Cow Creek Subbasin Assessment and Nutrient Total Maximum Daily Load

Department of Environmental Quality
December 2005

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Prepared for the
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Acknowledgments

The Cow Creek Watershed Advisory Group consists of various interest group members residing or working within the Cow Creek Watershed. The majority of members live in the proximity of Genesee, Idaho. The Idaho Department of Environmental Quality recognizes and acknowledges the importance of the watershed community's involvement in the development of this TMDL. The input, decision making ability, and leadership provided by the Watershed Advisory Group, and the cooperative participation of the City of Genesee and the Nez Perce and Latah Counties Soil Water Conservation Districts, were critical to completion of the document. The result is a TMDL watershed plan that allows for a focused and achievable cooperative implementation approach to meeting the goals and requirements of the Idaho State Water Quality Standards and the Federal Clean Water Act.

The Idaho Department of Environmental Quality extends our sincere gratitude to:

Mr. Steve Becker
Mr. Ray Esser
Mr. Joe Anderson
Mr. Bob Schwenne
Mr. Ken Fox
Mr. Jay Roach
Mr. Doug Stout
Mr. Steve Ford
Mr. Jay Nelson
Mr. Wayne Jensen
Mr. Mark Zenner
Mr. John Herman
Mr. Duane Roach
Mr. Rodger Kinyon
Mr. Bill Krick
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Mr. Jim Teare

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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

BAG Basin Advisory Group

BLM United States Bureau of Land Management

BMP best management practice

BOD biochemical oxygen demand

BOR United States Bureau of Reclamation

Btu British thermal unit

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

CW cold water

CWA Clean Water Act

CWE cumulative watershed effects

DEQ Idaho Department of Environmental Quality

DO dissolved oxygen

DOI U.S. Department of the Interior

DWS domestic water supply

EMAP Environmental Monitoring and Assessment Program

EPA United States Environmental Protection Agency

ESA Endangered Species Act

F Fahrenheit

FPA Idaho Forest Practices Act

FWS U.S. Fish and Wildlife Service

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

IDL Idaho Department of Lands

IDWR Idaho Department of Water Resources

INFISH The federal Inland Native Fish Strategy

IRIS Integrated Risk Information System

km kilometer

km^2 square kilometer

LA load allocation

LC load capacity

m meter

m^3 cubic meter

mi mile

mi^2 square miles

MBI macroinvertebrate index

MGD million gallons per day

mg/l milligrams per liter

mm millimeter

MOS margin of safety

MWMT maximum weekly maximum temperature

n.a. not applicable

NA not assessed

NB natural background

nd no data (data not available)

PCR primary contact recreation

ppm part(s) per million

NFS not fully supporting

NPDES National Pollutant Discharge Elimination System

NRCS Natural Resources Conservation Service

NTU nephlometric turbidity unit

ORV off-road vehicle

ORW Outstanding Resource Water

PACFISH The federal Pacific Anadromous Fish Strategy

PFC proper functioning condition

QA quality assurance

QC quality control

RBP rapid bioassessment protocol

RDI DEQ’s river diatom index

RFI DEQ’s river fish index

RHCA riparian habitat conservation area

RMI DEQ’s river macroinvertebrate index

RPI DEQ’s river physiochemical index

SBA subbasin assessment

SCR secondary contact recreation

SFI DEQ's stream fish index

SHI DEQ's stream habitat index

SMI DEQ's stream macroinvertebrate index

SRP soluble reactive phosphorus

SS salmonid spawning

SSOC stream segment of concern

STATSGO State Soil Geographic Database

TDG total dissolved gas

TDS total dissolved solids

T&E threatened and/or endangered species

TIN total inorganic nitrogen

TKN total Kjeldahl nitrogen

TMDL total maximum daily load

TP total phosphorus

TS total solids

TSS total suspended solids

t/y tons per year

U.S. United States

USC United States Code

USDA United States Department of Agriculture

USDI United States Department of the Interior

USFS United States Forest Service

USGS United States Geological Survey

WAG Watershed Advisory Group

WBAG *Water Body Assessment Guidance*

WBID water body identification number

WET whole effluence toxicity

WLA waste load allocation

WQLS water quality limited segment

WQMP water quality management plan

WQRP water quality restoration plan

WQS water quality standard

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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 Cow Creek Assessment Units #s ID17060108CL001_02 and ID17060108CL001_03 within the Palouse River Subbasin (HUC# 17060108). These waters are referred throughout this document as Cow Creek and the Cow Creek Watershed. This subbasin assessment (SBA) and TMDL analysis have 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 Cow Creek watershed, located in north central Idaho.

The first part of this document, the SBA, is an important first step in leading to the TMDL. The starting point for this assessment was Idaho's current §303(d) list of water quality limited water bodies. Cow Creek from headwaters to stateline, was placed on this list. The SBA examines the current status of the Cow Creek watershed and defines the extent of impairment and causes of water quality limitation throughout the watershed. The TMDL analysis quantifies point and nonpoint source pollution and allocates load reductions needed to return listed waters to a condition of meeting water quality standards.

Sub-basin at a Glance

Cow Creek, or Assessment Units #s ID17060108CL001_02 and ID17060108CL001_03, is considered to be both a second and third order tributary of the Palouse River in the southern part of Latah County and northern part of Nez Perce County, Idaho. The creek flows primarily southwest, from an elevation of approximately 3,000 feet above sea level to 2,500 feet, for an approximate total of 18.5 miles before it enters Union Flat Creek. It drains an approximate 21,000-acre watershed that has three distinct portions. In the western portion, Calf Creek flows along Idaho Highway 95 until it reaches Cow Creek just before it crosses the highway. In the eastern portion, several ephemeral creeks flow from the northeast and meet Cow Creek near the city of Genesee. The northern portion originates in a forested area on the southern side of Paradise Ridge and meets the eastern portion just east of the city of Genesee.

Primary land uses in the watershed consist of dry land agriculture, cattle grazing operations and a small urban area at the city of Genesee. A sewage lagoon facility is located along Cow Creek just downstream of the city of Genesee.

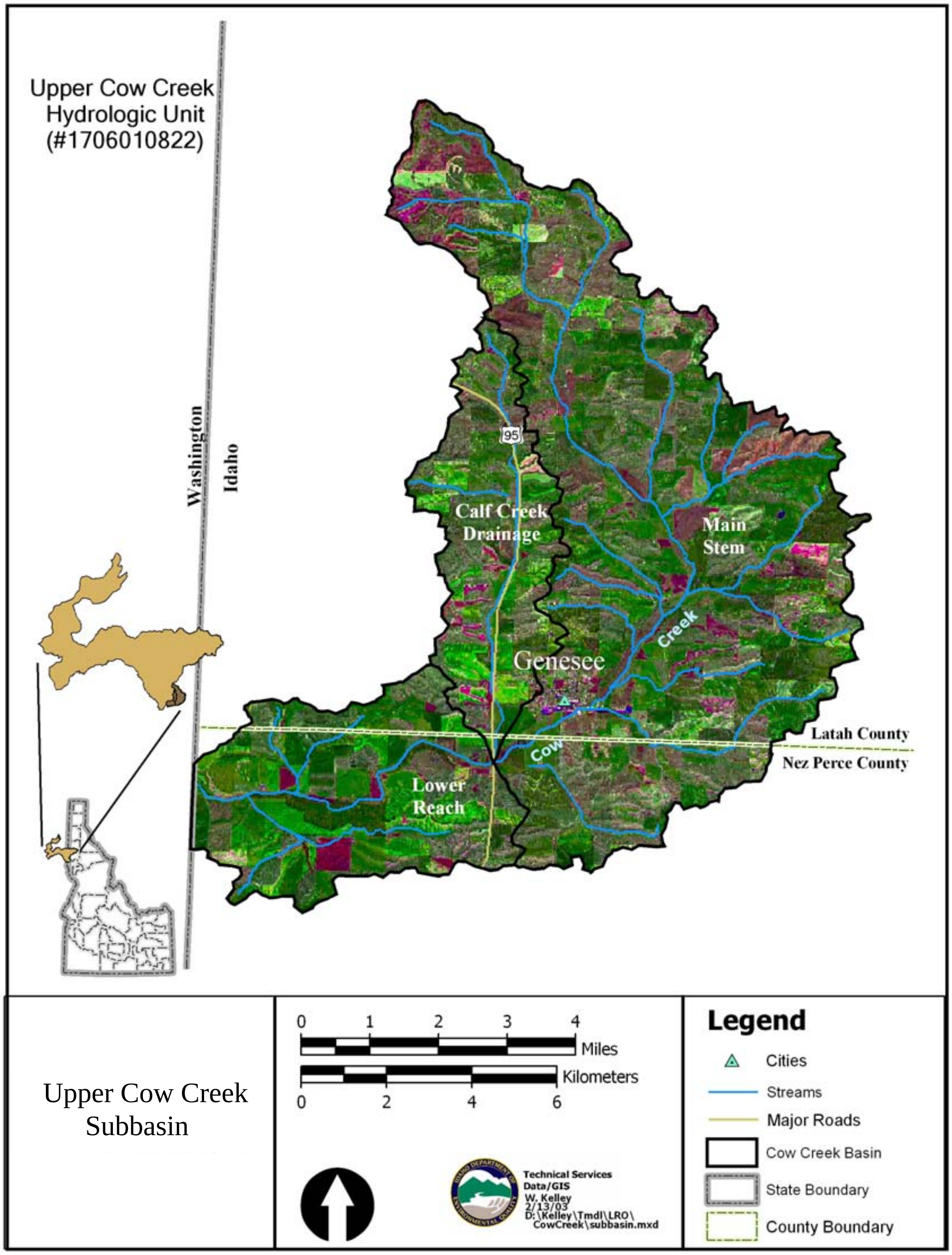

Figure A. Cow Creek Sub-basin Located in the Palouse River Basin.

Section 303(d) of the Clean Water Act requires states to develop a TMDL management plan for water bodies determined to be water quality limited. A water body is determined water quality limited if it does not meet criteria established for designated beneficial uses. A TMDL documents the amount of pollutant a water body can assimilate without violating a state's water quality standards and allocates that load capacity to known point sources and nonpoint sources. TMDLs are the sum of the individual waste load allocations for point sources and load allocations for nonpoint sources, including a margin of safety and natural background conditions.

Water quality standards for the State of Idaho are intended to provide protection of designated beneficial uses. TMDL targets are based on these water quality standards. Numeric water quality criteria are used where they exist. Narrative water quality criteria have numerical interpretations that are applied to Cow Creek for nutrients. Load capacities reflect these water quality targets based on available and estimated instream flow data. Load allocations distribute the existing pollutant loading between point and nonpoint sources within the watershed based on the available load capacity of Cow Creek.

Key Findings

In 1998 Idaho State Waterbody Identification Assessment Units #s ID17060108CL001_02 and ID17060108CL001_03, commonly referred to as Cow Creek, were listed as water quality limited under §303(d) of the CWA. Pollutants of concern included habitat alteration, temperature and nutrients.

Stream flow is not a pollutant that can be managed by a TMDL as flow does not lend itself to meeting the minimum requirements of a pollutant load (mass/time). Low flow periods in Cow Creek between July and September coincide with periods of diurnal dissolved oxygen exceedances in both the intermittent and perennial reaches of the watershed. This TMDL is intended to manage instream phosphorus concentrations, to reduce aquatic plant growth, and to enhance dissolved oxygen during the mid to late summer critical flow period between July and September.

The Genesee wastewater treatment lagoon is the only point source permitted to discharge in the Cow Creek watershed. In February 2005, the USEPA issued an NPDES permit to the City of Genesee effective April 2005 allowing discharge year round. Historically, the City only discharged from November to July. The April 2005 permit requires the City to monitor effluent quality as well as receiving surface waters of Cow Creek. Surface water monitoring is being required for temperature, pH, total phosphorus and ammonia. This TMDL provides a waste load allocation for total phosphorus of 0.60 kg/d during the annual critical low flow period of June through September.

The primary nonpoint sources of pollutants in the Cow Creek watershed are non-irrigated croplands and grazing lands. The entire length of Cow Creek and its tributaries typically receive pollutants from agricultural fields during rainfall and snow melt. Nutrients associated with sediment also enter the creek at these times from fields and unstable banks. During the summer low-flow periods, portions of Cow Creek experience temperature increases and low dissolved oxygen concentrations. Nitrogen and phosphorus nutrients are present in sufficient concentrations to influence aquatic plant growth. Excessive aquatic plant growth may cause diurnal and seasonal fluctuations in dissolved oxygen (DO) concentrations.

This TMDL attempts to manage diurnal and seasonal fluctuations in dissolved oxygen concentrations attributable to current nutrient loading. The TMDL examines whether the estimated load capacities for nutrients in Cow Creek are currently exceeded. Targets, loading analyses, and load allocations are presented for nutrient management.

Diurnal dissolved oxygen sags are present throughout the watershed during periods of low flow and summer temperatures. A key assumption is made that by reducing the nutrient concentrations instream dissolved oxygen sags will be reduced.

April 11 through September 9, 2002, was selected as the averaging period for estimating the nutrient load capacity, existing load, and load reductions. Although nutrients are probably added at all times of the year, the April to September time period coincides with the period most likely to contain the critical flow period for poor dissolved oxygen conditions.

The nutrient load capacities and existing loads were estimated by stream segment in kilograms per day during the months April through September. Total phosphorus should be reduced throughout the watershed by at least 28% as measured at CC-1 (Table A). Monitoring stations CC-5 and CC-4 are located within the intermittent headwaters of Cow Creek and reductions at CC-5 and CC-4 are relative to those periods of optimum flow (>1 cfs) and subsequent effects on conditions at CC-1. Station CC-1 is used as the watershed TMDL compliance point since it represents the only reach that has an annual mean flow of equal to or greater than 1 cfs for over eight months of the year and any significant measurable flow between July and September.

During the summer critical low-flow periods, portions of Cow Creek experience temperature increases and exceedances of the Idaho water quality temperature standard. The Initial economic analysis completed by the City of Genesee to address the nutrient TMDL allocation provided to the City's wastewater treatment facility in this document indicate that additional analysis during the critical low flow period is required to evaluate the most viable response. A temperature TMDL is not currently included in this document and temperatures in the watershed will continued to be monitored to determine whether a temperature TMDL is needed if the city is successful in reducing their surface water discharge to Cow Creek (Table B).

TMDL Implementation Plan

The Cow Creek Watershed Advisory Group (WAG) and supporting agencies will produce a TMDL implementation plan for this TMDL. The plan will specify projects and controls designed to improve Cow Creek water quality and meet the load allocations presented in this TMDL document. Implementation of best management practices within the watershed to reduce pollutant loading from nonpoint sources will be on a voluntary basis. Examples of best management practices include tree and shrub planting, grassed waterways, stream bank stabilization, conservation cropping and tillage practices, prescribed grazing, alternate livestock water supplies, livestock exclusions, animal waste systems, and protected riparian zones.

As additional information becomes available during the implementation of the TMDL, the targets, load capacity, and allocations may be revisited. In the event that new data or information shows that changes are warranted, TMDL revisions will be made with assistance of the Cow Creek WAG. Although specific targets and allocations are identified in the TMDL, the ultimate success of the TMDL is not whether these targets and allocations are met, but whether beneficial uses and water quality standards are achieved.

Table A. Phosphorus load allocation (LA).

Pollutant	**Target**	**Site ID**	**Existing Load**	**Target Load Capacity**	**Load Reduction** (after 10% margin of safety removed)
Total Phosphorus	0.10 **mg/l**	CC-5	0.19 kg/day	0.13 kg/day	37%
		CC-4	1.42 kg/day	0.49 kg/day	69%
		CC-3	0.74 kg/day	0.69 kg/day	16%
		CC-2	1.05 kg/day	0.69 kg/day	41%
		CC-1	1.65 kg/day	1.31 kg/day	28%

Table B. Summary of assessment outcomes.

Water Body Name	**Assessment Unit ID Number**	**§303(d) Boundaries**	**Pollutants**	**Listing Basis**
Cow Creek	ID17060108 CL001_02 & 03	2003 – headwaters to WA border	Nutrients	305 (b) report, 303d list (1996 and 1998)

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. (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.)

The overall purpose of the subbasin assessment (SBA) and TMDL is to characterize pollutant loads within the Idaho water quality Assessment Units ID17060108CL001_02 and ID17060108CL001_03, commonly referred to as Cow Creek. 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. This information is used to develop the TMDL in Section 5. Habitat alteration is identified on the 303(d) list as impairing use in Cow Creek. The TMDL does not address habitat alteration because this parameter is currently not required to be addressed as a pollutant under §303(d) of the Clean Water Act. Temperature was measured instantaneously during water quality sampling events. Instream temperatures can often exceed water quality criteria. Temperature issues are not addressed in this TMDL, but will be addressed in a separate temperature TMDL.

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, regulates 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 water body. The agency must also 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 state water quality standards. An SBA and TMDL provide a summary of the water quality status and allowable TMDL for water bodies on the §303(d) list. *Cow Creek Subbasin Assessment and Nutrient Total Maximum Daily Load* provides this summary for the currently listed Cow Creek watershed.

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 Cow 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. The TMDL is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (Water quality planning and management, 40 CFR Part 130). Consequently, a TMDL is water body and pollutant specific. The TMDL also allocates allowable discharges of individual pollutants among the various sources discharging the pollutant.

Some conditions that impair water quality do not receive TMDLs. The EPA considers 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 pollutant as "pollution." However, TMDLs are not required for water bodies impaired by pollution, but 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, modified
- Contact recreation–primary (swimming), secondary (boating)
- Water supply–domestic, agricultural, industrial
- Wildlife habitats
- Aesthetics

The Idaho legislature designates uses for water bodies. Industrial and agricultural 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 presumed designated uses when water bodies are assessed.

An 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

Idaho water quality assessment units ID17060108CL001_02 and ID17060108CL001_03, commonly referred to as Cow Creek, are located in the Palouse River Basin (PRB) south of Moscow, Idaho (Figure 1). Cow Creek flows southeast (140 degrees from north) for 50% of its length from its headwaters south of Moscow, Idaho, on Paradise Ridge in the Palouse Range. The creek then turns southwest (200 degrees from north) for 20% of its length, through the city of Genesee. Then it turns west (260 degrees from north) for 30% of its length before entering Union Flat Creek near Uniontown, Washington.

The watershed elevation varies from approximately 3,000 feet above sea level at the headwaters to just under 2,500 feet near Uniontown. The drainage area of Cow Creek watershed is approximately 51.1 square miles (Figure 1). The creek's main stem is approximately 40 miles long and its tributaries are a combined 29 miles long.

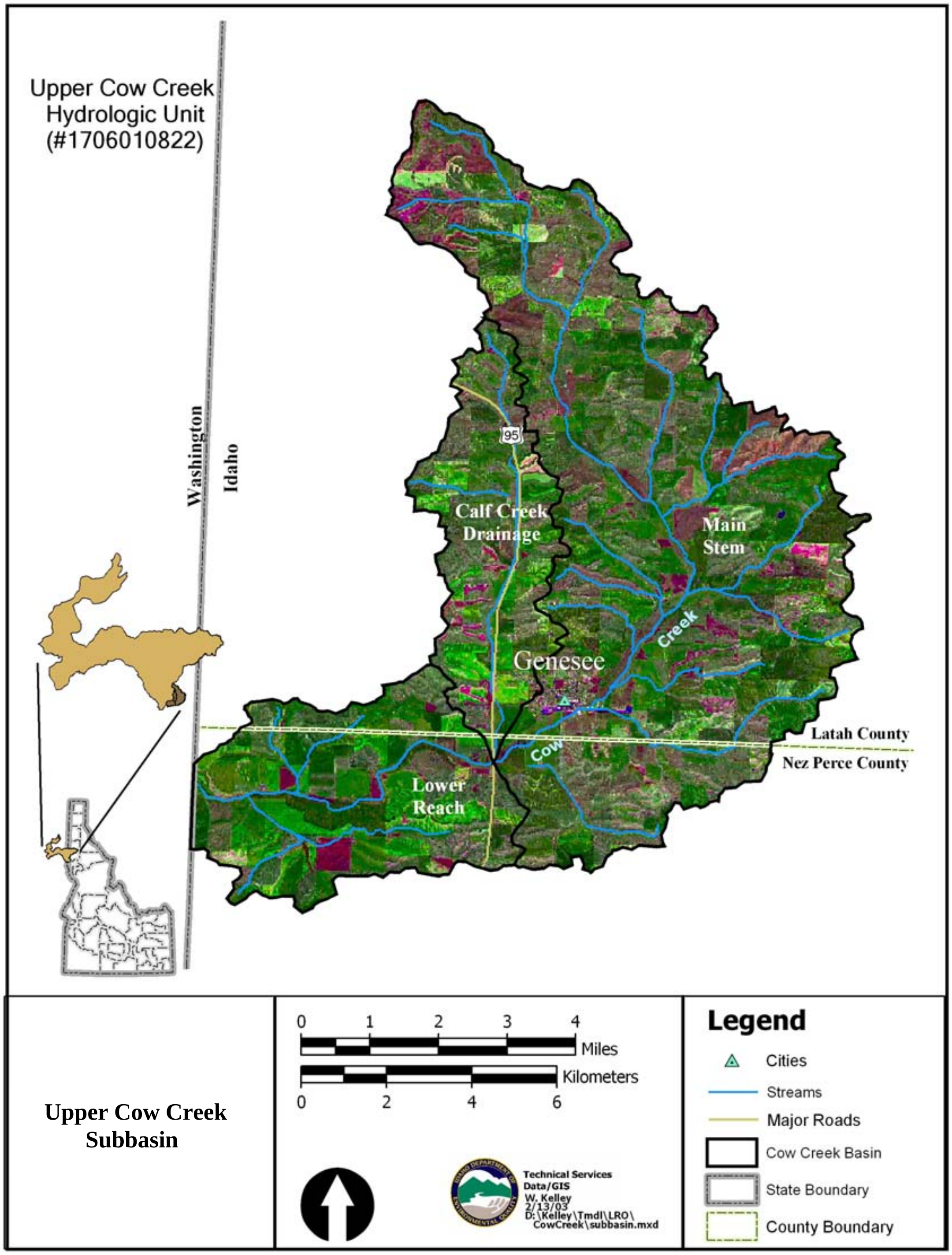

Figure 1. Cow Creek Sub-basin Located in the Palouse River Basin

Climate

The climate within the Cow Creek watershed as classified using the Köppen Climate Classification system, which characterizes a region based on 30-year averages of temperature and precipitation, is placed in class "Dfb." Class "Dfb" is described as humid continental with moderate summers and year-round precipitation. However, precipitation in the summer months is typically limited to showers and occasional thunderstorms.

Table 1. Average monthly maximum and minimum air temperatures and total precipitation for Genesee, Idaho.

Month	Average Maximum Temperature (F)	Average Minimum Temperature (F)	Average Total Precipitation (inches)
January	34	22	3.1
February	41	26	2.3
March	47	30	2.4
April	56	34	2.2
May	65	40	2.2
June	73	45	1.8
July	83	48	0.9
August	83	48	1.2
September	73	43	1.3
October	60	36	1.9
November	43	30	3.3
December	35	23	3.0

The watershed averages 25.6 inches of precipitation annually, of which an average of 48.1 inches of snow falls between November and April. The mean pan evaporation observed at nearby Moscow, Idaho ranges from 1.94 inches in October to 8.79 inches in July. Soil-water storage occurs between the months of October through March when precipitation is high and evaporative losses are low. During this period, the soil surface will often go through a freeze and thaw process that decreases soil stability and water infiltration, leaving it susceptible to erosion.

Air temperature and precipitation for 2002 during the most recent water quality sampling are reported in Table 2. Represented data indicate a near-normal season. June and August experienced higher than average precipitation, which recharged the shallow groundwater and enabled some tile drains to begin flowing again.

Table 2. Maximum and minimum monthly air temperatures and average precipitation for Cow Creek from April 2002 through August 2002.

	Maximum Temperature (F)		Minimum Temperature (F)		Precipitation (inches)	
	2002	Average	2002	Average	2002	Average
April	57	57	34	36	1.86	1.88
May	64	65	39	41	1.58	2.00
June	75	73	46	46	2.05	1.66
July	86	83	51	50	0.40	0.73
August	82	82	44	50	1.94	0.79

Subbasin Characteristics

Flow and vegetation within the watershed change substantially through the four seasons of the year. During snowmelt in early spring there is substantial water and no above ground vegetation in the riparian area in this section of the stream. As spring turns to summer, flow decreases and grass vegetation begins to grow, to the point where flow is miniscule and herbaceous vegetation dominates. The system remains so through the fall until heavy snow returns to higher elevations and cold weather suppresses the vegetation.

Cow Creek flows into Union Flat Creek and eventually into the Palouse River, which is a tributary to the Snake River. Cow Creek begins on the southern side of Paradise Ridge approximately 8 miles south of Moscow, Idaho. The uppermost 3 miles of the watershed experiences snow accumulation in winter. The creek flows through farmland and pasture at moderate slopes (5%) in the upper reaches to low slopes (1-4%) through the rest of the watershed where grazing and farming are common practices. The creek flows into Union Flat Creek as it enters Washington State near Uniontown. Union Flat Creek flows through the Palouse farm country toward its confluence with the Palouse River several miles west of Lacrosse, Washington.

Geology, Soils and Vegetation

The Cow Creek Watershed is in the Columbia Plateau Geomorphic Province. The bedrock is Tertiary-age Columbia River basalt. The watershed is characterized by rolling hills of the Quaternary-age Palouse formations, which are wind and stream deposited silts found throughout the watershed. The soils are of one geomorphic category and can generally be described as deep silt loams with good drainage. Small grains and legumes, such as peas and lentils, are the primary dry land crops grown in the watershed. Specifically the soils can be divided into the following categories:

- Palouse-Naff soil group: These are very deep, well-drained soils. They exist on gently sloping to moderately sloping landscapes. These soils are generally formed from a loess base (Barker, 1981).

- Latahco-Lovell soils: These are very deep and somewhat poorly drained soils. They are formed from alluvium, and permeability is moderately slow while available water capacity is relatively high. Soil is usually subject to brief periods of flooding in the winter and spring seasons (Barker, 1981).

- Palouse Silt Loam soil: A very deep soil that is well drained and usually lies on the south slopes of uplands. Soil is formed from loess. Permeability is moderate and the soil has a high available water capacity. Runoff is usually rapid, thus increasing the hazard of soil erosion (Barker, 1981).

Table 3. Soil series and natural vegetative communities on Cow Creek.

Soil Series	Natural Vegetation Community	Soil Series by Stream Length	Potential Cover by Natural Vegetation Community
Latah silt loam	Crataegus succulenta (succulent hawthorn)	7%	69%
Latahco silt loam	Pinus ponderosa (ponderosa pine)	59%	58%
Latahco-Lovell silt loam	Pinus ponderosa (ponderosa pine)	24%	58%
Latahco-Thatuna silt loam	Pinus ponderosa (ponderosa pine)	7%	58%
Westlake-Latahco silt loam	Phleum pretense (common timothy)	3%	14%

Subwatershed Characteristics

The Cow Creek watershed has three distinct sections—Calf Creek, upper Cow Creek, and lower Cow Creek. Upper Cow Creek is intermittent. The upper reach is approximately 37 square miles and is 99% annual cropland. This reach meets the lower reach just above the point where the Calf Creek sub-watershed, which is approximately 8 square miles and runs along Idaho Highway 95 for most of its length, drains into the main stem and where Idaho Highway 95 crosses Cow Creek. The upper main stem is dominated by annual cropland and other rural activities near the City of Genesee. The lower reach starts just above where Calf Creek enters the main stem and encompasses an area of approximately 11 square miles. The lower reach is dominated by annual crop production but also has the majority of cattle grazing that occurs in the watershed. There are numerous ephemeral creeks within the watershed that contribute flow to the Cow Creek in the winter and spring. These creeks, including Calf Creek, contribute flow from November through May, but are generally dry all summer.

1.3 Cultural Characteristics

Land Use

The Cow Creek watershed consists of mostly rural area. Agricultural crops, such as wheat and barley, and legume crops, such as peas, lentils, and garbanzo beans, dominate land use within the watershed. Some land is used as pasture for grazing animals, generally less than 100 head per pasture.

Land Ownership, Cultural Features, and Population

The majority of the watershed (upper reach and Calf Creek) is in Latah County. The lower reach is primarily in Nez Perce County. The city of Genesee is the only incorporated city in the watershed and was once a fairly active town with many businesses that supported local farmers. The town has since become a community with nearby larger cities on the Palouse (Lewiston and Moscow) and has a population of approximately 1,000 residents. The city of Genesee treats its municipal wastewater with a facultative lagoon located southwest of town and just north of Cow Creek. The rural residents treat their wastewater with septic systems and drain fields.

History and Economics

Native Americans lived in the Palouse region and grazed horses in the grassy Palouse prairie country. The first known Europeans to enter the area were fur trappers and the Lewis and Clark expedition in 1805. The expedition camped in the Weippe prairie to the east and in Lewiston to the south. Gold was discovered in 1860 in Idaho, which created opportunities for miners and others to move into and settle in the prairie country. Latah County was established at its present size and configuration on May 14, 1888 with its county seat at Moscow, just north of the Cow Creek drainage. Likewise, the University of Idaho and Washington State University were established as land-grant colleges in the 1880s. By 1890, when Idaho became the 43rd state in the Union, homesteaders were likely clamoring to get a piece of the prairie for farming. Likewise, logging and mining in the surrounding hills were reaching their peak of activity. Today, farming, grazing, and home residences are the primary land uses in and around the Cow Creek drainage.

2. Subbasin Assessment – Water Quality Concerns and Status

This section outlines the water quality concerns in the Idaho water quality assessment units ID17060108CL001_02 and ID17060108CL001_03, commonly referred to as Cow Creek, including the pollutants it is listed for as well as the standards that are to be achieved. A summary of the monitoring techniques and the collected data are analyzed in this section. Any data gaps that are apparent will also be addressed.

2.1 Water Quality Limited Segments Occurring in the Subbasin

Section 303(d) of the CWA states that waters that are unable to support their beneficial uses and that do not meet water quality standards must be listed as water quality limited waters. Subsequently, these waters are required to have TMDLs developed to bring them into compliance with water quality standards.

<u>About Assessment Units</u>

Assessment units (AU or 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 WBAGII (Grafe et al 2002). Assessment units 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 AUs 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

This document addresses the Cow Creek Assessment Units #s ID17060108CL001_02 and ID17060108CL001_03 within the Palouse River Subbasin (HUC# 17060108). These waters are referred throughout this document as Cow Creek and the Cow Creek Watershed. Table 4 shows the pollutants listed and the basis for listing.

Table 4. 303(d) Segments in the Cow Creek Subbasin.

Water Body Name	Assessment Unit ID Number	§303(d) Boundaries	Pollutants	Listing Basis
Cow Creek	ID17060108 CL001_02 & 03	2003 – headwaters to WA border	Habitat alteration Nutrients Temperature	305 (b) report, 303d list (1996 and 1998)

2.2 Applicable Water Quality Standards

This TMDL will be developed for the designated beneficial use of cold water aquatic life. Cold water aquatic life designation refers to water quality appropriate to the protection and maintenance of cold water aquatic life. Pollutants that most often affect this beneficial use include nutrients (that can result in aquatic plant growth and low dissolved oxygen), increased sediment loading, and temperature/heat loading.

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 instream 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 supported salmonid spawning on or after November 28, 1975, but salmonid spawning is not occurring now 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 apply (e.g., intergravel dissolved oxygen, temperature). However, if for example, cold water aquatic life is not found to be an existing use, a use designation to that effect is needed before some other aquatic life criteria (such as seasonal cold) can be applied in lieu of cold water criteria (IDAPA 58.01.02.101.01).

Table 5. Cow Creek subbasin beneficial uses of §303(d) listed streams.

Water Body	Uses[a]	Type of Use
Cow Creek	CW, SCR, A&I WS, WH, A	Designated

[a] CW – cold water aquatic life, SCR – secondary contact recreation, A&I WS – agricultural and industrial water supply, WH – wildlife habitat, A - aesthetics

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 5). 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 that 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 6 includes the most common numeric criteria used in TMDLs.

Figure 2 provides an outline of the stream assessment process for determining support status of the beneficial uses of cold water aquatic life, salmonid spawning, and contact recreation.

2.3 Pollutant/Beneficial Use Support Status Relationships

Most of the pollutants that impair beneficial uses instreams 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 cold water 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. High temperatures can also affect embryonic development. Acutely high temperatures can result in death if they persist for an extended length of time.

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 oxygen 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.

A dissolved oxygen level of 6 mg/L and above is considered optimal for aquatic life and is the minimum level required for Cow Creek by the Idaho State Water Quality Standards to support the designated beneficial use of Cold Water Aquatic Life. However, this TMDL attempts to provide for 8 mg/l dissolved oxygen in the water column as Cow Creek flows into Washington state since the required dissolved oxygen level in Washington State is 8 mg/l for salmonid spawning beneficial use. Salmonid spawning is neither a designated use nor an existing use on the Idaho reach of Cow Creek.

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.

Table 6. 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 5 samples over 30 days; no sample > 406 *E. coli* organisms/100 ml	Less than 126 *E. coli*/100 ml as a geometric mean of 5 samples over 30 days; no sample > 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
Temperature [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.	
EPA Bull Trout Temperature Criteria: Water Quality Standards for Idaho, 40 CFR Part 131				
Temperature				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 90th 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

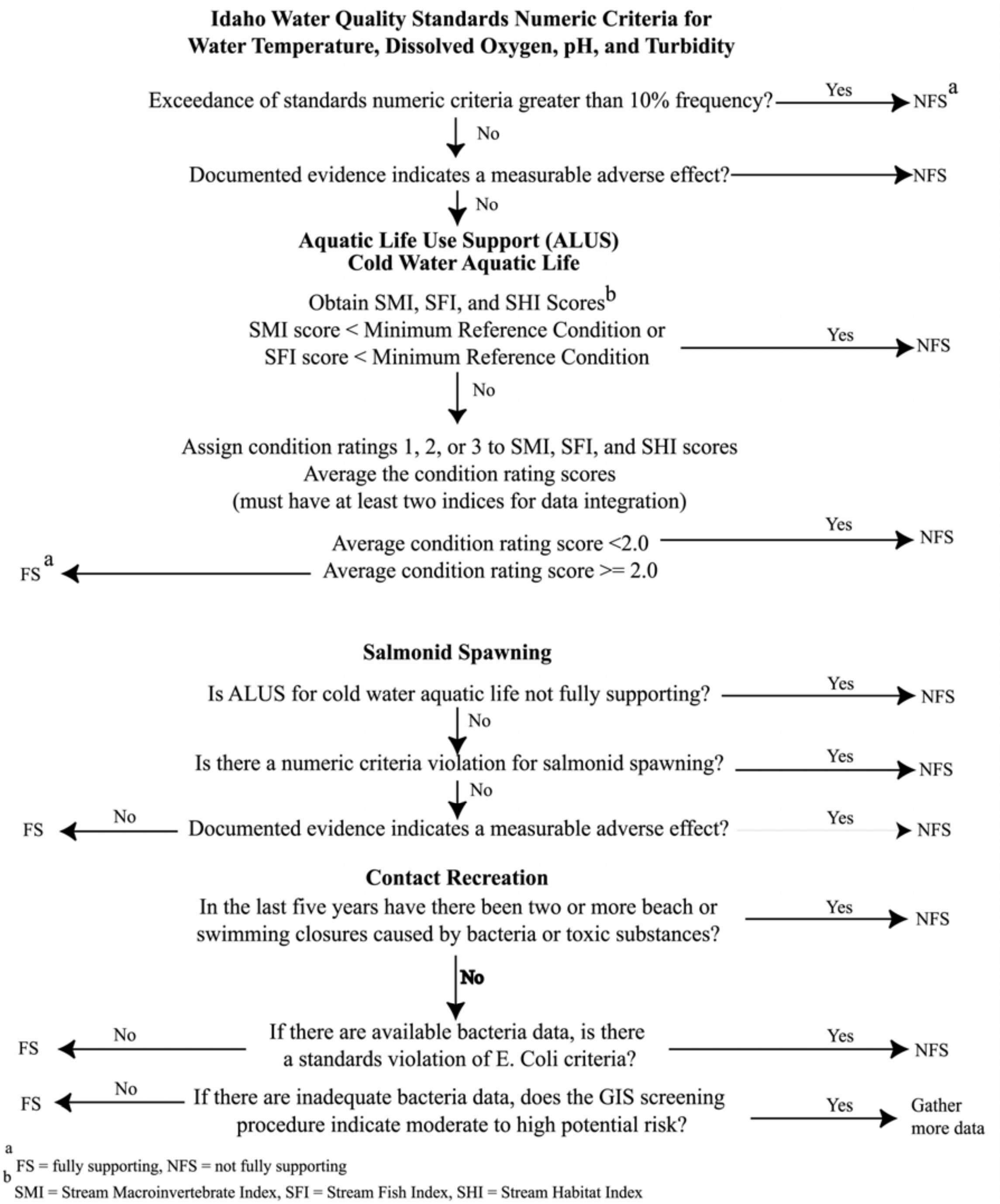

Figure 2. Determination Steps and Criteria for Determining Support Status of Beneficial Uses in Wadeable Streams: Water Body Assessment Guidance, Second Edition (Crafe et al. 2002)

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.

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. Nutrient limitations occur when a nutrient, usually phosphorus, is below the level needed for plant growth in the water column. Influxes of these nutrients will stimulate growth if other factors, such as light, temperature, and flow, are conducive to growth. Alternatively, a system can have high enough levels of nutrients that growth is limited by other factors besides nutrients, and nutrient levels must be decreased to limiting levels to have an effect on plant biomass.

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 algae 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. Total phosphorus (TP) consists of both particulate and dissolved fractions of both organic and inorganic phosphorus compounds. Dissolved phosphorus consists of all forms of phosphorus in solution, whether organic or inorganic. Phosphorus in solution in surface waters occurs almost solely as phosphates. Orthophosphate ($PO4^{-3}$) is the form that plants can use and, thus, best correlates to short-term stimulation of growth.

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 algae 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 algae 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, 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-stratums 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 algae concentrations to increase because physical removal by scouring and abrasion does not readily occur. Increases in temperature and sunlight penetration also result in increased algae 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 algae 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, algae 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 algae 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, large algae 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 absorbed 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 algae growth within the water column, combined with the direct effect of the legal 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

The data used for the development of this TMDL was provided by DEQ and contains measurements taken approximately every three weeks during the time period between April 11, 2002, and September 9, 2002 (Appendix C). The variables sampled include temperature, flow, pH, dissolved oxygen, turbidity, total and ortho-phosphorous, nitrates, and ammonia. The five sample sites, CC5 – CC1, are shown in Figure 3.

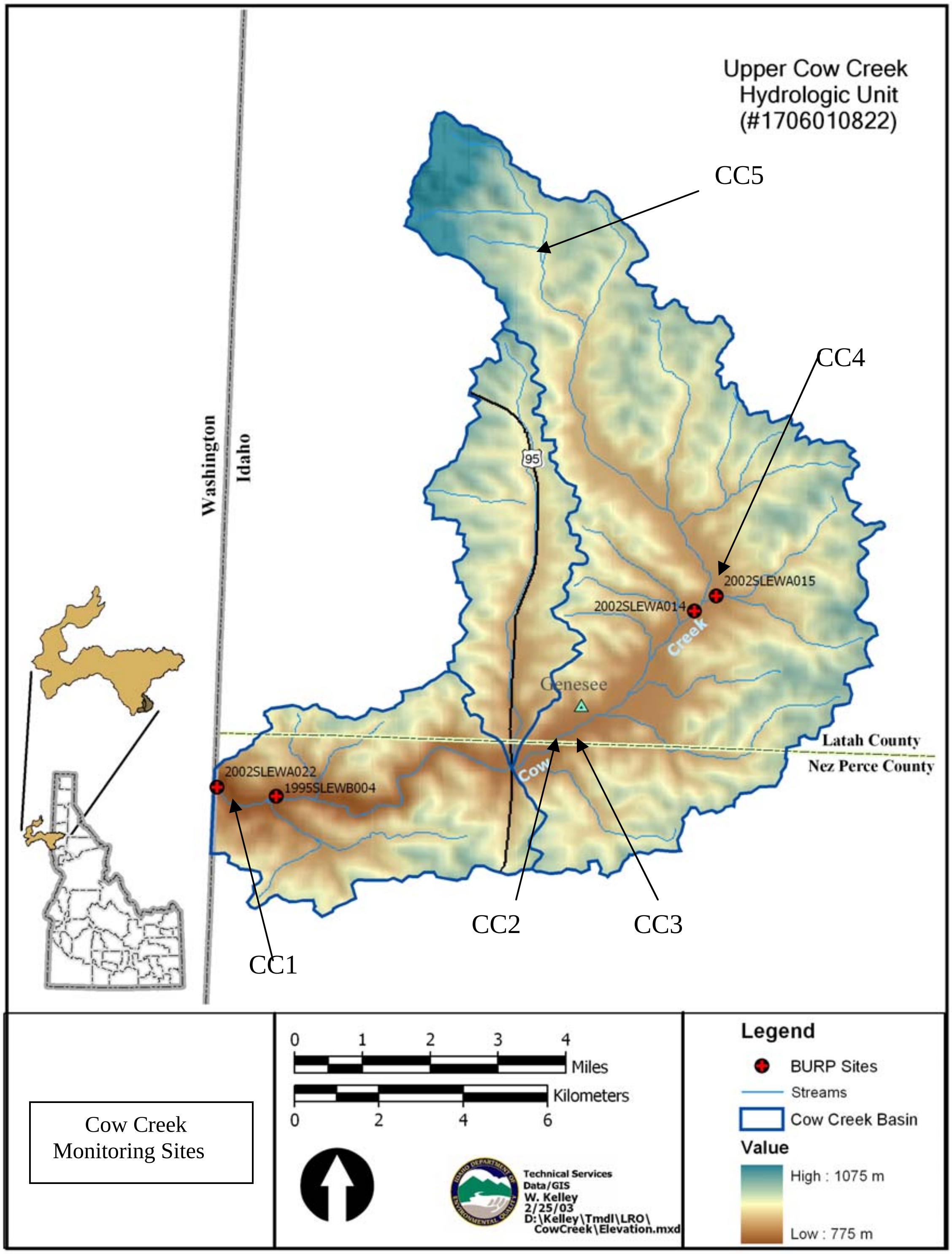

Figure 3. Cow Creek Monitoring Sites CC5 – CC1

The monitoring data in Appendix B shows that after July 1, most monitoring locations dropped below 1cfs flow. These low flows tend to exacerbate other water quality parameters. For example, at CC-2 when flows are between 0.21 and 0.018 cfs, DO drops below the required 6 mg/L to 3-4 mg/L. Likewise at CC-4 and CC-5, when flows drop below 1 cfs, temperatures occasionally rise above 22^{o}C. These excursions above or below standards could be caused by lack of flow and exacerbated by the one parameter (nutrients) that appears to be a more sustained problem in the watershed. Most parameters are within normal limits when there is sufficient flow. However, nutrients (TP and TN) are elevated during most flow levels.

Flow Characteristics

Discharge was measured in Genesee, Idaho, from 1979 through 1986 by the USGS. The USGS gauging station is located between monitoring sites CC4 and CC3. Records indicate Cow Creek is intermittent upstream of CC3. Monthly mean discharge and minimum and maximum flows are shown in Figure 4. Peak flow occurred in the late winter/early spring and averaged nearly 56 cfs. Creek flow between July and November averaged less than one (1) cfs according to USGS monitoring data. Minimum and maximum discharges are also depicted to illustrate the range of flow that can potentially occur in Cow Creek.

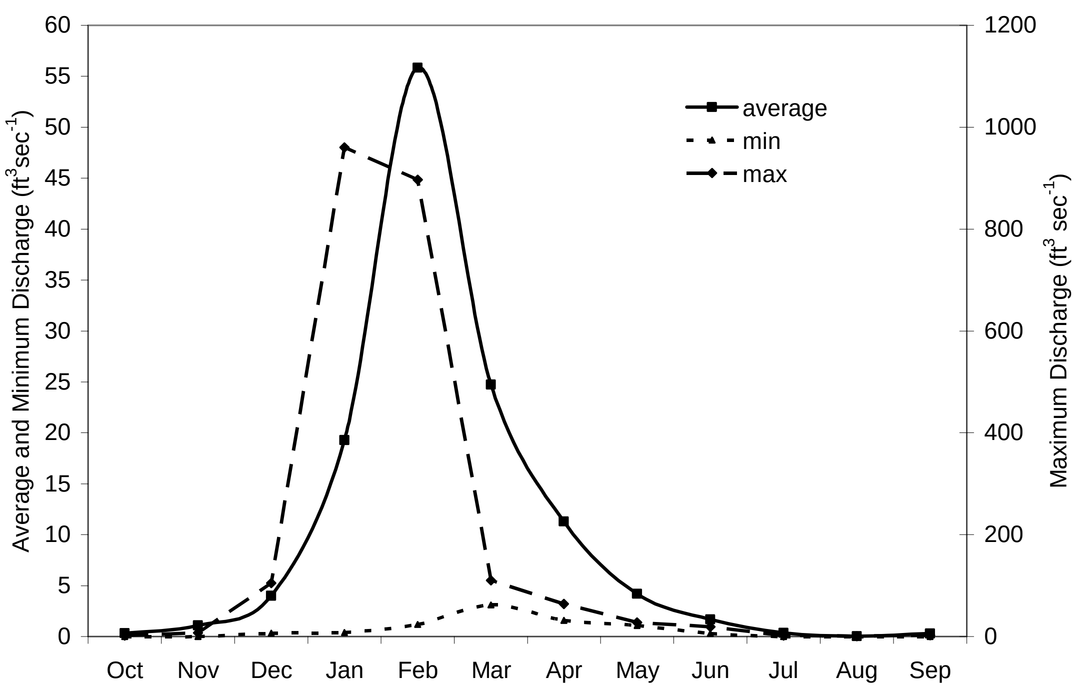

Figure 4. Average, Minimum and Maximum Flow Characteristics in Cow Creek at the USGS Gauging Station in Genesee, Idaho from 1979 – 1986

Flow in Cow Creek during the spring and summer of 2002 was similar to the averages monitored at the USGS gauging station and can be seen in Figure 5. Monitoring crews missed peak flow for Cow Creek but were able to capture the low-flow period during the summer months. The highest flow was at site CC1 and can be explained by the numerous ephemeral creeks that flow into the main stem near site CC2 in the western portion of the watershed. It is important to note that, for unknown reasons, the flow measured below the outfall of the WWTL was consistently lower than the flow above the outfall (CC-3). Sites CC5 and CC4 exhibited flow of less than one (1) cfs beginning early May and mid-June, respectively. Beginning in early July, flow was below one (1) cfs for sites CC3 and CC2, and site CC1 experienced flows less than one (1) cfs beginning in late July through the remainder of the monitoring period.

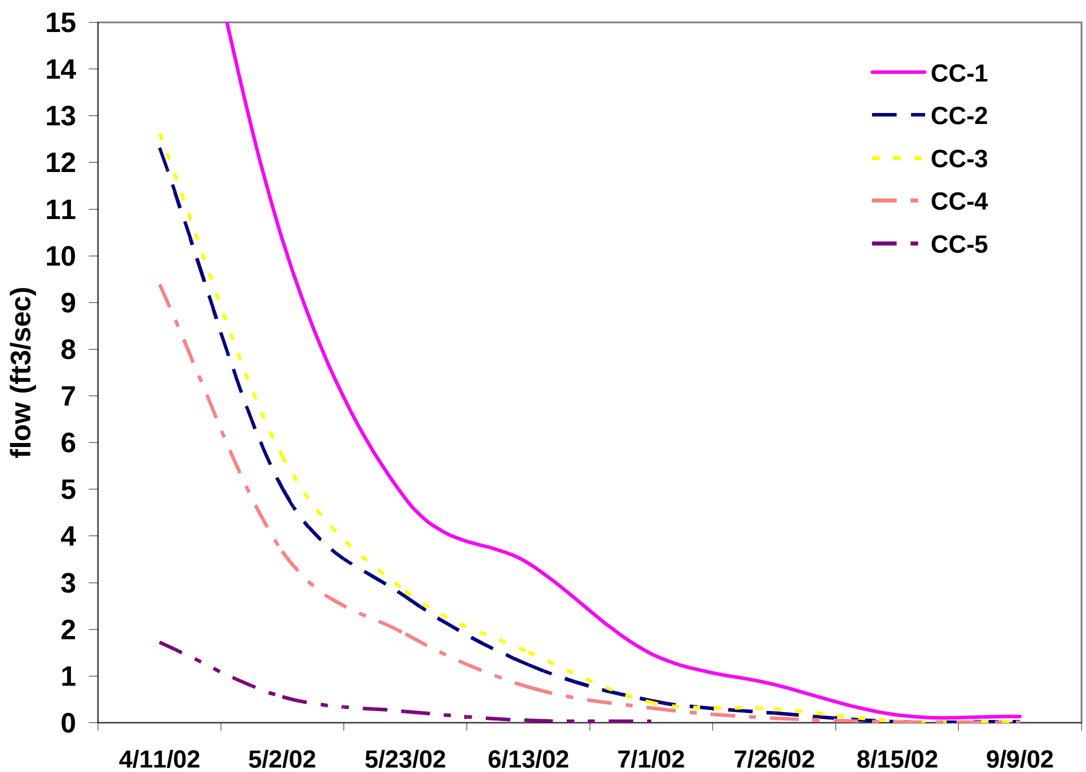

Figure 5. Flow in Cow Creek at Each Monitoring Site from April 11, 2002 through September 9, 2002

Biological and Other Data protocol

Beneficial Use Reconnaissance Program (BURP) field crews in the Cow Creek drainage (Figure 3) visited four sites. Two sites near CC1 were sampled in 1995 (1995SLEWB004) and 2002 (2002SLEWA022). Two other sites (2002SLEWA014 and 2002SLEWA015) further up in the watershed above CC 3 were dry at the time field crews visited in 2002.

The Idaho Beneficial Use Reconnaissance Program (BURP) protocol was followed to collect physical data and biological samples. Analysis of the data followed the Idaho Water Body Assessment Guidance for Cold Water Aquatic Life beneficial use. Based on the sampled macroinvertibrate population, poor habitat conditions, and exceedance of the numeric temperature standard the sites located near CC1, Cow Creek was determined to be not fully supporting Cold Water Aquatic Life beneficial use. Fish observed in Cow Creek during BURP sampling include redside shiner (*Richardsonius balteatus*) and dace (*Rhinichthys sp.*).

Water Column Data

Nutrients

At present, monitoring data indicate that phosphorus is the limiting agent for aquatic plant growth, and since it is also considered to be easier and more cost-effective to manage than nitrogen, phosphorus will be addressed in the load allocation section of this TMDL. Monitoring data pertaining to total nitrogen is represented; however, analysis of nutrients will focus primarily on total phosphorus.

Nitrogen Compounds

In order to prevent nuisance algae growth, USEPA (1993) developed a national guideline for streams of 0.3 mg/L TN. More recently, USEPA (2000) developed a recommended nutrient criterion of 0.22 – 0.36 mg/L TN specific to the Colombia Plateau subecoregion streams.

Figure 6 provides a graphical representation of TN for each of the sample sites and dates. While TN levels were never below the recommended nutrient criterion of 0.22 – 0.36 mg/L, all of the sites did experience a decrease during the summer months when nitrogen is typically taken up by plants. There was no increase in TN below the WWTL, and beginning in late May, TN actually decreased after the WWTL outfall.

Five springs were sampled for groundwater nitrate levels in the Cow Creek watershed in the summer of 2001 (IDEQ, 2001). Nitrate levels in the springs ranged from 4.3 to 13.7 mg/L with an average of 10.5 mg/L NO2+NO3-N. Twenty five deep wells (>100 ft) were also sampled as part of this effort. The average nitrate levels measured in samples collected from the wells averaged 1.5 mg/L NO2+NO3-N. Nitrate levels measured in surface water during this study ranged from <0.10 mg/L to 0.27 mg/L NO2+NO3-N for all sample sites and dates, and TN ranged from < 0.10 mg/L to 12 mg/L (IDEQ, 2001).

Phosphorus Compounds

In order to prevent aquatic plant growth and dissolved oxygen problems, USEPA (1986) developed a national guideline for streams of 0.1 mg/L TP. More recently, USEPA (2000) developed nutrient criteria for total phosphorus of 0.03 mg/L specific to Columbia Plateau sub-ecoregion streams based on the median of all seasons' 25th percentiles. This value roughly corresponds to reference conditions for the Columbia Plateau. These criteria provide USEPA's most recent recommendations to states for use in establishing their water quality standards. USEPA recommends that, wherever possible, states develop nutrient criteria that fully reflect localized conditions and protect specific designated uses. The Cow Creek drainage is an intensely agriculture system, one that is not anticipated to revert to reference quality. Therefore, USEPA's earlier guidelines for TP (0.1 mg/L) will be used as a target in Cow Creek.

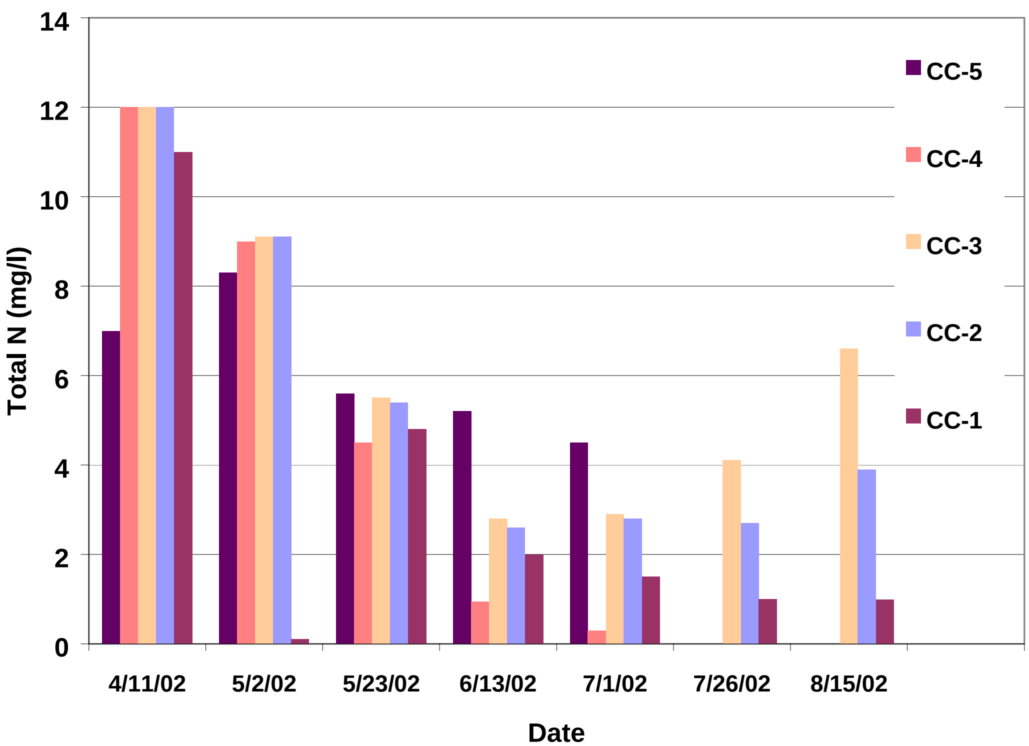

Figure 6. Total Nitrogen Monitoring Results for Cow Creek

Total phosphorus in Cow Creek ranged from 0.05 mg/L (several sites) to 0.59 mg/L (CC4) and averaged 0.168 mg/L, above the nutrient target of 0.1mg/L. Figure 7 shows TP measurements taken at each of the sample sites for Cow Creek, and Table 7 describes the range, mean, minimum, and maximum values associated with each sample site. TP at the headwaters site (CC-5) is relatively stable around 0.2 mg/L during April and May, then dips to 0.1 mg/L in June and the first of July. Site CC-4 farther down the watershed generally has lower TP concentrations than CC-5 except for a very large spike (0.59 mg/L) on May 2. The WAG has questioned the validity of this spike; however, the data met the project's data quality assurance objectives and therefore, there is no justification to remove this value from the data set at this time. Total phosphorus concentrations at CC-3 are lowest early on (0.05 – 0.1 mg/L), but then increase substantially in July and August (0.15 – 0.24 mg/L) as the water flow decreases. Concentrations at CC-2 are consistently higher than at CC-3. Near the bottom of the watershed at CC-1, TP concentrations show patterns consistent with CC-3.

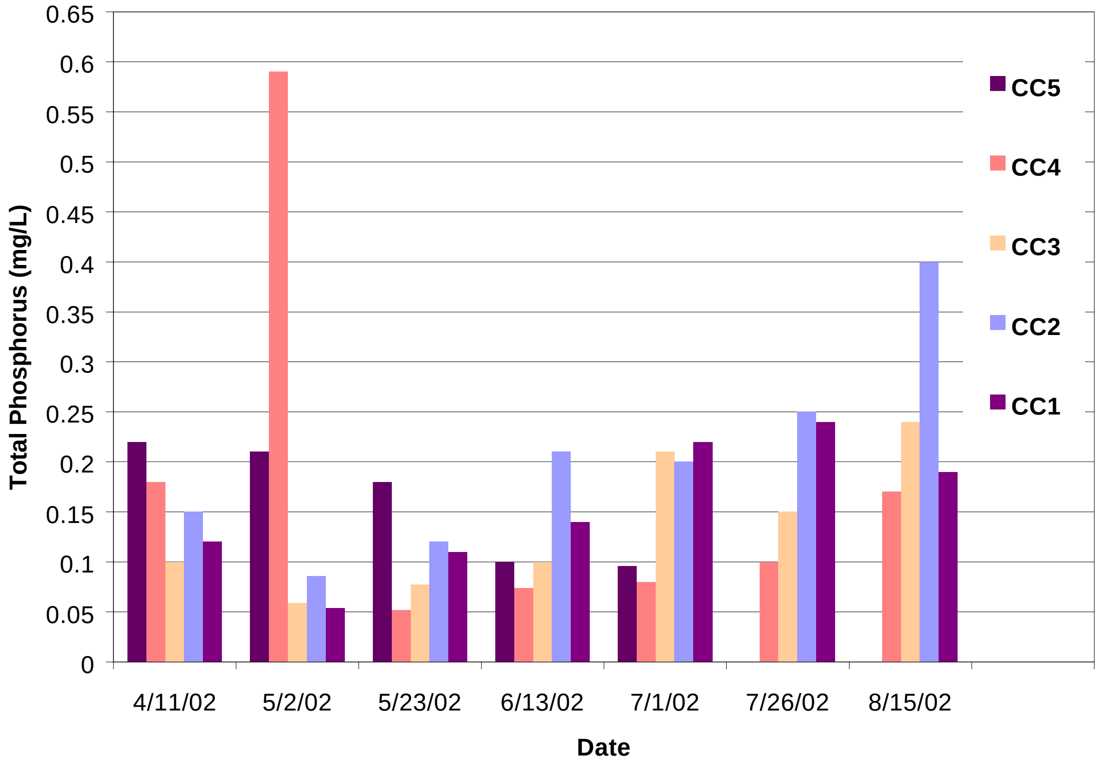

Figure 7. Total Phosphorus Monitoring Results for Cow Creek

Ortho-phosphorus, the form most readily available for plant uptake, ranged from 0.01 mg/L (multiple sites) to 0.20 mg/L (CC1) and averaged 0.07 mg/L. Site CC1 had the largest range in values, while site CC5 had the lowest range. Figure 8 represents the ortho-phosphorus concentrations for each of the sample sites from April 11, 2002, to August 15, 2002. Table 8 describes the range, mean, minimum, and maximum values in ortho-phosphorus associated with each sample site.

Table 7. Total Phosphorus concentrations in Cow Creek (April 11, 2002 to August 15, 2002).

mg/L	CC5	CC4	CC3	CC2	CC1
Mean	0.16	0.18	0.13	0.20	0.15
Minimum	0.10	0.05	0.06	0.09	0.05
Maximum	0.22	0.59	0.24	0.40	0.24
Range	0.12	0.54	0.18	0.31	0.19

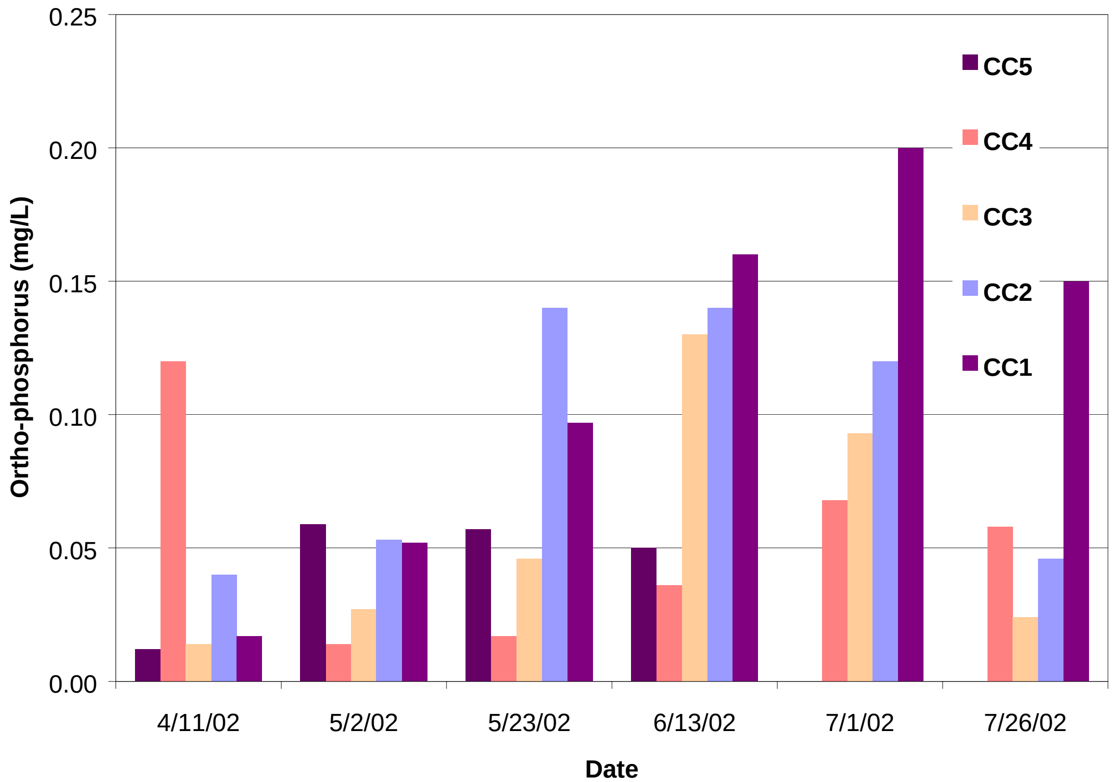

Figure 8. Ortho-phosphorus Monitoring Results for Cow Creek

Table 8. Ortho-phosphorus concentrations in Cow Creek (April 11, 2002 to August 15, 2002).

mg/L	CC5	CC4	CC3	CC2	CC1
Mean	0.04	0.05	0.06	0.09	0.11
Minimum	0.01	0.01	0.01	0.04	0.02
Maximum	0.06	0.12	0.13	0.14	0.20
Range	0.05	0.11	0.12	0.10	0.18

Ortho-phosphorus levels for groundwater in the Palouse ranged from <0.01 mg/L to 0.17 mg/L with a median value of 0.055 mg/L (IDWR 1995), which correlates to the surface water measurements conducted in the field during the monitoring season.

Dissolved Oxygen

The Idaho state criterion for dissolved oxygen (DO) in a water column for cold water aquatic life is a one-day minimum of not less than 6.0 mg/l (IDAPA 58.01.02.250.02). Figure 9 illustrates that sample timing is crucial for measuring DO. The smallest variance of DO is at site CC1. This is where flow is the greatest, illustrating a correlation between flow and DO where the continual movement of water allows aeration of the water. Dissolved oxygen concentrations measured at CC-1 did not fall below the 6.0 mg/l state water quality standard.

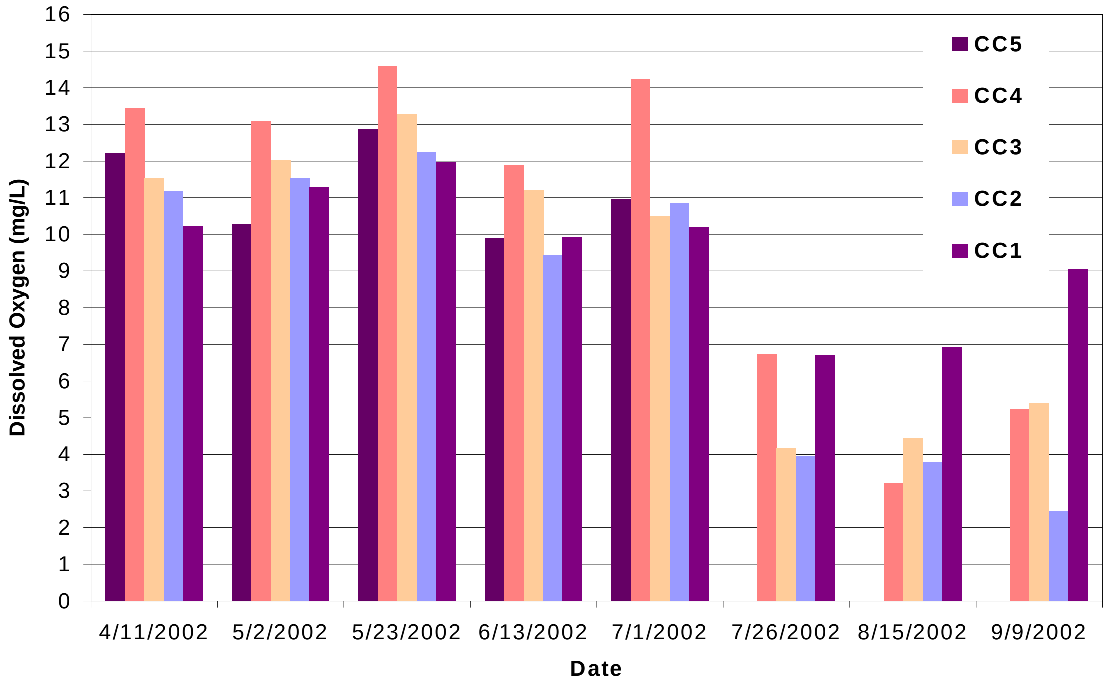

Figure 9. Dissolved Oxygen Monitoring Results for Cow Creek

Diurnal measurements were taken on July 17 and 18, 2002, to reflect over night conditions that occur during the critical flow period. During the evening, when plants are producing less oxygen, there are many organisms that continue to decompose plant material and utilize available oxygen. This decline in DO can be measured in the water column (Figure 10). Although data collected at a later date would most likely reveal a greater range, the intent is to show that diurnal DO sags are occurring to the extent of violating State water quality standards and fluctuations in the water column can be related to cyclic aquatic plant growth and decay in the creek.

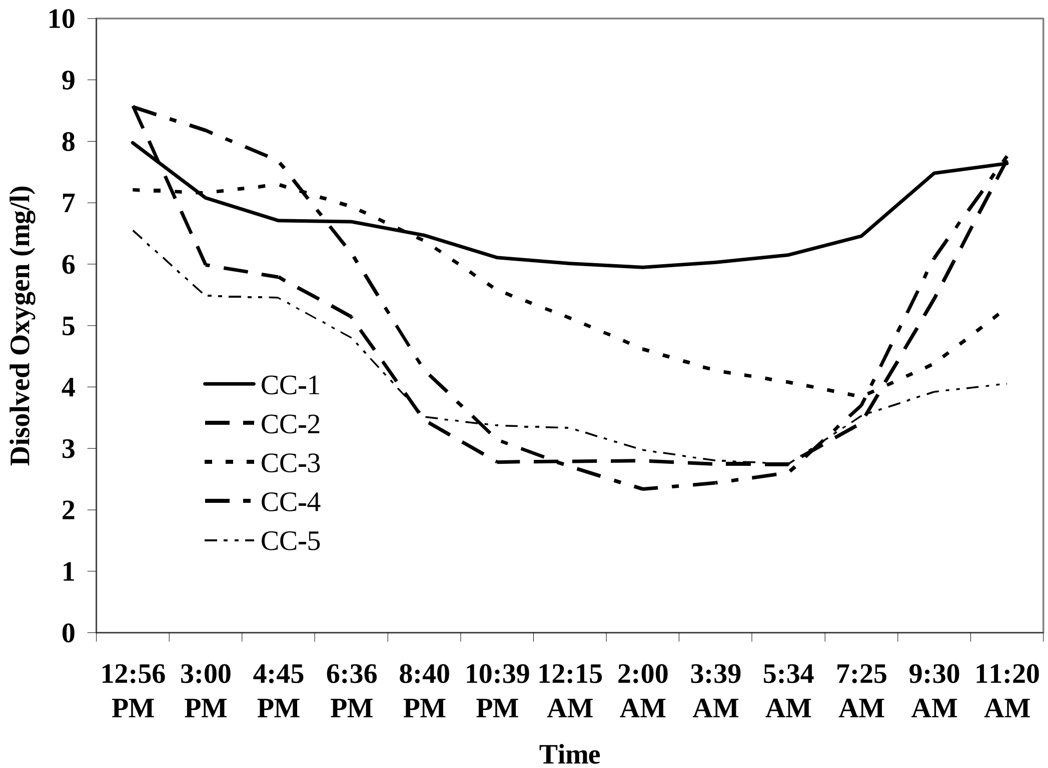

Figure 10. Diurnal Dissolved Oxygen from all Five Sites Taken on July 17 and 18, 2002

Conclusions

Nutrients have a substantial impact on plant growth. While total available nitrogen exceeds recommended levels (0.30 mg/L) most of the year, total phosphorus is sufficiently high to be the driver for plant growth. Since the ratio of mean total nitrogen to mean total phosphorus is well over 7:1 at all sampling locations (actual ratios vary from 20:1 to 47:1), total phosphorus appears to be the limiting nutrient for this TMDL.

Dissolved oxygen levels are below standard for several of the sites for specific dates and are subject to diurnal fluctuations. These levels appear to correlate with flow, vegetative growth, and the nutrient load in the creek. By reducing the total phosphorus load in the creek, plant growth should be reduced and dissolved oxygen enhanced.

2.5 Data Gaps

Water quality parameters and stream biology are greatly influence by the flow regime in Cow Creek. When flows decrease to low levels, water quality parameters, such as DO show problems. It is likely that macroinvertebrate and fish assemblages, as well as plant growth are affected by the low flow. The aquatic life communities are impacted during these low flows and the impacts are further exacerbated during the lower flows by nutrients being supplied to the system throughout the year. Future monitoring of biological communities for the assessment of stream health should take into account the differences in seasonal flow regimes. BURP monitoring is needed in the intermittent sections of Cow Creek prior to the critical flow period in order to evaluate more fully the impacts to macroinvertebrate communities by excess nutrients.

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3. Subbasin Assessment – Pollutant Source Inventory

3.1 Sources of Pollutants of Concern

Point Sources

Genesee operates a wastewater treatment lagoon. The lagoon was initially developed to discharge into the creek at high flows only during the winter and spring months. The lagoon was then going to hold the wastewater during the summer months and evaporate excess instead of discharging into the creek. Over time, the inflow increased greater than the evaporative rate during the summer months, and the facility continued to discharge overflow into Cow Creek year-round. The pond overflow (approximately 0.08 to 0.2 mgd at times) runs 50 feet down a ditch along a road, eventually leading to Cow Creek. Sometimes water stays within the ditch and remains without entering the creek. It is not known if other nonpoint sources contribute water or pollutants to this ditch. The ditch was sampled for TP twice in February 2004 (2.4 and 2.5 mg/L) and once in October 2004 (0.94 mg/L) by DEQ personnel. No flow was observed in the ditch and it is not clear that any discharge of TP to Cow Creek was occurring at these times. Because TP has not been measured in the effluent leaving the facility or entering the creek, it is not known precisely what the contribution of TP attributable to the facility is from the ditch.

The city selected an engineer in 2000 to pursue wastewater facility planning assisted by the DEQ's State Revolving Fund. The City of Genesee's Wastewater Facility Plan in June 2004 documents the City's wastewater lagoon is seeping below monitoring site CC-3.

Nonpoint Sources

The greatest potential nonpoint source in the watershed is agricultural activities. Agricultural production requires inputs of nutrients, which can reach Cow Creek through any of the numerous subsurface tile drains in the watershed well as in surface runoff entering Cow Creek. Some tillage operations can increase soil erosion, which not only adds sediment but also phosphorus and nitrogen to Cow Creek. Cattle grazing along the creek contributes nitrogen and phosphorus directly into the stream and also indirectly by streambed deterioration. Streambed deterioration includes stream bank destruction and soil compaction, which both contribute to increased runoff. Residential lawn fertilizer and drain field systems may also be nonpoint sources in the watershed.

3.2 Data Gaps

Point Sources

It cannot be demonstrated at this point that the water sampled in the ditch or at CC-2 is representative of effluent discharged to Cow Creek. Actual discharge volumes to Cow Creek from lagoon seepage, concentrations of TP in the seepage, and the fate and transport of seepage loss from the lagoon can not currently be documented. To determine a final, long term allocation for the wastewater facility, a hydrogeologic study of the impacts of the wastewater seepage to ground water will need to be conducted.

Nonpoint Sources

The greatest uncertainty of sources of pollution comes from nutrients entering the system from specific nonpoint source activities. While it is difficult to judge where phosphorus is coming from, it is generally assumed to be transported with sediment. Those activities and problem areas that contribute sediment to the stream as either runoff or bank erosion are assumed to provide the greatest sources of phosphorus. Additionally, some phosphorus enters the system from forested areas, from roads and rural landscapes, and from groundwater. Initial results from sampling of tile drains in recent years indicate that the concentration of nutrients in these drains is similar to that in the creek itself.

Because data gaps exist about specific sources in this watershed, load allocations are applied broadly, not specifically. Improvements in the watershed, wherever they occur, that cumulatively result in lower phosphorus loadings are assumed to be beneficial.

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

Pollution control efforts over the past few years within the Cow Creek watershed have been applied to both nonpoint sources, primarily USDA agricultural activities, and to the City of Genesee wastewater treatment facility through the USEPA NPDES program, the only known and permitted point source within the watershed.

4.1 Point Source Control Efforts

The City of Genesse was issued a National Pollution Discharge Elimination System (NPDES) permit by the US Environmental Protection Agency (EPA), Region 10, on November 8, 1974, to discharge treated municipal wastewater to Cow Creek. The permit (#ID00201125) was modified by EPA on January 1, 1977, and regulates the allowable biochemical oxygen demand (BOD), total suspended solids (TSS), and pH of the treated effluent discharged into Cow Creek. The lagoon was initially designed to discharge into the creek at high flows only during winter and spring months. The lagoon was to store the wastewater during summer months for evaporation and seepage rather than discharging to the creek.

Extreme high water years and difficulties with managing effluent flows led to two letters of violation and a realization that a more comprehensive approach was required. The city pursued wastewater facility planning assisted by the DEQ's State Revolving Fund. The city was awarded a planning grant in 2001. The city entered into a consent order with DEQ on July 17, 2002. The city also increased their wastewater user fees to generate funds and has begun to address immediate infiltration and inflow issues.

In 2000, Genesee began removal of storm water catch basins from downtown areas so they would not discharge into the wastewater collection system. They also installed an influent meter near their wastewater lagoon to better track flows and I/I reduction efforts. Smoke testing was performed in August 2002 to identify inflow sources. As a result of I/I control, as well as dryer weather, the city did not discharge wastewater during July, August, and September in 2001, 2002, 2003. The city also performed a leak test on their existing lagoon in 2002 and found seepage rates between 42,000 and 80,000 gallons per day.

In February 2005, the USEPA issued a NPDES permit to the City of Genesee effective April 2005 allowing discharge year round. The April 2005 permit requires the City to monitor effluent quality as well as receiving surface waters of Cow Creek. Surface water monitoring is being required for temperature, pH, total phosphorus and ammonia. This information can be used in part for determination of a final long term allocation for the wastewater facility.

4.2 Nonpoint Pollution Control Efforts

A variety of agricultural best management practices (BMPs) have been implemented in the Cow Creek watershed through Latah and Nez Perce Soil Conservation Districts efforts and available USDA programs. Erosion control practices, such as conservation tillage, water and sediment control structures, and grassed waterways, are applied to minimize erosion from croplands. Fencing, pasture and hayland management, and grazing management are applied to improve livestock grazing and management.

Currently, there are a few livestock operations in the Cow Creek watershed, but there are no concentrated animal feeding operations (CAFOs) such as feedlots, hog producers, or dairies.

Homeowners outside the Genesee city limits and within the watershed rely on individual septic tanks and drain field systems. The North Central District Health Department (NCDHD) regulates placement and installation of such systems to ensure minimum risk of surface water contamination from failure of septic systems. The NCDHD has no documentation of failing individual subsurface sewage systems that are causing a surface water contamination problem at this time.

5. Total Maximum Daily Load(s)

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

Practically, the MOS is a reduction in the load capacity that is available for allocation to pollutant sources. The natural background load is also effectively a reduction in the load capacity available for allocation to human made pollutant sources. This can be summarized symbolically as the equation: LC = MOS + NB + LA + WLA = TMDL. The equation is written in this order because it represents the logical order in which a loading analysis is conducted. First the LC is determined. Then the LC is broken down into its components: the necessary MOS is determined and subtracted; then NB, if relevant, is quantified and subtracted; and then the remainder is allocated among pollutant sources. When the breakdown and allocation is completed we have a TMDL, which must equal the LC.

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

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

5.1 Instream Water Quality Targets

Diurnal dissolved oxygen concentrations measured in Cow Creek indicate the designated beneficial use of cold water aquatic life is not being fully supported due to excessive nutrients. This section of the TMDL will outline the nutrient load target, the current nutrient load, critical flow periods and the sections of Cow Creek where the nutrient target applies.

Target Selection

Section 2.4 provides a discussion of the relative ratio between nitrogen and phosphorus concentrations found in samples collected from Cow Creek. The ratio shows that TP is the limiting nutrient and if controlled may be used to help manage the quality of water in Cow Creek.

A TP target of 0.1 mg/L was selected based on the watershed's characteristics and the EPA Gold Book, (1986) as opposed to EPA's Ecoregional Criteria (see phosphorus compounds discussion in section 2.4, on page 26). It is hoped that through application of the 0.1 mg/l target, aquatic plant growth in cow creek will be reduced and dissolved oxygen enhanced during the mid to late summer critical low flow period.

Design Conditions

The water quality standards for cold water aquatic life apply to the perennial reach of the creek at flows greater than 1 cfs. Monitoring station CC-1 represents the only reach that has an annual mean flow equal to or greater than 1 cfs for over 8 months of the year and any significant flow after June. Cow Creek becomes intermittent between stations CC-2 and CC-3, typically below CC-2 near its confluence with Calf Creek. Upstream of this point is considered intermittent and Cold Water Aquatic Life Standards will apply at flows greater than 1 cfs.

Nutrient loading begins to increase between the end of May and beginning of June with the decrease in flow. As flow decreases below 1 cfs at the end of June, the TP target value is exceeded and DO levels begin to decrease at the end of July (Figure 9).

During July, August and September flow, temperature and nutrients are affecting instream dissolved oxygen concentrations to a level exceeding state water quality standards. Diminishing flows affecting instream nutrient concentrations appear to begin in June. By the end of August, only CC1 maintains a measurable amount of flow above 0.1 cfs.

Considering the time periods of low flow and the amount of flow present during low flow periods, it is the intent of this TMDL to establish June through September as the critical flow period for application of load allocations and to establish monitoring station CC-1 as a point of measurement for compliance with this TMDL.

If riparian buffers are used to reduce sediment and phosphorus being delivered to the creek, elevated stream temperatures may also be lowered. DEQ will continue to monitor temperature to determine if a temperature TMDL is still necessary.

5.2 Load Capacity

This section describes the approach and results of load capacity and load reduction calculations. Refer to Section 2.4 for a discussion of instream flow and nutrient data used in the loading analysis.

Monthly concentrations were based on averages of measurements undertaken for the development of this TMDL for the calendar dates of April through September 2002. Flow estimates were measured in Cow Creek along with other water quality data (Appendix C). Daily load was estimated by multiplying the measured concentration of the pollutant and the estimated flow. Load capacities were estimated using target concentrations multiplied by the estimated flow (ft^3/sec)(2446575 L/day)(0.1 mg/L)(0.000001mg/Kg). Background loads are included as part of the loading capacity. A margin of safety of 10% was subtracted from the loading capacity to produce an available loading capacity to account for errors (Table 10).

5.3 Estimates of Existing Pollutant Loads

Regulations allow that loadings "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading," (Water quality planning and management, 40 CFR § 130.2(I)). An estimate must be made for each point source. Nonpoint sources are typically estimated based on the type of sources (land use) and area (such as a subwatershed), but may be aggregated by type of source or land area. Table 9 shows the existing TP loads calculated from field data collected at the five monitoring stations during each sampling period. These loads are then averaged for each station to be used in the loading analysis (Table 10).

Margin of Safety

An explicit margin of safety of 10% of the target load was deducted from the load allocation. Since the period of greatest aquatic plant growth and lowest flows was utilized to calculate the loading capacity, the loading capacity reflects a conservative estimate.

Seasonal Variation

The critical flow period for nutrients in Cow Creek is identified in section 5.1 and illustrated in Figure 9. During the July to September period, measured flows decrease significantly, measured TP increases significantly and dissolved oxygen concentrations violate state water quality standards. The TMDL is based on monitoring that has occurred during this time period.

5.4 Load Allocation

Pollutant loads for TP are presented in Table 10. Since specific source loading data is not available, listed loads are comprehensive estimates between each monitoring station. These gross allocations account for all sources, such as storm water runoff, agricultural practices, septic systems, livestock operations, etc. Due to the lack of sufficient data, it was not possible to differentiate natural background conditions from anthropogenic loading. As a result, loading capacities, as they are reported in Table 10, include background conditions. A margin of safety was specifically subtracted from the loading capacity to produce an available load for allocation. Loads to be available for future uses need to be subtracted from the load allocations before the margin of safety is included.

Flow measurements presented in Table 9 taken at CC-2 and CC-3 illustrate an inherent difficulty in collection techniques for flow data measured during periods of extremely low flows (note document cover pictures). Because of the difficulty in obtaining low flow data measurements and the close geographic proximity between stations CC-2 and CC-3, flow data for these two stations were averaged together for the loading analysis presented in Table 10.

There is no instream data available on the actual TP load discharged by the wastewater lagoon. The City of Genesee's Wastewater Facility Plan in June 2004, documents the City's wastewater lagoon is seeping. The seepage rate is estimated at 63,000 gallons per day with calculated phosphorus concentrations of approximately 4.1 mg/l. The total phosphorus flux potential in seepage is calculated to be 0.98 kg/d. Actual discharge volumes to Cow Creek, concentrations of TP in the discharge and, the fate and transport of seepage loss from the lagoon can not currently be documented due to the operational nature of the Genesee wastewater lagoon.

The city of Genesee was issued an NPDES permit by the USEPA in February 2005 becoming effective in April 2005. The permit allows discharge year round and requires water quality monitoring for temperature, pH, total phosphorus and ammonia to be monitored. In the interim, a percent load reduction required to meet the instream load capacity at the compliance point will be applied to all existing loads, including the waste treatment lagoon (Tables 11 and 12).

Several assumptions have been applied to develop a TP waste load allocation for the sewage treatment lagoon for this TMDL. These assumptions may need to be revised later based on information gained through the NPDES permit required monitoring program and a nutrient pathogen study of the wastewater pond seepage on the underlying shallow groundwater. The assumptions are: the three sampling events of TP in the ditch are not representative of effluent being discharged to Cow Creek through subsurface seepage; samples collected from CC-2 are not conclusively representative of effluent being discharged to Cow Creek through subsurface seepage since flow records do not account for an increase of 63,000 gallons per day between CC-3 and CC-2; and lagoon seepage flows down gradient with surface water and ground water towards the west until recharging the creek somewhere between CC-3 and CC-1.

A waste load allocation for the City of Genesee was developed for this TMDL using the information contained in the 2004 City of Genesee's Wastewater Facility Plan, the assumptions listed above, the loading data presented in Table 10 and the following information derived from the loading data presented in Table 10.

Current load occurring between CC-3 and CC-1 = 0.91 kg/d
Allowable load to allocate between CC-3 and CC-1 = 0.56 kg/d
Percent reduction needed from all sources between CC-3 & CC-1 = 38.5%
Current estimated load attributable to the WWTP = 0.98 kg/d
WWTP waste load allocation based on 38.5% required reduction = 0.60 kg/d

Table 9. Existing TP pollutant loads for Cow Creek monitoring sites.

		Mid April	Early May	Late May	Mid June	Early July	Late July	Mid August	Early Sept
CC-5	Flow (cfs)	1.72	0.56	0.24	0.05	0.03	**	**	**
	Measured P (mg/L)	0.22	0.21	0.18	0.10	0.10	**	**	**
	Measured P load (kg/day)	0.93	0.29	0.11	0.01	0.01	**	**	**
CC-4	Flow (cfs)	9.39	3.68	1.90	0.77	0.32	0.10	0.01	0.01
	Measured P (mg/l)	0.18	0.59	0.05	0.07	0.08	0.10	0.17	*
	Measured P load (kg/day)	4.13	5.31	0.24	0.14	0.06	0.02	0.00	*
CC-3	Flow (cfs)	12.62	5.71	2.83	1.51	0.44	0.30	0.04	0.02
	Measured P (mg/l)	0.10	0.06	0.08	0.10	0.21	0.15	0.24	*
	Measured P load (kg/day)	3.09	0.82	0.53	0.37	0.23	0.11	0.02	*
CC-2	Flow (cfs)	12.31	5.02	2.70	1.24	0.47	0.21	0.02	0.02
	Measured P (mg/l)	0.15	0.09	0.12	0.21	0.20	0.25	0.40	*
	Measured P load (kg/day)	4.52	1.06	0.79	0.64	0.23	0.13	0.02	*
CC-1	Flow (cfs)	21.57	10.36	4.81	3.42	1.48	0.82	0.17	0.13
	Measured P (mg/l)	0.12	0.05	0.11	0.14	0.22	0.24	0.19	*
	Measured P load (kg/day)	6.33	1.37	1.29	1.17	0.80	0.48	0.08	*

*Monitoring data not available ** No flow at site

Table 10. Total Phosphorus loads within the Cow Creek subbasin.

Location	Average daily flow (cfs)	Total Load Capacity (Kg/day)	Margin of Safety (Kg/day)	Available LC to Allocate (Kg/day)	Existing Load (Kg/day)
CC-5	0.52	0.13	0.01	0.12	0.19
CC-4	2.02	0.49	0.05	0.44	1.42
CC-3	2.84	0.69	0.07	0.62	0.74
CC-2	2.84	0.69	0.07	0.62	1.05
CC-1	5.35	1.31	0.13	1.18	1.65

Table 11 lists the cumulative watershed load allocation for all activities occurring upstream of the compliance point CC-1.

Table 11. Load allocations for Cow Creek subbasin.

All Sources	Pollutant	Allocation	Time Frame for Meeting Allocations
CC1	Total Phosphorus	1.18 Kg/d	2010

Table 12 lists the interim waste load allocation provided to the City of Genesee wastewater treatment facility.

Table 12. Waste Load allocations for City of Genesee wastewater treatment facility.

Source	Pollutant	Allocation	Time Frame for Meeting Allocations
WWTP	Total Phosphorus	0.60 kg/d	2010

Background

As previously discussed in the target selection section, it was difficult to differentiate natural background conditions from anthropogenic loading, so background has been included with other sources in the gross nonpoint source allocation. The inability to directly measure background conditions has been identified as a data gap, and in the future, it may be possible to determine background with more definitive monitoring techniques.

Reasonable Assurance

The Cow Creek Watershed Advisory Group (WAG) and supporting agencies will produce a TMDL implementation plan. The plan will list projects designed to improve Cow Creek water quality by meeting the load allocations presented in this TMDL document. Implementation of best management practices within the watershed to reduce pollutant loading from nonpoint sources will be on a voluntary basis. The Watershed Restoration Strategy provides a framework for the implementation plan. It lists the types of best management practices the Cow Creek WAG believes will best improve water quality. Example practices include tree and shrub planting, grassed waterways, stream bank stabilization, conservation cropping and tillage practices, prescribed grazing, alternate livestock water supplies, livestock exclusions, animal waste systems, and protected riparian zones.

DEQ recognizes that implementation strategies for TMDLs may need to be modified if monitoring shows that the TMDL goals are not being met or significant progress is not being made toward achieving the goals. As additional information becomes available during the implementation of the TMDL, the targets, load capacity, and allocations may be revisited. In the event that new data or information show that changes are warranted, TMDL revisions will be made with assistance of the Cow Creek WAG. Although specific targets and allocations are identified in the TMDL, the ultimate success of the TMDL is not whether these targets and allocations are met, but whether beneficial uses and water quality standards are achieved.

Reserve

An explicit reserve for future growth has not been set aside within this document. Discharge and loading from future development within the Cow Creek watershed would need to be consistent with the allocations and could not increase TP conditions above the target criteria previously identified.

Construction Storm Water and TMDL Waste Load Allocations

Construction Storm Water

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

The Construction General Permit (CGP)

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

Storm Water Pollution Prevention Plan (SWPPP)

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

Construction Storm Water Requirements

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

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

Remaining Available Load

Because reductions in TP are necessary throughout the Cow Creek watershed, there is no remaining available load. Because growth in this rural area is not anticipated to be substantial, no allocation for future growth has been set aside. Reductions from all sources are necessary to meet loading capacities.

5.5 Implementation Strategies

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

Time Frame

The expected time frame for attaining water quality standards and restoring beneficial use is a function of management intensity, climate, ecological potential, and natural variability of environmental conditions. If implementation of best management practices is funded and pursued, some improvements may be seen in as little as several years.

Approach

It is anticipated that implementation of agricultural best management practices and appropriate treatment of wastewater from the City of Genesee will reduce nutrient sources and improvements will occur to Cow Creek.

The City of Genesee is evaluating the 2004 facility plan to determine the most feasible options to best comply with the load reductions requested by this TMDL. Options being considered include: construction of storage facilities to eliminate discharge during critical flow periods, land application of effluent during critical flow periods, and mechanical or biological treatment of effluent prior to discharge during critical flow periods. The City of Genesee is currently waiting final approval of this TMDL prior to a final determination of the appropriate method to meet the allocated load reduction.

The Cow Creek Watershed Advisory Group supports and encourages adaptive management for nonpoint pollution controls to address nutrient load reductions and dissolved oxygen enhancement instead of application of discharge restrictions through NPDES permits issued to the Genesee wastewater facility. The Genesee wastewater facility is located in Idaho several miles upstream of the TMDL compliance point near the Washington state border. Upgrades to the facility to meet the more restrictive Washington state standard for dissolved oxygen will not be realized at the compliance point near the state line unless nonpoint source and instream conditions downstream of the facility are successfully mitigated first.

The Cow Creek Watershed Advisory Group supports and encourages instream and riparian restoration within the Cow Creek watershed when opportunities present themselves. The Cow Creek Watershed Advisory Group will remain active and engaged in community actions and watershed projects to ensure TMDL implementation opportunities are fully utilized.

Responsible Parties

In accordance with Idaho Code 39-3601 et.al., each watershed advisory group shall generally be responsible for recommending (to the Department) those specific actions needed to control point and nonpoint sources of pollution within the watershed so that, within reasonable periods of time, designated beneficial uses are fully supported and other state water quality plans are achieved.

The designated agencies, in cooperation with the appropriate land management agency and the department, shall ensure best management practices are monitored for their effect on water quality. The monitoring results shall be presented to the department on a schedule agreed to between the designated agency and the Department.

“Designated agency" means the Department of Lands for timber harvest activities, for oil and gas exploration and development, and for mining activities; the Soil Conservation Commission for grazing activities and for agricultural activities; the Department of Transportation for public road construction; the Department of Agriculture for aquaculture; and the Department of Environmental Quality for all other activities.

Monitoring Strategy

The Idaho Department of Environmental Quality is charged with conducting regular and routine water quality monitoring for compliance with Idaho State Water Quality Standards. Total Maximum Daily Loads for state waters are, through reference, state water quality standards. The Department will complete water quality monitoring for determination of compliance with TMDLs.

5.6 Conclusions

A nutrient TMDL in the form of total phosphorus loadings and reductions has been developed for Cow Creek. Nutrient reductions are specified for the watershed, including the City of Genesee Wastewater Treatment Facility and nonpoint source existing loads.

Table 13. Summary of assessment outcomes.

Water Body Segment/ AU	Pollutant	TMDL(s) Completed	Recommended Changes to §303(d) List	Justification
Cow Creek	Nutrients (TP)	Yes	NA	
Cow Creek	Habitat Alteration	No	NA	Pollution vs. Pollutant
Cow Creek	Temperature	No	Remain on list	Defer until more temperature data are collected

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Glossary

305(b)	Refers to section 305 subsection "b" of the Clean Water Act. 305(b) generally describes a report of each state's water quality, and is the principle means by which the U.S. Environmental Protection Agency, congress, and the public evaluate whether U.S. waters meet water quality standards, the progress made in maintaining and restoring water quality, and the extent of the remaining problems.
303(d)	Refers to section 303 subsection "d" of the Clean Water Act. 303(d) requires states to develop a list of 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.
Aerobic	Describes life, processes, or conditions that require the presence of oxygen.
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.
Algae	Non-vascular (without water-conducting tissue) aquatic plants that occur as single cells, colonies, or filaments.
Aquatic	Occurring, growing, or living in water.
Beneficial Use	Any of the various uses of water, including, but not limited to, aquatic biota, recreation, water supply, wildlife habitat, and aesthetics, which are recognized in water quality standards.
Beneficial Use Reconnaissance Program (BURP)	A program for conducting systematic biological and physical habitat surveys of water bodies in Idaho. BURP protocols address lakes, reservoirs, and wadeable streams and rivers.
Best Management Practices (BMPs)	Structural, nonstructural, and managerial techniques that are effective and practical means to control nonpoint source pollutants.

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 (Public Law 92-50, commonly known as the Clean Water Act), as last reauthorized by the Water Quality Act of 1987 (Public Law 100-4), 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).
Community	A group of interacting organisms living together in a given place.
Criteria	In the context of water quality, numeric or descriptive factors taken into account in setting standards for various pollutants. These factors are used to determine limits on allowable concentration levels, and to limit the number of violations per year. EPA develops criteria guidance; states establish criteria.

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

Decomposition — The breakdown of organic molecules (e.g., sugar) to inorganic molecules (e.g., carbon dioxide and water) through biological and non-biological 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. Their presence is often indicative of fecal contamination.

Ecology — The scientific study of relationships between organisms and their environment; also defined as the study of the structure and function of nature.

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

Effluent — A discharge of untreated, partially treated, or treated wastewater into a receiving water body.

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

Ephemeral Stream	A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long continued supply from melting snow or other sources. Its channel is at all times above the water table. (American Geologic 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	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).
Extrapolation	Estimation of unknown values by extending or projecting from known values.
Facultative Lagoon	Ponds in which the stabilization of waters is brought about by a combination of aerobic, anaerobic and facultative bacteria
Fauna	Animal life, especially the animals characteristic of a region, period, or special environment.
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).
Fixed-Location Monitoring	Sampling or measuring environmental conditions continuously or repeatedly at the same location.
Flow	See Discharge.

Fully Supporting	In compliance with water quality standards and within the range of biological reference conditions for all designated and exiting beneficial uses as determined through the *Water Body Assessment Guidance* (Grafe et al. 2000).
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 (EPA 1997).
Geographical Information System (GIS)	A geo-referenced database.
Geometric Mean	A back-transformed mean of the logarithmically transformed numbers often used to describe highly variable, right-skewed data (a few large values), such as bacterial data.
Grab Sample	A single sample collected at a particular time and place. It may represent the composition of the water in that water column.
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 sub-watersheds, respectively.
Hydrologic Unit Code	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.
Influent	A tributary stream.
Inorganic	Materials not derived from biological sources.
Instantaneous	A condition or measurement at a moment (instant) in time.
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.
Interstate Waters	Waters that flow across or form part of state or international boundaries, including boundaries with Indian nations.
Irrigation Return Flow	Surface (and subsurface) water that leaves a field following the application of irrigation water and eventually flows into streams.
Land Application	A process or activity involving application of wastewater, surface water, or semi-liquid material to the land surface for the purpose of treatment, pollutant removal, or ground water recharge.

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

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

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

Loading 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.

Loam Refers to a soil with a texture resulting from a relative balance of sand, silt, and clay. This balance imparts many desirable characteristics for agricultural use.

Loess A uniform wind-blown deposit of silty material. Silty soils are among the most highly erodible.

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

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

Mean Describes the central tendency of a set of numbers. The arithmetic mean (calculated by adding all items in a list, then dividing by the number of items) is the statistic most familiar to most people.

Median The middle number in a sequence of numbers. If there are an even number of numbers, the median is the average of the two middle numbers. For example, 4 is the median of 1, 2, 4, 14, 16; and 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, essentially equivalent to parts per million (ppm).

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

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

National 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 A condition indistinguishable from that without human-caused disruptions.

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 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. 2000).

Not Fully Supporting Cold Water	At least one biological assemblage has been significantly modified beyond the natural range of its reference condition (EPA 1997).
Nuisance	Anything which is injurious to the public health or an obstruction to the free use, in the customary manner, of any waters of the state.
Nutrient	Any substance required by living things to grow. An element or its chemical forms essential to life, such as carbon, oxygen, nitrogen, and phosphorus. Commonly refers to those elements in short supply, such as nitrogen and phosphorus, which usually limit growth.
Nutrient Cycling	The flow of nutrients from one component of an ecosystem to another, as when macrophytes die and release nutrients that become available to algae (organic to inorganic phase and return).
Organic Matter	Compounds manufactured by plants and animals that contain principally carbon.
Ortho-phosphate	A form of soluble inorganic phosphorus most readily used for algal growth.
Oxygen-Demanding Materials	Those materials, mainly organic matter, in a water body which consume oxygen during decomposition.
Parameter	A variable, measurable property whose value is a determinant of the characteristics of a system; e.g., temperature, dissolved oxygen, and fish populations are parameters of a stream or lake.
Pathogens	Disease-producing organisms (e.g., bacteria, viruses, parasites).
Perennial Stream	A stream that flows year-around in most years.
Pesticide	Substances or mixtures of substances intended for preventing, destroying, repelling, or mitigating any pest. Also, any substance or mixture intended for use as a plant regulator, defoliant, or desiccant.
pH	The negative $\log_{10}$ of the concentration of hydrogen ions, a measure which in water ranges from very acid (pH=1) to very alkaline (pH=14). A pH of 7 is neutral. Surface waters usually measure between pH 6 and 9.

Phased TMDL A total maximum daily load (TMDL) that identifies interim load allocations and details further monitoring to gauge the success of management actions in achieving load reduction goals and the effect of actual load reductions on the water quality of a water body. Under a phased TMDL, a refinement of load allocations, waste load allocations, and the margin of safety is planned at the outset.

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

Physiochemical In the context of bioassessment, the term is commonly used to mean the physical and chemical factors of the water column that relate to aquatic biota. Examples in bioassessment usage include saturation of dissolved gases, temperature, pH, conductivity, dissolved or suspended solids, forms of nitrogen, and phosphorus. This term is used interchangeable with the terms "physical/chemical" and "physicochemical."

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.

Pretreatment The reduction in the amount of pollutants, elimination of certain pollutants, or alteration of the nature of pollutant properties in wastewater prior to, or in lieu of, discharging or otherwise introducing such wastewater into a publicly owned wastewater treatment plant.

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

Qualitative Descriptive of kind, type, or direction.

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. The goal of QA is to assure the data provided are of the quality needed and claimed (Rand 1995, 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. QC is implemented at the field or bench level (Rand 1995, 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.

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 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.
Species	1) A reproductively isolated aggregate of interbreeding organisms having common attributes and usually designated by a common name. 2) An organism belonging to such a category.
Stream	A natural water course containing flowing water, at least part of the year. Together with dissolved and suspended materials, a stream normally supports communities of plants and animals within the channel and the riparian vegetation zone.
Stream Order	Hierarchical ordering of streams based on the degree of branching. A first-order stream is an unforked or unbranched stream. Under Strahler's (1957) system, higher order streams result from the joining of two streams of the same order.
Storm Water Runoff	Rainfall that quickly runs off the land after a storm. In developed watersheds the water flows off roofs and pavement into storm drains that may feed quickly and directly into the stream. The water often carries pollutants picked up from these surfaces.
Subbasin	A large watershed of several hundred thousand acres. This is the name commonly given to 4th field hydrologic units (also see Hydrologic Unit).
Subbasin Assessment (SBA)	A watershed-based problem assessment that is the first step in developing a total maximum daily load in Idaho.
Sub-watershed	A smaller watershed area delineated within a larger watershed, often for purposes of describing and managing localized conditions. Also proposed for adoption as the formal name for 6th field hydrologic units.

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

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

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 withinstreambed 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).

Total Maximum Daily Load (TMDL)
A TMDL is a water body's loading capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual bases. TMDL = Loading Capacity = Load Allocation + Waste Load Allocation + Margin of Safety. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several 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 (Greenborg, Clescevi, and Eaton 1995) call for using a filter of 2.0 micron or smaller; a 0.45 micron filter is also often used. This method calls for drying at a temperature of 103-105 °C.

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.

Trophic State — The level of growth or productivity of a lake as measured by phosphorus content, chlorophyll *a* concentrations, amount (biomass) of aquatic vegetation, algal abundance, and water clarity.

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.

Vadose Zone — The unsaturated region from the soil surface to the ground water table.

Waste Load Allocation (WLA) — The portion of receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. Waste load 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 Management Plan	A state or area-wide waste treatment management plan developed and updated in accordance with the provisions of the Clean Water Act.
Water Quality Modeling	The prediction of the response of some characteristics of lake or stream water based on mathematical relations of input variables such as climate, stream flow, and inflow water quality.
Water Quality Standards	State-adopted and EPA-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; ties in to the Idaho Water Quality Standards and GIS information.
Wetland	An area that is at least some of the time saturated by surface or ground water so as to support with vegetation adapted to saturated soil conditions. Examples include swamps, bogs, fens, and marshes.

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Appendix A. Unit Conversion Chart

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Appendix A. Unit Conversion Chart

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 (g) Cubic Feet (ft^3)	Liters (l) Cubic Meters (m^3)	1 g = 3.78 l 1 l = 0.26 g 1 ft^3 = 0.03 m^3 1 m^3 = 35.32 ft^3	3 g = 11.35 l 3 l = 0.79 g 3 ft^3 = 0.09 m^3 3 m^3 = 105.94 ft^3
Flow Rate	Cubic Feet per Second (ft^3/sec)[1]	Cubic Meters per Second (m^3/sec)	1 ft^3/sec = 0.03 m^3/sec 1 m^3/sec = ft^3/sec	3 ft^3/sec = 0.09 m^3/sec 3 m^3/sec = 105.94 ft^3/sec
Concentration	Parts per Million (ppm)	Milligrams per Liter (mg/l)	1 ppm = 1 mg/l[2]	3 ppm = 3 mg/l
Weight	Pounds (lbs)	Kilograms (kg)	1 lb = 0.45 kg 1 kg = 2.20 lbs	3 lb = 1.36 kg 3 kg = 6.61 kg

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

[1] 1 ft^3/sec = 0.65 million gallons per day; 1 million gallons per day is equal to 1.55 ft^3/sec.

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

Appendix B. Cow Creek Monitoring Project Data

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Appendix B. Cow Creek Monitoring Project Data

Table B-1. Cow Creek monitoring project data.

Site ID	Date	Time	D.O.	Temp (Deg C)	pH	Turb-idity	Flow (cfs)	Total P	Total N	NH3	Ortho -P	Specific Conduct-ance	Total Coliform (per 100 mL)	E. Coli	o-P:P
CC-1	4/11/02	0900	10.22	8.3	7.9	12.9	21.57	0.12	11	BDL (<0.10)					0
CC-1	5/2/02	1000	11.3	12	8.5	3.77	10.36	0.054	0.1	BDL (<0.10)	0.017	272.3			0.315
CC-1	5/23/02	0900	11.98	10.6	8.0	4.92	4.81	0.11	4.8	BDL (<0.10)	0.052	361.3			0.473
CC-1	6/13/02	1100	9.93	17.8	7.8	9.05	3.421	0.14	2.0	BDL (<0.10)	0.097	305.1			0.693
CC-1	7/1/02	1115	10.19	16.9	7.6	7.47	1.479	0.22	1.5	BDL (<0.10)	0.16	363.1	2400	56	0.727
CC-1	7/26/02	1000	6.7	18.1	7.6		0.821	0.24	1.0	BDL (<0.10)	0.2	357.1			0.833
CC-1	8/15/02	1000	6.94	15.1	7.7	8.14	0.168	0.19	0.99	BDL (<0.10)	0.15	337.8			
CC-1	9/9/02	1000	9.05	12.4	8.0	14.6	0.132					344.4			
CC-2	4/11/02	1000	11.18	8.2	7.6	13.8	12.314	0.15	12	0.11					0
CC-2	5/2/02	1100	11.53	12	8.8	6.63	5.017	0.086	9.1	BDL (<0.10)	0.04	258.3			0.465
CC-2	5/23/02	1000	12.25	10.9	8.2	6.34	2.703	0.12	5.4	BDL (<0.10)	0.053	396			0.442
CC-2	6/13/02	1200	9.43	18.5	8.0	5.82	1.238	0.21	2.6	0.27	1.14	321.5			0.667
CC-2	7/1/02	1130	10.85	17.2	7.8	5.92	0.472	0.2	2.8	BDL (<0.10)	0.14	381.7	>2400	340	0.7
CC-2	7/26/02	1030	3.94	19	8.2		0.21	0.25	2.7	BDL (<0.10)	0.12	452.9			0.48
CC-2	8/15/02	1100	3.8	16.5	7.4	22.34	0.021	0.4	3.9	BDL (<0.10)	0.046	467.3			
CC-2	9/9/02	1100	2.46	15.1	7.6	56.4	0.018					494.1			
CC-3	4/11/02	1030	11.53	7.7	8.1	10.8	12.622	0.1	12	BDL (<1.10)					0
CC-3	5/2/02	1130	12.02	12.1	8.7	7.28	5.707	0.059	9.1	0.26	0.014	251.8			0.237
CC-3	5/23/02	1130	13.28	11	8.2	4.43	2.825	0.077	5.5	BDL (<0.10)	0.027	346.3			0.351
CC-3	6/13/02	1300	11.2	18.4	8.0	6.66	1.508	0.1	2.8	BDL (<0.10)	0.046	308.9			0.46
CC-3	7/1/02	1200	10.49	17.1	7.6	9.75	0.439	0.21	2.9	BDL (<0.10)	0.13	377.5	>2400	100	0.619
CC-3	7/26/02	1100	4.18	19.3	7.6		0.301	0.15	4.1	BDL (<0.10)	0.093	457.8			0.62
CC-3	8/15/02	1130	4.44	16.5	7.7	14.67	0.04	0.24	6.6	BDL (<0.10)	0.024	503			
CC-3	9/9/02	1145	5.4	13.6	7.6	23.12	0.024					518			
CC-4	4/11/02	1100	13.45	8.4	8.4	10.9	9.386	0.18	12	BDL (<0.10)					0
CC-4	5/2/02	1500	13.1	18	9.5	5.43	3.675	0.59	9	BDL (<0.10)	0.12	258.7			0.203
CC-4	5/23/02	1300	14.58	15.3	8.8	3.98	1.901	0.052	4.5	BDL (<0.10)	0.014	303.4			0.269

CC-4	6/13/02	1400	11.9	25.5	9.1	7.68	0.767	0.074	0.95	BDL (<0.10)	0.017	279.6			0.23
CC-4	7/1/02	1300	14.25	20.3	8.6	4.71	0.317	0.08	0.3	BDL (<0.10)	0.036	273	>2400	84	0.45
CC-4	7/26/02	1145	6.74	21.4	7.7		0.1	0.1		BDL (<0.10)	0.068	302.5			0.68
CC-4	8/15/02	1230	3.21	16.1	7.6	12.25	0.012	0.17		BDL (<0.10)	0.058	327.3			
CC-4	9/9/02	1300	5.24	19	7.9	16.34	0.01			BDL (<0.10)		352.5			
CC-5	4/11/02	1200	12.21	8.9	7.8	22.6	1.721	0.22	7	BDL (<0.10)					0
CC-5	5/2/02	1330	10.28	18.2	8.9	14.4	0.558	0.21	8.3	BDL (<0.10)	0.012	182			0.057
CC-5	5/23/02	1400	12.87	15.5	9.2	24.9	0.244	0.18	5.6	BDL (<0.10)	0.059	214.5			0.328
CC-5	6/13/02	1500	9.89	22.2	8.2	8.16	0.054	0.1	5.2	BDL (<0.10)	0.057	216.9			0.57
CC-5	7/1/02	1400	10.96	17.9	7.8	4.55	0.031	0.096	4.5	BDL (<0.10)	0.05	240.4	>2400	190	0.521
CC-5	7/26/02	1230	No water left at this site												

(all units in mg/L)

Appendix C. Distribution List

Clearwater Basin Advisory Group

Cow Creek Watershed Advisory Group

City of Genesee

Latah County Library District

Lewiston City Library, Tsceminicum Branch

DEQ-State Office

DEQ-Lewiston Regional Office

DEW-Grangeville Satellite Office

Appendix D. Public Comments

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The Department accepted public comment on the draft Cow Creek Subbasin Assessment and Nutrient Total Maximum Daily Load (TMDL) from September 20 through October 31, 2005.

The Cow Creek Watershed Advisory Group provided comment on the draft Cow Creek Subbasin Assessment and Nutrient TMDL during their May 2005 meeting then advised the Department to open the TMDL for public comment. The Department announced a public comment period during the September Clearwater Advisory Group meeting and in the following papers of record:

- The Lewiston Morning Tribune,
- The Moscow Pullman Daily News,
- The Clearwater Progress,
- The Cottonwood Chronicle, and
- The Idaho County Free Press.

A copy of the TMDL was provided to the following groups, individuals, and locations to facilitate public review:

- Clearwater Basin Advisory Group Members,
- Cow Creek Watershed Advisory Group Members,
- The Mayor of the City of Genesee,
- The Latah County Library,
- The Lewiston City Library,
- The DEQ-State Office,
- The DEQ-Lewiston Regional Office, and
- The DEW-Grangeville Satellite Office.

A news release was disseminated to area news media and posted to DEQ Web site: http://www.deq.idaho.gov/Applications/NewsApp/shownews.cfm?event_id=1295.

The document was posted on the web page: http://www.deq.idaho.gov/water/data_reports/surface_water/tmdls/cow_creek.cfm

Comments were received from:

- Gregg N.Teasdale, Teasdale Environmental Associates, PO Box 446, Genesee, Idaho 83832;
- Bill Dansart, Idaho Soil Conservation Commission, 220 E. 5th St. Room 212-C, Moscow Idaho 83843; and
- Ken Stinson, Latah Soil and Water Conservation District, 220 E. 5th St. Room 212-A, Moscow Idaho 83843.

Comment
Has IDEQ determined that a 0.1 mg/L concentration has a reasonable expectation of protecting beneficial uses by preventing excessive aquatic plant growth in Cow Creek or similar agricultural streams? The 0.1 mg/L value appears to have originated in the U.S. Environmental Protection Agency publication, Quality Criteria for Water 1986 , based on work by Mackenthun in 1973. This publication, and a newer USEPA publication were cited in the draft TMDL, but were not included in the list of references.

Response
Reference to these guidance documents for nutrient TMDL targets is consistent with other nutrient TMDLs developed by the Department of Environmental Quality and our cooperative state and federal agency partners, the Nez Perce Tribe, and our watershed advisory groups. We do seek and will continue to seek other references as they become available and acceptable for application in TMDLs. The publication has been added to the list of references.

Comment
I believe that additional justification for adopting the 0.1 mg/L criteria should be included in a mixed source TMDL document to be reviewed by USEPA. It would be costly and frustrating to the residents of Genesee if, when faced with poor nonpoint source BMP implementation in the Cow Creek drainage, the City of Genesee was forced to construct expensive nutrient removal wastewater treatment facilities only to realize no improvement in the status of beneficial uses because of irreducible contributions of phophorus from agricultural runoff and stream bank sediment.

Response
The Department agrees with your concern for the City of Genesee to be required TMDL reductions through EPA's NPDES permit only to realize no improvement in the creek's beneficial uses because of the lack of reduction from the agricultural sources in the watershed.

The Lewiston DEQ TMDL staff has participated in numerous discussions with the Cow Creek Watershed Advisory Group, which includes representatives from the City of Genesee as well as the agricultural community and the state and federal agencies responsible for assisting agricultural producers, in meeting the TMDL requirements. The nutrient load allocation and the associated 38.5% total phosphorus load reduction required by the TMDL are applied throughout the watershed and do not discriminate between point and nonpoint sources. The reduction applies to all sources within the watershed including the agricultural sources you are concerned about.

The advisory group addresses the concern you raise in the implementation strategy included in Section 5.5 of the TMDL. Section 5.5 states that the Cow Creek Watershed Advisory Group supports and encourages adaptive management for nonpoint pollution controls to address nutrient load reductions and dissolved oxygen enhancement instead of application of discharge restrictions through NPDES permits issued to the Genesee wastewater facility.

The Latah and Nez Perce Counties Soil Water Conservation Districts, with the support of the Cow Creek Watershed Advisory Group, the Clearwater Basin Advisory Group, and the DEQ, have applied and have received Clean Water Act Section 319 Grant funds from the US EPA to offset financial costs acquired by agricultural producers in the watershed to implement the recommended best management practices deemed necessary to meet the nutrient reductions requested. We anticipate the Districts will execute the grants successfully as they have with similar projects in the in the past.

Comment
I was recently asked to produce a map outlining the Cow Creek Watershed. As I started digitizing the Cow Creek Watershed outline using the 1:24000 topographic map as a base, it became apparent that Cow Creek Watershed as delineated in the TMDL figures and described in the text is incorrectly drawn. If one examines the Uniontown and Genesee USGS 7.5 minute topo quadrangles, it is clear that Union Flat Creek has its headwaters in Idaho and flows across the state boundary into Washington, with Cow Creek draining into Union Flat Creek approximately 0.9 stream miles east of the state boundary. Cow Creek does not become Union Flat Creek in Washington as indicated in the TMDL. Since Cow Creek is not interstate water, do Washington water quality standards have to be met?

Response
Applicable watershed boundaries for the TMDL using the Idaho water quality standards identification methodology is presented in Table 4 of this document, headwaters to WA border, encompassing the portion of Union Flat Creek mentioned. Identification and delineation of assessment units for purposes of application of the state of Idaho's water quality standards are explained in Section 2.1 of the document. The Water Body Assessment Guidance II explains the Idaho Water Body Identification (WBID) System and assessment unit (AU) structure. The Cow Creek WBID (17060108CL001), as described in the Idaho water quality standards, includes Thorn Creek, Cow Creek, and Union Flat Creek.

Comment
April 11 through Sept 9, 2002 was chosen as the averaging period for estimating TMDL load information. Since the critical flow period the TMDL is intended to manage is between July and September (p. xv), wouldn't it make more sense to use late June to September for the averaging period? The monitoring data indicates DO values for April and early May didn't drop below 10 mg/l at any monitoring site; in fact, DO values don't fall below 9 mg/l until mid-July, when flows are significantly below 1 cfs.

Response
The averaging period was chosen relative to the aquatic vegetation growth season. Nuisance aquatic plant growth can result from factors other than flow, for example excessive nutrients, light, or temperature (page 18).

Comment
Shouldn't agricultural water supply be included among the list of designated beneficial uses for all waters in the state?

Response
Yes. Section 1.1 has been revised to reflect industrial and agricultural water supply, wildlife habitats, and aesthetics are designated beneficial uses for all water bodies in the state.

Comment
The last sentence of Section 2.2 Existing Uses does not appear to support the section unless it includes reference to salmonid spawning actually occurring after Nov 28, 1975 but prior to dams blocking migration.

Response
Agreed, the sentence has been changed. This is language included in DEQ's TMDL program template version IV, 2004, and should be revised during its next revision.

Comment
The words "hydrogeologic" should be one word. Replace "in stream" with "instream." "Nonpoint" needs to be spelled consistently.

Response
A search of the document has been made of Hydrogeologic, instream, nonpoint, and wastewater, to ensure proper spelling.

Comment
Shouldn't the Latah and NezPerce SWCD's be recognized as parties involved in TMDL implementation?

Response
Section 5.5 Implementation Strategies describes the direction provided by Title 39 Chapter 36 of the Idaho Administrative Code for implementation of TMDLs.

Comment
Should gravel mining be considered a primary nonpoint source given current activities within the watershed?

Response
Gravel mining is not considered a primary nonpoint source within the watershed.

Comment
There should be a reference to the approved 1998 303(d) list, if this is still the official list. Readers may assume a more recent list is being referenced since the publication date of this TMDL will probably be 2005. Has the 2002 303(d) list been approved by EPA?

Response
This is language included in DEQ's TMDL program template version IV, 2004 and should be revised during its next revision. The status of the 2002 303(d) list is not known at this time.

Comment
Review spelling of July in paragraph 3 on page 5.

Response
The spelling of July has corrected in paragraph 3 on page 5.

Comment
It may be very useful to clarify the difference between beneficial, existing, designated and presumed uses. Page 3 of the document identifies five “beneficial uses.” Table 5 identifies only two “beneficial uses.” Upon reading the description between designated and presumed uses, a reader may conclude Table 5 actually identifies cold water aquatic life and secondary contract recreation as “presumed uses” and not “designated uses.”

Response
Table 5 has been revised to include five beneficial uses. The language used to describe designated and presumed uses is included in DEQ’s TMDL program template version IV, 2004 and should be revised during its next revision.

Comment
What is an example of surveillance versus monitoring? How would surveillance be used to address sediment? This question may be very relevant given the statement in paragraph 2, line 8 specifically addressing suspended sediment from nonpoint source activities.

Response
The terms surveillance and monitoring are complimentary in this application rather than comparative; surveillance is synonymous with observation and monitoring with examining. This language is contained in the Idaho Administrative Code for the State Water Quality Standards and is included in DEQ’s TMDL program template version IV, 2004. It may be revised in the future.

Comment
Since the Table 6 highlights Idaho water quality standards related to Cow Creek, and salmonid spawning is neither a designated use nor an existing use for Cow Creek, the salmonid spawning column of Table 6 is probably not necessary. What might be necessary is Washington State’s salmonid spawning standards since Idaho must also meet these standards.

Response
The Table 6 is included in DEQ’s TMDL program template version IV, 2004. It may be revised in the future. Dissolved oxygen is the Washington State water quality standard considered the most applicable target for the nutrient TMDL.

Comment
Since Table 5 highlights Secondary Contact Recreation as a “designated beneficial use,” is it necessary to highlight primary contact recreation in Table 6? Individual readers may go to Table 6 and interpret all four designated and existing beneficial uses as applicable to Cow Creek. Table 6 may be more useful to the reader if only the applicable standards where

highlighted in this table. From a casual reader's perspective, the document may flow better if Figure 2 was transferred to an appendix. Replace anthropogenic with a more reader friendly phrase. This document should be designed for the affected parties (e.g., landowners). A statement summarizing the rationale for increased orthophosphate percentages in impaired systems would be useful for addressing implementation strategies for nutrient reductions. What can be done to an "impaired" system to lower phosphate levels? Replace the word "detritus" with a word or phrase more intuitive to the reader (e.g., plant debris, fragments). It might be worth defining how the State defines "normal" algal growth versus "excessive". When can the casual observer determine if algal growth is excessive? Can excess be determined visually?

Response
Good suggestions; however, the language used is from the DEQ TMDL program template version IV, 2004; it may be revised in the future.

Comment
It may be worth noting the significance and applicability of water quality standards, if any, of flows dropping below a minimum flow. Is there a minimum flow when water quality standards may not apply?

The water quality standard application for flows below 1 cfs on perennial reaches should be footnoted on page 23, paragraph 1 when the document begins referencing flows less than 1 cfs. This footnote would allow the reader to understand the significance of a flow < 1cfs when introduced to flow characteristics on page 23.

It appears that cold water aquatic life standards apply equally to perennial and intermittent reaches when the flow is greater than 1 cfs. If this is true, why differentiate between reaches? If it is not true, an explanation is needed to describe how cold water aquatic life standards vary between perennial and intermittent reaches for flows less than 1 cfs and/or greater than 1 cfs.

Given the statements in paragraph 4 on this page, is it significant that the TP target value is exceeded when flows go below 1 cfs? CC-1 is the only location where the water quality standards may apply for cold water aquatic life since some of the stations go below 1 cfs early in the year before the "critical flow period." For example, if the flows referenced on p. 24 hold true, the TMDL would not apply to CC-5 since the flow goes below 1 cfs in late April, and would only apply to others for a few weeks until flow drop. CC-1 would only be affected by the TMDL until mid-July when flows drop below 1 cfs. It appears during most of the "critical flow period," only station CC-1 will be affected since the majority of the other stations, although TP exceeds the target of 0.1 mg/l, will maintain flows less than 1 cfs.

Response
Application of Idaho's numeric water quality standards for aquatic life applies to all perennial waters. Application of Idaho's numeric water quality standards for aquatic life applies to intermittent waters when flows are greater than 1 cfs. Table 6 does not include

flow. Table 6 is from the DEQ TMDL program template version IV, 2004. It may be revised in the future. Application of standards relative to flow is explained in Section 5.1 on page 38. Section 5.1 includes a discussion of how known flow rates have led to the development of this watershed TMDL and a gross load allocation upstream of the compliance point CC-1.

Comment
An explanation should be given regarding the difference in flows above and below the outfall. The reasoning is not intuitive.

Response
An explanation for the difference in flow above and below the outfall is unknown has not been determined. The data is considered since it appears consistently relative to downstream measurements. A sentence has been added to qualify the measurements.

Comment
CC3 in Figure 5 is difficult to see when printed in yellow. It will probably not be visible when photocopied.

Response
Agreed.

Comment
Paragraph 5 on page 25 could use a closing sentence or paragraph summarizing the significance, if any, of the nitrate levels in springs and wells regarding TMDL implementation strategies and/or public health. Cow Creek is a groundwater nitrate priority area.

Response
Elevated NO2+NO3-N concentrations were measured in several samples collected and the information is provided. No significance is inferred.

Comment
A theory for the CC4 spike on 5/02/02 should be given. Without the presentation of possible explanations, the reader may be left to conclude it may be a data collection or recording error.

Response
No explanation is known. The document has been revised to state the data met the project's quality assurance objectives and therefore there is no justification to remove the value from the data set at this time.

Comment
What is the significance of the last paragraph on page 28 to the TMDL? A reader could make the argument that ortho-phosphorus levels within the surface waters of Cow Creek are near natural conditions (i.e., groundwater conditions) if they ranged up to 0.17 mg/l and/or had a mean value of 0.055 mg/l.

Response
Agreed, considering the range may also be spatial and temporal.

Comment
Replace “wheat” with “agricultural” in the third paragraph of page 33. More than wheat is grown within the watershed. Is any consideration given to rural and urban residential home sites with regard to nonpoint source contributions (e.g., lawn fertilization)?

Response
The reference to wheat has been revised. The document has also been revised to state residential lawn fertilizer may be a nonpoint source in the watershed.

Comment
Define I/I issues at this first reference on page 35, paragraph 3.

Response
The text has been revised.

Comment
Has NCDHD undertaken an inventory of drain field systems and documented no failing systems, or no failing systems have been reported?

Response
The North Central District Health Department issues permits for drain field systems and requires mitigation of failed systems when known. We recognize the potential for drain field systems to be a nonpoint source within the watershed and have included drain field systems as a potential nonpoint source within the document.

Comment
Is the list of designated beneficial uses exhaustive in the first paragraph of page 38 when it identifies only cold water aquatic life and secondary recreation? According to page 3, there are other designated beneficial uses for all water bodies. The reference to designated beneficial uses on page 38 should be comprehensive and include all designated beneficial uses since it is at the beginning of the TMDL section.

Response
The text has been revised to clarify the beneficial use impacted by the nutrient loadings the TMDL is attempting to manage.

Comment
There needs to be a link developed between lowered phosphorus reductions and lower stream temperatures. Phosphorus reductions could be developed through decreased sheet and rill erosion and decreased fertilization. It is unclear how this will lower stream temperatures.

Response
The document has been revised to state that if riparian buffers are used to reduce sediment and phosphorus being delivered to the creek, elevated stream temperatures may also be lowered.

Comment
Is a 10% margin of safety required, or is the rate determined at the discretion of DEQ? The rationale for the 10% should be referenced.

Response
A margin of safety is required. A 10 % margin of safety is suggested in EPA and DEQ guidance.

Comment
It would be worthwhile to the reader to see how total load capacities were calculated, especially for CC-1. A narrative summation is given in Section 5.2, but showing the actual calculation would be worthwhile as a footnote to Table 10. It does not appear that the document identifies the formulation of the load capacities for each location. This formulation is needed to allow the reader to follow the process for determining allocations at each site. It is not clear what level of reduction is needed either within the watershed, as a whole, or from each source (point v. nonpoint). A reader should be able to go to a single table reference and review the TP reductions needed. One interpretation of the information provided on Table 11 is a total load for the entire watershed (point and nonpoint). The wastewater treatment plant has a load allocation of 0.60 kg/day. If the subbasin load for all sources is 1.18 kg/d, the conclusion for nonpoint is a load allocation of 0.58 kg/d. If this is a correct assumption, this allocation is not identified.

Response
Load capacity = (ft^3/sec)(2446575 L/day)(0.1 mg/L)(0.000001mg/Kg) = Kg/day, has been added to the narrative summation. Table 10 identifies load capacities and existing loads for each station. Load allocations are not provided for each station. They are provided instead at the point of compliance because of watershed flow characteristics as is explained in Section 5.4. Based on the 38% load reduction needed for the entire watershed (point and nonpoint sources) at the compliance point CC-1, a load allocation is given to the Genesee Wastewater Treatment Facility calculated from its existing estimated load because the EPA National Pollution Discharge Elimination System (NPDES) program requires a load allocation for permits issued in the watershed.

Comment
Clarification is needed regarding the role, authorities and resources available to the WAG for the development of the TMDL implementation plan. Is DEQ responsible for the implementation plan? Will DEQ coordinate through the WAG and “supporting agencies”? What happens with the implementation plan if the WAG dissolves or becomes inactive? Fully identify ISCC as the Idaho Soil Conservation Commission. IASCD is the Idaho Association of Soil Conservation Districts and, in general, IASCD does not provide strategies for nonpoint source implementation. IASCD has been monitoring water quality with the

Idaho State Department of Agriculture (ISDA). The entities that should be referenced for nonpoint source issues include ISCC, Latah and Nez Perce Soil Water Conservation Districts and the USDA Natural Resources Conservation Service (NRCS). It is an overstatement to say IASCD, ISCC and IDA are responsible for implementing the TMDL. It has not been clearly stated within this document who will formally develop the TMDL Implementation Plan, implement the identified nonpoint strategies within the plan, etc. ISCC has a formal role with respect to agriculture practices and the conservation districts are the primary entities, not IASCD, for developing proposals and programs designed to implement nonpoint source BMPs on agriculture lands. ISCC's formal relationship to TMDLs needs to be referenced. In addition, these references need to be added to the Abbreviations, Acronyms, and Symbols list on p. ix.

The document needs a reference to the Watershed Restoration Strategy. What and where is this document? Modification to the implementation strategy may be required if monitoring indicates faster than anticipated progress occurs with regarding to meeting the TMDL and/or water quality standards change.

Response
Section 5.5 Implementation Strategies which lists responsible parties has been revised to reflect the direction provided by Title 39 Chapter 36 of the Idaho Administrative Code for implementation of TMDLs..

DEQ-90, TM64, 22069, 03/05
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