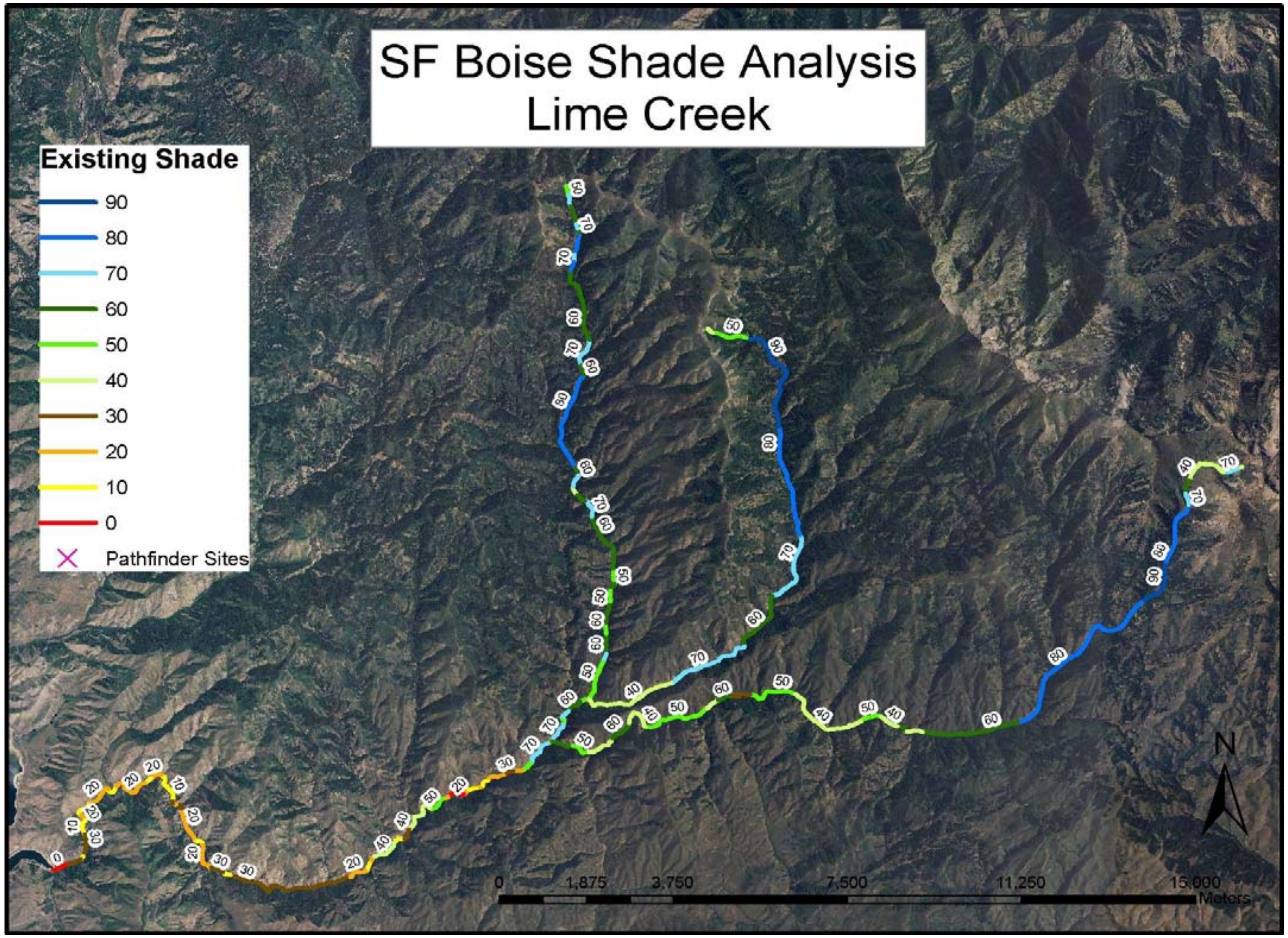

Figure 20. Existing Cover Estimated for Lime Creek by Aerial Photo Interpretation.

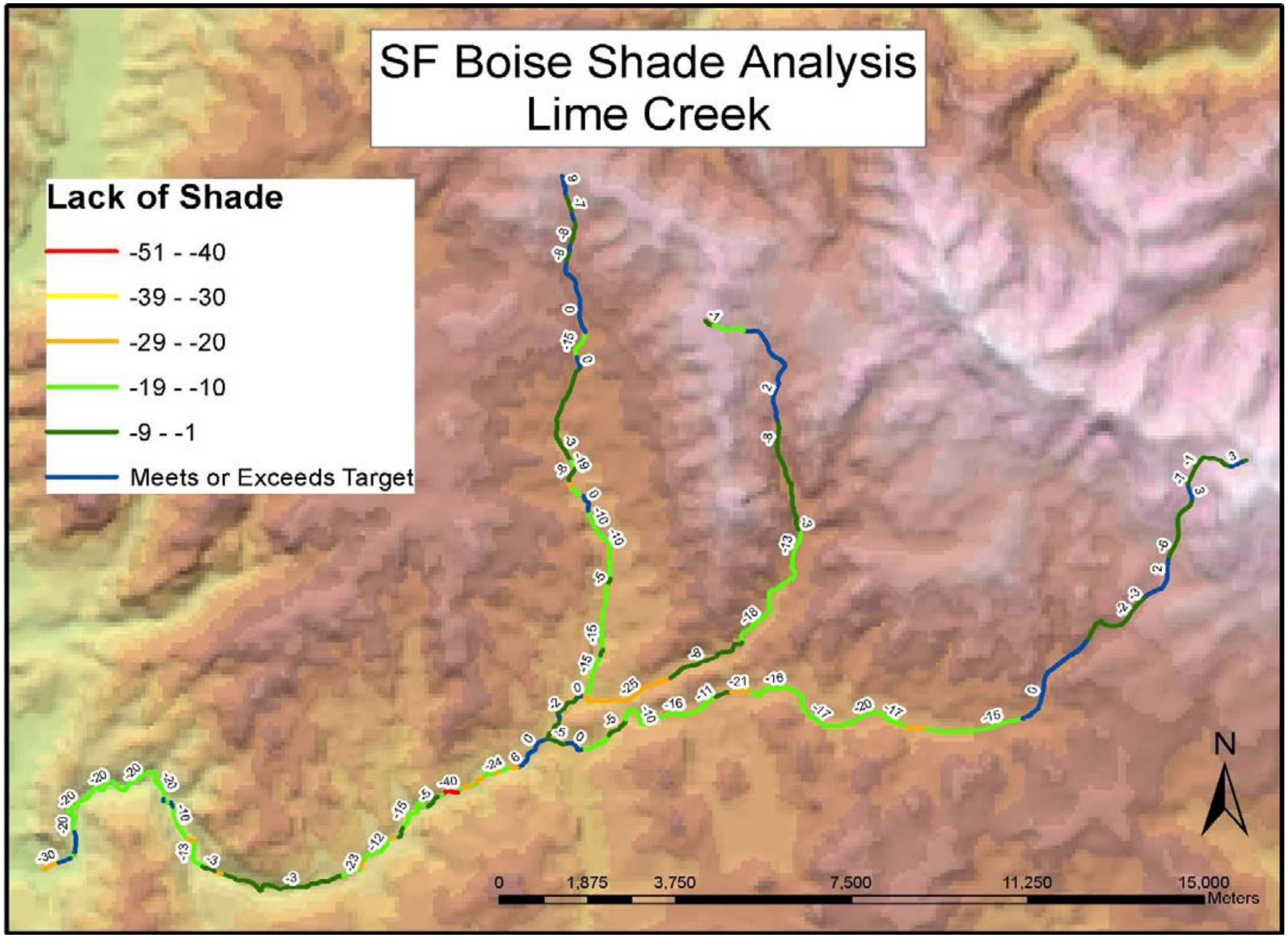

Figure 21. Lack of Shade (Difference Between Existing and Target) for Lime Creek.

5.4 Load Allocation

Sediment

Sediment load allocations are intermediate targets that are intended to result in attainment of water quality standards for temperature. Preventing streambank erosion is presumed to also result in channel morphology changes necessary to bring stream temperature regimes into compliance with salmonid spawning temperature criteria. This TMDL uses two stream habitat measures to determine support of beneficial uses affected by sediment. The following table shows the existing and target sediment loads for streams requiring sediment TMDLs as well as the percent reduction needed to meet the target load. The LA is determined by subtracting the MOS and WLA from the total TMDL. In this case, there are no point sources in the applicable water bodies, and the MOS in the subbasin is implicit (discussion in a later section). Therefore, the LA is the same as the TMDL.

Table 34 Excess Sediment Loads and Percent Reductions

Water Body/AU	Total Existing Load	Load Allocation (% Fines)	Total Target Load (% Fines)	Percent Reduction Needed
South Fork Boise River- Dixie Creek (ID17050113SW004_03)	81%	27%	27%	54%

Temperature

Temperature load allocations are based on the percent reduction of the highest observed temperature exceedences for the spring or fall salmonid spawning period, whichever is greater, to attain water quality standards. Because this TMDL is based on PNV, which is equivalent to background loading, the load allocation is essentially the target to achieve background conditions. To reach that objective, load allocations are assigned to non point source activities that have or may affect riparian vegetation and shade as a whole. Load allocations are therefore stream segment specific and are dependent upon the target load for a given segment. Tables 29 through 33 show the target or potential shade, converted to a potential summer load by multiplying the inverse fraction (1-shade fraction) by the average loading to a flat plate collector for the months of April through September. That is the loading capacity of the stream and it is necessary to achieve background conditions. There is no opportunity to remove shade from the streams in this TMDL, by any activity, without exceeding its loading capacity. Additionally, because this TMDL is dependent upon background conditions for achieving WQS, all tributaries to the waters examined here need to be at natural background conditions in order to prevent excess heat loads to the system.

Table 35 shows the total existing, total target, and excess heat load (kWh/day) experienced by each water body examined. The last column in the table lists the range of values for the excess load divided by the length (in meters) of each segment for a given stream. This excess load per linear meter is in the last column of each loading table (Tables 29 through 33). The size of a stream influences the size of the excess load. Large streams have higher existing and target loads by virtue of larger channel widths compared to smaller streams. Table 35 lists the tributaries in order of excess loads highest to lowest. Therefore, large tributaries tend to be listed first and small tributaries are listed last.

Table 35. Excess solar loads and percent reductions for all tributaries.

Water Body	Total Existing Load (kWh/day)	Total Target Load (kWh/day)	Excess Load (kWh/day)	Range of Excess Load/Linear Meter (kWh/day/m)
Smith Creek	911,900	626,911	284,989	0 to 25.52
Lime Creek	986,833	830,364	156,469	0 to 25.52
South Fork Lime Creek	288,306	216,648	71,658	0 to 9.38
Middle Fork Lime Creek	90,251	55,739	34,513	.06 to 7.98
North Fork Lime Creek	95,936	71,275	24,661	0 to 7.66

Smith Creek had the highest excess load at 284,989 kWh/day representing 31% of the total existing load. Smith Creek has a target load of 629,911 kWh/day. Lime Creek had the second highest excess load at 156,469 kWh/day or 16% of its total existing load. The South, Middle and North Forks of Lime Creek all had excess loads under 75,000 kWh/day with the North Fork Lime Creek having the smallest excess load at 24,661 kWh/day. The North Fork Lime Creek's excess load is 26% of its total existing load.

Although the following analysis dwells on total heat loads for streams in this TMDL, it is important to note that differences between existing shade and target shade, as depicted in Lack of Shade Figures (Figures 18 and 21), are the key to successfully restoring these waters to achieving WQS. Target shade levels for individual reaches should be the goal managers strive for with future implementation plans. Managers should key in on the largest differences between existing and target shade as locations to prioritize implementation efforts. Each loading table contains a final column that lists the excess load (kWh/day) per linear meter of stream. It is derived from dividing the excess load for each segment by the length of each segment. Stream segments with the largest excess load per meter are in the worst shape regarding shade.

A certain amount of excess load and percent reduction is created by the MOS inherent in the loading analysis. Because existing shade is reported as a 10% class level and target shade is a unique integer, there is always a difference between them. For example, say a particular stretch of stream has a target shade of 86% based on its vegetation type and natural bankfull width. If existing shade on that stretch of stream were at target level, it would be recorded as the next lowest 10% class level (80% existing shade) in the loading analysis. Using this method, the MOS is variable between 0 and 9% for each measured stream segment. There is an automatic difference of 6% which could be attributed to the margin of safety.

Comment [s2]: EPA is questioning our application of MOS because it appears as an arbitrary value to account for what could be 0 to 9% error rate in shade class definition and does not account for error or rounding bias in target shade calculations. We may want to consider revising our discussion to more clearly explain that our calculation always errs to favor target shade and underestimate existing shade..

Wasteload Allocation

Because there are no known NPDES permitted point sources in the affected watersheds, there are no wasteload allocations. Should a point source be proposed or discovered that may have thermal consequence on these waters, then background provisions addressing such discharges in Idaho water quality standards (IDAPA 58.01.02.200.09 & IDAPA 58.01.02.401.03) would apply (see Appendix B).

Margin of Safety

Sediment

The MOS for the sediment TMDLs in this subbasin is implicit because the water quality targets for percent fines and bank stability are consistent with values measured and set by local land management agencies, based on established literature values, and incorporate an adequate level of fry survival to provide for stable salmonid populations.

Temperature

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

Comment [s3]: So are we eliminating the 6%?

Seasonal Variation

Sediment

Monitoring of stream bank stability and subsurface and surface fine sediments was completed during low and stable flow conditions when it is possible to safely work in the flow conditions.

Temperature

This TMDL is based on average summer loads. All loads have been calculated to be inclusive of the six month period from April through September. This time period was chosen because it represents the time period when the combination of increasing air and water temperatures coincides with increasing solar inputs and increasing vegetative shade. The critical months are June, when spring salmonid spawning is occurring; July and August, when maximum temperatures exceed cold water aquatic life criteria; and September, when fall salmonids spawn. Water temperature is not likely to impair beneficial uses outside of this time period because of cooler weather and lower sun angle.

Reasonable Assurance

There is reasonable assurance that implementation, as the next step of the water body management process, will occur. Idaho's water quality standards identify designated agencies that are responsible for evaluating and modifying best management practices to protect impaired water bodies. The state has committed itself to having implementation plans developed within 18 months of EPA approval of the TMDL document. DEQ, the Technical Advisory Group (TAG), and the designated agencies will develop implementation plans, and DEQ will incorporate them into the state's water quality management plan. Also, in measuring the effectiveness of an implementation activity, DEQ will reassess the support status of the water body to determine if the water body has reached full support status. If full support status has not been obtained, then further implementation will be necessary and further reassessment performed until full support status is reached. Monitoring will be done at least every five years. When full support status is reached, then the requirements of the TMDL will be considered completed.

Background

Sediment

Natural background sediment levels are assumed to be no greater than 27% subsurface fine sediment. Therefore natural background is accounted for in the load capacity. It was not possible to calculate background loads in this watershed. A reference reach, having similar stream channel morphology and flow was not found.

Temperature

Natural background conditions for temperature can exceed numeric criteria if specific alternative narrative criteria are met. This is supported by documented conditions in wilderness waters that are relatively unaffected by human impacts. As research accumulates on natural background temperature for flowing water within the South Fork Boise River subbasin, the TMDL may be adjusted, or site specific criteria may be developed.

Reserve

If it is determined that full beneficial use support is achieved and standards are in fact being met at temperature and sediment loading rates higher than those set forth in this TMDL then the TMDL will be revised accordingly. Similarly, within a reasonable time after full implementation of best management practices, if it is determined that full beneficial use support is not forthcoming and/or standards are not being met, additional best management practices may be required.

Construction Storm Water and TMDL Waste Load Allocations

Construction Storm Water

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

The Construction General Permit (CGP)

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

Storm Water Pollution Prevention Plan (SWPPP)

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

Construction Storm Water Requirements

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

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

5.5 Implementation Strategies

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

Implementation strategies for TMDLs produced using PNV-based shade and solar loading should incorporate the loading tables presented in this TMDL. These tables need to be updated, first to field verify the existing shade levels that have not yet been field verified, and secondly to monitor progress towards achieving reductions and the goals of the TMDL. Using the solar pathfinder to measure existing shade levels in the field is important to achieving both objectives. It is likely that further field verification will find discrepancies with reported existing shade levels in the loading tables. Due to the inexact nature of the aerial photo interpretation technique, these tables should not be viewed as complete until verified. Implementation strategies should include solar pathfinder monitoring to simultaneously field verify the TMDL and mark progress towards achieving desired reductions in solar loads.

Time Frame

The expected time frame for attaining water quality standards and restoring beneficial use is dependent upon the intensity of management practices, climate, ecological potential, and natural variability of environmental conditions. If implementation of BMPs is embraced enthusiastically, some improvements may be seen in as little as several years. Even with aggressive implementation, however, some natural processes required for satisfying the requirements of this TMDL may not be seen for many years to come. The deleterious effects of historic land management practices have accrued for many years and recovery of natural systems may take longer than administrative needs allow for.

Approach

It is expected that by improving riparian vegetation and management practices, overall riparian zone recovery will increase streambank stabilization, reduce the percent of subsurface fine sediment, increase canopy cover, and lower stream temperatures. All of this will improve stream morphology and habitat and contribute to beneficial use attainment.

Responsible Parties

The Bureau of Land Management (BLM), United States Forest Service (USFS), Idaho Department of Water Resources (IDWR), Idaho Department of Lands (IDL), Idaho Fish and Game (IDFG), United States Bureau of Reclamation (BOR), and individual land owners may all have responsibilities regarding future implementation programs to improve the water quality of this subbasin.

Monitoring Strategy

The method of determining the percent subsurface fine sediment in this TMDL was the analysis of McNeil core samples. Core sampling should be done routinely to assess changes to the sediment load within the stream. In addition, streambank erosion inventories and/or BURP protocols for assessing streambank stability should be done on a routine basis to assess whether stability is improving to greater than 80% stability in areas that have been degraded. Monitoring of segments impaired by depth fines sediment should also be completed routinely.

Existing loads in the temperature TMDLs come from estimates of existing shade as determined from aerial photo interpretations. Those areas with the largest disparity between existing shade estimates and shade targets should be monitored with solar pathfinders to verify the existing shade levels and to determine progress towards meeting shade targets. It is important to note that many existing shade estimates have not been field verified, and may require adjustment during the implementation process. It is appropriate to monitor within a given existing shade segment to see if that segment has increased its existing shade towards target levels. Ten equally spaced solar pathfinder measurements within that segment averaged together should suffice to determine new shade levels in the future.

Alternatively, remote sensing technologies, such as thermal infrared (TIR), may offer efficient and cost effective opportunities to acquire longitudinal thermal profiles of all waterbodies in the subbasin during critical time periods. Data collection repeated every few years could provide useful in trend monitoring as resource restoration efforts progress throughout the subbasin.

The five year review of this TMDL is scheduled for 2008. Effort should be made during that process to include any sampling or monitoring that could help characterize the support status of the affected stream segments. This could involve a number of techniques including BURP surveys, streambank erosion inventories, sediment core sampling, and solar pathfinder monitoring.

5.6 Conclusions

This TMDL is a starting point for restoring beneficial uses in the watershed. Since many factors influence water quality, implementation is done within an adaptive management framework. Through the efforts of both private and public entities, water quality in impaired streams can be greatly improved. The following determinations were made regarding water quality in the South Fork Boise River subbasin.

Willow Creek

Willow Creek had four segments listed on the 2002 §303(d) list of impaired waters.

The 2^{nd} order segment of upper Willow Creek was listed for sediment. This includes Case, Cottonwood, Long Gulch, Salt, and Willow Creeks. The beneficial uses of this assessment unit could not be determined from data collection efforts because sites were dry at every attempt to survey. Upon further investigation, 16 constructed flow alterations were found in the assessment unit. It is recommended that 2^{nd} order upper Willow Creek be delisted for sediment, and listed for flow alteration.

The 3^{rd} order segment of upper Willow Creek was also listed for sediment and was also dry upon each sampling attempt. In addition to the 16 flow alterations in the 2^{nd} order AU, there are two additional constructed alterations in the 3^{rd} order stream segment. Like the 2^{nd} order segment, the 3^{rd} order AU should be delisted for sediment, and listed for flow alteration.

The 3^{rd} order segment of lower Willow Creek was listed for unknown pollutants. BURP data indicates sediment is the likely cause of impairment; however core sampling results indicate fine sediment is below the recommended maximum target. Based on expanded data collection results, sediment is not impairing the beneficial uses and no TMDL is necessary at this time.

The 4^{th} order segment of lower Willow Creek was listed for an unknown pollutant. There is no Tier I data currently available for this segment of Willow Creek, so it should be listed as Not Assessed until more data becomes available.

The South Fork Boise River – 3rd order Dixie Creek assessment unit

The 3rd order segment of the South Fork Boise River was listed for an unknown pollutant. This assessment unit includes Dixie, Deer, Dry Buck, and Rock Creeks. Elevated levels of subsurface fine sediment were found in Dixie Creek indicating that the pollutant causing the impairment is likely sediment. A TMDL for sediment has been developed.

The South Fork Boise River – 6th order assessment unit

The 6th order segment of the South Fork Boise River was listed for sediment. This AU includes the 6th order of Trail Creek and the 6th order South Fork Boise River. This segment could not be assessed because no appropriate data was available.

Comment [s4]: Is this because it isn't a wadeable water body? Should we recommend a modification of the listing for sediment as Not Assessed or leave it alone for now?

Anderson Ranch Reservoir

Anderson Ranch Reservoir was listed for an unknown pollutant in 1st and 2nd order tributaries. These are Lake, Evans, Louse, Magpie, Elk, Little Camas, Castle, Wilson, Goat and Lester Creeks. Goat and Lester Creeks are intermittent streams, meaning they often dry up in the summer. These sites were not used in determination of beneficial use support status. Data for the perennial streams in this AU indicate full support of beneficial uses and no TMDL is necessary at this time.

Moores Creek

Moores Creek was listed for an unknown pollutant in the 3rd order segment. This includes Moores Creek and Big Springs Creek. Sediment samples in this AU could not be completed due to high snow levels. This AU will be listed as Not Assessed until detailed sampling can be done at a later time.

Lime Creek

Lime Creek was listed for temperature in the 5th order segment. It was found to have beneficial uses impaired by temperature and a TMDL has been developed.

The South Fork Boise River – 2nd order assessment unit

The 2nd order segment of the South Fork Boise River was listed for unknown pollutants. Sites in this AU include Jumbo, Big Water, Deadwood, Myrtle, and West Fork Kelley Creeks. Data for these sites suggest full support of beneficial uses and no TMDL is necessary at this time. This AU should be delisted for unknown pollutants and moved to Section 2: Waters That Support Beneficial Uses in the next integrated report.

Fall Creek

Fall Creek was listed for an unknown pollutant in the 2nd order segment. This assessment unit includes Camp and Meadow Creek. Meadow Creek was shown to be fully supporting beneficial uses in 2006. Camp Creek was shown to be dry in 2006. The listed assessment unit is fully supporting beneficial uses and no TMDL is necessary at this time.

Smith Creek

Smith Creek had two segments listed on the 2002 §303(d) list.

The 2nd order segment of Smith Creek was listed for temperature. This segment was found to have beneficial uses impaired by temperature and a TMDL has been developed.

The 3rd order segment of Smith Creek was listed for an unknown pollutant. Data suggests that flow/habitat alteration is causing impairment of beneficial uses. There are nine constructed alterations in the 3rd order AU of Smith Creek. This includes eight reservoirs and one canal diversion being used to irrigate an agricultural patch west of Prairie. The 3rd order AU of Smith Creek should be delisted for unknown pollutants and listed for flow and habitat alteration.

Rattlesnake Creek

Rattlesnake Creek was listed for sediment in the 2nd order segment. This includes Corral, Elk, Grape, Little Rattlesnake, Rattlesnake, Slater, and Tipton Creeks. A rain on snow storm event caused landslides from Prairie to Garden Valley in December 1996 which impacted the sediment load to the 2nd order segment of the Rattlesnake Creek drainage (Lawrence Donohoo, Mountain Home Ranger District, Personal Communication, March 2008). Also, a fire burned much of the area around Rattlesnake Creek in 1992 (Idaho Bureau of Homeland Security website). Terracing is evident on some of the hillsides surrounding Little Rattlesnake Creek. This AU should also be delisted for sediment. No TMDL is necessary at this time.

Table 36. Summary of Assessment Outcomes

Water Body Segment/ AU	Pollutant	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
Upper Willow Creek (ID17050113SW002a_02)	Sediment	None	Delist for Sediment. Add to Section 4c for flow alteration.	Streams routinely go dry in mid-summer due to constructed flow alteration
Upper Willow Creek (ID17050113SW002a_03)	Sediment	None	Delist for Sediment. Add to Section 4c for flow alteration.	Streams routinely go dry in mid summer due to constructed flow alteration
Lower Willow Creek (ID17050113SW002b_03)	Unknown	None	Delist for Unknown. Add to Section 2 for Waters Supporting Beneficial Uses.	Data indicates full support
Lower Willow Creek (ID17050113SW002b_04)	Unknown	None	None	Not Assessed – BURP data outside Tier I parameters
South Fork Boise River-Dixie Creek (ID17050113SW004_03)	Unknown	Sediment	Delist for Unknown. Add to Section 4a for TMDL developed.	Data indicates sediment impairment
South Fork Boise River - South Fork Boise River and Trail Creek (ID17050113SW004_06)	Sediment	None	None	Not assessed – BURP data outside Tier I parameters

Anderson Ranch Res. – 1st and 2nd order tributaries –Goat, Lester, Wilson, Evans (ID17050113SW005_02)	Unknown	None	Delist for Unknown. Add to Section 2 for Water Supporting Beneficial Uses.	Data indicates full support
Moores Creek (ID17050113SW010_03a)	Unknown	None	None	Not Assessed
Lime Creek (ID17050113SW010_05)	Temperature	Temperature	Remove from Section 5. Add to Section 4a for TMDL developed.	Data indicates temperature impairment
South Fork Boise River - Jumbo Creek and Big Water Gulch (ID17050113SW015_02)	Unknown	None	Delist for Unknown. Add to Section 2 for Water Supporting Beneficial Uses.	Data indicates full support
Fall Creek (ID17050113SW031_02)	Unknown	None	Delist for Unknown. Add to Section 2 for Water Supporting Beneficial Uses.	Data indicates full support
Smith Creek (ID17050113SW032_02)	Temperature	Temperature	Remove from Section 5. Add to Section 4a for TMDL developed.	Data indicates temperature impairment
Smith Creek (ID17050113SW032_03)	Unknown	None	Delist for Unknown. Add to Section 4c for flow and habitat alteration.	Data indicates full support of beneficial uses. Nine constructed control structures alter flow.
Rattlesnake Creek (ID17050113SW033_02)	Sediment	None	Delist for Sediment. Add to Section 4c for habitat alteration.	Fire activity/landslide caused alteration.

Temperature

All streams examined had excess heat loads as a result of lack of shade. Smith Creek had the highest excess load, followed by, in order of decreasing load, Lime Creek, South Fork Lime creek, Middle Fork Lime Creek, and North Fork Lime Creek. Although Lime Creek is larger than Smith Creek, Smith Creek had almost double the load of Lime Creek. The North and Middle Fork Lime Creek are near the same size and had the smallest excess loads. South Fork Lime Creek is the third largest stream and had the third largest excess load. Smith Creek and Lime Creek had excess loads per linear meter that range from 0 to approximately 26 kWh/day/m. The South, Middle, and North Forks of Lime Creek had excess loads per linear meter from 0 to approximately 10 kWh/day/m. Loading tables and lack of shade figures can be used to identify segments of stream that lack the most shade and hence have the greatest excess load per linear meter. This can be used to prioritize implementation of efforts to restore and enhance shade on the streams examined.

Table 37. Summary of assessment outcomes for temperature TMDLs.

Water Body Segment/ AU	Pollutant	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
Smith Creek/ ID17050113SW032_03	Temperature	Yes	Move to Section 4c?	Existing Shade
Lime Creek/ ID17050113SW010_02 ID17050113SW010_04 ID17050113SW010_05	Temperature	Yes	None 4c?	Existing Shade

Comment [s5]: Does that mean PNV?

North Fork Lime Creek/ ID17050113SW010_02 ID17050113SW010_03	Temperature	Yes	None4c?	Existing Shade
Middle Fork Lime Creek/ ID17050113SW010_02 ID17050113SW010_03	Temperature	Yes	None 4c?	Existing Shade
South Fork Lime Creek/ ID17050113SW011_02 ID17050113SW011_03	Temperature	Yes	None4c?	Existing Shade