Birch Creek Subbasin Assessment

Department of Environmental Quality

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Birch Creek Subbasin Assessment and Total Maximum Daily Load

March 2005

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Acknowledgments

The Idaho Falls Regional Office of the Department of Environmental Quality would like to acknowledge the efforts of the Idaho Falls Resource Area of the Bureau of Land Management for providing information and data on the Birch Creek watershed under their management. The efforts of the Dubois Ranger District of the USDA Forest Service for providing a summary of management and anticipated future monitoring are also appreciated.

The cover aerial picture is of the diversion structure that eliminates flow in the natural channel and routes water to the hydropower plant several miles to the southeast.

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Table of Contents

List of Tables

List of Figures

List of Appendices

Abbreviations, Acronyms, and Symbols

§303(d)	Refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section
µ	micro, one-one thousandth
§	Section (usually a section of federal or state rules or statutes)
ADB	assessment database
AU	assessment unit
AWS	agricultural water supply
BLM	United States Bureau of Land Management
BMP	best management practice
BOD	biochemical oxygen demand
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
DEQ	Department of Environmental Quality
DO	dissolved oxygen
DOI	U.S. Department of the Interior
DWS	domestic water supply
EPA	United States Environmental Protection Agency
F	Fahrenheit
FPA	Idaho Forest Practices Act
GIS	Geographical Information Systems
HUC	Hydrologic Unit Code
I.C.	Idaho Code
IDAPA	Refers to citations of Idaho administrative rules
IDFG	Idaho Department of Fish and Game
km	kilometer
km²	square kilometer
LA	load allocation
LC	load capacity
m	meter
m³	cubic meter
mi	mile
mi²	square miles

MGD million gallons per day

mg/L milligrams per liter

mm millimeter

MOS margin of safety

NPDES National Pollutant Discharge Elimination System

NTU nephelometric turbidity unit

PCR primary contact recreation

ppm part(s) per million

QA quality assurance

QC quality control

SBA subbasin assessment

SCR secondary contact recreation

SHI DEQ's Stream Habitat Index

SMI DEQ's Stream Macroinvertebrate Index

SS salmonid spawning
suspended sediment

TMDL total maximum daily load

TP total phosphorus

TS total solids

TSS total suspended solids

t/y tons per year

U.S. United States

U.S.C. United States Code

USDA United States Department of Agriculture

USDI United States Department of the Interior

USFS United States Forest Service

USGS United States Geological Survey

WBAG *Water Body Assessment Guidance*

WBID water body identification number

WLA wasteload allocation

WQLS water quality limited segment

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 nation's waters whenever possible. Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently this list must be published 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 the water bodies in the Birch Creek Subbasin that have been placed on Idaho's current §303(d) list.

This subbasin assessment (SBA) analysis has been developed to comply with Idaho's TMDL schedule. The assessment describes the physical, biological, and cultural setting; water quality status; pollutant sources; and recent pollution control actions in the Birch Creek Subbasin, located in eastern Central Idaho.

The starting point for this assessment was Idaho's current §303(d) list of water quality limited water bodies. One segment of Birch Creek in the Birch Creek Subbasin was listed on this list. The SBA 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 hydrology of the Birch Creek subbasin is dominated by Birch Creek and its associated diversion structures for irrigation of farmland and hydropower production on the Snake River plain. A small section of Birch Creek below the hydropower diversion in the southern part of the subbasin is 303(d) listed for flow alteration, habitat alteration, sediment and nutrients. Flow in Birch Creek below the hydropower diversion has been eliminated by a permanent control structure that diverts water for hydropower production at a power plant several miles to the east. Water is not returned to the natural channel after flowing through the power plant, and is consumed for irrigation. Water not used for irrigation during winter is infiltrated in trenches above the Idaho National Laboratory's Test Area North facility for flood control and aquifer recharge. This dewatering of the natural channel renders any listing other than flow alteration meaningless. Because flow alteration is not a pollutant that is subject to total maximum daily load calculations, no TMDL has been completed for the listed segment of Birch Creek, but it is recommended that this stream reach remain on the 303d list for flow alteration, and the listing for nutrients, sediment and habitat alteration be dropped.

Birch Creek was added to the 1998 303(d) list for flow alteration, habitat alteration, sediment and nutrients by the Idaho Department of Environmental Quality (DEQ). A subsequent inspection of the water body revealed that the primary water quality problem is likely the absence of flow. Birch Creek is in a predominantly rangeland agricultural region. Little water quality data was available for Birch Creek, however, DEQ water quality data from the Beneficial Use Reconnaissance Project shows that other perennial tributaries, and Birch

Creek above the hydropower diversion, are in full support of beneficial uses; hence no TMDLs to restore beneficial uses have been developed in the Birch Creek watershed.

Other perennial waters evaluated in this subbasin assessment include Willow Creek and Cottonwood Creek, in the northern watershed near the Lemhi River watershed, and Pass Creek, in the western watershed. These streams have flows less than 1cfs throughout most of the year. All of the perennial waters in the Birch Creek watershed arise primarily from spring sources and infiltrate prior to connecting with any other surface waters. It was not possible to gain access to Cottonwood Creek because it exists almost entirely on private property with the exception of the source springs that arise on the Eighteenmile Wilderness just above the private boundary. There was no access to Cottonwood Creek on private property, though there was no evidence of water quality issues on this creek.

Subbasin at a Glance

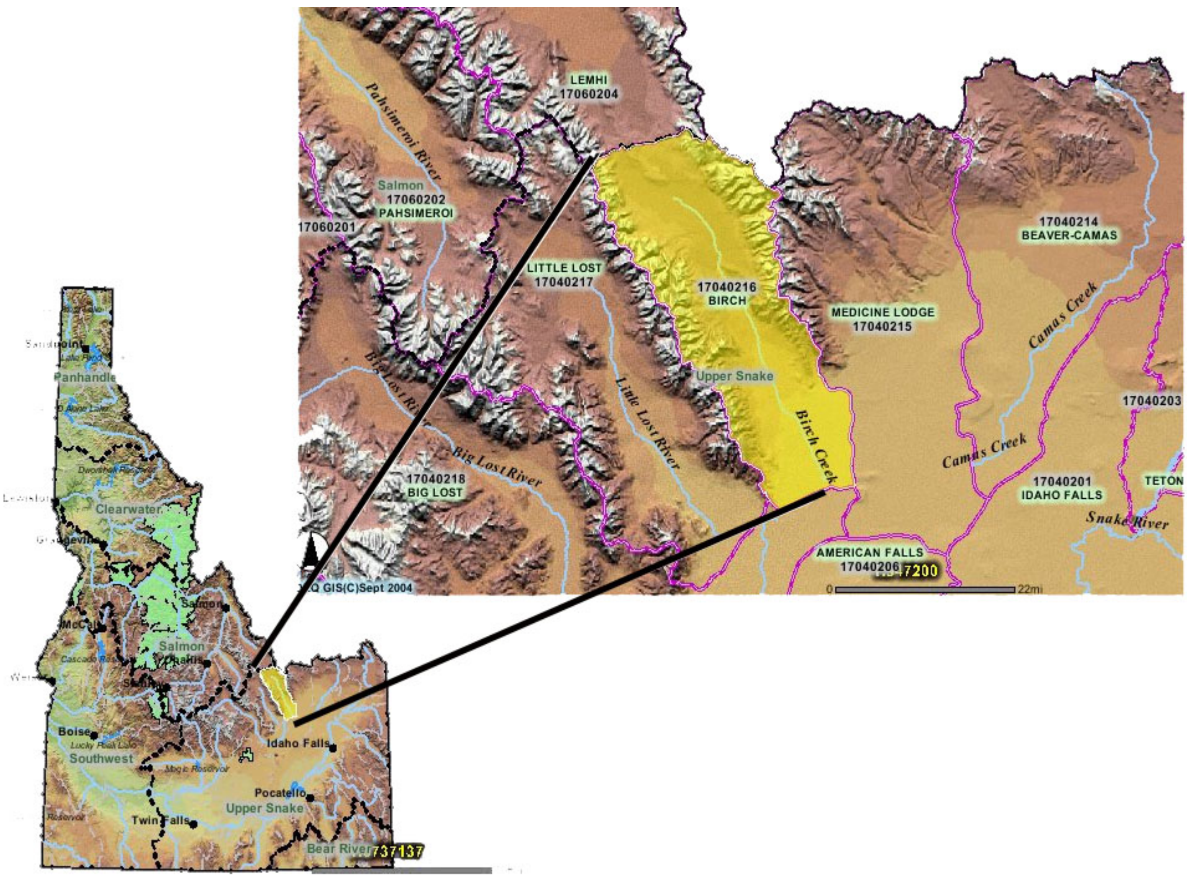

Figure A. Birch Creek watershed (Hydrologic Unit Code, HUC, 17040216)

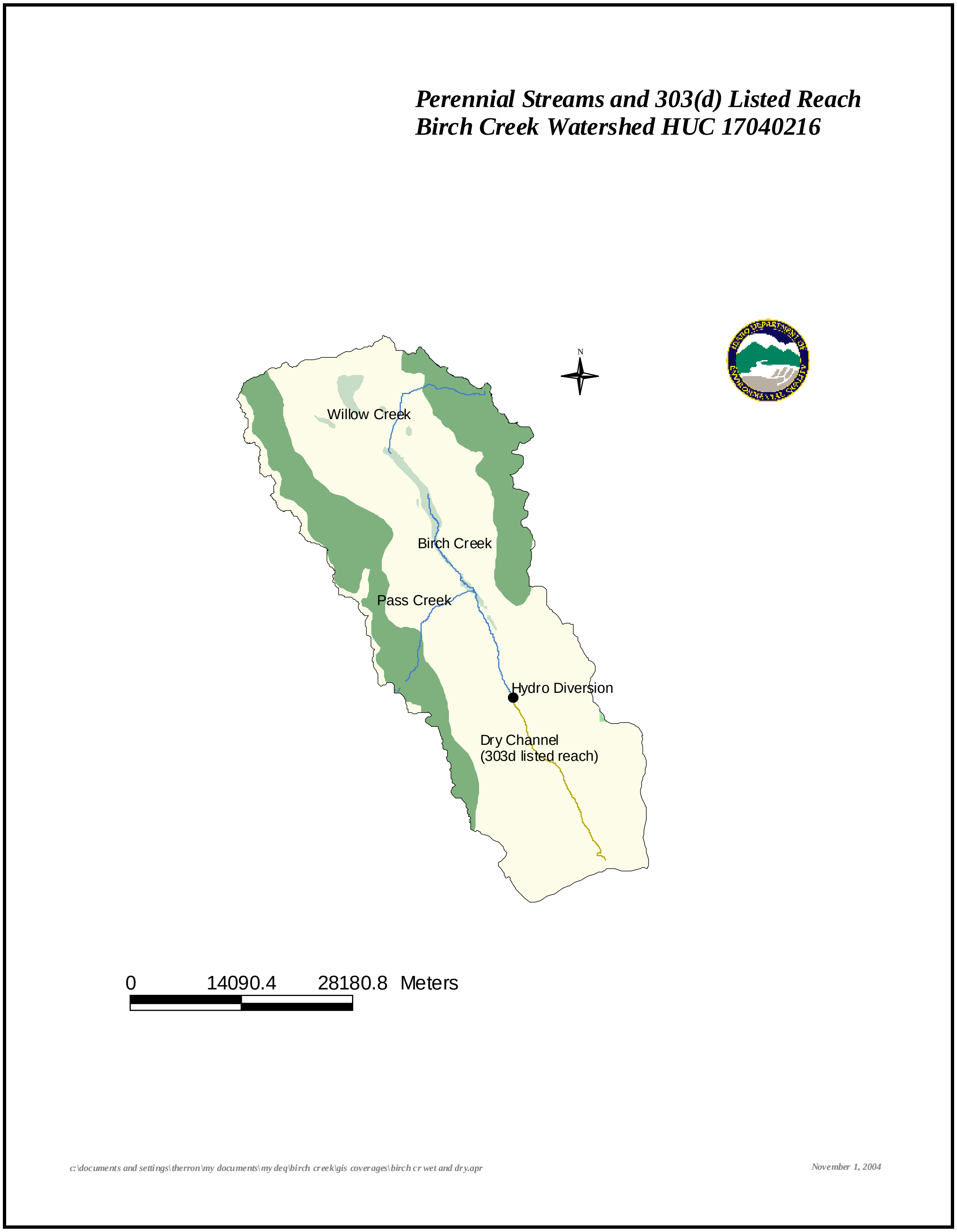

Figure B. Perennial streams and the listed reach in the Birch Creek watershed.

Key Findings

Table A. Summary of assessment outcomes.

Water Body Segment/ AU	Pollutant	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
Birch Creek-Reno Ditch to Playas	Nutrients, Sediment, Flow Alteration, Habitat Alteration	No	List For Flow Alteration	Channel is dry due to permanent diversion

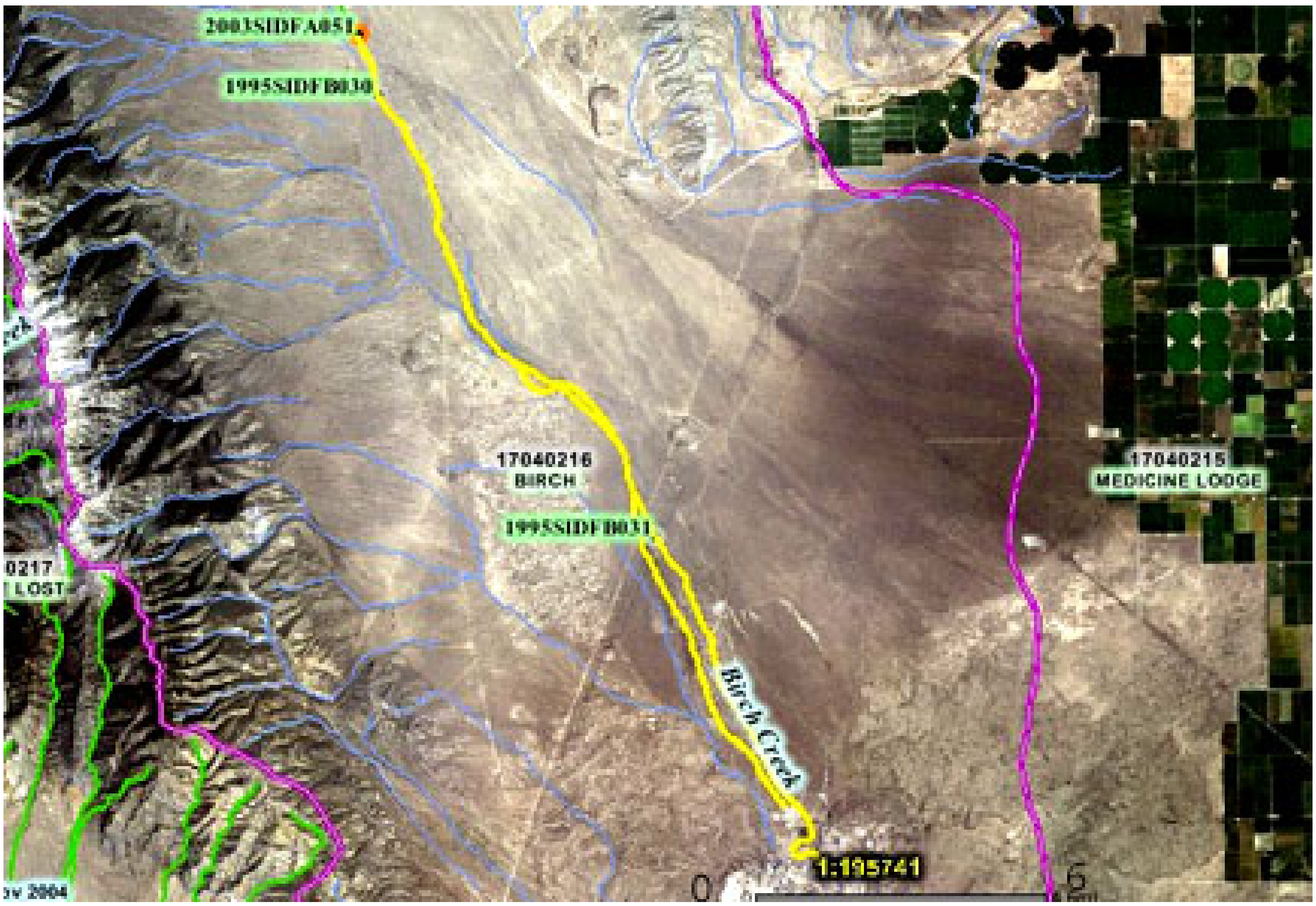

Figure C. §303(d) listed reach of Birch Creek.

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 nation's waters whenever possible. Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently this list must be published 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 the water bodies in the Birch Creek Subbasin that have been placed on Idaho's current §303(d) list.

The overall purpose of the subbasin assessment (SBA) is to characterize and document pollutant loads within the Birch Creek Subbasin. The first portion of this document, the SBA, 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 (Sections 1 – 4). This information will then be used to develop a TMDL for each pollutant of concern for the Birch Creek Subbasin (Section 5).

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 Environment Federation 1987, p. 9). 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 water quality standards and to review those standards every three years (EPA must approve Idaho's water quality standards). Additionally, DEQ must monitor waters to identify those not meeting water quality standards. For those waters not meeting standards, DEQ must establish a TMDL for each pollutant impairing the waters. Further, the agency must set appropriate controls to restore water quality and allow the water bodies to meet their designated uses.

These requirements result in a list of impaired waters, called the "§303(d) list." This list describes water bodies not meeting water quality standards. Waters identified on this list require further analysis. A SBA and TMDL provide a summary of the water quality status and allowable TMDL for water bodies on the §303(d) list. *The Birch Creek Subbasin Assessment* provides this summary for the currently listed waters in the Birch Creek Subbasin.

The SBA section of this document (Sections 1 – 4) includes an evaluation and summary of the current water quality status, pollutant sources, and control actions in the Birch Creek Subbasin 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.

Some conditions that impair water quality do not receive TMDLs. The EPA does consider certain unnatural conditions, such as flow alteration, human-caused lack of flow, or habitat alteration, that are not the result of the discharge of a specific pollutants as "pollution." However, TMDLs are not required for water bodies impaired by pollution, but not by specific pollutants. A TMDL is only required when a pollutant can be identified and in some way quantified.

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 water bodies to support. These beneficial uses are identified in the Idaho water quality standards and include the following:

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

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

A SBA 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.
- Determine the causes and extent of the impairment when water bodies are not attaining water quality standards.

1.2 Physical and Biological Characteristics

The Birch Creek subbasin (17040216) is located in eastern-central Idaho, along the Montana border. The nearest named towns are Leadore to the north and Mud Lake to the south; Birch Creek makes no surface connection with any other streams, and it is one of five central Idaho watersheds known as the Sinks Drainages (DEQ 2004).

Other than Birch Creek there are few natural waterways in the subbasin. Birch Creek, a spring-fed natural drainage, begins in a series of springs in the central part of the watershed. Birch Creek is completely diverted in the lower watershed to supply a hydroelectric project and is subsequently used for irrigation.

During the winter months outflow from the hydroelectric plant is diverted to a ditch that leads to a series of infiltration trenches to prevent flooding of Idaho National Laboratory properties below the natural sinks or playas. The 303(d) listed reach of Birch Creek occurs from the Reno Ditch to the Playas. This reach is permanently dewatered and there is no mechanism by which restoration of the stream channel is possible or practical.

Climate

The climate of the Birch Creek subbasin is classified as semiarid high desert characterized by warm to hot, dry summers and long, cool winters. The Birch Creek watershed is in the rain shadow of the Lemhi and Lost River Ranges, to the west, and the Snake River Plane, which is desert, to the south and west. Weather is primarily influenced by air masses moving inland from the Pacific Ocean during the winter months. In summer months, rainfall, cloud cover, and relative humidity are at a minimum due to the weakening of the westerly winds, allowing continental climate conditions to prevail (Abramovich et al., 1988).

Precipitation from rainfall throughout the subbasin is slightly variable (Table 1). The average precipitation from rainfall is about 8.28 inches annually while precipitation from snowfall is slightly more variable with an average of 20.7 inches annually (Table 2).

Table 1. Summary of precipitation data from three stations near the subbasin.

	Average Total Precipitation(in.)			Average Total Snowfall (in.)		
	Leadore	Howe	Hamer	Leadore	Howe	Hamer
January	0.36	0.55	0.57	3.4	3.4	6.9
February	0.17	0.54	0.48	1.9	2.5	5.2
March	0.42	0.47	0.57	2.6	1.5	2.6
April	0.67	0.67	0.78	2.1	0.7	1.1
May	1.35	1.03	1.35	0.3	2.3	0.4
June	1.18	1.2	1.23	0.4	0	0
July	0.83	0.59	0.72	0	0	0
August	0.7	0.78	0.7	0	0	0
September	0.8	0.53	0.59	0.3	0	0.1
October	0.5	0.46	0.58	0.3	0.4	0.8
November	0.46	0.59	0.66	2.0	1.5	3.4
December	0.42	0.69	0.64	3.5	4.4	8.0
Annual	7.87	8.11	8.86	16.9	16.7	28.4

Source: Western Regional Climate Center http://www.wrcc.dri.edu/summary/climsmid.html

Table 2. Summary of temperature data from three stations near the subbasin.

	Average Max. Temperature (F)			Average Min. Temperature (F)		
	Leadore	Howe	Hamer	Leadore	Howe	Hamer
January	30.2	30.2	28.2	3.7	6.5	4.2
February	35.4	36.2	34.5	8.2	12.0	9.7
March	42.0	47.2	46.0	16.3	21.9	18.6
April	52.6	59.7	59.4	23.2	30.2	27.1
May	63.5	68.5	69.7	30.8	38.5	36.1
June	73.0	77.4	78.4	37.7	45.5	43.0
July	84.4	87.1	87.7	41.2	50.4	47.8
August	82.6	85.1	86.3	40.0	48.2	45.7
September	71.6	74.5	75.8	32.5	38.9	36.9
October	59.0	61.1	62.2	25.0	28.9	26.6
November	41.2	43.2	43.0	16.6	18.7	16.5
December	30.7	31.3	30.3	5.4	8.2	6.4
Annual	55.5	58.5	58.5	23.4	29.0	26.5

Source: Western Regional Climate Center http://wrcc.dri.edu/summary/climsmid.html

Subbasin Characteristics

Geology/Topography

The Birch Creek Subbasin is located between the Lemhi Range to the west, the Beaverhead Range to the east, and the Snake River Plain to the South. The axis of the mountain ranges and the Birch Creek Valley is northwest to southeast. Most of the Lemhi Range is close to 11,000 feet in elevation, with the ridgeline ranging from 12,200 feet (Diamond Peak) and 11,612 feet (Bell Mountain) to 10,800 feet (Saddle Mountain). The Beaverhead Range comprises peaks ranging from 11,360 feet (Scott Peak) and 11,284 feet (Webber Peak) to 10, 941 feet (Eighteen Peak). Birch Creek flows on alluvium, resulting from erosion of the flanks of the mountains that have partially filled the valley.

These bordering mountain ranges, which include the Beaverhead and Lemhi Ranges, began to take form by the middle Cenozoic, prior to the subsidence of the Snake River Plain, which began in Late Cenozoic time. These ranges consist of metamorphic and sedimentary rocks of Precambrian to Mesozoic age that have been subjected to intensive uplifting, faulting, and folding. They are a result of a northeastern extension of the underlying continental crust and the consequent block-faulted Basin and Range topography characteristic of this part of the West. Uplift, tilting, faulting, and the concurrent subsidence of the Birch Creek basin (and watershed) has continued to the present (Alt and Hyndman, 1989). Challis volcanics, consisting of pale rhyolite ash and basalt lava flows erupted in the last several million years. Near Blue Dome, in the southern watershed, these flows were associated with Basin and Range faulting. There are abbreviated expressions of these flows in the northern and central areas of the watershed (Figure 1) The southern end of the watershed vanishes into the Blue Creek caldera, a large rhyolite volcano that contributed to the Snake River Plain.

A significant factor in terms of the surficial geology of the basin, operating late in the history of this area, is the work of glaciers during the Pleistocene. These glaciers added debris, in the form of terraces and outwash deposits, to the valley. Glacial deposits within the valley consist of heterogeneous mixtures of igneous and sedimentary rock fragments originating from the adjacent ranges.

Since Quaternary time, tributary streams have filled the valley with alluvium to considerable depth, perhaps as much as 3,000 feet. An obvious feature of the valley today is a series of coalescing alluvial fans, consisting of poorly sorted materials eroded from the flanking mountains. Toward the center of the valley, Birch Creek has reworked, somewhat leveled, and better sorted the alluvial deposits. This alluvium hosts a large reservoir of groundwater, which feeds the springs that are the source of Birch Creek. The abundance of these deposits on the floor of the Birch Creek valley cause the creek to infiltrate into the ground over its lower historic reach to become a sinking drainage. This same mechanism absorbs the flow of most tributaries before they emerge to the valley.

Soils formed on this alluvium are, for the most part, thin, stony and well drained. The Cretaceous Beaverhead gravel known as the Beaverhead Conglomerate forms large patches of the Lemhi and Beaverhead ranges and was deposited while crustal movements shaped the Rocky Mountains, then folded while it was still loose gravel contorting and combining constituent materials (Alt and Hyndman, 1989). Soils along riparian areas generally contain little clay.

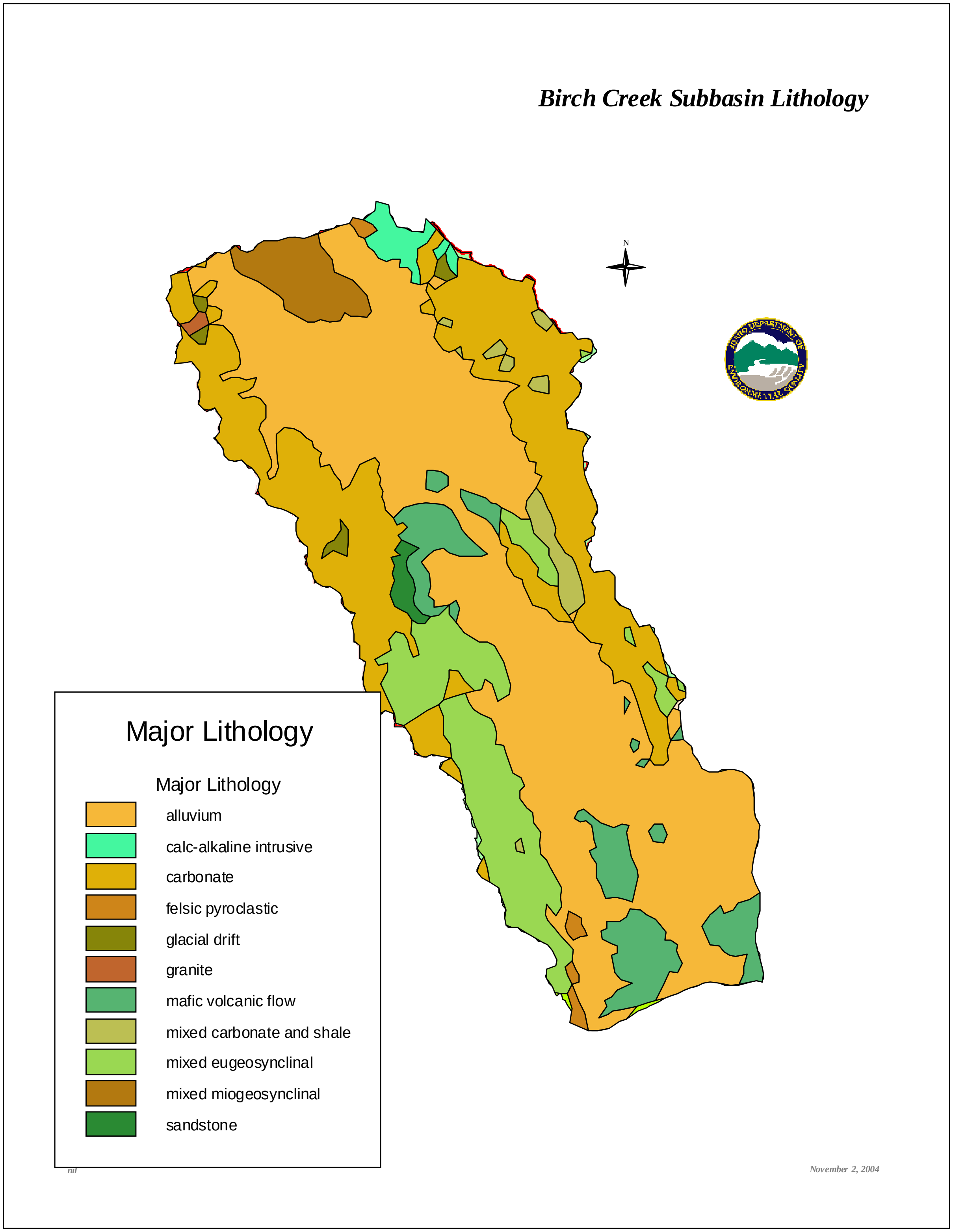

Figure 1. Birch Creek watershed lithology.

Vegetation

Vegetation in the Birch Creek watershed varies by altitude and moisture regime. Valley uplands are primarily rangeland, which include the sagebrush and grassland ecotype Riparian areas, include mature alder, willow and shrubs with some senescent cottonwood below the hydro diversion. Sagebrush and grasslands extend into higher elevations and include aspen and juniper stands where soil moisture permits. Higher subalpine elevations feature lodgepole pine, Douglas fir, whitebark pine, subalpine fir, and spruce. The highest elevations tend to be scree and barren rock with only lichen and shallow-rooted short grasses. An important function of vegetation is land cover to reduce erosion. This is very important on highly erodable soils, such as alluvial deposits and stratified glacial soils. Higher density land cover can be riparian vegetation, such as willow and perennial crops such as alfalfa. Riparian vegetation diversity and density is limited by the porous soils found along streams. Cropland consists of forage crops and is primarily limited to the northern part of the Birch Creek watershed, associated with the valley bottom and generally displaces riparian vegetation and upland sagebrush/grassland vegetation (Figure 2).

Hydrology

Due to deep alluvial deposits and low precipitation there is little surface flow in the Birch Creek watershed. Perennial streams in the watershed consist of Willow Creek and Cottonwood Creek in the northern part of the watershed, Pass Creek in the East Central area of the watershed, and Birch Creek. They are spring streams that do not flow beyond the mouth of their respective canyons with flows less than 1 cfs with the exception of Birch Creek. The flow regime of the streams other than Birch Creek exhibit a short period of snowmelt driven flow to set the peak of the hydrologic curve. There are no active U.S. Geological Survey (USGS) gages in the watershed. The USGS gage at Blue Dome, near the present day hydroproject diversion, stopped recording in 1991, when the hydroproject was completed (Figure 3).

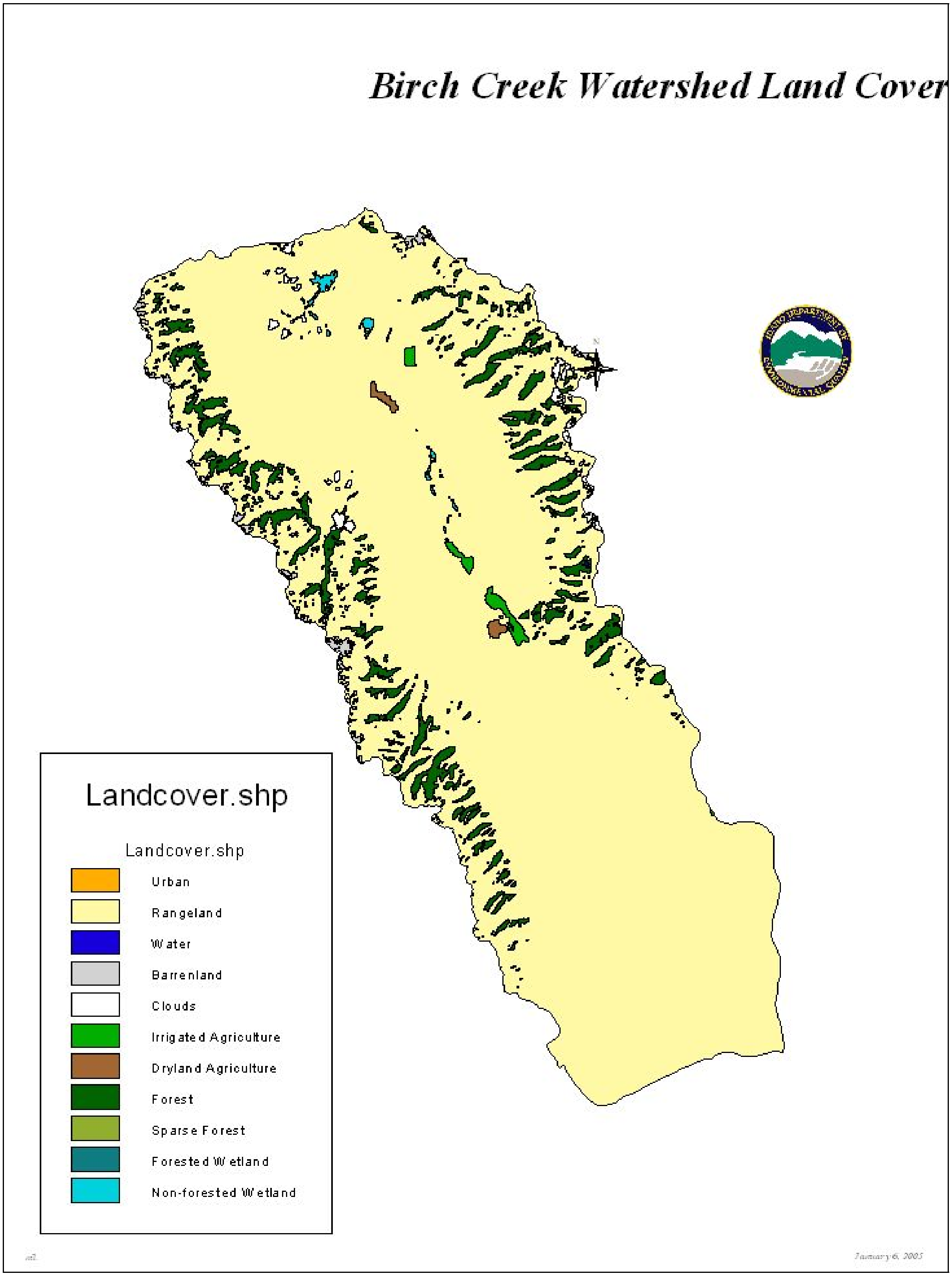

Figure 2. Birch Creek watershed vegetative land cover.

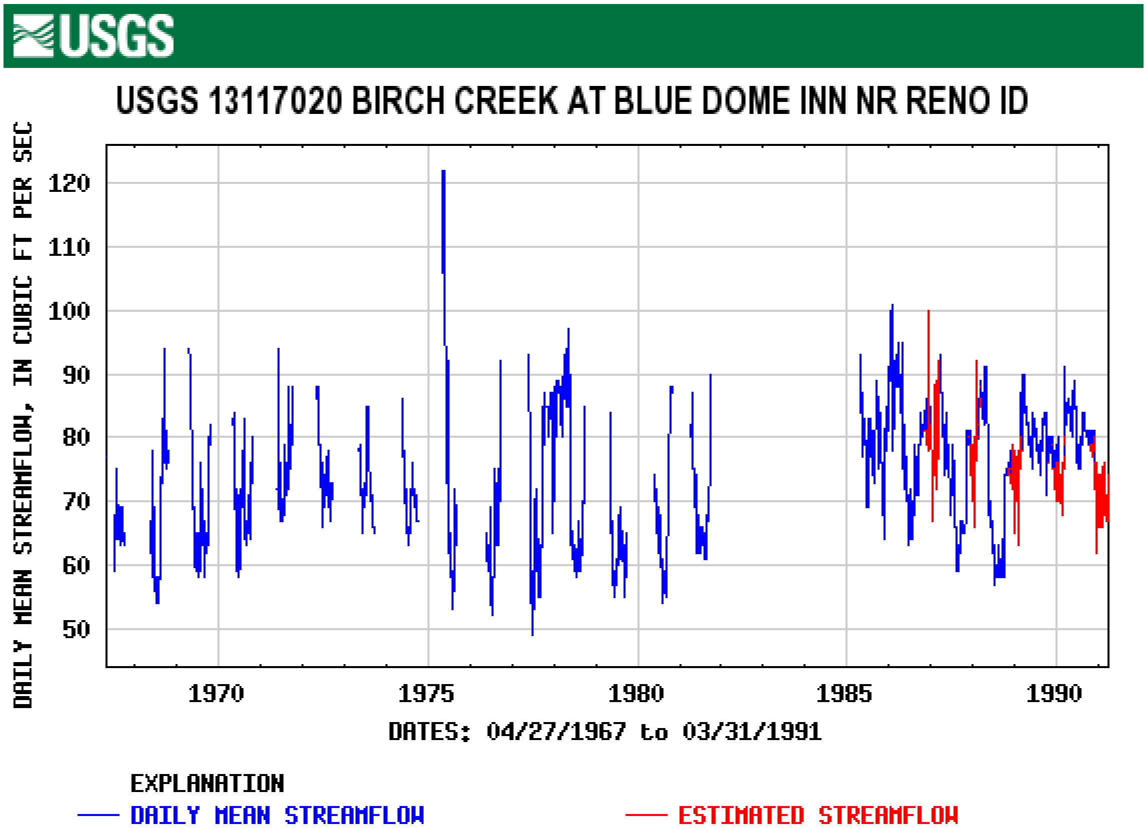

Figure 3. Daily mean stream flow for Birch Creek over the period of Record 1967 to 1991.

Fisheries

Fish species present in the Birch Creek watershed include brook trout (*Salvelinus fontinalis)*, rainbow trout (*Oncorhynchus mykiss)*, cutthroat trout (*Oncorhynchus clarki)*, Shorthead sculpin (*Cottus confusus*) and mottled sculpin (*Cottus bairdi*). This watershed exhibits the least species diversity of all of the Sinks drainages, however, fish density is among the highest in the perennial waters among the Sinks drainages. Natural reproduction combined with stocking sustains fish populations at high numbers, though stocking is limited to Birch Creek adjacent to BLM camping areas. The only native species to the Birch Creek watershed is the shorthead sculpin. All other species are introduced though Idaho Fish and Game manages rainbow trout as wild native game fish in Birch Creek. Normally hatchery stocking is not conducted where there is a wild native game fish unless genetic integrity and population viability of wild native stocks will be maintained.

Subwatershed Characteristics

There are four subwatersheds within the Birch Creek watershed that are perennial, but only Birch Creek typically has flow greater than 1 cubic foot per second (cfs) before and after spring runoff. There are 21 assessment units within the watershed, but only subwatersheds with perennial flow will be represented here (Table 3). In the upper (northern) watershed there are a series of springs that flank the southwestern exposure of an unnamed peak one-mile southwest of Eighteenmile Peak in the southern part of the Eighteenmile Wilderness Study Area along the Continental Divide. These springs form the source of Cottonwood and Willow Creeks.

Table 3. Birch Creek watershed assessment units, flow, support status and stream miles.

Assessment Unit	Named Streams	Flow	Status	Miles of Stream
ID17040216SK001_04	Birch Creek	**Dry**	Not Supporting	16.84
ID17040216SK002_04	**Birch Creek**	**Perennial**	Full Support	9.09
ID17040216SK003_04	**Birch Creek**	**Perennial**	Not Assessed	6.73
ID17040216SK005_03	**Birch Creek**	**Perennial**	Not Assessed	2.44
ID17040216SK005_04	**Birch Creek**	**Perennial**	Not Assessed	1.76
ID17040216SK007_03	Birch Creek	Dry	Not Assessed	4.67
ID17040216SK010_03	Birch Creek	Dry	Not Assessed	2.51
ID17040216SK011_02	Carlin Creek	Ephemeral	Not Assessed	3.08
ID17040216SK011_02	**Cottonwood Creek**	**Perennial**	Not Assessed	7.23
ID17040216SK011_02	Middle Creek	Ephemeral	Not Assessed	2.19
ID17040216SK001_02	Middle Fork Kyle Canyon	Dry	Not Assessed	2.58
ID17040216SK011_02	Mud Creek	Dry	Not Assessed	3.83
ID17040216SK011_03	Mud Creek	Dry	Not Assessed	5.25
ID17040216SK015_02	North Fork Pass Creek	Dry	Not Assessed	6.4
ID17040216SK010_02	North Jump Creek	Dry	Not Assessed	2.6
ID17040216SK015_03	**Pass Creek**	**Perennial**	Not Assessed	5.08
ID17040216SK011_02	Shears Creek	Ephemeral	Not Assessed	5.42
ID17040216SK001_02	South Fork Kyle Canyon	Dry	Not Assessed	1.96
ID17040216SK015_02	**South Fork Pass Creek**	**Perennial**	Not Assessed	6.46
ID17040216SK010_02	South Jump Creek	Ephemeral	Not Assessed	5.0
ID17040216SK009_02	**Willow Creek**	**Perennial**	Full Support	12.21

Streams in **BOLD** are included in Subwatershed Characteristics

Cottonwood Creek (17040216SK011_02)

Cottonwood Creek flows on private land below the Wilderness Study Area Boundary (Figure 4, Table 4). It flows in a dense willow riparian area before it completely infiltrates. There has not been any documented fish presence and the combined flow is less than 1 cfs

Table 4. Subwatershed characteristics for Cottonwood Creek.

Watershed Area	Land Form	Dominant Aspect	Relief Ratio	Mean Elevation	Slope	Hydrologic Regime	Mass Wasting Potential
13.14 sq mile	Basin & Range	West	1.6:1	7,632	5%	Spring fed	Low

Figure 4. Cottonwood Creek Subwatershed.

Willow Creek (17040216SK009_02)

Willow Creek originates in a series of springs on the southern flank of the same unnamed peak where Cottonwood Creek has its origin (Figure 5). It flows approximately 4 miles in a narrow canyon bottom across federally managed public land before encountering the first in a series of ditches that quickly remove flow from the natural channel (Table 5). Any remaining flow infiltrates on private land below stream mile 5. Willow Creek, like Cottonwood Creek, flows through dense riparian vegetation until it enters BLM land, where the riparian community begins to diminish. Beavers have greatly reduced the mature aspen from just below the BLM/Forest boundary to the sinks. There appears to be little recruitment of aspens over this reach. The fish community is made up exclusively of rainbow trout with good density and multiple year classes present to demonstrate good spawning and rearing conditions to the private BLM boundary. Since this is a spring creek, however, it is important that riparian management be initiated on BLM land to be consistent with Forest Service managed land above the BLM/Forest Service boundary and to prevent the further degradation of stream bank conditions and riparian vegetation.

Table 5. Subwatershed characteristics for Willow Creek.

Watershed Area	Land Form	Dominant Aspect	Relief Ratio	Mean Elevation	Slope	Hydrologic Regime	Mass Wasting Potential
19.48 sq mile	Basin & Range	West	1.5:1	7,632 ft	4%	Spring fed	Moderate

Figure 5. Willow Creek Subwatershed.

Pass Creek (ID17040216SK015_02 and 03)

The Pass Creek watershed includes the South Fork of Pass Creek and several hundred yards of Pass Creek above its permanent point of diversion. Pass Creek and the South Fork of Pass Creek flow through a narrow and deep canyon with a northern exposure that limits thermal input (Figure 6). There is a lush, dense riparian zone along the entire reach of the South Fork of Pass Creek and Pass Creek. Below the permanent diversion there is sage brush growing in the channel, and it is obvious that the natural channel seldom experiences flow. Above the point of diversion, there is a good population of naturally producing rainbow trout that are present in multiple year classes. Flow in Pass Creek is less than 1 cfs. Subwatershed characteristics are shown in Table 6.

Table 6. Subwatershed characteristics for Pass Creek.

Watershed Area	Land Form	Dominant Aspect	Relief Ratio	Mean Elevation	Slope	Hydrologic Regime	Mass Wasting Potential
38.89 sq.mile	Basin & Range	Northeast	1.6:1	7,179 ft	5%	Spring fed	Moderate

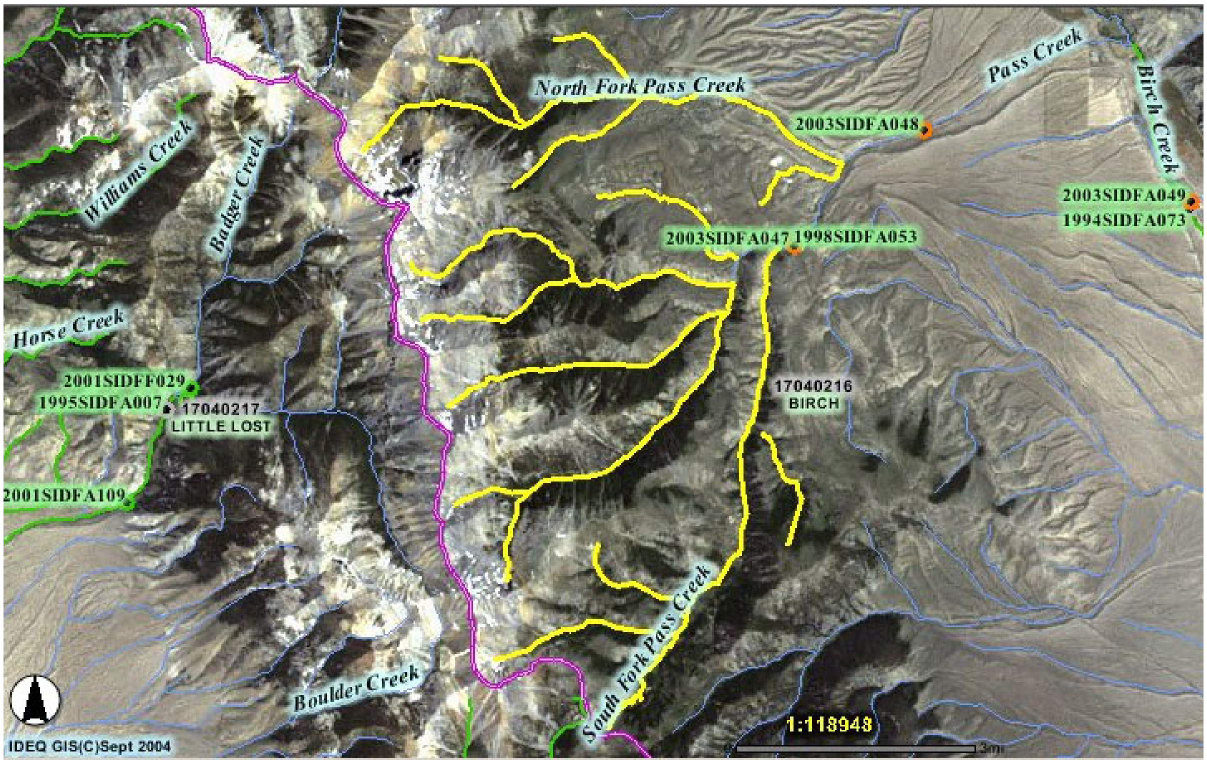

Figure 6. Pass Creek Subwatershed.

Birch Creek (ID17040216SK002_04)

Birch Creek watershed encompasses the perennial streams described above. Birch Creek is derived from a zone of springs located in the central part of the watershed. Above this spring zone, flow from Mud Creek and Willow Creek is ephemeral, so Birch Creek above the zone of springs is ephemeral, and not capable of supporting aquatic life. As a spring creek, Birch Creek is not subject to hydrologic extremes from snowmelt because potential tributary stream flow infiltrates into valley fill material (deep alluvium) long before connecting with the Birch Creek channel. Birch Creek flows within Pleistocene and Miocene terraces formed during previous periods of valley and continental glaciation. The riparian zone starts as a sedge dominated system until sufficient hyporheic zone (flowing groundwater adjacent to the stream) develops to support shrub species and subsequent larger woody species downstream. Subwatershed characteristics are shown in Table 7.

Table 7. Subwatershed characteristics for Birch Creek.

Watershed Area	Land Form	Aspect	Relief Ratio	Mean Elevation	Slope	Hydrologic Regime	Mass Wasting Potential
679.9	Glacial Valley	South	1.6:1	6,264	0.8%	Spring	Low

Stream Characteristics

Willow Creek flows in a narrow, moderately steep colluvial valley with a gradient of 4% in a B4 channel type (Rosgen 1996). These streams typically have width to depth ratios greater than 12, are slightly to moderately entrenched, and have sinuosity greater than 1.2 (stream length: valley length). Flow is less than 1 cfs over much of the year. The width to depth ratio at the BURP site measured 10.2 with stream bank stability and cover greater than 95%. Substrate is primarily gravel to cobble size of mixed limestone and volcanic parent material. There is a great deal of beaver activity over the upper third of the stream length. Mature aspen and cottonwood trees have been removed by beaver and there is minimal recruitment from the sinks upstream to just above the private/BLM boundary. Rainbow trout are present throughout the perennial reach in multiple year classes.

Pass Creek begins as discharge from a catastrophic mountain lake in a B channel, through upper meadows and sedge. It then flows through a narrow, moderately steep colluvial valley with a gradient of 5% in an A4 channel type (Rosgen 1996). Here the riparian zone is dense and lush with willow, alder, and river birch. Prior to its complete and permanent diversion, at the mouth of the canyon, Pass Creek again flows in a B5 channel for several hundred yards. A-channel streams typically have width to depth ratios less than 12, are slightly entrenched and have sinuosity less than 1.2 (stream length: valley length). The width to depth ratio at the BURP site measured 10.5 with stream bank stability measured at 100%. Substrate is primarily gravel to cobble size of mixed limestone and volcanic parent material. Rainbow trout are present throughout the perennial reach in multiple year classes.

Birch Creek begins in a series of springs and seeps that stretch over a half mile. The channel is initially bifurcated due to the numerous springs that contribute flow, and is classified as a B3 channel. It quickly becomes a 4th order stream. The valley constricts at the point where the stream flows in a single thread channel a mile below the spring zone and due to the presence of Pleistocene glacial berms it is classified as an F channel. Where the valley again widens sinuosity increases to create a C4 channel. Below this point the channel is constricted by Highway 28 and returns to a B4 channel. Historically, several miles above the diversion into a ditch leading to a hydroelectric plant, the channel has been reconstructed and artificially lined to reduce infiltration into the substrate. Over this artificial channel the stream is classified as a B channel. Ironically, because of the liner the riparian vegetation is much more vigorous and lush because of the reduced infiltration. The natural condition would provide for less riparian vegetation that is primarily sedge and low shrubs.

1.3 Cultural Characteristics

The Birch Creek Valley is contained within Lemhi, Butte and Clark Counties in eastern central Idaho. It is the most sparsely populated watershed within any of the three counties.

There are no incorporated cities within the Birch Creek Watershed, only named places such as Lone Pine, Blue Dome, Nicholia, and Hahn. Year round residents number less than 40, mostly on ranches. There are no industrial or municipal entities requiring National Pollutant Discharge Elimination System (NPDES) permits and land ownership is predominantly public lands managed by federal agencies including the U.S. Department of Agriculture (USDA) Forest Service, U.S. Department of Interior (USDI) Bureau of Land Management, and DOE Idaho National Laboratory. Remaining lands are primarily private ranches with isolated sections managed by the State of Idaho Department of Lands.

Land Use

Land use largely parallels that of land cover as shown in Figure 2, above. By far the predominant land use is rangeland (73%), followed by Forested Land Uses (24.9 %) and irrigated agriculture (2%) that supports livestock feeding (Figure 7.). Recreation and grazing is included in Forested Land Use. Recreation is the most prevalent land use immediately adjacent to Birch Creek including camping and fishing. The trend for land use within the watershed is not likely to change in the foreseeable future due to the remote location of this watershed and the lack of large adjacent populations.

Land Ownership, Cultural Features, and Population

Public lands comprise the vast majority of ownership within the watershed (67%). Private ranches are found on Cottonwood Creek, lower Willow Creek, and the upper portion of Birch Creek. Private lands total 17.4%. The Department of Energy lands are not considered public land because access is restricted. The Department of Energy manages 15.2 % of the watershed land (Figure 8). The majority of the watershed is contained within Lemhi County, though the perennial flow of Birch Creek is evenly split between Clark and Lemhi Counties. The nearest towns are Leadore (population 90) and Mud Lake, Idaho (population 270).

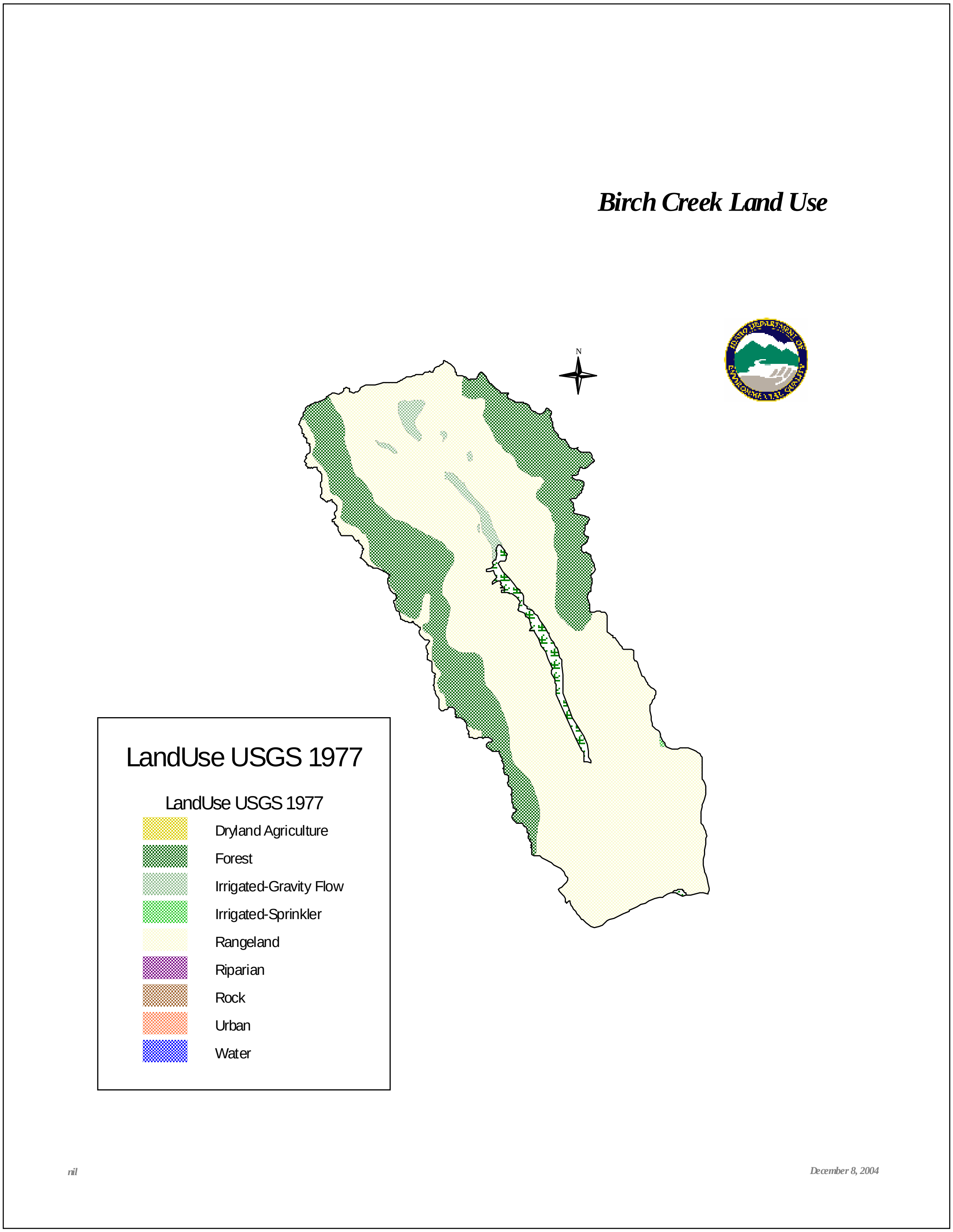

Figure 7. Land Use within the Birch Creek watershed.

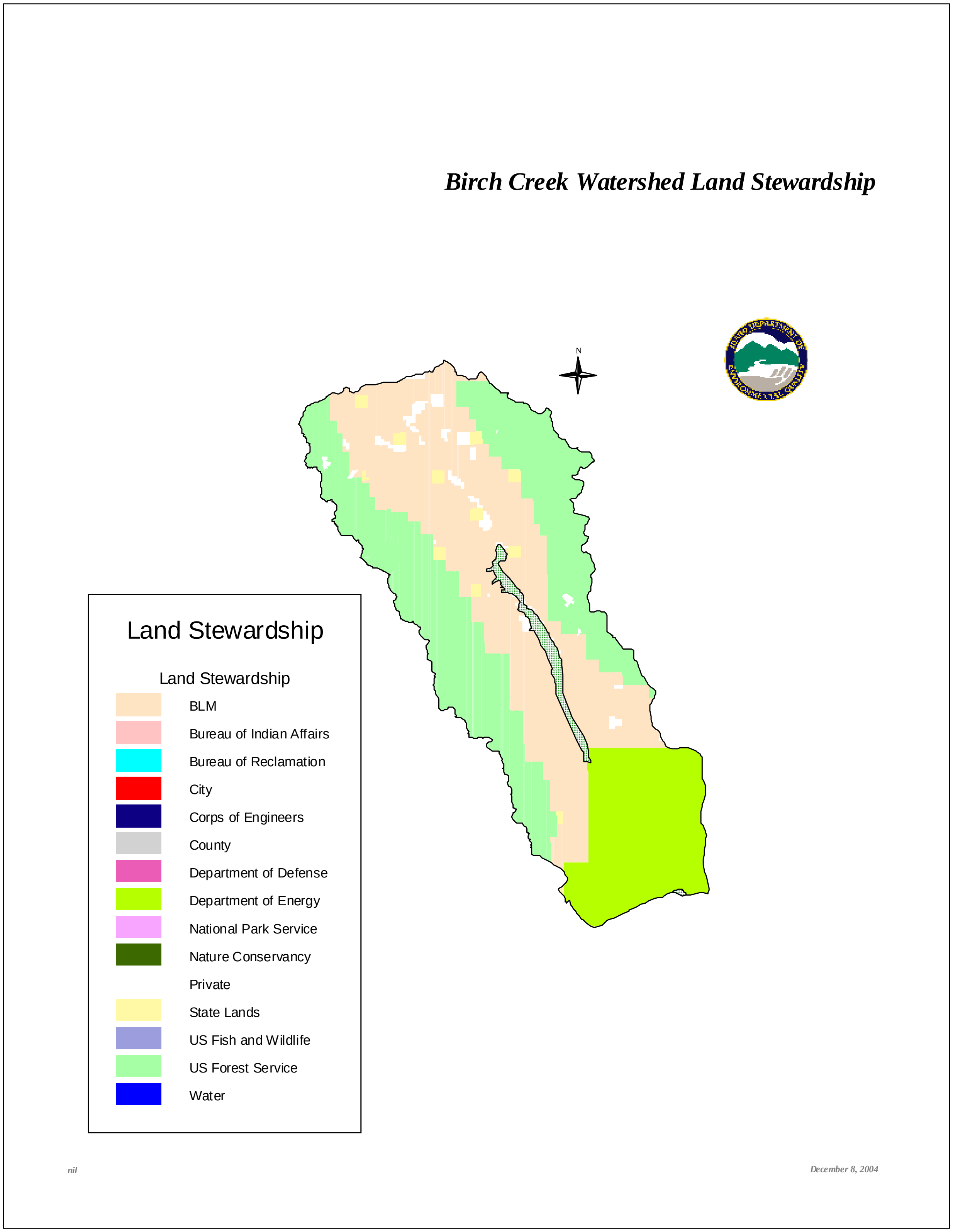

Figure 8. Land Stewardship within the Birch Creek watershed.

The history and economics of the Birch Creek Valley have been variable throughout the years. Because of the lack of surface water it is unlikely that the area was important to fur market trappers. It was an important travel corridor for Shoshone and Bannock tribes between seasonal hunting, fishing and trapping areas to the north and wintering areas to the south, near present day Fort Hall.

Mining is perhaps the most notable historic facet of the area, with large lead and copper operations. The Viola Mine was primarily producing lead following the discovery of lead ore in 1881. In 1883, English investors from Leadville, Colorado bought the Viola Mine and named the nearby town Nicholia, after the mine manager, Ralph Nichols. It was in full production by 1884, and a smelter was built in 1885. For a few years, the Viola mine was one of the top producing mines in the United States. The Nicholia smelter processed over $2,500,000 in lead and silver ore before the mine played out. Sixteen charcoal kilns were built near Meadow Canyon, across the valley, during 1885 and 1886 to supply charcoal to the Nicholia smelter. By 1888, the quality of ore dropped and the Viola mine and Nicholia smelter were shut down.

A rail line was extended into the valley from Montana in 1910 to serve the operation and the lead and silver mine at Gilmore. Production at the Gilmore mine (in the Lemhi River watershed, a short distance to the north) rivaled production in the Coeur D'Alene mines.

Operations around Skull Canyon, on the Paymaster claim, were oriented toward copper. From 1885 to the 1920s there were thousands of residents involved in mining and providing goods and services to miners, until the 1920s when falling copper prices combined with less copper in the ore-idled claims. The Great Depression in 1929 was the blow from which the mines never recovered. By 1940, the rail line was closed and the tracks were sold for scrap.

The mines have been worked periodically since the peak in operations but never again to rival the early days. The Viola mine was in limited operation as recently as the mid 70s.

Today, livestock production is the main economic endeavor in the valley with the Nicholia Ranch, located near the Historic Nicholia town site, and the Wagoner Ranch near Skull Canyon.

The Department of Energy operates the Idaho National Laboratory below the Birch Creek Sinks (formerly the Idaho National Engineering and Environmental Laboratory (INEEL).

Recreation is an important activity today in the valley, with fishing along Birch Creek and hunting in the surrounding mountains. Off Highway Vehicle trails are found in Eightmile Canyon and upper Pass Creek as well as Skull Canyon and the Willow Creek watershed on the southern boundary of the Eighteenmile Wilderness.

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2. Subbasin Assessment – Water Quality Concerns and Status

Because the perennial streams within the Birch Creek watershed originate in springs that infiltrate into the substrate not far from their origin, water quality issues are limited. There are four streams that have been found to be perennial, and the remaining streams are ephemeral dry wash systems that seldom flow, as evidenced by sage brush growing in most of the channels.

2.1 Water Quality Limited Assessment Units Occurring in the Subbasin

The only water quality limited segment on the 1998 §303(d) list is Birch Creek from the Reno Ditch to the Playas, or *Sinks*. This reach is listed for flow alteration, habitat alteration, nutrients and sediment.

The listed reach of Birch Creek, Assessment Unit ID17060216SK001_04, from the Reno Ditch to the Playas is permanently diverted into a hydroelectric project. Water is not returned to the natural channel below this point of diversion (Figure 9).

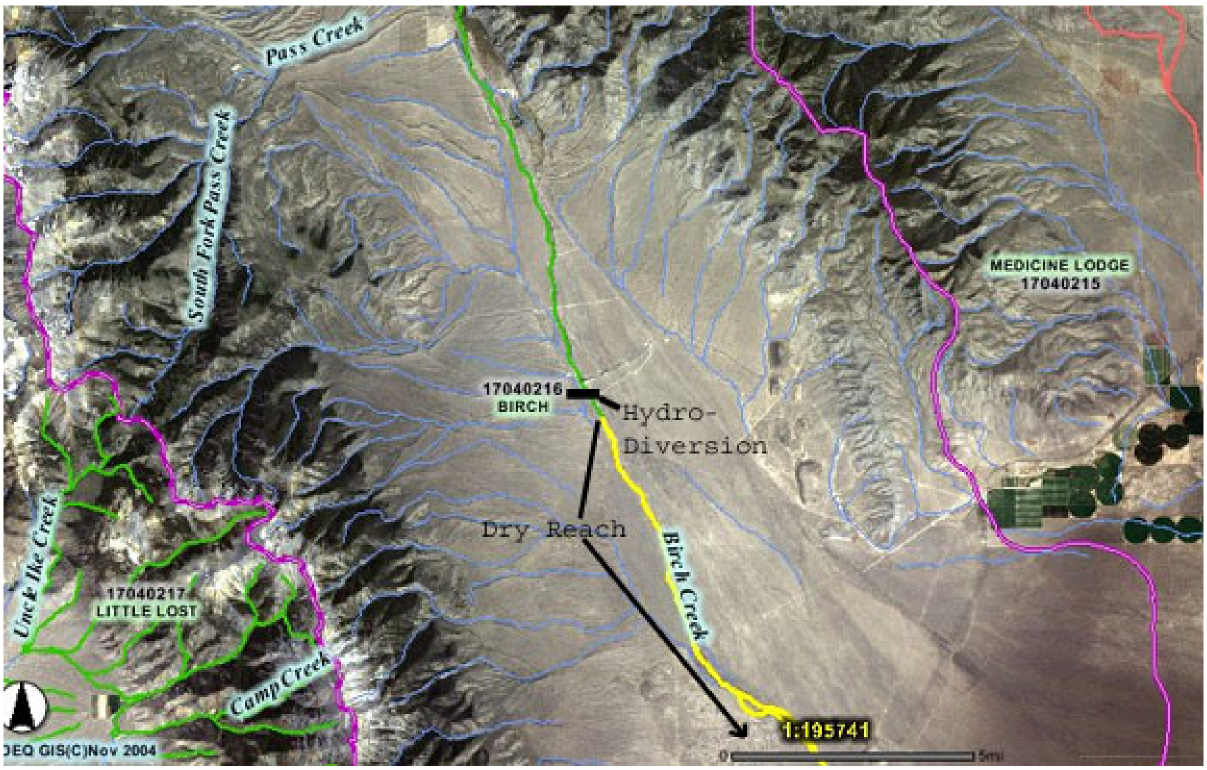

Figure 9. Landsat imagery of the dry, listed reach of Birch Creek.

Section 303(d) of the CWA states that waters that are unable to support their beneficial uses and that do not meet water quality standards must be listed as water quality limited waters. Subsequently, these waters are required to have TMDLs developed to bring them into compliance with water quality standards. Since it would seem to make little sense to develop a TMDL for a permanently diverted segment of stream, there will not be a TMDL developed for Birch Creek.

About Assessment Units

Assessment Units (AUs) now define all the waters of the state of Idaho. These units and the methodology used to describe them can be found in the Water Body Assessment Guidance (WBAG II; Grafe et al., 2002).

Assessment units (AUs) are groups of similar streams that have similar land use practices, ownership, or land management. Stream order, however, is the main basis for determining AUs—although ownership and land use can change significantly, the AU remains the same.

Using assessment units to describe water bodies offers many benefits, the primary benefit being that all the waters of the state are now defined consistently. In addition, using AUs fulfills the fundamental requirement of EPA's 305(b) report, a component of the Clean Water Act wherein states report on the condition of all the waters of the state. Because AUs are a subset of water body identification numbers, there is now a direct tie to the water quality standards for each AU, so that beneficial uses defined in the water quality standards are clearly tied to streams on the landscape.

However, the new framework of using AUs for reporting and communicating needs to be reconciled with the legacy of 303 (d) listed streams. Due to the nature of the court-ordered 1994 303(d) listings, and the subsequent 1998 303(d) list, all segments were added with boundaries from "headwater to mouth." In order to deal with the vague boundaries in the listings, and to complete TMDLs at a reasonable pace, DEQ set about writing TMDLs at the watershed scale (HUC), so that all the waters in the drainage are and have been considered for TMDL purposes since 1994.

The boundaries from the 1998 303(d) listed segments have been transferred to the new AU framework, using an approach quite similar to how DEQ has been writing SBAs and TMDLs. All AUs contained in the listed segment were carried forward to the 2002 303(d) listings in Section 5 of the Integrated Report. AUs not wholly contained within a previously listed segment, but partially contained (even minimally), were also included on the 303(d) list. This was necessary to maintain the integrity of the 1998 303(d) list and to maintain continuity with the TMDL program. These new AUs will lead to better assessment of water quality listing and de-listing.

When assessing new data that indicate full support, only the AU that the monitoring data represents will be removed (de-listed) from the 303(d) list (Section 5 of the Integrated Report.).

Listed Waters

Table 8 shows the pollutants listed and the basis for listing for each §303(d) listed AU in the subbasin. Not all of the listed water bodies will require a TMDL, as will be discussed later.

However, an evaluation, using the available data, was performed before this conclusion was made.

Table 8. §303(d) Segments in the Birch Creek Subbasin.

Water Body Name	Assessment Unit ID Number	1998 §303(d) Boundaries	Pollutants	Listing Basis
Birch Creek	ID17040216SK001_04	Reno Ditch to Playas (16.84 miles)	Nutrients, Sediment, Flow Alteration, Habitat Alteration	1998 §303(d) listed

2.2 Applicable Water Quality Standards

Water Quality standards are legally enforceable rules and consist of three parts: the designated uses of waters, the numeric or narrative criteria to protect those uses, and an antidegradation policy. Water quality criteria used to protect these beneficial uses include narrative "free-from" criteria applicable to all waters (IDAPA 58.01.02.200), and numerical criteria, which vary according to beneficial uses (IDAPA 58.01.02.210, 250, 251, & 252). Typical numeric criteria include bacteriological criteria for recreational uses, physical and chemical criteria for aquatic life [e.g. pH, temperature, dissolved oxygen (DO), ammonia, toxics, etc.], and toxics and turbidity criteria for water supplies. Idaho's water quality standards are published in the State's rules at *IDAPA 58.01.02 Water Quality Standards and Wastewater Treatment Requirements*. Designated beneficial uses for listed waters in the Birch Creek subbasin are listed in Table 9. Designated and presumed uses for non-listed streams are shown in Table 10. Designated and presumed uses for ephemeral/dry non-listed streams are shown in Table 11.

There are no water quality standards that relate to flow alteration or habitat alteration as a pollutant. Occasionally, ephemeral segments can contribute sediment and nutrients to receiving waters down stream, where streams reappear. Such is not the case with Birch Creek where there is no channel recharge below the permanent diversion.

Beneficial Uses

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

Existing Uses

Existing uses under the CWA are "those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards." The existing in-stream water uses and the level of water quality necessary to protect the uses shall be maintained and protected (IDAPA 58.01.02.050.02, .02.051.01, and .02.053). Existing uses include uses actually occurring, whether or not the level of quality to fully support the uses exists. A practical application of this concept would be to apply the existing use of salmonid spawning to a water body that could support salmonid spawning, but salmonid spawning is not occurring due to other factors, such as dams blocking migration.

Designated Uses

Designated uses under the CWA are “those uses specified in water quality standards for each water body or segment, whether or not they are being attained.” Designated uses are simply uses officially recognized by the state. In Idaho these include uses such as aquatic life support, recreation in and on the water, domestic water supply, and agricultural uses. Water quality must be sufficiently maintained to meet the most sensitive use. Designated uses may be added or removed using specific procedures provided for in state law, but the effect must not be to preclude protection of an existing higher quality use, such as cold water aquatic life or salmonid spawning. Designated uses are specifically listed for water bodies in Idaho in tables in the Idaho water quality standards (see IDAPA 58.01.02.003.27 and .02.109-.02.160 in addition to citations for existing uses).

Presumed Uses

In Idaho, most water bodies 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 cold water criteria 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 aquatic life is not found to be an existing use, an 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).

Table 9. Birch Creek Subbasin beneficial uses of §303(d) listed streams.

Water Body	Uses[a]	Type of Use
Birch Creek Reno Ditch to Playa	SS, CW, PCR, DWS, SRW	Designated

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

Table 10. Birch Creek Subbasin beneficial uses of assessed, non-§303(d) listed streams.

Water Body	Uses[a]	Type of Use
Willow Creek- Source to Mouth	SS, CW	Presumed
Birch Creek-Pass Creek to Reno Ditch	SS, CW, PCR, DWS, SRW	Designated

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

Table 11. Birch Creek Subbasin beneficial uses of unassessed, ephemeral/dry, non-§303(d) listed streams.

Water Body	Uses[a]	Type of Use
Birch Creek-Unnamed Tributary (T11N, R11W, Sec. 35)	SS, CW, PCR, DWS, SRW	Designated
Unnamed Tributary-source to mouth; includes Timber Canyon to Worthing Canyon Creeks (T11N, R11W, Sec. 35)	SS, CW	Presumed
Birch Creek-confluence of Mud and Scott Canyon Creeks to Unnamed Tributary (T11N, R11W, Sec.35)	SS, CW, PCR, DWS, SRW	Designated
Mud Creek-Willow Creek to Scott Canyon Creek	SS, CW, PCR, DWS, SRW	Designated

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

Criteria to Support Beneficial Uses

Beneficial uses are protected by a set of criteria, which include *narrative* criteria for pollutants, such as sediment and nutrients and *numeric* criteria for pollutants such as bacteria, dissolved oxygen, pH, ammonia, temperature, and turbidity (IDAPA 58.01.02.250) (Table 12).

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

Narrative criteria for excess nutrients are described in IDAPA 58.01.02.200.06, which states: "Surface waters of the state shall be free from excess nutrients that can cause visible slime growths or other nuisance aquatic growths impairing designated beneficial uses."

Narrative criteria for floating, suspended, or submerged matter are described in IDAPA 58.01.02.200.05, which states: "Surface waters of the state shall be free from floating, suspended, or submerged matter of any kind in concentrations causing nuisance or objectionable conditions or that may impair designated beneficial uses. This matter does not include suspended sediment produced as a result of nonpoint source activities."

DEQ's procedure to determine whether a water body fully supports designated and existing beneficial uses is outlined in IDAPA 58.01.02.053. The procedure relies heavily upon biological parameters and is presented in detail in the Water Body Assessment Guidance (Grafe et al. 2002). This guidance requires the use of the most complete data available to make beneficial use support status determinations. Table 12 includes the most common numeric criteria used in TMDLs.

Table 12. Selected numeric criteria supportive of designated beneficial uses in Idaho water quality standards.

Designated and Existing Beneficial Uses				
Water Quality Parameter	**Primary Contact Recreation**	**Secondary Contact Recreation**	**Cold Water Aquatic Life**	**Salmonid Spawning (During Spawning and Incubation Periods for Inhabiting Species)**
Water Quality Standards: IDAPA 58.01.02.250				
Bacteria, ph, and Dissolved Oxygen	Less than 126 *E. coli*/100 ml[a] as a geometric mean of five samples over 30 days; no sample greater than 406 *E. coli* organisms/100 ml	Less than 126 *E. coli*/100 ml as a geometric mean of five samples over 30 days; no sample greater than 576 *E. coli*/100 ml	pH between 6.5 and 9.0 DO[b] exceeds 6.0 mg/L[c]	pH between 6.5 and 9.5 Water Column DO: DO exceeds 6.0 mg/L in water column or 90% saturation, whichever is greater Intergravel DO: DO exceeds 5.0 mg/L for a one day minimum and exceeds 6.0 mg/L for a seven day average
Tempera-ture[d]			22 °C or less daily maximum; 19 °C or less daily average	13 °C or less daily maximum; 9 °C or less daily average Bull trout: not to exceed 13 °C maximum weekly maximum temperature over warmest 7-day period, June – August; not to exceed 9 °C daily average in September and October
			Seasonal Cold Water: Between summer solstice and autumn equinox: 26 °C or less daily maximum; 23 °C or less daily average	
Turbidity			Turbidity shall not exceed background by more than 50 NTU[e] instantaneously or more than 25 NTU for more than 10 consecutive days.	
Ammonia			Ammonia not to exceed calculated concentration based on pH and temperature.	

Designated and Existing Beneficial Uses				
Water Quality Parameter	**Primary Contact Recreation**	**Secondary Contact Recreation**	**Cold Water Aquatic Life**	**Salmonid Spawning (During Spawning and Incubation Periods for Inhabiting Species)**
EPA Bull Trout Temperature Criteria: Water Quality Standards for Idaho, 40 CFR Part 131				
Tempera-ture				7 day moving average of 10 °C or less maximum daily temperature for June - September

[a] *Escherichia coli* per 100 milliliters
[b] dissolved oxygen
[c] milligrams per liter
[d] Temperature Exemption - Exceeding the temperature criteria will not be considered a water quality standard violation when the air temperature exceeds the ninetieth percentile of the seven-day average daily maximum air temperature calculated in yearly series over the historic record measured at the nearest weather reporting station.
[e] Nephelometric turbidity units

2.3 Pollutant/Beneficial Use Support Status Relationships

Most of the pollutants that impair beneficial uses in streams are naturally occurring stream characteristics that have been altered by humans. That is, streams naturally have sediment, nutrients, and the like, but when *anthropogenic* sources cause these to reach unnatural levels, they are considered “pollutants” and can impair the beneficial uses of a stream.

Temperature

Temperature is a water quality factor integral to the life cycle of fish and other aquatic species. Different temperature regimes also result in different aquatic community compositions. Water temperature dictates whether a warm, cool, or coldwater aquatic community is present. Many factors, natural and anthropogenic, affect stream temperatures. Natural factors include altitude, aspect, climate, weather, riparian vegetation (shade), and channel morphology (width and depth). Human influenced factors include heated discharges (such as those from point sources), riparian alteration, channel alteration, and flow alteration.

Elevated steam temperatures can be harmful to fish at all life stages, especially if they occur in combination with other habitat limitations such as low dissolved oxygen or poor food supply. Acceptable temperature ranges vary for different species of fish, with cold water species being the least tolerant of high water temperatures. Temperature as a chronic stressor to adult fish can result in reduced body weight, reduced oxygen exchange, increased susceptibility to disease, and reduced reproductive capacity. Acutely high temperatures can result in death if they persist for an extended length of time. Juvenile fish are even more sensitive to temperature variations than adult fish, and can experience negative impacts at a lower threshold value than the adults, manifesting in retarded growth rates. High temperatures also affect embryonic development of fish before they even emerge from the substrate. Similar kinds of affects may occur to aquatic invertebrates, amphibians and mollusks, although less is known about them.

Dissolved Oxygen

Oxygen is necessary for the survival of most aquatic organisms and essential to stream purification. Dissolved oxygen (DO) is the concentration of free (not chemically combined) molecular oxygen (a gas) dissolved in water, usually expressed in milligrams per liter (mg/L), parts per million, or percent of saturation. While air contains approximately 20.9% oxygen gas by volume, the proportion of oxygen dissolved in water is about 35%, because nitrogen (the remainder) is less soluble in water. Oxygen is considered to be moderately soluble in water. A complex set of physical conditions that include atmospheric and hydrostatic pressure, turbulence, temperature, and salinity affect the solubility.

Dissolved oxygen levels of 6 mg/L and above are considered optimal for aquatic life. When DO levels fall below 6 mg/L, organisms are stressed, and if levels fall below 3 mg/L for a prolonged period, these organisms may die; oxygen levels that remain below 1-2 mg/L for a few hours can result in large fish kills. Dissolved oxygen levels below 1 mg/L are often referred to as hypoxic; anoxic conditions refer to those situations where there is no measurable DO.

Juvenile aquatic organisms are particularly susceptible to the effects of low DO due to their high metabolism and low mobility (they are unable to seek more oxygenated water). In addition, oxygen is necessary to help decompose organic matter in the water and bottom sediments. Dissolved oxygen reflects the health or the balance of the aquatic ecosystem.

Oxygen is produced during photosynthesis and consumed during plant and animal respiration and decomposition. Oxygen enters water from photosynthesis and from the atmosphere. Where water is more turbulent (e.g., riffles, cascades), the oxygen exchange is greater due to the greater surface area of water coming into contact with air. The process of oxygen entering the water is called *aeration*.

Water bodies with significant aquatic plant communities can have significant DO fluctuations throughout the day. An oxygen sag will typically occur once photosynthesis stops at night and respiration/decomposition processes deplete DO concentrations in the water. Oxygen will start to increase again as photosynthesis resumes with the advent of daylight.

Temperature, flow, nutrient loading, and channel alteration all impact the amount of DO in the water. Colder waters hold more DO than warmer waters. As flows decrease, the amount of aeration typically decreases and the instream temperature increases, resulting in decreased DO. Channels that have been altered to increase the effectiveness of conveying water often have fewer riffles and less aeration. Thus, these systems may show depressed levels of DO in comparison to levels before the alteration. Nutrient enriched waters have a higher biochemical oxygen demand due to the amount of oxygen required for organic matter decomposition and other chemical reactions. This oxygen demand results in lower instream DO levels.

Sediment

Both suspended (floating in the water column) and bedload (moves along the stream bottom) sediment can have negative effects on aquatic life communities. Many fish 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 feeding behavior (difficulty finding food due to visual impairment), damage gills, reduce growth rates, and in extreme cases eventually lead to death.

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

Organic suspended materials can also settle to the bottom and, due to their high carbon content, lead to low intergravel DO through decomposition.

In addition to these direct effects on the habitat and spawning success of fish, detrimental changes to food sources 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 adapted to burrowing, thereby making the macroinvertebrates less available to fish. Community structure, specifically diversity, of the aquatic macroinvertebrate community is diminished due to the reduction of coarse substrate habitat.

Settleable solids are defined as the volume (milliliters [ml]) or weight (mg) of material that settles out of a liter of water in one hour (Franson et al. 1998). Settleable solids may consist of large silt, sand, and organic matter. Total suspended solids (TSS) are defined as the material collected by filtration through a 0.45 µm (micrometer) filter (Standard Methods 1975, 1995). Settleable solids and TSS both contain nutrients that are essential for aquatic plant growth. Settleable solids are not as nutrient rich as the smaller TSS, but they do affect river depth and substrate nutrient availability for macrophytes. In low flow situations, settleable solids can accumulate on a stream bottom, thus decreasing water depth. This increases the area of substrate that is exposed to light, facilitating additional macrophyte growth.

Bacteria

Escherichia coli or E. coli, a species of fecal coliform bacteria, is used by the state of Idaho as the indicator for the presence of pathogenic microorganisms. Pathogens are a small subset of microorganisms (e.g., certain bacteria, viruses, and protozoa), which, if taken into the body through contaminated water or food, can cause sickness or even death. Some pathogens are also able to cause illness by entering the body through the skin or mucous membranes.

Direct measurement of pathogen levels in surface water is difficult because pathogens usually occur in very low numbers and analysis methods are unreliable and expensive. Consequently, indicator bacteria which are often associated with pathogens, but which generally occur in higher concentrations and are thus more easily measured, are assessed.

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, and diarrhea to 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 storm water and agricultural areas. *E. coli* is often measured in colony forming units (cfu) per 100 ml.

Nutrients

While nutrients are a natural component of the aquatic ecosystem, natural cycles can be disrupted by increased nutrient inputs from anthropogenic activities. The excess nutrients result in accelerated plant growth and can result in a eutrophic or enriched system.

The first step in identifying a water body's response to nutrient flux is to define which of the critical nutrients is limiting. A limiting nutrient is one that normally is in short supply relative to biological needs. The relative quantity affects the rate of production of aquatic biomass. Either phosphorus or nitrogen may be the limiting factor for algal growth, although phosphorous is most commonly the limiting nutrient in Idaho waters. Ecologically speaking, a resource is considered limiting if the addition of that resource increases growth.

Total phosphorus (TP) is the measurement of all forms of phosphorus in a water sample, including all inorganic and organic particulate and soluble forms. In freshwater systems, typically greater than 90% of the TP present occurs in organic forms as cellular constituents in the biota or adsorbed to particulate materials (Wetzel 1983). The remainder of phosphorus is mainly soluble orthophosphate, a more biologically available form of phosphorus than TP that consequently leads to a more rapid growth of *algae*. In impaired systems, a larger percentage of the TP fraction is comprised of orthophosphate. The relative amount of each form measured can provide information on the potential for algal growth within the system.

Nitrogen may be a limiting factor at certain times if there is substantial depletion of nitrogen in sediments due to uptake by rooted macrophyte beds. In systems dominated by blue-green algae, nitrogen is not a limiting nutrient due to the algal ability to fix nitrogen at the water/air interface.

Total nitrogen to TP ratios greater than seven are indicative of a phosphorus-limited system while those ratios less than seven are indicative of a nitrogen-limited system. Only biologically available forms of the nutrients are used in the ratios because these are the forms that are used by the immediate aquatic community.

Nutrients primarily cycle between the water column and sediment through nutrient spiraling. Aquatic plants rapidly assimilate dissolved nutrients, particularly orthophosphate. If sufficient nutrients are available in either the sediments or the water column, aquatic plants will store an abundance of such nutrients in excess of the plants' actual needs, a chemical phenomenon known as luxury consumption. When a plant dies, the tissue decays in the water column and the nutrients stored within the plant biomass are either restored to the water column or the detritus becomes incorporated into the river sediment. As a result of this process, nutrients (including orthophosphate) that are initially released into the water column in a dissolved form will eventually become incorporated into the river bottom sediment. Once these nutrients are incorporated into the river sediment, they are available once again for uptake by yet another life cycle of rooted aquatic macrophytes and other aquatic plants. This cycle is known as nutrient spiraling. Nutrient spiraling results in the availability of nutrients for later plant growth in higher concentrations downstream.

Sediment – Nutrient Relationship

The linkage between sediment and sediment-bound nutrients is important when dealing with nutrient enrichment problems in aquatic systems. Phosphorus is typically bound to particulate matter in aquatic systems and, thus, sediment can be a major source of phosphorus to rooted macrophytes and the water column. While most aquatic plants are able to absorb nutrients over the entire plant surface due to a thin cuticle (Denny 1980), bottom sediments serve as the primary nutrient source for most sub-stratum attached macrophytes. The USDA (1999) determined that other than harvesting and chemical treatment, the best and most efficient method of controlling growth is by reducing surface erosion and sedimentation.

Sediment acts as a nutrient sink under *aerobic* conditions. However, when conditions become anoxic sediments release phosphorous into the water column. Nitrogen can also be released, but the mechanism by which it happens is different. The exchange of nitrogen between sediment and the water column is for the most part a microbial process controlled by the amount of oxygen in the sediment. When conditions become anaerobic, the oxygenation of ammonia (nitrification) ceases and an abundance of ammonia is produced. This results in a reduction of nitrogen oxides (NO_x) being lost to the atmosphere.

Sediments can play an integral role in reducing the frequency and duration of phytoplankton blooms in standing waters and large rivers. In many cases there is an immediate response in phytoplankton biomass when external sources are reduced. In other cases, the response time is slower, often taking years. Nonetheless, the relationship is important and must be addressed in waters where phytoplankton is in excess.

Floating, Suspended, or Submerged Matter (Nuisance Algae)

Algae are an important part of the aquatic food chain. However, when elevated levels of algae impact beneficial uses, the algae are considered a nuisance aquatic growth. The excess growth of phytoplankton, periphyton, and/or macrophytes can adversely affect both aquatic life and recreational water uses. Algal blooms occur where adequate nutrients (nitrogen and/or phosphorus) are available to support growth. In addition to nutrient availability, flow rates, velocities, water temperatures, and penetration of sunlight in the water column all affect algae (and macrophyte) growth. Low velocity conditions allow algal concentrations to increase because physical removal by scouring and abrasion does not readily occur. Increases in temperature and sunlight penetration also result in increased algal growth. When the aforementioned conditions are appropriate and nutrient concentrations exceed the quantities needed to support normal algal growth, excessive blooms may develop.

Commonly, algae blooms appear as extensive layers or algal mats on the surface of the water. When present at excessive concentrations in the water column, blue-green algae often produce toxins that can result in skin irritation to swimmers and illness or even death in organisms ingesting the water. The toxic effect of blue-green algae is worse when an abundance of organisms die and accumulate in a central area.

Algal blooms also often create objectionable odors and coloration in water used for domestic drinking water and can produce intense coloration of both the water and shorelines as cells accumulate along the banks. In extreme cases, algal blooms can also result in impairment of agricultural water supplies due to toxicity. Water bodies with high nutrient concentrations that could potentially lead to a high level of algal growth are said to be eutrophic. The extent of the effect is dependent on both the type(s) of algae present and the size, extent, and timing of the bloom.

When algae die in low flow velocity areas, they sink slowly through the water column, eventually collecting on the bottom sediments. The biochemical processes that occur as the algae decompose remove oxygen from the surrounding water. Because most of the decomposition occurs within the lower levels of the water column, a large algal bloom can substantially deplete DO concentrations near the bottom. Low DO in these areas can lead to decreased fish habitat as fish will not frequent areas with low DO. Both living and dead (decomposing) algae can also affect the pH of the water due to the release of various acid and base compounds during respiration and photosynthesis. Additionally, low DO levels caused by decomposing organic matter can lead to changes in water chemistry and a release of sorbed phosphorus to the water column at the water/sediment interface.

Excess nutrient loading can be a water quality problem due to the direct relationship of high TP concentrations on excess algal growth within the water column, combined with the direct effect of the algal life cycle on DO and pH within aquatic systems. Therefore, the reduction of TP inputs to the system can act as a mechanism for water quality improvements, particularly in surface-water systems dominated by blue-green algae, which can acquire nitrogen directly from the atmosphere and the water column. Phosphorus management within these systems can potentially result in improvement in nutrients (phosphorus), nuisance algae, DO, and pH.

2.4 Summary and Analysis of Existing Water Quality Data

There is no water quality data for the 303d listed stream segment in this subbasin because it is permanently dewatered. Existing data related to water quality on perennial waters is BURP data collected in 1998 on Birch Creek and Willow Creek which shows these streams to be in full support of beneficial uses.

Flow Characteristics

Annual flow measurement from 4/27/1967 to 3/31/1991 is shown in Figure 3, page 13. This data is from the USGS gage at Blue Dome that is no longer in use. The flow regime represented in Figure 3 shows a hydrologic curve typical of a spring driven flow pattern. Peak flow is not significantly greater than base flow with the peak occurring after the typical snowmelt period for nearby surface waters. Birch Creek, as previously stated, is permanently diverted for hydropower production. There is no flow below the point of diversion.

There is no gage data for other waters in the subbasin. Willow and Pass Creeks, though they are predominantly spring driven, have peak flows that coincide with snow melt since they occur at higher elevations. At the mouths of each of their canyons, both streams are diverted and any remaining flow quickly infiltrates.

Water Column Data

Data collected by the USGS (USGS, 2000) shows that Birch Creek has a moderately basic pH with a strong buffering capacity as evidenced by moderate alkalinity and dissolved solids and specific conductance (Table 13). Total nitrogen increases progressively downstream as do groundwater values. Phosphorus values are below detection limits near the spring source of flow. There was no observed evidence of deleterious levels of nuisance aquatic plants in the main channel of Birch Creek that exceed narrative criteria.

Table 13. Results of field measurements by USGS.

Site	Date/Time	pH	Specific Conductance	Temp.	Alkalinity as $CaCO_3$	DO	Hardness	Dissolved Solids as $CaCO_3$
Birch Creek at Kauffman	6/27/00 1350	8.6	320	16.5	134	10.0	N/A	134
Kauffman Well	6/27/00 1455	8.1	373	11	193	<0.2	170	193
Birch Creek at Blue Dome	6/28/95 UNK	8.5	UNK	9.4	165	UNK	UNK	UNK
Wagoner Well (near Blue Dome)	6/28/00 1045	7.6	443	11.0	182	8.4	N/A	182

Units: specific conductance, microsiemens per centimeter at 25°C; temperature, °C; other measurements in milligrams per liter. N/A, not analyzed; UNK, unknown.

Table 14. Concentrations of dissolved nutrients and dissolved organic carbon in water from selected sites, Birch Creek Drainage.

Site	Ammonia as nitrogen	Nitrite as nitrogen	Nitrite plus nitrate as nitrogen	Orthophosphate as phosphorous	DOC
Birch Creek at Kauffman	<0.02	<0.01	0.146	<0.01	0.676
Kauffman Well	.077	<.01	<.05	.011	.474
Birch Creek at Blue Dome	N/A	N/A	.6	N/A	.75
Wagoner Well (near Blue Dome)	.05	<.01	.418	.011	.492

Biological and Other Data

Beneficial Use Reconnaissance Project Data

Data routinely collected by DEQ as part of the Beneficial Use Reconnaissance Project (BURP) show near-reference conditions for samples collected above ephemeral reaches in Pass, Willow and Birch Creeks (Tables 15 through 17, respectively). Data for sites sampled in 2003 has not been assessed because macroinvertebrate data has not yet been processed or reported. E-coli data is below exceedance thresholds for acute and chronic standards.

Table 15. Pass Creek BURP/Tier 1 Data

BURP Site Location	1998 303d Assessment	E-coli (CFU/ 100 ml	SMI Score	SHI Score	Flow (cfs)	Year
Pass Creek	Full Support	<10	3	3	4.7	7/1/1998
Pass Creek	Not Assessed	64	N/A	N/A	0.8	10/15/2003
Pass Creek	Not Assessed	308	N/A	N/A	0.6	8/5/2004

SMI—Stream Macroinvertebrate Index, SHI—Stream Habitat Index.

Table 16. Willow Creek BURP/Tier 1 Data

BURP Site Location	1998 303d Assessment	E-coli (CFU/ 100 ml	SMI Score	SHI Score	Flow (cfs)	Year
Willow Creek	Full Support	<10	3	3	20.29	7/1/1998
Willow Creek	Not Assessed	64	N/A	N/A	0.7	7/21/2003
Willow Creek	Not Assessed	32	N/A	N/A	0.6	8/5/2004

Table 17. Birch Creek BURP/Tier 1 Data

BURP Site Location	1998 303d Assessment	E-coli (CFU/ 100 ml	SMI Score	SHI Score	Flow (cfs)	Year
Birch Creek (Mid)	Full Support	N/A	3	3	76.15	7/1/1994
Birch Creek (Lower)	Full Support	N/A	3	1	50.0	8/10/1994
Birch Creek (Lower)	Full Support	N/A	2	3	58.96	07/06/95
Birch Creek (Mid)	Full Support	N/A	2	3	65.45	07/06/95
Birch Creek (Mid)	Not Assessed	58	N/A	N/A	68.9	8/19/2003
Birch Creek (Lower	Not Assessed	2	N/A	N/A	61.6	8/5/2004

Fisheries Data

Birch Creek was sampled along the channel reconstruction and remediation reach , above the hydropower diversion, by Idaho State University (ISU) in 1996 (Table 18). This sampling was geared toward identifying the fish holding capacity of the newly engineered channel. Total lengths of fish were measured on the first census run. Mean length of wild rainbow trout (N=351) was 257 millimeter (mm) in 1996. Mean length was similar to 1995 and significantly greater than 1990-1993 estimates. Only rainbow trout were collected, and they were present in greater than 3 age classes in addition to young-of-the-year rainbow trout. 30% of the wild rainbow trout exceeded 300 mm (12 inches) total length, as in 1995.

Table 18. Population estimates of trout in the Birch Creek hydroelectric channel, exclusive of the upper 340 m of channel above the upper livestock crossing site. Sample length was 3.1 kilometers (km).

Date	Wild Rainbow	Hatchery Rainbow	Total	Trout/mile	Method
1987	343	335	678	353	4-pass complete count
1988	590	641	1231	641	Total bank count
1989	1069	303	1372	714	Boat, mark-recapture
1990	1331	84	1415	737	Boat, mark-recapture
1991	942	80	1022	532	Boat, mark-recapture
1992	1814	56	1870	973	Boat, mark-recapture
1993	1026	77	1103	574	Boat, mark-recapture
1995	986	160	1146	596	Boat, mark-recapture
1996	1112	49	1161	605	Boat, mark-recapture

From Griffith (1996)

Also, on September 17th and 18th, 1996, the Bureau of Land Management (BLM) sampled 3 sites by multiple pass electrofishing at the headwaters springs on Birch Creek 0.9 miles above the Kaufman Guard Station. Data from this sampling effort is displayed in Table 19.

Table 19. Upper Birch Creek population estimates from BLM electrofishing data: 1996.

Site	Wild Rainbow Sample Size	Brook Trout Sample Size	Total Trout Population Estimate	Trout/mile	Age Classes in sample (young-of-year = yoy)
Site 1	310	73	416	5446	3+ yoy
Site 2	142	86	123	1855	3+ yoy
Site 3	277	115	226	3305	3+ yoy

On September 4, 2004, DEQ sampled lower Willow Creek (above private land) and Pass Creek (above the diversion at the trailhead) by single pass electrofishing. Results of that sampling show multiple year classes of rainbow trout plus young-of-the-year rainbow trout (Table 20).

Table 20. Willow and Pass Creek single pass electrofishing sample on 9/4/04.

Site	Wild Rainbow Sample Size	Age Classes in Sample (young of year = yoy)
Pass Creek	17	3+ yoy
Willow Creek	7	3+ yoy

Status of Beneficial Uses

The data exhibited above shows that the perennial waters of the Birch Creek watershed are in full support of cold water aquatic life beneficial uses. Bacteria data show that primary and secondary contact beneficial uses are also fully supported. Assessment scores are above thresholds to show full support when evaluated using WBAG 2. The only listed reach has not been assessed because it is a permanently dry channel below the hydropower diversion. The potential for restoration on the listed reach is zero, and this has been mitigated by the hydroproject owner completing habitat improvement projects above the diversion.

Willow Creek and Pass Creek exhibit flows less than 1 cfs for much of the year. They are ephemeral below their respective canyon mouths due to natural infiltration and diversion. Upper reaches, above sinks and diversions, demonstrate full support of beneficial uses.

Conclusions

Birch Creek is listed for flow alteration, habitat alteration, nutrients and sediment below the diversion. Flow alteration is not a conventional pollutant for which TMDLs are written. Idaho DEQ and EPA have agreed that TMDLs cannot be written for such “pollution,” however, flow altered streams will remain on the 303d list maintained by the state. Birch Creek will be listed for flow alteration only, and nutrients, sediment, and habitat alteration will be removed as pollutants affiliated with the listed reach.

Other than Beneficial Use Reconnaissance Program (BURP) assessments and the fisheries and geochemistry data from ISU, BLM, and USGS, respectively, no data exists on the water quality of Birch Creek. In rangeland stream systems, sediment is the usual cause of impairment. Spring creeks are much more vulnerable to impairment by sediment than obligate snowmelt driven hydrologies. The higher gradients of upper Birch Creek, Willow Creek, and Pass Creek, all spring creeks, reduce the risks from sediment and nutrients. Stream bank stability is generally above the 80% prescribed in most Forest and Resource Management Plans developed by Forest Service and BLM respectively. This does not relieve the responsibility of land management agencies from maintaining water quality on these few flowing streams within the watershed, however. Spring creeks manifest impairment differently than snowmelt streams: they tend to widen without entrenching and they lack hydrologic energy sufficient to transport sediment over lower gradients.

Width to depth ratios for each of the creeks is within normal limits established by Rosgen (1996). Temperature data is limited to instantaneous readings associated with BURP surveys, which do not show issues, particularly when considered with fish data. Fish data generally represents reference conditions throughout the reaches of perennial streams in this watershed. The assumption on the part of agencies is that spring creeks are dependant on groundwater temperatures, and, as a result, they stay cooler than other types of streams. Combined with the lush riparian vegetation found below the springs, it is likely that the temperature regime of these streams is optimal.

2.5 Data Gaps

Data gaps relate to more detailed monitoring than exhibited by land and resource management agencies than previously collected. With recreational trails within riparian corridors of Willow and Pass Creeks, sediment monitoring needs to be a priority for the future. The fragile hydrology of these streams is susceptible to impairment by sediment, even at the higher gradients exhibited by these streams. Much is dependant upon trend analysis of riparian conditions. With Resource Management Plans identifying 30% utilization of woody plants and 3 to 4 inch residual stubble height at the end of the grazing system—based on ocular surveys—as an acceptable buffer to prevent water quality impairment, more quantitative data is required. Observations during field work conducted by DEQ indicate that trends in sediment loading and integrity of riparian vegetation are not improving. It is a matter of time before impacts are realized that may require restoration. The effort to collect quantitative data to guide management is far less than the cost of restoration that follows the complacency of non-quantitative monitoring and water quality impairment.

The predominant riparian community adjacent to the springs at the source of Birch Creek, above the Kaufman Guard Station, is sedge. Evaluation of riparian potential above Highway 28 should be evaluated to see if the potential exists to improve the riparian diversity and structure of this reach to better support wildlife and fisheries values as well as create a thermal barrier to alleviate the potential for ice damming downstream.

The nitrogen levels are naturally high due to the inherent geochemistry of this watershed, monitoring of nutrient loading from anthropogenic sources may be important to future water quality, though there is not currently observed nuisance levels of aquatic plant growth observed adequate to limit beneficial use support.

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3. Subbasin Assessment–Pollutant Source Inventory

3.1 Sources of Pollutants of Concern

Point Sources

There are no point sources affiliated with water quality limited reaches within the Birch Creek Subwatershed.

Nonpoint Sources

Potential nonpoint sources of sediment pollution within the Birch Creek watershed include stream bank erosion, hill slope erosion, mass wasting, road and trail erosion. There are no return flows from irrigation diversions. However, stream bank stability recorded in BURP surveys and during subbasin assessment activities show that stream bank stability is well above 80% overall on Birch Creek and Pass Creek.

There is only several hundred meters (m) of road along Pass Creek, above the permanent diversion. Willow Creek has numerous motorized route fords across the stream on BLM managed public land but few on Forest Service managed upper reaches. Highway 28 is located within the riparian corridor of Birch Creek over several miles along the reach from the Kaufman Guard Station to Lone Pine. Below this point, there is dispersed camping and campground roads along both sides of the creek.

Livestock access is limited to the upper reaches near Kaufman. Below this point BLM has installed exclusion fencing with one water gap.

Potential nonpoint sources of nutrients are limited because irrigated forage crops and pasture is concentrated in the upper watershed, primarily well removed from flowing water. Livestock access is limited by riparian fences as evidenced by low e-coli counts on Birch Creek. Deleterious levels of nuisance plant growth have not been observed in natural channels of perennial streams.

Pollutant Transport

Transport and delivery of pollutants within and between perennial streams is limited because of the abbreviated fluctuation of flow in springs that are the primary source of water. Streams infiltrate or are diverted before they have confluence with other surface waters, even during snowmelt. Groundwater transport of pollutants has not been shown to be a significant conduit of pollutants.

3.2 Data Gaps

Additional data collection has been outlined by the Forest Service to include more quantitative trend monitoring related to rangeland and riparian interface areas on perennial streams. The primary fishery concern, due to the isolation of perennial streams, and the lack of connectivity with other surface waters, would be the impact from any particular catastrophic event on Pass Creek or Willow Creek. The greatest risk would be from sediment inputs related to extreme hydrologic events and the cumulative impacts from roads and trails. Trend data related to grazing impacts is also lacking. Birch Creek might serve as a reference stream related to thermal loading within spring fed systems in sagebrush-steppe ecosystems. Collecting background temperature data would be required to shed light on this issue. Additionally, data related to trends in geomorphology and riparian vegetation physical structure would be useful to determining long term risks associated with grazing.

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

Pollution control efforts are limited within the Birch Creek watershed because of the scarce amount of surface water found here. Pollution control efforts are contained within resource management plans as general policies related to grazing, trail maintenance, road maintenance and recreation management. Specific measures associated with perennial waters are limited to Birch Creek along the hydropower liner project which extends 3.1 km above the hydro diversion, trail maintenance on Pass Creek, and wilderness motorized closures on Willow Creek.

Grazing Management
The Forest service applies utilization standards in all livestock grazing allotments outlined in the 1997 revised Targhee Land Management Plan (*Revised Forest Plan*—RFP). Those utilization guidelines apply to native and desirable nonnative vegetation as recorded at the end of the grazing period (RFP III-29) (Table 21).

Table 21. Grazing utilization standards used by the Dubois Ranger District.

	Season-long Grazing			Rotation Grazing	
	Unsatisfactory Range Condition	Satisfactory Range Condition		Unsatisfactory Range Condition	Satisfactory Range Condition
Grasses and Herbaceous species	35%	45%		45%	55%
Shrubs	25%	35%		35%	35%
The figures shown represent the best estimate of acceptable use levels which will provide for maintenance or improvement of these ecosystems. They shall be used as maximum use levels unless there is site-specific information to show that these levels are incorrect. Percent use is based on a dry weight percentage.					

For riparian utilization at the Hydric Greenline (waters edge), a minimum of 4 inch stubble height is required and in the Aquatic Influence Zone (flood plain) a minimum of a 3 inch stubble height is required. These stubble heights must exist at the end of the grazing period. For riparian woody plant species, no more than 30% use of current year's growth is allowed.

It is the Forest Services' belief that moving livestock based on use levels, such as stubble height, bank disturbance, and percent utilization of the vegetation, instead of scheduled dates insures that resource needs are met regardless of annual environmental variation. In a dry year, where forage production levels are low, livestock will move through the allotments much faster than scheduled. This results in a de facto reduction of livestock grazing capacity.

Implementation Monitoring
This monitoring is used to determine if the goals, objectives, standards and guidelines, and practices of the Forest Plan are implemented in accordance with the Forest Plan. This includes short-term monitoring (e.g. Actual use record and forage utilization techniques – stubble height, ocular estimates, and use-mapping). Personnel from the Dubois Ranger District will be monitoring annually prior to livestock coming on the forest, throughout the season, and in the fall after livestock have left the allotments. If data is collected through monitoring that shows that livestock grazing practices on these allotments are not following the standards and guidelines in the Revised Forest Plan, and/or the Annual Operating Instructions, administrative actions will be taken. Direction from the RFP (CH. V Pg. 42-44 will be adhered to).

Effectiveness Monitoring
This monitoring is used to determine if the Forest Plan standards and guidelines, and practices, as designed and implemented, are effective in accomplishing the desired result. This includes long – term monitoring (e.g. nested frequency trend studies, riparian level II and III, photo-points, and point ground cover samples). Effectiveness monitoring will be done by Forest Service personnel and will be done approximately every 5-10 years depending on the monitoring location and type. Direction from the RFP (CH. V Pg. 42-44 will be adhered to).

Implementation monitoring is occurring annually by Forest Officers visiting the Willow Creek and Pass Creek allotments and conducting upland and riparian utilization surveys by stubble height and ocular estimation methods.

Effectiveness monitoring is more of a long-term process because the studies are much more in-depth and time consuming. The Dubois Ranger District is adhering to an effectiveness monitoring schedule from the Dubois District Rangeland Management 5 year Action Plan. Based on this schedule, upland and riparian studies will be conducted on the Pass Creek allotment in 2007, and the Willow Creek allotment will have two riparian studies conducted in 2007 and upland studies done in 2008.

BLM grazing management on Birch Creek, downstream of the Kaufman Guard Station, incorporates riparian fence and water gaps below Lone Pine, to the hydropower remediation project. BLM management on land below the forest boundary on Willow Creek appears to be season long grazing without use of utilization standards on riparian vegetation. No data on grazing management was provided on Willow Creek.

Recreational Vehicle Management

The Targhee National Forest established its motorized vehicle travel plan in 1999. The travel plan restricts motorized vehicle use to designated routes and trails. These trails are maintained by Forest Service personnel with assistance from the Idaho Department of Parks and Recreation, and volunteer publics. Monitoring of the trails is carried out yearly to assess usage and impacts. If problems are discovered, corrections are planned and implemented as soon as funding or assistance is available.

In 1999, a "trail cat," provided by the Idaho Department of Parks and Recreation, was used to improve the ATV trail that is in the Pass Creek subwatershed. Water bars were installed to lessen erosion impacts from water running down the trails, and the trail was sloped where appropriate to decrease the impacts from erosion. In the summer of 2004, a trail cat, once again, was planned to go over the ATV trails in the Pass Creek drainage to maintain previous improvements and create additional water bars and erosion barriers where needed. However, the trail cat broke down before being able to complete all the specified improvements and additional erosion barriers. The work is scheduled to be completed in 2005. The heavy fall and summer rains in 2004 have indicated some new problems and these will be corrected with the trail cat next year.

The Forest Law Enforcement Officers and district personnel of the Dubois Ranger District are increasing efforts to enforce the travel plan, and to focus on unlawful use of Off Highway Vehicles in the Pass Creek and Willow Creek subwatersheds. Additional efforts to post signs and distribute maps are being made to improve compliance. Citations are issued to individuals not in compliance with the law as deterrence to unlawful Off Highway Vehicle use.

In the Willow Creek subwatershed under BLM management there are jack-fence barriers on pioneered roads and designated routes that are signed. The Willow Creek and Pass Creek roads do not appear to receive regular maintenance.

Birch Creek Hydropower Project Remediation

On March 9, 1990, the Birch Power Company requested that the minimum flow requirement of article 404 of the license be modified to a minimum flow of 5 cfs, or 11 percent of the flow of Birch Creek, whichever is less. This flow would be measured immediately downstream from the project diversion, for the protection of riparian vegetation and wildlife resources. The licensee proposes to reduce the minimum flow to the amount necessary to maintain riparian habitat it will develop below the project diversion.

To mitigate not releasing 5-6 cfs minimum flow to the historic stream channel, the licensee built 6 to 8 ponds below the point of diversion. Approximately 2.46 acres of riparian habitat was created in association with the ponds. Additionally, 1.25 miles of livestock fencing and one livestock watering facility were developed.

The licensee proposed the alternative minimum flow and riparian habitat mitigation plan because the minimum flow discharged into the historic Birch Creek channel will not preserve a significant portion of the riparian habitat below the project point of diversion. The bypass flow percolates into the alluvium within a short distance from the diversion. By implementing the alternative mitigation plan, 2.46 acres of riparian habitat will be created and maintained as opposed to 1.64 acres estimated to have been supported in the natural channel.

The U.S. Fish and Wildlife Service, the Idaho Department of Fish and Game, and the Bureau of Land Management concur with the licensee's proposal to modify article 404 of the license and develop the riparian habitat below the diversion.

By reducing the minimum flow to the amount necessary to maintain the planned riparian habitat, about 2,700 acre-feet of water will be available for power production and irrigation.

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Glossary

305(b)

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

§303(d)

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

Aeration

A process by which water becomes charged with air directly from the atmosphere. Dissolved gases, such as oxygen, are then available for reactions in water.

Aerobic

Describes life, processes, or conditions that require the presence of oxygen.

Adjunct

In the context of water quality, adjunct refers to areas directly adjacent to focal or refuge habitats that have been degraded by human or natural disturbances and do not presently support high diversity or abundance of native species.

Alevin

A newly hatched, incompletely developed fish (usually a salmonid) still in nest or inactive on the bottom of a water body, living off stored yolk.

Algae

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

Alluvium

Unconsolidated recent stream deposition.

Ambient

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

Anaerobic

Describes the processes that occur in the absence of molecular oxygen and describes the condition of water that is devoid of molecular oxygen.

Anthropogenic

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

Anti-Degradation

Refers to the U.S. Environmental Protection Agency's interpretation of the Clean Water Act goal that states and tribes maintain, as well as restore, water quality. This applies to waters that meet or are of higher water quality than required by state standards. State rules provide that the quality of those high quality waters may be lowered only to allow important social or economic development and only after adequate public participation (IDAPA 58.01.02.051). In all cases, the existing beneficial uses must be maintained. State rules further define lowered water quality to be 1) a measurable change, 2) a change adverse to a use, and 3) a change in a pollutant relevant to the water's uses (IDAPA 58.01.02.003.61).

Aquatic

Occurring, growing, or living in water.

Aquifer

An underground, water-bearing layer or stratum of permeable rock, sand, or gravel capable of yielding of water to wells or springs.

Assemblage (aquatic)

An association of interacting populations of organisms in a given water body; for example, a fish assemblage or a benthic macroinvertebrate assemblage (also see Community) (EPA 1996).

Assessment Database (ADB)

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

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

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 life, recreation, water supply, wildlife habitat, and aesthetics, which are recognized in water quality standards.

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

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

Benthic Organic Matter.
The organic matter on the bottom of a water body.

Biochemical Oxygen Demand (BOD)
The amount of dissolved oxygen used by organisms during the decomposition (respiration) of organic matter, expressed as mass of oxygen per volume of water, over some specified period of time.

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

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.
Coliform Bacteria	A group of bacteria predominantly inhabiting the intestines of humans and animals but also found in soil. Coliform bacteria are commonly used as indicators of the possible presence of pathogenic organisms (also see Fecal Coliform Bacteria, *E. Coli*, and Pathogens).
Community	A group of interacting organisms living together in a given place.
Conductivity	The ability of an aqueous solution to carry electric current, expressed in micro (µ) mhos/centimeter at 25 °C. Conductivity is affected by dissolved solids and is used as an indirect measure of total dissolved solids in a water sample.
Cretaceous	The final period of the Mesozoic era (after the Jurassic and before the Tertiary period of the Cenozoic era), thought to have covered the span of time between 135 and 65 million years ago.
Criteria	In the context of water quality, numeric or descriptive factors taken into account in setting standards for various pollutants. These factors are used to determine limits on allowable concentration levels, and to limit the number of violations per year. The U.S. Environmental Protection Agency develops criteria guidance; states establish criteria.
Cubic Feet per Second	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.
Decomposition	The breakdown of organic molecules (e.g., sugar) to inorganic molecules (e.g., carbon dioxide and water) through biological and nonbiological processes.
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.
Disturbance	Any event or series of events that disrupts ecosystem, community, or population structure and alters the physical environment.
E. coli	Short for *Escherichia coli*, *E. coli* are a group of bacteria that are a subspecies of coliform bacteria. Most *E. coli* are essential to the healthy life of all warm-blooded animals, including humans, but their presence in water is often indicative of fecal contamination. *E. coli* are used by the state of Idaho as the indicator for the presence of pathogenic microorganisms.
Ecology	The scientific study of relationships between organisms and their environment; also defined as the study of the structure and function of nature.
Ecological Indicator	A characteristic of an ecosystem that is related to, or derived from, a measure of a biotic or abiotic variable that can provide quantitative information on ecological structure and function. An indicator can contribute to a measure of integrity and sustainability. Ecological indicators are often used within the multimetric index framework.

Ecological Integrity

The condition of an unimpaired ecosystem as measured by combined chemical, physical (including habitat), and biological attributes (EPA 1996).

Ecosystem

The interacting system of a biological community and its non-living (abiotic) environmental surroundings.

Environment

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

Eocene

An epoch of the early Tertiary period, after the Paleocene and before the Oligocene.

Ephemeral Stream

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

Erosion

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

Eutrophic

From Greek for "well nourished," this describes a highly productive body of water in which nutrients do not limit algal growth. It is typified by high algal densities and low clarity.

Eutrophication

1) Natural process of maturing (aging) in a body of water. 2) The natural and human-influenced process of enrichment with nutrients, especially nitrogen and phosphorus, leading to an increased production of organic matter.

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).

Fecal Coliform Bacteria

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

Flow

See *Discharge*.

Focal

Critical areas supporting a mosaic of high quality habitats that sustain a diverse or unusually productive complement of native species.

Fully Supporting

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

Fully Supporting Cold Water

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

Fully Supporting but Threatened

An intermediate assessment category describing water bodies that fully support beneficial uses, but have a declining trend in water quality conditions, which if not addressed, will lead to a "not fully supporting" status.

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.

Gradient

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

Ground Water

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

Growth Rate

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

Habitat

The living place of an organism or community.

Headwater

The origin or beginning of a stream.

Hydrologic Basin

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

Hydrologic Cycle

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

Hydrologic Unit

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

Hydrologic Unit Code (HUC)

The number assigned to a hydrologic unit. Often used to refer to fourth field hydrologic units.

Hydrology

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

Inorganic

Materials not derived from biological sources.

Instantaneous

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

Intergravel Dissolved Oxygen
: The concentration of dissolved oxygen within spawning gravel. Consideration for determining spawning gravel includes species, water depth, velocity, and substrate.

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

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

Limnology
: The scientific study of fresh water, especially the history, geology, biology, physics, and chemistry of lakes.

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

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

Load(ing) Capacity (LC)
: A determination of how much pollutant a water body can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, and a margin of safety, it becomes a total maximum daily load.

Luxury Consumption
: A phenomenon in which sufficient nutrients are available in either the sediments or the water column of a water body, such that aquatic plants take up and store an abundance in excess of the plants’ current needs.

Macroinvertebrate
: An invertebrate animal (without a backbone) large enough to be seen without magnification and retained by a 500 µm mesh (U.S. #30) screen.

Macrophytes

Rooted and floating vascular aquatic plants, commonly referred to as water weeds. These plants usually flower and bear seeds. Some forms, such as duckweed and coontail (*Ceratophyllum sp.*), are free-floating forms not rooted in sediment.

Margin of Safety (MOS)

An implicit or explicit portion of a water body's loading capacity set aside to allow the uncertainly about the relationship between the pollutant loads and the quality of the receiving water body. This is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The MOS is not allocated to any sources of pollution.

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.

Median

The middle number in a sequence of numbers. If there are an even number of numbers, the median is the average of the two middle numbers. For example, 4 is the median of 1, 2, 4, 14, 16; 6 is the median of 1, 2, 5, 7, 9, 11.

Metric

1) A discrete measure of something, such as an ecological indicator (e.g., number of distinct taxon). 2) The metric system of measurement.

Milligrams per Liter (mg/L)

A unit of measure for concentration. In water, it is essentially equivalent to parts per million (ppm).

Million Gallons per Day (MGD)

A unit of measure for the rate of discharge of water, often used to measure flow at wastewater treatment plants. One MGD is equal to 1.547 cubic feet per second.

Miocene

Of, relating to, or being an epoch of, the Tertiary between the Pliocene and the Oligocene periods, or the corresponding system of rocks.

Monitoring

A periodic or continuous measurement of the properties or conditions of some medium of interest, such as monitoring a water body.

Mouth

The location where flowing water enters into a larger water body.

National 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.

Natural Condition

The condition that exists with little or no *anthropogenic* influence.

Nitrogen

An element essential to plant growth, and thus is considered a nutrient.

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 Assessed (NA)

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

Not Attainable

A concept and an assessment category describing water bodies that demonstrate characteristics that make it unlikely that a beneficial use can be attained (e.g., a stream that is dry but designated for salmonid spawning).

Not Fully Supporting

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

Not Fully Supporting Cold Water

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

Nuisance

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

Nutrient

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

Organic Matter

Compounds manufactured by plants and animals that contain principally carbon.

Orthophosphate

A form of soluble inorganic phosphorus most readily used for algal 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.

Pathogens

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

Perennial Stream

A stream that flows year-around in most years.

Periphyton

Attached microflora (algae and diatoms) growing on the bottom of a water body 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.
Phosphorus	An element essential to plant growth, often in limited supply, and thus considered a nutrient.
Plankton	Microscopic algae (phytoplankton) and animals (zooplankton) that float freely in open water of lakes and oceans.
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.
Quality Assurance (QA)	A program organized and designed to provide accurate and precise results. Included are the selection of proper technical methods, tests, or laboratory procedures; sample collection and preservation; the selection of limits; data evaluation; quality control; and personnel qualifications and training (Rand 1995). The goal of QA is to assure the data provided are of the quality needed and claimed (EPA 1996).
Quality Control (QC)	Routine application of specific actions required to provide information for the quality assurance program. Included are standardization, calibration, and replicate samples (Rand

1995). QC is implemented at the field or bench level (EPA 1996).

Quantitative

Descriptive of size, magnitude, or degree.

Reach

A stream section with fairly homogenous physical characteristics.

Reconnaissance

An exploratory or preliminary survey of an area.

Reference

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

Reference Condition

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

Reference Site

A specific locality on a water body that is minimally impaired and is representative of reference conditions for similar water bodies.

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.

Respiration

A process by which organic matter is oxidized by organisms, including plants, animals, and bacteria. The process converts organic matter to energy, carbon dioxide, water, and lesser constituents.

Riffle

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

Riparian	Associated with aquatic (stream, river, lake) habitats. Living or located on the bank of a water body.
River	A large, natural, or human-modified stream that flows in a defined course or channel or in a series of diverging and converging channels.
Runoff	The portion of rainfall, melted snow, or irrigation water that flows across the surface, through shallow underground zones (interflow), and through ground water to creates streams.
Sediments	Deposits of fragmented materials from weathered rocks and organic material that were suspended in, transported by, and eventually deposited by water or air.
Settleable Solids	The volume of material that settles out of one liter of water in one hour.
Sinks	A zone of total absorption and infiltration of surface water flow. Can also be a geographic place name.
Sinuosity	A measure of stream curvature; stream length / valley length.
Species	1) A reproductively isolated aggregate of interbreeding organisms having common attributes and usually designated by a common name. 2) An organism belonging to such a category.
Spring	Ground water seeping out of the earth where the water table intersects the ground surface.
Stagnation	The absence of mixing in a water body.
Stream	A natural water course containing flowing water, at least part of the year. Together with dissolved and suspended materials, a stream normally supports communities of plants and animals within the channel and the riparian vegetation zone.

Stream Order

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

Subbasin

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

Subbasin Assessment (SBA)

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

Subwatershed

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

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*.

Taxon

Any formal taxonomic unit or category of organisms (e.g., species, genus, family, order). The plural of taxon is taxa (Armantrout 1998).

Tertiary

An interval of geologic time lasting from 66.4 to 1.6 million years ago. It constitutes the first of two periods of the Cenozoic Era, the second being the Quaternary. The Tertiary has five subdivisions, which from oldest to youngest are the Paleocene, Eocene, Oligocene, Miocene, and Pliocene epochs.

Total Maximum Daily Load (TMDL)

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

Total Dissolved Solids

Dry weight of all material in solution in a water sample as determined by evaporating and drying filtrate.

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 (Franson et al. 1998) call for using a filter of 2.0 microns 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.

Total Dissolved Solids

Dry weight of all material in solution in a water sample as determined by evaporating and drying filtrate.

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 (Franson et al. 1998) 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.

Toxic Pollutants

Materials that cause death, disease, or birth defects in organisms that ingest or absorb them. The quantities and exposures necessary to cause these effects can vary widely.

Tributary

A stream feeding into a larger stream or lake.

Turbidity

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

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

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

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

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

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

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

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

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

Water Quality Standards

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

Water Table

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

Watershed

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

Water Body Identification Number (WBID)

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

Young of the Year

Young fish born the year captured, evidence of spawning activity.

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Appendix A. Unit Conversion Chart

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Table A-1. 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 (gal) Cubic Feet (ft^3)	Liters (L) Cubic Meters (m^3)	1 gal = 3.78 L 1 L= 0.26 gal 1 ft^3 = 0.03 m^3 1 m^3 = 35.32 ft^3	3 gal = 11.35 L 3 L = 0.79 gal 3 ft^3 = 0.09 m^3 3 m^3 = 105.94 ft^3
Flow Rate	Cubic Feet per Second (cfs)[a]	Cubic Meters per Second (m^3/sec)	1 cfs = 0.03 m^3/sec 1 m^3/sec = 35.31 cfs	3 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[b]	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 lb
Temperature	Fahrenheit (°F)	Celsius (°C)	°C = 0.55 (F - 32) °F = (C x 1.8) + 32	3 °F = -15.95 °C 3 °C = 37.4 °F

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

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

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Appendix B. Fisheries Data

2002 CUTTHROAT TROUT DISTRIBUTION SURVEY REPORT
WILLOW CREEK
BRETT GAMETT

BACKGROUND

On September 3, 2002 the Caribou-Targhee Forest fisheries crew began a fish distribution survey on Willow Creek (Dubois RD). The survey team was composed of Fisheries Technicians Brett Gamett, Wade Johnson and Dan Curan. Team leader was Brett Gamett.

HISTORIC DISTRIBUTION OF SPECIES HABITAT/SPECIES

The Yellowstone cutthroat trout *Oncorhynchus clarki* is the most abundant and widely dispersed subspecies of inland cutthroat trout. The historic range of the subspecies includes the Yellowstone River drainage in Montana and Wyoming and portions of the Snake River drainage in Wyoming, Idaho, Nevada, and Utah. The subspecies only exists in about 10% of its original stream range and 85% of its original lake habitat (Varley and Gresswell 1988).

A combination of factors have contributed to the decline of genetically pure Yellowstone cutthroat in Idaho including habitat degradation, genetic introgression, and exploitation (Thurow et. Al 1988, Gresswell and Varley 1988). Introductions of nonnative fish including brook trout and rainbow trout have also affected Yellowstone cutthroat trout populations. Introduced brook trout are considered a serious threat because they almost always replace native cutthroat trout (Griffith 1972, Hickman and Duff 1978). Currently, the Forest recognizes the Yellowstone cutthroat trout as a Sensitive species.

It was therefore important to assess if Willow Creek has cutthroat trout present or other sensitive species. This could be instrumental in assessing whether or not the cutthroat was originally present in the Birch Creek drainage to which Willow Creek is a tributary.

METHODS

The portion of Willow Creek located within the Forest Service boundary was divided into one reach containing three units. Unit 1 was located immediately above the National Forest and BLM boundary. Only one reach was broken out and only contained three units due to the lack of time available to conduct this survey and due to the lack of water immediately above unit three.(Please refer to attached map). The reach break was established according to one of the following:

1) Changes in dominant vegetation type
2) Incoming tributaries supplying 10% or more of the flows
3) Changes in gradient steepness

All sample units were surveyed using a backpack shocker (Mark 10-Coffelt type). Units 1, 2 and 3 were carefully electroshocked using a single pass method. All fish captured within the sample units were identified, measured (total length to nearest 5 millimeter) and released.

In addition to recording fish characteristics, important habitat parameters were also measured. Stream width, depth, temperature, substrate type, dominant vegetation types, and bank stability were all recorded. Photos were also taken at each of the units documenting general stream and streamside condition.

PHYSICAL HABITAT

Willow Creek flows in a west to southwesterly direction, eventually reaching Birch Creek in the upper Birch Creek valley. However, diversions on the private property alter the original flows from the channel into a ditch for irrigation and this along with extreme drought are preventing the confluence of this stream to Birch Creek. Gradients were low to moderate along this reach.

Flows were low in the canyon, but still provided ample water to maintain fish habitat. Spring runoff may be significant, but beaver activity may lessen, or heighten these high water regimes.

Substrate types on Willow Creek varied greatly. Fines dominated the beaver complexes, and gravel, cobble and boulder were common in other habitat types. Water temperatures ranged only from 11 to 12° C

The vegetation along Willow Creek was mostly willow and aspen, but some cedar and Douglas fir were also found in the overstory. The understory was comprised of grasses, shrubs (mostly sagebrush and rosehip bushes), and sedges. Shading in many areas was high, but in others, mainly beaver complexes, the shading was minimal.

A rough and not well-maintained road paralleled and crossed Willow Creek for about two miles before veering off to the southeast. This road, along with moderate to heavy cattle grazing, contributed to sediment loading along this entire reach.

FISHERIES

The only fish species to be encountered by our fisheries crew was rainbow trout. This introduced, but naturally reproducing population seemed to be doing quite well when taking into account the small flows. These fish had remarkable color and looked to be rather healthy. The size range of these fish was from approximately 30 to over 200 mm, suggesting that all age classes were present. These trout were found in all three units and in both fast and slow water types.

RECOMMENDATIONS

We recommend that culverts along the access road be placed to minimize the sediment loading from the road. Cattle grazing management strategies might also be altered to prevent the degradation and to ensure the integrity of this stream system. Measures such as exclusion and fencing might help to accomplish this.

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Appendix C. Data Sources

Table C-1. Data sources for Birch Creek Subbasin Assessment.

Water Body	Data Source	Type of Data	When Collected
Birch Creek	Sorenson Engineering, P.A. Consulting Engineers 550 Linden Drive Idaho Falls, Idaho 83401	Application for License for the Birch Creek Water Power Project	January 1985
Birch Creek	J. S. Griffith, Dept. of Bio Science Box 8007 Idaho State University Pocatello, Idaho 83209	Status of the Trout Population in the Birch Creek Hydroelectric Channel,	August 1996
Birch Creek	BLM, Idaho Falls Resource Area	Upper Birch Creek Fishery Survey	September 1996
Birch Creek	USGS-Boise	Flow	POR 1911-1991
Birch Creek	DEQ	BURP	1997
Birch Creek	BLM, Idaho Falls Resource Area	Historic Interpretive Data	September 2004
Birch Creek	Western Regional Climate Center (http://wrc.dri.edu/summary/climsid.html)	Climate Summary Data	September 2004

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Appendix D. Distribution List

U.S. Department of Agriculture (USDA) Forest Service-Duboise Ranger District, Caribou Targhee National Forest

U.S. Department of Interior (USDOI) Bureau of Land Management-Idaho Falls Resource Area

USDOI Bureau of Land Management-Salmon Resource Area

Idaho Department of Fish and Game-Upper Snake River Region

Continental Divide Watershed Advisory Group

Upper Snake River Basin Advisory Group

United States Environmental Protection Agency-Idaho Operations Office

Shoshone-Bannock Tribes

Butte County Commissioners

Lemhi County Commissioners

Clark County Commissioners

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Appendix E. Public Comments

Environmental Protection Agency Comments on Birch Creek Subbasin Assessment

We appreciate the opportunity to review the Draft Birch Creek Subbasin Assessment (February 2005). The document [appears] to be very well written and organized, and provided a thorough assessment of activities and pollutant sources for the three waterbodies assessed. Although a TMDL was not written as a result of this assessment, we support the recommendation to collect quantitative data in BLM management areas where sediment loading and riparian vegetation are not improving or declining (p. 43).

The following are EPA's comments regarding Section 303(d) listing/delisting recommendations in this subbasin assessment. These comments are provided to help in IDEQ's waterbody assessment process, and are not final agency determinations. When IDEQ officially proposes these Section 303(d) actions, EPA may provide additional comments, if necessary. A final agency determination regarding these proposals will be made as part of EPA's Section 303(d) administrative review process when the final list revisions are submitted by IDEQ.

Only a single waterbody in the subbasin is currently included on the Idaho 303(d) list; Birch Creek from the Reno Ditch to Playas (Assessment Unit ID17040216SK001_04). This segment is listed for flow alteration, nutrients, sediment, and habitat alteration. The assessment indicates that this segment is permanently de-watered for hydroelectric power generation by a diversion structure at the Reno Ditch. Since water is completely and permanently diverted at this point, the assessment recommends that nutrients, sediment and habitat alteration be removed from the 303(d) list, and that the segment only be listed for flow alteration below this point. (p. 42). Further, the assessment recommends that a TMDL not be written at this time, since flow alteration is not considered to be a pollutant. Based on information presented in the subbasin assessment, this change in 303(d) listing appears justified. We request that you include this de-listing proposal and justification in the next Integrated Report you publish for public comment and submit to EPA. Until such time that EPA approves this de-listing, this water body will remain on the 303(d) list.

If you have any questions regarding these comments, please give me a call at (208) 378-5774, or contact me at woodruff.leigh@epa.gov.

Sincerely,

Leigh Woodruff
Watershed Restoration Unit

Dubois Ranger District Comments on Birch Creek Subbasin Assessment

I am writing this memo in response to your request for comments on the Draft Birch Creek Subbasin Assessment. This memo includes comments on the Draft in relation to Caribou-Targhee National Forest System lands included in the Subbasin Assessment.

On Page 17 Under "Willow Creek", the Draft Assessment Reads…

"Since this is a spring creek, however, it is important that riparian management be initiated to prevent the further degradation of stream bank conditions and riparian vegetation."

Comment:

This statement is most likely making reference to riparian conditions below the Forest Service boundary, but if you could make that more clear it would be appreciated.

Response:

It is stated earlier in the paragraph that the riparian degradation occurs primarily on BLM managed land. The closing statement of this paragraph will be changed to reflect that riparian management should be initiated on BLM land to be consistent with Forest Service managed land, above the BLM/Forest Service boundary.

On Page 43 Under "2.5 Data Gaps", the Draft Assessment Reads…

"With Resource Management Plans identifying 30% utilization of woody plants and 3 to 4 inch residual stubble height at the end of the grazing system – Based on ocular surveys – as an acceptable buffer to prevent water quality impairment, more quantitative data is required. Observations during field work conducted by DEQ indicate that trends in sediment loading and integrity of riparian vegetation are not improving."

Comment:

Does this statement make reference to Forest Service Lands? It is implied because the utilization standards noted are similar to the Forest Service standards shown later on page 47. If this is making reference to Forest Service lands, the statement is contrary to the data that is noted on pages 38, 40, and 42 of the same section which show that Pass Creek and Willow Creek demonstrate full support of beneficial uses.

The statement is also contrary to the Characteristics section on page 16 and 17 where it is written that Willow Creek….flows through dense riparian vegetation until it enters BLM lands; and there is a lush, dense riparian zone along the entire reach of the South Fork of Pass Creek and Pass Creek.

Moreover, the statement does not accurately portray Caribou-Targhee standards for utilization monitoring. Stubble height measurements are not based on ocular estimates;

measurements are taken along the stream's greenline and the aquatic influence zone, and recorded on an allotment inspection form as directed in the Rangeland Monitoring Protocol for the Targhee National Forest (1998) and kept at the Dubois District office.

Response:

In the text of the document, "ocular survey" is used to summarize implementation monitoring described by the Forest Service as short term monitoring. The techniques listed in the narrative supplied by the Dubois Ranger District of the Forest Service identify Actual Use Record and Forage Utilization Techniques that include stubble height, ocular estimates, and use-mapping. DEQ did not receive quantitative data from the Forest Service that reflects an Actual Use Record, Forage Utilization measurements for stubble height, or anything that could be construed as use-mapping. No allotment inspection forms were received. The only material received was a schedule of projected allotment use that consisted of Allotment name and number, kind and number of cattle or sheep permitted, and season of use. It is a reasonable assumption, in the absence of quantitative data (that was repeatedly requested by DEQ), that implementation monitoring must be based on ocular surveys.

The Beneficial Use status call of Full Support should not be construed as optimal, or maximal habitat or aquatic life beneficial use support, and does not imply an upward trend. The statement that: "…more quantitative data is required. Observations during field work conducted by DEQ indicate that trends in sediment loading and integrity of riparian vegetation are not improving." is not unreasonable, given the lack of quantitative data submitted to DEQ for this subbasin assessment, and conditions observed on the ground. Use of stubble height as a management tool, instead of a utilization target has been called into question by the University of Idaho and various conservation groups. The statement made in the document by DEQ is directed at this information. Given the presence of an off road vehicle trail along the South Fork of Pass Creek, in close proximity to the creek, monitoring of riparian vegetation along the green line and aquatic influence zone related to stubble height is not likely to detect sediment impacts.

On Page 48 under "Recreational Vehicle management", the Draft Reads…

"The Targhee National Forest established its motorized vehicle travel plan in 1977."

Comment:

This is incorrect. The Targhee National Forest established its motorized vehicle travel plan in 1999.

Response:

1977 will be changed to 1999 in the text.

I appreciate the opportunity to comment on the draft Birch Creek Subbasin Assessment. It makes sense to remove the 303(d) list impairment of Birch Creek by pollutants: nutrients, sediment, and habitat alteration from the Reno Ditch to the sinks. Also, listing the impairment as "flow alteration" for Birch Creek from the hydropower diversion to the sinks.

If you have any questions on these comments, or need more information please contact me at the office at (208) 374-5422.

Sincerely,

ROBERT G. MICKELSEN
District Ranger.

Idaho National Laboratory Comments on the Birch Creek Subbasin Assessment

The Idaho National Laboratory (INL) reviewed the Birch Creek Subbasin Assessment prepared by the Idaho Department of Environmental Quality, This letter formally transmits the INL's comment on the document:

> On page 1, *Executive Summary* and page 7, *Physical and Biological Characteristics,* the document indicates that winter flows not used for irrigation are infiltrated in natural sinks and playas above the Idaho National Laboratory for flood control and ground water recharge. The statement is not accurate for the following reasons, (1) the winter flows enter the INL, (2) the flows do not reach a natural sink or playa but rather travel through a man made conveyance and a pit until spreading out on the desert. The language in these sections should be modified to reflect an accurate description of winter flows.

We appreciate the opportunity to review and comment on this assessment. If you have any questions regarding the comment, please contact Catherine Reno at (208) 526-6888.

Sincerely,

Carolyn Mascarenas,

Response:

The *Executive Summary* section will be edited to indicate that winter flows do enter the INL north of the Test Area North Facility. The document states that: "During the winter months outflow from the hydroelectric plant is diverted to a ditch that leads to a series of infiltration trenches to prevent flooding of Idaho National Laboratory properties below the natural sinks or playas." This is an accurate statement. Winter flows no longer reach the particular feature location referred to as The Birch Creek Sinks. The historic flow of Birch Creek did not always reach the Sinks and was typically infiltrated to ground water across the alluvial fan above this named feature. The area of natural infiltration does include the current INL infiltration pit and overflow gullies (Figure E-1 and E-2). The existing text is accurate with regard to the infiltration of waters above the natural sinks and playas, which occur just above the INL facility referred to as Test Area North.

Figure E-1. Birch Creek zone of infiltration north of the Sinks.

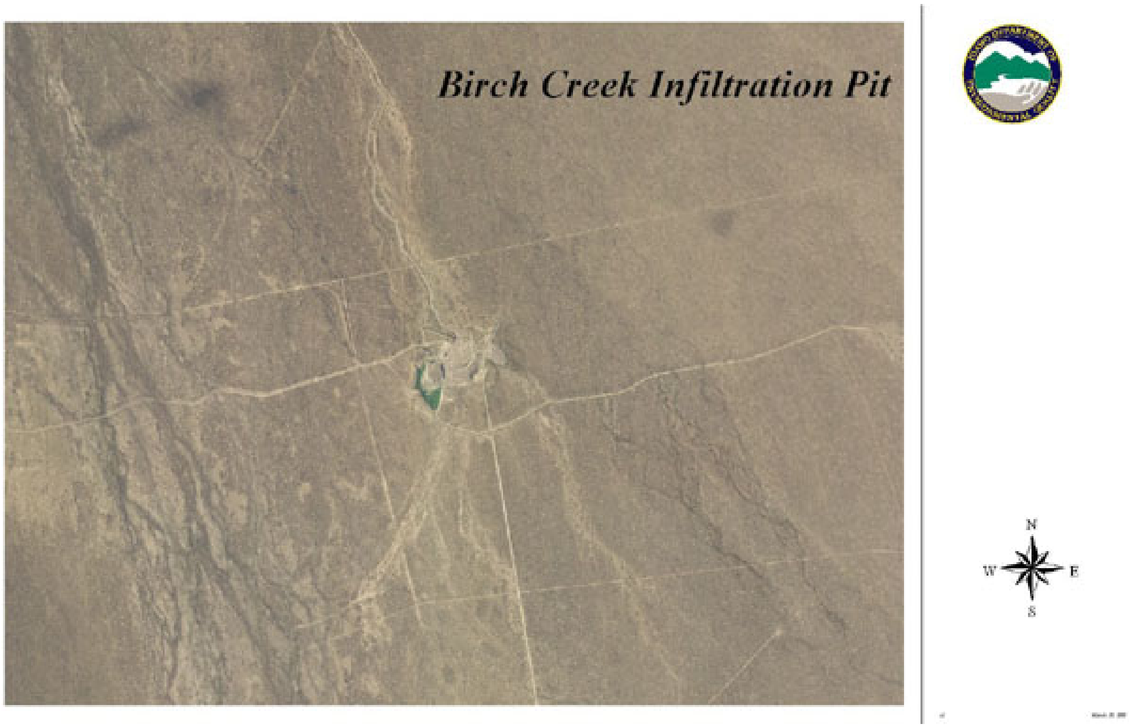

Figure E-2. INL Infiltration Pit on Birch Creek.

Comments from Roger Blew on the Birch Creek Subbasin Assessment

Comment:

The information contained in section 1.2 concerning winter return flows from the hydroelectric plant may be incomplete. Although designed as infiltration trenches, winter flow has exceeded the capacity of those trenches during many, if not all, winters for at least the past ten years. This water has created a new channel not far from the original, natural channel. Before making a final decision to not develop a TMDL for this Section 303(d) listed portion of Birch Creek, IDEQ should investigate more thoroughly the proximity of the winter return flows from the hydroelectirc plant to the original channel and perhaps re-evaluate the conslusion that "[t]his reach is permanently dewatered and there is no mechanism by which restoration of the stream channel is possible or practical."

Roger Blew
825 Jeri Ave.
Idaho Falls, ID

Response:

The original natural channel that you refer to is one of the most recent ephemeral channels to receive flow. As shown in the aerial photos in Figures E-1 and E-2, above, however, it is apparent that there are many remnant ephemeral channels distributed across the alluvial fan at the mouth of the valley. This reach was ephemeral prior to the development of the hydroelectric diversion. Development of the hydroelectric project does permanently dewater the most recently used remnant ephemeral channels. The fact that these remnant channels are ephemeral precludes developing riparian vegetation that would stabilize the stream channel and provide sustainable habitat for macroinvertebrates and fish. Water leaving the hydroelectric plant would flow to this location for a limited period that would not be adequate for restoration of vegetation or aquatic life. The cost of pumping water back to the point of diversion from the natural stream for the several months following the irrigation season ends precludes any mechanism by which restoration of the stream channel is possible or practical.