Bissel Creek Subbasin Assessment and Total Maximum Daily Load

Department of Environmental Quality

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Acknowledgments

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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 waterbodies required by this section
µ	micro, one-one thousandth
§	Section (usually a section of federal or state rules or statutes)
ADB	assessment database
AWS	agricultural water supply
BAG	Basin Advisory Group
BLM	United States Bureau of Land Management
BMP	best management practice
BOR	United States Bureau of Reclamation
BURP	Beneficial Use Reconnaissance Program
C	Celsius
CFR	Code of Federal Regulations (refers to citations in the federal administrative rules)
cfs	cubic feet per second
cm	centimeters
CWA	Clean Water Act
CWAL	cold water aquatic life
DEQ	Department of Environmental Quality
DO	dissolved oxygen
DWS	domestic water supply
EPA	United States Environmental Protection Agency
GIS	Geographical Information Systems
HUC	Hydrologic Unit Code
IDAPA	Refers to citations of Idaho administrative rules
LA	load allocation
LC	load capacity
m	meter
m^3	cubic meter
mi	mile
mi^2	square miles
MBI	macroinvertebrate index
mg/L	milligrams per liter
MOS	margin of safety
n.a.	not applicable
NA	not assessed
NB	natural background

NFS not fully supporting

NPDES National Pollutant Discharge Elimination System

NRCS Natural Resources Conservation Service

PCR primary contact recreation

PFC proper functioning condition

SBA subbasin assessment

SCR secondary contact recreation

SMI DEQ's stream macroinvertebrate index

SCC Soil Conservation Commission

SSC suspended sediment concentration

TMDL total maximum daily load

TP total phosphorus

TSS total suspended solids

t/y tons per year

USGS United States Geological Survey

WAG Watershed Advisory Group

WBAG Waterbody Assessment Guidance

WBID waterbody identification number

WLA wasteload allocation

WQLS water quality limited segment

WQS water quality standard

Executive Summary

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the CWA are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the waters whenever possible. Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize waterbodies that are water quality limited (i.e., waterbodies that do not meet water quality standards). States and tribes must periodically publish a priority list of impaired waters, currently every two years. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. This document addresses Bissel Creek, a stream that has been placed on what is known as the "§303(d) list."

This subbasin assessment and TMDL analysis has been developed to comply with Idaho's TMDL schedule. This assessment describes the physical, biological, and cultural setting; water quality status; pollutant sources; and recent pollution control actions in Bissel Creek, located in Southwest Idaho. The first part of this document, the subbasin assessment, is an important first step in leading to the TMDL. The starting point for this assessment was Idaho's current §303(d) list of water quality limited waterbodies. The subbasin assessment portion of this document examines the current status of §303(d) listed waters, and defines the extent of impairment and causes of water quality limitation throughout the subbasin. The loading analysis quantifies pollutant sources and allocates responsibility for load reductions needed to return listed waters to a condition of meeting water quality standards.

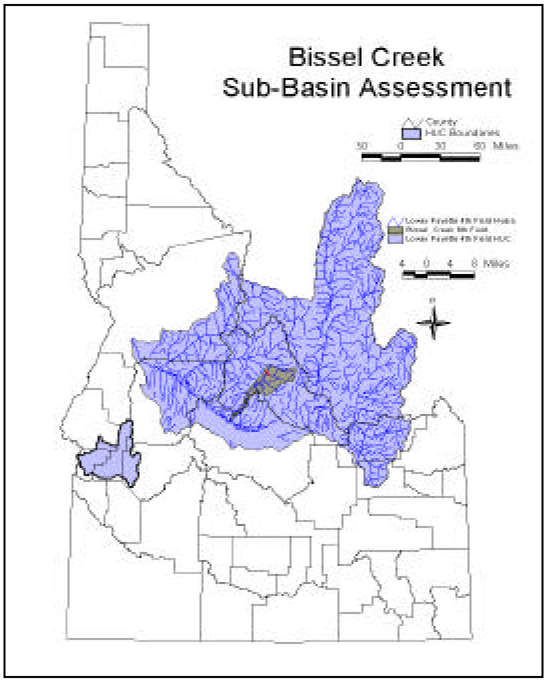
Subbasin at a Glance

Bissel Creek is 15.3 mile third order tributary to the Lower Payette River, Gem County, Idaho (Water Quality Limited Segment 2695). Bissel Creek generally drains south and west from Squaw Butte, under the Emmett Irrigation District North Side Main Canal, and into the Lower Payette River. The confluence of Bissel Creek and the Lower Payette River is located approximately 11 miles downstream and west of Emmett, Idaho at Letha. Land ownership within the Bissel Creek drainage includes both private and public lands. Much of the public land is managed for grazing by the Bureau of Land Management's (BLM) Cascade Resource Area. Other landowners include privately owned range, irrigated cropland, and lands managed by the Idaho Department of Lands (IDL).

In 1998, Bissel Creek was classified as water quality limited due to excessive sediment under §303(d) of the Clean Water Act. In addition, recent bacteria data obtained for Bissel Creek indicates that primary contact recreation is not supported at this time.

Beneficial use designations are not listed in the Idaho Administrative Procedures Act (IDAPA) at this time. Existing uses for the non-intermittent portions of Bissel Creek include cold water aquatic life, primary contact recreation, and agricultural water supply.

Figure A shows the Bissel Creek Subbasin at a glance.



Bissel Creek Subbasin

6th Field HUC#:	170501220702
Water Body:	Bissel Creek Headwaters to Mouth
Ecoregion:	Snake River
Pollutants:	Sediment and Bacteria
Beneficial Uses:	Cold Water Aquatic Life, Primary Contact Recreation
Pollution Sources:	Non-Point Sources
Size:	16,296.8 acres

Figure A. Bissel Creek Subbasin at a Glance.

Key Findings

The data indicate that below the North Side Canal Bissel Creek contains excess total suspended solids during the irrigation season (April – September). The irrigation season average at two of the three established monitoring locations exceeds the 22 mg/L target. A total suspended solids TMDL in necessary below the North Side Canal to reduce the amount of sediment in the water column.

The data also indicate that below the North Side Canal Bissel Creek contains excess *E. Coli* bacteria. Estimated geometric mean concentrations for the month of July at all three established monitoring locations show that the concentration is more than five times the standard of 126 organismsns/100 mL. At one location the concentration is more than seven times the standard. A TMDL is necessary to reduce the amount of *E. Coli* bacteria in the stream.

Upon approval of the Bissel Creek TMDL, DEQ expects to begin developing a TMDL implementation plan. The comprehensive implementation plan will provide details of the actions needed to achieve load reductions (set forth in a TMDL), a schedule of those actions, and specify monitoring needed to document actions and progress toward meeting state water quality standards. Development of the implementation plan will proceed under the existing practice established for the state of Idaho. DEQ, the Lower Payette River WAG, the affected private landowners, and other "designated agencies" with input from the established public process will cooperatively develop the plan.

Table A summarizes the outcomes of the Bissel Creek subbasin assessment and TMDL. Table B shows the specific stream segments for which TMDLs were set.

Table A. Summary of assessment outcomes.

Waterbody Segment	Pollutant	TMDL(s) Completed	Recommended Changes to §303(d) List	Recommended Schedule Changes
Bissel Creek WQLS:2695 AU:SW015_02	Sediment	None	De-list sediment	None
Bissel Creek WQLS:2695 AU:SW015_03	Sediment, Bacteria	Sediment, Bacteria	Split SW015_03 into SW015_03a (above North Side Canal) and SW015_03b (below North Side Canal). Delist sediment from 03a. List SW_03b for bacteria.	None

Table B. Streams and pollutants for which TMDLs were developed.

Stream	Pollutant(s)
Bissel Creek North Side Canal to Payette River WQLS:2695 AU:SW015_03b	Sediment, Bacteria

1. Subbasin Assessment – Watershed Characterization

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the CWA are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the waters whenever possible. Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize waterbodies that are water quality limited (i.e., waterbodies that do not meet water quality standards). States and tribes must periodically publish a priority list of impaired waters, currently every two years. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. This document addresses Bissel Creek, a stream that has been placed on what is known as the "§303(d) list."

The overall purpose of this subbasin assessment and TMDL is to characterize and document pollutant loads within Bissel Creek. The first portion of this document, the subbasin assessment, is partitioned into four major sections: watershed characterization, water quality concerns and status, pollutant source inventory, and a summary of past and present pollution control efforts (Chapters 1 – 4). This information will then be used to develop a TMDL for each pollutant of concern for Bissel Creek (Chapter 5). Much of the information in the watershed characterization section (Chapter 1) will refer to the Lower Payette TMDL (DEQ 1999).

1.1 Introduction

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

Background

The federal government, through the U.S. Environmental Protection Agency (EPA), assumed the dominant role in defining and directing water pollution control programs across the country. The Department of Environmental Quality (DEQ) implements the CWA in Idaho, while the EPA oversees Idaho and certifies the fulfillment of CWA requirements and responsibilities.

Section 303 of the CWA requires DEQ to adopt, with EPA approval, water quality standards and to review those standards every three years. Additionally, DEQ must monitor waters to identify those not meeting water quality standards. For those waters not meeting standards, DEQ must establish TMDLs for each pollutant impairing the waters. Further, the agency must set appropriate controls to restore water quality and allow the waterbodies to meet their designated uses. These requirements result in a list of impaired waters, called the "§303(d) list." This list describes waterbodies not meeting water quality standards. Waters identified on this list require further analysis. A subbasin assessment and TMDL provide a summary of the water quality status and allowable TMDL for waterbodies on the §303(d) list. The Bissel Creek Subbasin Assessment and TMDL provides this summary for Bissel Creek.

The subbasin assessment section of this report (Chapters 1 – 4) includes an evaluation and summary of the current water quality status, pollutant sources, and control actions to date. While this assessment is not a requirement of the TMDL, DEQ performs the assessment to ensure impairment listings are up to date and accurate. The TMDL is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (Water quality planning and management, 40 CFR 130). Consequently, a TMDL is water body- and pollutant-specific. The TMDL also includes individual pollutant allocations among various sources discharging the pollutant. The EPA considers certain unnatural conditions, such as flow alteration, a lack of flow, or habitat alteration, that are not the result of the discharge of a specific pollutants as "pollution." TMDLs are not required for waterbodies impaired by pollution, but not specific pollutants. 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 waterbodies and/or pollutants within a given watershed.

Idaho's Role

Idaho adopts water quality standards to protect public health and welfare, enhance the quality of water, and protect biological integrity. A water quality standard defines the goals of a water body by designating the use or uses for the water, setting criteria necessary to protect those uses, and preventing degradation of water quality through antidegradation provisions.

The state may assign or designate beneficial uses for particular Idaho waterbodies to support. These beneficial uses are identified in the Idaho water quality standards and include:

- Aquatic life support – cold water, seasonal cold water, warm water, salmonid spawning, modified
- Contact recreation – primary (swimming), secondary (wading)
- Water supply – domestic, agricultural, industrial
- Wildlife habitats, aesthetics

The Idaho legislature designates uses for waterbodies. Industrial water supply, wildlife habitat, and aesthetics are designated beneficial uses for all waterbodies in the state. If a water body is unclassified, then cold water and primary contact recreation are used as additional default designated uses when waterbodies are assessed.

A subbasin assessment entails analyzing and integrating multiple types of water body data, such as biological, physical/chemical, and landscape data to address several objectives:

- Determine the degree of designated beneficial use support of the water body (i.e., attaining or not attaining water quality standards).

- Determine the degree of achievement of biological integrity.

- Compile descriptive information about the water body, particularly the identity and location of pollutant sources.

- When water bodies are not attaining water quality standards, determine the causes and extent of the impairment.

1.2 Physical and Biological Characteristics

The following sections describe various characteristics of the Bissel Creek subwatershed. More detail about the Lower Payette Subbasin is located in the Payette River TMDL (DEQ 1999).

Lower Payette River Watershed Characteristics

Climate
The Lower Payette River watershed, in which Bissel Creek is found, is located in a semi-arid area. The watershed typically receives less than 20 inches/year precipitation. Summer months are usually hot and dry with occasional thunderstorms and brief heavy precipitation events. For the period from August 1, 1947 through June 30, 1997, at Payette, Idaho, the average maximum temperature for the months of June through September was 86.9^{o}F, with a minimum temperature during the same period of 51.7^{o}F. From June through September average monthly precipitation is 0.45 inches, with a total average precipitation for that period of 1.8 inches. Average annual precipitation is approximately 10.6 inches (Western Regional Climate Center 2000).

The winter months, December through March, are usually cool with approximately half of the annual precipitation events occurring during this period. The average maximum temperature for the period of August 1948 through June 1997 for the months of December through March was 44.5^{o}F, while the average minimum temperature was 24.3^{o}F. The average monthly precipitation is 1.27 inches. The average total precipitation is 5.1 inches during this period (Western Regional Climate Center 2002).

Geology
Most of the Lower Payette River and its tributaries below Black Canyon Dam flow upon a basement lithology of late Miocene and Pliocene lake and stream deposits and outwash from

Pleistocene mountain glaciation which produced multiple fluvial deposits on the surface of the older lake beds. Most recently, Holocene alluvial clay, silt, sand and gravel compose the more surficial deposits within the Lower Payette River tributaries.

Bissel Creek Subwatershed Characteristics

Hydrology

Bissel Creek is a spring-fed creek originating from Squaw Butte within the Boise Mountain Range. Approximately one (1) mile from the headwaters of Bissel Creek, water from an adjacent watershed (Sucker Creek) is diverted into Bissel Creek. The water from Sucker Creek is used to meet a water right in the upper portion of Bissel Creek. Depending on water supply and winter snow pack, the diversion from Sucker Creek can continue until May or June (Jim Little 2000, Personal Communication). Without the supplemental water from Sucker Creek, Bissel Creek subs underground directly below the inflow from Sucker Creek.

Water from another adjacent watershed (Corral Creek) is diverted into Bissel Creek approximately two (2) miles downstream from the Sucker Creek/Bissel Creek confluence. The diversion from the Corral Creek watershed is permanent with any available water from this drainage flowing into Bissel Creek. Although spring fed, Corral Creek is an intermittent stream for most of the summer months since the geology of the area allows for easy percolation into the ground.

With supplemental flows from Sucker Creek and Corral Creek, Bissel Creek is then completely diverted to the Van Duesan Reservoir. Any flows that would remain in the Bissel Creek channel would occur due to overflow from the diversion ditch. Most of the water supply storage to the reservoir relies on spring snowmelt.

United States Geological Survey (USGS) 7.5 Minute Quadrangle Maps (Squaw Butte) indicate that Bissel Creek is intermittent about two (2) miles downstream from the inflow location of Sucker Creek. USGS maps indicate Bissel Creek is perennial upstream to the headwaters from this point. A site visit conducted in 2000 verified that Bissel Creek is intermittent from just below the Sucker Creek inflow downstream to the point where Corral Creek enters the water body. Upstream of the Sucker Creek inflow, spring-seep inflows provide the only flowing water to the water body which was estimated to be less than one-tenth (0.1) of a cubic feet per second (cfs).

All water from the upper Bissel Creek watershed is diverted into the Van Duesan Reservoir from an elevation of 3000 feet and above. This diversion also includes the limited water supplied from Sucker Creek watershed to the north and the Corral Creek watershed to the south. Water stored in the reservoir is used to surface irrigate croplands downstream. Bissel Creek remains intermittent until it drops below the North Side Canal approximately four (4) miles upstream of the confluence with the Payette River.

Bissel Creek becomes perennial again four (4) miles upstream from the Payette River or approximately nine (9) miles downstream of Van Duesan Reservoir. Flowing water in this area is in all likelihood from ground water from adjacent irrigated croplands. Surface inflows include runoff from irrigated cropland during the irrigation season, which lasts from April 1st through September 30th. Most of the surface irrigated return flow originates from land directly adjacent to the stream. One small drain may originate from the Emmett Bench area, but the volume of surface water associated with this drain is not known.

Irrigation water from the North Side Canal is delivered directly to Bissel Creek near Hillview Road during the irrigation season. This irrigation water flows through a man-made conveyance southeast of Bissel Creek. The irrigation water from the North Side Canal in all likelihood supplements an existing water right, with Bissel Creek acting as a conveyance system. Near the confluence with the Payette River, some of the water in Bissel Creek is diverted to irrigate cropland within the Payette River floodplain area. This diversion as well as the perennial lack of flow near the North Side Canal creates an impassible barrier for fish from the river to the upper reaches of Bissel Creek. It has not been verified whether this diversion structure is a year-round placement, but DEQ noted that the structure was present in January and March of 2000 when irrigation water is not used (Ingham 2000, Personal Observation). The spillway on the North Side Canal spills into Bissel Creek. Near the site where the canal is siphoned under the stream channel, DEQ speculates that this spillway prevents excess water in the canal when water demand is less than available water. The excess irrigation water is returned to the river and may be diverted further downstream or it remains in the river. Figure 1 shows flows recorded by the Idaho Department of Agriculture (IDA) on Bissel Creek from April 1996 through March 1997. Figure 2 shows the probable intermittent and perennial segments of Bissel Creek. Large-scale flow management activities have changed very little over the past seven years. As such, the current flow regime is likely similar to that shown in Figure 1.

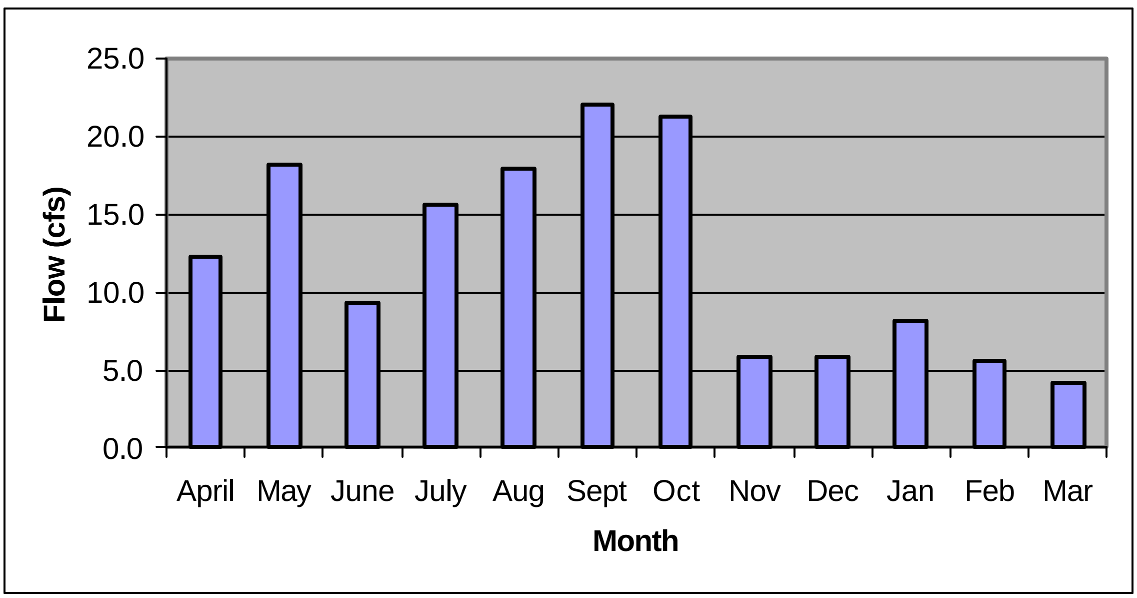


Figure 1. Bissel Creek Flows near Confluence with Lower Payette River, Gem County, Idaho.

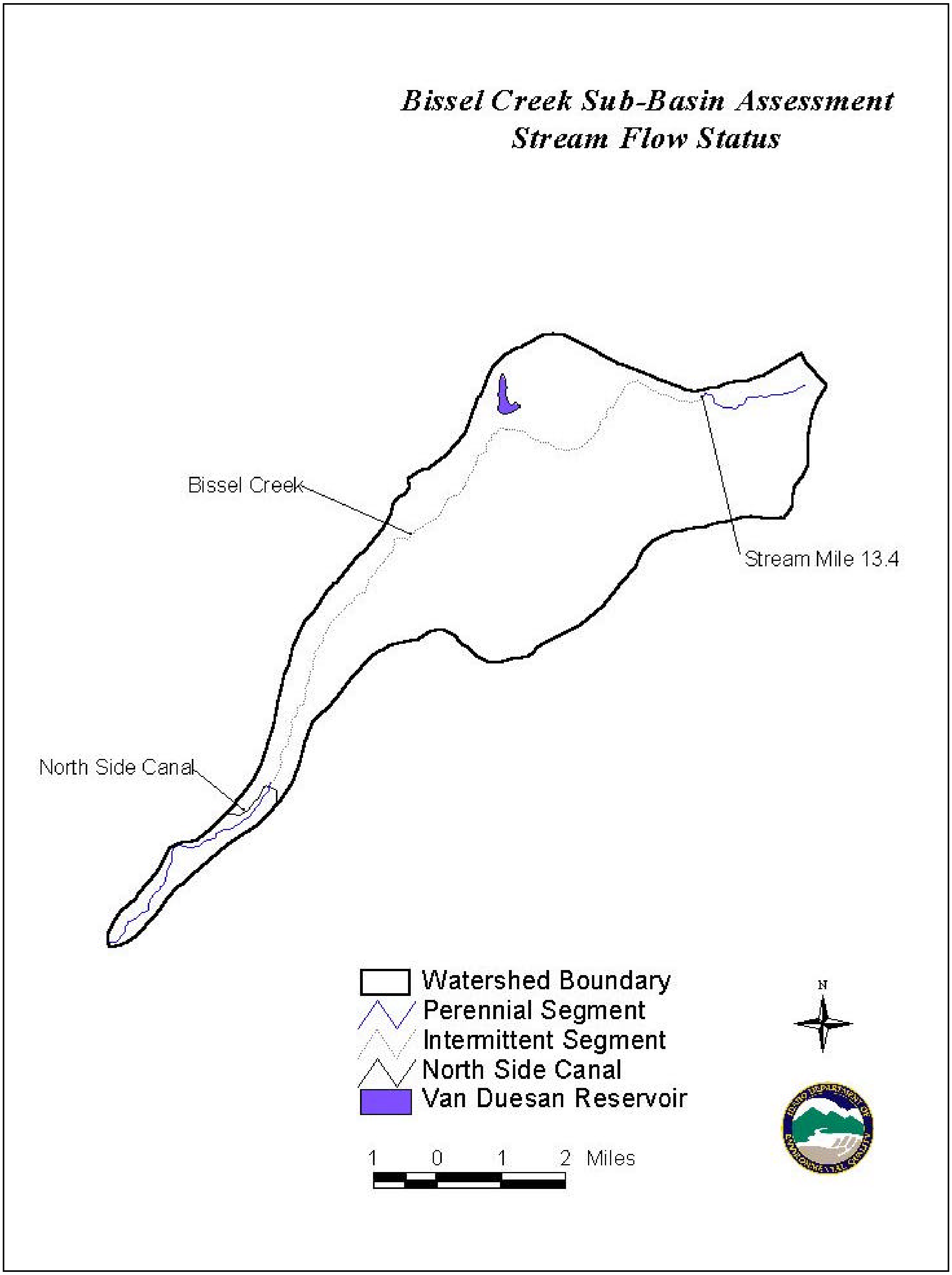


Figure 2. Intermittent and Perennial Flows for Bissel Creek. Gem County, Idaho. Bissel Creek Sub-Basin Assessment.

Riparian and Upland Vegetation
In the upper portion of the subwatershed (above the North Side Canal) the riparian area primarily consists of yellow willow, hawthorn and upland grass species. The low flow conditions and limited ground water most likely preclude the establishment of a robust riparian community. The upland vegetation consists of primarily rangeland species.

The riparian area in the lower portion of the subwatershed (below the North Side Canal) is primarily aged woody species such as willows, cottonwoods and Russian olive and reeds canary grass. The composition of the riparian area is largely dependent on the adjacent land use, which ranges from pasture to irrigated cropland.

Topography
Bissel Creek begins near the summit of Squaw Butte approximately ten (10) miles north of the city of Emmett, Idaho. The highest elevation of Squaw Butte is 5897 feet. The aspect of Squaw Butte is north to south with most of the drainages to the west and east sides of the mountain. Bissel Creek drains to the south to southwest from Squaw Butte. Numerous springs are located on both the east and west sides of Squaw Butte between 4000 and 5500 feet.

Slopes near the Squaw Butte summit are moderately steep at about 16%. Below 4000 feet, slopes decrease to about 10% and the landform is dominated by low rolling hills. Aspect is general a southern exposure with the stream flowing north to south to southwest. Bissel Creek flows out of the foothills into the relative flat area of the Emmett Bench. Bissel Creek is somewhat incised into the bench area and flows into the Payette River approximately five (5) miles northwest of Emmett, Idaho.

Fisheries
No fisheries information was located for Bissel Creek. Historically, some species of fish may have moved from the Lower Payette River into Bissel Creek. Currently, there is a potential fish barrier located approximately one-half mile upstream from the confluence with Payette River. The barrier is an irrigation diversion structure that appears to prevent the upward movement of fish from the Lower Payette River into Bissel Creek. If the diversion is indeed a fish barrier, there may be remedial opportunities that could be evaluated in the TMDL implementation phase.

Stream Characteristics

Stream morphology varies with the differing land use and landform. The upper headwaters exhibit general A to B channel type (Rosgen 1996) stream characteristics. Stream gradient is steep and averages 7% from the headwaters to Van Duesan Reservoir. Vegetation is mostly grassland with riparian vegetation consisting of willows and hawthorns. The valley bottom is characterized as a “V” shape and very confined. The valley widens near Van Duesan Reservoir and the stream classification becomes more of a B-type channel. It is this portion of the water body where abandoned stream channels are noted as the stream flows through alluvial deposits of sands and gravels. The substrate mimics the surrounding soils with clean gravels noted in the stream channel.

Below Van Duesan Reservoir, the valley is broad with sprinkler irrigated hayfields dominating the valley bottom. The uplands are still primarily rangeland. Rosgen channel type is mostly C with an interspersed mile of incised G-type channel. Large cottonwoods and willow species begin to be the dominant vegetation along the riparian areas. Stream gradient is near 1% through the irrigated section of the valley. However, the stream remains intermittent throughout this section, although groundwater begins to recharge the stream. As the stream leaves the irrigated area, the primary land use is open rangeland. Fine sands dominate the dry channel. Flows that occur in this reach are in all likelihood brief and associated with precipitation events or snowmelt in late winter. This flow regime (lack of water) greatly reduces the streams ability to move sediments through the system.

Below the North Side Canal and on to the Emmett Bench area, Bissel Creek is in all likelihood influenced by groundwater recharge. The Emmett Bench consists mostly of old out-wash from glacial activity which produced fluvial deposits throughout the lower Payette Valley. This out-wash of sands and gravels produced the benches that can be seen bordering the Payette River along with other lower elevation rivers in southwest Idaho. It is these bench areas that provide ideal soils for growing high water demanding crops, but offer high soil percolation rates to keep the areas from becoming saturated. Refer to the Lower Payette River TMDL (DEQ 1999) for further information on geology of the Payette River Valley.

Over time, Bissel Creek has down-cut through the Emmett Bench resulting in an elevation difference of 20 to 100 feet below the relatively flat bench. This down-cut has produced a natural funnel for groundwater, which is also influenced by the presence of gravity irrigated croplands in the higher elevated areas to the east and west. Although downcutting has occurred, Bissel Creek has a distinctive floodplain. Access to this floodplain has been modified in certain areas and in others areas stream morphology is unchanged.

Irrigation water from the North Side Canal is delivered directly to Bissel Creek near Hillview Road. This irrigation water flows through a man-made conveyance to the southeast of Bissel Creek. This conveyance joins Bissel Creek approximately one-half mile north of the Old Black Canyon Highway. Bissel Creek appears to be altered near Hillview Road area and follows the valley contour instead of the natural valley bottom.

There is evidence of sediment removal and stream alteration throughout the lower segment before emptying into the Payette River. The stream channel alteration in the surface irrigated areas was intended to accomplish three separate goals; 1) to assist in draining near surface ground waters to prevent over saturation (alkalinity) of soils; 2) to increase ground recharge for more flowing (available) water; and 3) to maintain the stream as a conveyance for irrigation water.

1.3 Cultural Characteristics

This section describes the land use and ownership patterns in the Bissel Creek subwatershed. Further description of the Lower Payette Subbasin's history, population, political boundaries and economy is located in the Lower Payette River TMDL.

Land Use and Ownership

Land ownership within the Bissel Creek drainage includes both private and public lands. Much of the public land is managed for grazing by the Bureau of Land Management's (BLM) Cascade Resource Area. Other landowners include privately owned range, irrigated crop production, and lands managed by the Idaho Department of Lands. Figure 3 shows the land ownership in the Bissel Creek subwatershed. The majority of the land (87%) in the Bissel Creek drainage is used as rangeland. The remaining 13% is used for irrigated cropland. Figure 4 shows the land use distribution within the drainage.

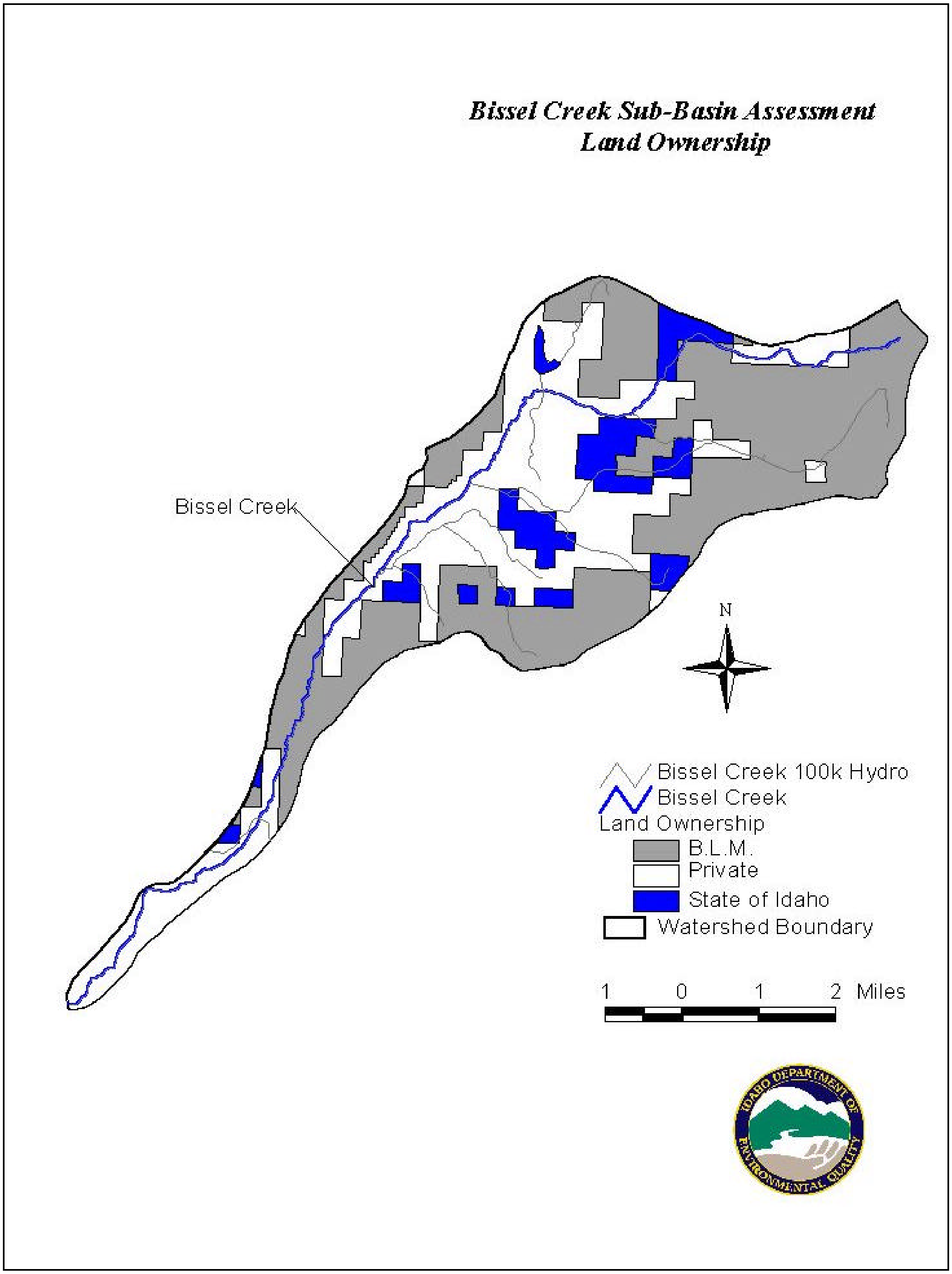


Figure 3. Land Ownership for Bissel Creek. Gem County, Idaho. Bissel Creek Sub-Basin Assessment.

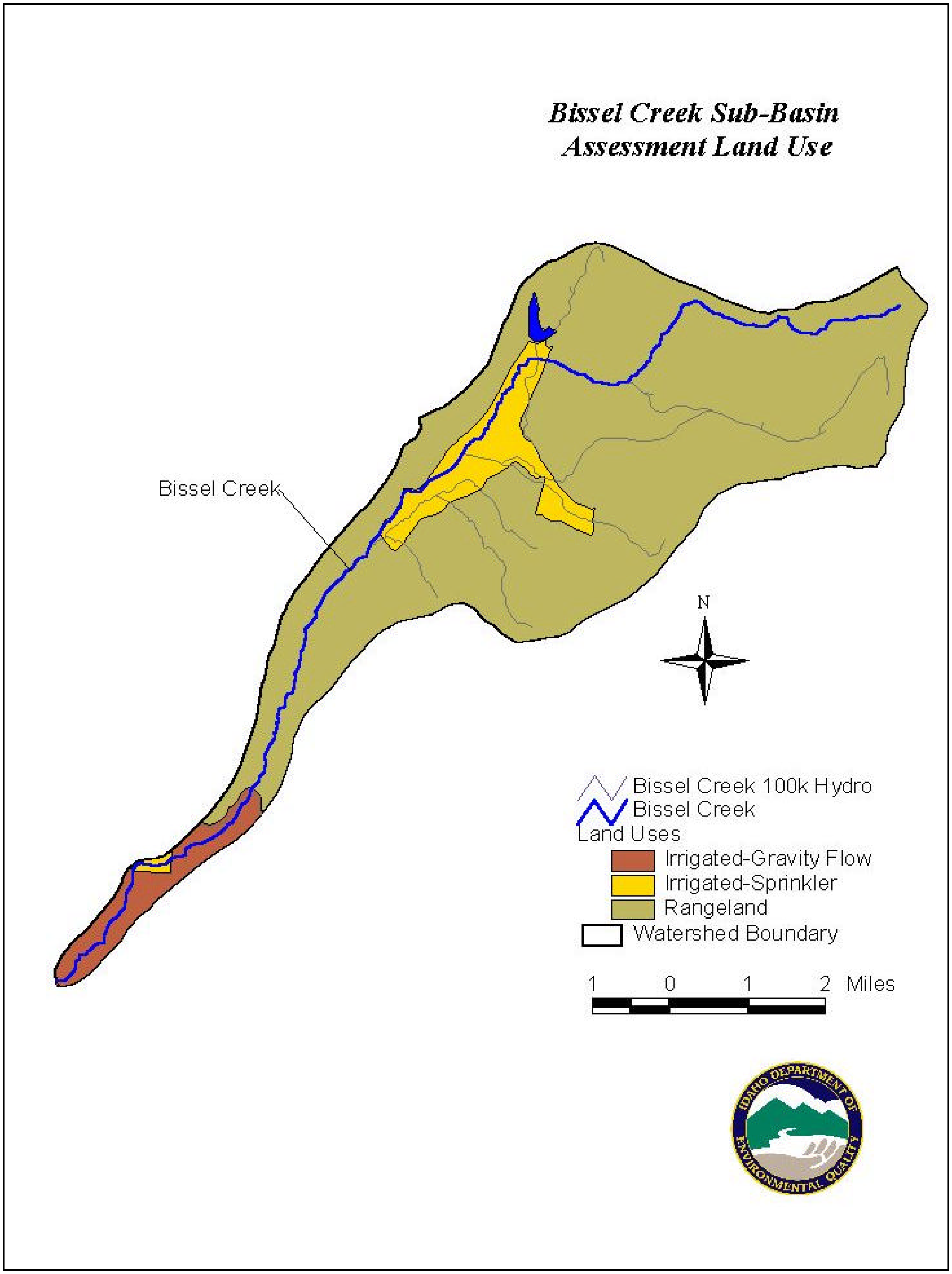


Figure 4. Land Use for Bissel Creek. Gem County, Idaho. Bissel Creek Sub-Basin Assessment.

2. Subbasin Assessment – Water Quality Concerns and Status

Bissel Creek is the only §303(d) listed segment within the 6th Field HUC. The 1988 §305(b) Report generated by DEQ reported Bissel Creek as not fully supporting cold water biota, salmonid spawning, primary contact recreation and secondary contact recreation. Agricultural water supply was classified as supported but threatened (DEQ 1988).

On three occasions (June 1995, August 1996 and June 1998), Beneficial Use Reconnaissance Program (BURP) monitoring was attempted on Bissel Creek. All three attempts focused on one location near the area where North Side Canal is siphoned under the Bissel Creek channel. On all three occasions, the creek was dry, thus no BURP data is available.

2.1 Water Quality Limited Segments Occurring in the Subbasin

As mentioned above, Bissel Creek is the only §303(d) listed segment within the 6th Field HUC. Table 1 shows the details of the §303(d) listing for Bissel Creek.

Table 1. §303(d) Segments in Bissel Creek

Water body Name	Segment ID Number	1998 §303(d)[1] Boundaries	Pollutants	Listing Basis
Bissel Creek	2695	Headwaters to Payette River	Sediment	1988 §305(b) Report

[1]Refers to a list created in 1998 of waterbodies in Idaho that did not fully support at least one beneficial use. This list is required under section 303 subsection "d" of the Clean Water Act.

The listed pollutant of concern for Bissel Creek is sediment (DEQ 1998). Data indicating that bacteria are in excess is also available. Under the General Surface Water Criteria (IDAPA §52.01.02.200) it must be demonstrated that the sediment and bacteria are at levels that impair the designated beneficial use. See Appendix B for an explanation of Idaho's WQS and full text of the appropriate IDAPA citations.

2.2 Applicable Water Quality Standards

Idaho adopts both narrative and numeric water quality standards to protect public health and welfare, enhance the quality of water, and protect biological integrity. By designating the beneficial use or uses for water bodies, Idaho has created a mechanism for setting criteria necessary to protect those uses and prevent degradation of water quality through anti-degradation provisions. According to IDAPA 58.01.02.050 (02)a "wherever attainable, surface waters of the state shall be protected for beneficial uses which includes all recreational use in and on the water surface and the preservation and propagation of desirable species of aquatic biota." Beneficial use support is determined by DEQ through its water body assessment process. Table 2 contains a listing of presumed beneficial uses for Bissel

Creek. The presumed uses apply since Bissel Creek contains no designated uses. Table 3 is a summary of the water quality standards associated with the beneficial uses and the pollutants of concern.

Also included in this section is a description of how the water quality criteria apply (from a TMDL standpoint) to intermittent waters. This is an important factor for Bissel Creek.

Table 2. Bissel Creek presumed beneficial uses

Water Body	Existing/Presumed Uses[1]	1998 §303(d) List[2]
Bissel Creek	CWAL, PCR	Yes

[1]CWAL – Cold Water Aquatic Life, PCR – Primary Contact Recreation
[2]Refers to a list created in 1998 of waterbodies in Idaho that did not fully support at least one beneficial use. This list is required under section 303 subsection "d" of the Clean Water Act.

Table 3. Water quality standards associated with beneficial uses

Pollutant & IDAPA Citation	Beneficial Use(s) to Which Standard Applies	Applicable Water Quality Standard
Sediment (58.01.02.200.08)	Cold Water Aquatic Life	Sediment shall not exceed quantities specified in general surface water quality criteria (IDAPA 58.01.02.250 or 252) or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses
Bacteria (58.01.02.251.01.b,c)	Primary Contact Recreation	Less than 126 *E. coli* organisms/100 mL as a 30 day geometric mean with a minimum of five samples AND no sample greater than 406 *E. coli* organisms/100 mL

The state of Idaho defines an intermittent stream as one that has a period of zero flow for at least one week during most years or has a 7Q2 (a measure of the annual minimum 7-day mean stream flow, based on either a 2 year low) hydrologically based flow of less than 0.10 cfs (IDAPA 58.01.02.003.51). If a stream contains naturally perennial pools with significant aquatic life, it is not considered intermittent. Using this definition as guidance, DEQ identified all but the upper 1.9 miles and the lower four miles of Bissel Creek as being intermittent (Figure 2). Appendix C contains a detailed photo documentation of Bissel Creek showing that the stream was dry at most locations in numerous years. The implication of this determination is that a TMDL will not be prepared for this segment because water is not present during the critical loading period (typically the irrigation season) or when aquatic life beneficial uses are expected to be fully supported (middle to late summer months). IDAPA 58.01.02.070.07 states that water quality standards shall only apply to intermittent waters during optimum flow periods sufficient enough to support the beneficial uses for which the water body has been designated. The optimum flow for contact recreation is equal to or greater than 5.0 cfs. The optimum flow for aquatic life is equal to or greater than 1.0 cfs.

Beneficial Uses

Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and "presumed" uses as briefly described in the following paragraphs. The *Water Body Assessment Guidance*, second edition (Grafe 2002) gives a more detailed description of beneficial use identification for use assessment purposes.

Existing Uses

Existing uses under the CWA are "those uses actually attained in the waterbody on or after November 28, 1975, whether or not they are included in the water quality standards." The existing in stream water uses and the level of water quality necessary to protect the uses shall be maintained and protected (IDAPA 58.01.02.003.35, .050.02, and 051.01 and .053). Existing uses include uses actually occurring, whether or not the level of quality to fully support the uses exists. Practical application of this concept would be when a water could support salmonid spawning, but salmonid spawning is not yet occurring.

Designated Uses

Designated uses under the CWA are "those uses specified in water quality standards for each waterbody or segment, whether or not they are being attained." Designated uses are simply uses officially recognized by the state. In Idaho these include things like aquatic life support, recreation in and on the water, domestic water supply, and agricultural use. Water quality must be sufficiently maintained to meet the most sensitive use. Designated uses may be added or removed using specific procedures provided for in state law, but the effect must not be to preclude protection of an existing higher quality use such as cold water aquatic life or salmonid spawning. Designated uses are specifically listed for waterbodies in Idaho in tables in the Idaho water quality standards (see IDAPA 58.01.02.003.22 and .100, and IDAPA 58.01.02.109-160 in addition to citations for existing uses.)

Presumed Uses

In Idaho, most waterbodies listed in the tables of designated uses in the water quality standards do not yet have specific use designations. These undesignated uses are to be designated. In the interim, and absent information on existing uses, DEQ presumes that most waters in the state will support cold water aquatic life and either primary or secondary contact recreation (IDAPA 58.01.02.101.01). To protect these so-called "presumed uses," DEQ will apply the numeric criteria cold water and primary or secondary contact recreation criteria to undesignated waters. If in addition to these presumed uses, an additional existing use, (e.g., salmonid spawning) exists, because of the requirement to protect levels of water quality for existing uses, then the additional numeric criteria for salmonid spawning would additionally apply (e.g., intergravel dissolved oxygen, temperature). However, if for example, cold water is not found to be an existing use, a use designation to that effect is needed before some other aquatic life criteria (such as seasonal cold) can be applied in lieu of cold water criteria. (IDAPA 58.01.02.101.01).

Pollutant Relationships to Beneficial Uses Support Status

Sediment

Both suspended and bedload sediment (sediment particles too large or heavy to be suspended, but still transported by flowing water) can have negative effects on aquatic life communities. Many fish and aquatic insect species can tolerate elevated suspended sediment levels for short periods of time, such as during natural spring runoff, but longer durations of exposure are detrimental. Elevated suspended sediment levels can interfere with fish feeding behavior (difficulty finding food due to visual impairment), damage gills, reduce growth rates, smother eggs and fry in the substrate, damage habitat, and in extreme cases eventually lead to death. Eggs, fry, and juveniles are especially sensitive to suspended sediment.

Newcombe and Jensen (1996) reported the effects of suspended sediment on fish, summarizing 80 published reports on suspended sediments in streams and estuaries. For rainbow trout, physiological stress, which includes reduced feeding rate, is evident at concentrations of 50 to 100 mg/L suspended sediment concentration (SSC) when those concentrations are maintained for 14 to 60 days. Similar effects are observed for other species, although the data set is less reliable. Adverse effects on habitat, especially spawning and rearing habitat, were noted at similar concentrations.

Bedload sediment also adversely affects aquatic species. As sand and silt wash downstream, they can cover spawning gravels, increasing embeddedness in the streambed. If this occurs during incubation periods or while small fry are using the spawning gravels to develop, it may eliminate those areas and result in death. Bedload can also reduce intergravel DO levels by decreasing the critical re-oxygenating flow through the intergravel matrix.

In addition to these direct effects on the habitat and spawning success of fish, detrimental food source changes may also occur. Aquatic insects, which serve as a primary food source for fish, are affected by excess sedimentation. Increased sedimentation leads to a macroinvertebrate community that is prone to burrowing, thereby making the macroinvertebrates less available to fish. Community structure, specifically diversity, of the aquatic macroinvertebrate community also diminishes due to the reduction of coarse substrate habitat.

Bacteria
Coliform bacteria are unicellular organisms found in feces of warm-blooded animals such as humans, domestic pets, livestock, and wildlife. Coliform bacteria are commonly monitored as part of point source discharge permits (National Pollution Discharge Elimination System [NPDES] permits), but may also be monitored in nonpoint source arenas. The human health effects from pathogenic coliform bacteria range from nausea, vomiting, diarrhea, acute respiratory illness, meningitis, ulceration of the intestines, and even death. Coliform bacteria do not have a known effect on aquatic life.

Coliform bacteria from both point and nonpoint sources impact water bodies, although point sources are typically permitted and offer some level of bacteria-reducing treatment prior to discharge. Nonpoint sources of bacteria are diffuse and difficult to characterize. Unfortunately, nonpoint sources often have the greatest impact on bacteria concentrations in water bodies. This is particularly the case in urban stormwater, agricultural areas and where wildlife is abundant. Wildlife may account for a significant percentage of the bacteria in some water bodies, although the exact percentage is difficult and costly to determine.

2.3 Summary and Analysis of Existing Water Quality Data

This section describes the physical, chemical and biological data for Bissel Creek as it pertains to determining beneficial use support status. The data were primarily collected by the Idaho Department of Agricultural (IDA) in 1996, 1997 and 1999. Additional data were collected by DEQ and the Soil Conservation Commission (SCC) in various years, as described in the following sections. Appendix D shows the various data sources used in this assessment. Figure 5 shows the location of the monitoring sites within the subwatershed.

Flow Characteristics

Bissel Creek is primarily an intermittent stream except for perennial flows associated with higher elevation near Squaw Butte and lower elevations within the Emmett Bench area. DEQ has located water in the upper reach during every site visit. However, it has been reported that the upper reach has occasionally gone dry in the past (Dinah Reaney 2002, Personal Communication). There is no data regarding the frequency or duration of flows from the upper portion of the watershed to the lower portion. The amount of spill from the North Side Canal that enters the stream and the amount of water diverted to fulfill a downstream water right in Bissel Creek are also unknown.

In early January 1997 a rain on snow event caused damaging floods throughout southwest Idaho. Available flow data from this period indicates only a slight increase in flow in early December 1996 and late January 1997. Anecdotal information for the streams entering the Payette River from the north indicated large flash floods occurred in the smaller drainages during the rain on snow event at the end of December. Since much of the water in the higher elevations of the watershed are diverted and stored, it is difficult to determine what impact this event may have had on Bissel Creek further downstream.

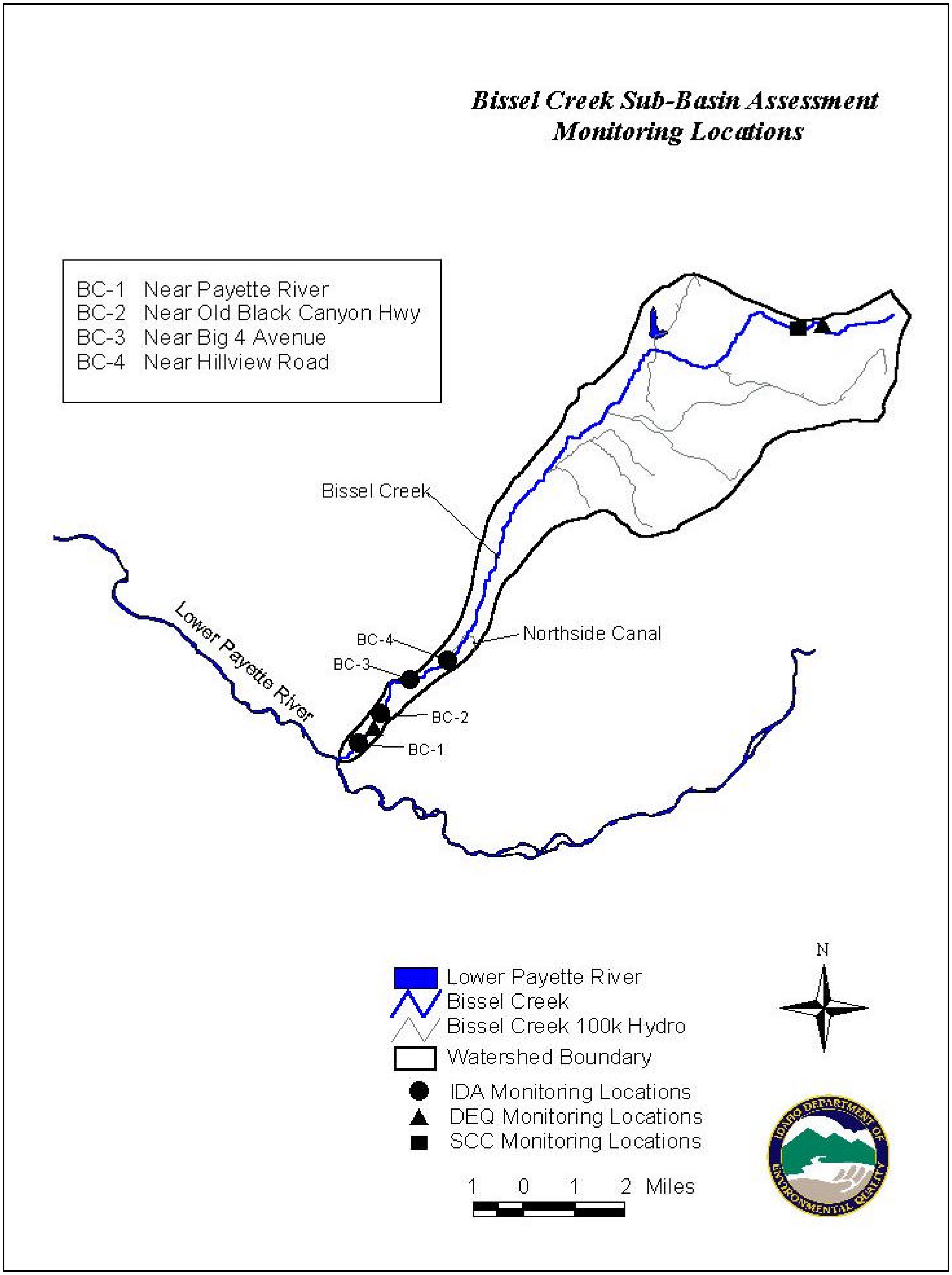
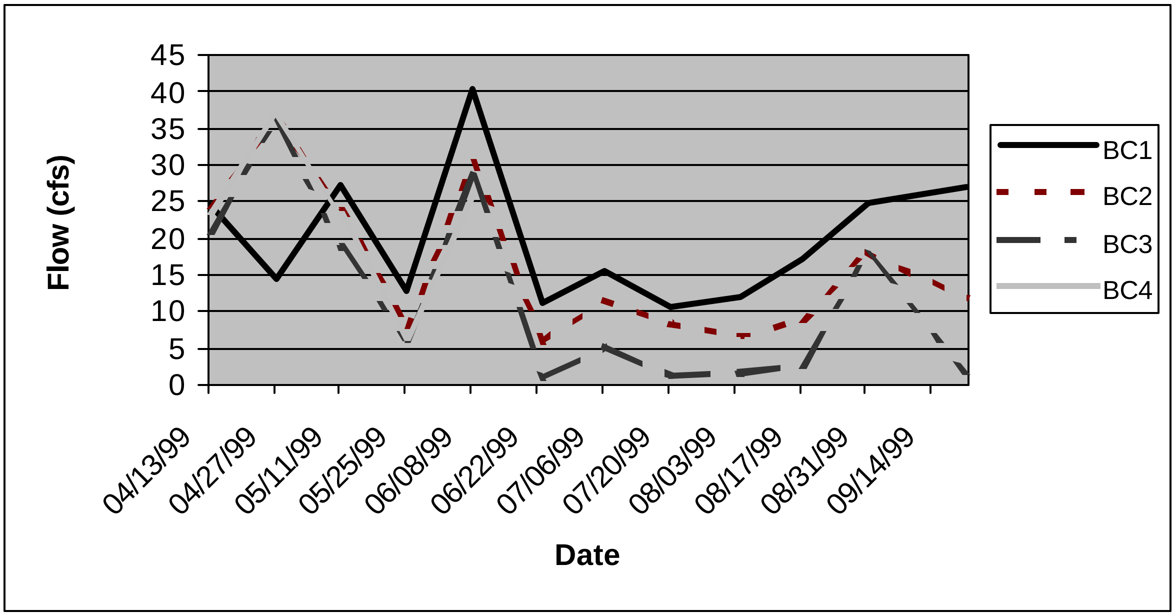


Figure 5. Monitoring Locations in the Bissel Creek Watershed. Gem County, Idaho. Bissel Creek Sub-Basin Assessment.

Figure 6 shows the irrigation season flows in Bissel Creek for 1999. It is unclear if the higher flows seen in the early parts of the season (April) are due to overflow from the North Side Canal or increased flows to supply water rights further down Bissel Creek. Based on the normal flow regimes in Bissel Creek, it is unlikely that the increased flows are associated with flows from the upper portion of the watershed in 1999.



BC-1, Bissel Creek near Payette River; BC-2, Bissel Creek near Old Black Canyon Highway; BC-3, Bissel Creek near Big 4 Avenue; BC-4, Bissel Creek near Hillview Road.

Figure 6. Irrigation Season Flows in Bissel Creek

<u>Water Column Data</u>

The established monitoring site on Bissel Creek is near the confluence with the Payette River. Three (3) additional upstream sites are located within the final four (4) river miles before the stream empties into the Payette River. These monitoring efforts focused mostly on water column parameters including physical, chemical and biological (bacteria) constituents.

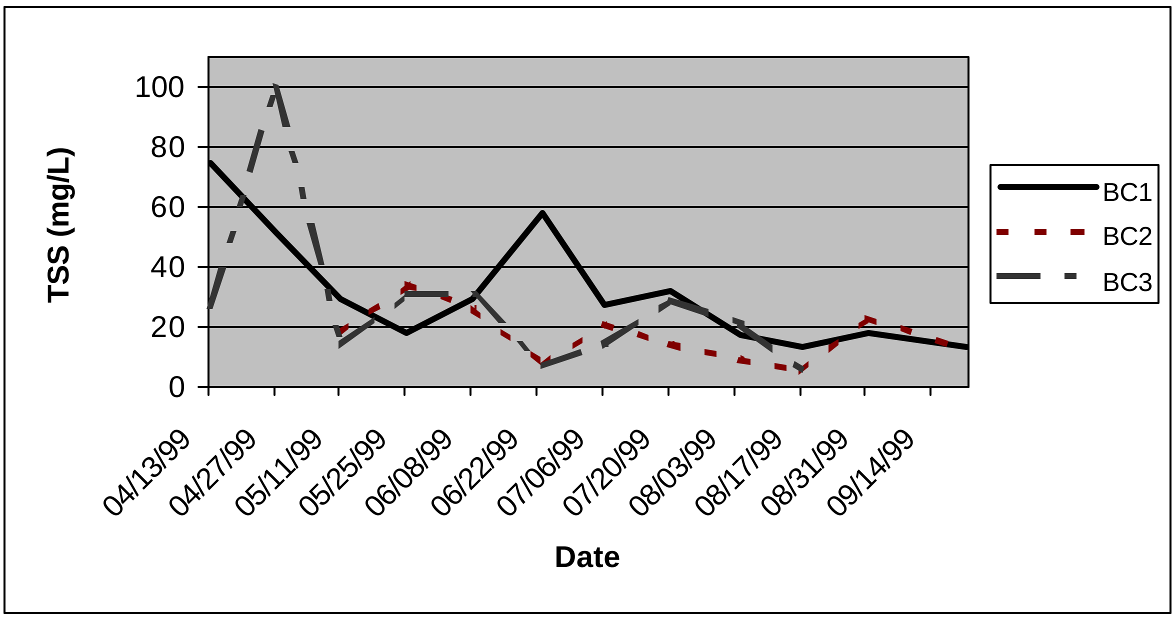
Suspended Solids (Sediment)
Suspended sediment concentration (SSC) data are not available for Bissel Creek. The available water column data are reported in terms of total suspended solids (TSS). As such, a direct comparison to the 50 mg/L target discussed in section 2.3 is not possible. However, when collected from the same water body, if TSS is low SSC is typically low as well. This allows for an indirect comparison between the Bissel Creek TSS data and the SSC target, as discussed below.

Table 4 shows the 1999 irrigation season average TSS conditions at three of the four IDA monitoring locations while Figure 7 shows the data on a monthly basis. BC-4 contained an incomplete data set due to beaver activity. Therefore, the water quality data are not used in this assessment. Table 5 shows similar data collected near the Payette River for 1996 and 1997. Note that the 1999 irrigation season average TSS concentration at the mouth (BC-1) and the 1996 irrigation season average concentration differ by only 4 mg/L. This indicates that water use, water management and land use activities in the area have changed very little over that period of time.

Table 4. 1999 irrigation season average TSS concentrations and loads in Bissel Creek

Locations	Average Flows (cfs)	Average TSS Concentration (mg/l)	Average TSS Load (lbs/day)	Average TSS Load (tons/day)
BC-1	19.8	31.7	3383	1.69
BC-2[1]	16.2	20.2	1766	0.88
BC-3[2]	11.8	25.7	1635	0.81

BC-1, Bissel Creek near Payette River; BC-2, Bissel Creek near Old Black Canyon Highway; BC-3, Bissel Creek near Big 4 Avenue; BC-2[1] TSS Results of 402 mg/l for 4/27/99 were not used; BC-3[2] TSS Results of 175 mg/l for 8/31/99 were not used.



BC-1, Bissel Creek near Payette River; BC-2, Bissel Creek near Old Black Canyon Highway; BC-3, Bissel Creek near Big 4 Avenue

Figure 7. 1999 Irrigation Season Average TSS Concentrations in Bissel Creek

Table 5. 1996-1997 irrigation season average TSS concentrations and loads in Bissel Creek near the Payette River

Season	Average Flows (cfs)	Average TSS Concentration (mg/l)	Average TSS Load (lbs/day)	Average TSS Load (tons/day)
Overall 1996-97	13.5	24.9	1815	0.90
Irrigation Season 1996	15.9	27.4	2352	1.18
Non-Irrigation Season 1997	8.5	19.7	904	0.45

As shown in Table 3, the Idaho water quality standard for sediment is narrative, meaning there is not a numeric value against which TSS conditions in Bissel Creek can be compared to determine compliance with the water quality standards. Site-specific conditions must be evaluated to determine an appropriate sediment target. The sediment target should be linked to conditions that will ensure the water quality standards are met.

To determine a TSS target that will support cold water aquatic life in Bissel Creek, the TSS conditions in lower Succor Creek (located southwest of Bissel Creek in hydrologic unit 17050103) are used as a comparison. Speaking in terms of TSS concentrations, the lower Succor Creek sediment TMDL (DEQ 2003) determined that cold water aquatic life would be supported at 22 mg/L TSS. The adjacent land uses and irrigation practices are very similar in the two subwatersheds, as such, the target of 22 mg/L TSS is used for Bissel Creek.

The target of 22 mg/L TSS will be applied during the irrigation season (April – September) because, as suggested in Table 5, the irrigation season is when most of the loading occurs to the stream. The target of 22 mg/L represents the TSS conditions in the stream during a time of year loads are the highest, yet, as discussed below, aquatic life beneficial uses can remain supported.

Tables 4 and 5 and Figure 7 illustrate that over the course of a typical irrigation season, TSS concentrations in Bissel Creek are typically in excess of 22 mg/L below the North Side Canal. Total suspended solids load reductions are necessary in Bissel Creek in order to continuously maintain 22 mg/L throughout the irrigation season. The TMDL portion of this document (Chapter 5) will identify the extent of the necessary reductions.

Bacteria

While bacteria is not a §303(d) listed pollutant in Bissel Creek, there is a significant amount of data indicating that *E. Coli* are in excess of the criteria. Bacteria monitoring for fecal coliform in 1996-97 and *E. coli* in 1999 showed that primary and secondary contact recreation is not fully supported in Bissel Creek. Table 6 shows the results for fecal coliform and *E. coli* monitoring from 1996-97 and the 1999 irrigation season.

Table 6. Bacteria monitoring results from 1996-1997 and 1999 irrigation season

Season / Location	Average Fecal Coliform (cfu/100ml)	Average *E. coli* (cfu/100ml)
Irrigation Season 1996	2132	NA
Non-Irrigation Season 1997	148	NA
BC-1	842	503
BC-2	1402	767
BC-3	2215	1388
BC-4	354	235

A review of the data used to generate the averages in Table 6 shows that nearly half (46%) of the samples exceed the instantaneous criterion of 406 organisms/100 mL. The 30-day geometric mean could not be calculated because five samples were never collected over a 30-day period. However, the magnitude of the *E. Coli* concentrations and the consistency with which the exceedances occur suggest that had the data been collected the geometric mean criterion (126 organisms/100 mL) would likely have been exceeded. To verify this, the geometric means for July were estimated at BC-1, BC-2 and BC-3. Three sampling events occurred within a 30 day period near the month of July. Using the data from the three days, interval averages were calculated to simulate the E. Coli concentration on a hypothetical day between the known sampling dates. Using this technique, the estimated July geometric means for BC-1, BC-2 and BC-3 are 662, 669 and 986 organisms/100 ml, respectively. These estimates far exceed the criterion of 126 organisms/100 ml.

Biological Data

Periphyton (Algae)

Periphyton samples were collected in 2000 on Bissel Creek near the headwaters, approximately two (2) miles upstream of Van Duesan Reservoir. Sampling methods followed standard BURP protocols (IDEQ 1999). Samples were shipped to Hannaea in Helen, Montana for analysis and species evaluation. Species analysis used various metrics to determine either the beneficial use support and/or impairment from a possible pollutant(s) (Bahls 2001).

The periphyton results suggest that upper Bissel Creek supports excellent biological integrity. The siltation index, one of the metrics used to evaluate the periphyton community, indicated that sediments are not in excess. Although one species that prefers to live in sandy substrates, *Achnanthes lanceolata*, was noted in abundance, the remaining species composition suggested that sediments is not in excess. An excerpt from Dr. Bahls' Report is located in Appendix E. Periphyton data are not available for Bissel Creek below the North Side Canal.

Macroinvertebrates (Aquatic Insects)
During the same monitoring event in 2000, macroinvertebrates samples were collected at the upper Bissel Creek site (described above). Sample collection followed Beneficial Use Reconnaissance Project (BURP) sampling methods (IDEQ 1999). The macroinvertebrate results were evaluated using the DEQ Biological Assessment Tool (BAT) database. The output generated by BAT contains a variety of indexes that can assist with determining existing beneficial uses and the support status of those uses. The primary indexes that give insight as to the beneficial use support status are shown in Table 7.

Table 7. Bissel Creek macroinvertebrate results – determined using the DEQ Biological Assessment Tool, August 2000.

Stream Segment	Total Abundance (# of organisms)	Taxa Richness (# of taxa)	Percent EPT[1] (%)	Stream Macroinvertebrate Index – SMI (unitless)
Upper Bissel Creek	635	37	29.8	59.29

1 EPT: Ephemeroptera, Plecoptera, Tricoptera

The Stream Macroinvertebrate Score Index (SMI) is a direct biological measurement of cold water aquatic life integrity. A SMI for the Snake River/High Desert Ecosystem (in which Bissel Creek is located) greater than or equal to 51 indicates a fully supported cold water aquatic life community. Upper Bissel Creek's SMI score was 59.29 indicating that cold water aquatic life is fully supported in the upper segment.

On June 29, 2001 macroinvertebrates were collected below Black Canyon Highway. The intent was to also sample above the North Side Canal if water was present, but the stream did not contain water. Once collected, the sample was not analyzed using the BAT (as described above). Rather, a more detailed, independent analysis of the sample was performed by DEQ's Technical Services division (Clark 2003). The analysis evaluated the critical metrics, including richness, composition, trophic status, and pollution tolerance of the community.

While the macroinvertebrate community contained good richness, it was primarily composed of pollution tolerant species. There were very few EPT species in the sample and those that were present were the pollution tolerant variety. No Plecoptera were found at the site, indicating the fine sediments are probably in excess. Scrapers, the functional feeding group typically found in gravel/cobble substrates, were sparse. Collector-gathers, however, the functional feeding group typically found in sediment laden substrates, were abundant.

While there are other pressures such as modified stream flow that have an effect on the macroinvertebrate community in Bissel Creek near Black Canyon Highway, the analysis showed that elevated amounts of fine substrate material are contributing to the impairment of the cold water aquatic life community in Bissel Creek below the North Side Canal (Clark 2003). A more detailed description of the macroinvertebrate sampling methodology and analysis technique is provided in Appendix F.

Other Data

Except for bacteria, other parameters collected by IDA in 1996-97 and 1999 do not indicate unexpected water quality concerns. For nutrients (phosphorus), the total phosphorus concentrations are higher than the recommended criteria of 0.10 mg/l (EPA 1986), but the available dissolved oxygen and pH data do not indicated that nutrient enrichment is causing extensive algal blooms. No violations of the standards were noted for either DO or pH. This phenomenon may be a function of the fact that Bissel Creek below the North Side Canal acts in part as irrigation water conveyance. As such, it contains elevated point velocities that scour the stream.

Instantaneous temperature taken during the monitoring events did not exceed the state numeric criteria for the protection of cold water aquatic life. Table 8 shows the statistical averages of the chemical parameters.

Table 8. Bissel Creek Average Temperature, Total Phosphorus and Ortho-P Concentrations 1996-97 and 1999.

Season / Location	Average Temperature (°C)	Average Total Phosphorus Concentration (mg/l)	Average Ortho-P Concentration (mg/l)
Irrigation Season 1996	14.5	0.20	0.12
Non-Irrigation Season 1997	9.2	0.38	0.20
BC-1	13.7	0.20	0.14
BC-2	14.4	0.20	0.12
BC-3	16.0	0.15	0.10
BC-4	9.7	0.06	0.03

BC-1, Bissel Creek near Payette River; BC-2, Bissel Creek near Old Black Canyon Highway; BC-3, Bissel Creek near Big 4 Avenue; BC-4, Bissel Creek near Hillview Road.

A Proper Functioning Condition (PFC) assessment was completed by the Idaho Soil Conservation Commission near the headwaters of Bissel Creek on July 25, 2000. PFC is an assessment tool used to evaluate a streams capability of withstanding annual and slightly larger storm events, up to a 30-year event (Ferguson 2000). The ability to withstand these flow events is determined be evaluating the vegetation, soils, and hydrologic conditions of the stream.

After evaluating the stream characteristics, the PFC team determined that Bissel Creek was functioning properly, and the manner in which the existing management activities (primarily grazing) were occurring did not need to change (Ferguson 2000). The “properly functioning” finding by the PFC team correlates with the findings of DEQ, which show that the headwaters portion of Bissel Creek fully supports its beneficial uses.

Status of Beneficial Uses

From the headwaters of Bissel Creek to where it becomes intermittent (approximately two miles below the headwaters), the biological data show that the stream fully supports a cold water aquatic life community. Below this segment the stream is dry for much or all of the year and is not expected to support an aquatic life community. Appendix C outlines the rationale behind this decision.

The data indicate that excess suspended solids are impairing cold water aquatic life below the North Side Canal. Consequently, DEQ recommends preparing a TMDL below the North Side Canal with the intent of reducing the amount of suspended material in the water column and the stream bottom.

The *E. Coli* data indicate that the primary contact recreation criteria are exceeded below the North Side Canal. Consequently, DEQ recommends preparing a bacteria TMDL below the North Side Canal with the intent of reducing the *E. Coli* levels in the stream to levels that will meet the water quality standards.

Table 9 summarizes the beneficial use support status throughout Bissel Creek as it relates to the pollutants of concern in the stream.

Table 9. Status of beneficial uses in Bissel Creek.

Pollutant / Segment	Beneficial Uses Support Status	Impaired Use[1]	Comments
Sediment	--[2]	--	--
Headwaters to River Mile 13.4	Not Impaired	None	Periphyton and macroinvertebrate data do not show impairment
River Mile 13.4 to North Side Canal	Not Impaired	None	The stream is intermittent, see Appendix C
North Side Canal to Lower Payette River	Impaired	CWAL	The stream contains excess suspended solids
Bacteria (*E. Coli*)	--	--	--
North Side Canal to Lower Payette River	Impaired	PCR	The stream contains excess *E. Coli*

[1]CWAL: cold water aquatic life, PCR: primary contact recreation
[2]--: Cells left intentionally blank

Conclusions

The segment of Bissel Creek extending from the headwaters to the North Side Canal will be proposed for sediment delisting during the next §303(d) listing cycle. Total Maximum Daily Loads will be prepared for sediment and bacteria below the North Side Canal. This segment will remain on the §303(d) list for sediment and bacteria will be added until it is demonstrated that cold water aquatic life and primary contact recreation are fully supported. From an assessment unit standpoint, the third order segment will be split at the North Side Canal. This will allow for the segment above the North Side Canal to be delisted, while the lower segment will remain listed.

Table 10 summarizes the outcome of the Bissel Creek subbasin assessment.

Table 10. Summary of the Bissel Creek subbasin assessment.

Water Body	Boundary	Pollutants	Proposed Action
Bissel Creek WQLS:2695 AU:SW015_02, 03	Headwaters to Payette River	Sediment	Headwaters to North Side Canal: **De-list sediment from AU: SW015_02, Split SW015_03 into SW015_03a (above North Side Canal) and 03b (below North Side Canal). Delist sediment from 03a.** North Side Canal to Payette River: **TMDL for sediment (03b)**
		Bacteria	North Side Canal to Payette River: **List bacteria for SW015_03b, TMDL for bacteria**

2.4 Data Gaps

The best available data were used to develop the current subbasin assessment and TMDL. The data were used to reach conclusions of support status and to develop defensible TMDLs. However, DEQ acknowledges there are additional data that would be helpful to increase the accuracy of the analyses. The data gaps that have been identified are outlined in Table 11.

Table 11. Data gaps identified during development of the Bissel Creek Subbasin Assessment and TMDL.

Pollutant or Other Factor	Data Gap
Flow	Multiple year flow data below the North Side Canal
Biological (fish, periphyton and macroinvertebrates)	Fish presence/absence information for Bissel Creek particularly during irrigation flow and spawning periods Additional macroinvertebrate data from multiple sites below the North Side Canal Periphyton data below the North Side Canal
Bacteria	Multiple year bacteria data for Bissel Creek. Particularly, enough data to calculate the monthly geometric mean during the months of April – September. Multiple year bacteria data at the North Side Canal outfall. Particularly, enough data to calculate the monthly geometric mean during the months of April – September.
Sediment	Multiple year suspended sediment concentration (SSC) data below the North Side Canal Multiple year total suspended solids (TSS) data below the North Side Canal Particle size distributions below the North Side Canal

Where viable, steps should be taken to fill the data gaps. Efforts to do so may be planned in the future, either by DEQ or other entities. The information developed through these efforts may be used to revise the appropriate portions of the TMDL, and determine and/or adjust implementation methods and control measures. Changes to the TMDL will not result in the production of a new TMDL document. Minor changes will be in the form of addenda to the existing document(s). More extensive changes will be in the form of supplementary documentation or chapter replacement. Wherever practical, the goal is to build upon rather than replace the original work. Any additional effort on the part of DEQ to revise the TMDL must be addressed on a case-by-case basis, as additional funding becomes available.

3. Subbasin Assessment – Pollutant Source Inventory

3.1 Sources of Pollutants of Concern

This chapter generally describes the pollutant sources within the Bissel Creek subwatershed. The nonpoint source descriptions are not intended to be specific. No discrete sources are identified in this chapter. Rather, a general description of the processes whereby the pollutants are delivered to Bissel Creek is provided.

Point Sources

There are no point sources that discharge to Bissel Creek.

Nonpoint Sources

This description is not intended to be specific. More description of the locations and potential sites for improvement will be determined in the TMDL implementation plan.

Sediment
The most common source of sediment to Bissel Creek is agriculture return water. Water column sediment loads appear to be the highest during the irrigation season (April – September), indicating that irrigated agricultural sources contribute most of the sediment to the stream. The contribution of mass wasting and bank erosion to the sediment load in Bissel Creek is low.

Bacteria
Bacteria may enter Bissel Creek in a number of ways. In agricultural areas the most common sources are farm/ranch animals and wildlife, although failing septic systems can also be a significant source if they are situated adjacent to a water body. Domestic pet waste can also be a source where they have access to the stream.

Pollutant Transport

Sediment
Within the stream channel and in agricultural return water, sediment transport and the delivery of sediment-bound pollutants are directly associated with flow volumes and velocities. While no quantitative information is available in this watershed, it is recognized that a substantial amount of sediment can be generated and transported relatively long distances by extreme precipitation events, such as flooding.

Bacteria

Bacteria are primarily transported from their point of origin during precipitation and irrigation activities. Bacteria can enter surface water via movement from manured fields, problem feedlots and overgrazed pastures. Insufficient sewage management systems (septic tanks) may also transport bacteria, especially in areas where the water table is shallow and readily mixes with surface water. Bacteria may also be transported in stormwater in areas where stormwater is discharged directly to the water body.

4. Subbasin Assessment – Summary of Past and Present Pollution Control Efforts

Point Sources
There are no point sources in the Bissel Creek subwatershed.

Nonpoint Sources
In Gem County there are existing water quality programs for nonpoint source pollutant reductions. Cooperators may make improvements on their own or seek cost-share funds from one of the many programs available. Most of the agricultural programs are either state or federally funded through the Idaho Soil Conservation Commission or the Natural Resource Conservation Service (NRCS). These programs are targeted at the agricultural community to assist with conservation practices. For example, the Gem Soil and Water Conservation District (SCD) has Water Quality Program for Agriculture money available to address on-the-farm pollutant reductions via best management practices (BMPs). The Water Quality Program for Agriculture is a state of Idaho water quality program that provides cost share incentives to local operators for pollutant reductions. The Gem SCD works with agricultural operators to provide technical assistance to implement BMPs. The agricultural community, through local conservation districts and other funding sources, has demonstrated a willingness to protect water quality throughout the basin. Table 12 shows the recently documented BMPs and/or other activities that are currently in place in the Bissel Creek subwatershed. However, it should be noted that additional, undocumented, BMPs are likely in place. Table 12 only accounts for those BMPs for which NRCS cost sharing programs were used.

Table 12. Current Best Management Practices in the Bissel Creek Subwatershed[1].

Best Management Practice	Treated Area (or) Number of Units Installed
Underground Pipeline	3,651 Ft
Gated Pipe	600 Ft.
Concrete Ditch	1,370 Ft
Gypsum Blocks	18 units
Other Irrigation Water Management	108.7 Ac.
Nutrient Management	108.7 Ac.
Proper Grazing Use	91.8 Ac.
Structure For Water Control - 2 No.	2 units
Pest Management	46.7 Ac.
Upland Wildlife Habitat	1.1 Ac.
Conservation Crop Rotation	28.7 Ac.
Filter Strip	1.0 Ac.

[1] Only accounts for those BMPs that have been installed in cooperation with NRCS.

Table 13 shows some of the typical component practices that may stand alone or be used in combination to address agricultural related pollutants. The appropriate component or combination of components is determined on a site-specific basis.

Table 13. Typical management components used to address agricultural related pollutants, either stand alone or in combination.

Best Management Practice	Control Effectiveness	Installation Cost	Maintenance Cost
Sediment			
Livestock Exclusion	High	Moderate	Low
Sediment Basins	High	Low	Moderate
Surge Irrigation System	High	High	Moderate
Sprinkler Irrigation System	High	High	Moderate
Filter Strips	Moderate	Low	Low
Polyacrylamide (PAM)	Moderate	Moderate	Moderate
Bacteria			
Livestock Exclusion	High	Moderate	Low
Waste Management System	High	High	Moderate
Wetland Development	Moderate	High	Moderate
Prescribed Grazing	Moderate	Low	Low
Fencing	Low	Moderate	Low

Other state and federal funding sources include the state §319 grant program, the Resource Conservation and Rangeland Development Program, the USDA Environmental Quality Incentive Program, the Wildlife Habitat Incentives Program, and IDWR agricultural loans. Participation from local operators is voluntary. Other sources of funding include private sources such as Ducks Unlimited, The Nature Conservancy, and colleges and universities.

Reasonable Assurance

The state has responsibility under Sections 401, 402, and 404 of the CWA to provide water quality certification. Under this authority, the state reviews dredge and fill, stream channel alteration, and NPDES permit applications that may arise to ensure that the proposed actions will meet the Idaho's water quality standards.

Under Section 319 of the CWA, each state is required to develop and submit a nonpoint source management plan. Idaho's most recent nonpoint source management plan was finalized in December 1999. The plan was submitted to and approved by the EPA. Among other things, the plan identifies programs to achieve implementation of nonpoint source BMPs, includes a schedule for program milestones, outlines key agencies and agency roles, identifies available funding sources, and is certified by the state attorney general to ensure that adequate authorities exist to implement the plan. Idaho's nonpoint source management plan describes many of the voluntary and regulatory approaches the state will take to abate nonpoint pollution sources. One of the prominent programs described in the plan is the provision for public involvement, such as the formation of Basin Advisory Groups (BAGs) and Watershed Advisory Groups (WAGs). The WAGs are to be established in high priority watersheds to assist DEQ and other state agencies in formulating specific actions needed to decrease pollutant loading from point and nonpoint sources that affect water quality limited water bodies. The Lower Payette WAG was established in 1995 and is the designated advisory group for the basin.

The Idaho water quality standards refer to existing authorities to control nonpoint pollution sources in Idaho. Some of these authorities and responsible state agencies are listed in Table 14.

Table 14. State of Idaho's regulatory authority for nonpoint pollution sources.

Authority	IDAPA Citation	Responsible Agency
Rules Governing Solid Waste Management	58.01.02.350.03(b)	Idaho Department of Environmental Quality
Rules Governing Subsurface and Individual Sewage Disposal Systems	58.01.02.350.03(c)	Idaho Department of Environmental Quality
Rules and Standards for Stream-channel Alteration	58.01.02.350.03(d)	Idaho Department of Water Resources
Rules Governing Exploration and Surface Mining Operations in Idaho	58.01.02.350.03(e)	Idaho Department of Lands
Rules Governing Placer and Dredge Mining in Idaho	58.01.02.350.03(f)	Idaho Department of Lands
Rules Governing Dairy Waste	58.01.02.350.03(g)	Idaho Department of Agriculture

The state of Idaho uses a voluntary approach to address agricultural nonpoint sources. However, regulatory authority can be found in the water quality standards (IDAPA 58.01.02.350.01 through 58.01.02.350.03). IDAPA 58.01.02.054.07 refers to the Idaho Agricultural Pollution Abatement Plan (Ag Plan), which provides guidance to the agricultural community and includes a list of approved BMPs. A portion of the Ag Plan outlines responsible agencies or elected groups (Soil Conservation Districts) that will take the lead if nonpoint source pollution problems need to be addressed. For agricultural activity, it assigns the local SCDs to assist the landowner/operator with developing and implementing BMPs to abate nonpoint pollution associated with the land use. If a voluntary approach does not succeed in abating the pollutant problem, the state may seek injunctive relief for those situations that may be determined to be an imminent and substantial danger to public health or the environment (IDAPA 58.01.02.350.02(a)).

The *Idaho Water Quality Standards and Wastewater Treatment Requirements* specify that if water quality monitoring indicates that water quality standards are not being met, even with the use of BMPs or knowledgeable and reasonable practices, the state may request that the designated agency evaluate and/or modify the BMPs to protect beneficial uses (IDAPA

58.01.02.52). If necessary, the state may seek injunctive or other judicial relief against the operator of a nonpoint source activity.

The water quality standards list designated agencies responsible for reviewing and revising nonpoint source BMPs: the Soil Conservation Commission for grazing and agricultural activities, the Department of Transportation for public road construction, Idaho Department of Agriculture for aquaculture, and DEQ for all other activities (IDAPA 58.01.02.003).

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, which receive a load allocation (LA). Natural background (NB), when present, is considered part of the load allocation, 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 130) require a margin of safety (MOS) be a part of the TMDL.

Practically, the MOS 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 human made 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 LC is determined. Then the LC is broken down into its components: the necessary MOS is determined and subtracted; then NB, if relevant, is quantified and subtracted; and then the remainder is allocated among pollutant sources. When the breakdown and allocation is completed we have a TMDL, which must equal the LC.

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. Also a required part of the loading analysis is that the LC be based on critical conditions – the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. Because both LC and pollutant source loads vary, and not necessarily in concert, determination of critical conditions can be more complicated than it may appear on the surface.

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 Instream Water Quality Targets

Instream water quality targets were selected such that they will restore full support of designated beneficial uses. Important considerations in target selections were critical periods for target application, recovery time for the water body, and appropriateness of surrogates.

Target Selection

The following section describes the water quality targets used to develop the sediment and bacteria TMDLs for Bissel Creek. In the sediment TMDL, a surrogate is used as the target. Additional details regarding how the surrogate is used are located in the following sections.

Sediment
Bissel Creek below the North Side Canal contains elevated suspended solids concentrations as a result of agricultural return water. A site-specific TSS target has been developed for Bissel Creek. The target is linked to conditions that will ensure the water quality standards are met and CWAL is returned to full support.

The TSS target was derived from a watershed that has similar land use and hydrology (see section 2.3). This value is 22 mg/L and will be applied continuously throughout the irrigation season (April-September), as the irrigation season is when most of the loading occurs to the stream. The target of 22 mg/L represents the TSS conditions in the stream during a time of year when loads are the highest, yet, aquatic life beneficial uses can remain supported.

Seasonal variability is taken into account for the TSS target by specifically applying the target when the loads are the highest, during the irrigation season. The sediment analysis characterizes loads using an average irrigation load determined from monitoring data collected over time. As such, the influence of peak and base irrigation season flow conditions are accounted for. Furthermore, the data can empirically be compared to other irrigation seasons because the characteristics under which observed conditions have developed occur each and every irrigation season.

Bacteria
Bacteria targets are consistent with the numeric water quality standards for the protection of human health. As described in Table 3, the targets are expressed in terms of an instantaneous maximum and a 30-day geometric mean. If the instantaneous maximum is exceeded in a single sample, 4 additional evenly spaced samples must be collected within a 30-day period to calculate the geometric mean. While the data suggest that there is seasonal variation in the bacteria loads to Bissel Creek, the targets will apply annually since contact recreation may occur at any time of the year.

Monitoring Points

Monitoring points for each water body were discussed in detail in Section 2.3 (Figure 5). Refer to that section for the location of monitoring points. An attempt was made to monitor representative sections of the stream, including a downstream compliance point for water chemistry measurements.

5.2 Load Capacity

The LC is the amount of pollutant a water body can receive without violating water quality standards. Seasonal variations and a MOS to account for any uncertainty are calculated within the LC. The MOS accounts for uncertainty about assimilative capacity, the precise relationship between the selected target and beneficial use(s), and variability in target measurement. The LC is based on existing uses within in the watershed. The LC for each water body and specific pollutant are tailored to both the nature of the pollutant and the specific use impairment.

A required part of the loading analysis is that the LC be based on critical conditions – the conditions when water quality standards are most likely to be violated. If protective under critical conditions, a TMDL will be more than protective under other conditions. Because both LC and pollutant source loads vary, and not necessarily in concert, determination of critical conditions can often be more complicated than it may appear on the surface.

Sediment
The LC for sediment is based on the instream load that would be present when a concentration of 22 mg/L is met. For example, the instream TSS target for Bissel Creek is 22 mg/L. The LC for Bissel Creek is based on maintaining 22 mg/L TSS throughout the stream during the entire critical flow period.

Bacteria
The LC for bacteria is based on the state water quality standard for *E. Coli.* The bacteria LC is expressed in terms of concentration (colonies/ml) because it is difficult to calculate a mass load for bacteria.

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, although there are no point sources in the Bissel Creek subwatershed. 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.

Sediment
Specific source loads could not be determined due to a lack of data. Rather, it is assumed that the existing in-stream loads are generated by the land uses or other combination of activities occurring upstream from the monitoring point. As such, load allocations will not be established for specific sources. Load allocations will be established for compliance

points within Bissel Creek itself, and all land uses upstream of the compliance point that contribute sediment should make combined reductions to meet the load allocation.

Bacteria
As with sediment, specific source loads could not be determined due to a lack of data. It is again is assumed that the existing loads are generated by the land uses that occur upstream and load allocations are formulated in a similar manner. No delineation between natural wildlife and man-influenced bacteria sources was made.

5.4 Load Allocation

The Bissel Creek sediment and bacteria TMDLs are found in the following section. The allocations include a margin of safety and as described above, take into account seasonality where applicable.

Margin of Safety

Uncertainty arises in selection of water quality targets, determining the load capacity, and estimating existing loads. This uncertainty is accounted for by adding a MOS to the TMDL. The MOS factored into each TMDL is described below. Where the MOS is implicit, it includes conservative assumptions used to determine existing sediment loads and the loading analysis. Where the MOS is explicit, a percentage of the assimilative capacity is removed from the allocations. These methods are described below.

Sediment: Water Column Targets
Explicit and implicit margins of safety are used. A TSS water column target of 22 mg/L is used for Bissel Creek. The 22 mg/L target is linked by reference to lower Succor Creek (DEQ 2003). Due to the uncertainly of directly applying the 22 mg/L TSS target to Bissel Creek, an explicit MOS of 5% is used in the Bissel Creek sediment TMDL. Often times a 10% MOS is chosen. However, a 5% MOS is used because, as described below, an implicit MOS also exists. The assimilative capacity is determined by calculating the existing load in the stream when 22 mg/L is met. Once the assimilative capacity is determined, 5% of the capacity is removed as being available to sources.

In addition to the explicit 5% MOS described above, the sediment TMDL contains an implicit MOS below BC-3. As noted later in Table 15 and Figure 8, there are no additional sediment reduction requirements between BC-3 and BC-2. However, there are required reductions upstream of BC-3 (between the North Side Canal and BC-3). The result of these reductions will be unaccounted for sediment decreases below BC-3. That is, while there are no reduction requirements between BC-3 and BC-2, there will be a realized decrease in sediment due to upstream reductions. This implicit MOS will then essentially apply to the stream at all locations below BC-3.

Bacteria
An implicit MOS is used. An implicit MOS is built into the TMDL by assuming that dilution is not available at any point in the stream. However, below the North Side Canal,

Bissel Creek is heavily influenced by groundwater infiltration. This ground water most likely contains very few *E. Coli*. As such, if all surface water sources discharge at the criteria, dilution would become available as a result of groundwater infiltration into the stream.

Seasonal Variation

TMDLs must be established with consideration of seasonal variation. In the Bissel Creek subwatershed seasonal influences are present for both sediment and bacteria. The irrigation season is when concentrations of sediment and bacteria are the highest. Seasonal variation as it relates to development of this TMDL is addressed simply by ensuring that loads are reduced during the critical period (when beneficial uses are impaired and loads are controllable). Thus, the effects of seasonal variation are built into the load allocations.

Critical Period

The critical period for the sediment and bacteria TMDLs is based on the time when beneficial uses must be protected and when pollutant loads are the highest. Each respective TMDL is developed such that the water quality standards will be achieved year around, yet the critical period defines when loading reductions must occur. Table 15 shows the critical period for each pollutant.

Table 15. Critical periods for TMDLs.

Pollutant	Critical Period (Time of Year Applicable)
Sediment (TSS)	April 1 –September 30
Bacteria	Year round

Reserve for Growth

Where applicable, states should include an allowance for future growth that accounts for reasonably foreseeable increases in pollutant loads with careful documentation of the decision-making process. This allowance is based on existing and readily available data at the time the TMDL is established. In the case of the Bissel Creek sediment and bacteria TMDLs an allowance for future growth is not recommended until such time as reductions indicate that beneficial uses or state water quality standards have been restored. Therefore, the allowance for future growth is zero. Growth can occur under the following conditions: 1) pollutant trading, 2) no net increase above the instream target parameters, and 3) no discharge where land application is the preferred option.

Sediment Allocations

Sediment: TSS TMDL

The TSS target for Bissel Creek is 22 mg/L. The 22 mg/L target is intended to provide protection for the mix of aquatic life species that inhabit the stream. The target is designed based on the TSS conditions in a similar watershed with similar land uses patterns.
The existing loads and load allocations are calculated using a portion the standard pollutant mixing equation with a built-in conversion factor: *(conc*flow*5.4)* (Hammer 1986). Fixed load targets were selected because the management practices that affect sediment loading to the stream is not expected to change on a day-to-day basis. Thus, the management practices should be developed to meet the load goals, which meet the target even when very low flow conditions occur in the stream. No point sources discharge to Bissel Creek. As such, no wasteload allocations exist.

As described in section 5.2, the loading capacity Bissel Creek is based on maintaining the instream target of 22 mg/L TSS at all locations and at all times below the North Side Canal. As such, the actual mass load capacity changes at any given location in the stream as flows increase (or decrease with diversions). However, if the target of 22 mg/L is maintained throughout the stream, the TSS load capacities shown in Table 16 should be met.

Load allocations were not developed for specific TSS sources (tributaries or return drains). This was primarily due to a lack of data that precluded the development of a load balance. As an alternative, in-stream load allocations were developed using the three IDA monitoring locations for which a full seasons data were available as compliance points. Land use sources upstream from each compliance point should be managed such that 22 mg/L is not exceeded at any given time at the compliance point. Table 16 shows the existing load (based on 1999 data) at each compliance point, the loading capacity, the load allocation, and the load reduction that must occur to meet the allocation. Note that reductions are not necessary at BC-2. This is because the 1999 irrigation season TSS concentration is below 22 mg/L (Table 4). However, this does not imply that **additional** sediment can be discharged to the stream between BC-3 and BC-2. This simply means that additional reductions are not necessary at this time.

Table 16. TSS Load Allocations for Bissel Creek, 1999 Data

Location (compliance point)	Typical Existing Load (lbs/day)	Loading Capacity, based on maintaining 22 mg/L	Load Allocation[1] (lbs/day)	Load Reduction
BC-1	3383	2250	2232	1151 lbs/day, 34%
BC-2	1766	1916	1766[2]	0 lbs/day, 0%[3]
BC-3	1635	1398	1328	307 lbs/day, 19%

[1] Included a 5% MOS
[2] The load allocation is the same as the typical existing load because no additional sediment should be discharged to the stream.
[3] No reduction necessary because the existing load is less than the loading capacity. However, no additional sediment should be discharged to the stream.

Table 17 and Figure 8 show the geographic boundaries represented by each of the compliance points in Table 16 from an allocation standpoint. The allocations apply to all sources extending from the compliance point to the next upstream compliance point. For example, sources located between BC-3 and the North Side Canal must combine to reduce the instream TSS load at BC-3 by 1151 lbs/day, a 34% reduction. For purposes of the applying the allocations, BC-1 begins at the Payette River.

Table 17. Geographic Area represented by each compliance point in Bissel Creek, Total Suspended Solids and Bacteria TMDL

Location (compliance point)	Geographic Area Represented by the Compliance Point
BC-1	Payette River to Old Black Canyon Highway
BC-2	Old Black Canyon Highway to Big 4 Avenue
BC-3	Big 4 Avenue to North Side Canal

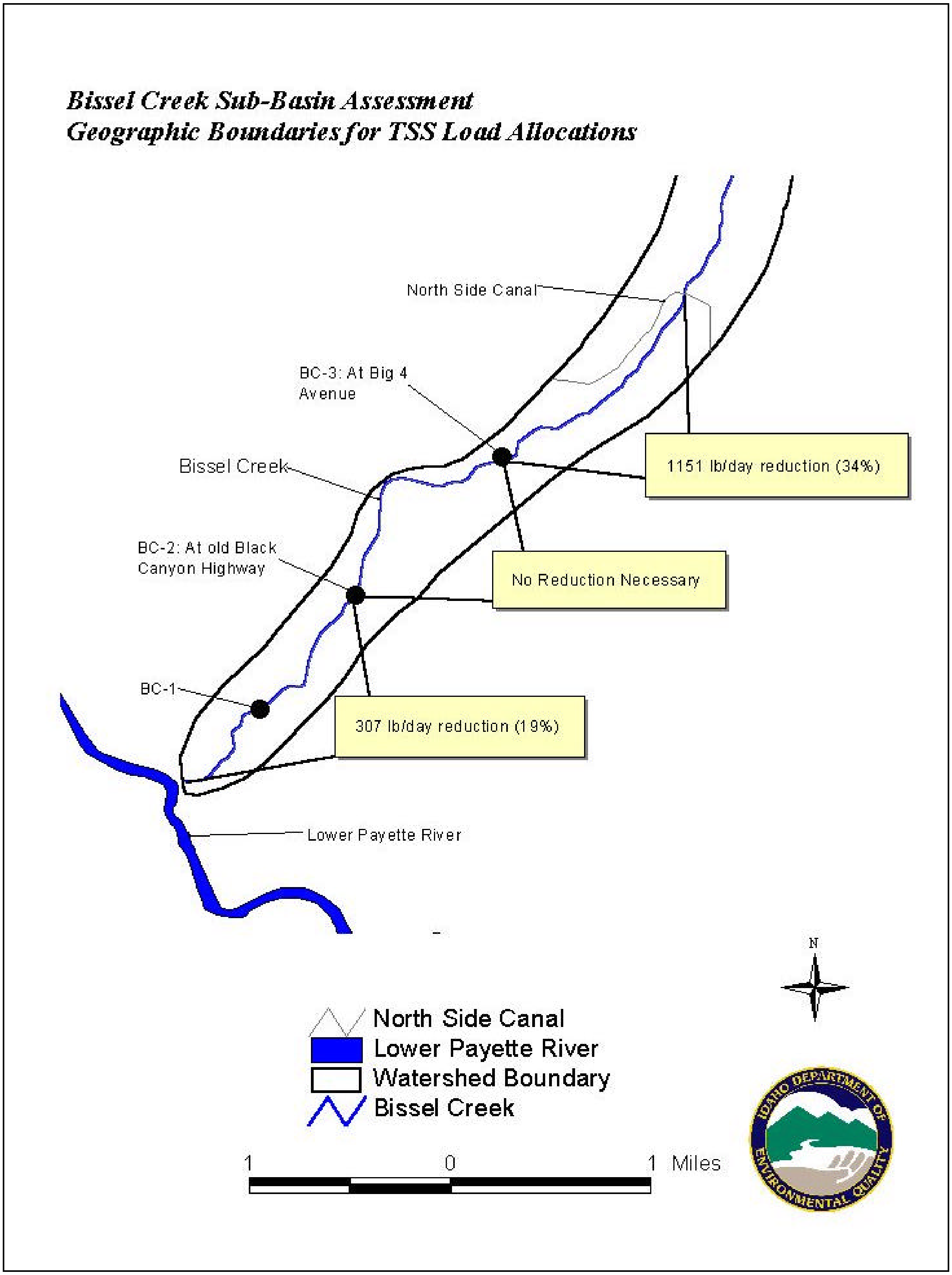


Figure 8. Geographic Boundaries Represented by Each Compliance Point in Bissel Creek, TSS TMDL

Bacteria Allocations

The bacteria target for Bissel Creek is based upon the state *E. Coli* criteria for primary contact recreation. The entire stream segment below the North Side Canal will accommodate primary contact recreation, therefore the compliance points for bacteria loading are any given location in the stream. The primary contact recreation beneficial use has associated numeric criteria in *Idaho's Water Quality Standards and Wastewater Treatment Requirements* (IDAPA 58.01.02.251):

Primary contact recreation *E. Coli* bacteria colonies:

- may not exceed 406/100 mL at any time;
- may not exceed a geometric mean of 126/100 mL based on a minimum of five samples taken every three days over a thirty day period.

Contact recreation is presumed to be possible or occurring at any location below the North Side Canal during any time of the year. Thus, no single flow condition is considered a critical flow.

Since the true geometric mean bacteria concentration in Bissel Creek is unknown, source specific loads and load reductions cannot be determined. However, the data presented in the subbasin assessment show that at all locations below the North Side Canal the *E. Coli* concentrations are in excess of the state criteria.

Similar to the TSS TMDL, bacteria allocations were not developed for specific bacteria sources (tributaries or return drains). Again, this was primarily due to a lack of data. In-stream allocations were again developed using the three IDA monitoring locations as compliance points. The allocations are based on data from July, whereby the geometric means at each compliance point were estimated using the procedure outlined in section 2.3. The allocations do not appear in terms of a load. Rather, the allocations are in terms of the allowable concentration, which is the 126 organisms/100 mL *E. Coli* criterion. This approach was used because while it is possible to express bacteria in terms of a mass load, bacteria are living organisms that have an associated die-off rate. This die-off rate varies with changing water quality conditions and complicates the allocation process because the "mass" of bacteria is highly variable and constantly changing. As such, the allocations are simplified by expressing the loads in terms of the geometric mean criterion. Land use sources upstream from each compliance point should be managed so that 126 organisms/100 mL is not exceeded at the compliance point.

Table 18 shows the existing bacteria concentrations (based on 1999 data) at each compliance point, the loading capacity, the primary contact recreation geometric mean load allocations, and the load reduction that must occur to meet the allocation.

Table 18. Bacteria Load[1] Allocations for Bissel Creek, 1999 Data

Location (compliance point)	Typical Existing Load (#/100 mL geomean)	Loading Capacity (#/100 mL geomean)	Load Allocation (#/100 mL geomean)	Load Reduction
BC-1	662	126	126	536 #/100 mL, 81%
BC-2	669	126	126	543 #/100 mL, 81%
BC-3	986	126	126	860 #/100 mL, 87%

[1] Expressed in terms of the allowable concentration

The bacteria TMDL for Bissel Creek is based on the same compliance points and associated geographic boundaries and TSS TMDL. Again, Table 17 shows the geographic boundaries represented by each of the compliance points in Table 18 from an allocation standpoint. Figure 9 shows the boundaries on a map. The allocations apply to all sources extending from the compliance point to the next upstream compliance point. For example, sources located between BC-3 and the North Side Canal must combine to reduce the instream *E. Coli* geometric mean concentration at BC-3 by 860 organismsn/100 mL, an 87% reduction. For purposes of the applying the allocations, BC-1 begins at the Payette River.

The implication of the bacteria TMDL is that all sources to Bissel Creek must be able to meet a geometric mean of 126 organisms/100 mL where they enter the stream. If it is documented that dilution becomes available, tributaries may be able to discharge at slightly higher than the criteria.

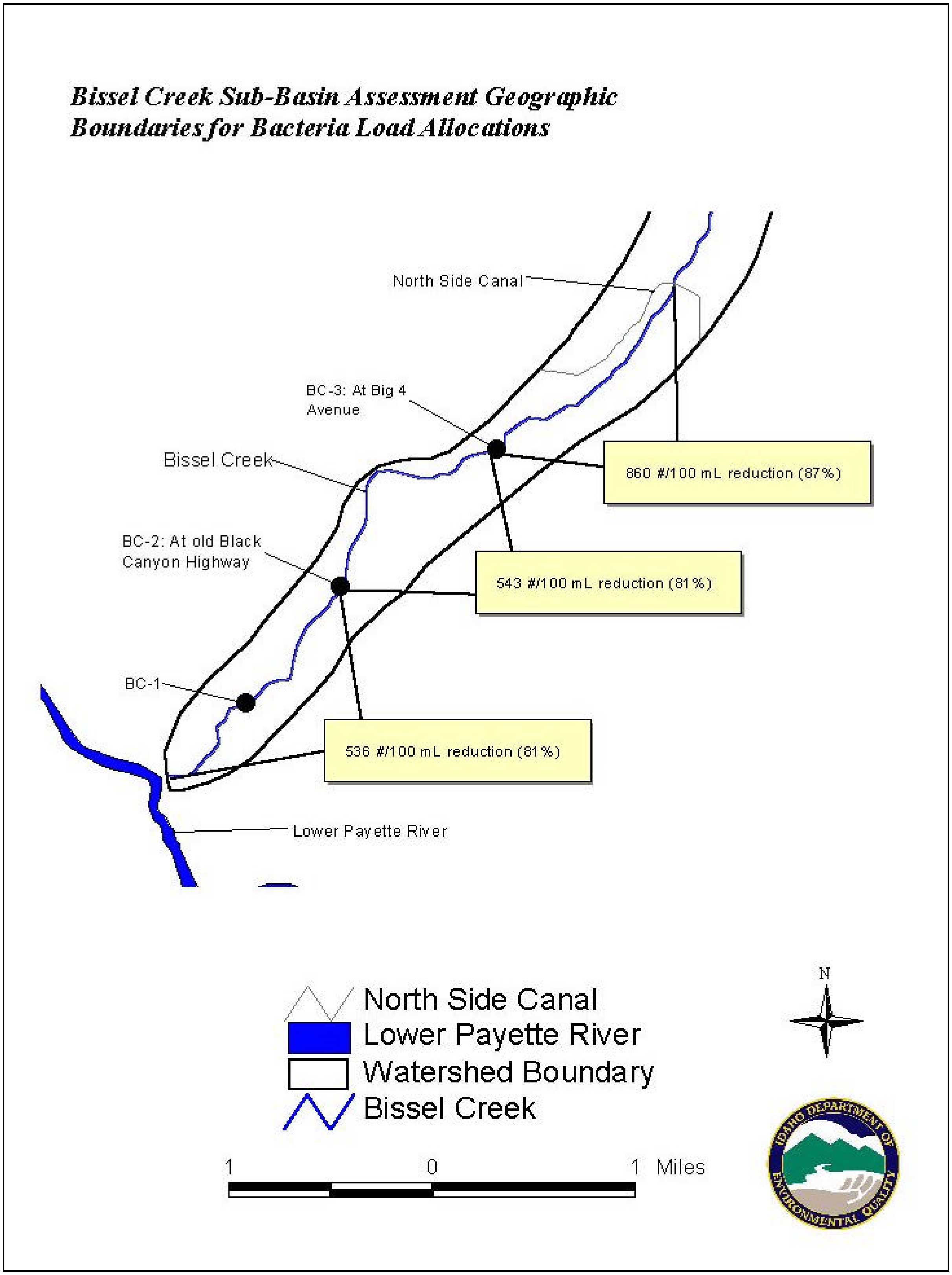


Figure 9. Geographic Boundaries Represented by Each Compliance Point in Bissel Creek, Bacteria TMDL

5.5 Implementation Strategies

Overview

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

Time Frame

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

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

A definitive timeline for implementing the TMDL and the associated allocations will be developed as part of the implementation plan. This timeline will be developed in consultation with the Lower Payette WAG, the designated agencies, and other interested publics. In the meantime, implementation planning should begin immediately as funding becomes available. The goal is to attain the water quality standards and return beneficial uses to full support in the shortest time possible. DEQ expects strides towards meeting the TMDL to be measurable within the first five years of implementation. Full implementation of the TMDL and recovery of the beneficial uses may take as long as 10-15 years.

Adaptive Management Approach

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

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

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

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

DEQ recognizes that expedited implementation of TMDLs will be socially and economically challenging. Further, there is a desire to minimize economic impacts as much as possible when consistent with protecting water quality and beneficial uses. DEQ further recognizes that, despite the best and most sincere efforts, natural events beyond the control of humans may interfere with or delay attainment of the TMDL and/or its associated targets and surrogates. Such events could be, but are not limited to floods, fire, insect infestations, and drought. Should such events occur that negate all BMP activities, the appropriateness of re-implementing BMPs will be addressed on a case by case basis. In any case, post event conditions should not be exacerbated by management activities that would hinder the natural recovery of the system.

Pollutant surrogates have been defined as targets for meeting the sediment TMDL. It is the expectation that the specific implementation plan will address how human activities will be managed to achieve the water quality targets and surrogates. It is recognized that full attainment of pollutant surrogates at all locations may not be feasible due to physical, legal, or other regulatory constraints. To the extent possible, the implementation plan should identify potential constraints, but should also provide the ability to mitigate those constraints should the opportunity arise. If a nonpoint source that is covered by the TMDL complies with the finalized implementation plan, it will be considered in compliance with the TMDL.

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

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

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

- Subject to available resources, DEQ intends to review the progress of the TMDLs and the implementation plans on a five-year basis.
- DEQ expects that designated agencies will also monitor and document their progress in implementing the provisions of the implementation plans for those pollutant sources for which they are responsible. This information will be provided to DEQ for use in reviewing the TMDL.
- DEQ expects that designated agencies will identify benchmarks for the attainment of TMDL targets and surrogates as part of the specific implementation plans being developed. These benchmarks will be used to measure progress toward the goals outlined in the TMDL.
- DEQ expects designated agencies to revise the components of their implementation plan to address deficiencies where implementation of the specific management techniques are found to be inadequate.
- If DEQ, in consultation with the designated agencies, concludes that all feasible steps have been taken to meet the TMDL and its associated targets and surrogates, and that the TMDL, or the associated targets and surrogates are not practicable, the TMDL may be reopened and revised as appropriate. DEQ would also consider reopening the TMDL should new information become available indicating that the TMDL or its associated targets and/or surrogates should be modified. This decision will be made based on the availability of resources at DEQ.

Responsible Parties

Development of the final implementation plan for the Bissel Creek TMDL will proceed under the existing practice established for the state of Idaho. DEQ, the Lower Payette River WAG, the affected private landowners, and other "designated agencies" with input from the established public process will cooperatively develop the plan. Other individuals may also be identified to assist in the development of the site-specific implementation plans as their areas of expertise are identified as beneficial to the process.

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

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

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

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

- **DEQ** will oversee and track overall progress on the specific implementation plan and monitor the watershed response. DEQ will also work with local governments on urban/suburban issues.
- **IDL** will maintain and update approved BMPs for forest practices and mining. IDL is responsible for ensuring use of appropriate BMPs on state and private lands.
- **ISCC**, working in cooperation with local Soil and Water Conservation Districts and ISDA, the NRCS will provide technical assistance to agricultural landowners. These agencies will help landowners design BMP systems appropriate for their property, and identify and seek appropriate cost-share funds. They also will provide periodic project reviews to ensure BMPs are working effectively.
- **IDT** will be responsible for ensuring appropriate BMPs are used for construction and maintenance of public roads.
- **IDA** will be responsible for working with aquaculture to install appropriate pollutant control measures. Under a memorandum of understanding with EPA and DEQ, IDA

also inspects AFOs, CAFOs and dairies to ensure compliance with NPDES requirements.

The designated agencies, WAG, and other appropriate public process participants are expected to:

- Develop BMPs to achieve LAs
- Give reasonable assurance that management measures will meet LAs through both quantitative and qualitative analysis of management measures
- Adhere to measurable milestones for progress
- Develop a timeline for implementation, with reference to costs and funding
- Develop a monitoring plan to determine if BMPs are being implemented, individual BMPs are effective, LA and WLA are being met, and water quality standards are being met

In addition to the designated agencies, the public, through the WAG and other equivalent processes, will be provided with opportunities to be involved in developing the implementation plan to the maximum extent practical. Public participation will significantly affect public acceptance of the document and the proposed control actions. Stakeholders (landowners, local governing authorities, taxpayers, industries, and land managers) are the most educated regarding the pollutant sources and will be called upon to help identify the most appropriate control actions for each area. Experience has shown that the best and most effective implementation plans are those that are developed with substantial public cooperation and involvement.

Monitoring Strategy

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

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

The "monitoring and evaluation" component has two basic categories:

- Tracking the implementation progress of specific implementation plans; and
- Tracking the progress of improving water quality through monitoring physical, chemical, and biological parameters.

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

Implementation plan monitoring has two major components:

- Watershed monitoring and
- BMP monitoring.

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

Watershed Monitoring

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

In the Bissel Creek TMDL, watershed monitoring has the following objectives:

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

BMP/Project Effectiveness Monitoring

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

Evaluation of Efforts over Time

Annual reports on progress toward TMDL implementation will be prepared to provide the basis for assessment and evaluation of progress. Documentation of TMDL implementation activities, actual pollutant reduction effectiveness, and projected load reductions for planned actions will be included. If water quality goals are being met, or if trend analyses show that implementation activities are resulting in benefits that indicate that water quality objectives will be met in a reasonable period of time, then implementation of the plan will continue. If monitoring or analyses show that water quality goals are not being met, the TMDL implementation plan will be revised to include modified objectives and a new strategy for implementation activities.

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Glossary

305(b)
Refers to section 305 subsection "b" of the Clean Water Act. 305(b) generally describes a report of each state's water quality, and is the principle means by which the U.S. Environmental Protection Agency, Congress, and the public evaluate whether U.S. waters meet water quality standards, the progress made in maintaining and restoring water quality, and the extent of the remaining problems.

§303(d)
Refers to section 303 subsection "d" of the Clean Water Act. 303(d) requires states to develop a list of waterbodies that do not meet water quality standards. This section also requires total maximum daily loads (TMDLs) be prepared for listed waters. Both the list and the TMDLs are subject to U.S. Environmental Protection Agency approval.

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

Algae
Non-vascular (without water-conducting tissue) aquatic plants that occur as single cells, colonies, or filaments.

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

Aquatic
Occurring, growing, or living in water.

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

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

Beneficial Use	Any of the various uses of water, including, but not limited to, aquatic biota, 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 waterbodies in Idaho. BURP protocols address lakes, reservoirs, and wadable 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.
Biomass	The weight of biological matter. Standing crop is the amount of biomass (e.g., fish or algae) in a body of water at a given time. Often expressed as grams per square meter.
Biota	The animal and plant life of a given region.
Biotic	A term applied to the living components of an area.
Clean Water Act (CWA)	The Federal Water Pollution Control Act (commonly known as the Clean Water Act), as last reauthorized by the Water Quality Act of 1987, establishes a process for states to use to develop information on, and control the quality of, the nation's water resources.
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. EPA develops criteria guidance; states establish criteria.

Cubic Feet per Second	A unit of measure for the rate of flow or discharge of water. One cubic foot per second is the rate of flow of a stream with a cross-section of one square foot flowing at a mean velocity of one foot per second. At a steady rate, once cubic foot per second is equal to 448.8 gallons per minute and 10,984 acre-feet per day.
Designated Uses	Those water uses identified in state water quality standards that must be achieved and maintained as required under the Clean Water Act.
Discharge	The amount of water flowing in the stream channel at the time of measurement. Usually expressed as cubic feet per second (cfs).
Dissolved Oxygen (DO)	The oxygen dissolved in water. Adequate DO is vital to fish and other aquatic life.
E. coli	Short for *Escherichia Coli*, *E. coli* are a group of bacteria that are a subspecies of coliform bacteria. Most *E. coli* are essential to the healthy life of all warm-blooded animals, including humans. Their presence is often indicative of fecal contamination.
Ephemeral Stream	A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long continued supply from melting snow or other sources. Its channel is at all times above the water table.
Erosion	The wearing away of areas of the earth’s surface by water, wind, ice, and other forces.
Exceedance	A violation (according to DEQ policy) of the pollutant levels permitted by water quality criteria.
Existing Beneficial Use or Existing Use	A beneficial use actually attained in waters on or after November 28, 1975, whether or not the use is designated for the waters in Idaho’s *Water Quality Standards and Wastewater Treatment Requirements* (IDAPA 58.01.02).
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).
Geographical Information Systems (GIS)	A georeferenced database.
Geometric Mean	A back-transformed mean of the logarithmically transformed numbers often used to describe highly variable, right-skewed data (a few large values), such as bacterial data.
Grab Sample	A single sample collected at a particular time and place. It may represent the composition of the water in that water column.
Ground Water	Water found beneath the soil surface saturating the layer in which it is located. Most ground water originates as rainfall, is free to move under the influence of gravity, and usually emerges again as stream flow.
Hydrologic Unit	One of a nested series of numbered and named watersheds arising from a national standardization of watershed delineation. The initial 1974 effort (USGS 1987) described four levels (region, subregion, accounting unit, cataloging unit) of watersheds throughout the United States. The fourth level is uniquely identified by an eight-digit code built of two-digit fields for each level in the classification. Originally termed a cataloging unit, fourth field hydrologic units have been more commonly called subbasins. Fifth and sixth field hydrologic units have since been delineated for much of the country and are known as watershed and subwatersheds, respectively.
Hydrologic Unit Code (HUC)	The number assigned to a hydrologic unit. Often used to refer to fourth field hydrologic units.
Hydrology	The science dealing with the properties, distribution, and circulation of water.

Intermittent Stream	A stream that flows only part of the year, such as when the ground water table is high or when the stream receives water from springs or from surface sources such as melting snow in mountainous areas. The stream ceases to flow above the streambed when losses from evaporation or seepage exceed the available stream flow. 2) A stream that has a period of zero flow for at least one week during most years.
Irrigation Return Flow	Surface (and subsurface) water that leaves a field following the application of irrigation water and eventually flows into streams.
Land Application	A process or activity involving application of wastewater, surface water, or semi-liquid material to the land surface for the purpose of treatment, pollutant removal, or ground water recharge.
Load Allocation (LA)	A portion of a waterbody'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.
Loading Capacity (LC)	A determination of how much pollutant a waterbody can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, and a margin of safety, it becomes a total maximum daily load.
Macroinvertebrate	An invertebrate animal (without a backbone) large enough to be seen without magnification and retained by a 500µ mesh (U.S. #30) screen.
Margin of Safety (MOS)	An implicit or explicit portion of a waterbody's loading capacity set aside to allow the uncertainly about the relationship between the pollutant loads and the quality of the receiving waterbody. This is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The MOS is not allocated to any sources of pollution.

Mass Wasting	A general term for the down slope movement of soil and rock material under the direct influence of gravity.
Mean	Describes the central tendency of a set of numbers. The arithmetic mean (calculated by adding all items in a list, then dividing by the number of items) is the statistic most familiar to most people.
Metric	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, 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 waterbody.
Mouth	The location where flowing water enters into a larger waterbody.
National Pollution Discharge Elimination System (NPDES)	A national program established by the Clean Water Act for permitting point sources of pollution. Discharge of pollution from point sources is not allowed without a permit.
Nonpoint Source	A dispersed source of pollutants, generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernable point or origin. They include, but are not limited to, irrigated and non-irrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.
Not Attainable	A concept and an assessment category describing waterbodies that demonstrate characteristics that make it unlikely that a beneficial use can be attained (e.g., a stream that is dry but designated for salmonid spawning).
Not Fully Supporting	Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002).

Nuisance	Anything which is injurious to the public health or an obstruction to the free use, in the customary manner, of any waters of the state.
Nutrient	Any substance required by living things to grow. An element or its chemical forms essential to life, such as carbon, oxygen, nitrogen, and phosphorus. Commonly refers to those elements in short supply, such as nitrogen and phosphorus, which usually limit growth.
Parameter	A variable, measurable property whose value is a determinant of the characteristics of a system, such as temperature, dissolved oxygen, and fish populations are parameters of a stream or lake.
Perennial Stream	A stream that flows year-around in most years.
Periphyton	Attached microflora (algae and diatoms) growing on the bottom of a waterbody or on submerged substrates, including larger plants.
pH	The negative $\log_{10}$ of the concentration of hydrogen ions, a measure which in water ranges from very acid (pH=1) to very alkaline (pH=14). A pH of 7 is neutral. Surface waters usually measure between pH 6 and 9.
Phased TMDL	A total maximum daily load (TMDL) that identifies interim load allocations and details further monitoring to gauge the success of management actions in achieving load reduction goals and the effect of actual load reductions on the water quality of a waterbody. Under a phased TMDL, a refinement of load allocations, wasteload allocations, and the margin of safety is planned at the outset.
Phosphorus	An element essential to plant growth, often in limited supply, and thus considered a nutrient.
Point Source	A source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable "point" of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater.

Pollutant	Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.
Pollution	A very broad concept that encompasses human-caused changes in the environment which alter the functioning of natural processes and produce undesirable environmental and health effects. This includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media.
Population	A group of interbreeding organisms occupying a particular space; the number of humans or other living creatures in a designated area.
Protocol	A series of formal steps for conducting a test or survey.
Qualitative	Descriptive of kind, type, or direction.
Quantitative	Descriptive of size, magnitude, or degree.
Reach	A stream section with fairly homogenous physical characteristics.
Representative Sample	A portion of material or water that is as similar in content and consistency as possible to that in the larger body of material or water being sampled.
Resident	A term that describes fish that do not migrate.
Riffle	A relatively shallow, gravelly area of a streambed with a locally fast current, recognized by surface choppiness. Also an area of higher streambed gradient and roughness.
Riparian	Associated with aquatic (stream, river, lake) habitats. Living or located on the bank of a waterbody.
River	A large, natural, or human-modified stream that flows in a defined course or channel, or a series of diverging and converging channels.
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 A reproductively isolated aggregate of interbreeding organisms having common attributes and usually designated by a common name. 2) An organism belonging to such a category.

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

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.

Substrate Fines Sediments of small size deposited on the surface of a streambed or lake bottom. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 605 mm depending on the observer and methodology used. Results are typically expressed as a percentage of observation points with fine sediment.

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

Suspended Sediments Fine material (usually sand size or smaller) that remains suspended by turbulence in the water column until deposited in areas of weaker current. These sediments cause turbidity and, when deposited, reduce living space within streambed gravels and can cover fish eggs or alevins.

Total Maximum Daily Load (TMDL) A TMDL is a waterbody's loading capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual bases. TMDL = Loading Capacity = Load Allocation + Wasteload Allocation + Margin of Safety. 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 waterbodies and/or pollutants within a given watershed.

Total Suspended Solids (TSS) The dry weight of material retained on a filter after filtration. Filter pore size and drying temperature can vary. American Public Health Association Standard Methods (Greenborg, Clescevi, and Eaton 1995) call for using a filter of 2.0 micron or smaller; a 0.45 micron filter is also often used. This method calls for drying at a temperature of 103-105 °C.

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 waterbody.

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

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

Water 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 Segment (WQLS)	Any segment placed on a state's §303(d) list for failure to meet applicable water quality standards, and/or is not expected to meet applicable water quality standards in the period prior to the next list. These segments are also referred to as "§303(d) listed."
Water Quality Management Plan	A state or area-wide waste treatment management plan developed and updated in accordance with the provisions of the Clean Water Act.
Water Quality Standards	State-adopted and EPA-approved ambient standards for waterbodies. The standards prescribe the use of the waterbody and establish the water quality criteria that must be met to protect designated uses.
Watershed	All the land which contributes runoff to a common point in a drainage network, or to a lake outlet. Watersheds are infinitely nested, and any large watershed is composed of smaller "subwatersheds." 2) The whole geographic region which contributes water to a point of interest in a waterbody.
Waterbody Identification Number (WBID)	A number that uniquely identifies a waterbody in Idaho ties in to the Idaho Water Quality Standards and GIS information.

Appendix A. Unit Conversion Chart

Metric - English unit conversions.

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

[1] 1 ft^3/sec = 0.65 million gallons per day; 1 million gallons per day is equal to 1.55 ft^3/sec.
[2] The ratio of 1 ppm = 1 mg/L is approximate and is only accurate for water.

Appendix B. State and Site-Specific Standards and Criteria

- The *Idaho Water Quality Standards and Wastewater Treatment Requirements* are available on the web at http://www2.state.id.us/adm/adminrules/rules/idapa58/0102.pdf.

- No site specific criteria were used in developing the Bissel Creek TMDL

- Table B-1 outlines the water quality standards used in the Bissel Creek Subbasin Assessment and TMDL.

Table B-1. Idaho water quality standards uses in the Bissel Creek Subbasin Assessment and TMDL.

Pollutant	Applicable Water Quality Standard
Sediment (58.01.02.200.08)	Sediment shall not exceed quantities specified in general surface water quality criteria (IDAPA 58.01.02.250 or 252) or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses
Bacteria (58.01.02.251.01.b,c)	Less than 126 *E. coli* organisms/100 mL as a 30 day geometric mean with a minimum of five samples AND no sample greater than 406 *E. coli* organisms/100 mL

Appendix C. Photo Documentation of Intermittence for Segments of Bissel Creek

The state of Idaho defines an intermittent stream as one that has a period of zero flow for at least one week during most years or has a 7Q2 hydrologically-based flow of less than 0.10 cfs (IDAPA 58.01.02.003.51). If a stream contains naturally perennial pools containing significant aquatic life, it is not considered intermittent.

The intent of this photo evaluation is to use the available data to show that Bissel Creek is intermittent from river mile 13.4 to the North Side Canal. Ideally, a calculation of the 7Q2 in combination with field notes and photographs would be used to determine the intermittence of a stream. Unfortunately, insufficient flow data exists to calculate the 7Q2. Given the lack of flow data to calculate the 7Q2, two lines of evidence are used for the evaluation: 1) instantaneous flow measurements collected as part of BURP and 2) time-dated site photographs. These lines of evidence provide sufficient data to determine whether periods of zero-flow exist.

The water quality standards (IDAPA 58.01.02.070.07) state that water quality standards shall only apply to intermittent waters during optimum flow periods sufficient enough to support the beneficial uses for which the water body has been designated. The optimum flow for contact recreation is equal to or greater than 5.0 cfs. The optimum flow for aquatic life is equal to or greater than 1.0 cfs.

The implication of this rule is that a TMDL for the intermittent portion of Bissel Creek is not appropriate unless it is shown that a *pollutant* impairs aquatic life when flows exceed 1.0 cfs. The hydrology of most intermittent streams is such that the time of year when flows exceed 1.0 cfs corresponds with spring runoff. Determining beneficial use support status during the runoff period typically yields false determinations of pollutant-caused impairment. These false determinations occur because the biotic community in the stream is limited by high velocity flushing flows as runoff occurs and then by a shortage of time to establish a fully functioning community before the stream goes dry. Thus, the aquatic life community is limited by hydrological conditions, not pollutants.

Analysis of Flow

Bissel Creek extends for a length of 15.3 miles from its headwaters to where it enters the Payette River. Flow data from June 1995, August 1996 and June 1998 all show a flow of 0 in the segment from below river mile 13.4 to the North Side Canal. The following pictures photo document the lack of water between river mile 13.4 and the North Side Canal in July 2000 (Ferguson 2000). Figure C-1 shows the location of each photo.

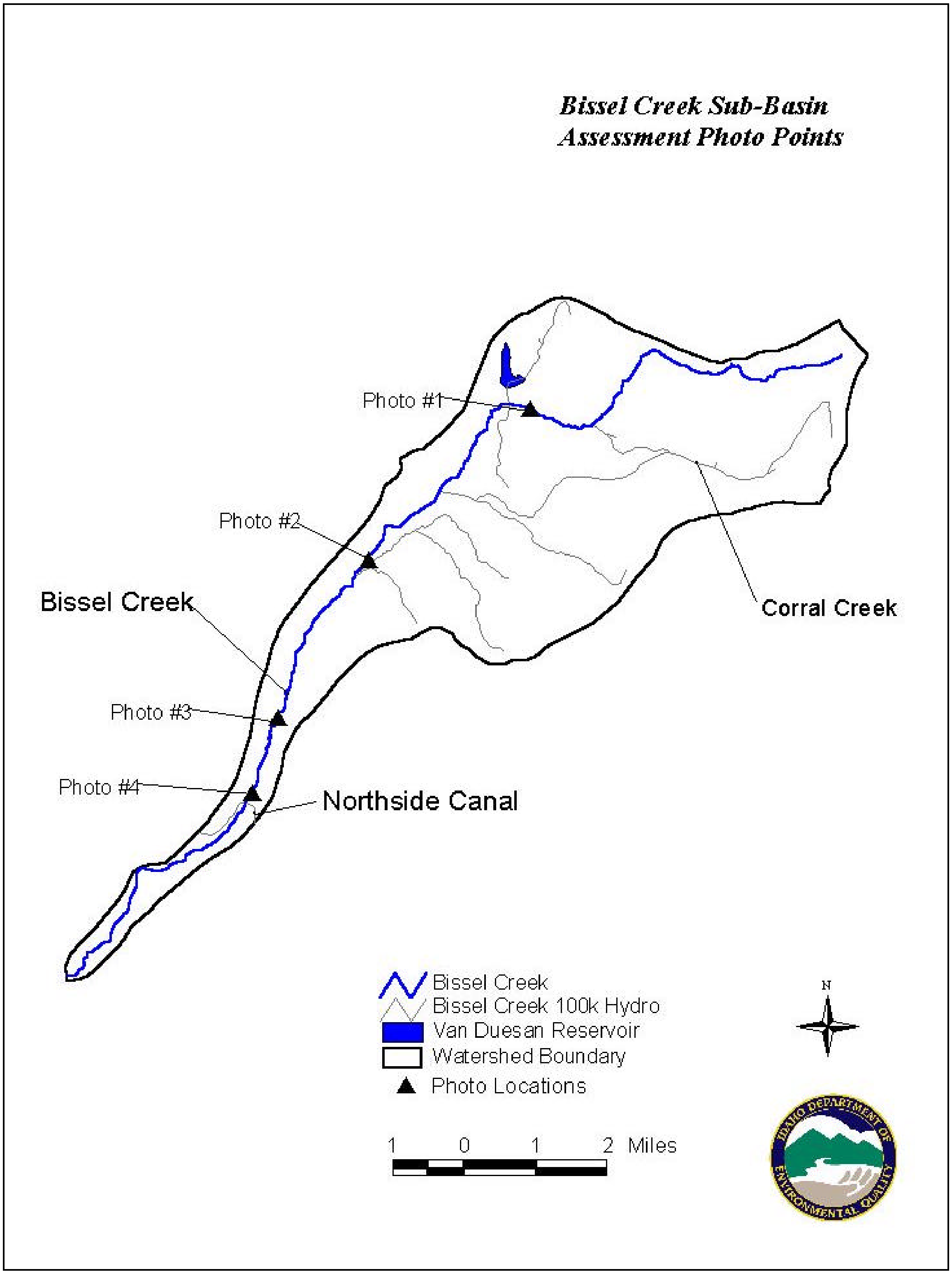

Figure C-1. Location of Photos

Photo #1

Photo #2

Photo #3

Photo #4

The lack of documented flow (as described above) in Bissel Creek shows that in a normal water year extended periods of zero flow occur from river mile 13.4 to the North Side Canal. As such, this segment of Bissel Creek is considered intermittent and the pollutant standards outlined in the *Idaho Water Quality Standards and Wastewater Treatment Requirements* apply only during base flow periods when flows exceed 1.0 cfs. These periods have not been documented.

Appendix D. Data Sources

Table C-1 Data sources for Bissel Creek Subbasin Assessment and TMDL

Location	Data Source[1]	Types of Data	When Collected
Headwaters	DEQ, ISCC	Physical, Chemical	2000
BC-4	IDA	Physical, Chemical, Biological	1999
BC-3	IDA	Physical, Chemical, Biological	1999
BC-2	IDA, DEQ	Physical, Chemical, Biological	1999, 2001
BC-1	IDA	Physical, Chemical, Biological	1996,1999

[1]DEQ = Department of Environmental Quality, IDA = Idaho Department of Agriculture, ISCC = Idaho Soil Conservation Commission

Table C-2. Data tiers[1] for data used in the Bissel Creek TMDL

Location	Data Source	Data Tier	Outcome
Headwaters	DEQ, ISCC	1	No impairment
BC-4	IDA	1	A sediment and bacteria TMDL has been prepared below the North Side Canal
BC-3	IDA	1	A sediment and bacteria TMDL has been prepared below the North Side Canal
BC-2	IDA, DEQ	1	A sediment and bacteria TMDL has been prepared below the North Side Canal
BC-1	IDA	1	A sediment and bacteria TMDL has been prepared below the North Side Canal

[1]Based on IDEQ Water Body Assessment Guidance definitions of Tier 1-Tier 3 data (Grafe et. al. 2002)

Appendix E. Periphyton Analysis for Bissel Creek, Dr. Loren Bahls.

The following paragraphs are an excerpt for the report entitled *Support of aquatic life uses in streams in southwest Idaho in 2000 based on the composition and structure of the benthic algae community* (Bahls 2001).

Soft Algae. The one periphyton sample from Bissel Creek was dominated by the filamentous green alga *Oedogonium*. This alga is common in low-gradient streams. *Mougeotia*, another filamentous green, ranked second, and diatoms ranked third in biomass. Cyanobacteria (*Oscillatoria*) were also present. A total of 8 genera of non-diatom algae were observed in the sample from Bissel Creek, which is a typical number for mountain streams.

Diatoms. The dominant diatom species in Bissel Creek was *Rhoicosphenia curvata*, which accounted for 42% of the diatoms in this sample. *Rhoicosphenia curvata* is an epiphytic diatom and its abundance in Bissel Creek may be explained by an abundance of filamentous green algae, which serve as attachment sites. *Cocconeis placentula*, another epiphytic diatom, was also common in Bissel Creek. Other than minor impairment due to a large percentage of *Rhoicosphenia curvata*, Bissel Creek had excellent biological integrity and fully supported it aquatic life uses.

The siltation index for Bissel Creek approached but did not cross the threshold for minor impairment. A large number of *Achnanthes lanceolata* also indicated some sedimentation here. *A. lanceolata* is an attached diatom that prefers sand grains as attachment sites. Bissel Creek had healthy diatom diversity and species richness, no abnormal cells, and no diatoms in the family Epithemiaceae. The pollution index was a bit low for a mountain stream, but still within the range of excellent biological integrity and no impairment.

Appendix F. Macroinvertebrate Biological Integrity Report

Bissel Creek (HUC 17050122)
Gem County, Idaho

Macroinvertebrate Biotic Integrity Report

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5 February 2003

ABSTRACT

The macroinvertebrates of Bissel Creek (HUC 17050122) in Gem County, Idaho, were sampled as part of the Lower Payette Total Maximum Daily Load (TMDL) project by the Idaho Department of Environmental Quality during summer 1998. Previous visits during 1995 and 1996 found the stream dry. The objective was to assess fine sediment impacts on the macroinvertebrate aquatic life in this area.

A preliminary look at the macroinvertebrate data from this site indicates a good taxa richness. Upon examination of the taxa present, however, we find that they are predominantly pollution tolerant taxa. The sample showed poor Ephemeroptera, Plecoptera, Trichoptera (EPT) richness. The EPT present are the pollutant tolerant species/groups. No Plecoptera were found at the site which indicates pollution problems and probable fine sediment impacts. The few taxa of Ephemeroptera and Trichoptera are composed of the more pollution tolerant groups. It appears that the taxa sensitive to fine sediment pollution are no longer found at these sites. This is probably due to a combination of the habitat present and the impacts of fine suspended sediment.

The site is very low in the scraper functional feeding group and very high in the collector gatherer feeding group. This again indicates an area dominated by fine sediment.

I recommend increasing the sample size by adding “above and below” and reference sites if possible. I recommend examination and comparison of the macroinvertebrate data to the periphyton data collected for a more complete analysis of potential sediment impacts at these stream sites. It is difficult to separate the impacts of fine sediment, high water temperature, and poor macroinvertebrate habitat.

INTRODUCTION

Macroinvertebrates of Bissel Creek, Gem County, Idaho, 303(d) listed streams (Idaho Division of Environmental Quality 1999) were sampled as part of the Lower Payette total maximum daily load (TMDL) project by the IDEQ Boise Regional Office. The sample site is located just northwest of Emmett.

Bissel Creek (Headwaters to Payette River, 16.99 river miles) in HUC 17050122 was listed on the 1998 303(d) list (Idaho Division of Environmental Quality 1999)(Table 1). The stream was listed for sediment as pollutant. This report provides findings from an analysis of macroinvertebrate data on these streams in an attempt to determine if the pollutant responsible for the 303(d) listing is fine sediment.

Previous studies of macroinvertebrates and water quality issues in this area include Robinson and Minshall (1994).

Table 1. Site visits for Bissel Creek (HUC 17050122). Stream sites and dates visited are given. The pollutant(s) as listed in the 1998 303(d) list (IDEQ 1999) is sediment. All sites are located in the Shake River Basin/High Desert Ecoregion.

STREAM	SITE	DATE	SITE ID	CONDITION
Bissel Creek	Just bl powerline	06-22-1995	95SWIROB57	Dry
Bissel Creek	@ canal crossing	08-06-1996	96SWIROA75	Dry
Bissel Creek	@ canal crossing	06-29-1998	1998SBOIB020	Dry
Bissel Creek	Bl old Black Canyon Hwy	06-29-2001	TMDL-BC-001-JUN	Flowing water present

MATERIALS AND METHODS

Study Area

The study area is in USGS cataloging unit (HUC) 17050122 in the Emmett area, Gem County, Idaho. Early sampling attempts to collect macroinvertebrates encountered a dry channel. In 2001 the sampling crew traveled about two miles further downstream where there was water present. The majority of the area consists of rangeland administered by the Bureau of Land Management at the higher reaches. Private land is found in the lower area. All sites are located in the Snake River Basin/High Desert Ecoregion (Omernik and Gallant 1986). Four stream sites were visited and in this macroinvertebrate biotic integrity report for this project (Table 1).

Sample Site Descriptions

The 1995 site was visited just below where the powerline crosses Bissel Creek. The 1996 and 1998 sites were at the canal crossing of Bissel Creek. By summer the stream is usually dewatered at this point. The 2001 sample site was moved a couple of miles down stream where the stream still had water. The streambed consists of gravel/cobble bottom substrate.

Field Methods

Macroinvertebrate sample methods follow Clark and Maret (1993) and Idaho Division of Environmental Quality beneficial use reconnaissance project (Beneficial Use Reconnaissance Project Technical Advisory Committee 1999). Three Hess samples were taken and combined for each of three separate riffles. Macroinvertebrates were processed by EcoAnalysts, Inc. of Moscow, Idaho. Voucher specimens of the macroinvertebrates will be deposited in the Orma J. Smith Museum of Natural History, Albertson College of Idaho, Caldwell.

Methods of Analysis

The macroinvertebrate sample metrics were interpreted consistent with current literature. Hafele and Hinton (1996), Oregon Watershed Enhancement Board (1999), Relyea (1999), Relyea et al. (2000), PEERS (1998), and Wisseman (1996) were especially helpful in determining the tolerance of the invertebrates collected to fine sediment.

Invertebrate taxa found during this study can be compared to information from southern Idaho (Robinson and Minshall 1994). Our knowledge of these invertebrate groups and the techniques used in making the identifications have improved in recent years and the resulting determinations are for the most part, done to a finer level.

The macroinvertebrate metrics currently used by this report to examine the sample data include: percent Ephemeroptera, Plecoptera, and Trichoptera (EPT), percent scrapers, EPT index, taxa richness and pollution tolerance. The metrics examined can be separated into four categories: richness, composition, tolerance, and trophic/habitat.

Richness (or community structure)

Taxa richness reflects the health of the assemblage through a measure of the variety of taxa (total number of distinct genera or species) present. Taxa richness can be equated to biodiversity. Taxa richness generally increases with increasing water quality, habitat diversity, or habitat suitability. Barbour and others (1992) and Karr and Chu (1999) report that taxa richness is a reliable indicator of human influence in the Pacific Northwest and will generally decrease with an increase in such influence. The EPT index is a metric that summarizes the taxa richness of these three orders of insects that are generally considered to be sensitive to pollution (including temperature and fine sediment).

Barbour et al. (1999) report that EPT Index is a reliable indicator of human influence in the Pacific Northwest and will generally decrease with an increase in such influence. It follows then that the number of Ephemeroptera taxa and the number of Plecoptera taxa will likewise be good indicators of temperature and fine sediment pollution. It is sometimes helpful to look at these taxa separately although they are considered in the two previously mentioned metrics. Karr and Chu (1999) show that these three metrics are reliable indicators of human influence across the Pacific Northwest, including central Idaho. Another way to measure diversity is with Shannon=s H= diversity index. This metric is based on the observation that relatively undisturbed environments support communities having great taxa richness with no individual species present in overwhelming abundance. It has been one of the most popular diversity indices used for water quality assessment.

Robinson and Minshall (1994) found that species richness and EPT richness were two of six community level metrics found important for the Snake River Plains Ecoregion. Robinson and Minshall (1994) also found that the values for both of these metrics were usually higher in upland stream sites in comparison with lowland sites.

Composition

Percent EPT increases as water quality increases, since these groups generally contain taxa that are considered more sensitive to temperature and fine sediment pollution. Karr and Chu (1999) show that these taxa decreased with increased human influence in the Pacific Northwest. They show the same relationship between intolerant taxa (which include EPT). It likewise follows, that each of the EPT groups examined separately (percent Ephemeroptera, percent Plecoptera, and percent Trichoptera) will also show the same trend in relation to temperature and fine sediment pollution. It may be useful to examine these metrics separately at times. Total Abundance of macroinvertebrate organisms in a sample can also serve as an indicator of stream health. Generally greater total abundance will indicate a stream of decreased impact and increased water quality. There comes a point (this is dependent on the particular stream, impacts, and taxa present) where larger Total Abundance indicates a decrease in water quality. This condition is evident when pollution (which includes temperature and fine sediment) has reduced or eliminated the sensitive species and the remaining tolerant species thrive with the resulting reduced competition.

Trophic/Habitat

Percent scrapers uses the functional feeding group approach to assessment. The relative abundance of scrapers provides an indication of the riffle community food base (periphyton or primary production composition). Scrapers increase with increased abundance of diatoms and decrease as filamentous algae and aquatic mosses increase. Scrapers decrease in relative abundance following increases in fine particle sedimentation in coarse particle substrate stream beds. Percent scrapers has been shown to be sensitive to human influence in Central Idaho (Karr and Chu 1999).

Collectors and collector gatherers groups are well known groups found inhabiting this soft substrate (Voshell 2002). These organisms would be expected to increase with increased fine sediment.

Pollution tolerance

Pollution tolerance is a value placed on the various macroinvertebrate taxa from 0 to 11. A 0 or low number would indicate a very low pollution tolerance. This means that the taxa would be very sensitive to pollution. A higher number indicates that the taxa have a high pollution tolerance and would be very tolerant of pollution. A value of 11 means the pollution tolerance is unknown. These values have come from a variety of sources including Hilsenhoff (1987), Relyea (1999), Wisseman (1996), and others, and are used in the DEQ database.

A preliminary list of cold water indicator macroinvertebrates is given in Clark (1997). This preliminary list gives the known cold water indicator taxa for Idaho along with appropriated literature references.

RESULTS AND DISCUSSION

Macroinvertebrates collected at Bissel Creek in June 2001 are given in Table 2. The data show a macroinvertebrate assemblage expected in a stream polluted by sediment.

Richness (or community structure)

A preliminary look at the macroinvertebrate data from this site indicates a good taxa richness (n=35)(Table 2). Upon examination of the taxa present, however, we find that they are predominantly pollution tolerant taxa. The sample showed poor Ephemeroptera, Plecoptera, Trichoptera (EPT) richness. The EPT present are the pollutant tolerant species/groups. No Plecoptera were found at the site which indicates pollution problems and probable fine sediment impacts. The few taxa of Ephemeroptera (n=3) and Trichoptera (n=4) are composed of the more pollution tolerant groups. It appears that the taxa sensitive to fine sediment pollution are no longer found at these sites. This is probably due to a combination of the habitat present and the impacts of fine suspended sediment.

Composition

Percent EPT increases as water quality increases and thus decreases as water quality decreases, since these groups generally contain taxa that are considered more sensitive to fine sediment pollution. Certainly the percent EPT is low in Bissel Creek (Ephemeroptera, 3 taxa, Trichoptera, 4 taxa, and no Plecoptera). There are no reference cites and no other sites on Bissel Creek to compare these data to Karr and Chu (1999) show that these taxa decreased with increased human influence in the Pacific Northwest.

Trophic/Habitat

Percent scrapers is a measure of the trophic and habitat condition of a stream and uses the functional feeding group approach to assessment. Since there were only three scraper taxa found in the Bissel Creek sample (approximately 8% of the total taxa present)(Table 2). This low percentage of the scraper feeding group is an indication of a low periphyton or primary producer assemblage in the riffle habitat. This is thus a good indicator of fine particle sedimentation. Karr and Chu (1999) have shown that the percent scrapers metric is sensitive to human influence in Central Idaho.

The majority of the taxa (57%) are collectors (Table 2). The implication is that the system is high in particulate matter which would be expected in a stream with high sediment composition. The midge (Chironomidae) and worm (Oligochaeta) groups are dominant in the collector gatherer functional feeding group. These are well known groups found inhabiting this soft substrate (Voshell 2002).

Pollution tolerance

The pollution tolerance of the macroinvertebrates collected on Bissel Creek is given in Table 2. The tolerance is high (mean 6.6, n=35). The tolerance values range from a central value of five for some insects (*Cardiocladius* and *Dicranota*, and *Glossosoma*) to a very high value of nine for some non-insects (the amphipod, *Hyalella* and the oligochaete worm, Enchytraeidae)(Table 2). As mentioned earlier, the Ephemeroptera and Trichoptera found were also of the more pollution tolerant taxa. The three mayflies (*Baetis tricaudatus*, *Tricorythodes* sp., and *Attenella margarita)* have a mean tolerance value of over seven (Table 2). The four caddisfly taxa (*Hydropsyche* sp., *Cheumatopsyche* sp., *Glossosoma* sp., and *Hydroptila* sp.) have a mean tolerance value of nearly seven (Table 2). The high tolerance values reported for these taxa indicate that fine sediment pollution is a problem at this site.

No cold water indicator taxa were found at this site (Table 2). The warm water indicator taxa found at the site (Table 2) also indicate tolerance to fine sediment.

CONCLUSIONS AND RECOMMENDATIONS

1. I recommend examination and comparison of the macroinvertebrate data to the periphyton data collected for a more complete analysis of potential sediment impacts at these stream sites.
2. I recommend increasing the sample size in the future as it is very difficult to make positive recommendations on a single sample. Both "above and below" samples as well as samples from reference sites would be valuable for comparison.
3. It is difficult to separate the impacts of fine sediment, high water temperature, and poor macroinvertebrate habitat. Considering the data from this single sample I believe that fine sediment is the primary pollutant of concern.

ACKNOWLEDGMENTS

EcoAnalysts, Inc. (Gary Lester) provided the macroinvertebrate identifications of the samples presented here. The Boise IDEQ Regional Office (Mike Ingham) took the field samples. Mike Ingham provided valuable information concerning the sample and samples sites and the project in general. Christina Relyea kindly provided literature on sediment impacts on aquatic invertebrates. Mark Shumar assisted with Table 2, data processing, and provided peer review of this document.

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Table 2. Macroinvertebrates collected at Bissel Creek, June 2001, along with water quality related attributes.

Name	Class	Order	Family	Genus	Species	Feeding Group	Temp. Tolerance	Tolerance Value
Nematoda		Nematoda (phylum)				Omnivore	Euryth: warm	6
Pisidium sp.	Bivalvia	Bivalvia (class)	Sphaeriidae	Pisidium	sp.	Collector Filterers	Euryth: hot	5
Acari	Arachnida	Acari (subclass)				Parasites	Euryth: warm	6
Hyalella sp.	Crustacea	Amphipoda	Talitridae	Hyalella	sp.			9
Crangonyx sp.	Crustacea	Amphipoda	Crangonyctidae	Crangonyx	sp.	Collector Gatherers	Euryth: cool	7
Dicranota sp.	Insecta	Diptera	Tipulidae	Dicranota	sp.	Engulfer Predators	Euryth: warm	5
Chelifera sp.	Insecta	Diptera	Empididae	Chelifera	sp.	Engulfer Predators	Euryth: warm	6
Optioservus sp.	Insecta	Coleoptera	Elmidae	Optioservus	sp.	Scrapers (grazers)	Euryth: warm	7
Baetis tricaudatus	Insecta	Ephemeroptera	Baetidae	Baetis	tricaudatus	Scrapers (grazers)	Euryth: warm	7
Tricorythodes sp.	Insecta	Ephemeroptera	Tricorythidae	Tricorythodes	sp.	Collector Filterers		8
Attenella margarita	Insecta	Ephemeroptera	Ephemerellidae	Attenella	margarita	Collector Gatherers	Euryth: warm	7
Hydropsyche sp.	Insecta	Trichoptera	Hydropsychidae	Hydropsyche	sp.	Collector Filterers		6
Cheumatopsyche sp.	Insecta	Trichoptera	Hydropsychidae	Cheumatopsyche	sp.	Collector Filterers	Euryth: warm	8
Glossosoma sp.	Insecta	Trichoptera	Glossosomatidae	Glossosoma	sp.	Scrapers (grazers)	Euryth: cool	5

Hydroptila sp.	Insecta	Trichoptera	Hydroptilidae	Hydroptila	sp.	Piercer Herbivore	Euryth: warm	8
Orthocladius sp.	Insecta	Chironomidae (family)	Chironomidae	Orthocladius	sp.	Collector Gatherers	Euryth: warm	6
Cricotopus trifascia gr.	Insecta	Chironomidae (family)	Chironomidae	Cricotopus	trifascia	Detritus Shredders	Euryth: warm	6

Name	Class	Order	Family	Genus	Species	Feeding Group	Temp. Tolerance	Tolerance Value
Cricotopus sp.	Insecta	Chironomidae (family)	Chironomidae	Cricotopus	sp.	Detritus Shredders	Euryth: warm	7
Cricotopus bicinctus gr.	Insecta	Chironomidae (family)	Chironomidae	Cricotopus	bicinctus	Detritus Shredders	Euryth: warm	7
Cardiocladius sp.	Insecta	Chironomidae (family)	Chironomidae	Cardiocladius	sp.	Engulfer Predators	Euryth: warm	5
Eukiefferiella brevicalcar gr.	Insecta	Chironomidae (family)	Chironomidae	Eukiefferiella	brevicalcar	Collector Gatherers	Euryth: cool	4
Eukiefferiella claripennis gr.	Insecta	Chironomidae (family)	Chironomidae	Eukiefferiella	claripennis	Collector Gatherers	Euryth: warm	8
Phaenopsectra sp.	Insecta	Chironomidae (family)	Chironomidae	Phaenopsectra	sp.	Collector Gatherers	Euryth: warm	7
Polypedilum sp.	Insecta	Chironomidae (family)	Chironomidae	Polypedilum	sp.	Collector Gatherers	Euryth: warm	6
Tanytarsus sp.	Insecta	Chironomidae (family)	Chironomidae	Tanytarsus	sp.	Collector Gatherers	Euryth: warm	8
Micropsectra sp.	Insecta	Chironomidae (family)	Chironomidae	Micropsectra	sp.	Collector Gatherers	Euryth: warm	7
Rheotanytarsus sp.	Insecta	Chironomidae (family)	Chironomidae	Rheotanytarsus	sp.	Collector Gatherers	Euryth: warm	6
Thienemannimy	Insecta	Chironomid	Chironomida	Thienemannim		Engulfer	Euryth:	6

ia gr. sp.		ae (family)	e	yia		Predators	warm	
Enchytraeidae	Oligochaet a	Oligochaeta (class)	Enchytraeida e			Collector Gatherers		9
Nais barbata	Oligochaet a	Oligochaeta (class)	Naididae	Nais	barbata	Collector Gatherers		8
Nais behningi	Oligochaet a	Oligochaeta (class)	Naididae	Nais	behningi	Collector Gatherers		8
Nais variabilis	Oligochaet a	Oligochaeta (class)	Naididae	Nais	variabilis	Collector Gatherers		8
Pristina leidyi	Oligochaet a	Oligochaeta (class)	Naididae	Pristina	leidyi			8
Pristinella jenkinae	Oligochaet a	Oligochaeta (class)	Naididae	Pristinella	jenkinae	Collector Gatherers		8
Tubificidae w/o cap setae	Oligochaet a	Oligochaeta (class)	Tubificidae			Collector Gatherers		8

Appendix G. Distribution List

TRACY CHELLIS
U.S. EPA REGION 10
SEATTLE WA 98101

LEVI MONTOYA
NRCS
1805 HWY 16 ROOM 1
EMMETT ID 83617

DAR OLBERDING
5454 W CENTER ROAD
EMMETT ID 83617

DIST 65 WATER MASTER
102 NORTH MAIN ST
PAYETTE ID 83661

CLAUDE BRUCE
PAYETTE SWCD
10550 HWY 95
PAYETTE ID 83661

TOM PENCE
5433 BIG WILLOW RD
PAYETTE ID 83661

DEAN CHARTERS
LAST CHANCE IRRIGATION
1507 JORDAN LANE
EMMETT ID 83617

DENNIS DICKINSON
PO BOX 1010
FRUITLAND ID 83619

GEORGE MCCLELLAND
1905 NW 1ST AVE
FRUITLAND ID 83619

KARL SILLER
EMMETT IRRIGATION DIST
1945 JACKSON AVE
EMMETT ID 83617

KATHY SKIPPEN
454 W CENTRAL
EMMETT ID 83617

KIRK VICKERY
GEM SWCD
2379 MESA AVE
EMMETT ID 83617

KIRK CAMPBELL
DEPT OF AG
2270 OLD PENITENTIARY RD
BOISE ID 83701

TOM HOPPELL
501 E MAIN ST
EMMETT ID 83617

MIKE RAYMOND
NRCS
1630 3RD STREET
PAYETTE, ID 83661

RICK SCHULTZ
FRUITLAND WASTEWATER
PO BOX 324
FRUITLAND ID 83619

Appendix H. Public Comments

This appendix documents the comments received during the 43-day comment period for the Bissel Creek Subbasin Assessment and Total Maximum Daily Load. The originally scheduled comment period extended from June 27, 2003 to July 25, 2003. However, the Lower Payette Watershed Advisory Group requested an extension and the comment period was extended to August 8, 2003. The comments received as well as DEQ's responses to the comments are documented in the following matrix. In some instances the comment is summarized. In others, the exact comment is given.

Comments From: **Dean Heideman** **Received via mail: July 11, 2003**	**DEQ Response:**
1) "I am quite pleased to see at long last, something is to be done about Bissel Creek."	Comment noted.
2) "However, I would like to draw your attention to two other drain ditches in my area, both are irrigation drain ditches. One is between Beacon and Big Four on West Idaho Blvd. It carries a large amount of sediment from the fields above. Most of the farmland that drains into this system is of hilly nature, so there is a lot of erosion in the fields until crops cover and root. The erosion problem is made even worse by the fact that the Emmett Irrigation District allows farmers to move water from field to field allowing them to apply lots of water in a short time. This is causing even more washing of the topsoil from the fields along with over loading smaller waste ditches that drain into the main stream to wash and erode from the bottom and sides, sending more sediment into the river. This drain also has a small feedlot on its bank. Even under the best of conditions some of this animal waste is going to make its way into the drain and then into the river. This is made especially bad during the wet snows of winter and heavy rains of spring as the elevation of the feedlot is downhill into the drain system."	This drain is beyond the scope the Bissel Creek TMDL. However, DEQ appreciates being made aware of potential sources of pollutants to the Payette River. We are forwarding your concern to the Soil Conservation Commission and the Natural Resource Conservation Service for their consideration. These two agencies would be able to assist landowners with conservation plans to reduce erosion.
"The second drain is between Big Four and Mesa. This drain suffers the same problems as the first, but is carrying more water as it drains a larger amount of farmland."	This drain is beyond the scope the Bissel Creek TMDL. However, DEQ appreciates being made aware of potential sources of pollutants to the Payette River.
3) "Although some of the farmers have installed some small sediment ponds for the most part they are too small for the amount of sediment and return water that runs through them, and are not kept dredged out so my mid summer they are full of sediment and no longer effective."	The local soil conservation district has resources available to assist landowners in these matters.

Comments From: **Dar Olberding** **Emmett Irrigation District, Chairman** **Received via fax: August 8, 2003**	**DEQ Response:**
1) "The board would like to thank you for attending our meeting Tuesday night." (August 5, 2003) Your presentation was informative and helped explain the process and implications of the TMDL. We also appreciate DEQ extending the comment period through Friday, August 8."	Comment noted.
2) "Emmett Irrigation District would like to express concerns as to whether a TMDL is necessary. In our opinion, Bissel Creek is and should be considered an intermittent stream. Periodically above Big 4 Avenue, the stream dries up and remains dry until spring runoff."	The flow data presented in the Subbasin Assessment shows that Bissel Creek at Big 4 Avenue contains water in all months of the year. DEQ agrees that periodically the stream goes dry above Big 4 Avenue. However, in April and May this segment discharges sediment and bacteria to the lower segments. As such, a TMDL is required for the segment.
3) "Also at issue is the fact regarding test results. The TMDL was prepared rather quickly and whether enough data has been collected to make the case is questionable at best."	DEQ agrees that the TMDL was quickly prepared. This was because the necessary biological data had only recently become available. However, the Subbasin Assessment shows quite conclusively that during a typical irrigation season, the total suspended solids and bacteria levels in Bissel Creek exceed the water quality standards. The poor biological communities substantiate this data.
4) "The board respectfully requests that more testing be done to support the necessity of placing a TMDL on Bissel Creek."	DEQ is legally compelled to prepare a TMDL at this time. However, as noted in Table 11 of the Subbasin Assessment, DEQ agrees that additional data collection is necessary to fill critical data gaps. The additional steps to fill these data gaps will be outlined in the TMDL implementation plan.
Comments From: **Tracy Chellis** **Environmental Protection Agency, Office of Water, Watershed Restoration Unit** **Received via e-mail: August 8, 2003**	**DEQ Response:**
1) Page xii - Table A: The "Recommended Changes to the §303(d) List" column notes that no changes are being suggested, however in the Subbasin Assessment-Watershed Characterization section it is being recommended that Bissel Creek from the Headwaters to North Side Canal be delisted.	DEQ is proposing to delist sediment from the headwaters to the North Side Canal and list bacteria from the North Side Canal to the Payette River. This discrepancy will be corrected in the final document.
2) Page 29 - Nonpoint Sources and Table 12: Are there currently any BMPs in effect in the Bissel Creek watershed or planned for the near future? If there are, please provide any details on the effect	DEQ with the assistance of the Soil Conservation Commission will attempt to determine the extent of existing or planned BMPs in the Bissel Creek subwatershed. Where applicable, this information

that they have had on any of the water quality problems.	will be included in the final document.
3) Page 35 - Margin of Safety: Please provide more discussion about how the 5% Margin of Safety for Sediment was arrived at or cite the specific page in the Succor Creek TMDL where it can be found.	Additional discussion will be added to the "Margin of Safety" section of the TMDL to further describe how the MOS was derived.
4) Page 37 - Table 15: In a watershed that has excess sediment and where a total load reduction is necessary it may appear misleading that one compliance point would be allowed an increase in the typical existing sediment load. While the data for 1999 (Table 4) show that the average TSS is 20.7, Table 11 suggests that there are data gaps for SSC and TSS. Perhaps you could include more discussion about how this increase will still allow for a decrease in sediment to the system and that if in the implementation of the TMDL it is found that these allocations are not allowing the watershed to meet water quality standards they could be changed.	Table 15 will be modified so that it does not appear as if an increase in sediment is acceptable between BC-2 and BC-3. Regarding the listing of TSS and SSC as a data gap in Table 11, the table defines the gap as "multiple years data." While there is certainly enough TSS data to develop a TMDL, DEQ would prefer to have data from multiple years to better define the temporal conditions.