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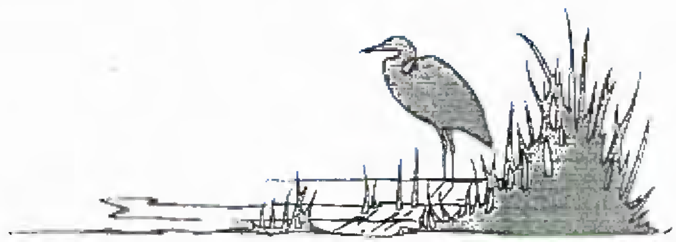

The Upper Snake Rock Watershed Management Plan

(or Upper Snake/Rock Creek Watershed Management Plan)

The Upper Snake Rock Subbasin Assessment

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The Upper Snake Rock Total Maximum Daily Load

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FINAL PLAN SUBMITTED TO USEPA
December 20, 1999

PREPARERS AND CONTRIBUTORS

The Middle Snake River Technical Advisory Committee of the Middle Snake River Watershed Advisory Group (WAG) was instrumental in the preparation of the Upper Snake Rock Subbasin Assessment (or SBA) and in providing technical comments on the total maximum daily load (TMDL) development portion. The SBA was prepared by the principle writer, Dr. Balthasar B. Buhidar, Ph.D., who wrote it to satisfy the Idaho Division of Environmental Quality's Suggested TMDL Outline. Maps and figures were prepared by Rob Sharpnack, Idaho Division of Environmental Quality (IDEQ)-Twin Falls Regional Office (-TFRO).

A Preliminary Draft No. 1 was prepared for internal IDEQ-TFRO and IDEQ-Central Office Boise beginning April 30, 1998. From comments received with additional extensive research, a Public Review Draft No. 1 was prepared on June 17, 1998 and presented to the Middle Snake River Technical Advisory Committee (TAC). Preliminary comments from the TAC were solicited and due by July 2, 1998, with additional comments received by July 15, 1998. A presentation was made to the Middle Snake River WAG on July 15, 1998 with a solicitation of comments from the WAG. A presentation was also made to the Upper Snake Basin Advisory Group (BAG) on August 5, 1998 with a solicitation of comments from the BAG. These comments were incorporated into Public Review Draft No. 2 on September 1, 1998. With additional comments coming from the TAC, the WAG, and the BAG, and additional research conducted, a Public Review Draft No. 3 was prepared on September 18, 1998. This draft was forwarded one more time to IDEQ-Central Office Boise for a second review. Their review was finished on December 18, 1998. All comments, where appropriate, were incorporated into a Proposed Final Draft, dated December 31, 1998. The final proposed draft was presented to the TAC and the WAG on February 17, 1999. Minor corrections and updating of information occured on April 30, 1999. The Upper Snake BAG received a similar presentation on October 6, 1999. The proposed final draft was completed on October 25, 1999. A 30-day public comment period followed beginning November 1, 1999. Submission to USEPA-Boise was December 20, 1999 (tentative).

The subbasin assessment was intended to be iterative during the TMDL development phase, so that the assessment and the final TMDL would complement each other when final submittal to USEPA-Boise/Seattle occurred. Preliminary final TMDL development was intended to be finished by August 31, 1999, allowing four additional months for legal review and biopolitical assessment.

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ACRONYMS AND GLOSSARY

The acronyms and glossary used in this document are summarized in the following list. The list is only inclusive for those terms used in this subbasin assessment and TMDL development.

TERM	DEFINITION
Acute toxicity	The ability of a substance to cause poisonous effects resulting in severe biological harm or death soon after a single exposure or dose.
ArcView™	ArcView is a computer Windows based program made by Environmental Systems Research Institute, Inc. (ESRI) for the creation of GIS-type maps.
Biopolitics	The integral relationship between the human institution of politics and the natural elements of the environment, such that no matter how scientific or technically correct certain processes or guidelines may seem, they are without foundation until accepted and established through the existing political system.
BSU	Boise State University (Boise, Idaho)
BURP	Beneficial Use Reconnaissance Project of IDEQ.
Ephemeral Stream	A stream which functions as a drainage channel which is normally dry but carries water in response to storms or annual snowmelt. There is no IDAPA definition. USBLM describes ephemeral streams as streams which last for brief periods of time. Many ephemeral streams do not appear on USGS maps as blue lines.
Epiphyte	Plants living on another plant or partly within the plant but nonparasitically, deriving its nutrients from the air, water, or debris accumulating around it.
GIS™	Geographic Information System (by ArchView)
HUC	Hydrologic Unit Code (USGS designation)
HUC 3rd Field	Basin hydologic unit (made up of several subbasins)
HUC 17040212	Upper Snake Rock Subbasin (8 digit HUC)
HUC 4th Field	Subbasin hydrologic unit
HUC 5th Field	Watershed hydrologic unit (a sub component of 4th Field HUCs)
HUC 6th Field	Subwatershed hydrologic unit (a sub component of 5th Field HUCs)
IDA	Idaho Department of Agriculture
IDL	Idaho Department of Lands
IDEQ	Idaho Division of Environmental Quality
IDFG	Idaho Department of Fish and Game
ISCC	Idaho Soil Conservation Commission

TERM	DEFINITION
ISU	Idaho State University (Pocatello, Idaho)
IDWR	Idaho Department of Water Resources
Intermittent Stream	IDAPA 16.01.02.003.50 defines intermittent stream(s) as "a stream which has a period of zero flow for at least one week during most years. Where flow records are available, a stream with a 7Q2 hydrologically-based design flow of less than one-tenth (0.1) cfs is considered intermittent. Streams with perennial pools which create significant aquatic life uses are not intermittent." USBLM describes intermittent streams as streams which have periodic interruptions in a normal pattern or process. USDA FS describes intermittent streams as streams in contact with the ground water table that flow only certain times of the year, such as, when the ground water table is high or when it receives water from springs or from some surface source such as melting snow in mountainous areas. It ceases to flow above the streambed when losses from evaporation or seepage exceed the available streamflow (USDA FS 1997d).
IWRRI	Idaho Water Resources Research Institute is an institute of the University of Idaho (Moscow) with offices statewide. One of those offices is at the Kimberly Research and Extension Center in Kimberly, Idaho.
LA	Load allocations for nonpoint source industries.
LC	Load Capacity = TMDL = Assimilative Capacity = WLA + LA + MOS
Man-made water body	IDAPA 16.01.02.003.57 defines man-made waterways as "canals, flumes, ditches, and similar features, constructed for the purpose of water conveyance." In Upper Snake Rock there are many natural stream drainage channels which have been converted into man-made waterways.
Mid-Snake	This is commonly used to mean Middle Snake River and implies the Middle Snake River Reach (or Mid-Snake Reach) from Milner Dam to King Hill, Idaho.
Mid-Snake TAC	Middle Snake River Technical Advisory Committee
Mid-Snake WAG	Middle Snake River Watershed Advisory Group
MOS	Margin of Safety in a TMDL
Nonpoint Source	Any unconfined and diffuse source of contamination, such as stormwater or snowmelt runoff, or atmospheric pollution. Legally, a nonpoint source of water pollution is any source of water pollution that does not meet the definition of "point source" in section 502(14) of the Clean Water Act. (USEPA 1997k [p. xii])
NPDES	National Pollutant Discharge Elimination System. Represents the USEPA permitting process used for point sources.
NRCS	Natural Resources Conservaton Service

TERM	DEFINITION
Perennial Stream	A stream which flows year-round in most years. There is no IDAPA definition. USBLM describes perennial streams as streams which have uninterrupted flow from year to year. USDA FS describes perennial streams as streams that flow continuously throughout the year (permanently) (USDA FS 1997d).
Point Source	Any discernable, confined or discrete conveyence (pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation (CAFO), or vessel or other floating craft from which pollutants are or may be discharged. (USEPA 1997k)
Primary nutrient	A biological and chemical term used to denote nitrogen, phosphorus, and potassium. The term is used as a subcomponent of macronutrients and does not include micronutrients. Primary nutrients are the most common and most abundantly used in fertilizer recommendations.
QA/QC	Quality Assurance/Quality Control
SBA	Subbasin Assessment
SCC	Soil Conservation Commission (the equivalent of ISCC)
SCD	Soil Conservation District
Secondary nutrient	A biological and chemical term used to denote calcium, magnesium, and sulfur. The term is used as a subcomponent of macronutrients and does not include micronutrients or the primary nutrients. In more recent years, the term has come to include micronutrients because they are used less in comparison to the primary nutrients.
Sediment	TSS = a procedural definition used for solids that do not pass a filter of 2.0 μm (Standard Methods, 20th Edition). Suspended Sediment = the sediment that is maintained in suspension by the upward components of turbulent currents or that exist in suspension as a colloid (USGS). Sediment = solid material that originates mostly from disintegrated rocks and is transformed by, suspended in, or deposited from water; it includes chemical and biochemical precipitates and decomposed organic material such as humus (USGS)
Suspended sediment	See Sediment.
TFRO	Twin Falls Regional Office
TMDL	Total maximum daily load. The standard formula for a TMDL is: TMDL = Loading Capacity = Assimilative Capacity = Point Source Wasteloads + Nonpoint Source Loads + Margin of Safety.

TERM	DEFINITION
Total Suspended Solids	See Sediment.
UI or U of I	University of Idaho (Moscow, Idaho)
Upper Snake BAG	Upper Snake Basin Advisory Group
USBLM	United States Bureau of Land Management
USDA/ARS	United States Department of Agriculture/Agriculture Research Service
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WLA	Wasteload allocations for point source facilities.

THE UPPER SNAKE ROCK SUBBASIN ASSESSMENT for SURFACE WATERS of HYDROLOGIC UNIT CODE 17040212

EXECUTIVE SUMMARY

UPPER SNAKE ROCK SUBBASIN AT A GLANCE	
Hydrologic Unit Code:	*17040212*
1996 Water Quality Limited Segments:	*16 tributaries, 5 reservoirs, 10 segments on the Middle Snake River*
Beneficial Uses Affected:	*Cold water biota, salmonid spawning, primary contact recreation, secondary contact recreation*
Pollutants of Concern:	*Sediment, nutrients, ammonia, pathogens, pesticides, oil & grease*
Stressors of Concern:	*Dissolved oxygen, flow alteration, thermal modification, temperature*
Major Land Uses:	*54% Rangeland & 41% Agriculture*
Area:	*2438 square miles or 1,536,880 acres*
Population (Year 2000):	*About 85,000 in the subbasin*

1.0 EXECUTIVE SUMMARY

The *Upper Snake Rock Subbasin Assessment (SBA) for Surface Waters of Hydrologic Unit Code (HUC) 17040212* and the *Upper Snake Rock Total Maximum Daily Load (TMDL)* describes those waterbodies that are listed on the 1996 §303(d) list of the federal Clean Water Act that are not meeting their beneficial uses or State water quality standards within HUC 17040212. Inclusively they are called *The Upper Snake Rock Watershed Management Plan*, of which sections 2.0, 4.0, and 5.0 encompass the subbasin assessment, and section 3.0 is the TMDL development section. The SBA is not a TMDL, but rather provides information that may be used in the development of TMDLs for these water quality limited water bodies based on pollutants described in the §303(d) list. It describes the affected subbasin (as a 4th field HUC), the water quality concerns and status of beneficial uses of individual waterbodies, the nature and location of pollution sources, and a summary of past and ongoing pollution control activities (IDHW 1998). The development of a typical "subbasin TMDL" is idealized as a 22-month process: the first ten months focusing on preparing the SBA and the following year spent on developing the TMDL itself (IDEQ 1998a). Once approved by USEPA the water user industries have 18 months to develop implementation plans which are coordinated by IDEQ and eventually submitted to USEPA.

This assessment was prepared as a collaborative effort between Idaho Division of Environmental Quality (IDEQ)-Twin Falls Regional Office (TFRO, who prepared the document), IDEQ-Central Office (who reviewed the document for statewide consistency and legal review), and the Middle Snake River Technical Advisory Committee (Middle Snake TAC or Mid-Snake TAC, who provided technical review comments). Additionally, the Middle Snake River Watershed Advisory Group (Middle Snake WAG or Mid-Snake WAG) and the Upper Snake Basin Advisory Group (Upper Snake BAG) provided comments.

Over 95% of Upper Snake Rock is a Snake River Basin/High Desert ecoregion such that: (1) Its topography consists of tablelands with medium to high relief; (2) Its vegetation is made up predominantly of a sagebrush-grass zone with minimal riparian vegetation in the Middle Snake River or its tributaries; (3) Its land use is 54% desert shrublands (of which grazing is a major activity) and 41% agricultural land (both irrigated and dryland); (4) Its soils are 87% Aridisols and 13% Mollisols, of which 37% are from loess while 63% contain residium, colluvium, and alluvium. The loessal portion is a type of soil structure more susceptible to water and wind erosion, particularly when vegetation cover is removed. Less than 5% of Upper Snake Rock is a Northern Basin and Range ecosystem (predominantley in the forested areas of the Mount Bennett Hills and the Sawtooth National Forest) such that: (1) Its land form is that of plains with low to high mountains which have open high mountains; (2) Its vegetation is a great basin sagebrush saltbush and greasewood; and, (3) Its land use is a desert shrubland which is grazed and comprises 3% of the total land use.

The SBA describes Upper Snake Rock as having 16 tributaries, 5 reservoirs, and 10 Middle Snake River segments (or a total of 31 waterbody segments) which are water quality limited (based on the 1996 303(d) list), thus requiring the development of a TMDL. Previous to this, the Billingsley Creek TMDL (in 1992) for total phosphorus from aquaculture facilities, and the Mid-Snake TMDL (IDEQ 1997b) for total phosphorus for point and nonpoint source industries were drafted and approved by the USEPA. This SBA is but a continuation of the TMDL process in Upper Snake Rock so that all water quality limited streams and their associated pollutants are brought into the TMDL development process. The point sources include the National Pollutant Discharge Elimination System (NPDES) permitted facilities: aquaculture, food processors, municipalities, and industrials. The nonpoint source industries include: FERC permitted hydroelectric impoundments and generation; confined feeding operations and confined animal feeding operations; agriculture; grazing; forestry; recreation; urban runoff/storm sewers; construction; and hydrologic modification.

The SBA attempts to describe the most current conditions of the water quality limited waterbodies in the subbasin, as well as provide supporting documentation for the various loading elements per tributary at their confluence with the Middle Snake River. Additionally, a summary of past/present pollution control efforts are presented, including the current NPDES permits being developed for point sources in the subbasin. FERC permits for Bliss, Shoshone Falls, Upper Salmon Falls, and Lower Salmon Falls dams are also discussed.

A *Trend Monitoring Plan* has been developed by IDEQ-TFRO and the Middle Snake TAC to determine water quality trends in Upper Snake Rock. This is included as an appendix to the SBA. Additional monitoring by point source industries as required by their NPDES permits is also discussed. Nonpoint sources will monitor as defined in their industry plans and the Middle Snake River TMDL (or Mid-Snake TMDL) (IDEQ 1997b). An additional monitoring plan will be developed for the tributaries in the subbasin during plan implementation.

In general, the Middle Snake River and all its tributaries are impacted by runoff from irrigated crop production, rangeland, pastureland, animal holding areas, feedlots, dredging, hydro-modification (as defined in *40 CFR 131.10(g)*), and urban runoff. Natural springs (such as Crystal Springs, Clear Springs, Niagara Springs) have exhibited hydro-modification and streambank modification from activities relating to sedimentation and siltation, aquaculture, hydropower, irrigated crop production, and land development. The Middle Snake River is a managed water system where *normal* flow regimes (such as spring flush) are no longer present. As a consequence, the absence of the *normal* flow regimes allows for sediment to accumulate which in turn exacerbates the growth of aquatic macrophytes during low flow years.

Applicable designated beneficial uses include agricultural water supply, domestic water supply, industrial water supply, cold water biota, salmonid spawning, primary and secondary contact recreation, wildlife habitats, and aesthetics (which is satisfied by IDAPA 16.01.02.250.05 for general surface water quality criteria which the TMDL addresses through the NPDES permitting program and self-imposed BMPs). At present, those designated beneficial uses not being met include cold water biota, salmonid spawning, primary and secondary contact recreation in some tributaries. Applicable state water quality standards to support these beneficial uses include waters being free of deleterious materials; floating, suspended, or submerged matter; excess nutrients; oxygen-demanding materials; and, sediment. At present, these standards are not being met in some tributaries and certain segments of the Middle Snake River.

In order to better define narrative standards in State water quality standards, instream water quality life and salmonid spawning. Because of natural environmental diversity, a protocol for measuring, reporting, and evaluating stream temperature will be developed to establish a temperature record that is acceptable for comparison to criteria. The study will produce new temperature criteria for proposal in Year 2000. Therefore, all streams listed for temperature as a pollutant will placed on a separate list and TMDLs will be postponed for 18-24 months to allow the study to develop new water quality standards.

For dissolved oxygen (DO), no TMDL is proposed for the Middle Snake River or its tributaries since it can be shown that violations of State water quality standards (< 6 mg/L DO) occur minimally and only in localized areas where the water is most shallow, low velocity, and under low flow conditions (the worst case scenario). Since the RBM10 modeled a plant biomass reduction of 20-60% (or 30% mean reduction) and a DO of 8.56 mg/L with an instream water quality target of 0.075 mg/L TP, restoration and protection of DO standards under the worst case scenario (which have a 6.3% chance of occuring within a 16 year period) is probable with imposed TP reductions under the Mid-Snake TMDL.

An evaluation and assessment of streams proposed for delisting is summarized for Ellison Creek and Vinyard Creek. Alpheus Creek, Clear Springs, Crystal Springs, Thousand Springs, and Segment 1 (Milner Dam to Pillar Falls) of the Middle Snake River are proposed for antidegradation protection with appropriate distinctions on the natural versus the manmade waterway portions. Blind Canyon Creek is proposed for modification of its listing so that the creek includes that portion of the canyon where the outfall discharge occurs from S-19/S Coulee from the North Side Canal Company. Cottonwood Creek is proposed for redefining in its listing such that there is a distinction made between Cottonwood Creek, North Cottonwood Creek, and Dry Cottonwood Creek.

A stream corridor approach model is proposed that looks at allocation of nonpoint loadings to the major land use nonpoint source industries (agriculture, grazing, forestry, etc.). The model takes into account that upland disturbances may not necessarily directly affect the delivery of pollution to a stream. Therefore, a stream corridor of 2 miles wide was used as a reasonable preliminary approach such that the greatest impact to any stream would come from the stream corridor and flood plain where slope was in the range of 0 to 10%.

Finally, endangered and threatened species affected by degraded water quality are listed and described. Hydroelectric development throughout the Middle Snake River, as well as hydrologic modification in Upper Snake Rock, have to some extent impacted snail species through inundation of lotic habitats, isolating segmented populations, and reducing suitable shallow water shoreline. Declines in snail populations have been attributed, in part, to water quality degradation due to tributary and agricultural return flows laden with sediment, nutrients, runoff from dairies and feedlots, effluent from aquaculture, industrial and municipal facilities, and storm water runoff.

It is proposed that with full implementation of the Mid-Snake TMDL after 3 years of monitoring and with full implementation of the Upper Snake Rock TMDL which will prinicipally center on suspended sediment reduction as well as function as an umbrella for the Mid-Snake TMDL and the Billingsley Creek TMDL, that beneficial uses will be achieved for the Middle Snake River and its tributaries after 10 years of plan implementation. Reductions in suspended sediment will result in reductions in total phosphorus, pathogens, and un-ionized ammonia. Additional reductions in total phosphorus in the Upper Snake Rock TMDL (in addition to what will be done in the Mid-Snake TMDL) will provide sufficient reduction to achieve a more "fishable and swimmable" Middle Snake River due to biological reductions of nuisance aquatic macrophytes. These reductions will in effect maintain DO levels well above the State water quality standard.

concentration targets were developed for specific pollutants of concern. For suspended sediment an instream target of 52 mg/L total suspended solids (TSS) was used to define the load capacity of the tributaries and the Middle Snake River. Values below this concentration were defined as meeting the applicable narrative standard for sediment. Values above this concentration are required to reduce to a level that is less than the target (such as 51.9 mg/L TSS). All waterbodies discharging to natural streams or rivers must discharge at concentrations less than 52 mg/L TSS. Substrate sediment targets are non defined or proposed at this time since minimal data exists to best describe what these targets should be for the Middle Snake River. Overall reduction for point and nonpoint sources is 30.4% but the major target reductions will come from the nonpoint source industries. Point sources have NPDES TSS effluent limits already inplace that meet beneficial uses for the particular waterbody where they discharge.

For total phosphorus (TP) a narrative standard of excess nutrients using USEPA "Blue Book" values was used as instream targets. The Mid-Snake TMDL water quality instream target of 0.075 mg/L TP was used to describe meeting the nuisance narrative standard on the Middle Snake River since about 25% is reservoir-like. For natural tributaries and other waterbodies which have flowing waters and which discharge directly or indirectly to the Middle Snake River, a water quality instream target of 0.100 mg/L TP was used to control accelerated or cultural eutrophication. This portion of the TMDL is affected to a great extent by the NPDES permitting process under the Mid-Snake TMDL. Wasteload allocations for point sources won't be effective till after three years of monitoring are done and a re-evaluation of the loading analysis is accomplished for all point source industries.

For pathogens, State water quality standards for primary and secondary contact recreation are the instream targets. Where data was available a TMDL was determined to be required for seven natural streams. Manmade waterbodies that discharge pathogens that exceed the beneficial uses into receiving natural streams will need to have some action (defined as best management practices) to retard these exceedences to a level where total exceedences for the stream are less than 10% of the total number of samples taken annually.

For un-ionized ammonia, streams with data indicate that no major exceedences were determined in the Middle Snake River or its tributaries with the exception of Clover Creek. Clover Creek does not have ammonia as a pollutant. Therefore, ammonia is proposed as a pollutant to be added to the list of pollutants in the next listing cycle and a TMDL will be developed accordingly afterwards. All other tributaries and segments of the Middle Snake River that are listed for ammonia are proposed for delisting of ammonia as a pollutant. Listed streams without monitoring data will have monitoring done over the next 36 months for assessment of ammonia conditions.

For nitrogen as nitrite+nitrate (NOX), it is proposed that it is not a limiting nutrient of the Middle Snake River or its tributaries. No proposed instream target or TMDL is suggested at this time. However, the parameter will continue to be reviewed by IDEQ based on monitoring information. A TMDL may be proposed if mean loads within the river and its tributaries increase significantly above where the 1990-1998 mean loads are.

For pesticides, only Cottonwood Creek was listed. Instream water quality data collected in 1999 by IDEQ during June, July and August indicates no signficant detections of herbicides, organophosphates or organochlorine insecticides. It is recommended that pesticides as a pollutant be removed. Thus, no TMDL is proposed.

For oil and grease, only Rock Creek is listed. Since the listing was done as a result of point source dischargers which no longer discharge to the stream, oil and grease is proposed for delisting as a pollutant. Thus, no TMDL is proposed.

For temperature, a State IDEQ study will be done to look at statewide inconsistencies or variations on aquatic

THE UPPER SNAKE ROCK SUBBASIN ASSESSMENT for SURFACE WATERS of HYDROLOGIC UNIT CODE 17040212

2.0 INTRODUCTION

The Upper Snake Rock Subbasin Assessment describes HUC 17040212 for those water bodies that are water quality limited and listed on the 1996 §303(d) list of the Clean Water Act. Included in those water quality limited streams (or stream segments) are the fourteen (14) stream segments of the Middle Snake River (already addressed by the Mid-Snake TMDL for total phosphorus) and Billingsley Creek (already addressed by the Billingsley Creek TMDL for total phosphorus). Important to the Middle Snake River system is its managed flow. Although the IDEQ does not consider flow to be a pollutant for TMDL development, it nevertheless affects how the river functions. In general, reduced flow reduces loading capacity and intensifies the effects of pollutant loading, particularly under seasonal low flow conditions.

2.0.1 IDENTIFICATION SYSTEM

The identification system used in this subbasin assessment follows the HUCs used by the U.S. Geological Survey (USGS). The Upper Snake Rock subbasin (or HUC 17040212) is a 4th field hydrologic unit that represents a geographic area in the Upper Snake Basin such that "it is a distinct hydrologic feature (Gregory and Walling 1973)." Figure 1 shows HUC 17040212 in relationship to other adjacent HUCs in southern Idaho. Figure 2 shows the 38 watersheds (or 5th field HUCs) in HUC 17040212. Figure 3 shows the overall Upper Snake Basin and where HUC 17040212 is located in relation to it. Figures 1, 2, and 3 are located at the end of this section of the subbasin assessment.

2.0.2 COMPILATION OF DATABASES

The IDEQ-TFRO reviewed a substantial amount of information from GIS coverages, databases from various internet sources, published water quality reports and maps, and data information requests from such sources as the U.S. Bureau of Land Management (USBLM), U.S. Forest Service (USFS), U.S. Geological Survey (USGS), U.S. Fish and Wildlife Service (USFWS), U.S. Environmental Protection Agency (USEPA), U.S. Department of Agriculture/Agricultural Research Service (USDA/ARS), Natural Resources Conservation Service (NRCS), Idaho Department of Fish and Game (IDFG), Idaho Department of Lands (IDL), Idaho Department of Water Resources (IDWR), Idaho Department of Agriculture (IDA), Soil Conservation Commission (SCC), various Soil Conservation Districts (SCDs), University of Idaho (U of I), Idaho State University (ISU), Boise State University (BSU), and various industries and organizations from the Upper Snake Rock subbasin.

As a primary concern, compilation and review of existing data (either as historical or recent) centered on the characterization of pollutant loads from all sources within Upper Snake Rock, so that the development of the "Upper Snake Rock TMDL" could readily be obtained from the loading descriptions provided in this subbasin assessment. Where technology-based controls are inadequate to achieve water quality standards, it is expected that the eventual TMDL will provide more stringent water quality-based controls in order to meet state water quality standards. Post-SBA includes the development of the Upper Snake Rock "TMDL," which will be structured on wasteload allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources, and a margin of safety (MOS): TMDL = WLA + LA + MOS. The MOS will account for scientific uncertainty in establishing the TMDL due to insufficient or poor-quality data, or a lack of knowledge about the relation between the receiving water quality and the effects of pollutant loading rates. It is expected that when the TMDL is developed, the loading capacity (LC) or assimilative capacity of all water quality limited waterbodies will be identified as *the greatest amount of pollutant loading that a water body can receive without violating water quality standards* (USEPA 1997k).

Sediment will be shown to be the prinicipal pollutant in Upper Snake Rock. It is a highly complex pollutant to assess, particularly for more than one affected water body. The model used in this assessment for the eventual development of a TMDL was a simple mass balance using average annual loadings. No attempt was made at this time to view the Upper Snake Rock "TMDL" as a complex water quality model, so as to simulate rainfall events, cumulative chemical fate, or transport (USEPA 1997k). Perhaps at some point in the future, consideration for such complex modeling may be realized, but at this point it is not an effort that IDEQ or the Mid-Snake TAC considered feasible under current time and financial constraints. Additionally, information on river flow as it relates to sediment transport dynamics and nutrient assimilation is also included. Flow, both as quantity and velocity, is a key component in the overall river system and is vital to the biological community, not only from a water quality perspective, but also for biological transport as it relates to the genetic interchange between aquatic animal populations and their reproductive needs.

An information disclaimer statement is provided at this time for those maps developed in this document that were used in the development of the SBA and the TMDL. It reads, "This computer representation has been developed by the IDEQ from sources which have supplied data or information that has not been verified by the IDEQ. The IDEQ does not guarantee the accuracy, completeness, or timeliness of the information shown. The IDEQ does not support its use for commercial purposes without verification by an independent professional qualified to verify such data or information. The IDEQ shall not be held liable for any loss or injury resulting from reliance upon the information shown." Rob Sharpnack, Water Quality Science Office with IDEQ-TFRO, was instrumental in developing all of the maps from ArcView GIS sources.

2.0.3 QUALITY ASSURANCE/QUALITY CONTROL OF DATA

The data information sources provided to IDEQ-TFRO and used in this subbasin assessment were scrutinized for quality assurance/quality control (QA/QC). As the majority of the data were collected under field conditions and transported for analysis to a laboratory, the following protocols were used to ascertain a minimum level of compliance for QA/QC field and laboratory considerations: (1) The data were reviewed for use of blanks, spikes, and duplicates as a minimum protocol; (2) Under QA all data had to be ensured to be scientifically valid, defensible, and of known precision and accuracy both in the field and in the laboratory so as to withstand scientific and legal challenges; (3) QC samples were introduced into the process to monitor performance of the system from the field collection to the final laboratory analysis; and, (4) In all databases reviewed, it had to be demonstrated that a QA/QC plan was enforced throughout the life of the project. As a consequence, a preliminary database was developed for the Middle Snake River and for the other water quality limited water bodies by IDEQ-TFRO, which will be incorporated over the next ten (10) years for use by the Mid-Snake TAC's *Trend Monitoring Plan*.

2.0.4 PUBLIC ADVISORY COMMITTEE INVOLVEMENT

As part of the public's involvement in the development of this subbasin assessment, the Middle Snake River WAG's TAC was instrumental in the review of the document. The document was prepared by the IDEQ-TFRO, with supplemental comments and review by IDEQ-Central Office, and the Mid-Snake WAG's TAC. The subbasin assessment was provided to the Mid-Snake WAG (as the general membership) and the Upper Snake Basin Advisory Group (Upper Snake BAG) for their review and comments before submission to the USEPA.

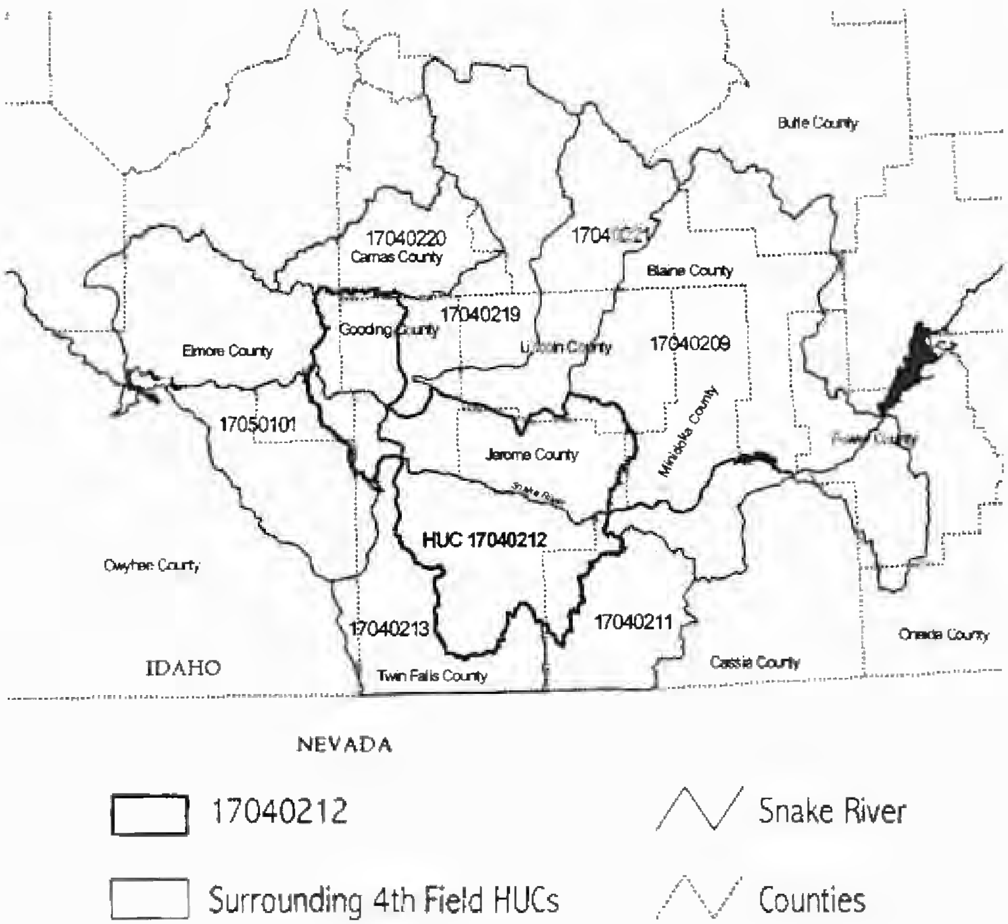
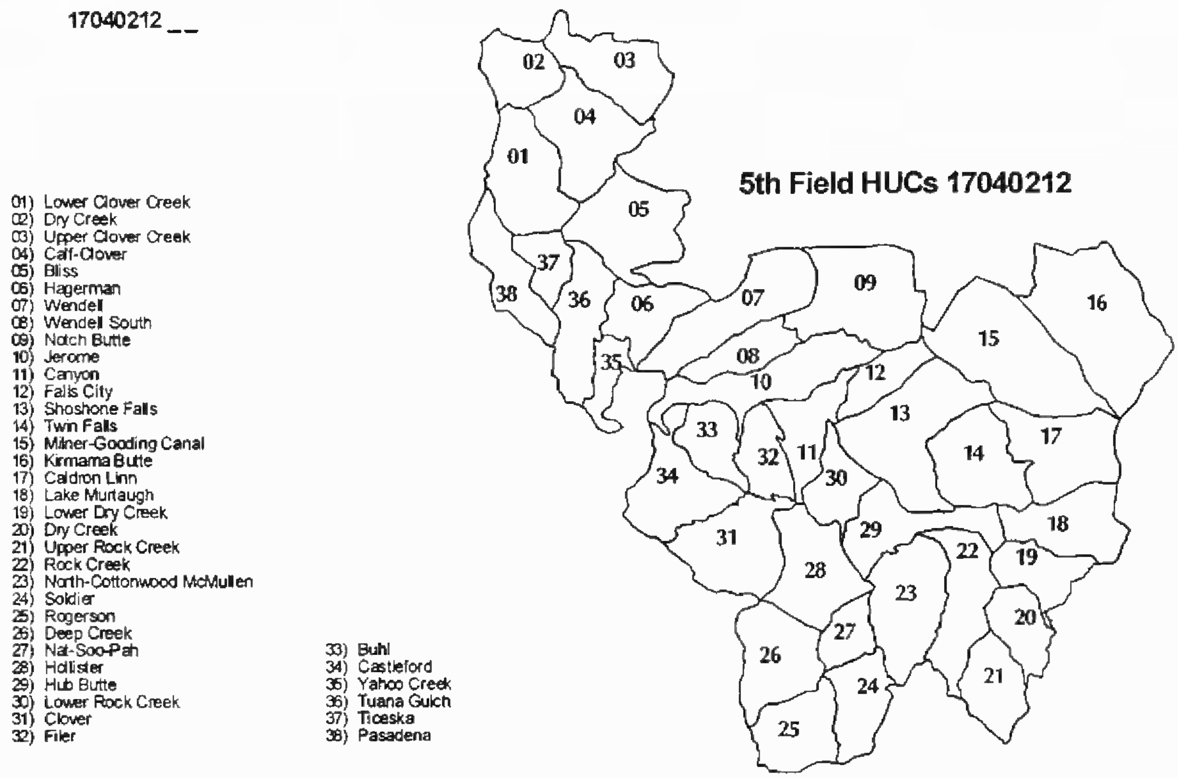


Figure 1 Hydrologic Unit Code (HUC) 17040212



1 Figure 2 Fifth Field HUCS in 17040212

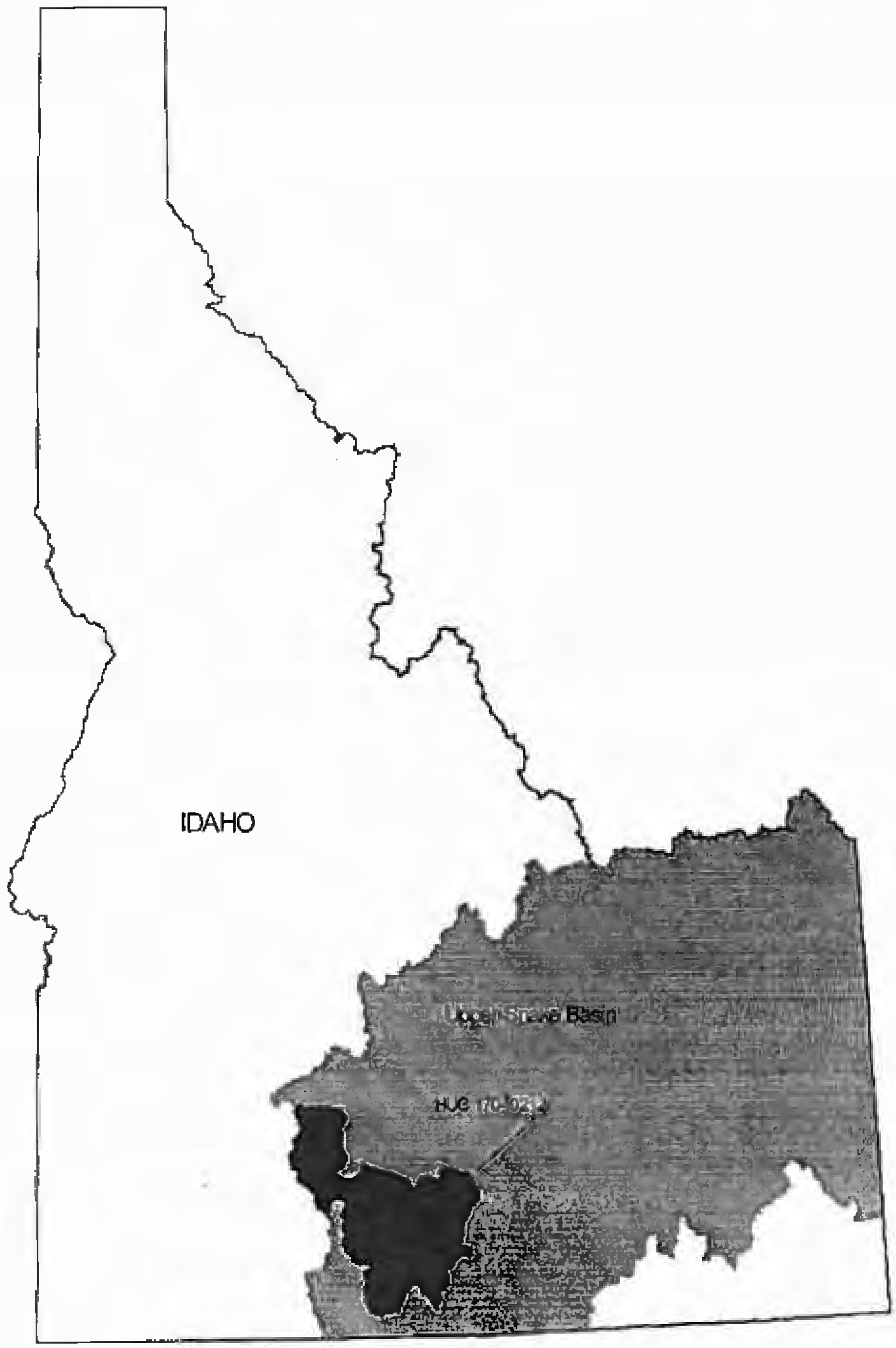


Figure 3 HUC 17040212 in the Upper Snake Basin

2.1 CHARACTERIZATION OF THE WATERSHED

The characterization of the Upper Snake Rock subbasin (or Upper Snake/Rock Creek subbasin) will be based on its physical and biological characteristics and how these characteristics interplay with ecoregional and hydrological traits. The Upper Snake Rock subbasin is complex in its ecoregional and hydrological traits principally due to its continual evolving physical and highly varied biological characteristics. Part of that complexity is the issue of sediment pollution in the waterbodies which is affected by soil characteristics, climate, vegetation, topography, and human activities (Singh *et al.* 1988 [p 260]). This complexity is described and discussed in the following subsections relative to sediment yield sources: natural sources (erosion, sheet erosion, rill erosion, gully erosion, massive runoff); artificial sources (human activities such as agricultural tillage, domestic animal grazing, highway construction and maintenance, timber cutting, mining, urbanization, and recreational land development); channel sources (stream bed, stream banks, hydraulic structure construction, channelization, dredging, dam breaches, mining of gravels); and, disaster sources (natural disasters, extra-large storms creating excessive floods, earthquakes causing slides and mudflows, fires, and droughts) (Singh *et al.* 1988 [p 260]).

2.1.1 SUBBASIN OVERALL GENERAL CHARACTERISTICS

The Middle Snake River traverses the Upper Snake Rock subbasin from Milner Dam (RM 638.5) to the town of King Hill, Idaho (RM 546.0). It extends 92.5 miles dropping from an elevation of 4135 feet at Milner Dam to 2498 feet at King Hill. Those Idaho counties making up HUC 17040212 are listed in Table 1.

Table 1 Estimated breakdown of HUC 17040212 in the indicated county

County	% in HUC 17040212	County	% in HUC 17040212
Jerome (M)	90%	Elmore (E)	3%
Twin Falls (UH)	60%	Owyhee (E)	1%
Gooding (W & SE)	60%	Minidoka (NW)	1%
Cassia (NW)	5%	Lincoln (SW & S)	1%
Camas (S)	3%		

Prepared by IDEQ-TFRO. NW = Northwestern portion; E = Eastern portion; S = Southern portion; SE = South eastern portion; SW = South western portion; W = Western portion; UH = Upper Half; M = Majority of county.

It is an unusually geographically structured drainage. Although Salmon Falls Creek and the Big Wood River (Malad River) drain into the Middle Snake River, they are not included in the drainage of Upper Snake Rock because they are considered separate and distinct subbasins. As defined in the Mid-Snake TMDL (IDEQ 1997b), the Upper Snake Rock subbasin describes 53.5% of the Middle Snake River Watershed Management Area (or 2438 square miles). The other portion of the management area (46.5%), or the Salmon Falls Creek drainage (2120 square miles), will be covered in a separate TMDL. Assigned water quality parameter loadings may occur for the mouth of the tributaries discharging to the Middle Snake River in Upper Snake Rock.

The Interior Columbia Basin Ecosystem Management Project has distinguished the Upper Snake Rock subbasin as a Category 3 Subbasin, such that it may be described by the following general characteristics:

1. "This subbasin may support populations of key salmonids or have other important aquatic values, such as threatened and endangered species, narrow endemics, and introduced or hatchery supported sport fisheries (USDA FS 1997a [Vol 1, Chpt 2, p 158])."

2. "In general this subbasin is strongly fragmented by extensive habitat loss or disruption throughout the component watersheds, and most notably through disruption of the mainstream corridor (USDA FS 1997a [Vol 1, Chpt 2, p 158])."

3. "Major portions of this subbasin are often associated with private and agricultural lands not managed by the Forest Service or USBLM (USDA FS 1997a [Vol 1, Chpt 2, p 158])."

4. "Although important and unique aquatic resources exist, they are usually localized (USDA FS 1997a [Vol 1, Chpt 2, p 158])."

5. "Opportunities for restoring connectivity among watersheds, full expression of life histories, or other large-scale characteristics of fully functioning and resilient aquatic ecosystems are limited or nonexistent in the near future (USDA FS 1997a [Vol 1, Chpt 2, p 158])."

6. "Opportunities for management of aquatic resources in this subbasin is primarily in conserving remaining habitats in specific locations, rather than restoration of a more functional mosaic (USDA FS 1997a [Vol 1, Chpt 2, p 158])."

7. "Although there may be greater flexibility in land-use management for subbasin areas outside of critical watersheds, some management conflicts may arise (USDA FS 1997a [Vol 1, Chpt 2, p 158])."

8. "Because the remaining aquatic resources are often strongly isolated, risks of local extinction may be high (USDA FS 1997a [Vol 1, Chpt 2, p 158])."

9. "Land-use activities within this subbasin may call for extreme caution to not aggravate present conditions (USDA FS 1997a [Vol 1, Chpt 2, p 158])."

10. "Conservation of the remaining productive areas may require a disproportionate contribution from Federal management agencies, because these subbasins often include large areas of non-Federal land (USDA FS 1997a [Vol 1, Chpt 2, p 158])."

Additionally, those lands administered by the Forest Service and Bureau of Land Management in Upper Snake Rock may be categorized according to integrated ecological measures. These measures are summarized as follows:

1. Low Composite Ecological Integrity: Ecological integrity describes the wholeness and resiliency of an ecological system (such as the Upper Snake Rock subbasin). An ecological system with a low integrity functions poorly because it does not have all its parts and processes intact. Such a system does not readily rebound quickly after wildfires, floods, road building, and other disturbances. In general, the more the ecological system has been altered, the lower its integrity. A low-integrity area may not be highly degraded, but may be filling societal needs including agricultural lands and roads related to recreational areas (USDA FS & USDI/BLM 1997b [p 8]).

2. Low Aquatic Integrity: An ecological system with low aquatic integrity does not possess a full complement of native fishes and other aquatic species that are well distributed in high-quality, well-connected habitats (USDA FS & USDI/BLM 1997b [pp 10-11]).

3. High Rangeland Hydrologic Integrity: An ecological system with high rangeland hydrologic integrity has a network of streams where upland, flood plain, and riparian areas have resilient vegetation. These networks support diverse and productive aquatic and terrestrial environments (USDA FS & USDI/BLM 1997b [p 11]).

4. Low Rangeland Integrity: An ecological system with low rangeland integrity does not have a mosaic of plant and animal communities that are well-connected. The habitat is not high quality because of poor diverse assemblages of native and desired nonnative species (USDA FS & USDI/BLM 1997b [p 11]).

5. Forest Integrity & Forest Hydrologic Integrity: Because of the low percentage of forest habitat (in terms of land use), no forest integrity ratings are assigned to the Upper Snake Rock subbasin (USDA FS & USDI/BLM 1997b [pp 10-11]).

2.1.1.1 5TH FIELD HUC CHARACTERISTICS

The Upper Snake Rock subbasin is cartographically subdivided into 38 watersheds (or 5th order HUCs). These are described in Table 2 with their appropriate name and 5th order HUC number. Figure 2 illustrates the 38 watersheds in Upper Snake Rock subbasin. See §2.0, Figure 2.

Table 2 5th order HUCs of Upper Snake Rock 17040212

5th Order Number	Watershed Name	Total Acres	5th Order Number	Watershed Name	Total Acres
1704021201	Lower Clover Creek	50758	1704021220	Dry Creek	25608
... 02	Dry Creek	30286	... 21	Upper Rock Creek	31935
... 03	Upper Clover Creek	44761	... 22	Rock Creek	43737
... 04	Calf-Clover	53750	... 23	North Cottonwood-McMullen	54547
... 05	Bliss	56284	... 24	Soldier	32066
... 06	Hagerman	31927	... 25	Rogerson	37558
... 07	Wendell	58719	... 26	Deep Creek	46341
... 08	Wendell South	24319	... 27	Nat-Soo-Pah	18628
... 09	Notch Butte	68825	... 28	Hollister	49067
... 10	Jerome	53027	... 29	Hub Butte	41009
... 11	Canyon	30939	... 30	Lower Rock Creek	25957
... 12	Falls City	21880	... 31	Clover	54088
... 13	Shoshone Falls	73777	... 32	Filer	24572
... 14	Twin Falls	48758	... 33	Buhl	25958

5th Order Number	Watershed Name	Total Acres	5th Order Number	Watershed Name	Total Acres
... 15	Milner-Gooding Canal	87798	... 34	Castleford	47756
... 16	Kimama Butte	95944	... 35	Yahoo Creek	16059
... 17	Caldron Linn	53225	... 36	Tuana Gulch	41865
... 18	Lake Murtaugh	43181	... 37	Ticeska	18588
... 19	Lower Dry Creek	27620	... 38	Pasadena	35387

Prepared by IDEQ-TFRO from USGS GIS maps. There are two Dry Creek watersheds in the Upper Snake Rock subbasin: 17040212-02 and 17040212-20, which are indicated in gray in the table.

2.1.1.2 CLIMATOLOGY: PRECIPITATION, HUMIDITY, TEMPERATURE

The climate of Upper Snake Rock is semiarid with low annual rainfall, moderately hot, dry summers, moderate to cold winters, and relatively windy springs.

Average annual precipitation is 10.5 inches and may vary from 50 to 150% of the mean. See Figure 4 at the end of §2.1. The figure illustrates that over 95% of the subbasin is in the 10.5 inches as average annual precipitation, while higher precipitation may be found in the uppermost northern boundary (Mount Bennett Hills) and the lowermost southern boundary (Sawtooth National Forest). In general, precipitation is fairly consistent throughout the year, except July through September, when the total for the three months may be less than 1 inch. More recently, from 1991 to 1996 the higher precipitation quarters were winter and spring, with values of 3.35" and 3.82", respectively (or a total of 7.17"). The lower precipitation quarters were summer and fall at 1.92" and 2.11", respectively (or a total of 4.03"). The higher average annual precipitation (11.20") when compared to the historical normal (10.5") was due to the above normal rains and snows of winter and spring (AgriMet 1994).

Relative humidity from 1991 to 1996 averaged 62.4%. Winter and spring for the same time period averaged 73.4% and 60.7%, respectively (or 67.0% average). Summer and fall averaged 53.8% and 61.8%, respectively (or 57.8% average)(AgriMet 1994).

Average annual air temperature ranges from 40 to 51°F. January and July are typically the coldest and warmest months with average temperatures of 29.4°F and 72.7°F, respectively. During the summer, temperatures in excess of 100°F are common. More recently, from 1991 to 1996 the higher annual air temperatures in the spring were principally due to higher than normal temperatures in 1992 and 1994 when compared to those years' mean air temperature (AgriMet 1994).

2.1.1.3 POPULATION AND RECREATION

Much growth has occurred in the population of Upper Snake Rock since 1990. Table 3 summarizes the projected estimates through the year 2010 for the three largest counties in the Upper Snake Rock subbasin as compared to the more expansive South Central Region (which includes eight counties).

Table 3 Major counties in Upper Snake Rock subbasin and their actual and projected populations

County	1970 (census)	1980 (census)	1990 (census)	2010 (projected)
Gooding	8645	11874	11633	12512
Incorporated	4271	5215	5568	5726
Unincorporated	4374	6659	6065	6786
Jerome	10253	14840	15138	17095
Incorporated	4922	6616	7237	7986
Unincorporated	5331	8224	7901	9109
Twin Falls	41807	52927	53580	59967
Incorporated	28389	32340	36290	40641
Unincorporated	13418	20587	17290	19326
SC Region vs Tricounty Area	102987 vs 60705	135367 vs 79641	136831 vs 80351	155901 vs 89574
Incorporated	60081 vs 37582	69673 vs 43339	79265 vs 49095	89021 vs 54353
Unincorporated	42906 vs 23123	65694 vs 36302	57566 vs 31256	66880 vs 35221

Prepared by DEQ-TFRO. Land use values for incorporated versus unincorporated is based on the number of persons living in these areas of the county, tricounty, or region. SC = South Central and includes Blaine, Camas, Cassia, Gooding, Jerome, Lincoln, Minidoka, and Twin Falls counties. The Tricounty Area includes only Gooding, Jerome, and Twin Falls counties (IDC 1993).

From these figures it is estimated that in the 40 years up to year 2010, the tri-counties will experience a 47.6% population increase as the South Central Region increases by 51.4%, with the tri-counties making up 57.5% of the region's total. Incorporated portions of the tri-counties will increase by 44.6% as the region increases by 48.2%, and the tri-counties will make up 61.1% of the region's total. Unincorporated portions of the tri-counties will increase by 52.3% as the region increases by 55.9%, and the tri-counties will make up 52.7% of the region's total. See Figure 5 at the end of §2.1 for an illustration of the human population according to the major towns and cities.

"The population of a community and rate of change of that population are often used as indicators of economic diversity, economic resiliency, community vitality, and whether the community is prospering or in decline. Economists use population growth as a proxy for economic growth (Haynes & Horne 1966; USDA/USBLM 1997a [Vol 1, p 196])." Communities with larger populations lead to more businesses such that many industries are represented with many firms in each industry. Population growth is usually associated with economic growth and vice versa. As a measure of economic diversity, the statistical Shannon-Weaver Diversity Index is used to characterize the economic resiliency as low, moderate, or high rating (Alward 1996; USDA/USBLM 1997a [Vol 1, p 196]). Table 4 describes the index per indicated county in the Upper Snake Rock subbasin.

Table 4 Economic resiliency ratings of the Upper Snake Rock tri-county area

County	Economic Resiliency Rating
Jerome	Moderate
Gooding	Moderate
Twin Falls	High

Prepared by IDEQ-TFRO from the *Interior Columbia Basin Ecosystem Management Project*. This index was also used to score timber/forage importance, such that the % Timber from National Forests in the three counties was not applicable (or zero), and the % Forage from Federal Land was 1, 1, and 8 for Jerome, Gooding, and Twin Falls counties, respectively (USDA/USBLM 1997a [Vol 1, pp 183-184]).

Because of population growth, recreational areas in Upper Snake Rock have become more prominent in the last few years due to their accessibility, commercial advertisement, and development. As the population experiences the more unaccessible water areas of Upper Snake Rock, and as commercial development grows into those areas, water quality concerns will need to be addressed as well. Even now, many recreational areas are having an effect on water quality due to degradation of their stream banks. Storm water runoff in the City of Twin Falls and in agricultural rural areas is becoming more of a public concern because of erosion and its contribution to sediment pollution.

2.1.2 ECOREGION CONSIDERATION

Over 95% of Upper Snake Rock comprises an ecoregional area known as the Snake River Basin/High Desert, as defined by Omernik (Omernik 1986). Less than 5% of Upper Snake Rock is considered a Northern Basin and Range ecoregion; specifically for the higher elevation headwater sources for Clover Creek (in the Mount Bennett Hills) and the Rock Creek Complex (in the Sawtooth National Forest). According to Omernik's ecoregional descriptors three general characteristics predominate as to land form, vegetation, and land use. These will be discussed in the following sub-sections.

2.1.2.1 TOPOGRAPHY

In general, Upper Snake Rock has a land-surface form or topography that consists of tablelands with medium to high relief. Its plains have hills or low mountains. The Snake River Canyon is a steep-sided trench, cut into the relatively flat, surrounding plain. Table 5 summarizes the width of the main channel, its slope (feet/river mile), elevations, and elevation drop of the Middle Snake River at various river mile locations or reaches. The Middle Snake River may be segregated into three "reaches" or segments according to slope: an "upper reach" (from river miles 619 to 638); a "middle reach" (from river miles 559 to 618); and, a "lower reach" (from river miles 545 to 558). The smallest width is estimated at 50 feet, and the widest width is estimated at 1500 feet.

Table 5 Width of the Middle Snake River (channel) at various "reaches"

River Miles	River width, feet			"Reach" Miles	Slope ft/RM	Elevation feet	Elevation Drop feet
	Mean	Max	Min				
638-619	103	225	50	20	29.5	4135-3380	755
618-559	441	1500	100	60	15.2	3380-2580	800
558-545	254	600	150	14	7.7	2580-2497	83
Prepared by IDEQ-TFRO.							

Shoshone Falls stands as a 212-foot-tall natural waterfall located about 2.7 miles downstream of Twin Falls Dam. It is recognized as a natural barrier to upstream migration of native species of fish (FERC 1997a).

The elevation within Upper Snake Rock also describes the varying topography of the subbasin. In the northwestern portion of the subbasin the Clover Creek drainage begins at 6400 feet in the Mount Bennett Hills and drains southwestward to the Middle Snake River at about 3000 feet. In the southeastern portion of the subbasin the Rock Creek drainage begins at 7700 feet in the Sawtooth National Forest and drains northward to the Middle Snake River at about 3500 feet. Generally speaking the topography of the subbasin is such that drainage moves towards the Middle Snake River, whether it be from natural drainage or the myriad of constructed canals, drains, and laterals. It is for this reason that the Upper Snake Rock subbasin is sometimes called the "Mid-Snake subbasin." See Figure 6 at the end of §2.1 for a view of the topography of Upper Snake Rock.

2.1.2.2 POTENTIAL NATURAL VEGETATION

In general, there are two types of natural vegetation in Upper Snake Rock: sagebrush-grass vegetation that predominates the entire subbasin and riparian vegetation in the tributaries and Snake River Canyon. The advent of irrigation canals changed some of the sagebrush-grass vegetation to agricultural crops and pastureland, and in some locations has provided a means by which some riparian and grassland plants have been established due to incidental leakage.

SAGEBRUSH-GRASS VEGETATION ZONE

Upper Snake Rock is a sagebrush steppe (made up of sagebrush and wheatgrass) with salt bush /greasewood. The HUC is 54% rangeland. The HUC is part of the Snake River Plain which occupies approximately 22,500 square miles and supports a sagebrush or a *SAGEBRUSH-GRASS VEGETATION ZONE*. Big sagebrush (*Artemisia tridentata*) and bluebunch wheatgrass (*Agropyron spicatum*) are the dominant shrub and grass species in this zone. Most of the "sagebrush" zone is found at elevations from 2000 to 7000 feet. Where sagebrush dominates below 7000 feet, annual precipitation characteristically varies between 8 and 20 inches (Cronquist 1972; Wright 1979; West 1983). Currently, large tracts of native rangelands have been converted to non-native crested wheatgrass monocultures in response to fire restoration by the USBLM and private land-owners. Sagebrush directly influences the soil microclimate by accumulating litter (litter, moss lichen) to a much greater depth when compared to adjacent grass or sparse vegetation; by insulating through its plant canopy and affecting the amount of radiant energy that reaches the surface of the soil or understory vegetation; and, by having a significant effect on the soil-water potential due both to the shading effects of the canopy and insulating effects of the litter (Wight *et al.* 1991).

RIPARIAN VEGETATION IN THE TRIBUTARIES AND SNAKE RIVER CANYON

Since forests are minimal in the Upper Snake Rock subbasin (comprising less than 5%), riparian areas and wetlands become most critical and important plant communities because of their vegetative diversity and value to wildlife. These communities vary from emergent herbaceous wetlands, associated with springs and seeps, to forest-scrub areas, containing small trees and understories of shrubs (FERC 1997a). In river and tributary canyons, little vegetation occurs on the basalt cliffs and talus slopes because of the steep walls and the lack of soil and organic material which limits the establishment of vegetation (Brinson *et al.* 1981; Smithman 1983). Where they do occur in the Middle Snake River and the tributaries, they occur primarily as a narrow fringe along the flood zone, near springs, and in low areas near the river (such as between Milner Dam and Auger Falls) (FERC 1987). Agricultural land use, commercial land development, and more diversified year-round recreational use have drastically changed many riparian "buffer zones" in Upper Snake Rock over the last twenty years by drawing the population closer to the edges of streams and tributaries. Because of this, sediment trapping has been minimized, nutrient retention and removal through filtering has been minimized, and wildlife habitat in areas with woody vegetation has been reduced (FERC 1990). With regard to the irrigation canal system, some irrigation return flows have increased the riparian area and vegetation by providing a water source via a sediment delta (Robison 1998).

2.1.2.3 LAND USE AND OWNERSHIP

In general, the Upper Snake Rock sub basin has 54% shrubland grazing land and 41% agricultural land (both irrigated and dryland) (ArcView 1996). These are the principle cultural land use types which affect water quality. In addition to USBLM and USFS, the Idaho Department of Lands (IDL) owns several scattered state sections, 640 acres, throughout the sub basin. Nearly all the IDL state sections are used for grazing livestock. Other land use types include forestry, urbanization, construction and development, but as a total represent less than 5%. Urban areas, in particular, should not be discounted as potent pollution sources. As much as 75% of the economy of southern Idaho is driven by agriculture (Hazen 1997a). Current land use for Upper Snake Rock in comparison to adjacent HUCs is described in Table 6. Figure 7 at the end of §2.1 illustrates land use and ownership in Upper Snake Rock, and shows the concentration of agriculture (dryland and irrigated) close to the Middle Snake River and rangeland further away from the Middle Snake River.

Table 6 Land use estimates for the IDEQ-TFRO

HUC	NAME	LANDUSE TYPE	FOREST	RANGE	AG	URBAN	OTHER	TOTAL
17040209	Lake Walcott	% Sq.Miles Acres	4 151 96100	54 1982 1260000	25 919 584000	1 24 15300	16 593 377000	100 3669 2332400
17040210	Raft River	% Sq.Miles Acre	24 350 225000	50 741 476000	25 371 238000	0 7 4220	0 1 470	99 1470 943690
17040211	Goose Creek	% Sq.Miles Acres	38 440 284000	44 500 323000	18 208 134000	0 2 1140	0 1 357	100 1150 742497
17040212	Upper Snake Rock	% Sq.Miles Acres	3 73 46300	54 1322 833000	41 1006 634000	1 31 19700	0 6 3880	99 2438 1536880
17040213	Salmon Falls	% Sq.Miles Acres	8 178 115000	85 1808 1170000	6 130 84000	0 1 616	0 3 1970	99 2120 1371586
17040219	Malad River	% Sq.Miles Acres	24 353 218000	63 917 567000	10 148 91600	1 10 6270	2 30 18500	100 1458 901370
17040220	Camas Creek	% Sq.Miles Acres	6 38 23900	70 468 298000	25 165 105000	0 1 432	0 0 100	101 672 427432
17040221	Little Wood River	% Sq.Miles Acres	5 56 35700	67 753 482000	17 189 121000	0 4 2390	11 118 75400	100 1120 716490
Prepared by DEQ-TFRO. HUC 17040212 is generally reported to have an area of 2440 square miles according to USGS.								

Idaho's Magic Valley economy remains very dependent on natural resources. Because the area has an overall elevation of 4000 feet, a moderate-to-long growing season (April to September) when compared to other parts of Idaho, and an average of 9-10 inches of average annual precipitation, it is very dependent on irrigation diversions from surface and ground water. The primary irrigation companies for the area have a major portion of their water rights as "natural flow" with supplemental storage rights (Robison 1998).

2.1.2.4 SOILS AND GEOLOGY

"Soils certainly owe more to climate and vegetation than to bedrock (Lambert 1998)." In Upper Snake Rock alkalization of the area lets the soil water bring salts and alkalis to the surface, which then evaporate to leave a whitish crush. This alkalization and evaportation has produced salty desert soils (or Aridisols) in many areas of Upper Snake Rock. In general, Upper Snake Rock has soils that are 87% Aridisols and 13% Mollisols. Aridisols are mineral soils that have developed in dry regions, are light colored, low in organic matter, and may have accumulations of soluble salts and lime. The lower the precipitation, the more likely these accumulations are to be near the surface. The vegetation found on aridisols are important contributors to the western livestock industry (USBLM 1991). Of the Aridisols and Mollisols in Upper Snake Rock, about 35% are loess (or buff-colored calcareous silt transported as wind deposits), while the remaining 63% contains residium (or residual soil that is developed from the weathering of rock directly beneath it), colluvium (loose and incoherent deposits at the foot of a slope or cliff brought there by gravity), and alluvium (deposits of silt or silty clay laid down during times of flooding). The loessal soils are composed of wind-blown particles from a variety of sources, and have a type of structure highly susceptible to water and wind erosion, particularly when vegetation cover is removed (Fenneman 1931; Freeman *et al.* 1945; Malde 1965; Cronquist *et al.* 1972; Alt & Hyndman 1989; FERC 1990; Myers 1996). See Figure 8 and Figure 9 for the soils and geology of Upper Snake Rock, respectively.

A summary of the more prominent soil characteristics and the properties of the more prominent soil series is described in Table 7. The topography of Upper Snake Rock is correlated to the particular soil series. The majority of the soils may be classified as a Portneuf silt-loam loessal aridisols which are characteristically highly erodible soils.

Table 7. Summary of soil characteristics and properties in HUC 17040212

SOIL SERIES	MEAN SOIL DEPTH inches	PARENT MATERIAL	Ppt as AMP	ELEVATION (Average) feet	SAGEBRUSH	WHEATGRASS	BLUEGRASS	RABBITBRUSH	NEEDLEGRASS	JUNEGRASS	BALSAM ROOT	HAWKS BEARD	FESCUE	WINTER FAT	SHADESCALE	RICEGRASS	SQUIRREL TAIL	LAND USE R	LAND USE IC
Gooding	50"	A over L over B	9 "	3500'	X	X	X											X	X
Portneuf	50"	L	9 "	3600'	X	X	X	X	X	X								X	X
Trevino	15"	L over B	9 "	3500'	X	X	X		X		X	X						X	X
Garbutt	60 "	A	8 "	3700'			X		X					X	X	X	X	X	X
Duric C.	30"	A over R	16 "	6300'	X	X	X						X					X	
MEAN	41"	A & L	10.2"	4120'	X	X	X		X										

SOIL SERIES	MEAN SOIL DEPTH inches	PARENT MATERIAL	Ppt as AMP	ELEVATION (Average) feet	SAGEBRUSH	WHEATGRASS	BLUEGRASS	RABBITBRUSH	NEEDLEGRASS	JUNEGRASS	BALSAMROOT	HAWKSBEARD	FESCUE	WINTERFAT	SHADESCALE	RICEGRASS	SQUIRREL TAIL	LAND USE R IC

Prepared by DEQ-TFRO. Duric C. = Duric Cryoborolis; Ppt = Annual Mean Precipitation (AMP); Land Use: R = Rangeland; IC = Irrigated Cropland. Of the ten soil orders which have worldwide distribution (USDA/SCS 1984), three are found in the Upper Snake Rock subbasin: aridisols (light-colored soils of dry regions), mollisols (dark-surfaced soils formed under grass), and vertisols (soils dominated by swelling clays). On a tri-county basis, the following is their distribution: (1) Twin Falls County: Mesic Aridisols (Map Units 38, 46, and 54), Xeric Frigid Mollisols (Map Unit 59), and Udic Cryic Mollisol (Map Unit 22); (2) Jerome County: Mesic Aridisols (Map Units 38, 42, 44, and 46); and, (3) Gooding County: Mesic Aridisols (Map Units 42 and 54) and Xeric Mesic Vertisols (Map Unit 47; General Soil Map Idaho, 1984).

In Upper Snake Rock, soil and soil productivity contribute to water quality problems in a number of ways: (1) Soil productivity is generally stable to declining due to greater intensities of vegetation management, roading, and grazing; (2) Woody material greater than 3 inches has been lost or has decreased in streams as a result of displacement and removal of soils, whole trees, and branches; (3) There is loss of soil material due to direct displacement of soils, surface and mass erosion yielding increased bare soils exposure, compaction, and concentration of water from roads; (4) Changes in the physical properties of soils have occurred in conjunction with activities that increase bulk density through compaction thus increasing surface erosion; (5) Sustainability of soil ecosystem function and process is at risk due to the redistribution of nutrients in terrestrial ecosystems due to changes in vegetation composition and pattern, removal of the larger size component of wood, and risk of uncharacteristic fire; and, (6) Flood plain and riparian area soils have reduced their ability to store and regulate chemicals and water, in areas where riparian vegetation has been reduced or removed or where soil loss associated with roading in riparian areas has occurred (USDA FS 1997a [Chpt 2, p 9]).

2.1.3 SUBBASIN HYDROLOGY

In general, "streams or water bodies" within Upper Snake Rock may be divided into perennial and intermittent waterbodies. Each of these may be further subdivided into springs, streams, aqueducts, and lakes/reservoirs or canals. These are described in Table 8 and are further defined in §2.2.1 of this assessment.

Table 8 Perennial and intermittent waterbodies of Upper Snake Rock

WATERBODY	METERS	MILES	% OF GRAND TOTAL
PERENNIAL WATERBODIES			
SPRINGS	10,297.3	6.4	0.2
STREAMS	797,277.5	495.4	15.2
AQUEDUCTS	1,226.6	0.8	0.0
LAKES, RESERVOIRS	143,486.1	89.2	2.7
SUBTOTAL	952,287.5	591.7	18.1

WATERBODY	METERS	MILES	% OF GRAND TOTAL
INTERMITTENT WATERBODIES			
SPRINGS	5,168.3	3.2	0.1
STREAMS	2,435,981.5	1,513.7	46.4
AQUEDUCTS	1,514.2	0.9	0.0
CANALS	1,857,934.3	1,154.5	35.4
SUBTOTAL	4,300,598.4	2,672.3	81.9
GRAND TOTAL	5,252,885.9	3,264.0	100.0

Prepared by IDEQ-TFRO from USGS GIS Maps via ArcView 1996. A "canal" is a man-made conveyance structure used to carry irrigation water from a recognized point of diversion. Natural streams which may at times convey irrigation water are not considered "canals" under the present legal definition. Aqueducts are defined as conduits or artificial channels which convey water above the surface across a river or hollow.

From this table three functional groups emerge: intermittent streams (which comprise 46.4% of the total stream miles), canals (which make up 35.4% of the total stream miles), and perennial streams (which make up 15.2% of the total stream miles). All streams, whether intermittent or perennial, if they are listed as water quality limited stream segments on the 1996 303(d) list will undergo the TMDL process as defined in the Clean Water Act and Idaho Code §39-3601 *et seq*. Other streams may serve as sources of pollution.

2.1.3.1 THE MIDDLE SNAKE RIVER

The Snake River traverses southern Idaho from east to west, originating at elevations above 9500 feet (USBOR 1996-1997) along the Continental Divide in Wyoming and flowing 1038 miles to the confluence of the Snake River with the Columbia River at Pasco, Washington. It is an n^{th}-order stream at the 1:100,000 map scale since it is greater than a 5^{th} order level by definition. The discharge into the Middle Snake River is highly dependent upon upstream storage, irrigation diversion rights in the Upper Snake River, and spring water discharge from the Snake River Plain aquifer. Discharge is highly variable and is managed by the USBOR and Water District No. 1. The major canal companies divert water from the Snake River at Milner Dam through traditional gravity diversion systems that flow in open channels along contours (Barry 1996). See *The Middle Snake River Watershed Management Plan, Phase 1 TMDL Total Phosphorus, January 29, 1998 Update* for further infomation. See Figure 10 for an illustrative summary of stream inputs into the Middle Snake River in Upper Snake Rock. The IDL owns the bed of the Middle Snake River.

2.1.3.2 IMPOUNDMENTS

Generally speaking, about 25.7% of the Middle Snake River is reservoir-like (from RM 639.1 to RM 565.7). American Falls Reservoir, 75 miles upstream from Milner Dam, is a large storage reservoir which directly affects the discharge into the Middle Snake River. Consumptive use of the Snake River is primarily for agriculture (USBOR 1996-1997).

The six major impoundments that regulate the water velocities of the Middle Snake River are described in Table 9. Water volume and discharges are regulated by American Falls Reservoir, Lake Walcott, Milner Lake, and other reservoirs. See Figures 11a and 11b at the end of §2.1 for a summary of major impoundments on Upper Snake Rock.

Table 9 Description of impoundments affecting water velocities of the Middle Snake River

PROJECT NAME and FERC No.	RIVER MILE	RESERVOIR DESCRIPTION Distance, RM	Capacity, acre-feet	Elevation, feet msl	OWNER
Bliss Dam (FERC 1975)	560.3	560.0-565.7	11,100	2,654.0	IPC
Lower Salmon Falls Dam (FERC 2061)	573.0	573.0-579.6	10,900	2,798.0	IPC
Upper Salmon Falls Dam (FERC 2777)	581.4	581.4-585.4	600	2,878.2	IPC
Shoshone Falls Dam (FERC 2778)	614.7	614.7-616.5	1500	3,354.5	IPC
Twin Falls Dam (FERC 0018)	617.4	617.4-618.2	1,000	3,511.4	IPC
Milner Dam (FERC 2899)	639.1	639.1-674.5	26,000	4,130.5	TFCC NSCC

Prepared by DEQ-TFRO. Based on FERC 1997a, and the individual FERC or NPDES license applications. IPC = Idaho Power Company; TFCC = Twin Falls Canal Company; NSCC = North Side Canal Company. msl = mean sea level. Twin Falls Dam, Shoshone Falls Dam, and Upper Salmon Falls Dam do not store water nor load follow, meaning they have no effect on discharge in the Middle Snake River on either a diel or seasonal basis. Lower Salmon Falls Dam and Bliss Dam load follow but do not alter their flows outside of a diel timeframe.

In the Middle Snake River the flow is principally influenced by snowmelt, springs, and seeps discharging from the Snake River Plain Aquifer, irrigation diversion, irrigation returns, and reservoir storage management by the USBOR above Milner Dam. Overall, the principal source of streamflow is snowmelt, which occurs primarily during the spring and early summer months. The aquifer is recharged by streamflow, by precipitation directly onto the plain, and by the percolation of irrigation water. Most of the ground water discharged from the aquifer occurs in the 92-mile reach of the Middle Snake River between Milner reservoir and King Hill, Idaho. Most of the spring water enters the river through numerous large springs where the aquifer discharges through seams or cracks in the basalt layers of the canyon walls (FERC 1990).

Annual mean discharge volumes of the Middle Snake River at various sites under low (1988-1995)and high flow conditions (1983-1987, 1996-1998) are compared and summarized in Table 10. The years 1991 and 1992 are referenced as "baseline" years.

Table 10 Middle Snake River annual mean flow (Q) under low and high Q conditions (WYs 1983 - 1998)

USGS GAGE SITE	RM	LOW Q YEARS AVERAGE ANNUAL DISCHARGE, cfs 1988	1989	1990	1991	1992	1993	1994	1995	Av Q cfs
At Milner 13088000	638.7	528	498	462	388	366	400	227	1,740	576
Near Kimberly 13090000	617.2	883	832	832	716	647	1,387	1,866	2,146	1,164
Near Buhl 13094000	596.8	2,495	2,404	2,380	2,341	2,116	2,752	3,232	3,579	2,662
Near Hagerman 13135000	572.5	6,408	6,058	6,234	5,991	5,366	6,156	6,588	6,956	6,220
Near Bliss 13153776	559.0	7,984	7,850	8,029	7,832	7,377	8,346	8,559	9,246	8,153
At King Hill 13154500	546.6	7,680	7,875	8,004	7,929	7,384	8,299	8,149	8,906	8,028
NET DIFFERENCE	92.1	7,152	7,377	7,542	7,541	7,018	7,899	7,922	7,166	7,452

USGS GAGE SITE	RM	LOW Q YEARS AVERAGE ANNUAL DISCHARGE, cfs 1988	1989	1990	1991	1992	1993	1994	1995	Av Q cfs
USGS GAGE SITE	RM	HIGH Q YEARS AVERAGE ANNUAL DISCHARGE, cfs 1983	1984	1985	1986	1987	1996	1997	1998	Av Q cfs
At Milner 13088000	638.7	7,988	9,432	6,470	6,925	3,439	5,360	9,296	6,325	6,904
Near Kimberly 13090000	617.2	8,200	10,210	6,991	7,345	3,894	5,846	9,502	6,625	7,327
Near Buhl 13094000	596.8	9,640	11,620	8,625	9,065	6,501	7,136	11,060	8,037	8,961
Near Hagerman 13135000	572.5	13,870	15,660	12,460	13,030	9,262	10,740	14,970	12,030	12,753
Near Bliss 13153776	559.0	16,902	19,169	15,170	16,160	11,501	13,360	16,590	13,540	15,299
At King Hill 13154500	546.6	15,580	18,070	14,210	15,464	11,020	12,630	16,920	13,990	14,769
NET DIFFERENCE	92.1	7,862	8,638	7,740	8,539	7,581	7,270	7,624	7,665	7,865

Prepared by DEQ-TFRO. Net difference between Milner and King Hill is obtained by subtracting the value at Milner from the value at King Hill. Av = Average or mean value. Q = discharge or flow in cfs. RM = river mile. Bliss values from 1983 to 1991 were estimated as interpolations of the average Q for Bliss:Hagerman and King Hill:Bliss for the low flow years (1988-1995). A ratio was established such that Bliss value = Hagerman value x 1.315, and Bliss value = King Hill value x 0.982. The average of these two ratio estimates was used as the estimate for Bliss.

Statistically speaking, the values in Table 10 indicate that the net difference from Milner to King Hill during low flow or high flow conditions does not deviate by much, although within stations there may be some marked variability between water years. It should be noted that from 1988 through 1995, drought conditions caused flows to reach zero below Milner Dam during the irrigation season. Previous drought conditions occured in the 1930s and the 1960s.

The impact of the water management above Milner Dam on the water quality in the Middle Snake River may be summarized as follows:

1. During low flow years in the Middle Snake River, sediment has a tendency to fall out and accumulate in pooled stream areas. Because of low flows, very little processing of waste in the water column occurs. Additionally, low flows result in low velocity thus potentially producing increased temperatures in the water column in conjunction with already elevated water temperatures in agricultural return flows.

2. During high flow years in the Middle Snake River, sediment has a tendency to move more readily from upstream to downstream, thus reducing the amount of accumulation that may occur in pooled stream areas. In fact, Table 11 shows the results of a bathymetric study conducted on the Middle Snake River before-and-after a period of high flows (1996) at three separate reaches: Thousand Springs, Niagara Springs, and Pigeon Cove. The results indicate that high flows in the spring and summer (of 1996) resulted in the moving of a fair amount of sediment out of these reaches, particularly the Niagara Springs and Pigeon Cove areas.

Table 11 1996 Bathymetric study of the Middle Snake River

RIVER REACH	SEGMENT LENGTH feet	VOLUME BEFORE 1996 yds	VOLUME AFTER 1996 yds	NET CHANGE yds	RIVER MILE
Thousand Springs	500	2462.2	866.6	1598.6	584.3
Niagara Springs	600	7183.5	205.7	6977.8	598.8
Pigeon Cove	600	4093.5	70.4	4028.1	602.8

Prepared by IDEQ-TFRO. Volume Below and Volume Above is the calculated volume below and above the river bottom as it was surveyed in September 1996 in each of the three areas. Volume Below represents material lost or scoured since the 1996 survey. Volume Above represents material deposited above the 1996 level. To determine the actual amount of sediment that is present in the system, you would need a sub bottom profiler that would penetrate the depth-to-bedrock level so as to calculate the amount of sediment (Ralston and Associates 1996). Reference line = 1996 survey.

3. Because of higher and possible scouring flows (particularly at flows > 20,000 cfs), processing of waste throughout the water column is potentially increased. This is especially true during the off-irrigation winter season when diversions for irrigation are minimal to none. Relatively speaking, higher flows provide higher velocities which in turn provide decreased temperatures in the water column. Table 12 compares the non-irrigation season (October 16 to April 14) against the irrigation season (April 15 to October 15) from 1990 to 1997, and shows that during the drought years (1990-1995) the net difference (highest flow - lowest flow) in the off-season (October 16 to April 14) flows were relatively low when compared to 1996-1997 which had relatively higher scouring flows. Average flows (1990-1997, 1990-1995, 1996-1997) show that irrigation season flows were greater than non-irrigation season flows. 1996-1997 had an unusually higher level of precipitation when compared to 1990-1995.

Table 12 Seasonal flows past Milner Dam (USGS 13088000)

WATER YEAR	OCT 16 to APR 14 RANGE of Q, cfs	NET DIFFERENCE (HIGH - LOW)	APR 15 to OCT 15 RANGE of Q, cfs	NET DIFFERENCE (HIGH - LOW)
1990	2.7 - 2,060	2,057.3	0.85 - 612	611.2
1991	1.4 - 1,590	1,588.6	2.70 - 827	824.3
1992	17 - 1,300	1,283.0	1.10 - 209	207.9
1993	80 - 998	918.0	12 - 8460	8,448.0
1994	213 - 291	78.0	221 - 246	25.0
1995	225 - 237	12.0	220 - 12,400	12,180.0
1996	230 - 20,000	19,770.0	220 - 17,200	16,980.0
1997	239 - 20,600	20,361.0	236 - 31,200	30,964.0
1990-1995 Avg Drought Years	989.5		3,716.1	
1996-1997 Avg High Flow Years	20,065.5		23,972.0	
1990-1997 Overall Average	5,758.5 Non-irrigation Season		8,780.1 Irrigation Season	

WATER YEAR	OCT 16 to APR 14 RANGE of Q, cfs	NET DIFFERENCE (HIGH - LOW)	APR 15 to OCT 15 RANGE of Q, cfs	NET DIFFERENCE (HIGH - LOW)
Prepared by IDEQ-TFRO. Net Difference = Highest Flow - Lowest Flow = Range.				

4. Table 13 compares the main portions of the seasonal irrigation/non-irrigation period between the major months of irrigation (May through September) versus non-irrigation (November through March). This comparison indicates that with the exception of 1993-1995, the average flows during the non-irrigation period were relatively greater than the average flows during the irrigation period. The years 1993-1995 indicate that the average flows during the non-irrigation period were relatively less or the same as the average flows during the irrigation period.

Table 13 Seasonal flows past Milner Dam (USGS 13088000): mean monthly flows (Q, cfs)

WY	NON-IRRIGATION PERIOD MONTHS Nov	Dec	Jan	Feb	Mar	NonIrrg Mean	IRRIGATION PERIOD MONTHS May	June	July	Aug	Sept	Irrg Mean
1990	1,335	1,388	889	743	91.5	869.3	2.81	2.27	345	283	109	148.4
1991	653	643	1,333	678	87.4	678.9	10.4	13.0	484	542	210	251.9
1992	692	1,025	1,173	729	263	776.4	7.28	1.65	1.52	2.03	56.2	13.7
1993	306	220	222	223	224	239.0	217	2402	228	224	221	658.4
1994	224	225	225	235	232	228.2	230	228	226	228	225	227.4
1995	229	230	228	228	228	228.6	3,560	3,265	228	227	242	1,504.4
1996	2,316	3,136	4,449	7,380	16,650	6,786.2	5,488	7,058	2,031	1,541	515	3,326.6
1997	2,181	3,503	8,968	18,740	19,930	10,664.4	8,405	23,580	3,182	3,899	6,778	9,168.8
90-95 MEAN						506.7						467.4
96-97 MEAN						8,725.3						6,247.7
90-97 MEAN						2,561.4						1,912.5

Prepared by IDEQ-TFRO. WY = USGS Water Year (October 1 to September 30). Irrg Mean = Irrigation period mean. NonIrrg Mean = Non-irrigation period mean. After construction of the lower Milner Power plant, USGS reported flows at two gages 13088000 (the original Milner river gage) and 13088001 (Combined flow of the Snake River and the Lower Milner Powerplant). Then, starting with water year 1996 USGS switched and started reporting the combined flow under gage 13088000 and the Snake River at Milner as river gage 13087995. Consequently the data in Table13 for 1993 to 1995 shows only the release through Milner Dam and not the total flow below where the Lower Powerplant returns water to the river.

5. Tributaries in Upper Snake Rock are affected by irrigation return flows, particularly if the irrigation return drains discharge directly to the tributary. During high flow years, the amount of waste appears to be relatively greater than low flow years. Some evidence exists that indicates that during low flow years water quality improvements may be demonstrated due to better water management by the water users. But in general, irrigation return flows with poor water quality degrade the water quality in tributaries and the Middle Snake River.

2.1.3.3 WATER RIGHTS, MANAGEMENT, AND STORAGE

The State of Idaho has statutory authority in administering water rights within its boundaries. Under the prior appropriation doctrine, natural flow rights in Idaho are satisfied in order of priority based on date ("first in time is first in right"). When the water supply is limited, a water right holder with an earlier natural flow right (or "senior" water right) may receive full supply, whereas a water right holder with a later or more recent date (or "junior" water right) may not receive full supply. Diversion rights for irrigation are appurtenant to the lands (belong to those lands), whereas diversion rights for other purposes (such as power, municipal, and industrial water supply) are not. As defined by USBOR, storage rights and natural flow rights have distinct priorities. Storage rights are not appurtenant to the lands and do not "provide for the water rights". The stored water supplements natural flow rights when the natural flow rights are not in priority. In general, reservoir storage rights are in priority when there is an excess of natural flow or a lack of diversion demand. Reservoir space is contracted to individuals or irrigation districts for use as a supplemental source of water, even if the primary right does not often yield water and the storage effectively provides the full supply. Thus, storage reservoirs (like American Falls, Jackson Lake, Palisades) are constructed and operated to change the flow regime for irrigation purposes (USBOR 1996-1997). Table 14 describes the spaceholder contracts (through November 1995) in the American Falls, Jackson Lake, and Palisades storage facilities for the specific canal companies in Upper Snake Rock subbasin. The two primary canal companies in Upper Snake Rock have their water rights based on primarily natural flow with supplemental storage rights (Robison 1998).

Table 14 Current spaceholder contracts (November 1995, acre-feet)

SPACEHOLDER	AMERICAN FALLS	JACKSON LAKE	PALISADES	TOTAL
American Falls Reservoir District	274,338 (NSCC) 148,747 (TFCC)	0 0	0 0	423,085
MID	44,951	0	44,500	89,451
NSCC	116,471	312,007	116,600	545,078
TFCC	0	97,183	0	97,183
TOTAL (and %)	584,507 (50.6%)	409,190 (35.4%)	161,100 (14.0%)	1,154,797

NSCC = North Side Canal Company; TFCC = Twin Falls Canal Company. MID = Milner Irrigation District. A spaceholder contract is defined as a type of repayment contract in which storage space is purchased in contrast to purchasing a specific amount of water. The amount of water that accumulates in that storage space belongs to the purchaser. Storage season is normally defined as beginning October 1 and extending to the date that no more water is available for storage. The irrigation season is defined in spaceholder contracts as April 1 to October 31, although the actual water may not be used until April 15 to October 15. A water year (or WY) begins on October 1 and extends to September 30 the following year (USBOR 1996-1997).

2.1.3.4 SPRINGS, SEEPS, AND GROUND WATER

In addition to tributary streams, springs and seeps provide a significant contribution to the flow of the Middle Snake River. Numerous springs and seeps emerge from the Snake River canyon walls from Milner Dam to King Hill. The greatest number of springs are located in the Thousand Springs area of the Hagerman valley and run year-round. On an annual basis, over 60% of the total streamflow measured at King Hill is from ground water discharge or irrigation returns (IDHW 1983). Additionally, USGS has allocated spring discharges into the Middle Snake River to north and south side sources: 90% of the spring discharges come from springs north of the river; and, 10% of the spring discharges come from springs south of the river (Robison 1998). Because spring water comprises such a large amount of the total streamflow in the Middle Snake River, it has an obvious beneficial effect on water quality. Additionally, the decline in average spring flows (since the 1950s) is credited to increased ground water pumping, change from furrow to sprinkler irrigation, changes in water management, and traditional drought conditions. Average discharge at Thousand Springs was around 4000 cfs in the early 1900s and increased to almost 7000 cfs in the 1950s. It has since decreased to about 5000 cfs (USBOR 1996-1997). See Figure 12 at the end of §2.1 for a view of the Snake River Plain Aquifer in relationship to Upper Snake Rock.

In a short-term study of twelve springs in the Hagerman area, Ecosystems Research Institute concluded that in general there is little variability from fall to spring in the overall aquifer discharge flow and water quality characteristics within a single year, although individual springs may show some significant differences (ERI 1997). Twelve (12) springs were sampled in September 1996 and in March 1997. The sites ranged from Blue Lakes Spring, which enters the Middle Snake River near the town of Twin Falls (RM 610.5) to the Malad springs complex, which enters the Middle Snake River below Lower Salmon Falls Reservoir (RM 571.5). Discharge from the springs ranged from about 100 cfs at Banbury and Box Springs to over 1400 cfs at the Malad River. Table 15 illustrates the various springs, their discharge, their various water quality parameters, and the statistics demonstrating the level of variability from the springs.

Table 15 Discharge and water quality parameters of spring sources in the Mid-Snake

NAME	RM	DISCHARGE, cfs Fall	DISCHARGE, cfs Spring	TSS, mg/L Fall	TSS, mg/L Spring	TP, mg/L Fall	TP, mg/L Spring	NOX, mg/L Fall	NOX, mg/L Spring	NH3, mg/L Fall	NH3, mg/L Spring
BLSp	610.5	172	159	2	<3	0.015	0.018	2.13	2.07	0.028	<0.025
CrSp	600.5	452	432	2	<3	0.017	0.021	3.09	2.85	0.036	<0.025
NSp	599.0	287	234	<3	<3	0.014	0.021	2.52	2.81	0.035	<0.025
ClrSp	593.0	528	456	<2	<3	0.016	0.018	1.80	1.68	0.028	<0.025
BgSp	590.3	110	101	-	<3	0.066	0.057	1.42	2.08	0.041	0.075
BbSp	589.0	108	108	2	<3	0.014	0.017	1.43	1.58	0.037	0.059
BoxSp	587.7	357	328	<2	<3	0.013	0.019	1.02	1.24	0.034	0.028
BHSp	587.5	UTA	UTA	<2	<3	0.015	0.018	1.30	1.23	0.031	<0.025
ThSp	584.2	659	632	2	<3	0.016	0.019	1.60	1.58	0.030	<0.025
MMSp	583.6	145	139	<2	<3	0.013	0.017	1.05	1.09	0.031	0.026
MgSp	582.7	UTA	UTA	<2	<3	0.015	0.017	0.847	0.758	0.033	0.052
MldSp	571.5	1419	1580	-	-	0.030	0.043	1.12	1.29	0.030	0.026
TOTAL		4237	4169								
OVERALL MEAN		423.7	416.9	1.45	1.50	0.020	0.024	1.611	1.688	0.033	0.028
% DIFFERENCE			1.6 %		3.3 %		20.0 %		4.8 %		17.9 %
t-Test (*p* value) Significance			0.741 Not Significant		0.758 Not Significant		0.036 Not Significant		0.288 Not Significant		0.441 Not Significant

Prepared by IDEQ-TFRO. BLSp = Blue Lakes Spring; CrSp = Crystal Spring; Nsp = Niagara Spring; ClrSp = Clear Spring; BgSp = Briggs Spring; BbSp = Banbury Spring; BoxSp = Box Spring; BHSp = Blue Heart Spring; ThSp = Thousand Springs; MMSp = Mini Miller Spring; MgSp = Magic Springs; MldSp = Malad Springs. UTA = Unable to Access. A *t*-Test (with a Bonferroni adjustment) was calculated showing, with the exception of TP, that there was no significant difference between the fall and spring databases ($p>0.010$). "-" excluded from data set due to field sampling contamination.

2.1.3.5 CANAL SYSTEMS

In Upper Snake Rock, there are two major canal companies that irrigate tracts on the south and north sides of the Middle Snake River: Twin Falls Canal Company (TFCC) and North Side Canal Company (NSCC), respectively. The Twin Falls area (or Twin Falls tract) is predominantly irrigated by the Twin Falls Canal Company (TFCC), the largest irrigation company in the state of Idaho. The TFCC diverts an average of 1.1 million acre-feet/year from the Middle Snake River. The irrigation water is delivered to the area by gravity feed via the High Line and Low Line canals. Approximately 202,000 acres are serviced by the TFCC. It is estimated that about 85-90% of irrigation in the Twin Falls tract is surface irrigated (primarily furrow irrigation) with sprinkler irrigation making up the balance (Barry 1996 [pp 5,7]; Cosgrove *et al.* 1997; Haye 1998).

The Hazelton-Jerome-Wendell-Gooding area (or Northside tract) is predominantly irrigated by the North Side Canal Company (NSCC). The NSCC diverts an average of 1.2 million acre-feet/year from the Middle Snake River. The irrigation water is delivered to the area by gravity feed via the Main Canal. Approximately 160,000 acres are serviced by the NSCC. It is estimated that about 80% of irrigation is primarily sprinkler irrigation (Barry 1996 [pp 5, 7]; Heaps 1998).

Approximately 6000 farms within the Twin Falls and Northside Tracts have a discharge to one or more points in a return flow channel. It should be noted that at Milner Dam there are ten (10) different loads or "leaks" (or discharges): (1) Middle Snake River, (2) Milner Hydro Plant, (3) North Side Canal Company, (4) Twin Falls Canal Company, (5) Milner-Gooding Canal, (6) "Cross-cut" canal, (7) A-Lateral, (8) PA-Lateral, (9) Milner Irrigation Pumping Plant, and (10) A & B Irrigation Pumping Plant. Figure 13 illustrates the canal system in the Upper Snake Rock sub basin.

2.1.3.6 TRIBUTARIES

Because of the hydrologic and geomorphic structure of Upper Snake Rock, in general all perennial tributaries eventually discharge to the Middle Snake River, whether directly or indirectly. The major tributaries to the Middle Snake River (from upstream to downstream) in Upper Snake Rock include:

Dry Creek (Murtaugh)	Salmon Falls Creek
Vinyard Creek	Sand (Thousand) Springs Creek
Perrine Coulee System (East and Main)	Riley Creek
Warm Springs Creek	Fossil Gulch
Rock Creek	Peters Gulch
Crystal Springs (Lake)	Billingsley Creek
Cedar Draw	Birch Creek
Niagara Springs Creek	Malad River
Clear Lakes	Tuana Gulch
Mud Creek	Cassia Gulch
Deep Creek	Little Pilgrim Gulch
Briggs Creek	Big Pilgrim Gulch
Blind Canyon Creek	Deer Gulch
Box Canyon Creek	Clover Creek

Included in an "other" category are an additional 54 unnamed streams (which are intermittent) and over 200 spring sources which eventually drain into the Middle Snake River. See Figure 10 and Appendix C for an illustration of the major tributaries to the Middle Snake River. See also Figure 14 for a summary list of the water quality limited stream segments in Upper Snake Rock. "Some of the perennial tributaries are simply depressions or at best ephemeral streams prior to the development of irrigation in the subbasin. There is some evidence to suggest that irrigation development in the subbasin increased aquifer recharge above the natural amount. Some of the south side perennial streams fed by springs or seeps would be perennial without surface irrigation. As irrigation methods change, the flows from these springs or seeps will change and most likely decrease (Robison 1998)."

DRY CREEK (MURTAUGH)

The portion of Dry Creek that discharges Murtaugh Lake to the Middle Snake River (at RM 630.6) is no longer an intermittent small stream, because enough seepage from Murtaugh Lake enters the stream below the dam to maintain water in Dry Creek on a year-round basis. From Murtaugh Lake to the Milner Low Lift Main Canal, Dry Creek has been completely altered into an agricultural return drain, completely changing the natural contour of the stream. From Murtaugh Lake to between 2800 North and 2900 North, Dry Creek has been completely altered into an irrigation delivery system and drain. The portion of Dry Creek above the Milner Low Lift Main Canal to its headwaters is considered a major tributary. This portion has its headwaters in the Dry Creek watershed, crosses the Lower Dry Creek watershed, and ends in the Lake Murtaugh watershed. Associated tributaries include: (1) West Fork of Dry Creek; (2) Middle Fork of Dry Creek (with its associated tributary Coyote Creek); (3) East Fork of Dry Creek (with its associated tributary Coal Pit Creek); (4) Medley Creek; (5) Cold Spring Creek; and (6) Dry Creek main stem. Dry Creek drains approximately 79,496 acres of predominantly rangeland and some irrigated-gravity flow agricultural fields. It should also be noted that presently a significant amount of spring runoff water from Dry Creek is diverted for ground water recharge via the South West Irrigation District. See Figure 15 for an illustration of the Dry Creek (Murtaugh Lake) Complex in Upper Snake Rock.

VINYARD CREEK

Vinyard Creek is also known as the Devil's Washbowl Spring and is located 0.5 miles upstream from the Twin Falls of the Snake River (USGS 1990-1997 [WY1997, p 164]). It is located on the north side of the Middle Snake River in Jerome County. The source of the stream is a large spring which feeds a small lake that overflows (via a waterfall) to form Vinyard Creek. The creek flows for approximately 570 meters through a canyon (called Box Canyon) before it discharges to the Twin Falls Reservoir at Rivermile 618.0. The creek drains a 9894 acre (15.5 square miles) watershed that is totally irrigated from ground water sources and the Middle Snake River (IPC 1997b [p 3]). The maximum daily discharge (1950-1959) is 27.5 cfs during the month of October. This has changed to 19 cfs (1986-1997) for the month of September. The average annual discharge is 22.3 cfs (1950-1959) which has now changed to 14.7 cfs (1986-1997). According to IPC, peak discharge in 1996 was 14.8 cfs (range 9.9 - 14.8 cfs) which is less than the average reported by USGS (IPC 1997b [p 3]). There is a channel carrying irrigation return water that entered Vinyard Creek approximately midway between the waterfall and the confluence with the Twin Falls Reservoir, but has since been re-routed so that the irrigation canal discharges directly to the Middle Snake River at Rivermile 617.9.

PERRINE COULEE SYSTEM

The Perrine Coulee System encompasses a natural drainage (Perrine Creek) interconnected with an irrigation canal system (Twin Falls Canal Company) and a storm drainage (City of Twin Falls). It drains into the Middle Snake River at two locations: East Perrine Coulee at RM 612.7 (elevation 3130 feet) and Perrine Coulee Falls at RM 610.9 (elevation 3130 feet). The Perrine Coulee System does not have associated tributaries. It drains approximately 22,400 acres of irrigated-gravity flow agricultural land and urban land.

Aside from the main drainage (known as the Perrine Coulee), three drainages of importance exist: (1) Perrine #1, (2) Perrine #2, and (3) Perrine #3. Perrine #s 1 and 2 are located parallel and east of the main Perrine Coulee. Perrine #3 lies parallel and west of the main coulee. All drainages drain to the north-northwest. According to the Twin Falls Canal Company, there are 19 linear miles of riparian areas in the Perrine Coulee "watershed," of which 3 miles are considered urban and 16 miles non-urban. The Twin Falls Canal Company diverts 125 cfs into the Perrine system, but calculates 176.8 cfs as actual use throughout the system. Additionally, TFC-1, TFC-2, and TFC-3 are natural drainages (termed coulees or laterals) fed by field runoff following natural land slopes but adjusted to follow farm and field boundaries. These natural drainages are significant because they accumulate in the large southwest areas of the Perrine Coulee System, which enters the Perrine Coulee drainage downstream (SRSCD 1998). See Figure 16 for an illustration of the Perrine Coulee System.

ROCK CREEK COMPLEX

The Rock Creek Complex is made up of the main Rock Creek System, McMullen Creek, and North Cottonwood Creek. The main Rock Creek System has its headwaters in the Upper Rock Creek and the Rock Creek 5th Field HUC watersheds. After being joined by McMullen Creek and North Cottonwood Creek, it traverses the Hub Butte 5th Field HUC watershed and then follows the eastern portion of Lower Rock Creek 5th Field HUC watershed until it drains into the Middle Snake River at RM 606.4 (elevation 2990 feet). It drains approximately 197,185 acres of rangeland, irrigated-gravity flow, and forested ground. Rock Creek has the following associated tributaries from the headwaters to Rock Creek town:

(1) Rock Creek main stem, Wooden Shoe Creek, Deer Creek, and Little Creek (with associated Bluff Creek and Niles Gulch);

(2) Harrington Fork main stem, Dry Fork, and East Line;

(3) Fourth Fork main stem, Narrow Creek (with associated North Fork and South Fork), Mountain View Creek, Thompson Creek, Elk Butte Creek, and Pike Mountain Creek;

(4) Third Fork main stem, Cotton Creek, AH Creek, Martindale Fork, Little Fork (with associated Trail Canyon, Middle Fork, Little Fork Spring Creek, and Telephone Canyon), Second Fork main stem, and First Fork main stem (with associated Bear Gulch);

(5) Fifth Fork main stem, Dooddlelink Creek, Lucky Gulch, Trail Gulch, Crockett Spring Creek, Secret Creek, Indian Spring Creek, Jones Fork Creek (with associated Joes Spring Creek), and Toolbox Creek;

(6) Cottonwood Creek main stem, McMullen Creek (with associated Donahue Creek), North Cottonwood Creek, Dry Cottonwood Creek (with associated Burnt Creek). Cottonwood Creek is formed from the confluence of North Cottonwood Creek and Dry Cottonwood Creek. These streams are used for irrigation. Cottonwood Creek is intercepted by the High Line Canal. McMullen Creek is a seasonal stream. It discharges directly into the High Line Canal. There is a diversion to Cottonwood Creek via the Twin Falls Canal Company flume. The closer McMullen Creek gets to Rock Creek, small amounts of seep water discharge into McMullen Creek, thus making the lowest portion of McMullen Creek, near Rock Creek, perennial. The typical historical trend for McMullen Creek below the canyon is:

Spring: High flows due to snow pack from February until June 15th.

Low Flow: from June 15th until about July 15th.
After July 15th: intermittent or dry.

In the canyon to the headwaters area, five miles upstream in the canyon McMullen Creek dissipates back into the ground. There are small springs that feed out from the headwaters area (known as McMullen Narrows). Access is very limited in the canyon portion of the stream.

Cottonwood Creek is similar to McMullen Creek in that it is intermittent. It has some artesian sources and is very swampy ground. North Cottonwood Creek is strictly reservoir water after June 15th.

Rock Creek has two small tributaries: Deadman Gulch, between Rock Creek town and the confluence with the Middle Snake River; and, Silo Creek which emanates from Slaughterhouse Gulch. Of note, Rock Creek has numerous irrigation return flows and several outlets to seepage tunnels between Rock Creek town and its confluence. Above Rock Creek town most of the stream flow is diverted for irrigation. See Figure 17 for an illustration of the Rock Creek Complex.

CEDAR DRAW

Cedar Draw has its headwaters in the upper portion of the Hollister watershed and traverses the eastern portion of the Filer watershed until it drains into the Middle Snake River at RM 599.1 (elevation 2980 feet). It drains approximately 73,639 acres of irrigated-gravity flow and urban ground. Cedar Draw has Desert Creek as an associated tributary that connects to the Main Canal. The High Line Canal blocks flow in Cedar Draw above the High Line Canal. Flow in Cedar Draw below the High Line Canal is blocked by the Low Line Canal, which forms Cedar Draw Lake. The portion of Cedar Draw below the Low Line Canal to the Middle Snake River is fed by seepage tunnels and is the only portion with year-round flow. See Figure 18 for an illustration of the Cedar Draw tributary.

MUD CREEK

Mud Creek has its "headwaters" in the Low Line Canal (of the Twin Falls Canal Company) in the Buhl watershed and traverses the western portion of the watershed until it drains into the Middle Snake River at RM 591.5 (elevation 2900 feet). It drains approximately 25,958 acres of irrigated-gravity flow agricultural land. Mud Creek has the following associated tributaries: Clear Creek, Silver Creek, Silo Creek, and other minor tributaries (seeps, seep tunnels, and springs) in Melon Valley. Because the Low Line Canal functions as the "headwaters," during the irrigation season (April to September) the majority of the flow may be attributed to irrigation return flows. Off-season flows are attributed to spring seeps and rainfall/snow. See Figure 18 for an illustration of the Mud Creek tributary.

DEEP CREEK

Deep Creek is divided into two portions: an Upper Deep Creek and a Lower Deep Creek. The irrigation canal system of Twin Falls Canal Company keeps these two portions segregated throughout much of the year. Upper Deep Creek has its headwaters in the Clover watershed and traverses the western portion of the watershed, draining approximately 54,088 acres of rangeland. Upper Deep Creek has associated tributaries: (1) South Fork of Deep Creek; (2) North Fork of Deep Creek; (3) Emerson Spring Creek; (4) Soldier Creek; (5) Green Creek; and (6) Cottonwood Creek. Upper Deep Creek is used for irrigation and if there is any irrigation left, it flows into the Salmon River Canal Company canal. Lower Deep Creek has its "headwaters" in the Castleford watershed. The portion of Deep Creek above the High Line Canal is blocked by the High Line Canal. Flow above the High Line Canal seldom occurs and is only due to extreme snowmelt conditions that last occurred in 1984. Therefore, the High Line Canal acts as "headwaters" into Deep Creek which eventually drains into the Middle Snake River at RM 591.4 (elevation 2900 feet). Excess flow from the Low Line Canal spills into Deep Creek. Flow in Deep Creek between the High Line and the Middle Snake River is partially diverted at several locations by the Twin Falls Canal Company. Deep Creek drains approximately 47,756 acres of irrigated-gravity flow agricultural land. See Figure 18 for an illustration of the Deep Creek tributary.

SALMON FALLS CREEK

Salmon Falls Creek drains from the Salmon Falls subbasin (HUC 17040213) into the Middle Snake River at RM 586.2 (elevation 2923 feet). It drains for the most part approximately 1,371,586 acres of rangeland and irrigated agriculture from both Nevada and Idaho. Salmon Dam separates the watershed on Salmon Falls Creek. On only three occasions since the dam was built in 1911 has any water been released by Salmon Dam down the canyon to the Middle Snake River.

BILLINGSLEY CREEK

Billingsley Creek has its headwaters in the Hagerman watershed and drains into the Middle Snake River at RM 573.8 (elevation 2804 feet). It drains approximately 31,927 acres of irrigated-sprinkler ground and rangeland. Billingsley Creek does not have any associated tributaries and is largely a spring fed stream. See Figure 19 for an illustration of the Billingsley Creek tributary.

MALAD RIVER

The Malad River drains from the Camas Creek HUC (17040220), the Big Wood River subbasin HUC (17040219), and the Little Wood River subbasin HUC (17040221) into the Middle Snake River at RM 571.4 (elevation 2776 feet). It drains for the most part approximately 427,432 acres of the Camas Creek HUC, 901,370 acres of the Big Wood River HUC, and 716,490 acres of the Little Wood River HUC, or a total of 2,045,292 acres.

CLOVER CREEK

Clover Creek has its headwaters in the Upper Clover Creek watershed, traverses through the lower portion of Calf-Clover watershed, and then drains into the Middle Snake River via the Lower Clover Creek watershed at RM 547.6 (elevation 2533 feet). Including its tributaries, it drains approximately 179,555 acres of principally rangeland, with minor irrigated-gravity flow and irrigated-sprinkler agricultural land. Clover Creek has the following associated tributaries: (1) Hog Creek; (2) Dry Creek (with associated Thorn Creek, East Dempsey Creek, and West Dempsey Creek); (3) Calf Creek; (4) Cottonwood Creek; (5) East Fork of Clover Creek; (6) Squaw Creek; and (7) Deer Creek. See Figure 20 for an illustration of the Clover Creek Complex.

CRYSTAL SPRINGS LAKE

Crystal Springs Lake is a natural spring-fed lake with an outfall that discharges to the Middle Snake River at RM600.4. It is a small (8 acre) shallow lake (existing mean depth of less than 3 m) that historically has received effluent discharges from a private commerical fish hatchery (USBLM 1985b). Historically, the lake received about 450-525 cfs of spring flows from the Snake Plain Aquifer. Flow from the springs averages (from 1950 to 1982) 450 to 550 cfs with maximum flows in September, October, and November, and barely enough flows to cover water rights during March, April, and May. The lake is located along the southwestern edge of the Snake Plain in the Thousand Springs area of the Snake River canyon. Soils in the vicinity of the lake and along the western edge of the Snake Plain may be characterized as predominantly fine sandy loams and silty clay loams with moderate to high erosion potentials. Land use is diverse and includes irrigated agriculture, grazing, fish propagation, and some residential development. No surface runoff or irrigation return flows from agricultural lands reach the lake. Historically, some soil erosion occurred near the lake as a result of hatchery construction activities with some sediment reaching the lake. These areas have since been stabilized and the sediment has been eliminated. Most recreational use of the lake at present is for fishing by bank fishermen who fish from the hatchery outfall structure or lake outlet bridge area. The hydraulic characteristics of the lake include: 7.8 acres of surface area; 16.0 feet maximum depth; 5.8 feet average depth; 45.20 acre feet volume; 1475 feet maximum length; 350 feet maximum width; 175 feet minimum width; and, 6.8 hours/0.3 days as hydraulic retention time at 80 cfs inflow (IDHW 1990 [p 3]). With a hydraulic retention time of 6.8 hours/0.3 days at 80 cfs inflow, there is little opportunity for a phytoplankton community to develop. Even with total phosphorus inputs which would promote eutrophic conditions, the rapid flushing rate precludes phytoplankton blooms in the lake (IDHW 1990 [p 30]). Historically, the lake was entirely spring fed with virtually no definitive watershed. Spring flows entered the lake directly on the north side, with water flowing through the lake to the Middle Snake River. At present, most of these flows are diverted away from the lake with a portion of the flow (0-80 cfs) returning to the lake after use in a nearby fish hatchery. No other surface water flows enter the lake.

BOX CANYON

The upper two-thirds of Box Canyon (or 117.5 acres, including the existing diversion structure) is privately owned, as is the mouth of Box Canyon Creek. The remainder (or 26.2 acres) is public (federal) land managed by the U.S. Bureau of Land Management. Box Canyon Creek discharges to the Middle Snake River at RM587.8 (although USGS records the mouth at RM588.8 in its water year resource books). It is the 11th largest spring in the United States. Numerous springs emerge from the creek bed throughout the 1.4 mile water course. The average discharge of Box Canyon (measured at the mouth) is 852 cfs (USGS 1990-1997 [WY1968]). In the 1950s the creek flowed at 850 cfs at its confluence with the Middle Snake River. In the 1980s there was one diversion (300 cfs) from the creek and extensive deep well pumping of the Snake River Plain Aquifer for agricultural irrigation, resulting in a stream flow at the mouth of approximately 400 cfs, which has reduced the natural dilution and instream flow values of the lower stream as well as the adjacent habitat in the Middle Snake River (Langenstein & Bowler 1989). More current USGS gage readings indicate that for the water years 1995-1997, the average discharge to the Middle Snake River is 329, 336, and 347 cfs, respectively (USGS 1990-1997 [WY1995, WY1996, WY1997]). The main spring emerges at the foot of a cliff at the head of a deep, narrow alcove canyon. Many other springs and seeps enter the outflow channel above and below the USGS gage. The head of Box Canyon contains a large alcove pool (about 1.2 acres) where the initial springs emerge. Below this pool, the creek rapidly descends approximately 804.6 m (about 0.5 miles) to a large waterfall approximately 12.2 m (or 40 ft) across and 3.7 m (or 12 ft) high. This waterfall is sufficiently high to be a barrier to some fish species, but it is estimated that salmon and steelhead from the Middle Snake River could have historically passed this mark (IPC 1998). The waterfall is sufficiently high to also be a barrier to at least one endemic species, the Shoshone sculpin (*Cottus greenei*) which occurs in the lower canyon, while its congener, the Mottled sculpin (*Cottus bairdi*) is found both above and below the waterfall. Other species of endangered or threatened species include: the Bliss Rapids Snail, the Utah or Desert Valvata Snail, the Giant Columbia River Limpet, Shoshone sculpin, and an undescribed Lanx species. These species are not uniformly distributed throughout the canyon, and each occupy unique habitats and may be affected by the barrier presented by the falls (Langenstein & Bowler 1989). See Figure 21 for an illustration of the Box Canyon tributary.

BLIND CANYON

Blind Canyon is entirely in private ownership (54.3 acres). It is situated immediately upstream of Box Canyon. The average discharge is 12.8 cfs (USGS 1990-1997 [WY1968]) and it discharges to the Middle Snake River at RM588.1. Blind Canyon is fed by numerous springs originating throughout the canyon. The topography of Blind Canyon is similar to Box Canyon. See Figure 21 for an illustration of the Blind Canyon tributary.

BRIGGS SPRINGS CREEK

Briggs Springs Creek is entirely in private ownership. The average disharge measured at Briggs Creek was 109.7 cfs (USGS WY1968) and discharges to the Middle Snake River at RM590.3).

RILEY CREEK

Riley Creek was classified as a Class A stream in southwestern Gooding County in 1977 (IDHW 1977b). It is entirely spring fed during the non-irrigation season. More than 20 springs discharge from the Snake Plain Aquifer to the creek. The creek discharges to the Middle Snake River at RM582.9. More than 20 springs discharge from the Snake Plain Aquifer to the creek. The creek's discharge increases to about 300 cfs in the less than two miles distance to its mouth (IDHW 1977b).

2.1.4 BIOLOGICAL CONSIDERATIONS

This section covers fisheries, macroinvertebrates, aquatic fowl, aquatic endangered species, and aquatic macrophytes.

2.1.4.1 FISHERIES

The fish fauna in the Upper Snake Basin, and specifically the Middle Snake River, consists primarily of native coldwater species in the families *Salmonidae* (trout), *Acipenseridae* (sturgeon), *Cottidae* (sculpins), *Cyprinidae* (minnows), and *Catostomidae* (suckers) (USGS 1997a), although other families are noted: *Petromyzontidae* and *Percopsidae*. Indigenous fishes are represented by 26 species in five families. Thirteen additional species have been introduced, primarily to enhance sport-fishing opportunities (Maret *et al.* 1993). Following the construction of large hydroelectric facilities on the main-stem of the Middle Snake River (i.e., Bliss Dam, Lower Salmon Falls Dam, Upper Salmon Falls Dam, Shoshone Falls Dam), salmon, steelhead, and Pacific lamprey were extirpated from the region between King Hill and Shoshone Falls (USGS 1997a).

Until the twentieth century, three anadromous species frequented the Middle Snake River and its tributaries as far upstream as Shoshone Falls. These include: Chinook salmon (*Oncorhynchus tshawytscha*), steelhead trout (*Onchorhynchus mykiss*), and the lamprey (*Lampetra tridentata*) (Everman 1896; FERC 1990; Myers 1996). All three runs of Chinook salmon (spring, summer, and fall) were at one time found in the Middle Snake River system. Spring and summer runs were the most prevalent with little historical information regarding use of the system by fall chinook salmon, although some references cite this run as occurring in the Middle Snake River (Simpson and Wallace 1982 [p 67]).

Although sockeye salmon (*Oncorhynchus nerka*) are occasionally mentioned in various sources (Everman 1896; FERC 1990; Myers 1996) as existing in the Middle Snake River system, sockeye historically resided only in the Payette River system and the Salmon River system in Idaho. Sockeye have specific habitat requirements which include a lake or other "impoundment" immediately below their spawning streams (for example Redfish Lake, Alturas Lake, Yellow Belly Lake, Pettit Lake, Payette Lake, Little Payette Lake). No spawning streams with an associated lake exist within the Middle Snake River system.

Native non-anadromous species include: white sturgeon (*Acipenser transmontanus*), rainbow trout as steelhead (*Oncorhynchus mykiss*), cutthroat trout (*Oncorhynchus clarki*), mountain whitefish (*Prosopium williamsoni*), northern squawfish (*Prychocheilus oregonensis*), suckers (*Catostomus* spp.), shiner (*Richardsonius* spp.), dace (*Rhinichthys* spp.), peamouth (*Mylocheilus* spp.) and bull trout (*Salvelinus confluencus*). There are closely related anadromous species of both white sturgeon and bull trout (see next paragraph). Not a great deal is known about historic existence or movements of these "potentially" anadromous species prior to damming of the Snake and Columbia Rivers. Additionally, some ichthyologists and geneticists believe the native redband trout found downstream of Shoshone Falls are a residualized form of anadromous steelhead (IDFG 1998b). White sturgeon do not migrate above Shoshone Falls, thus inhabiting the Snake River from Shoshone Falls downstream to the confluence of the Columbia River (FERC 1997b [pp 2, 4]).

IDFG notes that bull trout have been documented within the Rock Creek and Salmon Falls Creek drainages. It is possible that remnant, isolated populations still exist within the Rock Creek drainage. Bull trout distribution in the Middle Snake River system, like other areas of Idaho, paralleled distribution of anadromous fish species. Any of the perennial tributaries below Shoshone Falls containing anadromous fish probably also contained bull trout. Within the Rock Creek drainage, due to water quality degradation and migration barriers, bull trout could only exist in headwater areas as isolated remnant populations (IDFG 1998b).

Other species (of which their reproductive and population status in the Middle Snake River is unknown at this time) includes the following native and non-native fish species of the Middle Snake River:

1. Native Fish Species: Leatherside chub (*Gila copei*), Utah chub (*Gila atraria*), Chiselmouth (*Arocheilus alutaceus*), Mottled sculpin (*Cottus bairdi*), Shoshone sculpin (*Cottus greenei*), and Mountain whitefish (*Prosopium williamsoni*).

2. Non-native Fish Species: Brown bullhead (*Ictalurus nebulosus*), Black bullhead (*Ictalurus melas*), Channel catfish (*Ictalurus punctatus*), Smallmouth bass (*Micropterus dolomieui*), Yellow perch (*Perca flavescens*), and Carp (*Cyprinus carpio*).

Mountain whitefish, as a native fish species of the Middle Snake River, are probably the most widely distributed native fish species of the family *Salmonidae* found in Idaho. They have persisted, without population augmentation or special management, in the Middle Snake River drainage. Little is known about local populations other than they are widely distributed within the Middle Snake River reach, and they are commonly sampled near flowing riverine habitats (IDFG 1998b).

Table 16 describes the fish species occurring in the Middle Snake River reach by drainage, as the Snake River below Shoshone Falls (Sb) and the Snake River above Shoshone Falls (Sa), and by origin, as native or introduced species.

Table 16 List of fishes in the Middle Snake River drainage

FAMILY TAXONOMY		SPECIES TAXONOMY		Sb	Sa
Common Name	Scientific Name	Common Name	Scientific Name		
NATIVE ORIGIN					
Sturgeon	*Acipenseridae*	White sturgeon	*Acipenser transmontanus*	X	X'

FAMILY TAXONOMY Common Name	FAMILY TAXONOMY Scientific Name	SPECIES TAXONOMY Common Name	SPECIES TAXONOMY Scientific Name	Sb	Sa
Trout	*Salmonidae*	Mountain whitefish	*Prosopium williamsoni*	X	X
		Chinook salmon	*Oncorhynchus tshawytscha*	X	
		Cutthroat trout Yellowstone	*Oncorhynchus clarki bouvieri*	X	X
		Cutthroat trout Finespotted	*Oncorhynchus clarki ssp.*		X
		Rainbow trout	*Oncorhynchus mykiss*	X	X[1]
		Redband trout	*Oncorhynchus mykiss gairdneri*	X	
		Bull trout	*Salvelinus confluentus*	X	
Minnow	*Cyprinidae*	Chiselmouth	*Acrochellus alutaceus*	X	
		Utah chub	*Gila atraria*	X	X
		Leatherside chub	*Gila copei*	X	X
		Peamouth	*Mylocheilus caurinus*	X	
		Northern squawfish*	*Ptychocheilus oregonensis*	X	
		Longnose dace	*Rhinichthys cataractae*	X	X
		Speckled dace	*Rhinichthys osculus*	X	X
		Redside shiner	*Richardsonius balteatus*	X	X
Sucker	*Catostomidae*	Utah sucker	*Catostomus ardens*		X
		Bridgelip sucker	*Catostomus columbianus*	X	
		Largescale sucker	*Catostomus macrocheilus*	X	
		Mountain sucker	*Catostomus platyrhynchus*	X	X
Sculpin	*Cottidae*	Mottled sculpin	*Cottus bairdi*	X	X
		Shorthead sculpin	*Cottus confusus*	X	
		Shoshone sculpin	*Cottus greenei*	X	
		Wood River sculpin	*Cottus leiopomus*	X	
		INTRODUCED ORIGIN			
Sturgeon	*Acipenseridae*	White sturgeon	*Acipenser transmontanus*		X
Trout	*Salmonidae*	Rainbow trout	*Oncorhynchus mykiss*		X
		Coho salmon	*Oncorhynchus kisutch*	X	X
		Brown trout	*Salmo trutta*	X	X
		Brook trout	*Salvelinus fontinalis*	X	X

	FAMILY TAXONOMY		SPECIES TAXONOMY		Sb	Sa
38 39	Common Name	Scientific Name	Common Name	Scientific Name		
			Lake trout	*Salvelinus namaycush*	X	X
			Arctic grayling	*Thymallus arcticus*	X	X
1	Pike	*Eocidae*	Tiger muskie	*Esox lucius x E. masquinongy*	X	
			Goldfish	*Carassius auratus*	X	
			Carp	*Cyprinus carpio*	X	X
2	Minnow	*Cyprinidae*	Grass carp	*Ctenopharyngodon idella*	X	X
			Tui chub	*Gila bicolor*	X	
			Spottail shiner	*Notropis hudsonius*	X	X
			Fathead minnow	*Pimephales promelas*	X	X
			Black bullhead	*Ameiurus melas*	X	
			Brown bullhead	*Ameiurus nebulosus*	X	X
			Blue catfish	*Ictalurus furcatus*	X	X
3	Catfish	*Ictaluridae*	Channel catfish	*Ictalurus punctatus*	X	X
			Tadpole madtom	*Noturus gyrinus*	X	
			Flathead catfish	*Pylodictis olivaris*	X	
4	Livebearer	*Poeciliidae*	Mosquitofish	*Gambusia affinis*		X
			Pumpkinseed	*Lepomis gibbosus*	X	X
			Warmouth	*Lepomis gulosus*	X	
			Bluegill	*Lepomis macrochirus*	X	X
5	Sunfish	*Centrarchidae*	Smallmouth bass	*Micropterus dolomieu*	X	X
			Largemouth bass	*Micropterus salmoides*	X	X
			Black crappie	*Pomoxis nigromaculatus*	X	X
			White crappie	*Pomoxis annularis*	X	
6	Perch	*Percidae*	Yellow perch	*Perca flavescens*	X	X
			Walleye	*Stizostedion vitreum*	X	X
7	Loach	*Cobitidae*	Oriental weatherfish	*Misgurnus anguillicaudatus*	X	
8	Shad	*Clupeidae*	American shad	*Alosa sapidissima*	X	

FAMILY TAXONOMY Common Name	Scientific Name	*SPECIES TAXONOMY* Common Name	Scientific Name	*Sb*	*Sa*

Prepared by IDEQ-TFRO. Adapted from IDFG 1996. Sb = Below Shoshone Falls. Sa = Above Shoshone Falls. X' = Introduced native fish. In addition to the above introduced species, there are three species of the Cichlid family (*Cichlidae*) which are introduced Sb specifically confined to geothermal waters: Mozambique (Java) talapia (*Talapia mossambica*), Redbelly (Zill's) talapia (*Talapia zilli*), and Convict cichlid (*Cichlasoma nigrofasciatum*). *At the time of this writing, an international committee of fish experts had agreed to change the common name of the "squawfish" to avoid use of a term that many American Indian women find offensive and derogatory. The new name proposed is "pikeminnows," and won't be final until publication in the American Fisheries Society journal. Table verified by IDFG-Jerome for the Upper Snake Rock subbasin.

A knowledge of IDFG's fisheries management in the Middle Snake River is important to understanding the diversified nature of the native and introduced species of fish. The major responsibility of the IDFG fisheries activities is to provide continued supplies of game fish for sport fishermen. Primary fish species from a management standpoint include: native sport fish, including rainbow trout, cutthroat trout, bull trout, steelhead (rainbow trout), chinook salmon, kokanee salmon, whitefish, and white sturgeon. Two of these, steelhead and chinook salmon, migrate to the ocean to complete a portion of their life cycle (i.e., they are "anadromous" species). Introduced game fish, such as brown trout, lake trout, brook trout, landlocked coho and chinook salmon, bass, sunfish, perch, crappie, catfish, walleye, northern pike, and tiger muskie, provide sport fisheries where habitat conditions are unsuitable for native species and also provide a diversity for angling opportunity. According to IDFG the most preferred species of fish sought by anglers in Idaho is rainbow trout followed by bass (warmwater). Most waters suitable for establishment of a warmwater fishery have received introductions. Regulations have been developed purposely to improve the quality of bass and provide some trophy opportunities. Additional species have been introduced to existing warmwater fisheries to diversify the opportunity and provide forage. During the five-year period 1996-2000, the primary emphasis by IDFG will be on management to improve existing warmwater fisheries. Addition of habitat structure and fish concentration devices will be used to improve catch rates for bluegill and crappie. Regulations will be used to provide quality and trophy bass fishing opportunities. Further evaluation of forage needs for bass and other species will be made, and forage introduced where needed. Additional species will be added to diversity fisheries in some cases. Areas with warmwater or mixed water fisheries are fairly numerous in the main Middle Snake River, and are described in Table 17:

Table 17 IDFG water types by river segment

MIDDLE SNAKE RIVER SEGMENT	IDFG MANAGEMENT GOALS
Bliss Reservoir	Warm Water
Bliss Pool to Lower Salmon Falls Dam	Mixed Water
Lower Salmon Falls Reservoir	
Upper Salmon Falls Reservoir	
Upper Salmon Falls Pool to Shoshone Falls	
Shoshone Falls Reservoir	
Shoshone Falls Reservoir to Twin Falls Dam	
Twin Falls Reservoir	Cold Water
Twin Falls Reservoir to Murtaugh Bridge	
Murtaugh Bridge to Milner Dam	

MIDDLE SNAKE RIVER SEGMENT	IDFG MANAGEMENT GOALS

Prepared by IDEQ. These water types are IDFG's fisheries management for the segments on the Middle Snake River. Warm water fisheries are supported by warm water or cool water game fish including bass, crappie, sunfish, catfish, northern pike, tiger muskie, walleye, and yellow perch. Mixed water fisheries are supported by a combination of cold water and warm water fish species. Cold water fisheries are supported by resident populations of salmonid game fish, including trout, char, non-anadromous salmon (kokanee, coho, chinook), and whitefish. Anadromous fisheries are supported by anadromous salmonids (steelhead trout, chinook salmon, and sockeye salmon).

According to IDFG, a great demand exists for mixed waters in the populated portions of the drainage. The Middle Snake River has the greatest potential for increasing angler opportunity of any major water in the southern portion of Idaho. Lack of flows, especially during irrigation season, apparently deteriorating water quality, and loss of spawning areas appear to be the factors most significantly affecting fish populations in the Middle Snake River. Should water become available, IDFG will make every effort to improve summer flows (IDFG 1996 [pp 2-3, 23-24, 35, 58, 197-198]).

Finally, IDAPA 16.01.02.250(02. Aquatic Life)(c. Cold water biota)(iv.Time periods for salmonid spawning and incubation) defines the time periods for salmonid spawning and incubation for cold water biota stream segments. These are listed in Table 18.

Table 18 Time periods for salmonid spawning and incubation on cold water biota stream segments

FISH SPECIES	J	F	M	A	M	J	J	A	S	O	N	D
Chinook salmon (spring): native species	... April 1st							August 1st to ...				
Chinook salmon (summer): native species	... June 15th							August 15th to ...				
Steelhead trout: native species		February 1st to July 15th										
Redband trout: native species			March 1st to July 15th									
Cutthroat trout: native species				April 1st to August 1st								
Bull trout: native species	... April 1st								September 1st to ...			
Rainbow trout: native species	January 15th to July 15th											
Mountain whitefish: native species	... March 15th									Oct 15th to ...		
Brown trout: introduced species	... April 1st									Oct 1st to ...		
Brook trout: introduced species	... June 1st									Oct 1st to ...		

Prepared by IDEQ-TFRO. Months of the year symbolized by first letter of month's name. Fall Chinook salmon may not occur on the Middle Snake River and are not included in this table. Sockeye salmon, sunapee trout, Golden trout, Kokanee salmon, lake trout, and arctic grayling do not occur on the Middle Snake River and are not included in this table. Contents of table verified by IDFG-Jerome for the Upper Snake Rock subbasin.

2.1.4.2 MACROINVERTEBRATES

The aquatic insect fauna in the Middle Snake River is dominated by two orders, *Diptera* (flies) and *Trichoptera* (caddisflies) (FERC 1990). Caddisflies have been reported as the predominant taxa in benthic invertebrate samples collected at most river sites (Falter *et al.* 1976). A study (1978-1979) conducted on the Middle Snake River area (including some of the tributaries) found the greatest number of macroinvertebrate taxa in the Milner area (30.2%), Rock Creek (20.0%), and the Malad River (25.3%), and that the most common taxa were *Trichoptera* (51.8%), *Amphipoda* (17.4%), *Gastropoda* (15.0%), and *Diptera* (7.6%) (Bauer 1986). The aquatic insect fauna in the tributaries (excluding the Middle Snake River) of Upper Snake Rock includes *Diptera* (chironomids), *Oligochaeta* (worms), *Amphipoda* (scuds), and molluscs (mud snail).

Additional studies by Idaho Power Company have shown that the reservoirs in the Buhl to King Hill area are characterized by species commonly found in eutrophic waters (Myers *et al.* 1995 [p 17]). Families include *Diptera*, *Ephemenoptera*, *Odonata*, *Crustacea*, *Annelida*, and *Mollusca*. In these studies, the family *Tricoptera* was not found.

2.1.4.3 AQUATIC FOWL

The Middle Snake River is a major wintering area and migration corridor for waterfowl using the Pacific flyway. Mallards (*Anas platyrhynchos*) and Canada geese (*Branta canadensis* or *Anser canadensis*) comprise much of the waterfowl population using the flyway. Waste grain from croplands outside the canyon provides forage for these species. Ducks that commonly feed in the fast-water sections of the Middle Snake River include Common merganser (*Mergus merganser*) and Common goldeneye (*Bucephala clangula*). As many as a half million ducks migrate through the Snake River Canyon each winter, primarily between the Hagerman Wildlife Management Area and the Minidoka National Wildlife Refuge (FERC 1997a).

2.1.4.4 AQUATIC ENDANGERED SPECIES

This section describes those species of fish, aquatic wildlife, and aquatic plants which are in danger of, or threatened with, extinction.

RARE AND ENDANGERED AQUATIC SPECIES

Those rare and endangered aquatic species are categorized by county in Table 19. The distributions of the federally listed mollusc species in the Middle Snake River and its tributaries are represented by the counties along the extent of the current known ranges of the species.

Table 19 Rare aquatic wildlife species in the tri-county area: Gooding, Jerome, and Twin Falls

COUNTY	RARE WILDLIFE SPECIES
GOODING	Shoshone sculpin, White sturgeon, Inland columbia basin redband trout, Desert valvata, California floater, Columbia pebblesnail, Shortface lanx, Banbury springs limpet, Snake river physa, Bliss rapids snail
JEROME	White sturgeon, California floater, Desert valvata, Snake river physa, Bliss rapids snail
TWIN FALLS	Shoshone sculpin, White sturgeon, Inland columbia basin redband trout,California floater, Banbury springs limpet, Desert valvata, Snake river physa, Columbia pebblesnail, Shortface lanx, Bliss rapids snail
Prepared by DEQ-TFRO.	

2.1.4.5 MACROPHYTES AS ROOTED AND NON-ROOTED SPECIES

The most common macrophytes occuring on the Middle Snake River have been studied from the standpoint of eutrophication since 1974 (Falter et al. 1974). Nuisance plants in the Brownlee to American Falls reservoirs region were studied in 1974 and identified as: *Potomageton pectinatus, Potamogeton crispus, Potamogeton filiformis, Potamogeton pusillus, Chara vulgaris, Brasenia schreberi, Rorippa nasturtium-aquaticum, Myriophyllum spp., Lemna minor, Nasturtium officinale,* and *Zannichellia palustris.* In 1992-1994, the IDEQ-TFRO contracted with the University of Idaho to ascertain biomass and % species composition. Table 20 summarizes the results of the 3-year research. In general, *Ceratophyllum demersum*, *Potamogeton* *pectinatus*, and *Potamogeton crispus* dominated the species composition of the aquatic plant communities in the Crystal Springs reach. Sub-dominants were *Potamogeton foliosus*, *Elodea nuttallii*, and *Elodea canadensis*. The *Ceratophyllum spp.* is a genus of aquatic macrophyte that does not have a well developed root system, thus getting most of its nitrogen and phosphorus from the water column. The *Potamogeton spp.* is a genus of aquatic macrophyte that has a well developed root system and gets most of its nitrogen and phosphorus from the sediment.

The Idaho Power Company also conducted studies from Buhl to King Hill and found extensive areas of submerged vegetation (Myers et al. 1995 [p. 19-20]). Their qualitative survey of Lower and Upper Salmon Falls reservoirs found 13 species: *Elodea nuttallii* and *Elodiea canadensis; Ranunculus aquatilis; Certatophyllum demersum; Potamogeton crispus, Potamogeton pectinatus, Potamogeton filiformes,* and *Potomageton foliosus; Myriophyllum spicatum* and *Myriophyllum sp.; Chara sp.; Zannichellia palustris; Veronica sp.;* and *Lemna minor.*

The primary components of the epiphyton community are the filamentous green algae *Hydrodictyon spp.*, the multi-branching green algae *Cladophora spp.*, and (in 1994) the fresh-water adapted green algae *Enteromorpha*. The *Hydrodictyon spp.* is the familiar "water net" which often grows in such dense mats in lakes, small ponds, or irrigation ditches. The *Cladophora spp.* has the characteristic habitat of flowing water, especially on dams and waterfalls and derives all of its nutrients from the water column. The *Enteromorpha spp.* is primarily a marine alga but becomes adapted rather successfully in fresh-water habitats. *Enteromorpha spp.* is always attached (at least when young) to submersed aquatic plants, sticks and stones, especially in flowing water and nearly always in hard (calcareous) or saline water. Due to the mixed nature of the epiphyton community and the relative difficulty of separating the different algae to genus, the functional group epiphyton was treated in the same fashion as individual species of macrophytes, although in the 1994 study an attempt was made to segregate out the three major epiphyton species. There were several instances where epiphyton was the principal component of the total macrophyte biomass.

The Idaho Power Company also conducted studies on phytoplankton from Buhl to King Hill and found similar species in all three reservoirs from the following families: *Chlorophyta, Chrysophyta, Cryptophyta, Cyanophyta, Euglenophyta,* and *Pyrrophyta.* Zooplankton families included: *Cladocera, Copepoda, Rotifera, Hydracarina,* and *Ostracoda.*

The Crystal Springs reach was chosen by IDEQ-TFRO and the University of Idaho (Mike Falter) as an area potentially impacted by agricultural, aquaculture, and Twin Falls Sewage Treatment Plant returns. Table 20 indicates that only three species dominated the Crystal Springs reach: *Ceratophyllum spp., Potamogeton spp.,* and three *Epiphytes.* Although dependent on the individual site location, in general the rooted macrophytes (*Ceratophyllum spp.* and *Potamogeton spp.*) comprised from 38.1% to 79.1% of the total biomass, whereas the non-rooted plants comprised from 20.5% to 61.3% of the total biomass. Other species were found in the mixture of aquatic plants, but their % species composition (as biomass) was not significant (< 0.4% of the biomass).

It should be noted that *Ceratophyllum spp.* is not a typical rooted macrophyte. It behaves more like an epiphyte. The roots are a modified stem that the plant uses as an anchor rather than a nutrient source. In low phosphorus water *Ceratophyllum spp.* are seldom found. It derives the majority of its nutrients from the water column through its leaves.

Nutrient uptake through the leaves of macrophytes occurs when the water is rich in phosphate. However, lake waters or reservoir-like waters are usually low in available phosphate. Thus, the main method by which rooted macrophytes obtain phosphorus is absorption of phosphate directly from the interstitial soil water. Plant phosphorus losses are attributed to two reasons: (1) direct excretion by the plants, or (2) eventual loss by death and decomposition. Sediment phosphorus is controlled to a great extent by the amount of dissolved oxygen present. When the sediment-water interface becomes anoxic, phosphate passes rapidly into the water above. Anoxic sediments release phosphate at rates as much as 1000 times faster than releases from oxygenated sediments. This is attibutable to both classical chemical bonding and physiochemical sorptive mechansims (Goldman 1983 [pp 137-140]).

Table 20 Three major species of aquatic plants on the Crystal Springs reach of the Middle Snake River

SITE	NAME	CHARACTERIZATION OF DRY BIOMASS AS % OF TOTAL SPECIES PER INDICATED PLANT SPECIES		
	1992 AQUATIC ROOTED MACROPHYTES AND EPIPHYTES:	*Ceratophyllum spp.*	*Potamogeton spp.*	*Epiphytes spp.*
1	Above the weedbed areas	25.4	0.8	73.7
2	Right/Left channel around island in weeds	36.9	15.8	47.0
3	Large cross-channel weedbed	28.4	7.1	63.3
	AVERAGE OF 3 SITES:	30.2	7.9	61.3
	1993 AQUATIC ROOTED MACROPHYTES AND EPIPHYTES:	*Ceratophyllum spp.*	*Potamogeton spp.*	*Epiphytes spp.*
1	Upstream from Crystal Springs Hatchery	11.7	84.1	4.1
2	Across channel from Crystal Springs Hatchery	77.3	2.5	18.4
3	Right side of island 50m into the channel	22.0	53.1	24.9
4	Left channel midway down the island	7.4	83.9	8.7
5	Bottom end of Magic Valley Steelhead	43.3	32.8	23.8
6	100m downstream from Site 5	29.3	42.2	27.8
7	200m downstream from Site 5	46.7	17.3	35.8
	AVERAGE OF 7 SITES:	34.0	45.1	20.5
	1994 AQUATIC ROOTED MACROPHYTES AND EPIPHYTES:	*Ceratophyllum spp.*	*Potamogeton spp.*	*Epiphytes spp.*
2	Across channel from Crystal Springs Hatchery	50.8	15.4	31.2
5	Downstream from Magic Valley Steelhead	78.6	21.5	0.0
7	200m downstream from Site 5	27.6	28.3	43.9
R	Between Sites 2 and 7	17.0	51.4	31.5
	AVEAGE OF 4 SITES:	43.5	29.2	26.7
Prepared by IDEQ-TFRO. *Falter et al., 1994; Falter et al., 1995; Falter et al., 1996.*				

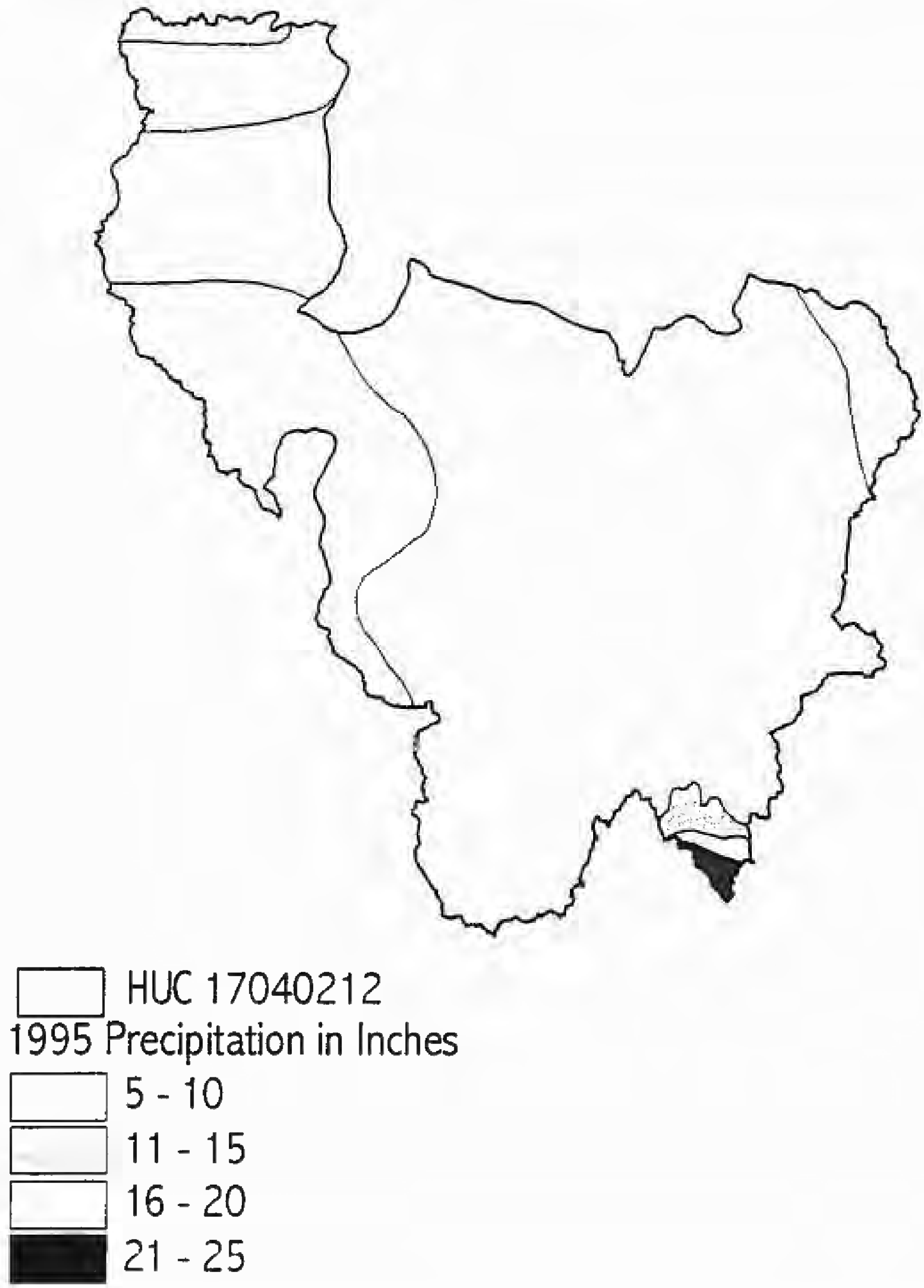


Figure 4 Precipitation in Upper Snake Rock

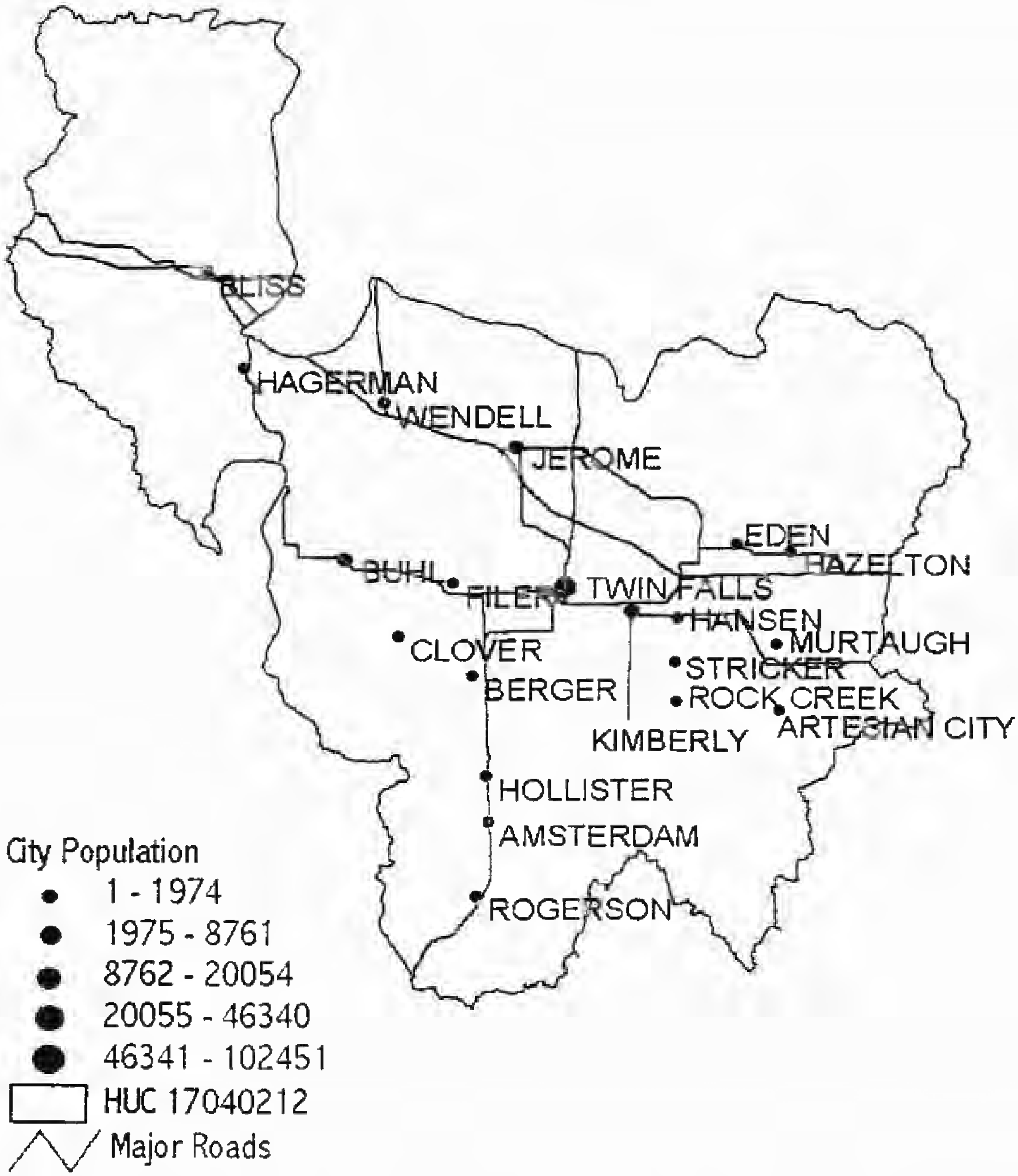


Figure 5 Human population centers in Upper Snake Rock

Figure 6 Topography of Upper Snake Rock

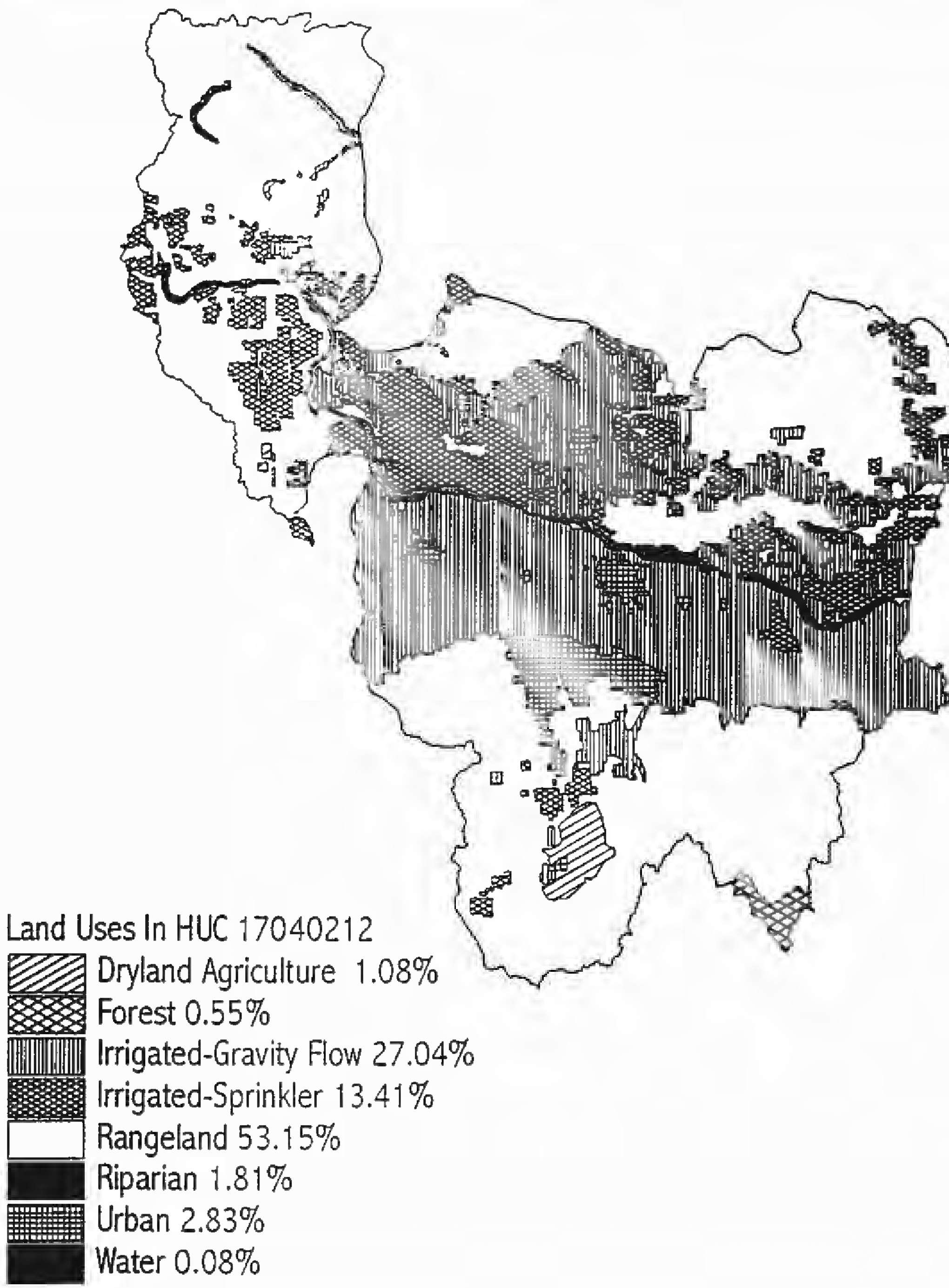


Figure 7 Landuse and ownership in Upper Snake Rock

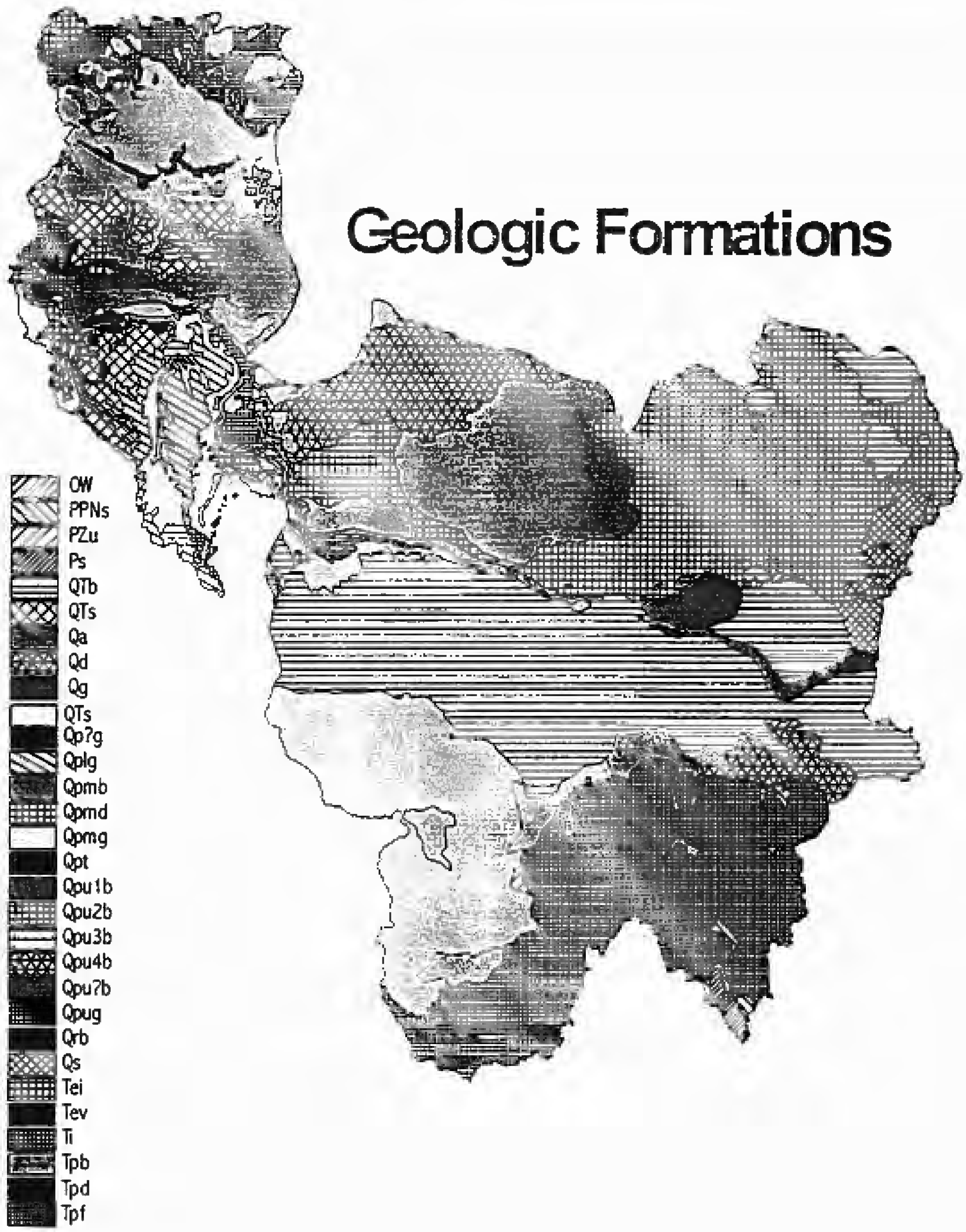


Figure 8 Soils of Upper Snake Rock

Figure 9 General geology of Upper Snake Rock

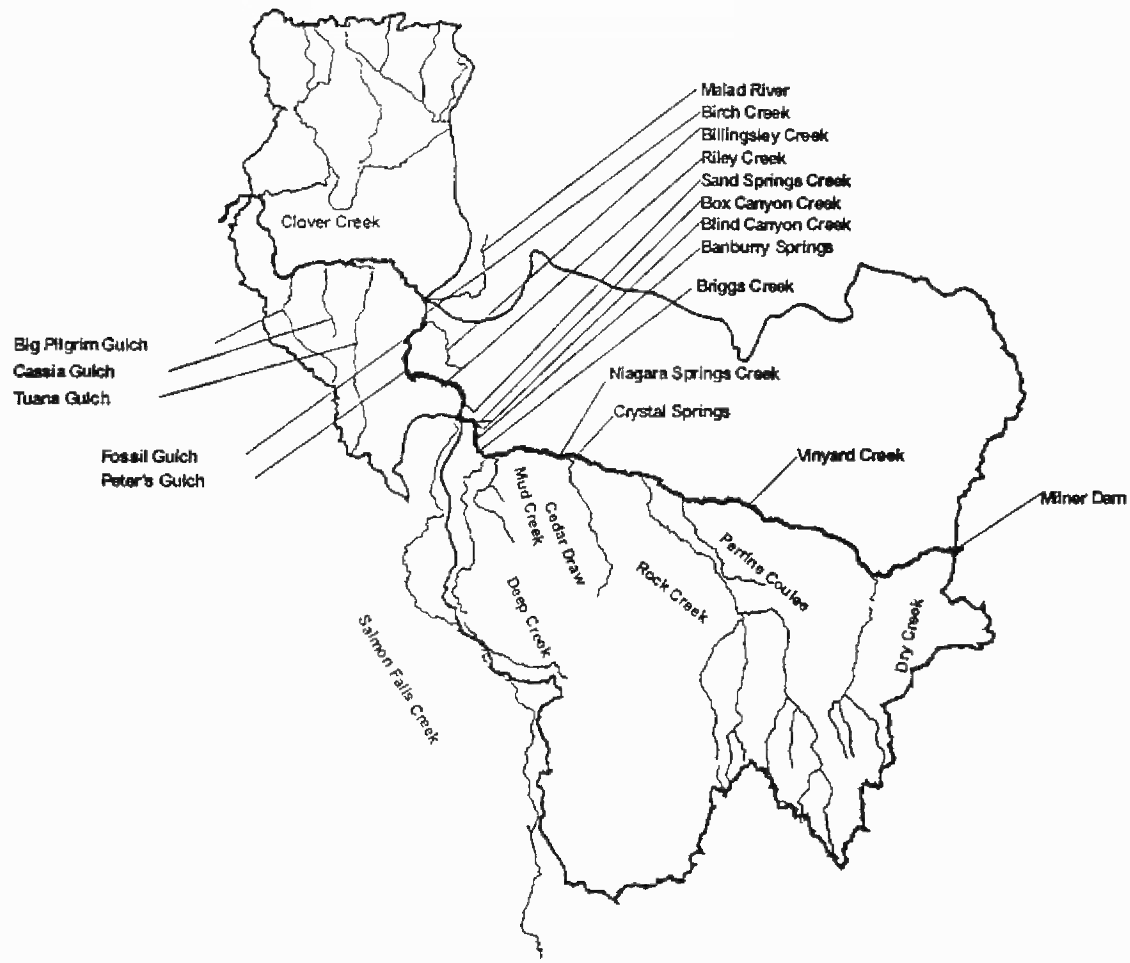


Figure 10 Summary of various tributary inputs into the Middle Snake River

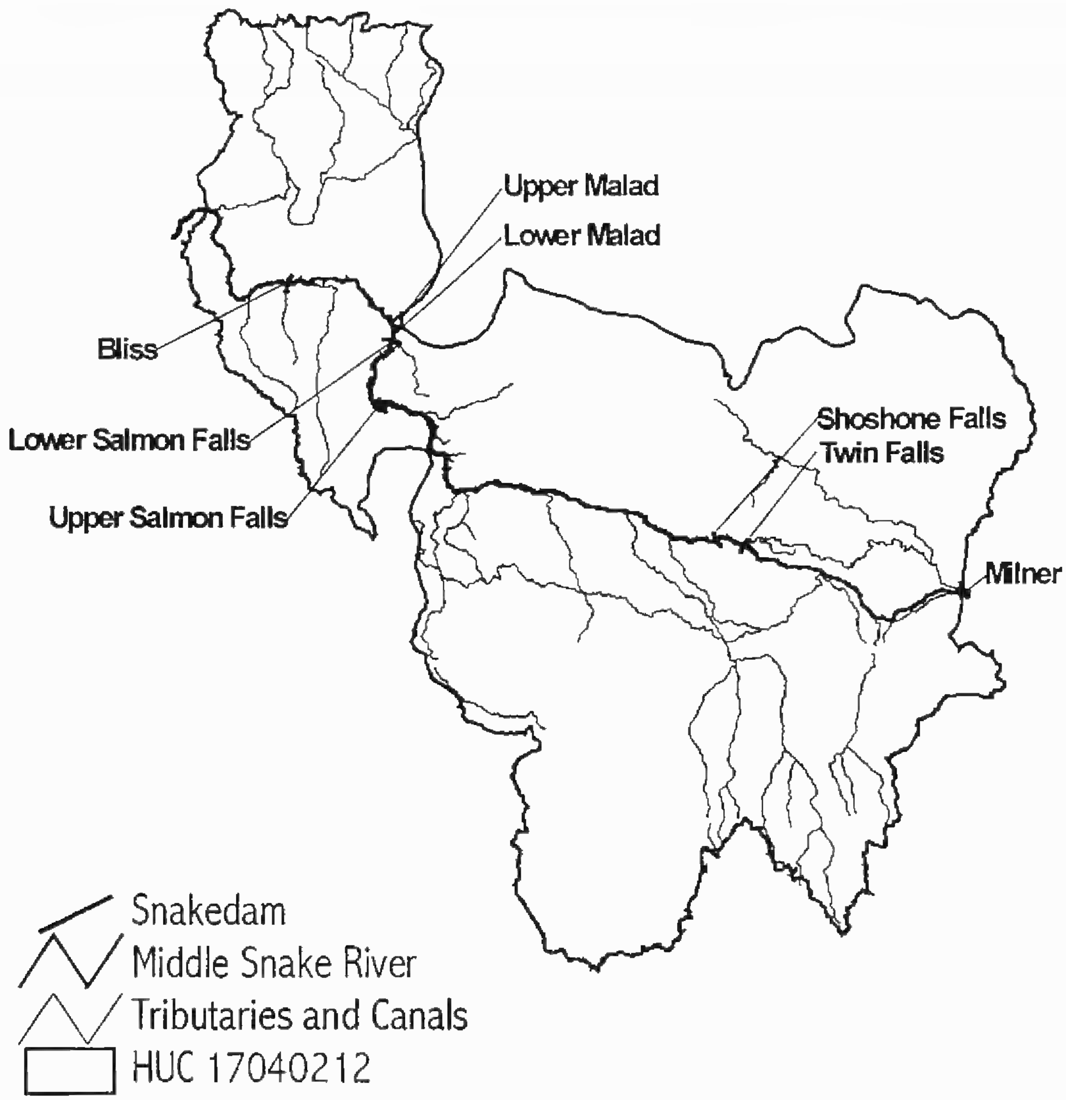


Figure 11a Major impoundments on the Middle Snake River

1. Freeway Drop
2. Dike
3. Bliss
4. A. J. Wiley
5. Stevenson No. 2
6. Stevenson No. 1
7. Lower Salmon
8. Upper Salmon Falls
9. Blind Canyon
10. Kanaka Rapids
11. Empire
12. Boulder Rapids
13. North Side Jerome
14. North Side Jerome
15. North Side Jerome
16. North Side Jerome
17. North Side Jerome
18. Cedar Draw Creek
19. Sahko
20. LQ-LS Drains
21. Rock Creek
22. Auger Falls*
23. Rock Creek No. 2
24. Kasel-Witherspoon
25. Shoshone Falls
26. Twin Falls
27. Lower Low Line
28. Low Line Canal Drop
29. Dietrich Drop
30. Mile-28 Water Power
31. Wilson Lake
32. Star Falls*
33. Hazelton A
34. Hazelton B
35. Bypass
36. Milner
37. Milner

* Proposed Projects

Figure 11b Additional power generation projects near the Middle Snake River

Figure 12 The Eastern Snake River Plain Aquifer in Upper Snake Rock

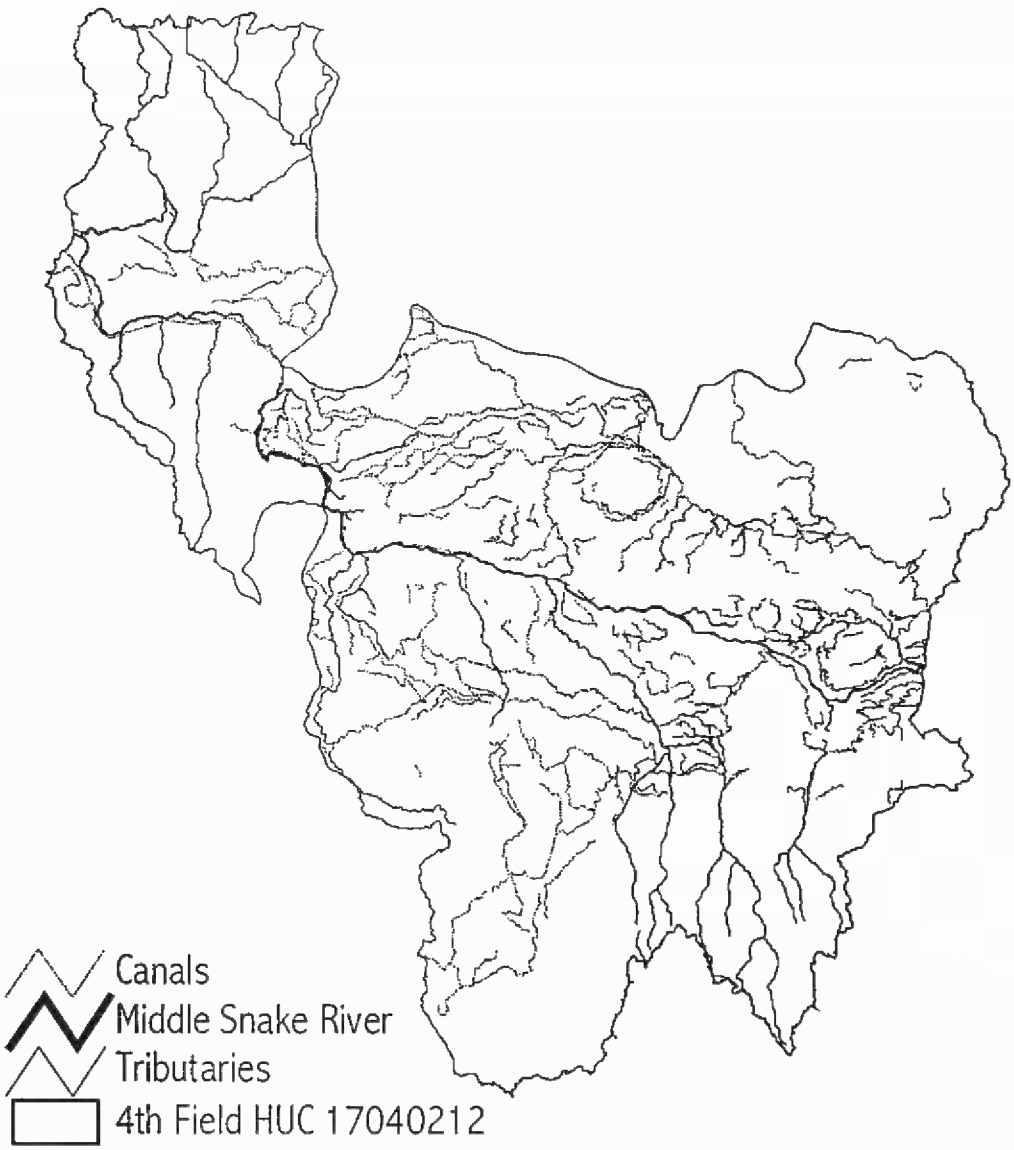


Figure 13 Canal system integration with tributaries and the Middle Snake River

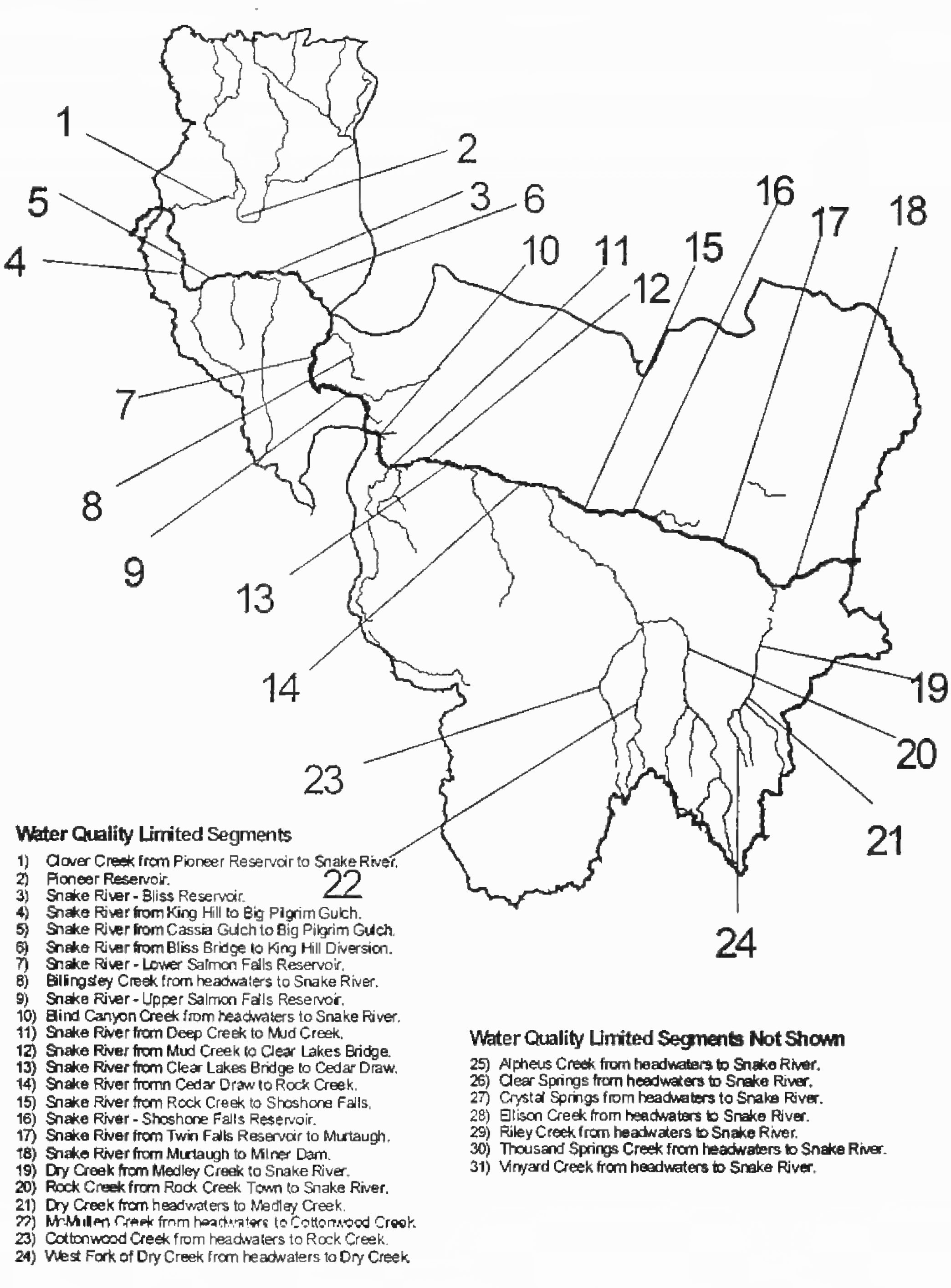


Figure 14 Water quality limited stream segments of Upper Snake Rock

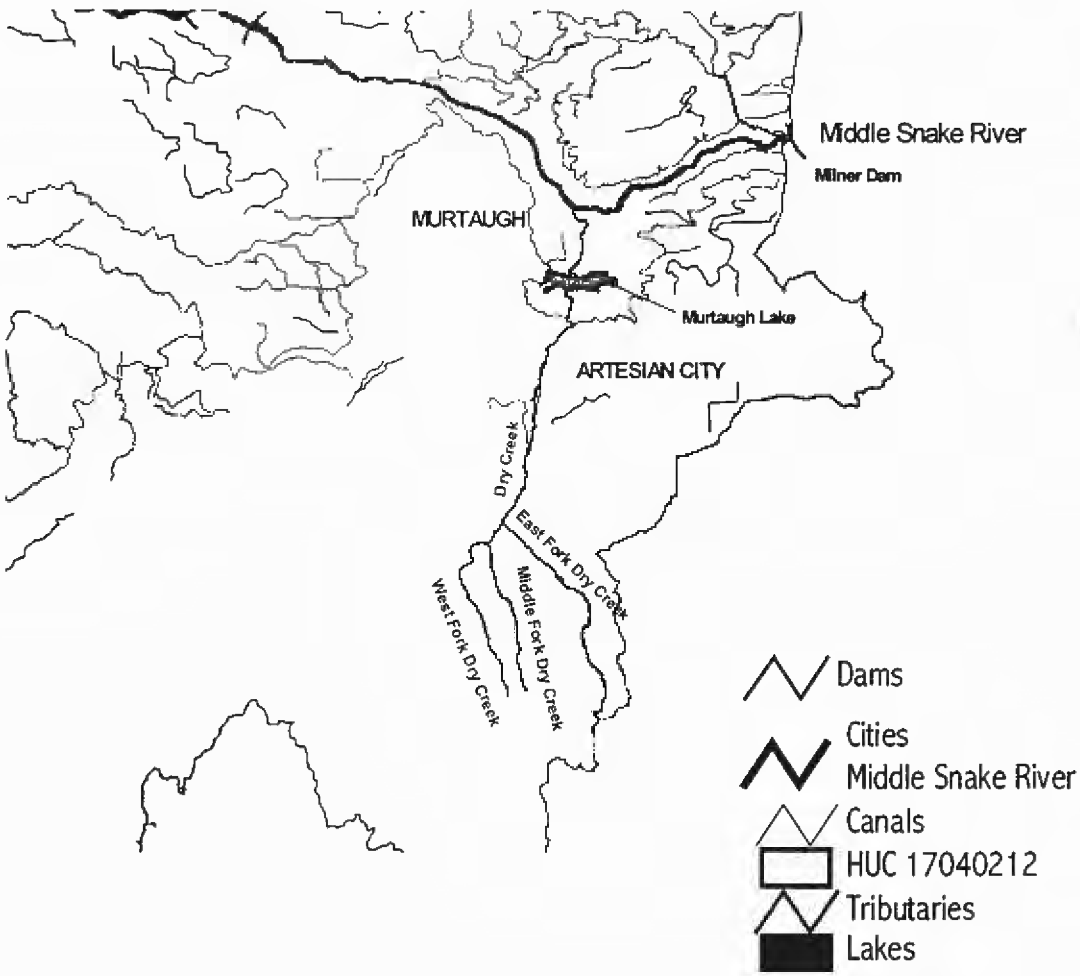


Figure 15 Dry Creek (Murtaugh) Complex of Upper Snake Rock

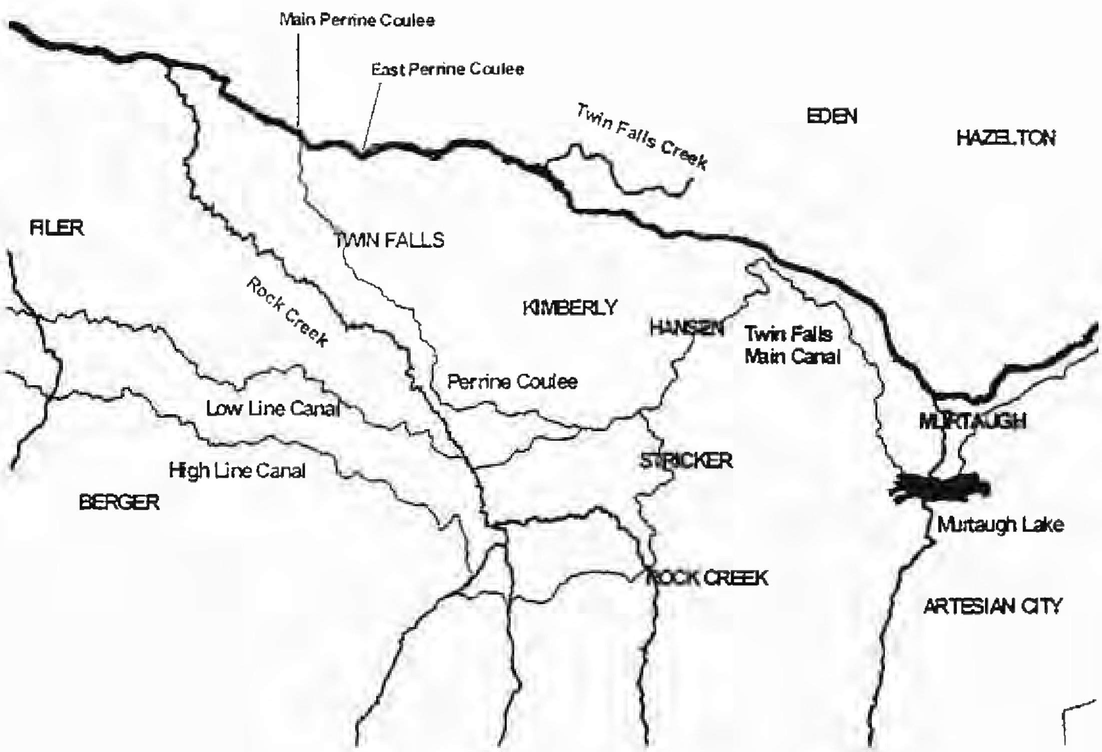


Figure 16 The Perrine Coulee System of Upper Snake Rock

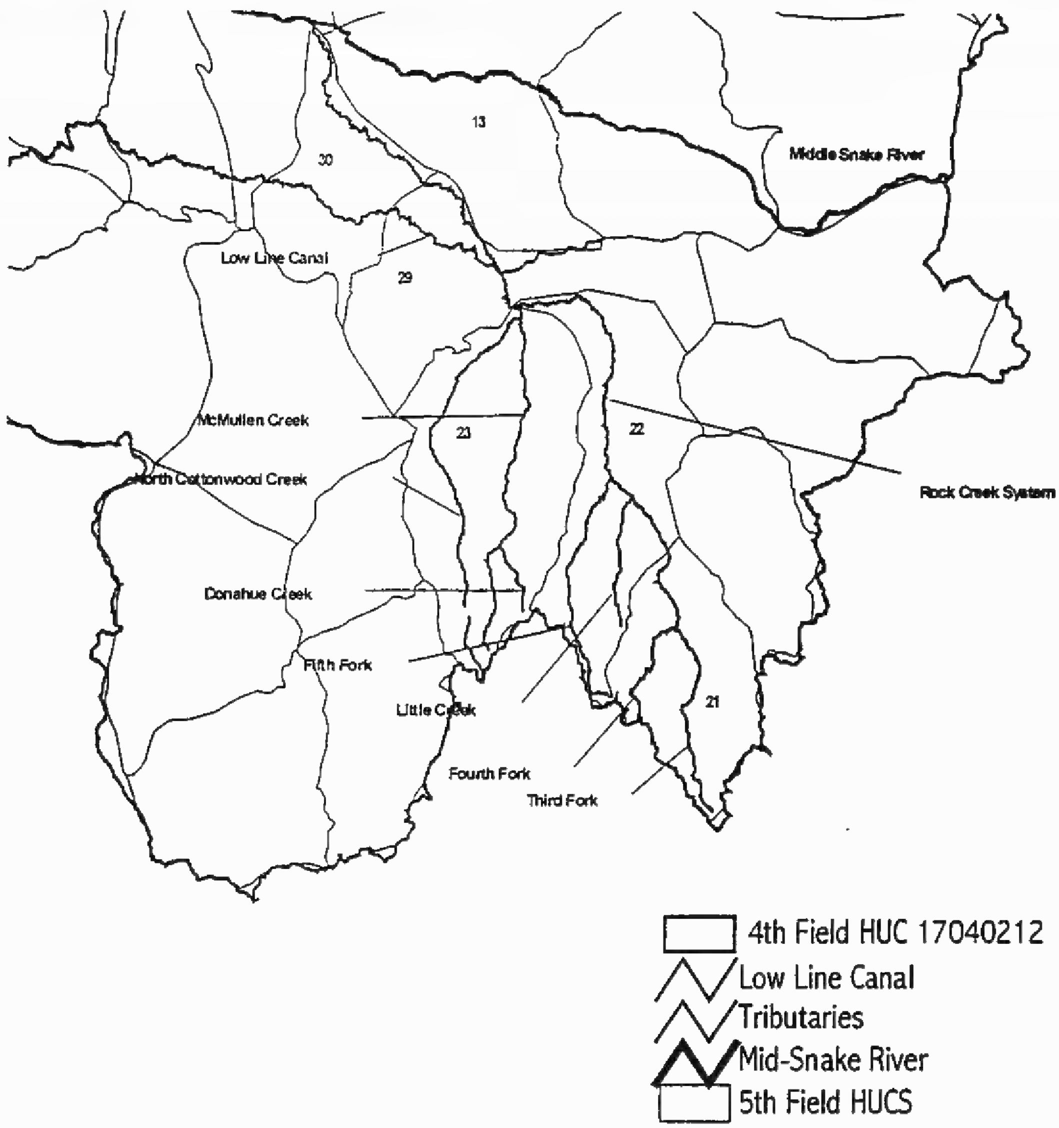


Figure 17 The Rock Creek Complex of Upper Snake Rock

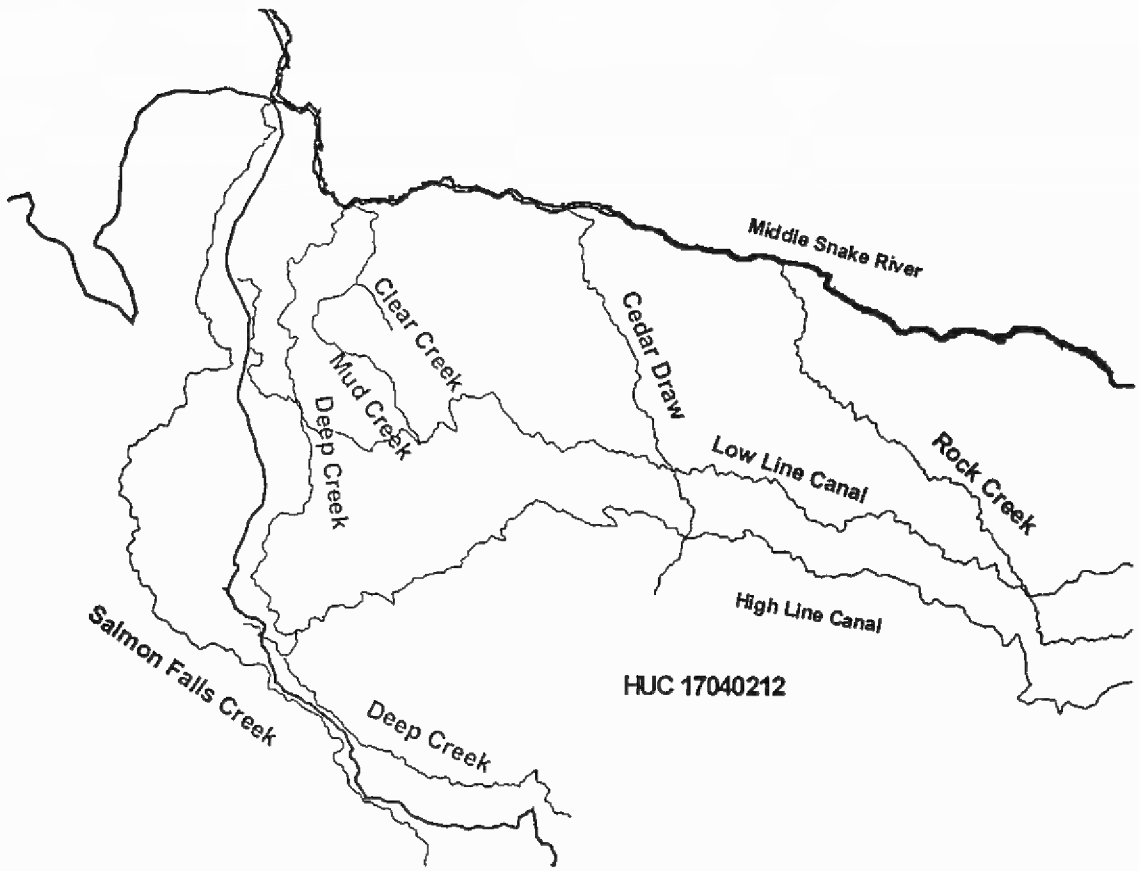


Figure 18 Cedar Draw, Mud Creek, and Deep Creek in Upper Snake Rock

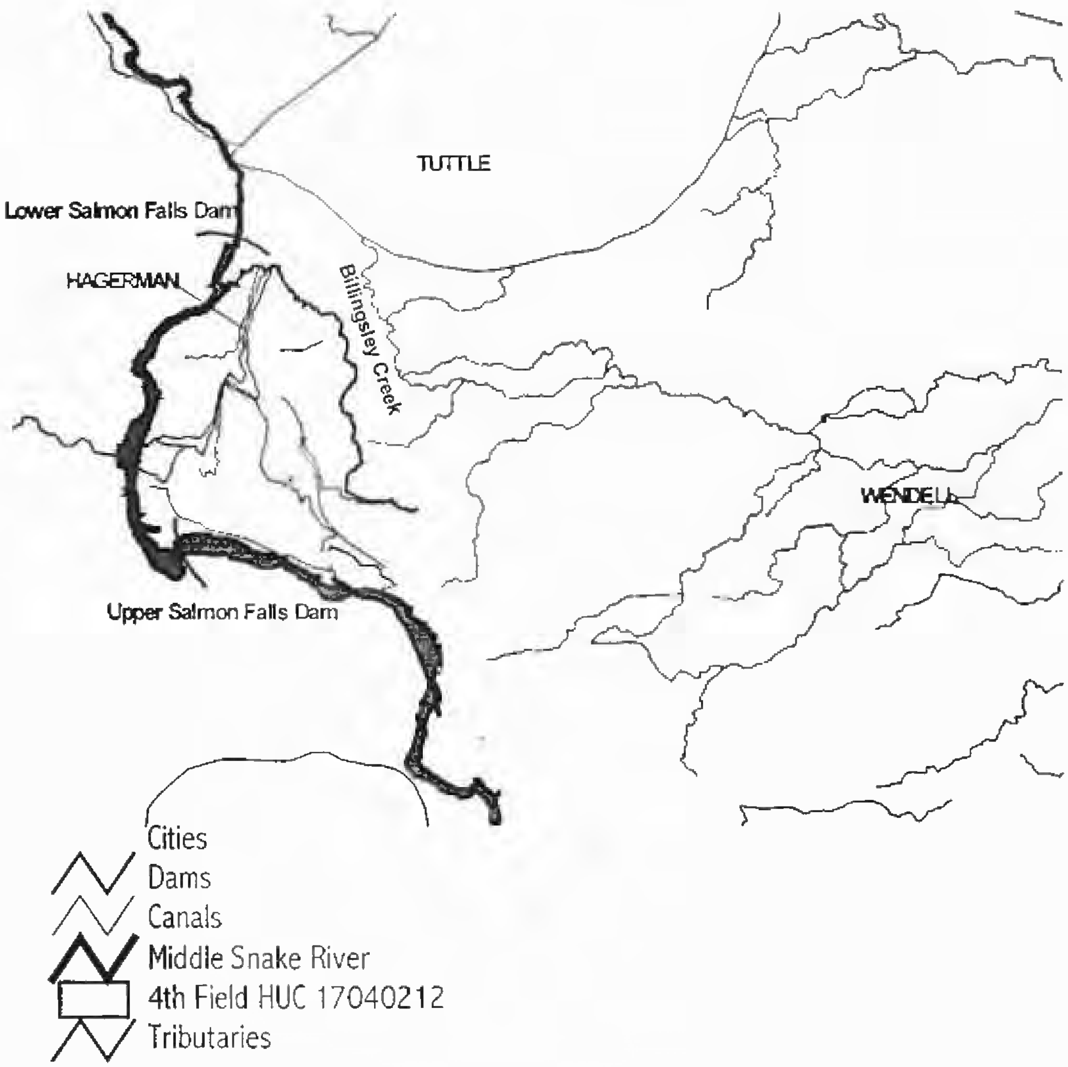


Figure 19 Billingsley Creek in Upper Snake Rock

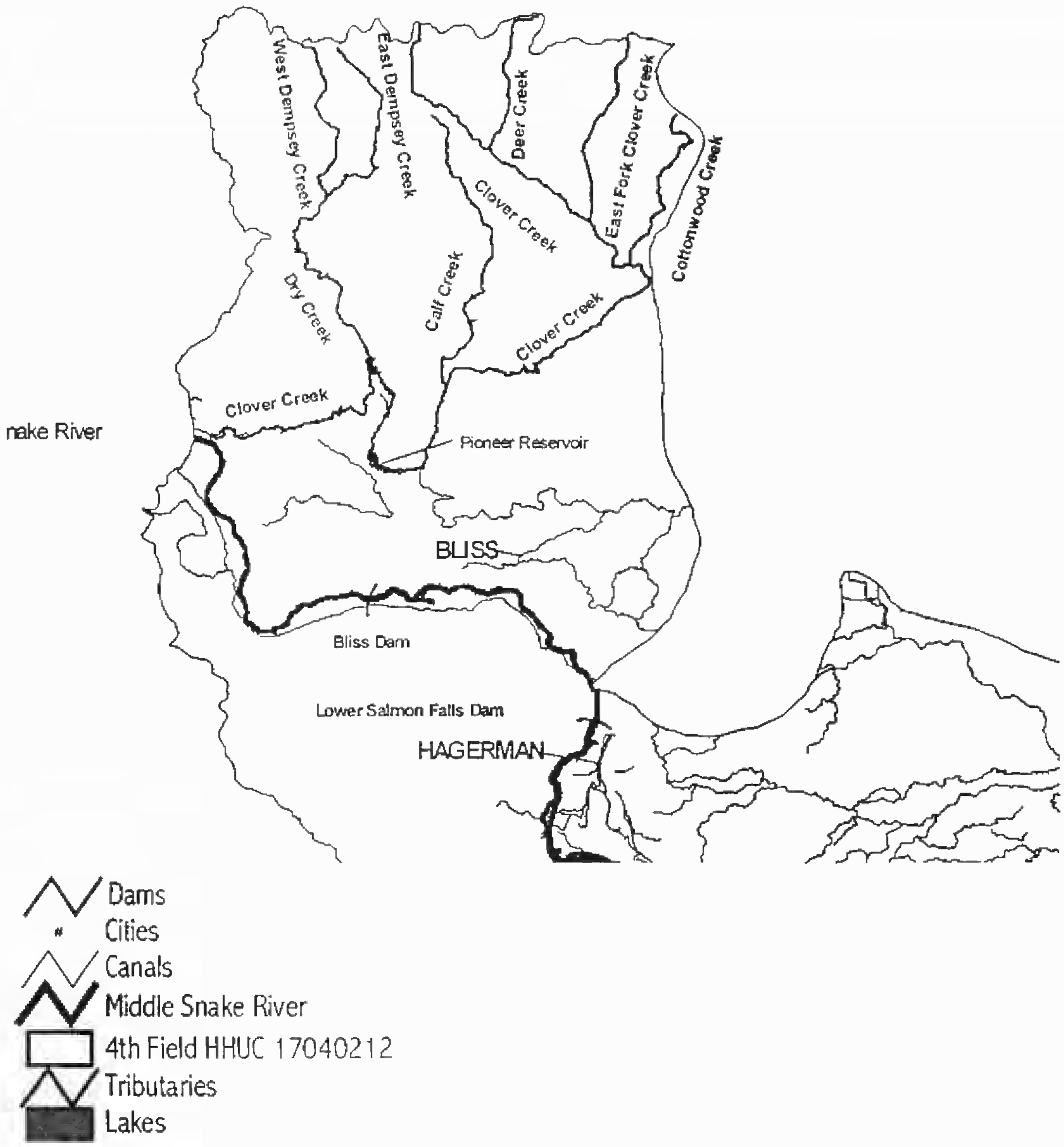


Figure 20 The Clover Creek Complex of Upper Snake Rock

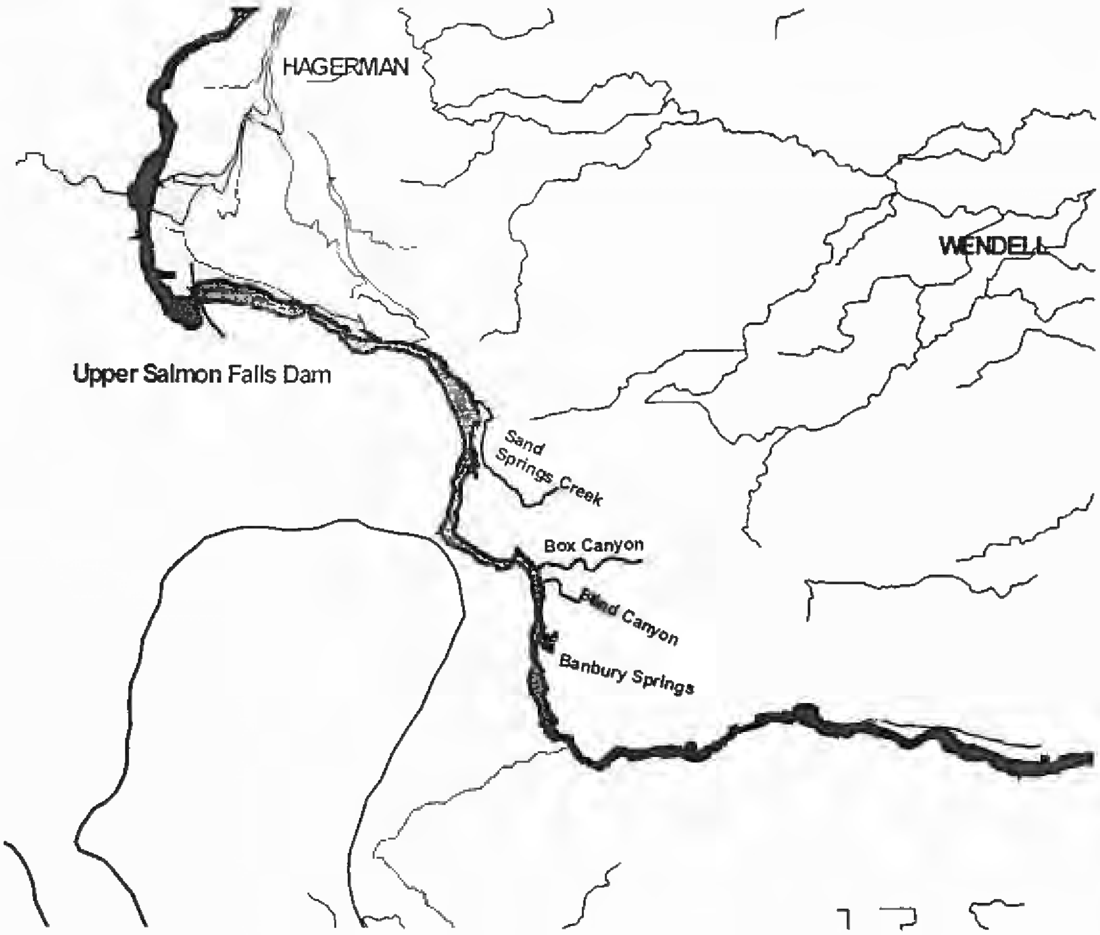


Figure 21 Box Canyon, Blind Canyon, and Sand Springs Creek.

2.2 WATER QUALITY CONCERNS AND STATUS

Sixteen (16) tributaries, five (5) reservoirs, and ten (10) river segments on the Middle Snake River from the Upper Snake Rock subbasin are listed in Table 22 (for a total of 31 waterbodies). The Table reflects the 1996 303(d) list (which was a continuation of the 1994 list). The overall basis on which these streams were selected as water quality limited stream segments was based on best professional judgment (BPJ). BPJ assessment included evaluating the designated beneficial uses on a HUC as being full support, threatened, partially supporting, not supporting, not being attained, or not assessed.

Table 22. 1996 Pollutants/Stressors of water quality impaired streams in Upper Snake Rock sub basin

STREAM NAME (STREAM MILES)	BOUNDARIES	POLLUTANTS/STRESSORS									
		S	N	DO	NH3	FA	T	TM	PG	PC	O
TRIBUTARIES											
Alpheus Creek	From headwaters to the Snake River	X	X	X							
Billingsley Creek	From headwaters to the Snake River	X		X	X	X					
Blind Canyon Creek	From headwaters to the Snake River	X	X	X	X	X			X		
Clear Springs	From headwaters to the Snake River	X	X	X	X						
Clover Creek	From Pioneer Reservoir to the Snake River	X									
Cottonwood Creek	From headwaters to Rock Creek	X	X		X	X			X	X	
Crystal Springs	From headwaters to Snake River	X	X	X	X	X					
Dry Creek	From Medley Creek to Snake River	X				X		X	X		
Dry Creek	From headwaters to Medley Creek	X				X		X	X		
Dry Ck, West Fork	From headwaters to Dry Creek	X	X	X		X			X		
Ellison Creek	From headwaters to Snake River	X	X	X	X	X			X		
McMullen Creek	From headwaters to Cottonwood Creek	X	X	X		X		X	X		
Riley Creek	From headwaters to Snake River	X	X	X	X				X		
Rock Creek	From Rock Creek Town to Snake River	X	X	X	X	X			X		X
Thousand Springs Creek	From headwaters to Snake River	X	X			X					
Vinyard Creek	From headwaters to Snake River	X	X	X	X				X		
RESERVOIRS											
Bliss Reservoir	The entire reservoir	X		X	X	X			X		
Lower Salmon Falls Reservoir	The entire reservoir	X		X		X					
Pioneer Reservoir	The entire reservoir	X	X	X	X	X	X		X		
Shoshone Falls Reservoir	The entire reservoir	X		X		X					
Upper Salmon Falls Reservoir	The entire reservoir	X		X		X					
ON THE MIDDLE SNAKE RIVER = 61.80 miles											

STREAM NAME (STREAM MILES)	***BOUNDARIES***	***POLLUTANTS/STRESSORS***									
		S	***N***	***DO***	***NH3***	***FA***	***T***	***TM***	***PG***	***PC***	***O***
Middle Snake River (8.53 miles)	From Milner Dam to Murtaugh	X		X		X		X	X		
Middle Snake River (7.27 miles)	From Cedar Draw to Rock Creek	X					X				
Middle Snake River (6.10 miles)	From Clear Lakes Bridge to Cedar Draw	X					X				
Middle Snake River (0.11 miles)	From Deep Creek to Mud Creek	X					X				
Middle Snake River (9.31 miles)	From King Hill to Big Pilgrim Gulch	X					X				
Middle Snake River (1.33 miles)	From Mud Creek to Clear Lakes Bridge	X					X				
Middle Snake River (8.25 miles)	From Shoshone Falls to Rock Creek	X					X				
Middle Snake River (3.47 miles)	From Cassia Gulch to Big Pilgrim Gulch	X	X				X				
Middle Snake River (5.78 miles)	From Bliss Bridge to King Hill Diversion	X									
Middle Snake River (11.65 miles)	From Murtaugh to Twin Falls Reservoir	X		X	X				X		

S = Sediment; N = Nutrients; DO = Dissolved Oxygen; NH3 = Ammonia; FA = Flow Alteration; T = Temperature; TM = Thermal Modification; PG = Pathogens; PC = Pesticides; O = Oil and Grease. Temperature and Thermal Modification mean essentially one in the same thing and may be combined

2.2.1 GENERAL INFORMATION ON POINT AND NONPOINT SOURCES

Two major sources of pollutants are identified in Upper Snake Rock: point and nonpoint source. Point sources include: aquaculture, food processors, municipalities, and industrials. Their pollutants as defined in their permits include: ammonia; BOD; biological wastes; deleterious materials; fecal coliform and other bacteria; floating, suspended or submerged matter; nutrients, including phosphorus and nitrogen compounds; oil and grease; oxygen-demanding materials; residual disinfectants, including total residual chlorine; residual disease control drugs and other chemicals; residual feed and nutritional supplements; sediment; setteable solids; temperature and pH; total suspended solids; toxic substances; and turbidity (USEPA 1997b-i).

For Upper Snake Rock, the nonpoint sources include: irrigated and nonirrigated agriculture, grazing, confined feeding operations (CFOs), NPDES permitted confined animal feeding operations (CAFOs), urban runoff/storm sewers, and recreation. Their pollutants include: sediment, nutrients, pathogens, salts, toxics substances, petroleum products, and pesticides, which contribute to surface and ground water (USEPA 1997k [pp xii, 1-4])." "Pollutants-of-concern resulting from these [*nonpoint source*] activities include sediment, bacteria, nutrients, organic enrichment, and pesticides (IDHW 1991b [p2])." "In 1988 IDEQ conducted an assessment of nonpoint source pollution in Idaho [*and concluded that*] the primary nonpoint source activities in the region are agriculture, hydrologic modification, forest practices, and some construction and mining. Agriculture is by far the greatest source of nonpoint source pollution to...river impoundments (IDHW 1991b [p2])."

In the Mid-Snake TMDL (IDEQ 1997b) irrigated and nonirrigated agriculture, CFOs, NPDES permitted CAFOs, and urban runoff/storm sewers are discussed and defined. Grazing was not defined and was referenced as "to be defined more fully within five years of the final plan (IDEQ 1997b [p 73])." The "final plan" is the Mid-Snake TMDL, but also includes the Upper Snake Rock TMDL. One of the priniciple concerns of over-grazing is the degradation of riparian sites. Livestock grazing in riparian areas is a controversial issue (UI-IFWRPAG 1997 [p 6]). "Grazing by livestock has had the most destructive effect upon riparian vegetation (Platts 1983 [p 83]; Armour *et al.* 1991 [p 7])." Exclusion of grazing animals from the affected areas may not completely allow riparian habitats and revegetation programs to recover. For the grazing industry, the following concerns which ultimately affect water quality need to be considered:

1. VEGETATION FOR STREAMSIDE COVER

Many studies have documented that salmonid abundance declines as stream cover is reduced, and that it increases as stream cover is added. Stream cover is highly significant in determining fish biomass and fish populations. Thus, trees, brush, grasses, and forbs each play an important role in building and maintaining productive streams: trees to provide shade and streambank stability; brush to provide cover for streambank protection and stability; and, grasses and forbs to provide vegetative mats and sod banks that reduce surface erosion and mass wasting of streambanks (Platts 1983 [p 184]).

2. VEGETATION FOR STREAMBANK STABILITY

The elimination of streamside vegetation and the caving in of overhanging streambanks by animals are the principal factors contributing to the decline of native trout populations in western streams (Armour *et al.* 1991 [p 7]). Streambank erosion or collapsing have been going on since banks were first formed by glaciation, floods, drought, debris flows, and ice flows, but this for the most part occurred over prolonged time and in equilibrium with bank rebuilding processes so that as banks were naturally being eroded there were just as many banks being built. During the past century this state of equilibrium has been upset by altering the banks much faster then they can be rebuilt (Platts 1983 [p 185]). Several studies have noted that the average stream temperature dropped 12°F in an enclosure that was ungrazed for 10 years (Armour *et al.* 1991 [p 9]).

3. VEGETATION FOR STREAM TEMPERATURE CONTROL

Streamside vegetation shades the stream and reduces water temperatures. Solar radiation accounts for about 95% of the heat input into Intermountain West streams during the midday periods in mid-summer. Because streamside vegetation has been reduced, which increases summer stream temperatures, there has been a gradual shift in the management of game fish to less non-game fish tolerant to higher stream temperatures. Streams in the west that have had a change in the riprarian plant forms (from brush to grass), are often too warm in the summer and too cold in the winter (Platts 1983 [pp 186-187]). Additionally, several studies have attributed high *E. coli* counts in streams to livestock. Mortality for rainbow trout can exceed 75% when sediments elevate to 200 mg/L, which is a common occurrence in streams damaged by improperly managed grazing (Armour *et al.* 1991 [p 9]).

4. VEGETATION FOR FISH AND WILDLIFE PRODUCTION

Streamside vegetation provides habitat for terrestrial insects, which are an important part of the fish diet. The vegetation also provides direct organic material to the stream which makes up 50% of the stream's nutrient energy supply for the food chain. Removal of streamside vegetation can affect the diet of fish by reducing both the terrestrial and aquatic insect production (Platts 1983 [p 187]). Additionally, stream channel sedimentation caused by soil erosion has been recognized as a major watershed-fisheries problem (Armour *et al.* 1991 [p 7]). Also, riparian vegetation is critical to wildlife for several reasons: (1) riparian areas provide security cover between patches or "islands" of habitat (migratory corridors), foraging areas, nesting habitat for a host of waterfowl along with migratory neotropic birds, and reproductive habitat for small mammals; and, (2) riparian areas are also important for larger mammalian species. During periods of extreme hot or cold temperatures within Idaho's high desert ecosystem wildlife use the microclimate created by riparian vegetation for thermo-regulation. By utilizing microclimates, big game reduce energy output necessary to maintain their core body temperature.

5. VEGETATION FOR CHANNEL HYDROLOGY CHANGES

Livestock grazing can affect the riparian environment by changing and reducing vegetation or by actual elimination of riparian areas by channel widening, channel aggradation, or lowering of the water Table. Areas heavily grazed by sheep have been found to be four times as wide when compared to adjacent areas lightly grazed. Studies have shown that livestock grazing on the vegetative cover causes caving in of overhanging streambanks (thus causing the streams to widen), probably affecting fish populations. Vegetation influences hydrologic conditions within a watershed. Any activity, including grazing, that decreases vegetation can result in adverse hydrological conditions (Armour *et al.* 1991 [p 9-10]).

6. VEGETATION FOR REDUCTION IN NUTRIENT LOSSES

The highest concentration of nutrients in stream water samples occurs when cattle are present in a watershed (Jawson *et al.* 1982 [p 630]). Moderate grazing intensities generally do not increase nutrient concentrations in surface runoff or stream water. In fact, grazing intensity is the most important variable affecting response of upland range to cattle grazing (UI-IFWRPAG 1997 [p 13]).

2.2.2 WATER QUALITY LIMITED STREAM SEGMENTS VERSUS MANMADE CANALWAYS

As previously described in §2.1.2.1, the topography of the Upper Snake Rock sub basin is such that the majority of the subbasin drains into the Middle Snake River, whether it be from natural drainage or the myriad of miles of constructed canals, canal drains, coulees, and laterals. By definition, all of the waters in the Upper Snake Rock subbasin drain towards the Middle Snake River (with some minor exceptions). See also §2.1.3.6. Therefore, it may be concluded that the water quality of the tributaries or any discharging waterbody to the Middle Snake River will directly effect the water quality of the Middle Snake River.

Initially, the IDEQ-TFRO will do a TMDL on water quality limited streams that are listed on the 1996 303(d) list, whether they be perennial or intermittent (or ephemeral). According to Idaho Code §39-3602.27, a TMDL means "a plan for a water body not fully supporting designated beneficial uses and includes the sum of the individual wasteload allocations for point sources, load allocations for nonpoint sources, and natural background levels of the pollutant impacting the water body." What about manmade canalways?

The definition of water quality limited streams applies only when water is present in the stream. Idaho Code §39-3602.28 defines "waters or water body" as "the accumulations of surface water, natural and artificial, public and private, or parts thereof which are wholly or partially within, flow through or border upon this state...and shall not include municipal or industrial wastewater treatment or storage structures or private reservoirs, the operation of which has no effect on waters of the state." Manmade waters do not function like natural tribuatries and it would be ludicrous to expect to see a load capacity (or assimilative capacity) to be of a similar nature to that of natural tributaries. The canal companies have constructed and designated storage structures at Murtaugh Lake (south side of the Middle Snake River) and Wilson Lake (north side of the Middle Snake River) *and* their connecting canal system (High Line and Low Line Canals, and the North Side Main Canal, respectively) delivers storage water to various landowers. This canal system is privately owned by the canal companies and are considered waters of the United States. The canal system functions as a conveying arm for storage water to meet the demands of water rights to their stockholders. IDAPA 16.01.02.050.01 specifically states that "the enforcement of water quality standards is not intended to conflict with the apportionment of water to the state...or to interfere with the rights of Idaho appropriators, either now or in the future." A TMDL on any of these canal systems would violate IDEQ's interpretation of State regulations (as previously cited) and would force legal redress on the part of the canal companies against IDEQ and USEPA for the "taking of water rights." IDEQ will not "conflict with the apportionment of water" or "interfere with the rights of Idaho appropriators." Also, IDEQ-TFRO is following the USGS HUC system for waterbody typing. IDEQ-TFRO has evidence that is contrary to some of the map descriptions that are described as tributaries when in fact they are manmade convenyences and the property of the canal company. These too are exempt from the TMDL process at this time. Additionally, if the waterbody is not specifically listed in IDAPA 16.01.02.150 with designated beneficial uses, or if the BURP process has not assessed the waterbody, it is not a candidate for the TMDL process. It is not IDEQ's intention to BURP or assess manmade waterways at this time. Therefore, man-made waterways will not be considered for TMDL development at this time except that management actions, such as best management practices (BMPs), will be pursued that will reduce levels of pollutants prior at the point where they discharge to natural waterways.

2.2.2.1 THE MIDDLE SNAKE RIVER

The Middle Snake River and its tributaries have altered streamflow dynamics. These have created changes in the balance of erosion/transport and deposition reaches and increased the levels of seasonal suspended sediment. The flows in the Middle Snake River are highly regulated for agricultural irrigation. Under extreme low flow conditions the water quality is adversely impacted (USDA FS 1997a). In fact, where excess irrigation occurs: "erosion washes soil away...and water-borne silt contaminates the rest of the irrigation system, the river, and the groundwater (Palmer 1991)." The published sources for water quality concerns and the status of those segments on the Middle Snake River listed on the §303(d) list are summarized in Table 23. These literature sources are used as the basis for which the segments are listed.

Table 23 Sources defining water quality concerns for the Middle Snake River

STREAM SEGMENT	PNRS No.	86	88	89	89 NP	91	92	94	92-94	303(d) Listed Streams 92	94	96	98
MIDDLE SNAKE RIVER													
Milner Dam to Murtaugh	378	X	X	X	X	X	(X)	X	X	(X)	X	X	X
Cedar Drw to Rock Creek	374			X		X	X	X	X	(X)	X	X	X
Clear Lakes Bdg to Cedar Drw	-			X		X	X	X	X	(X)	X	X	X
Deep Creek to Mud Creek	-	X		X		X	X	X	X	(X)	X	X	X
King Hill to Big Pilgrim Gch	371	X		X		X	X	X	X	(X)	X	X	X
Mud Creek to Clear Lakes Bdg	-			X		X	X	X	X	(X)	X	X	X
Rock Creek to Shoshone Falls	374.1	X		X		X	X	X	X	(X)	X	X	X
Cassia Gch to Big Pilgrim Gch	-			X		X	X	X	X	(X)	X	X	X
Bliss Bridge to King Hill Divrs	369	X	X	X	X	X	(X)	X	X	(X)	X	X	X
Murtaugh to Twin Falls Reserv	372	X	X	X		X	(X)	X	X	(X)	X	X	X

STREAM SEGMENT	PNRS No.	86	88	89	89 NP	91	92	94	92-94	303(d) Listed Streams 92 94 96 98

Prepared by IDEQ-TFRO. References cited which define water quality concerns are: 86 = *Pacific Northwest Rivers Study, Final Report*; 88 = *1988 Idaho Water Quality Status Report and Nonpoint Source Assessment*; 89 = *Chairman's Report 1989 Basin Area Meetings State of Idaho Antidegradation Agreement*. (X) in this report defines those waterbodies which are indirectly referenced via the Middle Snake River; 89 NP = *1989 Idaho Nonpoint Source Management Program*. 91 = *1993 Idaho Agricultural Pollution Abatement Plan* based on the *1979 Appendix of the Idaho Agricultural Pollution Abatement Plan*. 92 = *1992 Idaho Water Quality Status Report*. 94 = *1994 Idaho Water Quality Status Report*. 92-94 = *Water Quality Working Committee Designated Stream Segments of Concern, 1992-1994*. 303(d) Listed Streams: 92 = *1992 §303(d) List*. X = 1992 Designated Stream Segments of Concern. (X) = 1991 Stream Segments of Concern Nominations. 94 = *1994 §303(d) List, October 7, 1994, Appendix C*. 96 = *1996 §303(d) List, April 2, 1996, plus Attachment D*. 98 = 1998 §303(d) List. Reserv = Reservoir. Bdg = Bridge. Drw = Draw. Gch = Gulch. Divrs = Diversion.

The 1994 and 1996 §303(d) lists identified the level of beneficial support status for the Middle Snake River according to various segments on the river. These are identified in Table 24.

Table 24 1994 & 1996 Beneficial support status for the Middle Snake River

SEGMENT NAME	FULL SUPPORT	THREATENED	PARTIAL SUPPORT	NOT SUPPORTING
King Hill to Pilgrim Gulch	AG	PC/SC	CW/SS	
Cassia Gulch to Big Pilgrim Gulch	AG/PC/SC		CW/SS	
Malad River to Bliss Reservoir	AG	PC/SC	CW/SS	
Lower Salmon Falls to Malad River	AG	PC/SC	CW/SS	
Hwy 30 to Upper Salmon Falls Power Plant	AG		CW	PC/SC/SS
Salmon Falls Creek to Highway 30	AG	PC/SC	CW	SS
Box Canyon to Salmon Falls Creek	AG	PC/SC	CW	SS
Deep Creek to Box Canyon	AG	PC/SC	CW	SS
Deep Creek to Mud Creek	AG	PC/SC	CW	SS
Clear Lakes Bridge to Mud Creek	AG	PC/SC	CW	SS
Cedar Draw to Clear Lakes Bridge	AG	PC/SC	CW	SS
Rock Creek to Cedar Draw	AG	PC/SC	CW	SS
Auger Falls to Shoshone Falls Power Plant	AG	PC/SC/CW/SS		
Shoshone Falls PP to Shoshone Falls Rsrvoir	AG	PC/SC/CW/SS		
Twin Falls Creek to Shoshone Falls Reservoir	AG	PC/SC/CW	SS	
Hansen Bridge to Twin Falls Reservoir	AG	PC/SC	CW/SS	
Dry Creek to Hansen Bridge	AG		CW/SS/PC/SC	
Milner Lake to Dry Creek	AG		CW/SS/PC/SC	

Prepared by IDEQ-TFRO. Based on the 1994 and 1996 §303(d) lists. PP = Power Plant. Rsrvoir = Reservoir. AG = agricultural water supply. PC = primary contact recreation. SC = secondary contact recreation. CW = cold water biota. SS = salmonid spawning.

Additionally, agricultural nonpoint sources have historically affected the listed segments of the Middle Snake River as indicated in Table 25.

Table 25 Agricultural nonpoint source effects on the Middle Snake River

MIDDLE SNAKE RIVER SEGMENTS	*IRRIGATED CROPLAND*			*LIVESTOCK GRAZING*		
	Slight	*Moderate*	*Severe*	*Slight*	*Moderate*	*Severe*
Milner Dam to Murtaugh			Sediment	X		
Murtaugh to Twin Falls Reservoir			Sediment	X		
Shoshone Falls to Rock Creek			Sediment	X		
Cedar Draw to Rock Creek			Sediment	X		
Clear Lakes Bridge to Cedar Draw			Sediment	X		
Mud Creek to Cedar Draw			Sediment	X		
Deep creek to Mud Creek			Sediment	X		
Cassia Gulch to big Pilgrim Gulch		Sediment		X		
King Hill to Big Pilgrim Gulch		Sediment		X		
Bliss Bridge to King Hill Diversion		Sediment		X		

Prepared by IDEQ-TFRO. Dryland cropland was shown to not directly affect the Middle Snake River. Descriptors of Irrigated Cropland and Livestock Grazing provided by Soil Conservation Commission and Soil Conservation Districts from *Soil Conservation Commission, 1979, Idaho Agricultural Pollution Abatement Plan, Tables 2 & 3.* An X describes the general effect but not the specific agricultural effect from sediment.

Point source industries (like aquaculture, food processors, municipalities, and industrials) also contribute pollution. In general, "the Middle Snake River exhibits severe eutrophication from nutrient enrichment (www._____ 1997h)" that comes from both point and nonpoint sources. This eutrophication appears to be heightened during low flow/drought years, because during the 1996-1997 water years (years in which high flows were very characteristic) eutrophication and nuisance macrophytes were not as evident in those locations (Crystal Springs, Niagara Springs, Box Canyon) previously known to be severely afflicted by water quality problems.

Thus, the degradation of water quality on the Middle Snake River is caused by flow modifications, agricultural activities, urbanization, hydroelectric activities, industrial activities, impoundments, municipal waste, flood control, mining, forestry, aquaculture, and habitat conversion. Additionally, whitewater boating opportunities are severely limited by reduced flow effects from hydroelectric and irrigation facilities. Recreational cold-water fishing is reduced as is limited hunting opportunities (USDA FS 1997a). Also, although there has been a loss in natural wetlands, there has been some significant amount of artificial wetlands created by irrigation water and irrigation flows (USDA SCS 1998). On the other hand, opportunities for warmwater fishing, flatwater recreation, picnicking, and sightseeing improves by creation of reservoirs and developed recreation sites.

2.2.2.2 SALMON FALLS CREEK

As noted in §2.1.3.6, Salmon Falls Creek, although representing a separate and distinct subbasin (HUC 17040213), discharges directly into the Middle Snake River, thus impacting its water quality. "Water quality within the Salmon Falls River watershed is impacted by nonpoint source pollution. The pollutants of primary concern include sediment, phosphorus, nitrogen, and bacterial contamination. The water quality standards typically violated include low dissolved oxygen, high water temperature, and the presence of coliform bacteria. The prinicipal activities affecting water quality within the watershed include: irrigated agriculture, pasture and rangeland grazing. Water quality above Salmon Falls Reservoir is impacted principally by rangeland grazing. Downstream from Salmon Falls Reservoir the flows are highly regulated and water quality is influenced more by irrigated farmland and pasture grazing. It should be noted that very little water is ever released from

Salmon Falls Dam down Salmon Falls Creek to the Middle Snake River. The overall water quality condition of the Salmon Falls River watershed is fair to poor (IDHW 1994)." This is supported by water quality monitoring conducted by IDEQ-TFRO since 1990. Historically, agricultural nonpoint sources have affected the Salmon Falls River slightly from irrigated cropland and slightly from livestock grazing (ISCC 1979 [Table 3]).

2.2.2.3 MALAD RIVER DRAINAGE

As noted in §2.1.3.6, the Malad River discharges to the Middle Snake River (at RM571.42) It includes drainage from Camas Creek (HUC 17040220), Big Wood River (HUC 17040219), and Little Wood River (HUC 17040221). Historically, agricultural nonpoint sources have affected the Malad River (from Magic Dam to the mouth with the Middle Snake River) moderately from irrigated cropland for sediment and slightly for livestock grazing (ISCC 1979 [Table 3]). The Camas Creek subbasin is heavily impacted by nonpoint source pollution from irrigated agriculture, and pasture and rangeland grazing (ISCC 1979 [Table 3]; IDHW 1994). The Big Wood River subbasin is impacted by point and nonpoint source pollution from irrigated agriculture, pasture and rangeland grazing, confined animal feeding operations, and municipal wastewater treatment plants (ISCC 1979 [Table 3]; IDHW 1994). The Little Wood River subbasin is impacted by nonpoint source pollution from irrigated agriculture, pasture and rangeland grazing, and confined animal feeding operations (ISCC 1979 [Table 3]; IDHW 1994).

2.2.2.4 RESERVOIRS AND LAKES

"Artificial river impoundments dominate this region of the state. Many are reservoirs on the main stem of the Snake River created for irrigation water storage and power generation (IDHW 1991b)." The Middle Snake River hydropower projects have significantly changed the river environment and the river's ability to assimilate wastes and have created a range of impacts. The issue of flow modification is one of timing (as seasonal shifts and changes) and volume. Timing is critical because of the hydroelectric development itself, flow augmentation, flood control, dam operations, and irrigation (as diversions, pumping, and return flows). Volume is critical because of the development of the hydroelectric development itself, irrigation, municipal water consumption, agricultural development, aquaculture, mining, and impoundments. Timing and volume affect the fisheries resource in the potential anadromous fish spawning and rearing habitat, native resident fish, listed snails, riparian vegetation, recreational use, aesthetics, and cultural resources. The effects are on habitat loss, unsuiTable water temperature, alteration of sediment transport resulting in the loss of spawning habitat and loss of sand and gravel bar recruitment (USDAFS & USDI/BLM 1997a)." The dams on the Middle Snake River have had the effect of "converting much of the river into lakes. In addition, diversions greatly reduce the flows along the river. These two aspects of development have greatly influenced the quality of the waters (Parametrix 1977)." Table 26 illustrates those sources that define water quality concerns for the reservoirs in Upper Snake Rock.

Table 26 Literature sources defining water quality concerns for the reservoirs in Upper Snake Rock

STREAM NAME	PNRS No.	86	88	89	89 NP	91	92	94	92-94	303(d) Listed Streams 92	94	96	98
Bliss Reservoir	370.00	X	X	X	X		(X)	X		(X)	X	X	X
Lower Salmon Falls Res.	372.00	X	X	X	X	X	(X)	X	X	X	X	X	X
Pioneer Reservoir	380.00	X	X	X	X		X		X	(X)	X	X	X
Shoshone Falls Reservoir	375.00	X		X	X	X	X	X	X	(X)	X	X	X
Upper Salmon Falls Reser.	373.00	X	X	X	X	X	(X)	X	X	X	X	X	X

STREAM NAME	PNRS No.	86	88	89	89 NP	91	92	94	92-94	303(d) Listed Streams			
										92	94	96	98

Prepared by IDEQ-TFRO References cited which define water quality concerns are: 86 = *Pacific Northwest Rivers Study, Final Report*; 88 = *1988 Idaho Water Quality Status Report and Nonpoint Source Assessment* 89 = *Chairman's Report 1989 Basin Area Meetings State of Idaho Antidegradation Agreement* (X) in this report defines those waterbodies which are indirectly referenced via the Middle Snake River; 89 NP = *1989 Idaho Nonpoint Source Management Program*. 91 = *1993 Idaho Agricultural Pollution Abatement Plan*. 92 = *1992 Idaho Water Quality Status Report*. 94 = *1994 Idaho Water Quality Status Report*. 92-94 = *Water Quality Working Committee Designated Stream Segments of Concern, 1992-1994*. 303(d) Listed Streams: 92 = *1992 §303(d) List*. X = 1992 Designated Stream Segments of Concern. (X) = 1991 Stream Segments of Concern Nominations. 94 = *1994 §303(d) List, October 7, 1994, Appendix C*. 96 = *1996 §303(d) List, April 2, 1996, plus Attachment D*. 98 = 1998 §303(d) List.

Additionally, hydroelectric impoundments and their associated reservoirs exacerbate the following problems:

1. "Artificial impoundments alter the natural hydrograph of the Middle Snake River system which in-turn affects the biological communities. A prime example is white sturgeon spawning. White sturgeon is typically key on spring-time changes in flow and temperatures to maximize reproductive success. With dams regulating upstream flow, the hydrograph flattens and changes in peak events no longer occur at the same time as they historically occurred. Now, sturgeon spawning is sometimes not cued (or spawning occurs) and then drastic regulated flow changes alter temperatures and wetted channel area which reduces reproductive success (IDFG 1998c)."

2. "The hydropower projects alter the physical characteristics of the river, which in turn affects water quality and habitat conditions. Riverine characteristics affected by the dams include water velocity, discharge, water depth, and water retention times. Water quality changes associated with the operations of the hydropower projects include dissolved oxygen, temperature modification, gas supersaturation, sedimentation, and in-stream nutrient processing. While the hydropower plants do not add nutrients to the river, nutrient processing is increased and flushing of pollutants downstream is reduced. The impoundments behind the dams have impacts on the ability of the river to process sediment and nutrients. The loss of anadromous ecosystem is due to hydroelectric development, irrigation, flood control, and other factors (USDA FS 1997a)."

3. The "run-of-the-river" reservoirs have also altered the ability of the Middle Snake River to produce self-sustaining recreational fisheries. Insects and other invertebrates that once provided an ample food source for rainbow trout, mountain whitefish, and white sturgeon have been replaced by an insect community that is less available as a food source. Existing sport fisheries in the area include a limited population of naturally produced rainbow trout, catch and release fishing for white sturgeon, and hatchery produced rainbow trout (although it could be argued that hatchery reared fish are a good source to supplement the limited resource). The practice of using reservoir storage to follow short-term peaks in power demand (known as "load following") adds further impacts. The resulting changes in river levels degrade downstream riparian areas and adversely affect fish populations. Load following activities create river velocities that may cause undue expenditure of energy during winter months, provide false spawning cues, increase drift of aquatic insects, and deteriorate habitat for macro-invertebrates. "The Lower Salmon Falls and Bliss Projects are operated in load-following manner, and as a result, the impoundments have fluctuated by as much as 6 feet and 5 feet, respectively, over a 24-hour period (FERC 1998 [p 41])."

4. According to USEPA, lakes and reservoirs in Upper Snake Rock when surveyed for meeting state water quality standards indicated that about 11% were threatened, about 60% were partially supporting, and about 28% were not supporting their aquatic life use (www._____ 1997 [/IDlakes-us.html]). The most prevalent causes of pollution of the surveyed acres were: about 100% of the time was siltation and nutrients, about 90% of the time was flow alteration, and about 78% of the time was pathogens and organic enrichment/low dissolved oxygen. The most prevalent sources of pollution of the surveyed acres were: about 100% of the time was agriculture and hydromodification

(www._____ 1997 [/ldlakes-cs.html]). See also IDHW 1989b for a review of nonpoint source affects on reservoirs and lakes.

5. "Cold water biota and salmonid spawning have been reported as impaired...Agriculture is the main nonpoint source activity affecting lakes [and reservoirs] in this region. Pollutants of concern include nutrients, sediment, bacteria, and organic wastes. Water level fluctuations from irrigation water draw-downs have also impacted water quality by increasing temperatures and decreasing dissolved oxygen in some [lakes and] reservoirs (IDHW 1991b)." It should be noted that, according to Idaho Power Company, none of the mainstem Middle Snake River reservoirs drawn down for irrigation. However, "the Lower Salmon Falls and Bliss Projects are operated in load-following manner, and as a result, the impoundments have fluctuated by as much as 6 feet and 5 feet, respectively, over a 24-hour period (FERC 1998 [p 41])."

6. Ecosystems Research Institute studied the primary productivity (PP) and respiration (R) of the Middle Snake River at three reservoirs: Twin Falls, Shoshone Falls, and Upper Salmon Falls reservoirs in 1997. PPR was measured in each reservoir using the light bottle/dark bottle method, so as to use simplified stoichiometric relationships between the carbon fixed and the oxygen produced through photosynthesis, and the carbon and oxygen consumed during respiration. Average extinction coefficients for each reservoir on each date of sampling, and incident light recordings from the continuous light monitoring were used to determine the light intensity at each incubation depth throughout the water column throughout the day. Table 27 shows the average results on a monthly basis for the extinction coefficient and the depth to 1% light within each reservoir.

Table 27 Mean extinction coefficients and mean depth to 1% light per reservoir

MONTH	TWIN FALLS		SHOSHONE FALLS		UPPER SALMON FALLS	
	Ext.Coeff.	Depth to 1%	Ext.Coeff.	Depth to 1%	Ext.Coeff.	Depth to 1%
May 1996	1.863 ± 0.154	2.5 ± 0.2	1.755 ± 0.264	2.7 ± 0.4	1.942 ± 0.144	2.4 ± 0.2
Jun 1996	1.387 ± 0.039	3.4 ± 0.1	1.366 ± 0.065	3.4 ± 0.2	1.717 ± 0.106	2.8 ± 0.3
Jul 1996	1.024 ± 0.108	4.6 ± 0.4	1.210 ± 0.153	3.8 ± 0.5	1.275 ± 0.128	3.7 ± 0.4
Aug 1996	---	---	---	---	0.978 ± ---	4.7 ± ---
Sep 1996	1.266 ± 0.248	3.7 ± 0.7	0.982 ± 0.108	4.7 ± 0.5	0.985 ± 0.248	4.9 ± 1.1
Oct 1996	1.106 ± 0.281	4.3 ± 1.0	0.869 ± 0.118	5.4 ± 0.7	0.753 ± 0.114	6.2 ± 0.9
Prepared by IDEQ-TFRO. ERI 1997.						

In general, light extinction in the reservoirs was quite high for most of the study period (May through October). For all three reservoirs extinction coefficients averaged 1.755 to 1.942 in May, then declined to averages of 0.753 to 1.106 in October, which translate to a 1% light depth of about 2.4 to 2.7 meters in May to 4.3 to 6.2 meters in October. Net primary productivity peaked at over 400 mg $C/m^3/hr$ in early May and reached a maximum rate of about 250 mg $C/m^3/hr$ for most of the summer. By September, the peak rate had fallen to about 120 $C/m^3/hr$. Total net primary production in Upper Salmon Falls Reservoir peaked in early May at almost 7000 kg C/day, and declined to a low of 1400 kg C/day by the end of the season. In contrast, both Twin and Shoshone Falls reservoirs varied between 300 and 1000 kg C/day through most of the season, dipping to negative values on one date in mid-July. When averaged over the entire reservoir volume, Upper Salmon Falls had a higher rate of carbon fixation than the other two reservoirs. These values indicate that the Middle Snake River has an autotrophic stratum (the upper "green belt" layer of chlorophyll-containing plants) during the summer, and a marginally heterotrophic stratum (the lower "brown belt" layer of soils and sediments) during the spring and fall. Spring is the period of highest net primary productivity, with relatively low respiration rates due to low temperatures, but high gross production rates due to increasing light and high nutrients (ERI 1997).

7. Water quality in the Middle Snake River has deteriorated because of point and nonpoint sources, compounded by managed, altered, or reduced flows and velocities, which have yielded extensive growths of nuisance aquatic vegetation, degraded stream habitat, and elevated water temperatures. The high rates of primary productivity (as shown in item 6 above) and decomposition of aquatic vegetation causes fluctuations in dissolved oxygen that often violate Idaho water quality standards. In fact, oxygen deficits occur when "the amount of oxygen lost from the hypolimnion (the deeper, relatively cold, undisturbed region of the water column) during summer stratification not only increases with depth, but becomes increasingly depleted as the summer stratification period progresses (Wetzel 1975 [pp 137-141])." These conditions have resulted in the loss of native cold-water species (such as trout and white sturgeon) and have favored exotic and pollution tolerant species. As previously stated, hydroelectric projects do not add nutrients to the river. Instead nutrient processing is intensified and flushing of pollutants downstream is reduced. The impoundments behind the dams may have significant impacts on the ability of the river to process sediment and nutrients. Thus, the dams on the Middle Snake River (particularly Upper Salmon Falls and Lower Salmon Falls dams) have added to the water quality problems of the river in two ways: (1) the river's capacity to process nutrients has been altered to encourage plant growth, and (2) the reservoirs have created large shallows and areas of sediment deposition that are ideal for aquatic weeds. As part of the §401 Water Quality Certification for hydroelectric impoundments on the Middle Snake River under a consent order, the Idaho Power Company shall take certain specific actions to mitigate water quality impacts and achieve in conjunction with other proposed actions compliance with Idaho water quality standards.

8. The Middle Snake River dams have affected recreation by inundating or dewatering unique features such as cascades and rapids. Access to certain areas of the river have also become more difficult. According to the Idaho Department of Parks and Recreation (IDPR), recreation impacts are not distinct from other categories of impacts because good water quality as well as fishing, hunting, and wildlife viewing opportunities are all essential components of recreation. Reasonable access to the river for a growing population and protection of the river's special attractions (including the remaining springs and waterfalls and the river itself) are key issues that have been impacted by the degraded water quality.

For the reservoirs, the following additional sources provide information on water quality concerns and status of the indicated water body:

1. BLISS RESERVOIR

The water quality concerns and status of Bliss Reservoir are further substantiated in the *Idaho Power Company, New License Application for Bliss FERC Project No. 1975, 1995, pp. E2-17 to E2-20.* As previously noted, this reservoir is listed for sediment, nutrients, dissolved oxygen, flow alteration, ammonia, and pathogens as pollutants and/or stressors of concern.

2. LOWER SALMON FALLS RESERVOIR

The water quality concerns and status of Lower Salmon Falls Reservoir are further substantiated in the *Idaho Power Company, New License Application for Lower Salmon Falls FERC Project No. 2061, 1995, pp. E2-17 to E2-20.* This reservoir is listed for sediment, nutrients, dissolved oxygen, and flow alteration as pollutants and/or stressors of concern.

3. UPPER SALMON FALLS RESERVOIR

The water quality concerns and status of Upper Salmon Falls Reservoir are further substantiated in the *Idaho Power Company , New License Application for Upper Salmon Falls FERC Project No. 2777, 1995, pp. E2-15 to E2-18.* Additionally, contract studies conducted on Upper Salmon Falls Reservoir indicate it is well mixed, nearly isothermal throughout the water column and along the longitudinal axis. Temperatures seldom vary by more than 1°C (ERI 1997). This reservoir is listed for sediment, nutrients, dissolved oxygen, and flow alteration as pollutants and/or stressors of concern.

4. SHOSHONE FALLS RESERVOIR

The water quality concerns and status of Shoshone Falls Reservoir are further substantiated in the *Idaho Power Company, New License Application for Shoshone Falls FERC Project No. 2778, 1997, pp. E2-1 to E2-15*; and, the *1983 Idaho Agriculture Pollution Abatement Plan.* Additionally, contract studies conducted on Shoshone Falls Reservoir indicate it is well mixed, nearly isothermal throughout the water column and along the longitudinal axis. Temperatures seldom vary by more than 1°C (ERI 1997). This reservoir is listed for sediment, nutrients, dissolved oxygen, and flow alteration as pollutants and/or stressors of concern.

5. TWIN FALLS RESERVOIR

The Twin Falls Reservoir is not specifically listed as a reservoir-segment on the 303(d) list, but it is included in the Middle Snake River segment (from Murtaugh to Twin Falls Reservoir). Several agency reports indicate that from Twin Falls Reservoir to Bliss Reservoir, the impoundments are exhibiting nonpoint source impacts from irrigated crop production and animal holding areas. Runoff from irrigated crop production, rangeland, pastureland, animal holding areas, feedlots, dredging, urban runoff from combined sewers and surface runoff, some construction, surface mining, land development, and its flow modification affect the watershed detrimentally. The Snake River between Bliss Reservoir and King Hill Dam is primarily impacted from irrigated crop production, rangeland, flow modification, and streambank modification (IDHW 1989b [p 37]). As a Middle Snake River segment it is listed for sediment, nutrients, dissolved oxygen, ammonia, and pathogens as pollutants and/or stressors of concern.

6. PIONEER RESERVOIR

Pioneer Reservoir is a man-made reservoir that functions as a nonpoint source sink for the Clover Creek drainage prior to discharge to the Middle Snake River. It is highly affected by nonpoint sources of pollution. This reservoir is listed for sediment, nutrients, dissolved oxygen, flow alteration, ammonia, pathogens, and thermal modification as pollutants and/or stressors.

According to IDFG, "Upper Salmon Falls, Lower Salmon Falls, and Bliss Reservoirs have collectively inundated over 1055 acres of terrestrial and riverine habitat. Combined, the three reservoirs stretch over 12.6 miles of the Middle Snake River, inundating over 25 miles of riparian vegetation and associated uplands, with an estimated loss of 365 riparian species habitat units and 1320 upland species habitat units. In places where riparian vegetation has recolonized areas along reservoirs, it has been predominated by the non-native shrub, Russian-olive. Idaho Power Company has described the existing nongame bird community in detail and points out that bird densities average 22 times higher in riparian habitat than upland habitat, although no information is provided for comparing impounded versus unimpounded areas (FERC 1997b [Appendix A, pp 1, 3])."

Finally, the 1994 and 1996 §303(d) lists identified the level of beneficial support status for various reservoirs and lakes in HUC 17040212. These are identified in Table 28.

Table 28 1994 & 1996 Beneficial support status for the reservoirs and lakes

SEGMENT NAME	FULL SUPPORT	THREATENED	PARTIAL SUPPORT	NOT SUPPORTING
Bliss Reservoir	AG	CW/SS	PC/SC	
Lower Salmon Falls Reservoir	AG	PC/SC	CW/SS	
Upper Salmon Falls Reservoir (PNRS 372.00)	AG	PC/SC	CW/SS	
Upper Salmon Falls Reservoir (PNRS 373.00)	AG/CW	PC/SC		SS
Shoshone Falls Reservoir	AG/CW/PC/SC			SS
Twin Falls Reservoir	AG	PC/SC/CW/SS		
Murtaugh Lake	AG		PC/SC/CW/SS	
Pioneer Reservoir	AG	PC/SC/SS	CW	
Prepared by IDEQ-TFRO. Based on the 1994 & 1996 §303(d) lists. AG = agricultural water supply. PC = primary contact recreation. SC = secondary contact recreation. CW = cold water biota. SS = salmonid spawning.				

2.2.2.5 TRIBUTARIES

The results of the Idaho surveyed waters by USEPA for meeting state water quality standards within Upper Snake Rock for the aquatic life beneficial use show that about 1% of the waters are good, about 28% were threatened, about 51% were partially supporting, and about 19% were not supporting this benefical use (*www.epa.gov /surf/IWI/17040212/Drivers-us.html*). Water quality concern sources and the status for these tributaries are summarized in Table 29.

Table 29 Literature sources defining water quality concerns for the indicated waterbody

STREAM NAME	PNRS No.	86	88	89	89 NP	91	92	94	92-94	303(d) Listed Streams 92	94	96	98
Alpheus Creek	405.00	X		X		X			X	(X)	X	X	X
Billingsley Creek	384.00	X	X	X		X	(X)		X	X	X	X	X
Blind Canyon Creek	389.00	X	X	X			(X)		X	(X)	X	X	X
Cedar Draw	397.00	X		X		X	X		X	(X)			X
Clear Springs	395.00	X	X	(X)	X		(X)		X	(X)	X	X	X
Clover Creek	379.00	X	X	X	X	X	X		X	(X)	X	X	X
Cottonwood Creek	403.00	X	X	X	X	X	(X)		X	(X)	X	X	X
Crystal Springs	398.00	X	X	X		X	(X)		X	(X)	X	X	X
Deep Creek	392-93	X		X		X			X	(X)			X
Dry Creek	408.00	X	X	X			(X)		X	(X)	X	X	X
Dry Creek, West Fork	411.00	X		X			(X)		X	(X)	X	X	X

STREAM NAME	PNRS No.	86	88	89	89 NP	91	92	94	92-94	303(d) Listed Streams 92	94	96	98
McMullen Creek	404 00	X	X	X			(X)			(X)	X	X	X
Mud Creek	394.00	X		X			X		X	(X)			X
Riley Creek	385.00	X	X	X		X	(X)		X	(X)	X	X	X
Rock Creek	400.00	X	X	X		X	(X)		X	(X)	X	X	X
Sand Springs Creek*	386.00	X	X	X			(X)		X	(X)	X	X	X
Toolbox Creek													X

Prepared by IDEQ-TFRO. References cited which define water quality concerns are: 86 = *Pacific Northwest Rivers Study, Final Report*; 88 = *1988 Idaho Water Quality Status Report and Nonpoint Source Assessment*; 89 = *Chairman's Report 1989 Basin Area Meetings State of Idaho Antidegradation Agreement*. (X) in this report defines those waterbodies which are indirectly referenced via the Middle Snake River; 89 NP = *1989 Idaho Nonpoint Source Management Program*. 91 = *1993 Idaho Agricultural Pollution Abatement Plan*. 92 = *1992 Idaho Water Quality Status Report*. 94 = *1994 Idaho Water Quality Status Report*. 92-94 = *Water Quality Working Committee Designated Stream Segments of Concern, 1992-1994*. 303(d) Listed Streams: 92 = *1992 §303(d) List*. X = 1992 Designated Stream Segments of Concern. (X) = 1991 Stream Segments of Concern Nominations. 94 = *1994 §303(d) List, October 7, 1994, Appendix C*. 96 = *1996 §303(d) List, April 2, 1996, plus Attachment D*. 98 = 1998 §303(d) List. Sand Springs Creek is sometimes referred to as Thousand Springs Creek.

Additional sources beyond those identified in the previous Table that define the cause of concern and status of the waterbody are referenced as follows:

1. BILLINGSLEY CREEK

In 1991 the IDFG responded to the then-proposed reissuance of the NPDES aquaculture permits on seven aquaculture farms (002499-6; 002704-9; 002303-5; 000073-6; 002440-6; 002497-0; and 000086-8) on Billingsley Creek. In general, IDFG was concerned over the number of aquaculture facilities, such that cumulative impacts were being seen on Billingsley Creek. Sampling in Billingsley Creek indicated that a high percentage of fish were wild rainbow trout, wild brown trout, and hatchery rainbow trout (IDFG 1991). The water quality concerns and status of Billingsley Creek are further substantiated in the following reports: *IDHW, WQ Status Report No. WQ-21, Billingsley Creek (Gooding County), Problem Assessment; Billingsley Creek, NPDES Permits, 1991; IDHW, WQ Status Report No. 64, Billingsley Creek, 1984;* and, *IDHW, Upper Snake River Basin Status Report, 1991.* Historically, agricultural nonpoint sources have affected Billingsley Creek slightly from irrigated cropland and slightly from livestock grazing (ISCC 1979 [Table 3]).

2. CEDAR DRAW

The water quality concerns and status of Cedar Draw Creek are further substantiated in the following reports: *IDHW, Water Quality Status Report No. 100, 1991* and *IDHW, 1980, Channel Stability Evaluation for Cedar Draw.* It should be noted that IDAPA 16.01.02.280 identifies Cedar Draw as a "spillway, collection and conveyance facility" for the Twin Falls Canal Company from the intersection with the High Line Canal to the mouth. It is not "exempt" from water quality regulations that recognize Cedar Draw as having designated beneficial uses (IDAPA 16.01.02.150[Map Code hh]). Historically, agricultural nonpoint sources affect Cedar Draw (from the source to the mouth) severely from irrigated cropland for sediment and slightly for livestock grazing (ISCC 1979 [Table 2]).

3. CLOVER CREEK

The water quality concerns and status of Clover Creek are further substantiated in the following field monitoring reports: (1) Monitoring conducted by USBLM during 1993-1994 at the sites of Dry Creek, Bell Mare Creek, and Hog Creek indicate "that the water temperature standard established to support cold water biota will not support established beneficial uses, most notably cold water biota and salmonid spawning" because the water temperatures are too high. Macroinvertebrate sampling "...exhibited signs of low to moderate water quality impairment...Impairment appeared to be due to water quality limitations, primarily temperature and fine sediment. An analysis of the macroinvertebrate community...indicates water quality impairment is high. This impairment was due to both water quality limitations and physical habitat conditions. Water quality limitations include high water temperatures, and high levels of fine sediment deposition and nutrients (Lewis 1994);" and, (2) Reconnaissance and monitoring in 1997 by IDEQ-TFRO indicated that the confluence was impacted by cattle grazing, irrigated agriculture, roads, and recreational dirt biking. Above the confluence to its headwaters, Clover Creek was principally covered by sagebrush/grassland with moderate to high cattle grazing. Sprinkler irrigated ground used the natural contour slope as drainage access for runoff. In both the USBLM and private ground, minimal fencing-off of cattle from the streams was evident. During the summer months, many filamentous algae and long strands of macrophytes were evident in the stream. Stream embeddedness appeared to be very high in many stream areas. Headwater areas where seeps come out of the ground were generally trampled by cattle who seek out the more lush grasses for food. Riparian habitat was minimal or not evident, or where it existed it was impaired due to grazing. Embeddedness appeared to be much higher in the private ground area and towards the confluence when compared to the headwaters area and the USBLM ground (Buhidar & Sharpnack 1997). Historically, agricultural nonpoint sources affect Clover Creek (from the source to the mouth) slightly for irrigated cropland and slightly for livestock grazing due to channel problems (ISCC 1979 [Table 3]).

4. COTTONWOOD CREEK

The water quality concerns and status of Cottonwood Creek are further substantiated in the 1997 reconnaissance and monitoring report by IDEQ-TFRO. It indicated that the stream was still principally impacted by cattle grazing, followed by irrigated agriculture as pastureland and flow alteration/diversion. In many areas of Cottonwood Creek a dense riparian buffer zone prohibited intrusion by man or cattle. However, approximately 40% of the stream itself (beginning from the lower USBLM fenceline to its confluence with Rock Creek) is impaired due to cattle intrusion into the stream. Typically, manure piles exist along the exposed banks and numerous cow trails lead in and out of the stream. Stream banks are uncovered and exposed. Embeddedness in the USBLM area averages less in the stream, while on the private ground (below the USBLM area) averages much more. Flow alteration due to diversion is a major factor and typically occurs throughout the irrigation season (Buhidar & Sharpnack 1997). Cottonwood Creek does not go beyond the High Line Canal. What water appears below the High Line Canal is from seeps and springs. The Twin Falls Canal Company uses Cottonwood Creek for emergency spills of canal water (USDA SCS 1998).

The Riparian & Wetland Research Project (RWRP) of the University of Montana (administered through the USBLM) conducted a Proper Functioning Condition (PFC) assessment of Cottonwood Creek, of which select results from 1994 are summarized in Table 30. Of the three location sites on Cottonwood Creek, two were rated "unhealthy" as to its overall health rating and one was rated "healthy but with problems." Grazing was listed as the most predominant on-site human activity, with two location sites being also affected by roads. Lifeform canopy covers were predominantly shrubs followed by graminoids.

Table 30 Proper functioning condition assessment of Cottonwood Creek

LOCATION ON COTTON WOOD CREEK	TYPE OF STREAM	OVERALL HEALTH RATING	LIFEFORM CANOPY COVER % Trees/Shrubs/Grams/Forbs	CHANNEL BOTTOM	STREAM BANK MATERIALS	ON-SITE HUMAN ACTIVITIES
9400305	Intermittent	45.6% (Unhealthy)	0-80-40-10	30% Sand 10% Silt & Clay	40% Sand 20% Silt & Clay	90%/10% Grazing/Roads
9400303	Perennial	68.4% (Healthy w/problems)	0-90-40-40	30% Sand 3% Silt & Clay	60% Sand 20% Silt & Clay	97.5% Grazing
9400302	Perennial	53.3% (Unhealthy)	0.5-90-20-20	20% Sand 10% Clay	30% Sand 40% Silt & Clay	80%/20% Grazing/Roads

Prepared by IDEQ-TFRO. Based on database at www.rwrp.umt.edu. Lifeforms include trees, shrubs, graminoids, and forbs. Channel bottom silt & clay fractions <10% are considered optimal, 10-30 suboptimal, 30-50 marginal, and >50 poor.

5. DEEP CREEK

The water quality concerns and status of Deep Creek are further substantiated in the *1983 Idaho Agriculture Pollution Abatement Plan*. It should be noted that IDAPA 16.01.02.280 identifies Deep Creek as a "spillway, collection and conveyance facility" for the Twin Falls Canal Company from the intersection with the High Line Canal to the mouth. Historically, agricultural nonpoint sources affect Deep Creek (from the source to the mouth) severely for irrigated cropland sediment and slightly for livestock grazing (ISCC 1979 [Table 3]).

6. DRY CREEK (MURTAUGH LAKE)

The water quality concerns and status of Dry Creek are further substantiated in the *IDHW, Idaho WQ Status Report on Dry Creek, 1979*. Additionally, complaints in 1996 from various recreationists indicated that Murtaugh Lake was filled with nuisance aquatic plant growths due to impacts from cattle grazing along the shoreline of the lake. Site visitation by IDEQ-TFRO personnel verified that cattle grazing was in fact impacting the lake and supposedly contributing to high levels of macrophyte growths throughout the lake. Fecal coliform bacteria samples taken at eight sites on the lake were below the primary contact recreation regulations: 136, <2, 14, <2, <2, 60, 100, and 10 estimated colonies/100 mL (sampled 7-30-1996), thus indicating that nuisance growth was probably due to excess nutrients (Cizmich *et al.* 1998).

USBLM/Burley District, Idaho has various annual reports from the 1980s that describe Dry Creek as to its aquatic habitat and soil/water status. In 1980, Dry Creek was found to have "excellent" aquatic habitat: excellent streambank vegetation condition, streambank stability, and stream channel stability. The East Fork of Dry Creek was rated as "good" stream habitat with the possibility of improvement by stabilization of its streambanks. "Streambank instability along East Fork of Dry Creek and Middle Fork of Dry Creek primarily results during high streamflow which cuts into steep, exposed banks. These banks are cut in unstable alluvium, are easily undercut, and probably cannot be stabilized completely (USBLM 1980)." Additionally, it was noted that portions of the Dry Creek system have a high potential to become unique aquatic habitats since the stream appears "to have good year-round flow for supporting fish." However, it was presently somewhat degraded due to livestock grazing nearby. "Its uniqueness could be improved substantially by preventing access by cattle except to selected areas which may be necessary for livestock watering (USBLM 1980)." In 1985, the monitored stream condition of Dry Creek was divided into the "high in the forks" and "from the forks to private ground." Table 31 summarizes the results.

Table 31 1985 Dry Creek stream condition

STEAM NAME	AQUATIC QUALITY	CHANNEL STABILITY	RIPARIAN CONDITION	FORAGE UTILIZATION	OVERALL STREAM CONDITION	WAYS TO IMPROVE CONDITION
High in Forks	Good	Good	Excellent	40-59% Use	Good	Relieve cattle
Forks to Private	Good	Fair	Fair	40-59% Use	Fair	Plant beaver
Prepared by IDEQ-TFRO. Aquatic, Channel, Riparian, and Forage metrics based on USBLM water quality standards for appropriate fisheries and recreation (USBLM 1985a).						

The spring of 1984 had unusual high flows, exceeding 200 cfs, and caused substantial damage to Dry Creek Ranch, destroying the road up the creek on public land and devasting the bottom mile of BLM administered stream. Dry Creek is one of the few streams in the region supporting a native cutthroat trout fishery. Invertebrate samples collected in 1983 suggested an abundant supply of sediment that may have a debilitating long term effect on the fishery if sediment impacts in the headwaters are similar to impacts farther down stream where samples were taken (USBLM 1985a). In 1986, the annual watershed monitoring report revealed that Dry Creek was "holding static and improving in deteriorated spots. The lower stretches of public land blown out so severely in the 1984 flood were stabilizing nicely with shrubs and forbs. The upper reaches, however, appeared to be in motion, indicated by consistent raw cutbanks and fallen undercut trees. This development was not attributed to cattle-caused trauma (USBLM 1986)." In 1987, annual watershed monitoring report revealed that Dry Creek was a "candidate" for most highly impacted stream of the year. It was recovering from the flood impacts of 1984 until it was "double whammied late last summer by heaving grazing and wild fire (USBLM 1987)." Additionally, Dry Creek became intermittent half-way through the canyon and dried up once on private land. Historically, agricultural nonpoint sources affect Dry Creek (from source to the mouth) slightly for irrigated cropland and slightly for livestock grazing (ISCC 1979 [Table 2]).

The Riparian & Wetland Research Project (RWRP) of the University of Montana (administered through the USBLM) conducted a Proper Functioning Condition (PFC) assessment of Dry Creek in 1994 of which select results are summarized in Table 32. Of the five location areas (two or three sites per area), only one site had an average healthy rating (with problems), while the rest were unhealthy: Lower Dry Creek was 65.9% healthy, Upper Cry Creek was 58.3% unhealthy, East Fork was 54.2% unhealthy, Middle Fork was 52.5% unhealthy, and West Fork was 57.2% unhealthy. Grazing was listed as the most predominant on-site human activity, with three location sites being also affected by roads. Lifeform canopy covers were predominantly shrubs followed by graminoids, trees, and forbs.

Table 32 Proper functioning condition assessment of Dry Creek

LOCATION ON DRY & MEDLEY CREEKS	TYPE OF STREAM	OVERALL HEALTH RATING	LIFEFORM CANOPY COVER % Trees/Shrubs/Grams/Forbs	CHANNEL BOTTOM	STREAM BANK MATERIALS	ON-SITE HUMAN ACTIVITIES
Upper Dry Ck 9400082	Perennial	71.7% (HWP)	30-90-30-10	10% Sand 0.5% Silt&Clay	30% Sand 0.5% Silt&Clay	97.5% Grazing
Upper Dry Ck 9400524	Perennial	53.3% (U)	20-40-70-3	20% Sand 10% Silt & Clay	20% Sand 20% Silt & Clay	90%/10% Grazing/Roads
Upper Dry Ck 9400526	Intermittent	50% (U)	40-60-60-40	3% Sand 0.5% Silt&Clay	10% Sand 20% Silt & Clay	97.5% Grazing

LOCATION ON DRY & MEDLEY CREEKS	TYPE OF STREAM	OVERALL HEALTH RATING	LIFEFORM CANOPY COVER % Trees/Shrubs/Grams/Forbs	CHANNEL BOTTOM	STREAM BANK MATERIALS	ON-SITE HUMAN ACTIVITIES
Lower Dry Ck 9400231	Perennial	65% (HWP)	3-80-40-40	3% Sand 0.5% Silt & Clay	30% Sand 10% Silt & Clay	97.5% Grazing
Lower Dry Ck 9400145	Perennial	66.7% (HWP)	60-60-50-0.5	10% Sand 3% Silt & Clay	10% Sand 20% Silt & Clay	80%/20% Grazing/Roads
East Fork 9400135	Perennial	41.7% (U)	70-30-80-3	10% Sand 0.5% Silt & Clay	10% Sand 20% Silt & Clay	97.5% Grazing
East Fork 9400528	Perennial	66.7% (HWP)	30-80-50-30	10% Sand 3% Silt & Clay	20% Sand 20% Silt & Clay	97.5% Grazing
Middle Fork 9400517	Perennial	58.3% (U)	0.5-60-60-10	20% Sand 3% Silt & Clay	20% Sand 30% Silt & Clay	97.5% Grazing
Middle Fork 9400523	Perennial	46.7% (U)	30-70-60-30	10% Sand 3% Silt & Clay	40% Sand 3% Silt & Clay	97.5% Grazing
West Fork 9400481	Intermittent	54.4% (U)	0-40-50-10	20% Sand 10% Silt & Clay	20% Sand 20% Silt & Clay	97.5% Grazing
West Fork 9400516	Intermittent	60% (HWP)	3-80-40-20	10% Sand 3% Silt & Clay	20% Sand 20% Silt & Clay	50%/50% Grazing/Roads

Prepared by IDEQ-TFRO. Based on database at www.rwrp.umt.edu. Lifeforms include trees, shrubs, graminoids, and forbs. Channel bottom silt & clay fractions <10% are considered optimal, 10-30 suboptimal, 30-50 marginal, and >50 poor. Medley Creek has data with proper functioning condition ratings but is not included in this assessment. HWP = Healthy with problems; U = Unhealthy.

Taking into account the historical condition of Dry Creek during the 1980s, and the PFC assessment of Table 32, a preliminary analysis by USBLM indicates that since the 1984 flood and the 1986 fire vegetation along the creek is improving and there is an apparent healthy cutthroat trout fishery with numerous juvenile and adult fish. Furthermore, as Table 32 indicates, channel bottom silt and clay percentages are optimal or near optimal. Livestock grazing practices have been improved with three years of rest during the last eight years. Prior to 1992 the creek received yearly grazing.

7. MCMULLEN CREEK

In 1985, USBLM indicated that McMullen Creek's aquatic habitat was excellent, its channel stability was good, its riparian condition was good, its forage utilization was 40-59% use, and its overall stream condition was good. Suggestions indicated that opportunities to improve the existing situation included planting beavers to increase the water supply (USBLM 1985a). In 1986, the USBLM indicated that McMullen Creek was "improving via the dominance of woody riparian vegetation growing in otherwise absent sites, with beaver having a difficult time being established due to trappers. Livestock utilization at the Forest line on the creek can best be described as devastating. Stream stability starts on the USBLM land. This situation likely accounts for some of the high coliform counts sampled in years past when the livestock have been off BLM lands and 3 miles up stream on the Forest (USBLM 1986)." In 1987, USBLM indicated that the stream was "continually improving due to changes in livestock management and diverse and vigorous woody vegetation with abundant regeneration." Beavers were still considered necessary for a "natural equilibrium" in the system, but persistent trappers kept erradicating them and high flows would eliminate their dams. The beaver were considered "the missing link in the recovery phase of McMullen Creek so as to store water to supplement late summer flows, encourage riparian shrubs to invade the dry perched flood plain, and develop a good sport fishery (USBLM 1987)."

The Riparian & Wetland Research Project (RWRP) of the University of Montana (administered through the USBLM) conducted a Proper Functioning Condition (PFC) assessment of McMullen Creek, of which select results from 1994 are summarized in Table 33. Of the seven location sites on "Lower" McMullen Creek, six were rated "unhealthy" and one was rated "healthy but with problems." Grazing was listed as the most predominant on-site human activity, with one location also being affected by roads. Lifeform canopy covers were predominantly shrubs followed by graminoids.

Table 33 Proper functioning condition assessment of McMullen Creek

LOCATION ON MCMULLEN CREEK	TYPE OF STREAM	OVERALL HEALTH RATING	LIFEFORM CANOPY COVER % Trees/Shrubs/Grams/Forbs	CHANNEL BOTTOM	STREAM BANK MATERIALS	ON-SITE HUMAN ACTIVITIES
Lower 9400319	Intermittent	53.5% (Unhealthy)	3-90-30-10	20% Sand 10% Silt & Clay	60% Sand 30% Silt & Clay	97.5% Grazing
Lower 9400318	Perennial	57.9% (Unhealthy)	0-90-10-10	30% Sand 3% Silt & Clay	50% Sand 30% Silt & Clay	97.5% Grazing
Lower 9400315	Perennial	52.6% (Unhealthy)	0-90-40-20	30% Sand 3% Silt & Clay	50% Sand 30% Silt & Clay	97.5% Grazing
Lower 9400314	Perennial	45.6% (Unhealthy)	0-80-3-3	10% Sand 3% Silt & Clay	40% Sand 10% Silt & Clay	97.5% Grazing
Lower 9400312	Intermittent	56.1% (Unhealthy)	0-97.5-20-10	20% Sand 3% Silt & Clay	50% Sand 20% Silt & Clay	80%/20% Grazing/Roads
Lower 9400310	Perennial	61.4% (HWP)	0-80-30-20	10% Sand 0.5% Silt &Clay	30% Sand 20% Silt & Clay	97.5% Grazing
Lower 9400309	Intermittent	57.9% (Unhealthy)	0-97.5-30-20	20% Sand 10% Silt & Clay	40% Sand 20% Silt & Clay	97.5% Grazing

Prepared by IDEQ-TFRO. Based on database at www.rwrp.umt.edu. Lifeforms include trees, shrubs, graminoids, and forbs. Channel bottom silt & clay fractions <10% are considered optimal, 10-30 suboptimal, 30-50 marginal, and >50 poor. HWP = Healthy with problems.

Taking into account the conditions as existed in the 1980s, and the PFC assessemnt of 1994, the USBLM has yet to make a determination as to whether or not livestock grazing is a problem along McMullen Creek. However, indications are that the riparian area along the creek is improving.

8. RILEY CREEK

The water quality concerns and status of Riley Creek are further substantiated in the *1988 Idaho Water Quality Status Report and Nonpoint Source Assessment*. Historically, agricultural nonpoint sources affect Riley Creek (from the source to the mouth) slightly from irrigated cropland and slightly from livestock grazing (ISCC 1979 [Table 3]). Traditionally, the creek meets all water quality standards except those for total and fecal coliform bacteria (IDHW 1977b [p 1]).

9. ROCK CREEK

The water quality concerns and status of Rock Creek are further substantiated in the 1997 reconnaissance and monitoring by IDEQ-TFRO. Monitoring done indicates that the major cause of sediment runoff into the stream is bank instability, particularly in areas where grazing and irrigated agriculture function to the edge of the creek without any buffer strips. IDAPA 16.01.02.280 identifies Rock Creek as a "spillway, collection and conveyance facility" for the Twin Falls Canal Company from the intersection with the High Line Canal to the mouth. Historically, agricultural nonpoint sources affect Rock Creek under two segments or waterbodies: from the source to Rock Creek Town, slightly for livestock grazing only; and, from Rock Creek Town to the mouth, severely from irrigated cropland for sediment and slightly for livestock grazing (ISCC 1979 [Table 2]).

The Riparian & Wetland Research Project (RWRP) of the University of Montana (administered through the USBLM) conducted a Proper Functioning Condition (PFC) assessment of the Fifth Fork of Rock Creek, of which select results from 1994 are summarized in Table 34. Of the two location sites on the Fifth Fork of Rock Creek, one had a rating of "unhealthy" and one had a rating of "healthy but with problems." Grazing was listed as the most predominant on-site human activity. Lifeform canopy covers were predominantly shrubs followed by graminoids, and then forbs.

Table 34 Proper functioning condition assessment of Fifth Fork of Rock Creek

LOCATION ON ROCK CREEK	TYPE OF STREAM	OVERALL HEALTH RATING	LIFEFORM CANOPY COVER % Trees/Shrubs/Grams/Forbs	CHANNEL BOTTOM	STREAM BANK MATERIALS	ON-SITE HUMAN ACTIVITIES
Fifth Fork 9400323	Perennial	73.7% (HWP)	0-80-50-60	10% Sand 10% Silt & Clay	20% Sand 30% Silt & Clay	97.5% Grazing
Fifth Fork 9400326	Perennial	57.9% (Unhealthy)	0-70-50-40	0.5% Sand 3% Silt & Clay	10% Sand 0.5% Silt &Clay	97.% Grazing

Prepared by IDEQ-TFRO. Based on database at www.rwrp.umt.edu. Lifeforms include trees, shrubs, graminoids, and forbs. Channel bottom silt & clay fractions <10% are considered optimal, 10-30 suboptimal, 30-50 marginal, and >50 poor. HWP = Healthy with problems.

More recently, Rock Creek has had "bacteria contamination" postings from District Health at the Rock Creek Park in Twin Falls, Idaho due to elevated levels of fecal coliform above the primary and secondary recreational water quality standards. These elevated levels have been investigated by IDEQ-TFRO, and it has been found that the major sources include: (1) runoff from fields where manure has been applied; (2) grazing, where animals are allowed to urinate or defecate in the stream or associated streams; (3) septic systems that are unmaintained and which have direct or indirect discharge as sewage and otherwise; and, (4) runaway sewage from the City of Twn Falls municipality due to operational or maintenance problems. These are not the only sources, but they are the most visible. Other sources (and not as visible) may include: unmaintained septic systems in the rural areas that have a linkage to a canal drain or stream; over-application of manure in land areas affected readily by storm events outside the immediate boundary of the suspected zone-of-impact, but which have a linkage via a canal or agricultural drain to Rock Creek; and, animals that are known to urinate and defecate in or near streams. These problems as shown by the bacteria data collected by IDEQ-TFRO since 1990 (and before) have been more prevalent during the irrigation season. In response to public concerns the IDEQ-TFRO, the Mid-Snake WAG, and the Mid-Snake TAC have formed a task force with other local groups to provide technical assistance to private land owners through education and an understanding of the application of voluntary best management practices.

10. BOX CANYON CREEK AND BLUE HEART SPRINGS

The Box Canyon Area of Critical Environmental Concern (as previously discussed in §2.1.3.6) is a nesting ground for the following endangered or threatened species: (1) Box Canyon Creek is habitat for the Shoshone Sculpin (*Cottus greenii*). The stable aquatic temperatures and chemistry support the largest known population of Shoshone Sculpin on public lands, and the third largest known population in the world. Few are known to exist upstream on private land; and, (2) Box Canyon Creek also contains populations of three endangered molluscs: the Bliss Rapids snail, the giant Columbia River limpet, and the Utah valvata. Additionally, Box Canyon Creek provides feeding areas for furbearers and game fish. The riparian areas are important for non-game birds particularly during the winter months (USBLM 1985b [p 1-2]).

Blue Heart Springs is a large, aqua blue, cold, clear water spring emerging from the Snake River Canyon. It supports the fourth largest known population of Shoshone sculpin. It is surrounded by riparian vegetation and talus rock which makes physical access difficult, thus protecting the area from heavy disturbance. Blue Heart Springs is "protected" because the Idaho Department of Parks and Recreation holds a water right of 100 cfs for the people of Idaho (USBLM 1985b [p 3-4]). About 26.2 acres of public (federal) land is managed by the USBLM as an Area of Critical Environmental Concern for four threatened or endangered species (Bliss Rapids snail, Utah Valvata snail, Banbury Springs lanx, Snake River physa), and a species-of-special-concern (Shoshone sculpin), and the scenic and unique natural qualities of the area. The area provides recreation, hunting, fishing, and aesthetics for human visitors plus an array of habitats for resident and migrating wildlife species. The land includes a portion of Box Canyon Creek, the entire Blue Heart Springs and its riparian habitat along the Middle Snake River, and 87.1 acres of land above the canyon rim (USBLM 1985b). Approximately 300 cfs of Box Canyon Creek are diverted and piped under the Middle Snake River to a fish propagation facility (Clear Springs Foods, Inc.) located on the south side of the river. The same 300 cfs serves as a small hydro project (Mantech Inc./B.C. Hydro Ltd.) at the outflow of the hatchery.

A study conducted by D.W. Taylor in 1985 as a survey of Box Canyon Creek for molluscs found several populations of living Bliss Rapids snails and Utah Valvata snails along with shell deposits containing numerous specimens of the Bliss Rapids snail and several shells of the Giant Columbia River Limpet. Many of the shells were heavily eroded, indicating that these animals had once experienced heavy sediment load exposure, an unusual occurrence in this canyon-enclosed, spring-fed watershed with virtually no turbidity or suspended solids and little natural sediment load. The surveys showed that a recent extensive deposit area in a natural pool on public land supported a healthy population of Utah Valvata snail, while causing a severely adverse impact to the Bliss Rapids snail by reducing its habitat and also probably that of the Giant Columbia River Limpet (Lanagenstein *et al.* 1989 [p 4]).

11. CRYSTAL SPRINGS LAKE

Nutrients in ground water, hatchery wastewater discharges, and from the deposited organic sediments promote extensive growths of aquatic plants and algae. Aesthetics, recreational uses, and salmonid spawning are impaired by the organic deposits (USBLM 1985b [p. 1-2]) A 1990 restoration study indicated that Crystal Springs Lake "should be considered an endangered resource as it represents one of the few remaining spring areas in the Thousand Springs reach of the Snake River that is in the public domain and available for public use and enjoyment (IDHW 1990 [p 1])." Data collected by IDHW-IDEQ in its restoration study showed: (1) nitrate-nitrogen levels exceeded the 0.3 mg/L criterion and ranged from 2.28 to 2.40 mg/L, and reflected elevated nitrate-nitrogen levels in the groundwater feeding the lake; (2) total phosphorus levels generally exceeded the 0.100 mg/L criterion and ranged from 0.160 to 0.250 mg/L with a groundwater background level of <0.050 mg/L; (3) fecal coliform densities were quite variable, but geometric means were all below the 50/100 mL standard with exceedences only occurring in the hatchery effluent as *Streptococcus faecalis*. Coliform bacteria in the hatchery effluent likely arose from contamination of the spring source or fish feed, since fish do not have a permanent coliform flora in their intestinal tracts; and, (4) solids/sediment organic loadings ranged from 4 to 8 mg/L with an average loading of 2200 lbs/day (flow being 73.6 cfs) (IDHW 1990 [pp 8-19]).

Recreational use of the lake is confined to bank fishermen who fish from the hatchery outfall structure or lake outlet bridge area. Individuals attempt to access the lake to fish along the south shore between these two locations. The IDPR has received complaints from individuals regarding sludge accumulations and macrophyte growths along this side of the lake. These solids release offensive odors when disturbed, and they physically threaten the elderly or children who attempt to wade out into the lake to enjoy this resource. The sediments of the lake contain a mean TKN level of about 930 mg/L. Highest sediment TKN (like TP) levels were measured in sediments collected near the hatchery outfall and on the south side of the lake. Methane and hydrogen sulfide production, in addition to a black color, indicate lake sediments to be decomposing anaerobically (IDHW 1990 [p 26, 35]).

12. BLIND CANYON

The water of Blind Canyon is largely diverted to commercial fish-rearing ponds. Most of the inner canyon has been developed for fish propagation. Much of the original spring ecosystem has been altered by water diversion for fish production and establishment of fish hatcheries in the canyon. Associated unique wildlife probably has disappeared (IPC 1998).

13. BRIGGS SPRINGS CREEK

The property adjacent to Briggs Springs is mainly used for livestock grazing. Briggs Springs itself is severely impacted by small hydro-development and fish hatchery operations. The undeveloped portions of the property are grazed by livestock, causing local impacts to the vegetation, particularly wetlands. Nearly one-third of the spring flow is diverted to a small fish farm. After passing through this facility, water is returned to one of the original lower elevation stream channels. About two-thirds (70 to 120 cfs) of the spring water is diverted to a private small hydro plant (Briggs Creek Project, FERC No. 4360-001) which began operation in 1989. Water diversion destroyed riparian habitats associated with the springs. As a result of complete dewatering, the *Forested Wetland* vegetation was ultimately destroyed. From the point where hatchery water reenters the stream bed, vegetation remains viable. At the point of entry, there is a 30 cfs minimum stream flow held of the State of Idaho (IPC 1998).

14. PERRINE COULEE SYSTEM

Water quality in the Perrine Coulee System is impacted by irrigated agriculture, livestock operations, aquaculture, wastewater discharges, hydropower development, urban development, and recreation. Water from the Perrine Coulee System enters the Middle Snake River at five main branches and contributes to water quality problems within the river. Primary pollutants of concern are sediment, nutrients, pathogens, and pesticides. The majority of sediment within the Perrine Coulee System and potentially being delivered to the Middle Snake River originates on the surface (furrow) irrigated cropland. Sheet and rill erosion do not contribute significantly, making irrigation-induced erosion on surface (furrow) irrigated clean-tilled cropland the significant contributor. Excess tillage, lack of adequate surface residue (from growing low residue crops), soil compaction, and poor irrigation water management practices all contribute to the resource problems. Overall, sediment loading is greatest from the East Perrine Coulee, although there appears to be some indication that this load has been reduced since 1985. Total phosphorus (predominantly as a sediment-bound species) is frequently above the concentration recommended for water quality protection. Nitrogen, although it does not appear to present a serious water quality problem within the Perrine Coulee System, does deliver relatively high loads to the Middle Snake River. Pathogens pose a potential health risk to humans recreating in and around the Perrine Coulee "tributaries" (SRSCD 1998).

15. VINYARD CREEK

As previously described, there is a channel carrying irrigation return water that enters Vinyard Creek approximately midway between the waterfall and the confluence with Twin Falls Reservoir. IDEQ-TFRO has reported a peak discharge for the irrigation return channel of 14.8 cfs in 1986, and an annual deposition of approximately 707 metric tons of sediment into the Twin Falls Reservoir (IDHW 1989a). This channel was re-routed in 1996 by constructing a rock and earthen embankment at the inflow of the pipe in order to pool the irrigation return water for re-route into the pipe (IPC 1997b [p 4]). At the point where the historical creek channel and the irrigation return joined, this has been re-routed so that Vinyard Creek discharges water from Vinyard Lake only. The irrigation return discharges only irrigation return water to Twin Falls Reservoir just downstream from where Vinyard Creek discharges. Fish species collected by IPC biologists in 1996 included: cutthroat trout, rainbow trout, rainbow-cutthroat trout hybrid, speckled dace, reside shiner, Utah sucker, and mottled sculpin (IPC 1997b [p 4]). Vinyard Creek has historically supported a unique population of cutthroat trout. Additionally, the stream has likely provided a spawning, rearing, and adult habitat for cutthroat trout, rainbow trout, and rainbow-cutthroat trout hybrids (IPC 1997b [p 4]).

Finally, the 1994 and 1996 §303(d) lists identified the level of benefical support status for various tributaries in HUC 17040212. These are identified in Table 35.

Table 35 1994 & 1996 Beneficial support status for tributaries

SEGMENT NAME	FS	T	PS	NS	NA
DEEP CREEK					
Deep Ck (Low Line Canal to SR)	AG	PC/SC	CW/SS		
Deep Ck (HW to LowLineCanal)	AG	PC/SC	CW/SS		
MUD CREEK					
Mud Ck (T09SR14ES33 to SR)	AG	PC/SC	CS/SS		
Mud Ck (HW to T09SR14ES33)	AG	PC/SC	CW/SS		
ROCK CREEK					
Rock Ck (Cottonwood Ck to SR)	AG	PC/SC	CW/SS		
Rock Ck (5th Fork to McMullen Ck)	AG		CW/SS/PC/SC		
MCMULLEN CREEK					
Cottonwood Ck to Rock Ck	AG	PC/SC/CW/SS			
Donahue Ck to N. Cottonwood Ck	AG	PC/SC/CW		SS	
HW to Donahue Ck	AG	PC/SC/CW	SS		
COTTONWOOD CREEK & NORTH COTTONWOOD CREEK					
McMullen Ck to N. Cottonwood Ck	AG	PC/SC	CW	SS	
HW to Dry Cottonwood Ck	AG	PC/SC	CW	SS	
DRY CREEK					
Murtaugh Lake to SR	AG	PC/SC/CW/SS			

SEGMENT NAME	FS	T	PS	NS	NA
EF Dry Creek to Murtaugh Lake	AG	PC/SC	CW/SS		
NF Dry Creek to EF Dry Creek	AG	PC/SC	CW/SS		
HW to WF Dry Creek	AG	PC/SC	CW/SS		
HW to Dry Creek	AG	PC/SC	CW/SS		
HW to MF Dry Creek	AG	PC/SC	CW/SS		
CLOVER CREEK					
Dry Creek to SR	AG	PC/SC/CW/SS			
Pioneer Reservoir to Dry Creek	AG	PC/SC/CW/SS			
Calf Creek to Pioneer Reservoir	AG	PC/SC/CW/SS			
T4SR13ES31 to Calf Creek	AG	PC/SC/CW/SS			
Cottonwood Ck to T4SR13ES31	AG	PC/SC/CW/SS			
Squaw Creek to Catchall Creek	AG	PC/SC/CW/SS			
Deer Creek to Squaw Creek	AG	PC/SC/CW/SS			
HW to Deer Creek	AG	PC/SC/CW/SS			
Catchall Ck to Cottonwood Creek	AG	PC/SC/CW/SS			
OTHER TRIBUTARIES					
Niagara Springs (T9SR15ES11)	DW		PC/SC/CW/SS		
Crystal Springs (T9SR15ES12)			AG/PC/SC/CW/SS		
Cedar Draw (HW to SR)	AG	PC/SC/CW/SS			
Billingsley Creek (HW to SR)	AG/DW	PC/SC/CW/SS			
Cedar Draw Ck (HW to SR)	AG				CW/SS/PC/SC
Perrine Coulee (Low Line Canal to SR)	AG	PC/SC/CW		SS	

Prepared by IDEQ-TFRO. Based on the 1994 & 1996 §303(d) lists. SR = Snake River. HW = Headwaters. Ck = Creek. AG = agricultural water supply PC = primary contact recreation. SC = secondary contact recreation. CW = cold water biota. SS = salmonid spawning. EF = East Fork. WF = West Fork. NF = North Fork. Lk = Lake. FS = Full support. T = Threatened. PS = Partial support. NS = Not supporting. NA = Not assessed.

2.2.2.6 BENEFICIAL USE RECONNAISSANCE PROJECT DATA

In addition to the data previously described in §2.2.1.1 through §2.2.1.4, information was collated from the Beneficial Use Reconnaissance Project (BURP) in the Twin Falls Regional Office of IDEQ for the streams on the §303(d) list. Tables 37 and 38 provide an indication of why these streams are not fully supporting their beneficial uses. Dry streams are not included. The ecoregional geographic area is the Snake River Basin/High Desert. Although traditional water quality monitoring for chemical parameters has its benefits, biomonitoring (as BURP) goes beyond the chemistry and centers on the ecological status of the beneficial use (IDEQ 1998). However, BURP monitoring encompasses a small fraction of a watershed and at only one moment in time, usually during late summer. It does not account for seasonality. The process used to assess the beneficial use support covers both a chemical and a biological process known as IDEQ's Bioassessment

Process. BURP by itself is the monitoring protocol. The interpretation of the BURP data for determination of beneficial support status is known as the Waterbody Assessment process. Table 36 describes the BURP location sites.

Table 36 Site number, latitude and longitude for each of the BURP sites

TRIBUTARY	SITE No.	LATITUDE	LONGITUDE	TOWNSHIP/RANGE/SECTION
Billingsley Creek	9423	42°48'1.79"	114°52'8.42"	T 075 R 13E S 19
	9424	42°47'15.09"	114°51'54.74"	T 07S R 13E S 11
	9441	42°47'14.72"	114°51'55.36"	T 07S R 13E S 30
Clover Creek	9510	43°0'3.70"	115°9'13.75"	T 05S R 11E S 09
	9511	42°59'55.00"	115°3'0.00"	T 05S R12E S 08
Cottonwood Creek	9661	42°26'3.41"	114°23'26.73"	T 11S R 18E S 30
Cottonwood Creek, North	9409	42°18'46.46"	114°25'36.42"	T 13S R 17E S 11
	9603	42°19'52.03"	114°25'34.81"	T 13S R 17E S 02
Deep Creek	9647	42°37'51.72"	114°50'35.14"	T 09S R 13E S 20
Dry Creek	9512	42°22'4.63"	114°11'18.05"	T 12S R 19E S 24
	9513	42°28'30.00"	114°8'40.00"	T 11S R 20E S 07
Dry Creek, East Fork	9630	42°20'53.29"	114°12'7.93"	T 12S R 19E S 26
	9647	42°17'54.62"	114°9'9.88"	T 13S R 20E S 18
McMullen Creek	9532	42°14'37.87"	114°25'15.57"	T 13S R 17E S 36
Riley Creek	9503	42°45'34.49"	114°51'26.14"	T 08S R 13E S 01
	9539	42°45'49.17"	114°51'50.59"	T 08S R 13E S 06
Rock Creek, Above (Headwaters to Rock Creek Town)	9439	42°23'91.60"	114°18'32.20"	T 12S R 18E S 13
	9531	42°18'1.85"	113°15'17.88"	T 13S R 19E S 17
	9543	42°22'1.18"	114°18'16.05"	T 12S R 18E S 13
Rock Creek, Below (Rock Creek Town to Confluence with Snake River)	9558	42°35'38.90"	114°31'48.11"	T 09S R 16E S 36
	9559	42°34'2.87"	114°30'15.78"	T 10S R 17E S 08
	9560	42°27'15.35"	114°21'45.94"	T 11S R 18E S 21
	9561	42°33'40.67"	114°29'22.28"	T 10S R 17E S 17
Tool Box Creek	9557	43°13'49.78"	114°19'3.72"	T 14S R 18E S 11
Prepared by IDEQ-TFRO.				

Table 37 describes portions of the BURP data for the indicated waterbody.

1 *Table 37 SELECTED STREAM CHARACTERISITICS FROM DEQ-TFRO METHODOLOGY.*

	WATERBODY NAME	SITE IDENTIFICATION	FLOW cfs	VALLEY TYPE	SINUOSITY	FINES	EMBEDDEDNESS	BANK VEGETATION	LOWER BANK STABILITY	ROSGEN STREAM TYPE
3	Alpheus Creek	No BURP data available.								
4	Billingsley Creek	9424	46.50	TL	Moderate	23	9	10	10	-
		9441	6.40	TL	Moderate	90	15	10	9	-
		9423	30.40	TL	Moderate	62	8	10	9	-
5	Blind Canyon Creek	No BURP data available.								
6	Cedar Draw Creek	No BURP data available.								
7	Clear Springs	No BURP data available.								
8	Clover Creek	9510	20.20	US	Low	64	4	8	8	C
		9511	1.05	TL	Braided	42	11	8	9	C
9	Cottonwood Creek	9661	4.36	FB	High	80	0	10	10	G
10	Cottonwood Creek, North	9409	0.40	TL	Moderate	47	10	9	9	-
		9603	4.00	VS	Moderate	32	7	4	1	B
11	Crystal Springs	No BURP data available.								
12	Deep Creek	9647	75.32	FB	Moderate	32	0	9	10	C
13	Dry Creek	9513	3.90	US	Moderate	61	7	9	2	C
		9512	16.20	VS	Braided	41	10	7	9	B
14	Dry Creek, East Fork	9630	2.50	VS	Moderate	9	18	7	9	B
15	Dry Creek, West Fork	9647	0.50	VS	Moderate	6	13	2	3	A
16	McMullen Creek	9532	7.80	TL	Moderate	100	0	9	9	C
17	Mud Creek	No BURP data available.								

WATERBODY NAME	SITE IDENTIFICATION	FLOW cfs	VALLEY TYPE	SINUOSITY	FINES	EMBEDDEDNESS	BANK VEGETATION	LOWER BANK STABILITY	ROSGEN STREAM TYPE
Riley Creek	9503	1.40	FB	Low	91	2	10	9	A
	9539	58.01	TL	Moderate	70	11	10	10	C
Rock Creek, Above (Headwaters to Rock Creek Town)	9439	5.22	FB	High	53	13	8	6	-
	9543	13.60	FB	High	20	5	8	5	B
	9531	24.00	YS	Moderate	34	15	8	10	B
Rock Creek, Below (Rock Creek Town to Confluence with Snake River)	9560	16.70	BC	Moderate	46	16	6	6	C
	9559	193.0	BC	Moderate	44	6	6	8	C
	9558	>200	BC	Low	43	7	8	10	-
	9561	138.8	BC	Moderate	49	6	10	9	C
Tool Box Creek	9557	0.50	TL	Moderate	50	10	8	9	A

Prepared by IDEQ-TFRO: Site Id. = BURP Site Identification for the specific year; Valley Types: FB = Flat Bottomed, TL = Trough Like, YS = Y-Shaped, US = U-Shaped, VS = V-Shaped,BC = Box Canyon; F = % Fines (<6 mm diameter): Optimal = <10, Suboptimal = 10-30, Marginal = 30-50, Poor = >50, E = Embeddedness Score: Optimal = 16-20, Suboptimal = 11-15, Marginal = 6-10, Poor = 0-5; BVP = Bank Vegetation Protection Score: Optimal = 9-10, Suboptimal = 6-8, Marginal = 3-5, Poor = 0-2; LBS = Lower Bank Stability Score: Optimal = 9-10, Suboptimal = 6-8, Marginal = 3-5, Poor = 0-2; R = Rosgen Stream Type. The flow parameter is noted as one of the principle abiotic factors shaping stream ecosystems (Minshall 1993). The Valley Type parameter is a characterization of the dominant shape of the "valley" in which the stream is located. Sinuosity is a parameter measure of the straightness of the channel. Fines is a fraction of the substrate less than 6.00 mm in diameter as an ocular estimate of the percentage of bottom substrate that is fine material. Embeddedness is the degree to which boulders, rubble, or gravel are surrounded by fine sediment and indicates the suitability of the stream substrate as habitat for benthic macroinvertebrates and fish spawning and egg incubation. Bank vegetation protection is an estimate of bank vegetation covering the bank and provides an indication of bank stability and potential instream sedimentation. Lower bank stability is rated by observing existing or potential detachment of soil from the lower streambank and its potential movement into the stream (IDEQ 1996a [pp 55-58]).

Rosgen stream types deal with the broad-level description of a major stream type. These types are labeled A through G and have the following Level 1 descriptions, as show in Table 38.

Table 38 Modified Rosgen geomorphic characterization of stream types (Level 1)

STREAM TYPE	DESCRIPTION	ENTRENCHMENT RATIO	W/D RATIO	SINUOSITY	SLOPE
A	Steep and entrenched	<1.4	<12	1.0 - 1.2	0.04 - 0.10

STREAM TYPE	DESCRIPTION	ENTRENCHMENT RATIO	W/D RATIO	SINUOSITY	SLOPE
B	Moderately entrenched	1.4 - 2.2	>12	>1.2	0.02 - 0.039
C	Low gradient	>2.2	>12	>1.4	<0.02
G	Entrenched "gully"	<1.4	<12	>1.2	0.02 - 0.039
Prepared by DEQ-TFRO: after Table 4-1, p. 4-5, of *Applied River Morphology* by Dave Rosgen. W/D = Width to depth.					

Table 39 describes the bioassessment process of these streams and considers major numeric standard exceedence (such as temperature) if data is present, Macroinvertebrate Biotic Index (MBI), Reconnaissance Index of Biotic Integrity (RIBI), Algal Biotic Index (ABI), and Habitat Index (HI) in hierarchical sequence. IDEQ uses the MBI as a normalized multimetric index (made up of seven metrics) which include: Hilsenhoff Biotic Index (HBI); Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) or EPT; Percent Ephemeroptera, Plecoptera, and Trichoptera (%E); Taxa Richness (TAX); % Scrapers (%SC); % Dominance (%D); and, Shannon's H'Diversity Index (SHW). See the IDEQ1996 reference for more detailed information. For a site support status (SiteSupStat) for a specific site, an MBI score of < 2.50 indicates the water body is Not Fully Supporting (NFS) its beneficial uses. An MBI score in range 2.50 to 3.50 indicates the water body Needs Verification (NV) on its beneficial uses, and results in the waterbody assessment process looking at other indicators (like RIBI or HI) to determine the status of site support. An MBI score > 3.50 indicates the water body is Fully Supporting (FS) its beneficial uses. The lowest MBI score would be NFS, followed by NV, and then FS. An additional metric used by IDEQ is the HI to assess cold and warm water biota beneficial uses for wadable streams for the Snake River Basin/High Desert. In the Snake River Basis ecoregion, an HI score of < 34 indicates the habitat is impaired. An HI score in the range from 34 to 66 indicates the habitat needs verification. An HI score > 66 indicates the habitat is not impaired. For the overall support status (OverSupStat) for the entire segment or water body, the lowest SiteSupStat in a group becomes the OverSupStat for the stream. For example, Billingsley Creek has three SiteSupStat on three segments: NFS, NV, and NV. The OverSupStat would be the lowest SiteSupStat of the three, which would be NFS.

Table 39 Bioassessment of BURP data of 303(d) listed water bodies

NAME	SITE	IDEQ MULTIMETRIC INDICES							MBI	HI	Site Sup Stat	Over Sup Stat
		HBI	EPT	%E	TAX	%SC	%D	SHW				
Billingsley Creek	9441	0.41	0	0	0.24	0.79	0.45	0.45	2.39	54	NFS	NFS
	9424	0.48	0.09	0.09	0.24	1.00	0.31	0.33	2.56	97	FS	
	9423	0.55	0.03	0.05	0.29	0.55	0.74	0.57	2.85	82	NV	
Clover Creek	9511	0.39	0.06	0.03	0.45	0.37	0.87	0.71	2.88	73	NV	NV
	9510	0.61	0.12	0.49	0.38	0.01	0.79	0.63	3.03	70	NV	
Cottonwood Creek	9661	0.61	0.15	0.14	0.36	0.01	0.30	0.36	1.83	54	NFS	NFS
Cottonwood Creek North	9409	0.83	0.38	0.64	0.67	0.24	1.00	0.97	4.73	92	FS	FS
	9603	0.88	0.35	0.92	0.50	0.47	0.70	0.59	4.41	65	FS	
Deep Creek	9647	0.63	0.09	0.02	0.21	0	0.05	0.08	1.08	63	NFS	NFS
Dry Creek	9512	0.74	0.29	0.76	0.45	0.21	0.54	0.60	3.59	98	FS	NFS
	9513	0.59	0.12	0.05	0.29	0.01	0.70	0.50	2.26	66	NFS	

NAME	SITE	IDEQ MULTIMETRIC INDICES HBI	EPT	%E	TAX	%SC	%D	SHW	MBI	HI	Site Sup Stat	Over Sup Stat
Dry Creek East Fork	9630	0.86	0.82	0.64	0.98	0.62	0.93	0.91	5.76	133	FS	FS
Dry Creek WestFork	9647	0.79	0.56	0.53	0.64	0.32	0.98	0.87	4.69	110	FS	FS
McMullen Creek	9532	0.50	0.09	0.07	0.55	0.01	0.57	0.50	2.29	45	NFS	NFS
Riley Creek	9539	0.33	0.12	0.01	0.36	0.79	0.48	0.42	2.83	85	FS	NFS
	9503	0.50	0.06	0.03	0.31	0.04	0.18	0.26	1.23	95	NFS	
Rock Creek (Headwaters to Rock Creek Town)	9439	0.09	0.38	0.69	0.76	0.36	0.87	0.74	4.78	98	FS	FS
	9531	0.92	0.53	0.72	0.76	0.62	0.98	0.86	5.39	103	FS	
	9543	0.84	0.41	0.70	0.60	0.35	0.96	0.88	4.94	95	FS	
Rock Creek (Rock Creek Town to Confluence with Snake River)	9561	0.92	0.12	0.07	0.21	1.14	0.15	0.20	2.81	85	NV	NFS
	9560	0.66	0.18	0.33	0.33	0.69	0.60	0.53	3.32	96	FS	
	9559	0.83	0.18	0.08	0.29	1.19	0.12	0.19	2.88	67	NFS	
	9558	0.58	0.21	0.15	0.40	1.01	0.26	0.33	4.69	91	NFS	
Toolbox Creek	9557	0.58	0.24	0.12	0.33	0	0.26	0.30	1.83	77	NFS	NFS

Prepared by IDEQ-TFRO. SITE = Site Identification by Year and Segment Number (YYNN). SiteSupStat = Site Support Status (for a specific site) OverSupStat = Overall Support Status (for the entire segment or water body). HBI = Hilsenhoff Biotic Index. EPT = Ephemeroptera, Plecoptera, and Trichoptera. %E = % Ephemeroptera, Plecoptera, and Trichoptera. TAX = Tax Richness. %SC = % Scrapers. %D = % Dominance. SHW = Shannon's H'Diversity Index. MBI = Maroinvertebrate Biotic Index. HI = Habitat Index.

As of this writing, the protocols for large rivers (Middle Snake River), lakes and reservoirs had not been completed. They are still under development and will be included at a later time.

2.2.3 APPLICABLE BENEFICIAL USES AND WATER QUALITY STANDARDS

Designated beneficial use(s) or designated use(s) are defined by IDAPA 16.01.02.003 (24) as "those beneficial uses assigned to identified waters in Idaho Department of Health and Welfare Rules, Title 01, Chapter 02, 'Water Quality Standards and Wastewater Treatment Requirements,' Sections 110 through 160 and 299, whether or not the uses are being attained." Those designated uses include: domestic water supply, agricultural water supply, cold water biota, warm water biota, salmonid spawning, primary contact recreation, secondary contact recreation, and special resource water. Existing beneficial use(s) or existing use(s) are defined by IDAPA 16.01.02.003 (35) as "those beneficial uses actually attained in waters on or after November 28, 1975, whether or not they are designated for those waters in Idaho Department of Health and Welfare Rules, Title 01, Chapter 02, 'Water Quality Standards and Wastewater Treatment Requirements.'" As part of their statutory defined duties, the basin advisory group shall make "revisions in the beneficial uses designated for each stream and the status and attainability of designated or existing beneficial uses for the water bodies within the basin (Idaho Code 39-3614)." "In determining whether a water body fully supports designated and existing beneficial uses," the IDEQ "shall determine whether all of the applicable water quality standards are being achieved, including any criteria developed pursuant to IDAPA rules, and whether a healthy, balanced biological community is present (IDAPA 16.01.02.053)." "Beneficial uses impaired by nonpoint source pollution include cold water biota (trout, salmon, and other aquatic organisms), salmonid (trout and salmon) spawning and primary (swimming) and secondary (wading) contact recreation (IDHW 1991b)."

2.2.3.1 APPLICABLE DESIGNATED BENEFICIAL USES

Applicable designated beneficial uses (as designated by the State Legislature through negotiated rulemaking based on recommendations provided by IDEQ via the Board of IDHW) are described in Table 40. Undesignated surface waters are protected under IDAPA 16.01.02.101(01).

Table 40 Designated beneficial uses of waterbodies in Upper Snake Rock

STREAM NAME	*BOUNDARIES*	*BENEFICIAL USES*							
		Ag	*D*	*CW*	*WW*	*SS*	*PC*	*SC*	*RW*
TRIBUTARIES									
Alpheus Creek	From headwaters to the Snake River	*IDAPA 16.01.02.101.01*							
Billingsley Creek	From headwaters to the Snake River	X	X	X		X	X	X	X
Blind Canyon Creek	From headwaters to the Snake River	*IDAPA 16.01.02.101.01*							
Cedar Draw	From headwaters to the Snake River	X		X		X		X	
Clear Springs	From headwaters to the Snake River	*IDAPA 16.01.02.101.01*							
Clover Creek	From headwaters to the Snake River	X		X		X	X	X	
Cottonwood Creek	From headwaters to Rock Creek	*IDAPA 16.01.02.101.01*							
Crystal Springs	From headwaters to Snake River	*IDAPA 16.01.02.101.01*							
Deep Creek	From headwaters to Snake River	X		X		X		X	
Dry Creek	From Medley Creek to Snake River	X		X		X		X	
Dry Creek	From headwaters to Medley Creek	X		X		X		X	
Dry Creek, West Fork	From headwaters to Dry Creek	X		X		X		X	
McMullen Creek	From headwaters to Cottonwood Creek	*IDAPA 16.01.02.101.01*							
Mud Creek	From Deep Creek road to Snake River	X		X		X		X	
Riley Creek	From headwaters to Snake River	X	X	X		X	X	X	X
Rock Creek	From headwaters to Rock Creek Town	X	X	X		X	X	X	X
Rock Creek	From Rock Creek Town to Snake River	X		X		X	*	X	
Sand Springs Creek	From headwaters to Snake River	*IDAPA 16.01.02.101.01*							
Tool Box Creek	From headwaters to Fifth Fk Rock Creek	*IDAPA 16.01.02.101.01*							
RESERVOIRS									
Bliss Reservoir	The entire reservoir	*IDAPA 16.01.02.101.01*							
Lower Salmon Falls Reservoir	The entire reservoir	*IDAPA 16.01.02.101.01*							
Pioneer Reservoir	The entire reservoir	*IDAPA 16.01.02.101.01*							
Shoshone Falls Reservoir	The entire reservoir	*IDAPA 16.01.02.101.01*							
Upper Salmon Falls Reservoir	The entire reservoir	*IDAPA 16.01.02.101.01*							

STREAM NAME	BOUNDARIES	BENEFICIAL USES Ag	D	CW	WW	SS	PC	SC	RW
ON THE MIDDLE SNAKE RIVER: *(1) Snake River - Milner Dam to Buhl (IDAPA 16.01.02.150.01)* *(2) Snake River - Buhl to King Hill (IDAPA 16.01.02.150.01).*									
Middle Snake River	From Milner Dam to Murtaugh *(1)*	X		X		X	X	X	
Middle Snake River	From Cedar Draw to Rock Creek *(1)*	X		X		X	X	X	
Middle Snake River	From Clear Lakes Bridge to Cedar Draw *(1)*	X		X		X	X	X	
Middle Snake River	From Deep Creek to Mud Creek *(1)*	X		X		X	X	X	
Middle Snake River	From King Hill to Big Pilgrim Gulch *(2)*	X		X		X	X	X	
Middle Snake River	From Mud Creek to Clear Lakes Bridge *(1)*	X		X		X	X	X	
Middle Snake River	From Rock Creek to Shoshone Falls *(1)*	X		X		X	X	X	
Middle Snake River	From Cassia Gulch to Big Pilgrim Gulch *(2)*	X		X		X	X	X	
Middle Snake River	From Bliss Bridge to King Hill Diversion *(2)*	X		X		X	X	X	
Middle Snake River	From Murtaugh to Twin Falls Reservoir *(1)*	X		X		X	X	X	

Prepared by IDEQ-TFRO: Ag = Agricultural water supply; D = Domestic water supply; CW = Cold water biota; WW = Warm water biota; SS = Salmonid spawning; PC = Primary contact recreation; SC = Secondary contact recreation; RW = Special Resource Water. *IDAPA 16.01.02.101.01* in the Beneficial Uses columnes references Undesignated Surface Waters: "Surface waters not designated in Sections 110 through 160 shall be designated according to Section 39-3604, Idaho Code, taking into consideration the use of the surface water and such physical, geological, chemical, and biological measures as may affect the surface water. Prior to designation, undesignated waters shall be protected for beneficial uses, which includes all recreational use in and on the water and the protection and propagation of fish, shellfish, and wildlife, wherever attainable." * = Protected for future use. All surface waters are designated for industrial water supply, wildlife habitats, and aesthetics (IDAPA 16.01.02.100(01c) & (04) & (05).

Existing beneficial uses are summarized in Table 41 for select streams as observed by the waterbody assessment process through BURP.

Table 41 Existing beneficial uses of the 303(d) listed streams

STREAM NAME	BOUNDARIES	BENEFICIAL USES Ag	D	I	CW	WW	SS	PC	SC	W	A
Billingsley Creek	From headwaters to the Snake River	X			X		X		X		
Clover Creek	From Pioneer Reservoir to the Snake River	X									
Cottonwood Creek	From headwaters to Rock Creek	X			X		X				
Deep Creek	From headwaters to Snake River	X			X						
Dry Creek	From West Fork Dry Ck to Murtaugh Lake	X			X		X				
Dry Creek, West Fork	From headwaters to Dry Creek				X				X		
McMullen Creek	From headwaters to Cottonwood Creek	X			X						
Riley Creek	From headwaters to Snake River	X			X		X				
Rock Creek	From Rock Creek Town to Snake River	X			X		X	X			
Tool Box Creek	From headwaters to Fifth Fk Rock Creek	X			X				X		

STREAM NAME	BOUNDARIES	BENEFICIAL USES Ag	D	I	CW	WW	SS	PC	SC	W	A

Prepared by IDEQ-TFRO: Ag = Agricultural water supply; D = Domestic water supply; I = Industrial water supply; CW = Cold water biota; WW = Warm water biota; SS = Salmonid spawning; PC = Primary contact recreation; SC = Secondary contact recreation; W = Wildlife habitats; A = Aesthetics. Information collated from BURP

2.2.3.2 PROTECTION OF BENEFICIAL USES AND THE TMDL PROCESS

Under Idaho Code (IDAPA 16.01.02.003.57) man-made waterways are defined as canals, flumes, ditches, and similar features, constructed for the purpose of water conveyance. Waters of the State (IDAPA 16.01.02.003.116) are defined as all the accumulations of water (surface and underground, natural and artificial, public and private, or parts thereof which are wholly or partially within) which flow through or border upon the state.

According to IDAPA 16.01.02.050(02)(a), "Wherever attainable, surface waters of the state shall be protected for beneficial uses which includes all recreational use in and on the water surface" (for primary and secondary contact recreation) "and the preservation and propagation of desirable species of aquatic biota" (for salmonid spawning, cold or warm water biota, aquatic habitats). Although certain waters of the State may be protected for agricultural conveyence, that protection does not preceed the protections of other beneficial uses. It is recognized by the scientific community that waters of the state which are used for water conveyance may find it difficult to meet their beneficial uses (USDA/SCS 1998). However, the administrative policy (IDAPA 16.01.02.050 (02)(c)) stipulates that "in all cases, existing beneficial uses of the waters of the state will be protected." As part of IDAPA, the Antidegradation Policy allows for maintenance of existing uses for all waters, such that "the existing in-stream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected (IDAPA 16.01.02.051(01))."

Beneficial use support status is determined by IDEQ (IDAPA 16.01.02.053) through its *Water Body Assessment Guidance*, but parameters (e.g., aquatic habitat parameters and biological parameters) defined in this document are not considered or treated as individual water quality criteria or otherwise interpreted or applied as water quality standards. After determining that a water body does not fully support designated or existing beneficial uses (as determined through the *Water Body Assessment Guidance* document), the DEQ in consultation with the applicable Basin Advisory Group (i.e, Upper Snake BAG) and Watershed Advisory Group (i.e., Mid-Snake WAG) shall evaluate whether the application of required pollution controls to sources of pollution affecting the impaired water body would restore the water body to full support status (IDAPA 16.01.02.054.01).

2.2.3.3 APPLICABLE WATER QUALITY STANDARDS

Violations of narrative and numeric water quality standards include the following on the Middle Snake River and its tributaries:

1. DELETERIOUS MATERIALS

"Surface waters of the state shall be free from deleterious materials in concentrations that impair designated or protected beneficial uses (See IDAPA §16.01.02.200.03)." Deleterious materials are defined as "any nontoxic substance which may cause the tainting of edible species of fish, taste and odors in drinking water supplies, or the reduction of the usability of water without causing physical injury to water users or aquatic and terrestrial organisms (See IDAPA §16.01.02.003.20)." "These materials do not include suspended sediment produced as a result of nonpoint source activities (See

IDAPA §16.01.02.200.03)" but do include aquatic plant growths. Like the Middle Snake River, the tributaries have widespread aquatic plant growths, including rooted and non-rooted macrophytes, epiphytic algae, and filamentous algae, which may cause the reduction of the usability of the waters without causing physical injury to water users. These aquatic plants are deleterious materials which appear in concentrations which impair designated beneficial uses of the particular waterbody, particularly primary and secondary contact recreation, cold water biota, salmonid spawning, aesthetics, and wildlife habitats.

Mud Creek and Deep Creek in particular, followed by Rock Creek, Cedar Draw, and East Perrine Coulee, and then followed by Salmon Falls Creek and Clover Creek had organic black deposits which when exposed to the atmosphere gave off offensive odors. Local fishermen and fowl hunters were interviewed and they claim that these organic deposits (particularly on Mud Creek and Deep Creek) are so offensive that the fish have been reduced in population numbers and the ducks "avoid the stench" areas when the deposits are exposed (Buhidar & Sharpnack 1997).

2. FLOATING, SUSPENDED, OR SUBMERGED MATTER

"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 (See IDAPA §16.01.02.200.05)." Nuisance is defined as "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 (See IDAPA §16.01.02.003.65)."

AQUATIC MACROPHYTES

In addition to the Middle Snake River, the tributaries have concentrations of macrophytes, algae, and organic solids (where point source industries are localized) which are discharged at concentrations which may be defined as floating, suspended, or submerged matter, and which cause definable nuisance and objectionable conditions which adversely effect their beneficial uses. IDEQ-TFRO during the 1996-1997 monitoring seasons identified high levels of macrophytes and epiphytic algae in certain sections of East Perrine Coulee, Rock Creek, Cedar Draw, Mud Creek, Deep Creek, Salmon Falls Creek, and Clover Creek that gave the streams the appearance of green-brown discoloration (Buhidar & Sharpnack 1997). By definition, these high levels of macrophytes could easily be construed as "nuisance," since they could readily "obstruct" the free use of the waters at certain times during the irrigation season when temperatures are warm and the majority of the discharged water is coming from agricultural drains and runoff. The designated beneficial uses affected include primary and secondary contact recreation, cold water biota, salmonid spawning, aesthetics, and wildlife habitats.

ORGANIC DEPOSITS

More especially on Mud Creek and Deep Creek organic black deposits were found at locations close to but downstream from localized point sources, as compared to upstream transects where no organic deposits were found mixed with nonpoint source sediments. This organic material, particularly on Deep Creek, was offensive in odor, viscous, and slick in appearance, and from various discussions with local citizens provided a negative aesthetic appearance to the bedrock (where bedrock was exposed) as well as the cobble and sediment. Salmon Falls Creek and Clover Creek are of particular interest because no point sources are found here, no black organic deposits were noted, but nusiance aquatic plants were found at specific locations where the streams were slow moving and less than 3 meters (Buhidar & Sharpnack 1997).

ALGAL BIOMASS

Algal biomass may be considered "nuisance floating, suspended, or submerged matter." "Chlorophyll *a* is used as a versatile measure of algal biomass or productivity. The ranges presented for mean summer chlorophyll *a* concentration determined in epilimnetic water supplies collected at least biweekly and analyzed according to *Standard Methods* are indices of the trophic stage of a lake: oligotrophic, 0-4 mg chlorophyll a/m^3 ; mesotrophic, 4-10 mg chlorophyll a/m^3 ; and, eutrophic, 10-100 mg chlorophyll a/m^3 (USEPA 1972 [p 21])." Because the Middle Snake River has a modified flow regime with reservoir-lake-type portions, these values may be used as preliminary indicators of a mesotrophic/eutrophic system. Biomass, as a standing crop, is different than algal biomass, and is a quantitative estimate of the total mass of living plant organisms within a given area or volume after drying (APHA 1995 [p 10-25]). IDEQ-TFRO contracted in 1992-1994 with the University of Idaho/Idaho Water Resources Research Institute to study the primary productivity of the Middle Snake River. The study focused on the highly productive shallow reach rich in aquatic macrophyte development throughout the Crystal Springs Reach (RM 599.5-601.3). The Crystal Springs Reach was determined to be the most productive reach in the water quality limited section due to a dense aquatic macrophyte community dominated by *Potamogeton pectinatus, Potamogeton crispus,* and *Ceratophyllum demersum.* Associated with these rooted macrophytes were luxuriant growths of the attached filamentous green algae *Hydrodictyon* and *Cladophora* that formed dense mats on the water surface. Table 42 shows the results of the 3-year study on the Crystal Springs Reach, which indicate:

1. This reach is on the average eutrophic (>10 mg chlorophyll a/m^3).

2. The chlorophyll *a* versus the month is negatively linear correlated (r^2=0.359, *F*-ratio=15.3, *p*=0.000), decreasing from April to November.

3. The biomass versus the rivermile (RM) is negatively linear correlated (r^2=0.309, *F*-ratio=10.9, *p*=0.001), decreasing from downstream (RM 600.0) to upstream (RM 600.6), or increasing from upstream to downstream.

4. A negative power regression relationship exists between the mean dry biomass (Y-axis) and the mean chlorophyll *a* (X-axis). As the mean chlorophyll *a* increases the mean biomass decreases.

Table 42 1992-1994 Falter studies on the Crystal Springs reach

YEARS OF STUDY	DRY BIOMASS g/m^3	CHLOROPHYLL-a mg/m^3	N
1992 MEAN	1052.367	8.922	66
1993 MEAN	422.698	26.787	199
1994 MEAN	390.525	13.291	105
1992-1994 MEAN	525.887	19.770	370
Prepared by IDEQ-TFRO. Falter et al. 1994 (for the year 1992), Falter et al. 1995 (for the year 1993); and, Falter et al. 1996 (for the year 1994)			

3. EXCESS NUTRIENTS

"The two nutrients of greatest potential concern in aquatic systems are nitrate and phosphate. These nutrients are the two most related to the eutrophication of surface waters, the assocated nuisance growths of algae, and the development of other noxious conditions (USDA FS 1990b [p 11])." In the

State of Idaho, "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 (See IDAPA §16.01.02.200.06)." Nutrients are defined as "the major substances necessary for the growth and reproduction of aquatic plant life, consisting of nitrogen, phosphorus, and carbon compounds (See §IDAPA 16.01.02.003.66)." "An excess supply of nutrients may cause an over-abundance of plant and animal biomass, especially of undesirable species or communities (IDHW 1991a)." For the Upper Snake Rock subbasin the excess nutrients include nitrogen and phosphorus, at a minimum.

These excess nutrients may also exist as limiting nutrients. Of the two, phosphorus is considered the limiting nutrient in waters of Upper Snake Rock. A limiting nutrient is a chemical (or physical) condition that determines the growth potential of an organism, and can result in less than maximum or complete inhibition of growth, but typically results in less than maximum growth rates. Because phosphorus is often in short supply relative to biological needs, this element limits plant growth in aquatic systems. Ecologically, when additional phosphorus is added to the system, excess aquatic plant growths are noted (IDEQ 1997b [p 44]). It is possible that nitrogen may be a limiting nutrient at certain times if there is substantial depletion of nitrogen in sediments due to uptake by rooted macrophyte beds.

Dissolved nutrients, especially orthophosphate, are rapidly taken up by aquatic plants. If sufficient nutrients are available in either the sediments or the water column, aquatic plants will take up and store an abundance of such nutrients in excess of the plant's actual need through a chemical phenomenon known as *luxury consumption or luxury uptake.* Phosphorus is the primary limiting nutrient in the Upper Snake Rock subbasin. During the life of the aquatic plant, whether macrophyte or algae, it will continue to store phosphorus in its tissue in quantities far in excess of the plant's immediate need. At the death of the plant, the tissue will decay in the water column and its stored nutrients within the plant biomass will be either returned to the water column or become incorporated into the river sediment. Thus, the submersed macrophytes are unique among rooted aquatic vegetation because they link the sediment with the overlying water. This linkage is responsible for great complexities in nutrition, and has important implications for nutrient cycling. Based on a variety of scientific sources, Table 43 describes the primary sources of nutrient uptake by submersed aquatic macrophytes for various nutrients-of-concern.

Table 43 Primary sources of nutrient uptake by submersed aquatic macrophytes

NUTRIENTS	SOURCE	COMMENTS
Nitrogen	Sediment	Sediment is primary source for uptake
Phosphorus	Sediment	Sediment is primary source for uptake
Iron	Sediment	Sediment is primary source for uptake
Manganese	Sediment	Sediment is primary source for uptake
Micronutrients	Sediment	Sediment is primary source for uptake
Trace metals	Sediment	Sediment is primary source for uptake
Calcium	Open Water	Component of carbonate system & photosynthetic bicarbonate utilization; uptake from open water
Magnesium	Open Water	Component of carbonate system & chlorophyll component
Sodium	Open Water	May be exchanged for potassium in sediment
Potassium	Open Water	May be exchanged for NH_4 ions in sediment; uptake also from open water
Sulfate	Open Water	May be exchanged for potassium in sediment or be a component with calcium

NUTRIENTS	SOURCE	COMMENTS
Chloride	Open Water	May be exchanged for sulfate in sediment

Prepared by IDEQ-TFRO. Sources include the following: Lowenhaupt 1956; Sculthorpe 1967; Golterman 1975; Denny 1980; Barko *et al.* 1982, 1986 1988; Huebert and Gorham 1983; Smart & Barko 1985, 1986; Agami & Walsel 1986; Jackson et al. 1994a,b; and, Barko & James 1998. Rooted submerged macrophytes even with relatively diminutive root systems are capable of significantly depleting pools of nitrogen and phosphorus in sediments (Barko & James 1998). For algae, "since algae on an average contain nitrogen and phosphorus in ratio of 16:1, this ratio in natural waters is commonly cited as an important indicator of relative nutrient limitations by these two nutrients (Stumm & Morgan 1970)." "Higher ratios indicate possible phosphorus limitation, while lower ratios indicate possible nitrogen limitation (USDA FS 1990b [p 11])."

An additional study conducted by Idaho State University on decomposition rates (the process by which nutrients are recycled through ecosystems) for two aquatic macrophyte species, *Ceratophyllum demersum* and *Potamogeton pectinatus*, which are common as dense populations in large, eutrophic rivers, were determined at the beginning and end of the growing season during 1994. The decomposition rate of a highly recalcitrant plant material, leaves of *Populus tremuloides*, also was determined. All three species decomposed at rates much faster than any previously reported values. Furthermore, the decay of the macrophytes was best described by a linear, rather than exponential, model. The decomposition of *P. tremuloides* leaves was best described by an exponential model with a decay constant of 0.002 (standardized for water temperature). The accelerated rates of decomposition are likely a result of the eutrophic condition of the Middle Snake River. An analysis of the carbon and nitrogen concentrations in the plant material suggested that the microbial decomposers in the Middle Snake River are limited by labile organic carbon. Microbial respiration rates were quite high for the macrophytes (*C. demersum* had a daytime of 18 and a nighttime of 4 mg O_2/hr/g dry weight; *P. pectinatus* had daytime of 12 and a nighttime of 3 mg O_2/hr/g dry weight) indicating that potentially large amounts of organic nitrogen, and lesser amounts of phosphorus, can be leached during the early stages of decomposition, thus suggesting that macrophytes play a major role in the nutrient dynamics of the Middle Snake River through the storage and release of carbon, nitrogen, and phosphorus (Royer 1995 [pp iii-iv]).

The following nutrients are described more fully relative to their effect on fisheries and aquatic macrophytes.

a. INORGANIC NITROGEN (NITRITE + NITRATE)

A concentration of total inorganic nitrogen (nitrite+nitrate as N + ammonia-N) of 0.3 mg/L is considered the limit for preventing the development of biological nuisances and the acceleration of cultural eutrophication (IDHW 1980a; USDA FS 1990b [p 11]). Agricultural return flows in Upper Snake Rock often exceed the 0.3 mg/L criterion (IDHW 1991a). The USEPA concluded in 1986 that "nitrate-nitrogen concentrations at or below 90 mg/L should be protective for warmwater fishes, while concentrations at or below 0.06 mg/L should be protective for salmonid fish (USDA FS 1990b [p 11]; USEPA 1986)."

"Nitrate concentrations in ground water from wells that are unaffected by cattle manure, fertilizer, legume crops, or domestic spetic system sources are typically less than 1 mg/L as nitrogen. It is suggested that nitrite plus nitrate as nitrogen concentration in ground water exceeding 2 mg/L probably indicate degradation of water quality from land use activities (USGS 1996a [p 4]). A study conducted by ERI of the major springs discharging to the Middle Snake River indicate nitrite+nitrate levels of 1.611 mg/L in the fall versus 1.688 mg/L in the spring. The % difference of 4.8 is not statistically different (ERI 1997).

One of the major sources "of nitrate is from the production (and eventual plowout) of alfalfa-hay (*Medicago sativa* L.) in southern Idaho. About 50% of the nitrate present in ground water has been determined to be the result of plowout of alfalfa (Robbins & Carter 1980)." In fact, alfalfa-hay dried and ground to pass a 1 mm sieve, then combined with a silt loam soil (at a rate of 1 gram to 500 grams, respectively) showed an average increase in nitrate from 15 mg/L to 85 mg/L (Buhidar 1990).

b. AMMONIA

"Ammonia can enter natural water systems from several sources, including industrial wastes, sewage effluents, alternative fuel conversion processes, and agricultural discharges. It is a natural biological degradation product of nitrogenous organic matter (Rand GM & Petrocelli SR circa 1981 [pp 456])." Ammonia is toxic to fisheries in aqueous media due to its characteristic chemical equilibrium in water as two chemical species: ionized or the ammonium form (NH_4^+) as a dissociated form, and un-ionized or the ammonia form (NH_3) as the undissociated, uncharged form. Total ammonia is the sum of NH_3 and NH_4^+, and the undissociated but combined form NH_4OH. In aqueous solutions ammonia assumes two chemical forms:

$$NH_3 + nH_2O \rightleftharpoons NH_3{\cdot}nH_2O \rightleftharpoons NH_4^+ + OH^- + (n-1)H_2O$$

These species are NH_3, NH_4^+, and the hydrogen-bonded to at least three ($n \geq 3$) water molecules. The relative concentrations of ionized and un-ionized ammonia in a given ammonia solution are principally a function of the pH, temperature, and ionic strength of the aqueous solution. If pH increases, the equilibrium is shifted toward the un-ionized species, and the concentration of NH_3 increases while that of NH_4^+ decreases. Temperature increases also favor the NH_3 species but to a lesser extent. And, an ionic strength increase (increase in total salt content) at low concentrations favors the NH_4^+ species.

"Ammonia is clearly toxic to fish and has many effects. Fish mortality caused by ammonia may be due to different effects in different cases, and it is likely that ammonia has a different mode of action at high than at low concentrations (Rand GM & Petrocelli SR circa 1981 [pp 456-457])." Table 44 gives some typical examples of the acute toxicity (48- or 96-hour LC50) of un-ionized ammonia. "There is some evidence that salmonid fish species are more susceptible to ammonia than are nonsalmonid species, at least on an acute toxicity basis. Although, in general, nonsalmonids are less sensitive to NH_3 than salmonids, the lower values for nonsalmonids are only slightly higher than the lowest value for salmonids, suggesting that sensitivity differences between these groups are not large (Rand GM & Petrocelli SR circa 1981 [pp 457])."

Table 44 Representative acute toxicity values for un-ionized ammonia on select fisheries

SPECIES	*48- or 96- hour LC50 mg/L NH_3*	*REFERENCE*
Pink salmon	0.08 - 0.10	Rice and Bailey (1980)
	0.030 (simulates early emergence of immature fry)	Rice and Bailey (1980)
Chinook salmon	0.015 (Effluent maximum allowable concentration)	Westers (1981)
	0.006 (gill hyperplasia, 6 wks)	Burrows (1964)
	0.004 (gill hyperplasia)	Emerson et al. (1975)
	0.025 (adverse affects, prolonged exposure)	EIFAC (1970); Smith and Piper (1975)
	0.097 (12 hr/day exposure)	Burrows (1964)
	0.704 (1 hr/day exposure)	Burrows (1964)

	SPECIES	48- or 96- hour LC50 mg/L NH_3	REFERENCE
29			
1	Atlantic salmon	0.38	Herbert and Shurben (1965)
2	Salmonid Hatchery Fish	0.0125 (Upper limit for continous exposure)	IDEQ, Idaho Waste Management Guidelines for Aquaculture Operations (1997)
		0.012 (Maximum level)	SECL (1983)
3	Rainbow trout	0.20 - 1.10; 0.39; 0.41; 0.42 - 0.89; 0.88	Calamari et al. (1977); Broderius and Smith (1979); DeGraeve et al. (1980); Thurston et al. (1981); Lloyd and Orr (1969); Ball (1967); Lloyd and Herbert (1960); Herbert and Shurben (1965)
		0.015 (mild gill & liver pathology, 6 month exposure)	Smith and Piper (1975); Piper et al. (1982); Soderbert et al. (1983)
		0.020 (protection of aquatic life in 30-day old fish); 6 month exposure results in gill and liver pathology)	USEPA (1975) ± 0.1 safety factor; Smith and Piper (1975)
		0.328 (acute effluent level)	Willingham et al. (1979)
		0.389-3.764 (96-hr LC50)	Ruffier et al. (1981)
		0.182(temporary growth effect)	Willingham et al. (1979); Wiehenbrauck (1976); Smart (1981)
		0.158 (harmless to growth and food conversion)	Smart (1981); Willingham et al. (1979); Wiehenbrauck (1976)
		0.304-0.364 (gill changes, 36 day exposure)	Mitchell and Cech (1983)
		0.049 (reasonably safe max.)	Mead (1985)
		0.012 - 0.085 (sublethal hyper trophy gill effects)	Thurston et al. (1984)
4	Steelhead trout	0.005(gill changes to juveniles)	Bradley and Rourke (1985)
5	Lake trout	0.0012 - 0.004 (Hyperplasia of gills when reared in ammonia)	Mead (1985)
6	Perch	0.29	Ball (1967)
7	Bluegill	0.49 - 4.60	Emery and Welch (1969); Roseboom and Richey (1977)
		1.093 (96-hr LC50)	Ruffier et al. (1981)
		0.911 (96-hr LC50)	Roseboom and Richey (1977)
8	Red shiner	2.80	Hazel et al. (1979)
9	Channel catfish	1.80 - 3.80	Colt and Tchobanoglous (1976); Roseboom and Richey (1977)
		0.389-3.764 (96-hr LC50)	Ruffier et al. (1981)
		0.146(gill hyperplasia, 27days)	Robinette (1970)
		0.219 (no hyperplasia, 83days)	Mitchell and Cech (1983)
10	Striped bass	1.90 - 2.80	Hazel et al. (1971)
11	Largemouth bass	0.90 - 1.40	Roseboom and Richey (1977)

SPECIES	*48- or 96- hour LC50 mg/L NH_3*	*REFERENCE*
Carp	0.11 - 0 34	Flis (1968)
Most fish and shellfish	0.121 (max. tolerable conc.)	Wickins (1981)
Most cultured animals	0.06 - 0.24	Colt and Armstrong (1981)

Prepared by IDEQ-TFRO. References listed in this table are not found in §6.0, Sources and References, since they are referenced in USEPA 1972 and Rand & Petrocellia 1981. For a test duration of 96 hours, LC50 values reported for two salmonid species fall in the range 0.08 - 1.10 mg/L NH_3, although salmonid hatchery fish have an upper limit for continuous exposure at 0.0125 mg/L NH_3. LC50 values for nonsalmonids species fall in the range 0.50 - 4.60 mg/L NH_3. The most sensitive freshwater fish is the rainbow trout (*Onchorynchus mykiss*) with a 96-hour LC50 of 0.072 mg/L. The most sensitive freshwater invertebrate is the worm *Lumbriculus variegatus* with a 10-day LC50 of 0.455 mg/L. The most sensitive freshwater alga is *Ochromonas sociabilis* with an LC50 of 0.6 mg/L. See www2 internet sources. It should also be noted that the Mitchell and Cech (1983) study (1) debased proposals by Smith and Piper (1975) that gill hyperplasia is a common sign of chronic ammonia poisoning, and (2) that macroscopic/microscopic changes in gills are not necessarily hyperplastic gill damage.

The intent of the previous Table was not to provide an exhaustive review of all research on un-ionized ammonia and its effect on fisheries at various concentrations. In order to develop a more holistic understanding of un-ionized ammonia and its effects on fisheries, one must consider it in conjunction with other parameters. It should be noted that until 1962 only un-ionized ammonia was considered toxic (Mead 1985 [p 138]). Synergistic effects must be considered also in order to establish safe levels of combined toxicants (Mead 1985 [p 137]) for such things as ammonium, dissolved oxygen, carbon dioxide, pH, temperature, and ionic gradients. In fact, sublethal effects of un-ionized ammonia may be related to ammonium and ambient sodium concentrations (Mead 1985 [p 139]). Until such synergistic effects are researched in greater detail, the preliminary use of maximum concentration limits will have to suffice, based on appropriate fisheries research. Therefore, USEPA recommends no concentration greater than 0.020 mg/L of un-ionized ammonia as a toxic substance for fisheries at any time or place (USEPA 1972 [p 187]). Idaho state water quality standards (IDAPA 16.01.02.250(02)(c)(iii)) specify an un-ionized ammonia (NH_3^o) or a total ammonia (NH_3 + NH_4^+) criteria at selected water temperatures and pH values for protection of cold water biota. On the Middle Snake River and its tributaries, un-ionized ammonia can be and has been a problem but its occurrence is in less than 10% of the total number of samples taken in any single year. Additionally, the 0.02 mg/L instream target is a more restrictive target than what is in the State water quality standards in order to account for possible synergistic effects. See §2.2.3 of this subbasin assessment.

c. TOTAL PHOSPHORUS

To prevent the development of biological nuisances and to control accelerated or cultural eutrophication, total phosphorus (as P) should not exceed 0.05 mg/L in streams where it enters a lake or reservoir (USEPA 1977, 1985). A desired goal for the prevention of plant nuisances in flowing waters not discharging directly to lakes or impoundments is 0.10 mg/L total phosphorus (MacKenthun 1973). "The USEPA suggests as a guideline to prevent nuisance algal growths and limit cultural eutrophication that total phosphates as phosphorus should not exceed 0.1 mg/L in any stream or other flowing water, exceed 0.05 mg/L in any stream at the point where it enters a lake or reservoir, or exceed 0.025 mg/L in any lake or reservoir (USDA FS 1990b [p 11]; USEPA 1986)." Therefore, a reasonable criteria for total phosphorus per tributary is in the range of 0.05 - 0.10 mg/L, depending on the location of the tributary and its confluence with the free-flowing stretches of the Middle Snake River (IDHW 1991a). Phosphorus levels below 0.05 mg/L are desirable when waters flow into any impoundment (USEPA 1985; USDA NRCS & IDEQ 1991 [p 123]). The Mid-Snake TMDL uses a water quality target of 0.075 mg/L total phosphorus at Gridley Bridge, Hagerman, Idaho because of the Middle Snake River's modified flow regime with run-of-the-river impoundments on a large river system (IDEQ 1997b [p. 53]). This water quality target is proposed as a representative average of the whole river system, assuming that the water pollution targets by the various water user industries are implemented over a 10-year period. It is not a target that is assumed to be completely protective of the resource or the designated beneficial uses, or the final target in total phosphorus reductions for the Middle Snake River. But it is a target that industries and agencies agreed would be a starting point for targeting of phosphorus reductions to reduce nuisance aquatic plant growth at select portions of the river where most nuisance plant growths are known to exist, and where the swimmability and boatability of the river could be restored. This same instream target was never suggested for application to tributary waters that feed to the Middle Snake River because it was always assumed that these smaller tributaries were not modified flow regime systems as is the larger river system. Since these tributaries are flowing water regimes, an instream target of 0.100 mg/L TP is appropriate to prevent nuisance algal growths as a preliminary target.

In combination with nitrate, a total phosphorus ratio of 16:1 (N:TP) in natural waters is used as the same ratio found in algae on an average. This ratio is commonly used as an important indicator of relative nutrient limitations by these two nutrients: (1) higher ratios indicate possible phosphorus limitation, and (2) lower ratios indicate possible nitrogen limitation (USDA FS 1990b [p 11]).

4. OXYGEN-DEMANDING MATERIALS

"Surface waters of the state shall be free from oxygen-demanding materials in concentrations that would result in an anaerobic water condition (See IDAPA §16.01.02.200.07)." A measure of oxygen-demanding materials is biochemical oxygen demand (BOD) which is the rate at which organisms use the oxygen in the water (or wastewater) while stabilizing decomposable organic matter under aerobic conditions. Anaerobic is defined as a condition in which life or activity occurs in the absence of free oxygen (IDEQ 1997).

Those dark, organic sediments of the Middle Snake River and tributaries of Upper Snake Rock subbasin associated with facilities' discharge outfall have dissolved oxygen concentrations that are by definition zero (see next few sentences for explanation) and remain below the State-established minimum standards in the water column for some distance off the stream bottom. Sediments discharged from aquaculture facilities are considered anaerobic, because in general their discharge occurs after the mineralization process has occurred (aerobic decomposition) and the anaerobic bacteria continue the decomposition process to produce hydrogen sulfide (instead of sulfate), ammonia, nitrogen gas, methane, and soluble ferrous iron. Under these conditions the organic sediment (which is typically at the bottom of the aquaculture pond, tributary, or river) is "dead," as is the deoxygenated water close to it. When disturbed, the dark, organic sediments produce foul and offensive odors due to released hydrogen sulfide and methane (Avault 1996 [pp 370-376]). Phosphorus is also released directly back into the water column to become available for increased algal and macrophyte production in the immediate area and downstream of such anaerobic conditions.

It is possible that a mixing zone at the outfall of these facilities could be issued under §401 water quality certification. IDEQ authorizes mixing zones for meeting Idaho water quality standards (IDAPA 16.01.02.060) for dissolved oxygen in flowing receiving waters limited to the following:

1. The cumulative width of the adjacent mixing zones when measured across the receiving water is not to exceed fifty percent (50%) of the total width of the receiving water at that point (IDAPA 16.01.02.060(01)(e)(i)).

2. The width of the mixing zone is not to exceed twenty-five percent (25%) of the stream width or three hundred (300) meters plus the horizontal length of the diffuser

as measured perpendicularly to the stream flow, whichever is less (IDAPA 16.01.02.060(01)(e)(ii)).

3. The mixing zone is to be no closer to the ten (10) year, seven (7) day low-flow (7Q10) shoreline than fifteen percent (15%) of the stream width (IDAPA 16.01.02.060(01)(e)(iii)).

4. The mixing zone is not to include more than twenty-five percent (25%) of the volume of the stream flow (IDAPA 16.01.02.060(01)(e)(iv)).

5. SEDIMENT AND "SETTLEABLE SUBSTANCES"

"Sheet and rill, gully, and ephemeral gully erosion from hillslopes are the major source of most sediment introduced into stream channels. Exceptions to this are where sediment is substantially produced by landslides, debris, flows, streambanks, irrigation, and roadsides. The hillslopes are the portions of the landscape that are zones of sediment production. The most effective way to deal with the accumulation of fine sediment in aquatic habitats is to stop the excess at its source. This is only feasible for the sediment derived from accelerated erosion. If the degree of erosion has progressed too far (like gully headcuts), then accelerated erosion requires stabilization and revegetation of slopes and possibly other measures. Fine bed streams have silt or clay bottoms and are unusual in western mountainous watersheds except in estuaries (Castro & Reckendorf 1995 [pp 3-4, 20-29])."

In general, fine suspended sediment affects the aquatic fauna as follows:

1. The highest diversity of benthic macroinvertebrates occurs in gravel-bed streams, not in silt or clay bottom streams. Gravel-bed streams have larger, more diverse macroinvertebrate populations when compared to silt or clay bottom streams, and are extremely important spawning areas for anadromous fish. An average of 70% of freshwater fish species depend on insects as a food source, thus indicating that the macroinvertebrate population controls the fish population because it is the primary food source.

2. Aquatic plants are affected by both increased bedload and suspended load. An increase in bedload may bury an area in which a plant species is growing. Subaqueous plants will be significantly affected by increased suspended sediment loads because primary plant production is reduced with increases in turbidity. This results in a decrease in benthic organism diversity and density because of a limited food supply, thus forcing the fish to migrate to other reaches of the stream.

Additionally, "the European Inland Fisheries Advisory Commission concluded that suspended sediment can affect aquatic organisms by killing them directly, by reducing growth rates and resistance to disease, by preventing successful development of eggs and larvae, by modifying natural movement or migration patterns, or by reducing the natural availabilities of food (USEPA 1986; USDA FS 1990b [p 10])." "A review completed by the National Academy of Sciences suggested that a limit of 25 mg/L of suspended sediment would provide high, 80 mg/L moderate, 400 mg/L low, and over 400 mg/L very low levels of protection for aquatic organisms ((USDA FS 1990b [p 10]; Thurston *et al.* 1979)." The USEPA and IDEQ have historically used a maximum of 25-80 mg/L of TSS as a guideline for concentrations which may be harmful to aquatic life (IDHW 1983b [p 7]).

"Sediment is the most common nonpoint source pollutant in Idaho affecting the beneficial uses of salmonid spawning and cold water biota (IDHW 1989b)." "In southern Idaho suspended sediment is the dominant portion of the total sediment load of streams in the Upper Snake Rock subbasin (IDHW 1988)." In fact, all streams on the 1996 §303(d) list have sediment listed as one of the pollutants. "Sediment impacts salmonid spawning and cold water biota beneficial uses by smothering fish spawning and rearing habitats, by smothering fish-food organisms (benthic macroinvertebrates), and by increasing turbidity which can affect light penetration and impair fish feeding behavior (IDHW 1991a)."

A study of particle size composition of the sediment on the Middle Snake River was conducted by the University of Idaho from 1992 to 1994 (See Falter et al. 1994, 1995, and 1996). In 1992 five depositional sites limited to weedbed sites and deep pools on the Middle Snake River were monitored. Overall the average of all sites indicated that one silt size dominated the fines: <0.075 mm. Considering site specific locations:

1. At the Auger Falls site (RM606.3) two silt sizes dominated the fines: between 1.18 mm and 2.36 mm.

2. At the Crystal Springs site (RM599.9) one silt size dominated the fines: <0.075 mm.

3. At the Box Canyon site (RM588.3) one silt size dominated the fines: <0.075 mm.

4. At the Thousand Springs Site (RM535.1) one silt size dominated the fines: <0.300 mm.

5. The site at Blue Heart Springs (RM588.0) was used as a comparison site because it was in a predominant spring fed area. Four silt sizes dominated the fines: at the 5.0-6.0 m depth the sizes were 1.18 mm and 2.36 mm; and, at the 13.0 m depth the sizes were 0.150 mm and 0.300 mm.

In general, the Crystal Springs and Box Canyon sites were dominated by silts <0.075 mm, whereas the most upstream (Auger Falls) and most downstream (Thousand Springs) were dominated by silts >0.075 mm (Falter et al. 1994). In 1993 and 1994 monitoring of the Crystal Springs sites for particle size analysis/texture indicated the following:

1. 1993 monitoring showed an overall average of 56.7% sand, 40.0% silt, and 3.3% clay, with a range for all transects (7) of 53.6-61.4% sand, 36.5-43.6% silt, and 2.1-4.5% clay. In relationship to river mile stretch, sand and clay are statistically significant: sand decreasing from upstream (RM601.0) to downstream (RM600.0), and clay increasing from upstream to downstream. Other parameters studied in the sediment in relationship to river mile stretch showed a statistically significant correlation in organic carbon (an increase from upstream to downstream), organic matter (an increase), carbon (an increase), hydrogen (an increase), and nitrogen (an increase) (Falter et al. 1995).

2. 1994 monitoring showed an overall average of 53.6% sand, 5.5% clay, and 39.8% silt, with a range for all transects (4) of 51.2-72.1% sand, 2.7-6.2% clay, and 25.2-41.2% silt. In relationship to river mile stretch, none of the particle size classes are statistically significant. Other parameters studied in the sediment in relationship to river mile stretch showed a statistically significant correlation in organic carbon (an increase from upstream to downstream), organic matter (an increase), carbon (an increase), nitrogen (an increase), and hydrogen (an increase) (Falter et al. 1996).

3. Comparison of 1993 to 1994 sediment data showed little difference in the particle size analysis: sand was on average a little more in 1993 than 1994, 56.7% to 53.6%, respectively; silt was on average about the same from 1993 to 1994, 40.0% to 39.8%, respectively; and, clay was a little less in 1993 than 1994, 3.3% to 5.5%, respectively. The patterns of sand, silt, and clay from month-to-month were similar between 1993 and 1994: mean sand content of sediments was greater at higher velocity, open-channel sites than under aquatic macrophyte beds, since open water channels have greater velocity; mean silt content of sediments was always higher in the aquatic macrophyte beds than in the open water areas, meaning the aquatic macrophyte beds were functioning as traps for fine particulate matter; and, mean clay content of sediments was always higher in the aquatic macrophyte beds than in the open water areas, and increased steadily from April through July.

Idaho water quality standards for sediment have a narrative criteria but no fixed numeric value at which the standard can be met: "Sediment shall not exceed quantities specified in" IDAPA §16.01.02.250, "or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses (See IDAPA §16.01.02.200.08)." Suspended sediment is legally defined as "organic and inorganic particulate matter which has been removed from its site of origin while suspended in surface water (See IDAPA §16.01.02.003.101)." The NRCS defines suspended sediment as solid material (mineral or organic) that is in suspension and is being transported 3 inches above the stream bottom to the top of the water column (IDHW 1986 [p 25]). USEPA defines sediment in conjunction with "settlable substances" for the protection of wildlife. As such, accumulations of "settleable substances," like silt deposits, are destructive to aquatic plants due especially to the creation of a soft, semi-liquid substratum inadequate for the anchoring of roots. Thus, "settleable substances" can destroy the usefulness of aquatic bottoms to waterfowl, and for that reason, settleable substances should be minimized in areas expected to support waterfowl. Additionally, clear waters are normally preferred for recreation as well as the aesthetic value of the water. Because sediment-laden water reduces water clarity, inhibits the growth of plants, displaces water volume as sediments settle, and contributes to the fouling of the bottom, prevention of unnatural quantities of suspended sediments or deposit of sediments is desirable. Individual waters vary in the natural amounts of suspended sediments they carry; therefore, no fixed recommendation can be made. Management decisions should be developed with reference to historical base line data concerning the individual body of water (USEPA 1972 [pp 195,16-17]).

In order to quantify numerically the sediment narrative standard, the IDEQ-TFRO proposes a preliminary interim target of total suspended solids not to exceed a monthly average of 52 mg/L with a daily maximum of 80 mg/L to allow for natural spikes during flood events over a ten (10) year period. The average monthly of 52 mg/L is identified by the scientific community as "supporting a good fishery (EIFAC 1964; NAS/NAE 1973)." This target is also well in line with the Nevada Division of Environmental Protection's standard, the Washington Department of Ecology's target within the Yakima River subbasin, and the Utah Department of Environmental Quality's targets in the Lower Bear River basin. For a regional comparison in southern Idaho, the proposed target is also close to the proposed 50 mg/L criteria for suspended sediment which provides a "high level of protection for cold water biota (IDHW 1991a)." It is, however, below Lloyd's recommended level of 100 mg/L for a "moderate level of protection of cold water habitat which has been historically suggested for various tributaries in Upper Snake Rock (USDA NRCS & IDEQ 1991 [pp 120-123).

Narrative criteria applicable to the Middle Snake River and its tributaries include: deleterious materials; floating, suspended, or submerged matter; excess nutrients; and, oxygen-demanding materials. Streams in which sediment is listed as a pollutant exceed these narrative criteria as a result of existing point and/or nonpoint activities. Table 45 summarizes those narrative standards violated.

Table 45 Water quality narrative violations of waterbodies in the Upper Snake Rock sub basin

STREAM NAME	BOUNDARIES	NARRATIVE WQ STANDARDS DM	FSS	EN	ODM	S
	TRIBUTARIES					
Alpheus Creek	From headwaters to the Snake River	None listed on §303(d) list.				
Billingsley Creek	From headwaters to the Snake River	X	X	X	X	X
Blind Canyon Creek	From headwaters to the Snake River	X	X	X		X
Cedar Draw	From headwaters to the Snake River	X	X	X	X	X
Clear Springs	From headwaters to the Snake River	X	X	X	X	X
Clover Creek	From Pioneer Reservoir to the Snake River	X	X	X	X	X
Cottonwood Creek	From headwaters to Rock Creek	X	X	X	X	X
Crystal Springs	From headwaters to Snake River	X	X	X	X	X
Deep Creek	From headwaters to Snake River	X	X	X	X	X
Dry Creek	From West Fork Dry Ck to Murtaugh Lake	X	X	X		X
Dry Creek, West Fork	From headwaters to Dry Creek	X	X	X		X
McMullen Creek	From headwaters to Cottonwood Creek	X	X	X	X	X
Mud Creek	From headwaters to Snake River	X	X	X	X	X
Riley Creek	From headwaters to Snake River	X	X	X	X	X
Rock Creek	From Rock Creek Town to Snake River	X	X	X	X	X
Sand Springs Creek	From headwaters to Snake River	X	X	X		X
Tool Box Creek	From headwaters to Fifth Fork Rock Creek	None listed on §303(d) list.				
	RESERVOIRS					
Bliss Reservoir	The entire reservoir	X	X	X	X	X
Lower Salmon Falls Reservoir	The entire reservoir	X	X	X	X	X
Pioneer Reservoir	The entire reservoir	X	X	X	X	X
Shoshone Falls Reservoir	The entire reservoir	X	X	X	X	X
Upper Salmon Falls Reservoir	The entire reservoir	X	X	X	X	X
	ON THE MIDDLE SNAKE RIVER					
Middle Snake River	From Milner Dam to Murtaugh *(1)*	X	X	X	X	X
Middle Snake River	From Cedar Draw to Rock Creek *(1)*	X	X	X	X	X
Middle Snake River	From Clear Lakes Bridge to Cedar Draw *(1)*	X	X	X	X	X
Middle Snake River	From Deep Creek to Mud Creek *(1)*	X	X	X	X	X
Middle Snake River	From King Hill to Big Pilgrim Gulch *(2)*	X	X	X	X	X

STREAM NAME	*BOUNDARIES*	*NARRATIVE WQ STANDARDS* DM	FSS	EN	ODM	S
Middle Snake River	From Mud Creek to Clear Lakes Bridge *(1)*	X	X	X	X	X
Middle Snake River	From Rock Creek to Shoshone Falls *(1)*	X	X	X	X	X
Middle Snake River	From Cassia Gulch to Big Pilgrim Gulch *(2)*	X	X	X	X	X
Middle Snake River	From Bliss Bridge to King Hill Diversion *(2)*	X	X	X	X	X
Middle Snake River	From Murtaugh to Twin Falls Reservoir *(1)*	X	X	X	X	X

Prepared by IDEQ-TFRO: DM = Deleterious materials; FSS = Floating, suspended, submerged materials; EN = Excess nutrients; ODM = Oxygen demanding materials; S = Sediments. Information taken from 1994 & 1996 303(d) lists and various reference materials already cited in the subbasin assessment from IDEQ, NRCS, USEPA, USGS, and IDFG.

6. TURBIDITY

"Turbidity has been described as a major water quality characteristic affecting freshwater fish communities (Lloyd 1987 [p 34])." The justification and implementation of appropriate statndards are important to protect fish resources from habitat degradation caused by this common form of pollution. As an optical property of water, it describes suspended and some dissolved materials such as clay, silt, finely divided organic and inorganic matter, plankton, and other microscopic organisms which cause light to be scattered and absorbed rather than transmitted in straight lines (APHA 1995). "Measurements of turbidity have been developed to quickly estimate the amount of sediment within a sample of water, and they are also used to describe the effect of suspended sediment in blocking the transmission of light through a body of water (Lloyd 1987 [p 34])." By definition, turbidity and suspended sediment concentrations are closely intertwined. A turbidity standard can be used to address the effects of turbidity as an optical property of water and as an indicator of suspended sediment concentrations (Lloyd 1987 [p 38]. Both parameters are most often used as indicators in nonpoint source monitoring programs. Increases in both these parameters have been associated with reduced light penetration, decreased production and abundance of plant production, decreased fish food organisms, aesthetics, and decreased fish production and abundance (Lloyd 1987; USDA NRCS 1991 [p 120]).

IDAPA 16.01.02.250.02.c.iv for cold water biota states that "turbidity, below any applicable mixing zone set by the Department, shall not exceed background turbidity by more than fifty (50) NTU instantaneously or more than twenty-five (25) NTU for more than ten (10) consecutive days." IDAPA 16.01.02.003.07 defines background as "the biological, chemical, or physical condition of waters measured at a point immediately upstream (up-gradient) of the influence of an individual point or nonpoint source discharge." For point source treatment requirements, IDAPA 16.01.02.401.03.b. states that "the wastewater must not increase the turbidity of the receiving water outside the mixing zone by (i) more than five (5) NTU over background turbidity, when background turbidity is fifty (50) or less; or, (ii) more than ten percent (10%) increase in turbidity when background turbidity is more than fifty (50) NTU, not to exceed a maximum increase of twenty-five (25) NTU."

7. TEMPERATURE

"Most biological and chemical processes in aquatic environments ultimately are regulated by water temperature. In fact, temperature has been described as a catalyst, a depressant, an activator, a restrictor, a stimulator, a controller, a killer, one of the most important and influential water quality characteristics to life in water (USEPA 1986; USDA FS 1990b [p 10-11])." "Temperature exerts an important influence on the chemical and biological processes in a water body. It determines the distribution of aquatic species; controls spawning and hatching; regulates activity; and, stimulates or suppresses growth and development. The two most important causes of temperature change in a water body are process and cooling water discharges, and solar radiation (USEPA 1983c [p II-5-1])." Stream temperatures have been described by USFWS as being influenced directly by air temperature, relative humidity, percent shade, and stream flow and can be readily modeled to predict mean daily water temperature (Barthalow 1989 [p 139]; IDEQ 1998c [p 2]).

COLD WATER BIOTA

Temperature or temperature modification is listed on various streams of Upper Snake Rock as a pollutant/stressor. IDAPA §16.01.02.250(02)(c)(ii) states that waters designated for cold water biota are to exhibit water temperatures of 22°C or less (daily maximum) with a maximum daily average of no greater than 19°C. On the Middle Snake River and its tributaries, cold water biota field monitoring data collected by IDEQ-TFRO, shows exceedences in temperature above 22°C as follows in Table 46:

Table 46 Cold water biota temperature exceedences (> 22.00 °C) in Upper Snake Rock

Stream Segment Name	*Temperature Exceedence*	*Date of Exceedence*
Middle Snake River	22.28°C at Twin Falls Reservoir	July 1, 1996 (ERI)
	22.16°C at Twin Falls Reservoir	July 29, 1996
	22.65°C at Twin Falls Reservoir	July 29, 1996
	25.30°C at Shoshone Falls Dam	July 2, 1996 (ERI)
	22.02°C at Below Pillar Falls	July 29, 1996
	22.38°C at Upper Salmon Falls Dam	July 17, 1996 (ERI)
East Perrine Coulee	23.46°C	June 4, 1996 (ERI)
	26.29°C	July 1, 1996 (ERI)
	24.50°C	July 15, 1996 (ERI)
Cedar Draw	22.50°C	June 22, 1990
Salmon Falls Creek	23.50°C	August 18, 1992
Mud Creek	22.60°C	July 27, 1994
Deep Creek	22.40°C	July 29, 1991
Clover Creek	24.66°C	May 28, 1997
	22.40 & 27.70°C	June 9, 1997
	23.98 & 27.66°C	July 22, 1997
	23.64°C	August 5, 1997

Prepared by IDEQ-TFRO. **ERI** – Ecosystems Research Institute study of 1996. Other monitoring done by IDEQ-TFRO for 1995-1997 seasons.

IDEQ-TFRO proposes that these exceedences per indicated water body for cold water biota are minor excursions (with the exception of Clover Creek) and do not necessarily constitute violations of the temperature water quality standard, especially when compared to the overall length of time in which IDEQ-TFRO did the monitoring. Clover Creek exceedences are the result of joint geothermal well inputs and complete diversion appropriations of irrigation water. IDEQ-TFRO proposes that water flow diversions constitute a greater threat to water temperature violations especially in low flow or drought years because impounded reservoir water and agricultural return flow water exceeds temperature criteria for cold water biota.

As presently constituted, the Middle Snake River (as part of the larger "middle Snake River" as defined by USBOR) has been transformed in recent times from a free-flowing, coldwater system to a slow-moving, warmwater system because of hydroelectric impoundment (USBOR 1998). IDAPA 16.01.02.260.01.b. allows for variances from the state water quality standards, provided at least one of the variances will prevent the attainment of the beneficial uses and/or State water quality standards. In the Middle Snake River a number of variances occur, and accumulatively are sufficient to disallow attainment of the standard. These variances are:

1. "ii. Natural, ephemeral, intermittent, or low flow conditions or water levels prevent the attainment of the standard." As described in §2.1.1.2, the average annual precipitation may vary from 5 to 15 inches which affects not only the rainfall, but also the potential for high snowpack levels in the mountains. Because Upper Snake Rock is a semiarid region, a characteristic is its low annual rainfall with moderately hot,dry summers. Low precipitation indicates low water inputs into the tributaries and streams that feed directly into the Middle Snake River and tributaries of Upper Snake Rock. This causes low flow conditions at Milner Dam, which in turn allows for very low volumes of water, if any, to be discharged directly to the Middle Snake River past Milner Dam. Such low flow conditions create low water levels and low velocity flows in the Middle Snake River, thus enhancing the tendency for higher temperatures that exceed water quality standards, particularly during the summer irrigation months. Under low flow conditions water quality standards and designated beneficial uses are not attained until conditions are changed that allow more water into the system. Therefore, low flow conditions or low water levels prevent the attainment of the standard.

2. "iii. Human caused conditions or sources of pollution prevent the attainment of the standard and cannot be remedied or would cause more environmental damage to correct than to leave in place." As described in §2.1.3.2, impoundments on the Middle Snake River impact its water quality. These impoundments were structured for flood control, irrigation demand, storage rights, and hydropower prior to the promulgation of the Clean Water Act. To believe that these impoundments provide minimal impact to water quality and the beneficial uses for cold water biota and salmonid spawning is unfounded. However, in spite of this impact (or stressor impact) the management of the system allows for a variety of fisheries to be introduced which provide a source for diverse fishing and boating recreation. Additionally, the State water quality standards and the TMDL cannot conflict with the apportionment of water (under IDAPA 16.01.02.050.01) in terms of flow being used to enhance water quality. Essentially, when little water is available, water rights and storage rights must be answered first before water quality "apportionment" may occur.

3. "iv. Dams, diversions or other types of hydrologic modifications preclude the attainment of the standard, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in attainment of the standard." As described in §2.1.3, the Middle Snake River is a flow regulated system from American Falls, Lake Walcott, Milner Lake, and other reservoirs. Irrigation return flows constitute a large part of the re-entry water to the Middle Snake River between Milner Dam and King Hill. From 1909 to 1926 the historic average flow (as regulated at gage 13088000) has averaged 5,206 cfs (USGS 1997 [WY1997]). Then, from 1926 to 1998 the historic average flow (as regulated at gage 13088000) has averaged 2,799 cfs (USGS 1998 [WY1998]). However, on a monthly

basis, the monthly flow from WY1990 to WY1997 averaged less than 5,000 cfs past Milner Dam 85.4% of the time (or a range of 2 to 4,449 cfs). It wasn't until WY1995 that flows increased past 5,000 cfs due to increased rains; first, for two months in WY1995; then, five months in WY1996; and then, seven months in WY1997. In fact, temperature exceedences during the WY's 1995-1997 occurred only in those months when flows were less than 5000 cfs, especially during the summer months. Additionally, there are six (6) major impoundments on the Middle Snake River which greatly affect the water temperature of the system, particularly when only 25.7% of the river system is reservoir-like. See §2.1.3.2 of the subbasin assessment.

4. "v. Physical conditions related to the natural features of the water body, unrelated to water quality, preclude attainment of the standard." These physical conditions have to do with the six (6) major impoundments and how they make 25.7% of the Middle Snake River system reservoir-like. Additionally, the Middle Snake River's water quality degradation due to high rates of primary productivity and decomposition of aquatic vegetation which cause fluctuations in dissolved oxygen have resulted in the loss of native cold-water species such as trout and white sturgeon, and have favored exotic and pollutant tolerant species. "The hydropower projects on the Middle Snake River alter the physical characteristics of the river, which in turn affect water quality and biotic communities. The reservoirs in particular have altered the river's capacity to process the nutrients that encourage excessive plant growth and create large shallows and areas of sediment deposition that are ideal for the aquatic weeds. Riverine characteristics affected by the dams include water velocity, discharge, water depth, and water retention times. Potential water quality changes associated with the construction and operation of the hydropower projects include dissolved oxygen and temperature modifications, gas supersaturation, sedimentation, and local nutrient processing. While the hydropower projects do not add nutrients to the river, the impoundments behind the dams affect the ability of the river to process sediment and nutrients (FERC 1997b [p 10-11])." "Prior to construction of hydropower dams, the Middle Snake River supported a diverse and rich aquatic community. Salmon, steelhead, white sturgeon, rainbow trout, lamprey, and a host of other aquatic species inhabited the river and could freely range throughout the river. Construction of hydro projects on the Middle Snake River eliminated anadromous species, severely reduced native rainbow trout, contributed to the depletion of white sturgeon, and reduced the diversity of both aquatic species and their habitats. The conversion of a free-flowing river into a slack water environment eliminates important habitat for many native species and does not provide adequate habitat for desirable non-native species. These physical changes to the river environment mean that insects and other invertebrates that once provided an ample food source for rainbow trout, mountain whitefish, and white sturgeon have been replaced by an insect community that is less available as a food source. Existing sport fisheries in the area include a limited population of naturally produced rainbow trout, catch and release fishing for white sturgeon, and hatchery produced rainbow trout (FERC 1997b [p 12-13])."

5. "vi. Controls more stringent than technology-based effluent limitations would result in substantial and widespread economic and social impact." Nonpoint source influence on certain tributaries may be greater since no point sources are present. Under these conditions to attempt to get pollution control mechanisms that are more stringent than technology-based effluent limitations (for point sources) would result in serious economic and social upheaval for industries and citizens of the watershed.

However, in spite of these possible variances, the water user industries will respect the Upper Snake Rock TMDL and pursue attainment of beneficial uses and/or State water quality standards under the worst case scenario (low flow conditions). Yet, one should keep in mind that as a result of these variances, the type of water quality optimally necessary in the Middle Snake River for cold water biota cannot exist year 'round due to the slow-moving, warmwater system that has evolved due to hydroelectric impoundment, storage management, and irrigation diversion. Despite this warmwater condition, IDFG is stocking fisheries of a similar nature that has created a greater demand by fishermen for this type of fisheries. (See §2.1.4.1, Table 17 and previous and subsequent paragraphs to this paragraph.) IDFG will continue to managed the river system according to the average temperature (as "water types"): from Milner Dam to Twin Falls Reservoir as cold water (about 21.7 miles); from Twin Falls Reservoir to Lower Salmon Falls as mixed water (about 44.4 miles); and, from Lower Salmon Falls to Bliss Dam as warm water (about 12.7 miles). In effect, 16% of the river is stocked for warm water fishes, 56% for mixed water fishes, and 28% for cold water fishes (or 72% of the river is stocked for mixed or warm water fishes). Restoration of the Middle Snake River to a cold water biota benefical use will result in a reduced warmwater fisheries. This goal will not be accomplished in less than 10 years of plan implementation.

SALMONID SPAWNING

For salmonid spawning, IDAPA §16.01.02.250(02)(d)(ii) states that waters so designated are to exhibit water temperatures of 13°C or less (daily maximum) with a maximum daily average of no greater than 9°C. A daily average based on diel work is preferred, but minimum standard requirements allow for only two samples since IDAPA §16.01.02.003(19)) states that a daily mean is the average of at least two appropriately spaced measurements accepTable to IDEQ, calculated over a period of one day. Additionally, "The National Academy of Sciences has listed the following temperatures: for rainbow trout and brook trout adults and juveniles, the maximum weekly average temperature for growth during the summer is listed as 19°C, and the short-term maximum temperature limit for survival during summer is 24°C. The average weekly maximum temperature is reported as 9°C, and 13°C as the short-term maximum reported for survival of their embryos (USEPA 1986; USDA FS 1990b [p 11])." On the Middle Snake River and its tributaries, salmonid spawning was assessed for temperature exceedences greater than 13°C during the spawning period or season-of-concern. Table 47 summarizes the number of (and percent of) exceedences for the particular fisheries for the season-of-concern. Only the native species were assessed.

Table 47 Number of temperature exceedences (> 13 °C) based on IDEQ-TFRO data for 1995-1997 for native fisheries

Fisheries' Species	*Spawning Season*	*Number of Exceedences*	*% Exceedences*
Chinook salmon (spring)	August 1st to April 1st	214 out of 539	39.7
Chinook salmon (summer)	August 15th to June 15th	275 out of 720	38.2
Steelhead trout	February 1st to July 15th	204 out of 470	43.4
Redband trout	March 1st to July 15th	201 out of 423	47.5
Cutthroat trout	April 1st to August 1st	250 out of 376	66.5
Rainbow trout	January 15th to July 15th	207 out of 487	42.5
Mountain whitefish	October 15th to March 15th	21 out of 276	7.6

Prepared by IDEQ-TFRO. Number of exceedences and total number of samples were taken from only within the season-of-concern. The % Exceedences represents the percent of the number of samples that exceeded the temperature criteria. Introduced species were not considered in this assessment.

Present Idaho water quality standards contain surface water temperature criteria which do not appear to conform to conditions in the Middle Snake River that have been unchanged since before the inception of the Clean Water Act in 1972. In fact, the dilemma of applying uniform temperature criteria in a diverse environment affected by spatial variation, temporal variation, and the relation of climate to stream temperature is something that needs to be resolved since fisheries data from various agencies indicate that affected fisheries are more tolerant to thermograph exceedences than previously thought. These data indicate that more than 50% of the time where Idaho temperature criteria exceedences occur, the affected age classes of fish are present. Salmonid spawning and incubation have occurred coincidentally with measured temperature criteria exceedences (IDEQ 1998c [p 21]). Therefore, IDEQ-TFRO will defer 24 months from the time of TMDL acceptance for a more complete study to resolve some of these issues, and to allow the Idaho State Legislature to make the necessary changes in the regulations that reflect a more realistic picture of temperature.

2.2.3.4 HABITAT MODIFICATION, FLOW ALTERATION, AND AESTHETICS

HABITAT MODIFICATION AND FLOW ALTERATION

It is Idaho DEQ's position that habitat modification and flow alteration, while they may adversely affect beneficial uses, are not pollutants per §303(d) of the Clean Water Act. There are no Idaho water quality standards for habitat or flow, nor are they suitable for estimation of load capacity or load allocations. Because of these practical limitations, TMDLs will not be developed at this time that address habitat modification or flow alteration. For many of the water quality limited waters on Idaho's §303(d) list this will have little effect on implementation plans because concerns which resulted in a listing for habitat modification or flow alteration are often reflected in the listed pollutants---sediment or nutrients, for example. In such cases, actions taken to address these related pollutants will likely address habitat or flow as well. In other cases alternate control strategies would be applied outside the TMDL process. If and when USEPA determines that habitat and flow are considered pollutants under §303(d), USEPA would then require that a TMDL be developed to cover these parameters (USEPA 1998b) and IDEQ would follow suit as perscribed. Because sediment is defined as a pollutant in all the streams listed on the §303(d) list for Upper Snake Rock; and because sediment is linked to the degradation of snail habitat of the endangered snails on the Middle Snake River and its associated tributaries; and because IDFG stipulates that sediment is a detriment to fisheries and fisheries habitat over the long term; the TMDL for sediment asserts that sediment reductions implemented by point and nonpoint sources in the Upper Snake Rock watershed will yield a less adverse effect on the snail and fish habitats. As a result of sediment allocations, some recovery of habitat and species specific to their known location is expected over the long term. High or scouring flows may have a direct impact on the recovery of the habitat as well as the species if flows are available above those allocated for storage and irrigation diversion.

AESTHETICS

Aesthetics is considered a surface water classification and is applicable to all surface waters of the state (IDAPA 16.01.02.100.05). "Water quality criteria for aesthetics will generally be satisfied by the general water quality criteria set forth in Section 200 (IDAPA 16.01.02.250.05)." Section 200 of IDAPA covers general surface water quality criteria for hazardous materials; toxic substances; deleterious materials; radioactive materials; floating, suspended or submerged matter (does not imply suspended sediment); excess nutrients; oxygen-demanding materials; and sediment. Therefore, under the Upper Snake Rock TMDL, aesthetics concerns are satisfied through Section 200 of IDAPA 16.01.02. Specifically, reductions in deleterious materials; floating, suspended or submerged matter; excess nutrients; oxygen-demanding materials; and sediment will satisfy aesthetics concerns through imposed wasteload and load allocations for all water user industries. Wasteload allocations will be enforced through the NPDES permitting process and their effluent limits as defined in the TMDL. Load allocations will generally be satisfied through self-imposed best management practices as directed by the TMDL, and will specifically be defined during the implementation phase of the TMDL. Relative to nonpoint source self-imposed BMPs, this action will satisfy the aesthetics concern "so long as a nonpoint source activity is being conducted in accordance with applicable rules, regulations and best management practices as referenced in Subsection 350.03, or in the absence of referenced applicable best management practices, conducted in a manner that demonstrates a knowledgeable and reasonable effort to minimize resulting adverse water quality impacts (IDAPA 16.01.02.350.02.a)." In all cases, if it is determined by IDEQ "that imminent and substantial danger to the public health or environment is occurring, or may occur as a result of a nonpoint source by itself or in combination with other point or nonpoint source activities," then IDEQ will seek immediate injunctive relief to stop or prevent that danger as provided in Section 39-108, Idaho Code (IDAPA 16.01.02.350.02.a). Other limitations to nonpoint source restrictions are defined in IDAPA 16.01.02.350.02.b, c, d.

2.2.3.5 EFFECT OF EUTROPHIC WATER ON ENDANGERED AND THREATENED SPECIES

As discussed in §2.1.4.4 various species in Upper Snake Rock are listed as Endangered or Threatened. as discussed in §3.2 point source industries (food processors, municipalities, and aquaculture) have undergone reissuance, modification, or general permitting of their NPDES permits. Also, the major impoundments on the Middle Snake River (Bliss, Upper Salmon Falls, Lower Salmon Falls, Shoshone Falls, and previously Twin Falls Dams) are undergoing FERC relicensing. Because these are major federal permitted activities, the USEPA is required, under the consultation process in Section 7 of the Endangered Species Act, to conduct a biological evaluation with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) to identify impacts on endangered or threatened species that may result from the discharges covered by the NPDES and FERC permits. In §2.1.4.4, Table 19, a description of these species (Endangered and Threatened) is listed. Table 48 describes the effect of eutrophic waters from the Middle Snake River and Billingsley Creek on these species.

Table 48 Effect of eutrophic surface waters on endangered and threatened species

SPECIES NAME	HABITAT PREFERENCE	REASONS FOR DECLINE
	ENDANGERED SPECIES	
Utah valvata snail	Prefers well-oxygenated areas of limestone mud or mud-sand substrate among beds of submergent aquatic vegetation.	Hydroelectric dam development; deterioration of water quality; presence of New Zealand mudsnail, an exotic species.
Snake River physa snail	Prefers the undersides of gravel to boulder substrate in swift current in the mainstem.	Hydroelectric dam development; deterioration of water quality; presence of New Zealand mudsnail, an exotic species
Banbury Springs limpet	Prefers well-oxygenated, spring-run habitats, with clear waters between 15-16°C, on cobble to boulder substrate.	Hydroelectric dam development; deterioration of water quality; presence of New Zealand mudsnail, an exotic species
Idaho springsnail	Prefers permanent flowing waters of the mainstem, not in tributaries or marginal cold-water springs.	Hydroelectric dam development; deterioration of water quality; presence of New Zealand mudsnail, an exotic species
	THREATENED SPECIES	
Bald eagle	No critical habitat is determined.	Habitat loss and food sources due to human intervention.
Bliss Rapids snail	Prefers sTable, cobble-boulder size substrate in flowing waters of the unimpounded reaches of mainstem and a few spring habitats requiring cold, clean, well-oxygenated flowing water of low turbidity.	Hydroelectric dam development; deterioration of water quality; presence of New Zealand mudsnail, an exotic species
Ute ladies' tresses	May survive in areas where streams remain in a somewhat natural condition, or where conditions mimic naturally created habitat.	Loss of habitat especially riparian and wetland habitats lost to economic development, stream channelization, water diversions.

SPECIES NAME	HABITAT PREFERENCE	REASONS FOR DECLINE
Prepared by IDEQ-TFRO.		

The USFWS listed five species of freshwater snails of the Snake River as threatened or endangered under the Endangered Species Act, effective January 13, 1993. All five species are charactered as geographically limited and generally intolerant of pollution. The USFWS related that the free-flowing, cool water environments required by these species had been impacted by and were vulnerable to continued adverse habitat modification and deteriorating water quality from one or more of the following: hydroelectric development, peak loading effects from existing hydroelectric project operations, water withdrawal and diversions, water pollution, and inadequate government regulatory mechanisms (USBOR 1998). This deterioration, which has accelerated in the last decade because of an extended drought, is the result of water withdrawal for irrigation, agricultural return flows laden with nutrients, runoff from dairies and feedlots, effluent from aquaculture, industrial, and municipal facilities, and storm water. Increased nutrient loads from these sources have contributed to dense blooms of free-living and attached filamentous algae which cannot be utilized by the listed mollusc species. Algal blooms can cause dissolved oxygen depressions, leading to anoxic conditions in sediments and the water column following seasonal algal die-off. In fact, declines in snail populations are attributed to fragmentation of remaining free-flowing habitats in the Snake River as well as deteriorating water quality (USEPA 1997a).

Finally, the New Zealand mudsnail (*Potamopygus antipodarum*) is an exotic species that is experiencing explosive population growth in the Middle Snake River. "Its rapid population rise was paralleled by a corresponding precipitous decline in populations of indigenous mollusks. [it] shows a wide range of tolerance for temperature, turbidity, and water velocity fluctuations. The mudsnail appears to prefer warmer, polluted waters over pristine spring environments. It competes directly for habitats of the Snake River physa and Bliss Rapids snails (USEPA 1997a)."

RECENT DATA ON ENDANGERED SNAILS

Recently, data from Idaho Power Company indicate that the Bliss Rapids snail, the Idaho springsnail, and the Utah valvata are found in a wide variety of habitats descriptively contrary to those habitat requirements recounted by Falter (1992), Frest *et al.* (1991), Hershler *et al.* (1994), and USFWS (1992 and 1995). These three snails appear to be not tolerant of only a narrow range of environmental factors (stenotopic), nor does it appear that the requirements of historic description apply to these organisms. The data appear to indicate that the three molluscs are well adapted to and maintain healthy colonies in various habitats. It is suspected that earlier findings were the result of a prolonged drought period (12 years). Thus, the periods of extremely low flows brought a progressive deterioration of Snake River aquatic habitat (accumulation of sediments, macrophyte production, and anoxic sediments). A major faunal turnover had begun as several coldwater biota were replaced with more tolerant species. Detrimental conditions most likely continued until the drought cycle reversed. The synoptic surveys performed by Idaho Power Company suggest an aquatic invertebrate community, including the endangered and threatened river snails, with a high tolerance to nonpoint source pollution (organic effluent and sediment). At present, the Idaho Power Company data suggest that colonies of the Bliss Rapids snail, the Idaho springsnail, and the Utah valvata have met the recovery criteria of increasing, self-producing colonies dwelling in non-threatened habitats for two years (since higher flows have prevailed since the spring of 1995). Idaho Power Company reports that declines in snail population density and distribution and impaired reproduction has not been observed or documented as a trend and the habitat is not currently threatened. Idaho Power Company has recommended that a status review of the Bliss Rapids snail, the Idaho springsnail, and the Utah valvata be done by the USFWS (USBOR 1998). This recommendation does not include the Snake River physa, since it is not known whether this mollusc persists or not. In 1994, two populations (or colonies) were believed to remain in the Hagerman and King Hill reaches, with possibly a third area of concentration immediately downstream of Minidoka Dam. Live specimens of this species have not been found even during USBOR's intensive instream, near shoreline sampling efforts in the free-flowing river sections below Minidoka and American Falls Dam, or within reservoir waters at Lake Walcott. At this time, it appears that the Snake River physa has not adapted to a changing river environment and, thus, may be a relic of a former, more suitable ecosystem (USBOR 1998).

RECENT DATA ON THE NORTHERN LEOPARD FROG (RANA PIPIENS)

Recently, a survey of the northern leopard frog (*Rana pipiens*) in southcentral Idaho by the USBLM (Burley, Idaho) was documented as a springboard to further surveys and monitoring efforts due to the widespread concern in North America over the population status and trend of this species. A statewide survey of natural resource personnel, academicians and others indicated at least anecdotal evidence for declines in northern leopard frogs. The distribution and relative abundance of northern leopard frogs appears to have decreased considerably in southern Idaho, as well as the Greater Yellowstone Ecosystem. Presently, the species is designated as "sensitive" by the USBLM, and a "priority species of special concern" by the IDFG. The survey study area in Southcentral Idaho encompassed public lands (USBLM), USBOR, USFS, the Minidoka National Wildlife Refuge (USFWS), and selected private lands within the perimeter of the USBLM's Snake River Resource Area. Idaho counties represented in the survey included portions of Bannock, Blaine, Cassia, Jerome, Minidoka, Oneida, Power, and Twin Falls. Although the survey is still infant, one of the conclusions drawn from conversations with several long-time residents was that chemicals (such as xylene and acrolein) used routinely to control aquatic vegetation in irrigation waterways have allegedly resulted in local frog mortalities in the past. In conjunction with copper sulfate, the use of these chemicals is "a likely factor in limiting the distribution of frogs in these water systems today (USBLM 1998a)."

2.2.3.6 FISHERIES CONCERNS ON 303(d) LISTED WATER BODIES

In 1994, recreational fishing opportunities were surmised by IDFG to have been negatively impacted by poor water quality in the Middle Snake River. Native coldwater fish species, such as cutthroat trout, bull trout, and rainbow trout along with sturgeon, had experienced dramatic population decreases due to a variety of water quality related factors. Those factors included:

1. In response to increased nutrient loading and other impacts, massive macrophyte beds have developed throughout the Middle Snake River. Sediments provide a suitable foothold for rooted macrophytes to develop. Macrophytes have physically limited available coldwater fish habitat by reducing the useable area in pools, riffles, and runs, and conversely decreased river habitat diversity. Aquatic vegetation has also slowed river flow velocities and caused strong diel oxygen fluctuations beyond the tolerance levels of most coldwater fish species.

2. Increased sediment loading coupled with modification of the natural hydrograph has also adversely impacted coldwater fish populations. Sediment has choked most spawning gravels, both in tributaries and main river channels. This has led to a decrease in population recruitment for salmonids which require well-oxygenated gravel areas for reproduction. Also, sediment has filled interstitial spaces within the river substrate which has reduced juvenile rearing habitat and over-wintering habitat which can sometimes be a limiting factor for fish populations.

3. Summertime water temperatures have increased due to a variety of complex interrelated reasons. Decreases in water clarity from an increase in nutrients, suspended sediments, plant growth, and decreased river flow velocity appear to increase solar radiation absorption. The result has been an increase in water temperatures to the threshold or above tolerance levels for most coldwater fish species in traditional use areas for the Middle Snake River.

Overall, environmental condition changes associated with a decrease in water quality, impacts of drought and flow, have given the competitive edge to more tolerant warmwater and non-game fish species. Historically, fishing pressure focused on the coldwater salmonids and sturgeon in the Middle Snake River due to their abundance and recreational qualities. Today, depressed coldwater fish populations and limited available fishing areas make recreational fishing opportunities for cold water fisheries minimal throughout the reach (IDFG 1994).

In response to IDEQ-TFRO's request for information on the various §303(d) listed waterbodies in the Upper Snake Rock subbasin, IDFG stated that, "It's also important to note when reviewing data collected by our agency that our funding source is from the sale of fishing and hunting licenses, therefore, our sampling concentrates on gamefish populations which provide a recreational fishery; not entire fish communities (IDFG 1998c)." Using IDFG's best professional judgement and experience the following conclusions may be drawn on the §303(d) listed waterbodies:

1. "A massive amount of literature documents the decline in water quality, modification of river hydrology, and alteration of the natural hydrograph in the Snake River Basin. This information can be used to support the deduction that all native fish communities along the Middle Snake River reach and tributaries, from American Falls Dam to King Hill/Glenns Ferry, are depressed over historical levels and in some instances, facing extinction." "Historically, Yellowstone cutthroat and Mountain whitefish were the primary salmonid in the reach from American Falls to Shoshone Falls. Now, whitefish are sampled in the remaining free-flowing riverine environment, both main river and tributaries, with Yellowstone cutthroat only occasionally appearing in the scientific sampling of headwater tributaries. Strongest known remaining remnant populations of Yellowstone cutthroat can be found in perennial South Hill's tributaries to the Snake River, but, it is safe to deduce range and populations are only a fraction of what historically existed in this reach of the Snake River drainange (IDFG 1998c)."

2. "Native fish communities were adapted to riverine type conditions and habitats. Habitat modification due to impoundment, increased sedimentation resulting from conversion of native vegetation to agricultural uses, river and stream diversion for irrigation and hydropower, and the introduction of exotic fish species more tolerant of warmer water temperatures, stagnant flows, and lower dissolved oxygen levels have all, individually, proven to cause coldwater fish population declines. Every HUC and tributary listed [*on the §303(d) list*] has been impacted by one or more of these habitat modifiers. It would, therefore, be logical to assume present fisheries status is diminished when compared to historic range and actual numbers (IDFG 1998c)."

3. "Historical native fish communities in the Snake River and tributaries from Shoshone Falls downstream to King Hill predominantly focused on anadromous fish along with other prominent species such as bull trout, white sturgeon, mountain whitefish, and the resident Redband trout. Several varieties of nongame fish including sculpin, suckers, and a host of native cyprinids provided forage for piscivorous fish and wildlife. Spring areas and tributaries were the primary spawning and juvenile rearing habitats for both native and anadromous fish species. Today, several of these species are no longer sampled within the reach, either because of degradation of water quality or construction of dams which acted as fish migration barriers. The reach is dominated by exotic fishes which are more tolerant of warmer tempeatures, lower dissolved oxygen levels, and a river system with a streambed predominantly of fine sediments and macrophytes rather than gravels, rubble, and boulders. Spring areas and tributaries which were the primary spawning and juvenile rearing habitats for both native and anadromous fish species, now are captured for aquaculture, hydropower,

agricultural irrigation, or municipal use prior to being returned to the Snake River in a degraded condition (IDFG 1998c)."

4. "Although comprehensive fisheries information hasn't been collected in every HUC, it's reasonable to conclude, all native fish species within this reach of the Snake River and tributaries are at depressed levels compared to their historic levels. Not enough information exists to evaluate changes between 1975 and the present, but, information we have collected coupled with literature reviewed from your agency and others regarding water quality and habitat modification would indicate conditions have not improved sufficiently to cause a rebound in individual populations or inhabited range (IDFG 1998c)."

Therefore, fish populations are depressed at the present time over historical numbers based on some native species of fish which are no longer sampled at sites which once were inhabited. Also, there is a general lack of age class diversity in wild fish populations sampled. Creek information indicates it takes longer time periods to collect fish compared to previously collected data. The proposed TMDL for Upper Snake Rock does not propose to restore fisheries to historical levels (as were known prior to the Clean Water Act or November 28, 1975), but rather to restore State water quality standards and designated beneficial uses to "full support" which would allow for recovery of the species (either from themselves or by stocking regimes by the IDFG) within what the particular tributary or stream can attain based on pollutant reductions agreed to by industries. "Full support" is a broad category of water quality status such that a water body is in compliance with those levels of water quality criteria listed in Idaho's *Water Quality Standards and Wastewater Treatment Requirements*, or with reference conditions approved by the IDEQ Administrator in consultation with the appropriate Basin Advisory Group (IDEQ 1996a [p 48]). Other categories include: "Not full support," "Needs verification," or "Not assessed."

In the case of white sturgeon this species does not migrate above Shoshone Falls, but inhabits the Snake River from Shoshone Falls downstream to the confluence of the Columbia River. White sturgeon is a recently introduced native fish above Shoshone Falls. The construction and operation of the Middle Snake River impoundment projects (Milner Dam, Twin Falls Dam, Shoshone Falls Dam, Upper Salmon Falls Dam, Lower Salmon Falls Dam, Bliss Dam), C.J. Strike Dam, Swan Falls Dam, and the Hells Canyon Complex all affect the viability of the white sturgeon. These projects have a wide range of impacts on white sturgeon, including: inundation of important sturgeon habitat, fragmentation and genetic isolation of populations due to inadequate project passage, entrainment, impacts to sturgeon food base due to water quality degradation and physical changes in the river environment and interference with spawning and rearing due to flow fluctuations. As a result of these and other impacts, none of the remaining populations of white sturgeon are strong, and some (such as the population between Shoshone Falls and Upper Salmon Falls Dam) are severely depleted. The Idaho Power Company dams below Shoshone Falls have additive effects on white sturgeon (FERC 1997b [p 4-5]). The Upper Snake Rock TMDL proposes pollutant reduction measures for the Middle Snake River and its water quality limited stream segments and reservoirs, which will allow for attainment of IDEQ's "full support" status.

2.2.3.7 SEPTIC TANK SYSTEMS

South Central District Health Department (Health District V) responsibilities on septic tank systems is summarized in Table 49 based on information provided by Health District V personnel. The impact of any septic tank system on water quality is dependent on its upkeep and maintenance, and its location to canals, drains, and tributaries.

Table 49 Septic tank system estimates on a per county basis in the Upper Snake Rock sub basin

County	*Rural Residences (Individual Households)*	*Number of People/Household*	*Number of Gallons/ Day/Household*
Twin Falls	6206	16,756.2	1,551,500.0
Jerome	6076	16,405.2	1,519,000.0
Gooding	4700	12,690.0	1,175,000.0
Total for 17040212	16982	45,851.4	4,245,500.0

Prepared by IDEQ-TFRO. Rural residences based on Twin Falls, Jerome, and Gooding counties' assessors' office. Health District V estimates 2.7 people per household and 250 gallons/day/household of sewage effluent. Values provided by Dan Kriz of Health District V.

Table 49 figures are more likely over-estimates. Based on data provided by the Association of Idaho Cities (AIC 1997), Twin Falls, Jerome, and Gooding counties have a total estimate population of 88,477. A summary of city estimate population for the same counties is 58,612. The city estimate makes up the urban population for Upper Snake Rock (which is 66.2% of the total population). The variance between the total county estimate population (88,477) and the city estimate population (58,612) is 29,865, or the rural population estimate (33.8%). Therefore, the 45,851.4 population estimated in Table 49 for Upper Snake Rock is an over-estimate of the rural population estimate of 29,865 (according to AIC). This is critical to TMDL development since these estimates will help to determine the allocation percentages for the loadings to the various nonpoint sources. At 29,865 population, it is estimated that there exists 11,061.1 households (29,865/2.7=11,061.1) which provide 2,765,275.0 gallons/day/household (11,061.1x250=2,765,275.0) of sewage effluent.

2.2.3.8 RECREATIONAL USES AND IMPACTS

"Generally, nonconsumptive recreation has not been directly linked with reductions in salmonid populations, but it has been coupled with water quality changes. Often, campgrounds or water-based recreation do not significantly lower water quality. Nonetheless, campgrounds accessible to automobiles increase bacterial water pollution more than do backpack campgrounds. Recreationists may also concentrate use in riparian zones and thus increase soil compaction and vegetation damage. Ski areas may significantly contribute amounts of sediment to streams, and could desynchronize snowmelt and lead to unusually high peak flows. Snow making at ski areas also can reduce streamflows. Due to poor sewage disposal, homes located in forested watersheds may elevate concentrations of coliform bacteria and nutrients in streams (USDA FS 1990b [p 23])."

"Under some circumstances, anglers possess the ability to alter the size, structure, and distribution of fish populations. Not all trout species are equally susceptible to angling. Data from various sources indicate that anglers more readily caught rainbow trout than brown trout, but both brown and rainbow trout greater than 30 cm were more susceptible to angling than were smaller fish. Based on available data, vulnerability to angling appears to be greatest for cutthroat trout, then brook trout, then rainbow trout, with brown trout seeming to be the least vulnerable. Also, susceptibility to capture by anglers apparently increases with trout size (USDA FS 1990b [p 23])."

"The Middle Snake River dams have affected recreation by inundating or dewatering unique features such as cascades and rapids and by leaving only two reaches for riverine recreation in the project areas. The projects have also made access to certain areas of the river more difficult and decreased the diversity of recreational opportunities in the area. In an important sense, recreational impacts are not distinct from other categories of impacts because good water quality as well as fishing, hunting, and wildlife viewing opportunities are all essential components of recreation. The population of the Magic Valley has grown significantly in the last ten years and recreational demands are increasing even more rapidly. The huge growth in whitewater boating on the Middle Snake River in recent years is an example of this trend (FERC 1997b [p 18])." A key challenge facing the recreation industry is to provide reasonable access to the Middle Snake River for a growing population and to protect the area's special attractions, including the remaining springs and waterfalls and the Middle Snake River itself.

2.2.4 SUMMARY AND ANALYSIS OF EXISTING WATER QUALITY DATA

The IDEQ reviewed its existing monitoring database on the Middle Snake River and its tributaries and statistically analyzed this data on sediment and excess nutrients.

2.2.4.1 MIDDLE SNAKE RIVER

Data analysis of 986 samples of the Middle Snake River (1990-1997 monitoring seasons) is described in Table 50. Total nitrogen (TKN + NO2+NO3) had a median value of 1.353 mg/L. Total inorganic nitrogen (NO2+NO3 + NH3) had a median value of 0.955 mg/L. Total organic nitrogen (TKN - NH3) had a median value of 0.398. SRP generally represented 28.7% of the median total phosphorus. See Appendix D for the various databases.

Table 50 Water quality parameters on the Middle Snake River (1990-1997)

PARAMETER	8-YEAR MINIMUM	8-YEAR AVERAGE	8-YEAR MAXIMUM	8-YEAR MEDIAN
TSS, mg/L	0.5	22.3	305.0	17.0
TP, mg/L	0.008	0.104	0.471	0.101
SRP, mg/L	0.002	0.040	0.268	0.029
TKN, mg/L	0.010	0.431	1.430	0.430
NH3-N, mg/L	0.003	0.045	0.503	0.032
(NO2+NO3)-N, mg/L	0.020	0.991	2.840	0.923
Turbidity, NTU	0.1	15.1	107.0	14.2
Flow (Q), cfs	1.7	8729.4	57355.0	5038.5

Prepared by IDEQ-TFRO. Data from the 1995-1997 monitoring seasons is summarized for all samples taken in the three year period. TSS = total suspended solids; TP = total phosphorus; SRP = soluble reactive phosphate; TKN =total Kjeldahl nitrogen; NH3-N = ammonia as nitrogen; (NO2+NO3)-N = nitrite + nitrate as N.

Additionally, a subset (1995-1997; N = 908) was selected that belonged exclusively to IDEQ-TFRO. The following percentages represent the number of samples that were found to be above (as an exceedence) or below the indicated water quality target.

1. INORGANIC NITROGEN (NITRITE + NITRATE or NOX)

Out of IDEQ-TFRO's 884 samples, 4 samples (or 0.50% of the samples) were below the protective level (<0.06 mg/L NOX) for salmonid fish, and 89 samples (or 10.1% of the samples) were below the suggested prevention level (<0.3 mg/L NOX) for the development of biological nuisances and the acceleration of cultural eutrophication. Thus, 99.5% of the samples were well above the protective level for salmonid fish, and 89.9% of samples were well above the suggested prevention level for nuisance eutrophication. There is no statistical correlation in the mean NOX value per river mile location from upstream to downstream, although the NOX value averages had higher values downstream from Milner Dam: 0.276 mg/L NOX at Milner Dam, 1.067 mg/L NOX at Gridley Bridge, and 0.866 mg/L NOX at King

Hill.

2. UN-IONIZED AMMONIA

Out of IDEQ-TFRO's 1498 samples in which pH, temperature, and total ammonia were tested, 5 samples (or 0.3% of the samples) exceeded the protective level (<0.02 mg/L NH_3^0 as a toxic substance) for fisheries. A summary of the Middle Snake River for the the reaches sampled is found in Table 51.

Table 51 Un-ionized ammonia exceedences (>0.020 mg/L) in the Middle Snake River from 1990-1998

REACH OF SNAKE RIVER	NUMBER OF NH_3° of TOTAL NUMBER OF SAMPLES TAKEN	% EXCEEDENCES
Milner Dam	2 out of 199 on 3/21/1995 & 4/4/1995	1.0%
Murtaugh Bridge	1 out of 27 on 4/23/1991	3.7%
Twin Falls Pool	0 out of 25	0.0
Twin Falls Reservoir	0 out of 68	0.0
Twin Falls Dam	1 out of 26 on 4/23/1991	3.8%
Below Shoshone Falls	0 out of 26	0.0
Pillar Falls	0 out of 74	0.0
Pigeon Cover	0 out of 68	0.0
Crystal Springs	1 out of 197 on 6/26/1992	0.5%
Niagara Springs	0 out of 13l0	0.0
Boulder Rapids	0 out of 69	0.0
Kanaka Rapids	0 out of 68	0.0
Above Box Canyon	0 out of 47	0.0
Blue Heart Springs	0 out of 47	0.0
Below Box Canyon	0 out of 45	0.0
Above Salmon Falls Creek	0 out of 23	0.0
Gridley Bridge Area	0 out of 97	0.0
Below Upper Salmon Falls Dam	0 out of 47	0.0
Shoestring Bridge	0 out of 143	0.0
Above Clover Creek	0 out of 23	0.0
King Hill Bridge	0 out of 26	0.0
Below King Hill Bridge	0 out of 23	0 0

Prepared by IDEQ-TFRO The un-ionized fraction of total ammonia may be calculated from the equilibrium stoichiometric relationship NH3 + nH20 = NH3:nH2O = NH4 + OH + (n-1)H2O. Most water quality models predict the concentration of measured ammonia in units of weight/volume as a resultant of processes of nitrification, ammonification, respiration, and assimilation. Therefore, Un-ionized NH3, mg/L = (X)/(1 + R), where X = total ammonia, mg/L R = 10^Exponent; Exponent = (0.09018)+(2729.92/C+273.15)-(pH); C = degrees Centigrade (USEPA 1985 [pp 261-264].

3. TOTAL PHOSPHORUS (TP)

Out of IDEQ-TFRO's 884 samples, 130 samples (or 14.7% of the samples) were below the water quality target (<0.075 mg/L TP) for the suggested preliminary prevention level for the development of biological nuisances and the acceleration of cultural eutrophication. Thus, 85.3% of the samples were well above the suggested prevention level for nuisance eutrophication. There is no statistical correlation in the mean TP value per river mile location from upstream to downstream, although the TP value averages had higher values downstream from Milner Dam: 0.089 mg/L TP at Milner Dam, 0.101 mg/L TP at Gridley Bridge, and 0.113 mg/L TP at King Hill.

In reviewing the larger dataset (N=986; file = c:\data\snake\1995-97\iversusn.sys, dated 1-20-1999), irrigation season (April 15 to October 15) versus nonirrigation season (October 16 to April 14) were reviewed preliminarily for seasonality issues. TP in the larger dataset (N=986) had a mean of 0.104 mg/L, with an irrigation season mean (N=542) of 0.099 mg/L and a nonirrigation season mean (N=420) of 0.109 mg/L. Additionally, the SRP to TP percentage was 38.5% in the larger dataset, but averaged 34.3% in the irrigation season and 43.1% in the nonirrigation season.

4. TOTAL SUSPENDED SOLIDS (TSS)

Out of IDEQ-TFRO's 908 samples, 48 samples (or 5.3% of the samples) were above the suggested monthly average (52 mg/L TSS) target. Thus, 94.7% of the samples were well below the suggested monthly target. In general, there is a statistical correlation (r^2 = 0.729, F-ratio = 19.3, p = 0.000) in the mean TSS value per river mile location increasing from upstream to downstream: from 7.8 - 19.7 mg/L TSS at RM613.4 - 638.7 (Pillar Falls to Milner Dam), to 21.8 - 28.0 mg/L TSS at RM579.5 - 603.6 (Upper Salmon Falls Dam to Pigeon Cove), to 38.1 - 43.8 mg/L TSS at RM545.0 - 565.7 (Below King Hill Bridge to Shoestring Bridge near Bliss). In reviewing the larger dataset (N=986; file = c:\data\snake\1995-97\iversusn.sys, dated 1-20-1999), irrigation season (April 15 to October 15) versus nonirrigation season (October 16 to April 14) were reviewed preliminarily for seasonality issues. TSS in the larger dataset (N=986) had a mean of 22.3 mg/L, with an irrigation season mean (N=555) of 24.7 mg/L and a nonirrigation season mean (N=431) of 19.1 mg/L.

5. TURBIDITY (NTU) AND TOTAL SUSPENDED SOLIDS (TSS)

Turbidity (NTU), as previously discussed in §2.2.3.3, item 6, is an optical property of water that correlates closely to levels of suspended sediment. Of IDEQ-TFRO's 908 samples, there is a linear correlation between NTU versus TSS over the range 0.5 to 240.6 mg/L TSS, such that r^2 = 0.765, F-ratio = 1281.9, and p = 0.000. The linear regression equation states: NTU = (0.418 x TSS) + 6.423. Thus, at a monthly average of 52 mg/L TSS target, it is expected that the turbidity would be about 28.2 NTU (or 28.2 = (0.418 x 52)+6.423). At a daily maximum of 80 mg/L to allow for spikes during flood events, the turbidity is expected to be about 39.9 NTU (or 39.9 = (0.418 x 80)+6.423). Only 8 samples exceeded the 80 mg/L daily maximum, or 0.9% of the samples were greater than 80 mg/L. The mean value for the 908 samples is 16.0 NTU; the median is 15.4 NTU; the minimum value is 0.1 NTU; and, the maximum value is 107.0 NTU. Approximately, 10.2% (or 93 out of 908 samples) of the samples showed turbidity levels greater than 28.2 NTU (or the equivalent 52 mg/L TSS target). Additionally, there is a statistical correlation (r^2 = 0.555, F-ratio = 7.6, p = 0.014) in the mean NTU value per river mile location increasing from upstream to downstream: from 8.9 - 12.8 NTU at RM613.4 - 638.7; to 15.2 - 18.6 NTU at RM579.5 - 603.6; to 19.8 - 25.2 NTU at RM545.0 - 565.7. In reviewing the larger dataset (N=986; file = c:\data\snake\1995-97\iversusn.sys, dated 1-20-1999), the overall mean for turbidity was 15.1 NTU, the irrigation mean was 16.3 NTU, and the nonirrigation mean was 13.5. The larger dataset (N=986) also showed a statistical correlation (r^2=0.284, F-ratio=86.0, p=0.000) in the mean NTU value per river mile location increasing also from upstream to downstream: from 8.4 - 12.6 NTU at RM 613.4 - 638.7; to 14.3 - 18.4 NTU at RM 579.4 - 603.6; to 20.7 - 24.2 NTU at RM 545.0 to 565.7.

ERI, in their short term study, developed similar linear relationships but over the range 5 to 30 mg/L TSS in various locations (Twin Falls, Shoshone Falls, Upper & Lower Salmon Falls reservoirs) on the Middle Snake River (ERI 1997 [pp 67-70]). The following compares ERI's dataset to IDEQ-TFRO's datasets in the NTU versus TSS relationship:

a. <u>ERI 1997 Reservoir Study on the Middle Snake River</u>:

NTU=(0.7098 x TSS) - 2.4826, r^2=0.497 (Four Reservoirs together)
NTU=(0.7825 x TSS) - 3.2142, r^2=0.622 (Twin Falls & Shoshone Falls Reservoirs)
NTU=(0.6547 x TSS) - 2.3017, r^2=0.409 (Upper Salmon Falls Reservoir)
NTU=(1.0933 x TSS) - 7.3718, r^2=0.760 (Middle Snake River)

b. <u>IDEQ-TFRO's Dataset(s) on the Middle Snake River</u>:

NTU=(0.4180 x TSS) + 6.423, r^2=0.765 (1995-1997 Dataset; N=908)
NTU=(0.4070 x TSS) + 6.032, r^2=0.749 (1990-1997 Dataset; N=986)
NTU=(0.3880 x TSS) + 6.710, r^2=0.734 (Irrigation Season; N=555)
NTU=(0.4560 x TSS) + 4.806, r^2=0.776 (Nonirrigation Season; N=431)

6. PATHOGENS

Fecal coliform bateria data on the Middle Snake River indicates levels that are meeting State water quality standards for primary contact recreation and secondary contact recreation. An assessment of the river for those segments that are listed on the 303(d) list is summarized as follows:

SNAKE RIVER SEGMENT	NO. OF EXCEEDENCES PER TOTAL NUMBER (N)	PERCENT EXCEEDENCES
Bliss Reservoir	0 out of 72 samples	0.0%
Lower Salmon Falls Reservoir	0 out of 142 samples	0.0%
Shoshone Falls Reservoir	1 out of 25 samples	4.0%
Upper Salmon Falls Reservoir	0 out of 46 samples	0.0%
Murtaugh to Twin Falls Reservoir	4 out of 51 samples	7.8%
Milner Dam to Murtaugh	1 out of 198 samples	0.5%

These levels are <10% of the total number of samples taken and constitute minor purterbations of the standards.

2.2.4.2 MAJOR TRIBUTARY FLOWS AND WATER QUALITY PARAMETER COMPARISONS

Table 52 describes the average eight (8) year flow, the minimum and maximum flows from the monitoring data on the major tributaries of the Upper Snake Rock subbasin from 1990 through 1997. See Appendix D.

Table 52 Minimum, mean, and maximum flows per major tributary

TRIBUTARY	MINIMUM FLOW, cfs	MEAN FLOW, cfs	MAXIMUM FLOW, cfs
East Perrine Coulee	2.80	29.27	91.15
Rock Creek	68.71	219.91	480.93

TRIBUTARY	MINIMUM FLOW, cfs	MEAN FLOW, cfs	MAXIMUM FLOW, cfs
Cedar Draw	2.91	130.44	505.38
Mud Creek	29.55	102.09	295.60
Deep Creek	14.78	92.38	314.78
Salmon Falls Creek	35.00	146.22	363.00
Billingsley Creek	39.94	120.78	189.28
Malad River	1.30	306.42	2790.00
Clover Creek	2.30	30.39	300.00
TOTAL FLOW	197.29	1177.90	5330.12
Prepared by IDEQ-TFRO. It is highly unlikely that all maximum flows coincide in time.			

Implications and characteristics from these loading Tables per parameter per tributary are summarized in Table 53. TP/TSS and SRP/TP ratios are converted to percentages (multiplying by 100) and are based on the overall mean of Years 1990 through 1997 per parameter. Total inorganic nitrogen (TIN) and total organic nitrogen (TON) are also described.

Table 53 Select characteristics per indicated stream

TRIBUTARY	PERCENT as TP/TSS x 100	PERCENT as SRP/TP x 100	TIN in tons/yr (% of TN)	TON in tons/yr (% of TN)	TN tons/year
East Perrine Coulee	0.21	32.4	69.3 (78.8)	18.7 (21.2)	88.0
Rock Creek	0.26	46.1	448.7 (78.7)	121.4 (21.3)	570.1
Cedar Draw	0.25	33.6	228.8 (75.7)	73.6 (24.3)	302.4
Mud Creek	0.44	50.6	258.0 (83.8)	49.8 (16.2)	307.8
Deep Creek	0.29	34.7	208.6 (78.5)	57.1 (21.5)	265.7
Salmon Falls Creek	0.27	44.6	392.1 (86.6)	60.6 (13.4)	452.7
Billingsley Creek	1.48	59.3	138.0 (88.7)	17.6 (11.3)	155.6
Malad River	0.20	33.2	64.3 (28.0)	165.4 (72.0)	229.7
Clover Creek	0.39	46.7	1.45 (24.6)	4.45 (75.4)	5.9
Prepared by IDEQ-TFRO. TIN=Total Inorganic Nitrogen = NOX + NH3; TON = Total Organic Nitrogen = TKN - NH3; TN = Total Nitrogen = TON + TIN. Billingsley Creek based on 1990 to 1996 values. TP/TSS and SRP/TP ratio based on 8 year mean.					

The TP/TSS percentage is used as a way to ascertain the amount of TP there is in the system in relationship to the amount of TSS that exists. These percentages are then ranked numerically from high to low to determine which stream has the most TP in relationship to TSS. The ranking indicates that Billingsley Creek was greatest (1.48%), followed by Mud Creek (0.44%), Clover Creek (0.39%), Deep Creek (0.29%), Salmon Falls Creek (0.27%), Rock Creek (0.26%), Cedar Draw (0.25%), East Perrine Coulee (0.21%), and Malad River (0.20%). The SRP/TP percentage which is used to determine the numerical ranking (from high to low) based on the most SRP that is present in relationship to the TP. It indicates that Billingsley Creek was greatest (59.3%), followed by Mud Creek (50.6%), Clover Creek (46.7%), Rock Creek (46.1%), Salmon Falls Creek (44.6%), Deep Creek (34.7%), Cedar Draw (33.6%), Malad River (33.2%), and East Perrine Coulee

(32.4%). With the exception of the Malad River and Clover Creek, all tributaries had TIN values (75.7 - 88.7%) that were much greater than the TON values. The ranking of the tributaries with the most total nitrogen was Rock Creek (570.1 tons/year), followed by Salmon Falls Creek (452.7 tons/year), Mud Creek (307.8 tons/year), Cedar Draw (302.4 tons/year), Deep Creek (265.7 tons/year), Malad River (229.7 tons/year), Billingsley Creek (155.6 tons/year), East Perrine Coulee (88.0 tons/year), and Clover Creek (5.9 tons/year).

1. INORGANIC NITROGEN (NITRITE + NITRATE as NOX)

Samples which were at a protective level for salmonid fish (<0.06 mg/L NOX) and below the suggested prevention level (<0.3 mg/L NOX) for the development of biological nuisances and the acceleration of cultural eutrophication are summarized in Table 54.

Table 54 Inorganic nitrogen (NOX) for protection of salmonid fish and prevention of biological nuisances

Tributaries	*Salmonid Fish Protection*		*Biological Nuisance Prevention*	
	#<0.06 mg NOX/L per N	*% Protected*	*#<0.30 mg NOX/L per N*	*% Prevention*
East Perrine Coulee	0 out of 225	0.0	0 out of 225	0.0
Rock Creek	0 out of 288	0.0	1 out of 288	0.3
Cedar Draw	1 out of 277	0.4	2 out of 277	0.7
Mud Creek	0 out of 277	0.0	0 out of 277	0.0
Deep Creek	0 out of 275	0.0	1 out of 275	0.4
Salmon Falls Creek	0 out of 270	0.0	0 out of 270	0.0
Billingsley Creek	0 out of 387	0.0	1 out of 387	0.3
Malad River	23 out of 80	28.8	39 out of 80	48.9
Clover Creek	4 out of 17	23.5	17 out of 17	100.0
Prepared by IDEQ-TFRO. Dataset from 1990-1997 monitoring.				

2. UN-IONIZED AMMONIA

A summary of un-ionized ammonia (NH_3^o) exceedences is detailed in Table 55 for the tributaries listed. Toxic exceedences were considered as values ≥ 0.020 mg NH_3^o/L which are not protective for fisheries relative to eutrophication concerns. The data indicates that Clover Creek has major exceedences (>10%) whereas the other waterbodies have none or minor exceedences (<10%).

Table 55 Un-ionized ammonia exceedences in tributaries of Upper Snake Rock from 1990 through 1997

Tributaries	*% Un-ionized of Total Ammonia*	*Number of Un-ionized Samples per N*	*Specific Dates and Concentrations*
East Perrine Coulee	0.0	0 out of 278	None found
Rock Creek	0.7%	2 out of 288	03-18-91 = 0.035 07-01-91 = 0.058
Cedar Draw	1.8%	5 out of 277	7/24/1990; 9/3/1990; 3/19/1991; 7/22/1997; 8/4/1997
Mud Creek	1.4%	4 out of 277	7/10/1990; 9/3/1990; 3/19/1991; 7/22/1997; 8/4/1997

Tributaries	*% Un-ionized of Total Ammonia*	*Number of Un-ionized Samples per N*	*Specific Dates and Concentrations*
Deep Creek	1.8%	5 out of 275	3/20/1991; 6/12/1991; 7/1/1991; 7/8/1991/ 7/10/1991
Salmon Falls Creek	0.0	0 out of 270	None found
Billingsley Creek	2.4%	10 out of 417	3/30/1992; 5/27/1992; 6/30/1992; 7/28/1992; 5/23/1994; 8/29/1995; 4/16/1996 (on 4 separate sites)
Malad River	0.0	0 out of 88	None found
Clover Creek	2.4%	1 out of 42	2/12/1997

Prepared by IDEQ-TFRO. Dataset from 1990-1997 monitoring. The un-ionized fraction of total ammonia was calculated from the equilibrium stoichiometric relationship NH3 + nH2O = NH3:nH2O = NH4 + OH + (n-1)H2O. Most water quality models predict the concentration of measured ammonia in units of weight/volume as a resultant of processes of nitrification, ammonification, respiration, and assimilation. Therefore, un-ionized NH3, mg/L = (X)/(1+R), where X = total ammonia, mg/L; R = 10^Exponent; Exponent = (0.09018)+(2729.92/C+273.15)-(pH); C = degrees Centrigrade (USEPA 1985 [pp 261-264].

3. TOTAL PHOSPHORUS (TP)

Samples at or below the water quality target of 0.075 mg/L TP for the suggested preliminary prevention level for the development of biological nuisances and the acceleration of cultural eutrophication are listed in Table 56. Overall, the Deep Creek, Salmon Falls Creek, Billingsley Creek, Malad River, and Clover Creek had the highest ranking in terms of the number of samples that were less the 0.075 mg/L TP. However, all tributaries had a sufficient number of samples that exceeded the 0.075 mg/L TP level.

Table 56 Total phosphorus in tributaries of Upper Snake Rock

Tributaries	*Number ≤ 0.075 mg/L TP*	*% ≤ 0.075 mg/L*	*% > 0.075 mg/L*
East Perrine Coulee	14 out of 225	6.2	93.8
Rock Creek	20 out of 288	6.9	93.1
Cedar Draw	12 out of 277	4.3	95.7
Mud Creek	11 out of 277	4.0	96.0
Deep Creek	71 out of 275	25.8	74.2
Salmon Falls Creek	120 out of 270	44.4	55.6
Billingsley Creek	135 out of 387	34.9	65.1
Malad River	51 out of 80	63.8	36.2
Clover Creek	9 out of 17	52.9	47.1

Prepared by IDEQ-TFRO. Dataset from 1990-1997 monitoring.

4. TOTAL SUSPENDED SOLIDS (TSS)

Table 57 summarizes on a per-tributary basis the number of samples that exceed the preliminary 52 mg/L TSS instream target, and 80 mg/L daily maximum. Additionally, the percentage of samples that are above the proposed instream target is also calculated and summarized.

Table 57 Total suspended solids (TSS) that exceed the proposed instream target of 52 mg/L

Tributary	*Number of TSS values > 52 mg/L*	*Number of TSS values > 80 mg/L*	*Percent of TSS values > 52 mg/L*	*Percent of TSS values > 80 mg/L*
East Perrine Coulee	152 out of 225	111 out of 225	70.7	49.3
Rock Creek	125 out of 288	72 out of 288	43.4	25.0
Cedar Draw	152 out of 277	111 out of 277	54.9	40.1
Mud Creek	55 out of 277	21 out of 277	19.9	7.6
Deep Creek	81 out of 275	43 out of 275	29.5	15.6
Salmon Falls Creek	60 out of 270	16 out of 270	22.2	5.9
Billingsley Creek	0 out of 417	0 out of 417	0.0	0.0
Malad River	8 out of 79	2 out of 80	10.1	2.5
Clover Creek	0 out of 17	0 out of 17	0.0	0.0
Prepared by IDEQ-TFRO. Dataset from 1990-1997 monitoring				

5. TURBIDITY (NTU) AND TOTAL SUSPENDED SOLIDS (TSS)

Table 58 summarizes on a per tributary basis relationship/correlation between turbidity (as NTU) versus TSS. Their statistical significance is provided as well as what the estimated turbidity reading would be given 52 mg/L TSS.

Table 58 NTU versus TSS on a tributary basis and its significance

Tributary	*NTU versus TSS equation*	*Parameters of Significance* r^2	*F-ratio*	*p*	*Equivalent NTU at 52 mg/L TSS*
East Perrine Coulee	NTU=0.547TSS + 13.235	0.847	568.2	0.000	41.7
Rock Creek	NTU=0.530TSS + 3.535	0.893	1124.3	0.000	31.1
Cedar Draw	NTU=0.387TSS + 19.738	0.722	300.0	0.000	39.9
Mud Creek	NTU=0.219TSS + 23.685	0.267	21.1	0.000	35.1
Deep Creek	NTU=0.392TSS + 10.839	0.821	562.6	0.000	31.2
Salmon Falls Creek	NTU=0.881TSS - 4.471	0.770	388.6	0.000	41.3
Billingsley Creek	NTU=1.237TSS + 1.401	0.758	560.7	0.000	54.6
Malad River	NTU=0.075TSS + 0.579	0.332	9.6	0.003	4.5
Clover Creek	NTU=0.862TSS + 4.534	0.647	10.8	0.005	49.4
Prepared by IDEQ-TFRO. Dataset from 1990-1997 monitoring.					

Temporal variation by Julian Day per NTU or TSS was also examined in order to account for the varying time periods from year-to-year from 1990 to 1997. Since NTU is correlated to TSS (as demonstrated in Table 58), it was necessary to know if NTU and/or TSS are increasing or decreasing from year-to-year. These are summarized as follows:

1. East Perrine Coulee has a weak increasing trend for NTU (NTU = 0.015 JULIAN

+ 51.147, $r^2 = 0.159$, F-ratio = 5.8, $p = 0.017$) while TSS appears to be stationary ($r^2 = 0.058$, F-ratio = 0.7, $p = 0.390$).

2. Rock Creek has a weak increasing trend for both NTU (NTU = 0.010 JULIAN + 23.718, $r^2 = 0.189$, F-ratio = 10.6, $p = 0.001$) and TSS (TSS = 0.011JULIAN + 49.962, r^2 0.123, F-ratio = 4.4, $p = 0.038$).

3. Cedar Draw has an increasing trend in NTU (NTU = 0.017JULIAN + 26.344, $r^2 = 0.297$, F-ratio = 26.6, $p = 0.000$) and a TSS that appears stationary ($r^2 = 0.034$, F-ratio = 0.3, $p = 0.568$).

4. Mud Creek has a stationary NTU ($r^2 = 0.042$, F-ratio = 0.5, $p = 0.482$) but a weak decreasing TSS trend (TSS = -0.005JULIAN + 47.339, $r^2 = 0.143$, F-ratio = 5.8, $p = 0.017$).

5. Deep Creek has an increasing trend for NTU (NTU = 0.017JULIAN + 5.010, $r^2 = 0.338$, F-ratio = 35.2, $p = 0.000$) but a weak stationary trend for TSS ($r^2 = 0.105$, F-ratio = 3.1, $p = 0.081$).

6. Salmon Falls Creek has both a weak increasing trend for NTU (NTU = 0.008JULIAN + 14.264, $r^2 = 0.152$, F-ratio = 6.3, $p = 0.012$) and TSS (TSS = 0.007JULIAN + 25.207, $r^2 = 0.148$, F-ratio = 6.0, $p = 0.015$).

7. Billingsley Creek has a decreasing NTU trend (NTU = -0.004JULIAN + 13.075, $r^2 = 0.161$, F-ratio = 11.0, $p = 0.001$) but a stationary TSS trend ($r^2 = 0.010$, F-ratio = 0.04, $p = 0.842$).

8. Malad River has both an increasing trend for NTU (NTU = 0.002JULIAN - 0.037, $r^2 = 0.321$, F-ratio = 8.8, $p = 0.004$) and for TSS (TSS = 0.012JULIAN + 7.141, $r^2 = 0.464$, $F = 21.1$, $p = 0.000$).

9. Clover Creek has a decreasing NTU trend (NTU = -0.089JULIAN + 260.858, $r^2 = 0.626$, F-ratio = 9.7, $p = 0.007$) and a stationary TSS trend ($r^2 = 0.374$, F-ratio = 2.4, $p = 0.139$).

2.2.4.3 TRIBUTARY FECAL BACTERIA DATA ASSESSMENT

Table 59 describes per indicated tributary the bacteria assessment based on bacteria monitoring from 1990 through 1997. Assessment is based on the number of instantaneous samples that had exceedences greater than 500 colonies/100 mL of water for primary contact recreation (PCR), and the number of instantaneous samples that had exceedences greater than 800 colonies/100 mL of water for secondary contact recreation (SCR) from 1990 through 1997. See IDAPA §16.01.02.100.03.a and 16.01.02.250.01.a for primary contact recreation, and IDAPA §16.01.02.100.03.b and 16.01.02.250.01.b for secondary contact recreation. A weighted means analysis was also conducted between the fecal value for PCR and the fecal value for SCR to arrive at a weighted means value for ranking of the tributaries according to both criteria. Finally, a comparison of the geometric mean and the arithmetic mean of the fecal data was conducted as irrigation season versus nonirrigation season versus overall year.

Table 59 Bacteria assessment summary of primary and secondary contact recreation (1990-1997) on tributaries

Tributaries	Primary Contact Recreation % Samples > 500 Fecal Colonies	Secondary Contact Recreation % Samles > 800 Fecal Colonies	% Weighted Means Assessment Analysis (PCR+SCR)	Means Comparisons Geomean (Arithmetic Mean)		
				Overall Means	Irrigation Means	Non Irrigation
East Perrine Coulee	66/225 = 29.3%	30/225 = 13.3%	24.3% (N=96)	270(731)	410(970)	96(143)
Rock Creek	69/246 = 28.0%	42/246 = 17.1%	23.9% (N=111)	214(467)	398(583)	58(223)
Cottonwood Creek	4/36 = 11.1%	1/36 = 2.8%	7.0% (N=36)	40(181)	69(220)	6(43)
Cedar Draw	80/225 = 35.6%	35/225 = 15.6%	29.5% (N=115)	233(664)	541(937)	36(58)
Mud Creek	111/227 = 48.9%	77/227 = 33.9%	42.8% (N=188)	413(750)	725(1006)	123(198)
Deep Creek	36/224 = 16.1%	13/224 = 5.8%	13.4% (N=49)	146(305)	289(396)	30(97)
Salmon Falls Creek	17/270 = 6.3%	11/270 = 4.1%	5.4% (N=28)	96(867)	127(184)	54(2278)
Billingsley Creek	44/421 = 10.5%	27/421 = 6.4%	8.9% (N=71)	81(437)	77(511)	87(351)
Malad River	5/23 = 21.7%	5/23 = 21.7%	21.7% (N=10)	45(3571)	63(4913)	26(1382)
Clover Creek	2/17 = 11.8%	0/17 = 0%	11.8% (N=2)	48(95)	41(79)	156(213)

Prepared by IDEQ-TFRO. FECAL COLI. = FECAL COLIFORM. Weighted means assessment analysis = [(N1 x %1) + (N2 x %2)] / NT; where, N1 = population of Primary Contact Recreation (PCR) sample, N2 = population of Secondary Contact Recreation (SCR) Sample. Cottonwood Creek fecal coliform data based on 1997 monitoring.

Ranking the fecal coliform samples in the primary and secondary contact recreation areas according to % exceedence provides the following assessment:

1. For primary contact recreation the ranking of the tributaries of the most-to-least exceedences in fecal coliform are: Mud Creek (48.9%), Cedar Draw (35.6%), East Perrine Coulee (29.3%), Rock Creek (28.0%), Malad River (21.7%), Deep Creek (16.1%), Clover Creek (11.8%), Billingsley Creek (10.5%), and Salmon Falls Creek (6.3%).

2. For secondary contact recreation the ranking of the tributaries of the most-to-least exceedences in fecal coliform are: Mud Creek (33.9%), Malad River (21.7%), Rock Creek (17.1%), Cedar Draw (15.6%), East Perrine Coulee (13.3%), Billingsley Creek (6.4%), Deep Creek (5.8%), Salmon Falls Creek (4.1%), and Clover Creek (0%).

3. For a weighted means analysis of primary and secondary contact recreation values to rank the tributaries from the most-to-least exceedences are: Mud Creek (42.8%), Cedar Draw (29.5%), East Perrine Coulee (24.3%), Rock Creek (23.9%), Malad River (21.7%), Deep Creek (13.4%), Clover Creek (11.8%), Billingsley Creek (8.9%), and Salmon Falls Creek (5.4%).

4. The means comparison of the geometric mean to the arithmetic mean indicates that in most cases, the irrigation season had fecal coliform levels much greater than the nonirrigation season. Exceptions to this are Salmon Falls Creek which increases when comparing its arithmetic mean and Clover Creek which increases in both geometric and arithmetic means.

2.2.5 IDENTIFICATION OF ANY DATA GAPS

"Generally, monitoring programs are financially constrained to a limited number of sampling days. It is difficult to make inferences about a monthly or biweekly monitoring program from these types of results (ERI 1997)."

Therefore, data gaps still deemed necessary and essential to better describe and understand the Middle Snake River system may include the following:

1. "The most serious data gap in the water quality data of Upper Snake Rock is diel pattern studies for continuous number of days and months (ERI 1997)."

2. Trend monitoring over a 12-month period when compared to a fraction of the year is more descriptive of the system, particularly when attempting to make inferences about the water quality and its seasonality. Sufficient data should be collected to allow for this type of analysis.

3. Twelve (12) month surveys should be reviewed from the standpoint of irrigation (April 15 to October 15) versus non-irrigation (October 16 to April 14) seasons. Sufficient data should be collected to allow for this type of comparison.

4. Macrophyte biomass data should be collected so as to correlate samples taken in low flow years versus samples taken in better or high flow years.

5. "The determination of the reference condition primarily from reference sites is based on the premise that streams minimally affected by human activity will exhibit biological conditions most natural and attainable for streams in the region (USEPA 1996c [pp 29-30])." In practice, most reference sites will have some impacts, but not substantial enough for the stream to not meet its beneficial uses. Reference sites should be considered more seriously in developing any monitoring plan.

6. A coordinated monitoring program between agencies, organizations, and industries should be maintained and reviewed again and more definitively used to bring all stakeholders into the monitoring realm for total phosphorus, sediment, and other essential water quality parameters.

7. "It is important to note that listing impaired waters by State standards, segments, or PNWRS [*Pacific Northwest Rivers Study*] may in some cases, significantly overstate the spatial extent of the water quality problem. It should be understood that the listing of a specific segment does not necessarily imply that the entire length or area of that segment is affected (Biswas H and Mabbitt ML 1988 [p 1-2])." Over a period of monitoring years, an effort should be made to specifically characterize the listed stream segment so that what is affected is inventoried against what is not affected.

8. In order to develop a more holistic understanding of un-ionized ammonia and its effects on fisheries, one must consider it in conjunction with other parameters. It should be noted that until 1962 only un-ionized ammonia was considered toxic (Mead 1985 [p 138]). Synergistic effects must be considered also in order to establish safe levels of combined toxicants (Mead 1985 [p 137]) for such things as ammonium, dissolved oxygen, carbon dioxide, pH, temperature, and ionic gradients. In fact, sublethal effects of un-ionized ammonia may be related to ammonium and ambient sodium concentrations (Mead 1985 [p 139]). Until such synergistic effects are researched in greater detail, the preliminary use of maximum concentration limits will have to suffice, based on appropriate fisheries research.

9. "There is no doubt that sediment is the primary pollutant which impacts fish habitat more

than any other. Literature has long documented the roll of sediment in substrate compaction and cementing as it relates to spawning gravels and loss of interstitial wintering habitats, loss of pool habitats, reduction in insect diversity, providing a nutrient rich growing media for macrophytes which can contribute to diel oxygen fluctuations, etc. It's safe to say that every stream listed [*on the §303(d) list*] has suffered from sediment inputs greater than what can be hydrologically transported under the current modified hydrographs. Even spring-fed streams such as Billingsley Creek and Crystal Springs have experienced sediment deposition from agricultural run-off and aquaculture which has caused major modifications to streambed substrate resulting in a reduction in carrying capacity of the streams to support native fish populations (IDFG 1998c)." Any monitoring plan should include at a bare minimum total suspended solids analysis.

10. "There is no doubt, from a fisheries perspective, eliminating <u>excessive</u> sediment from a riverine system will result in improved habitat conditions for native fish populations. What is a reasonable time-frame for recovery of a fishery? The science does not exist to answer this question. It is our opinion, however, any action taken which results in an upward trend in native fish populations should be considered reasonable. It's recognized by all agencies that fish and wildlife habitats and populations were not destroyed over-night [*sic*] by degraded water quality and they will not recover immediately once the stressor or pollutant is removed from the system. <u>Don't confuse this statement with a lack of urgency for action to reduce sediment and nutrient inputs</u>! Native fish and other freshwater based biological populations are continuing their spiral towards the point of no recovery as evident by the number of aquatic species listed or proposed for listing within the last 10 years under the federal Endangered Species Act. Actions taken to improve water quality will undoubtedly have a positive impact on all native species within the Snake River drainage (IDFG 1998c)." Where applicable, efforts should be made to include bedload sediment analysis as part of the monitoring regime or plan.

11. "Aquatic biological populations, like all biological populations, are constantly in a state of flux. Due to sampling limitations there is no way to accurately estimate population numbers of any one species for the Middle Snake River. What we can do is look at general trends in populations, over time, at limited locations. Using this information to make specific population projections for Mid-Snake fish populations is risky at best. Some drawbacks to keep in mind are: sampling was done just along the shoreline using electrofishing equipment (areas and shocking depth are variable and equipment is biased towards larger fish); there are seasonal variations in use of shallow water habitats by the different fish species; the areas selected for sampling may not have been representative habitats for the Mid-Snake Reach (described as "general sample areas" in the text); and, the stated purpose of the study was to look at the general species composition of the fish community in short reaches of the Mid-Snake (IDFG 1998b)." Any biological monitoring plan should take into account these drawbacks and include consideration of means to deal with the variables associated with monitoring fish populations.

12. "If the goal is to re-establish coldwater salmon spawning within the various reaches, there needs to be a linkage between sediment goals and substrate condition. There are several methods for measuring cobble or substrate embeddedness that can be used. This should part of the monitoring plan in bodies of water designated with a support of 'salmonid spawning'. Technical personnel should identify suitable spawning and juvenile rearing locations, as part of your 'additional data needs,' to distinguish appropriate locations for monitoring." (IDFG 1999)

13. According to IDFG, "If salmonid spawning and support of coldwater biota is the beneficial use designated, then shouldn't sampling of fish populations be part of the trend monitoring program?'

14. According to USEPA: "EPA recommends IDEQ establish substrate sediment targets for both the Middle Snake River and listed tributaries, all of which are designated for salmonid spawning. In the interim, load allocations could be based on the TSS target, since we are not aware of any means to establish a quantitative link between TSS and substrate conditions. The substrate would need to be monitored periodically at selected locations to ensure that the TSS reductions were resulting in the substrate sediment target being met. Such monitoring sites could be potential salmonid spawning habitat and sturgeon, whitefish and other coldwater biota rearing habitat."

These data gaps will be reviewed by the Mid-Snake TAC in conjunction with IDEQ-TFRO for inclusion in the trend monitoring plan (Appendix A). No attempt is made here at this time by IDEQ-TFRO to include any of these suggested data gaps as part of the trend monitoring plan without the express advice of the Mid-Snake TAC (which will include representation from USEPA, USFWS, USBLM, USFS, USGS, USBOR, NRCS, IDFG, IDWR, SCC, IASCD, IDL, aquaculture industry scientists, food processing industry scientists, municipality industry scientists, Idaho Power Company, irrigation industry specialists, and other scientists that may provide professional and scientific advice).

2.3 POLLUTANT SOURCE INVENTORY

Table 60 summarizes the pollutant sources within the Upper Snake Rock subbasin for specific streams listed on the 303(d) list or which are known to be impaired. For point sources, the number of aquaculture, public owned treatment works (POTW), and food processing facilities are identified. For nonpoint sources, a simple YES or NO tells if the stream is affected by the particular nonpoint source activity based on known historical information. Nonpoint sources include grazing, agriculture, forestry, CFOs, recreation, and FERC licensed facilities. During TMDL development the IDEQ-TFRO and the Mid-Snake WAG/TAC will determine the extent to which these sources affect the various water bodies.

TABLE 60 General inventory of point and nonpoint sources

WATERBODY IDENTIFICATION	*INVENTORY OF POINT AND NONPOINT SOURCES*									
	POINT SOURCES				*NONPOINT SOURCES*					
	A/Q	*POTW*	*FOOD*	*INDUS*	*FERC*	*GRAZE*	*AG*	*FOREST*	*CFOs*	*REC*
Alpheus Creek	0	0	0	0	0	0	0	0	0	Yes
Billingsley Creek	8	0	0	0	2	Yes	Yes	0	Yes	Yes
Blind Canyon Creek	1	0	0	0	1	Yes	Yes	0	Yes	0
Cedar Draw	9	1	0	0	2	Yes	Yes	0	Yes	Yes
Clear Springs	5	0	0	0	1	0	Yes	0	Yes	Yes
Clover Creek	0	0	0	0	0	Yes	Yes	0	Yes	Yes
Cottonwood Creek	0	0	0	0	0	Yes	Yes	0	Yes	Yes
Crystal Springs	1	0	0	0	0	0	Yes	0	Yes	Yes
Deep Creek	6	0	0	0	1	Yes	Yes	0	Yes	Yes
Dry Creek	0	0	0	0	0	Yes	Yes	0	Yes	Yes
Dry Creek, West Fork	0	0	0	0	0	Yes	0	0	0	Yes
McMullen Creek	0	0	0	0	0	Yes	Yes	0	Yes	Yes
Mud Creek	10	1	0	0	2	Yes	Yes	0	Yes	Yes
East Perrine Coulee	0	0	0	0	1	Yes	Yes	0	Yes	Yes
Riley Creek	2	0	0	0	0	0	Yes	0	0	Yes
Rock Creek	8	0	1	2	2	Yes	Yes	0	Yes	Yes
Sand Springs Creek	1	0	0	0	1	0	Yes	0	0	Yes
Middle Snake River	37	4	2	0	18	Yes	Yes	0	Yes	Yes
Tool Box Creek	0	0	0	0	0	Yes	0	0	0	Yes
Total No. Facilities % Streams Affected	88 50%	6 14%	3 9%	2 5%	31 45%	? 77%	? 84%	? 0%	? 74%	? 91%

Prepared by IDEQ-TFRO: A/Q = Aquaculture; POTWs = Privately owned treatment works or sewage treatment plants; FOOD = Food processors; FERC = FERC-type facilities for power generation and/or daming; INDUS = Industrial-type facilities; GRAZE = Grazing; AG = both irrigated and nonirrigated agriculture; FOREST = Forestry; CFOs = Confined Feeding Operations; REC = Recreation.

From this table several conclusions may be drawn. First, point sources affect the listed waterbodies in the following amounts: aquaculture affects 50% of the streams, POTWs affect 14% of the streams, food processors affect 9% of the streams, and industrials affect 5% of the streams. Second, although no specific numbers of farms or operations are determined at this time for nonpoint sources, the affect of nonpoint sources for the listed waterbodies may be characterized by the following relative amounts: agriculture affects 95% of streams, recreation affects 91% of the streams, CFOs affect 86% of the streams, grazing affects 77% of the streams, forestry affects none of the streams (0%), and FERC facilities affect 45% of the streams. It should be noted that these effects, whether from point or nonpoint sources, are not necessarily negative on water quality if the overall impact to tributaries and the Middle Snake River is below the assimilative capacity of the particular tributary or river system.

2.3.1 IDENTIFICATION OF POINT AND NONPOINT SOURCES

Specific point sources and general nonpoint sources for the tables in §2.3 are identified in the following subsections per listed waterbody. For nonpoint sources, the IDEQ-TFRO has identified overall an inventory of 779 major CFOs (dairies, feedlots, cow-calf operations): 309 in Twin Falls County, 258 in Gooding County, and 212 in Jerome County although their effect on specific streams is unknown at this time. Of these, 122 dairies are in Twin Falls County, 126 dairies in Gooding County, and 92 dairies in Jerome County, or a total of 340 dairies in Upper Snake Rock (Cizmich & McMasters 1998). In general, the Upper Snake Rock subbasin has nonpoint source land uses that are estimated to be: 2.4% dryland agriculture, 2.0% forest, 16.6% irrigated agriculture---gravity flow, 5.2% irrigated agriculture---sprinkler, 50.6% rangeland, 20.8% riparian vegetation, 1.2% urban, and 1.3% water (Arcview 1996).

For FERC licensed hydroelectric facilities, these are exempt from NPDES permit requirements on the grounds that the change in water condition following its discharge over or through the dam does not constitute a "discharge of pollutants" within the meaning of the Clean Water Act. This was based on a U.S. Court of Appeals, District of Columbia Circuit, dated September 13, 1982. As of May 1, 1998, the NPDES permits for the following facilities on the Middle Snake River have been terminated: Bliss Power Plant, NPDES 00257-8; Lower Malad Power Plant, NPDES 002258-6; Upper Malad Power Plant, NPDES 002259-4; Lower Salmon Power Plant, NPDES 002260-8; Upper Salmon Plant "A," NPDES 002261-6; Upper Salmon Plant "B," NPDES 002262-4; Thousand Splrings Power Plant, NPDES 002263-2; Clear Lakes Power Plant, NPDES 002264-1; Shoshone Falls Power Plant, NPDES 002265-9; Twin Falls Power Plant, NPDES 002266-7).

As of this writing, the aquaculture industry in Idaho is undergoing NPDES permitting requirements on a General Permit for total suspended solids and total phosphorus, and other pollutants where applicable. For the Middle Snake River facilities an interim effluent limit will be used for a period of three years. Data collected during that period will be used to develop a wasteload allocation so that the industry as a whole does not exceed 970.2 lbs/day. Food processors and municipalities are also undergoing NPDES permitting requirements, but on individual permits. These already have pre-assigned wasteload allocations which are being translated into effluent limits in their permits.

Of major concern in identification of point and nonpoint sources is the effect from sediment, and particularly from nonpoint sources that contribute to it. This pollutant is identified in all the water quality limited stream segments as a source of impairment to the designated and existing beneficial uses. As described in §2.1.2.3, Upper Snake Rock has 54% desert shrubland grazing land. "Available data indicates sediment yields from rangelands are less than one (1) ton per acre (range of ½ to ¾ ton). Much of this appears to come from steep and eroding channel banks and during high water runoff periods. Erosion from seriously overgrazed or burned ranges will occur if heavy rain should fall before vegetation regrowth or re-establishment occurs. The most serious potential erosion of rangeland occurs on slopes greater than 30% (ISCC 1979)." Additionally, agriculture represents 41% of the land use in Upper Snake Rock. Sediment contributions more notably may come from irrigation runoff or from tailwater in fields that has collected sediment loads that have moved into canal systems and eventually into associated tributaries and the Middle Snake River. See Appendix C.

2.3.1.1 ALPHEUS CREEK (SPRINGS)

Blue Lakes Spring is typical of many large springs issuing from the Eastern Snake Plain Aquifer System. It issues from a major interbed, although the specific interbed is covered with talus and windblown sand and is not visible. The orifice of the spring is adequately defined and flows out over a wide area and flows into Upper Blue Lake (water surface elevation 3294.0 feet). The flows into Upper Blue Lake range from 165 cfs to 235 cfs. It is estimated that since 1950 the flow has decreased by 21% (based on USGS gaging station at the mouth of Upper Blue Lake). From Upper Blue Lake, the water flows into Lower Blue Lake (water surface elevation 3288.1 feet). A large volume of the flow disappears through the porous formation in the bottom of Lower Blue Lake. Only 5 cfs to 7 cfs flows out of the Lower Blue Lake. The rest of the water travels through the porous rock formations to again resurface in Alpheus Spring near the Blue Lakes Country Club with a flow of approximately 200 cfs (JUB 1993). From this point to where the water meets the first main diversion at Blue Lakes Trout Farm main headquarters, the creek is known as Alpheus Creek. After this diversion there is no longer a true Alpheus Creek. Instead, the creek has been channelized and diverted into what is locally called Perrine Ditch (or Alpheus Ditch) which feeds two aquaculture facilities (Blue Lakes Trout Farm and Pristine Springs) on the north side of the Middle Snake River. At the main diversion, water is diverted across the Middle Snake River to the south side of the Middle Snake River to the Canyon Springs aquaculture facility.

Therefore, Alpheus Creek has three aquaculture facilities that divert water from it: Blue Lakes Trout Farm (with processing plant, NPDES 000095-7) and Pristine Springs/Sunnybrook Warm Water facility (NPDES 002501-1) which divert water in series on the north side of the Snake River Canyon from Alpheus Ditch; and, Canyon Springs (NPDES 002731-6) which diverts water across the river to the south side of the Snake River Canyon from the main diversion above Alpheus Ditch. Each of these aquaculture facilities discharges back to the Middle Snake River.

Additionally, the City of Twin Falls diverts water for its domestic supply and irrigation water for its residents, industry, and commerical users at the head of Upper Blue Lake Springs via four large pumps. The water is diverted from the north side of the Snake River Canyon (or North Rim) across the river through a 36" concrete cylinder pipe to the south side of the Snake River Canyon (or South Rim). It is then pumped into the Harrison Street tank (after chlorine disinfection), and finally pumped into the City distribution system.

There are no food processors, municipalities, or hydroelectric projects on Alpheus Creek, so it is principally affected by nonpoint sources of pollution. Alpheus Creek is also affected occasionally by nonpoint source storm water. As shown in §2.20, Alpheus Creek is listed for sediment, nutrients, and violations of the dissolved oxygen standard.

The Blue Lakes aquaculture facility has fresh spring water from Alpheus Ditch and two discharge points: one which functions as reuse effluent water for the Pristine Springs facility; and, the second which discharges to the Middle Snake River. The Pristine Springs aquaculture facility has input water from two sources: first, from the tail raceway water from the Blue Lakes facility which functions as reuse water; and then from fresh spring water from Alpheus Ditch. Pristine Springs has two discharge points: one discharge point goes directly to the Middle Snake River as discharge from the second set of raceways which are at a higher elevation; and, the other discharge point goes through the Whiskey Slew which has two additional spring sources that mingle at the hatchery house which then discharges to the Middle Snake River at a lower elevation (McMasters 1998b).

2.3.1.2 BILLINGSLEY CREEK

Billingsley Creek has eight aquaculture facilities that discharge to it. They take water from adjacent springs along the stream course or from Billingsley Creek itself. These facilities include: Rangen's Inc. (NPDES

002303-5), Schrank (Spring Creek Springs) Farm Ponds (now owned by Lee; NPDES _____), Charlie Johnson Farm Ponds (NPDES _____), Bill Jones Raceways (NPDES 000086-8), McFadden Farm Ponds (NPDES 002612-3), Idaho Springs/Gold Springs Ponds (NPDES 000073-6), Hidden Springs (NPDES 002440-6), Fisheries Development (NPDES 002499-6) and Tupper Ponds (not permitted). There are no city sewage treatment plants or food processing facilities discharging to the stream. There two hydroelectric facilities: Billingsley Creek Plant (FERC 06208-01) and Fisheries Development Project (FERC 07885-06). Nonpoint sources include grazing operations (permitting direct access to the stream for water), agricultural irrigation return flow to the stream, and two dairies. In 1991 Billingsley Creek was assessed by DEQ-TFRO to have water quality impairment: 75% from point sources (specifically, aquaculture) and 25% from nonpoint source pollution based on best professional judgement that nonpoint source pollution was fairly well contained (USEPA 1991b). This assessment was challenged by the aquaculture industry, but no specific data was provided to defend the challenge. However, the assessment of Billingsley Creek for total suspended solids (TSS) in this document (see Table 103, §3.5.5) reveals that an estimated 673.3 tons/year of TSS is discharged from Billingsley Creek to the Middle Snake River. About 27% is attributable to nonpoint sources (181.5 tons/year / 673.3 tons/year x 100%) and 73.0% is attributable to aquaculture facilities (491.8 tons/year / 673.3 tons/year x 100%) based on their estimated effluent discharge. Therefore, the 1991 asssessment by IDEQ-TFRO was probably correct. Nonpoint source land uses are for Billingsley Creek are estimated to be: 5.1% irrigated agriculture---gravity flow, 24.5% irrigated agriculture---sprinkler, 19.5% rangeland, and 50.9% riparian vegetation (ArcView 1996).

2.3.1.3 BLIND CANYON

Blind Canyon has one aquaculture facility, Blind Canyon Hatchery (NPDES 002599-2), and one hydroelectric project, Blind Canyon Project (FERC 08375-04). No food processors or sewage treatment plants are located on the stream. Nonpoint source land uses for Blind Canyon are estimated to be 100% rangeland. Blind Canyon Springs nonpoint source land uses are estimated to be: 20.4% irrigated agriculture (sprinkler), 29.2% rangeland, and 50.6% riparian vegetation (ArcView 1996).

2.3.1.4 CEDAR DRAW

Cedar Draw has seven aquaculture facilities that discharge directly to it and two aquaculture facilities that indirectly discharge to it via a tributary, Tunnel Creek. The direct dischargers are: Rainbow Trout Farm Inc./Filer Hatchery (NPDES 000102-3), Yoder Farm Ponds with SEAPAC Processing Plant (NPDES 002423-6), Cedar Draw Hatchery (NPDES 002503-8), Olson Ponds (NPDES 002592-5, via "F"Coulee), Stutzman Farm Ponds (NPDES 002730-8), Rainbow Trout Farm Inc./Filer Processing (NPDES 000102-3), and SEAPAC (as previously identified). The indirect dischargers (via Tunnel Creek) are: Tunnel Creek Fish Farm (NPDES 002292-6) and Leo Martin's Fish Farm (NPDES 002775-8). Additionally, the City of Filer Wastewater Treatment Plant discharges to Cedar Draw Creek. Two hydroelectric projects are also located on the stream: Cedar Draw Creek Project (FERC 08278-04) and Little Mac (FERC 06443-00). No food processors are located on the stream. Nonpoint source land uses are estimated to be: 99.4% irrigated agriculture (gravity flow) and 0.6% riparian vegetation (ArcView 1996).

2.3.1.5 CLEAR SPRINGS CREEK

Five aquaculture facilities discharge to Clear Springs Creek and Clear Springs Lake: Clear Lakes Trout Co./Processing Plant (NPDES 000101-5, via Clear Lakes), Middle Hatchery/Clear Springs Clear Lakes (NPDES 000093-1, via Clear Lakes), Snake River Hatchery/Clear Springs (NPDES 000075-2, via Clear Lakes), Clear Springs Processing Plant (NPDES 002688-3, via Clear Lakes), and Clear Lakes Trout Co./Processing Plant (NPDES 000101-5, via Clear Lakes). Additionally, there is a hydroelectric project that discharges to Clear Lakes Creek: IPC/Clear Lake Power Plant (NPDES 002264-1). No food processors or city sewage treatment plants discharge to the creek. Clear Lakes nonpoint source land uses are estimated to be: 99.4% irrigated agriculture (gravity flow) and 0.6% riparian vegetation (ArcView 1996).

2.3.1.6 CLOVER CREEK

There are no point sources discharging to Clover Creek from its headwaters to where it discharges into the Middle Snake River. It is affected 100% by nonpoint sources including grazing, agriculture, and confined feeding operations (including feedlots, dairies, cow-calf operations, and cattle ranches). Nonpoint source land uses are estimated to be: 3.3% dryland agriculture, 14.5% irrigated agriculture (gravity feed), 5.0% irrigated agriculture (sprinkler), 48.6% rangeland, and 28.6% riparian vegetation (ArcView 1996).

2.3.1.7 COTTONWOOD CREEK

There are no point sources discharging to Cottonwood Creek from its headwaters to where it discharges to Rock Creek. It is affected 100% by nonpoint sources including grazing, agriculture, and confined feeding operations (including feedlots, dairies, cow-calf operations, and cattle ranches). Nonpoint source land uses are estimated to be: 15.4% dryland agriculture, 10.6% irrigated agriculture (gravity flow), 71.2% rangeland, and 2.9% riparian vegetation (ArcView 1996).

2.3.1.8 CRYSTAL SPRINGS

There is one aquaculture facility that discharges to Crystal Springs Creek and Crystal Springs Lake: Crystal Springs Trout Farm/Clear Springs (NPDES 000089-2). Magic Valley Steelhead Hatchery uses this spring for source water, but discharges to the Middle Snake River. No food processors or city sewage treatment plants discharge to the creek or lake. Nonpoint source land uses are estimated to be 100% riparian vegetation (ArcView 1996).

2.3.1.9 DEEP CREEK

There are six aquaculture facilities that directly discharge to Deep Creek. These are: Deep Creek Trout Farm/Boswell Trout (NPDES 002515-1), Deep Creek Trout Farm (NPDES 002670-1), Peter's Farm Ponds/Kaufman Farm Ponds (NPDES 002424-4), Harder Livestock Partnership/Cox Farm Ponds (NPDES 002533-0), Dolana Farm Ponds (NPDES 002615-8), and Howell Farm Ponds (NPDES 002763-4, via irrigation canal). There are no city sewage treatment plants or food processors that discharge to the stream. There is one hydroelectric power plant: Cox's Project (FERC 06850-00). Nonpoint source land uses are estimated to be: 21.4% dryland agriculture, 48.3% irrigated agriculture (gravity flow), 28.0% rangeland, and 2.3% riparian vegetation (ArcView 1996).

2.3.1.10 DRY CREEK (MURTAUGH LAKE)

There are no point sources discharging to Dry Creek (Murtaugh Lake area) from its headwaters to where it discharges to Murtaugh Lake and afterwards to the Middle Snake River. It is affected 100% by nonpoint sources including grazing, agriculture, and forestry. Nonpoint source land uses are estimated to be: 18.1% irrigated agriculture (gravity flow), 13.6% irrigated agriculture (sprinklers), 36.1% rangeland, and 32.4% riparian vegetation. For the West Fork of Dry Creek, land use estimates are 100% rangeland (ArcView 1996). USBLM states that the West Fork of Dry Creek is not affected by agriculture (irrigated or nonirrigated), but is strictly rangeland (USBLM 1998b).

2.3.1.11 MCMULLEN CREEK

McMullen Creek is affected by nonpoint sources. No point sources are known to discharge to it. Nonpoint source land use estimates are estimated to be: 2.3% irrigated agriculture (gravity flow), and 97.7% rangeland

(ArcView 1996).

2.3.1.12 MUD CREEK

There are eight aquaculture facilities that directly discharge to Mud Creek. These are: Rainbow Trout Farm Inc./Buhl Hatchery (NPDES 000103-1), W & W Trout Farm (NPDES 002606-9), White's Trout Farm (NPDES 002604-2), Buhl Trout Rearing Facility/Bill Fulmer Trout Farm (NPDES 002674-3), Buhl Trout Farm/Blau Farm Ponds (NPDES 002673-5, via unnamed stream), First Ascent Fish Farm (NPDES 002777-4), Rocky Ridge Ranch (NPDES 002729-4), and Mi Vida Loca/Larry Compton (NPDES 002788-0). There are two aquaculture facilities that indirectly discharge to Mud Creek via Silo Creek: Juker Farm Ponds (NPDES 002618-2) and RCP (NPDES 002752-9). The City of Buhl Wastewater Treatment Plant discharges to the east fork of Mud Creek. No food processors discharge to Mud Creek. There are two hydrolelectric projects on Mud Creek: Mud Creek Project (FERC 04769A02) and White Ranch Project (FERC 04115-06). Nonpoint source land uses are estimated to be 100% riparian vegetation (ArcView 1996).

2.3.1.13 EAST PERRINE COULEE

East Perrine Coulee is not listed on the §303(d) list, but it is a major pollutant source of TSS to the Middle Snake River. Table 100, §3.5.2, estimates that East Perrine Coulee delivers 11.2% of the total TSS (3,365.8 tons/year / 30,159.8 tons/year x 100%) to Segment 2 (Pillar Falls to Crystal Springs) on the Middle Snake River. Perrine Coulee has no food processors, industrials, or municipalities that discharge to it. One aquaculture facility, Green's Trout Farm (NPDES 000096-5), discharges to East Perrine Coulee. There is one hydroelectric power generation project: K.W. Inc. (Kasel-Witherspoon (FERC 06410A01). Nonpoint source land uses are estimated to be: 18.9% irrigated agriculture (gravity flow), 18.4% rangeland, 18.6% riparian vegetation, and 44.1% urban (ArcView 1996). USDA/SCS suggests that the 18.40% rangeland is really "other land or recreational land," since in a strict sense it is not used as rangeland (USDA SCS 1992). "Additionally, Perrine Coulee does not contain any perennial streams. Several drainage branches carry excess rainfall and irrigation return flows to the Snake River Canyon. Rapid snowmelt may also add some winter and early spring flows to several branches of this natural drainage system. During the irrigation season all the drainages carry primary irrigation water or return flows. In some cases, the drainages terminate at topographical depressions and disappear into the underlying lava rock. This ground water feeds such [*sic*] small lakes as Dierkes Lake or appears as springs flows in the Snake River Canyon wall (SRSCD 1998)."

2.3.1.14 RILEY CREEK

There are two fish rearing aquaculture facilities that discharge untreated and treated wastewater directly to Riley Creek. These are: USFWS/Hagerman National (NPDES 000082-5) and IDFG/Hagerman State (NPDES 000080-9). The USFWS facility uses about 55 cfs of water collected from 12 springs, while the IDFG uses about 50-90 cfs of water diverted through the hatchery from Riley Creek and 40 cfs from springs (IDHW 1977b). No food processors or city wastewater treatment plants discharge to Riley Creek, and no hydroelectric projects are located on the creek. All domestic sanitary wastes in the area are treated by subsurface waste disposal systems with the exception of the Idaho State Fish and Game Wildlife Management Area which has a collection system for all private and public facilities that discharges to a total containment lagoon (IDHW 1977b).

2.3.1.15 ROCK CREEK

There are seven aquaculture facilities that discharge directly to Rock Creek. These are: Canyon Trout Farm (NPDES 002191-1), Daydream Ranch (NPDES 002680-8), Deadman Hatchery (NPDES 002689-1, via Deadman Gulch seep stream), CSI Fish Hatchery (NPDES 002630-1), Aquaculture Industries/Frame Hatchery (NPDES 002703-1), Coats Farm Ponds (NPDES 002761-8), and Canyon Trout Farm/Processing

Plant (NPDES 002191-1). There is no city sewage treatment plant that discharges to the creek; however, there are City of Twin Falls sewage lines and pumps in Rock Creek Canyon which have in the past occasionally malfunctioned or overflowed into Rock Creek. There are two hydroelectric projects: Rock Creek Project (FERC 06450-00) and Rock Creek No. 2 Project (FERC 06015-42); one food processor: Independent Meat Co. (NPDES 000038-8); and, two industrials: Monroc, Inc./Magic Valley Division (NPDES 000033-7) and Amalgamated Sugar Company (NPDES 000023-0) that discharge to Rock Creek. Nonpoint source land uses are estimated to be: 62.0% irrigated agriculture (gravity flow), 26.6% rangeland, 2.2% riparian vegetation, and 9.3% urban (ArcView 1996).

2.3.1.16 SAND SPRINGS CREEK (or Thousand Springs Creek)

This creek is affected by discharge from one aquaculture facility: Ten Springs Facility/Blind Canyon Aqua Ranch (NPDES 002600-0). There are no food processors or city sewage treatment plants however, there is one hydroelectric project that discharges to Sand Springs Creek: IPC/Thousand Springs Project (NPDES 002263-2). Nonpoint source land uses are estimated to be: 42.7% irrigated agriculture (gravity flow), 18.7% irrigated agriculture (sprinkler), 19.3% rangeland, and similarly 19.3% riparian vegetation (ArcView 1996).

2.3.1.17 VINYARD CREEK

As previously cited and described, the re-route irrigation canal to Vinyard Creek has been reported (prior to the re-route) to have a peak discharge for the irrigation return channel of 14.8 cfs in 1986, and an annual deposition of approximately 707 metric tons of sediment into the Twin Falls Reservoir (IDHW 1989a). As a result of the pvc pipe re-route approximately 20.1 cfs of irrigation return water can be accommodated for an estimate of 960 metric tons of annual sediment.

2.3.1.18 MIDDLE SNAKE RIVER

The Middle Snake River has point sources that discharge directy and indirectly to it. Those that discharge directly include: 20 aquaculture facilities and 2 wastewater treatment plants. Nonpoint sources include 6 hydroelectric impoundments and 7 hydroelectric generation projects. Indirect dischargers include: 15 aquaculture facilities, 2 wastewater treatment plants, 5 hydroelectric projects, and 2 food processors. These are listed in Table 61.

TABLE 61 Direct and indirect aquaculture facilities discharging to the Middle Snake River

DISHCHARGE TYPE	AQUACULTURE FACILITIES NAME OF FACILITY	PERMIT No.
Direct Discharger	1. Barret Farm Pond	NPDES 002718-9
	2. Birch Creek Trout Inc.	NPDES 002601-8
	3. Blue Lakes Trout Farm	NPDES 000095-7
	4. Box Canyon Trout Farm/Clear Springs	NPDES 002290-0
	5. Buckeye Farm Ponds	NPDES 002611-5
	6. Canyon Springs	NPDES 002731-6
	7. Catfish Farm	NPDES 002295-1
	8. Flemming Farm Ponds	NPDES 002732-4
	9. Flemming Ponds	NPDES 002780-4
	10. Kaster Trout Farm/Sheldon Ponds	NPDES 002517-8
	11. Magic Valley Steelhead Hatchery/IDFG	NPDES 002304-3
	12. Pisces Investment Inc./Magic Springs	NPDES 000097-3
	13. Pristine Springs/Sunnybrook Cold Water Hatchery	NPDES 002501-1
	14. Rim View Trout Co. Inc./Wendell Hatchery	NPDES 000099-0
	15. Slane Ponds	NPDES 002779-1
	16. Smith Farm Ponds	NPDES 002687-5
	17. Stevenson Ponds	NPDES 002781-2
	18. White Springs Trout Farm	NPDES 002580-1
	19. Woods Farm Ponds/Rangen Inc.	NPDES 002733-2
	20. Wright Farm Ponds	NPDES 002725-1
Indirect Discharger	1. Bell Fish Ponds (via unnamed tributary to Stoddard Creek)	NPDES 002491-1
	2. Briggs Creek Fish Hatchery (via Briggs Creek)	NPDES 002684-1
	3. C.J. Simms Ponds (via Birch Creek)	NPDES 002683-2
	4. Decker Springs Farm Pond (via Decker Springs Creek)	NPDES 002734-1
	5. Lemmon Ponds (via Curren Ditch)	NPDES 002668-9
	6. Niagara Springs Hatchery/IDFG & IPC (via Niagara Springs Creek)	NPDES 002238-1
	7. Rand Trout Farm (via LQ/LS Drains)	NPDES 002583-6
	8. Standal Ponds (via Stoddard Creek)	NPDES 002778-2
	9. White Water Ranch/Bliss Hatchery (via Stoddard Creek)	NPDES 000091-4
	10. Boyer Farm Ponds (Billingsley Creek)	NPDES 002704-9
	11. Big Bend Trout Inc. (via irrigation ditch)	NPDES 002532-1
	12. Eckles Fish Farm (Billingsley Creek)	NPDES 002676-0
	13. Henslee Hatchery (via irrigation ditch)	NPDES 002762-6
	14. Rainbow Falls Fish Ponds /Dunn (Billingsley Creek)	NPDES 002675-1
	15. Talbot Trout Ponds (Billingsley Creek)	NPDES 002677-8

Direct dischargers to the Middle Snake River include the following point sources: 2 wastewater treatment plants---City of Hagerman (NPDES 002594-1) and City of Twin Falls (NPDES 002127-0). Nonpoint sources include 6 hydroelectric impoundments---Milner Dam (FERC 2899), Twin Falls Dam (FERC 0018), Shoshone Falls Dam (FERC 2778), Upper Salmon Falls Dam (FERC 2777), Lower Salmon Falls Dam (FERC 2601), and Bliss Dam (FERC 1975); and, 7 hydroelectric generation projects which discharge to the Middle Snake River---IPC/Bliss Power Plant (NPDES 002257-8, near Bliss), IPC/Lower Malad Power Plant (NPDES 002258-6, near Hagerman), IPC/Lower Salmon Power Plant (NPDES 002260-8, near Hagerman), IPC/Upper Salmon Plant "A" (NPDES 002261-6, near Hagerman), IPC/Upper Salmon Power Plant "B" (NPDES 002262-4, near Hagerman), IPC/Shoshone Falls Power Plant (NPDES 002265-9, near Twin Falls), and IPC/Twin Falls Power Plant (NPDES 002266-7, near Twin Falls).

Indirect point source dischargers may be summarized as follows: 2 wastewater treatment plants---City of Hansen (NPDES 002244-6, via an agricultural ditch) and City of Jerome (NPDES 002016-8, via "J" canal); and 2 food processors above Milner Dam---J.R. Simplot Co. (NPDES 000066-3, at RM 652.2 in Burley, Idaho) and McCain Foodservice Inc. (NPDES 000061-2, at RM 648.8 in Burley, Idaho). Nonpoint sources include 5 hydroelectric projects---Birch Creek Project (FERC 06458B03, via Birch Creek), White Water Ranch Project (FERCs 06271C00, 06271B00, & 06271A00, via Stoddard Creek), Rim View Project (FERC 09543-04, via trout pond), Briggs Creek Project (FERC 04360-02, via Briggs Creek), and IPC/Upper Malad Power Plant

(NPDES 002259-4, via Malad River).

Reservoirs have nonpoint source land uses that affect them directly and that can be estimated as shown in Table 62.

TABLE 62 Nonpoint sources land uses affecting reservoirs on the Middle Snake River

RESERVOIR	*RANGELAND %*	*IRRIGATED AGRICULTURE %*	*RIPARIAN VEGETATION %*	*WATER %*	*WATERBODY SIZE acres*
Bliss	38.70	0	22.46	38.84	254.00
Lower Salmon Falls	66.37	0	33.63	0	168.00
Pioneer	100.00	0	0	0	220.00
Shoshone Falls	0	0	100.00	0	60.00
Twin Falls	0	39.97	60.03	0	85.00
Upper Salmon Falls	3.14	7.75	89.11	0	810.00
Mean (weighted)	28.51	6.06	59.26	6.18	Total = 1597.00
Non-reservoir areas	20.89	22.11	55.50	0.71	

Prepared by IDEQ-TFRO. Percentage land uses from *ArcView GIS 1996*. Waterbody size from *IDEQ & USEPA 1994*. Weighted means based on waterbody size and a total of 1597.00 acres. Water in this table is defined as that water within the reservoir that is affected by nonpoint sources. Non-reservoir areas is a specific land use on the Middle Snake River.

2.3.1.19 ADDITIONAL NONPOINT SOURCES

Additional nonpoint sources that indirectly affect the Middle Snake River or any of its tributaries may be found with FERC-type generation facilities either on canal systems or non-listed tributaries. These facilities will not be listed at this time as their place of discharge is to waterbodies that are not water quality limited or are man-made conveyances.

2.3.2 CHARACTERIZATION OF SPECIFIC POLLUTANTS PER POINT SOURCE INDUSTRY

As of this writing, the USEPA was in the process of modifying and reissuing the NPDES permits for food processors, municipalities, and aquaculture in order to incorporate the wasteload allocations of the Mid-Snake TMDL. Effluent characterization of specific pollutants are summarized in Table 63.

TABLE 63 Point sources and their pollutant contributions in the Upper Snake Rock sub basin

POINT SOURCE INDUSTRIES	*TSS*	*BOD5*	*NH3*	*TEMPERATURE*	*PH*	*PATHOGENS*	*NUTRIENTS*	*CHLORINE*	*DO*	*CHEMICALS*	*OIL & GREASE*
Aquaculture Facilities Effluent Discharge	X	Y		X	X		X	Y	X	X	Y

POINT SOURCE INDUSTRIES	TSS	BOD5	NH3	TEMPERATURE	pH	PATHOGENS	NUTRIENTS	CHLORINE	DO	CHEMICALS	OIL & GREASE
Municipalities (POTW) Effluent Discharge	X	X	X	X	X	X	X	X	X		X
Food Processors Effluent Discharge	X	X	X	X	X	X	X				X
Prepared by IDEQ-TFRO. Y = Fish Processors.											

2.3.2.1 FOOD PROCESSORS

Under the conditions of their NPDES permits, food processors are allowed discharges of the following pollutants: BOD_5, total suspended solids, ammonia (as N), temperature, pH, fecal coliform, total phosphorus (as P), dissolved orthophosphate (as P), nitrite+nitrate (as N), and total Kjeldahl nitrogen (as N). A compliance schedule is based on the Mid-Snake TMDL for total phosphorus and requires the food processing industry to meet the final wasteload allocation for total phosphorus over the next five years. In accordance with IDAPA §16.01.02400.03, discharge permits can incorporate compliance schedules which allow a discharger to phase-in compliance with water quality-based effluent limits when new limits are in the permit for the first time. Consistent with *40 CFR 127.47*, the permittee will be required to submit annual reports which document progress towards reaching the final compliance level. IDEQ-TFRO believes that issuance of this permit for allowable discharge of the effluent parameters (at the levels prescribed in the permit) will not adversely affect the bald eagle, the Bliss Rapids snail, or the Ute ladies' tresses. (See the USEPA Fact Sheet and NPDES Permit for permittees 000066-3 (J.R. Simplot) and 000061-2 (McCain's Food) for more information.)

2.3.2.2 MUNICIPALITIES

Under the conditions of their NPDES permits, municipalities are allowed discharges of the following pollutants: BOD_5, total suspended solids, fecal coliform, total residual chlorine, pH, total phosphorus, ammonia (as N), temperature, dissolved oxygen (where applicable), total Kjeldahl nitrogen, and nitrite+nitrate (as N). Like food processors, a compliance schedule is based on the Mid-Snake TMDL for total phosphorus and requires the municipality industry to submit an annual report of progress which outlines the progress made toward reaching the compliance date for total phosphorus effluent limitations, an assessment of the previous year of phosphorus data, and a comparison to final effluent limitations and milestones targeted for the upcoming year. Consistent with *40 CFR 127.47*, the permittee will be required to submit annual reports which document progress towards reaching the final compliance level.

2.3.2.3 AQUACULTURE

Under the conditions of their NPDES permits, aquaculture facilities are allowed discharges of the following pollutants: BOD_5 (applicable to processors only), total phosphorus, pH, temperature, total suspended solids, settleable solids, nutrients, dissolved oxygen, oil and grease (applicable to processors only), and total residual chlorine (applicable to processors only). The Mid-Snake TMDL requires that the final wasteload allocation for total phosphorus be met over the next five years. In accordance with IDAPA §16.01.02.400.03 a compliance schedule is incorporated which allows a discharger to phase-in compliance with water quality-based effluent limits when new limits are in the permit for the first time. Consistent with *40 CFR 122.47*, the permittee is required to submit annual reports which document progress toward reaching the final compliance level. Compliance with total phosphorus concentration limits must be met in the interim. The proposed permit will improve water quality by significantly reducing total phosphorus loads to the Middle Snake River, which will reduce eutrophication.

However, USEPA and USFWS have determined that sediment discharges (either as settleable solids or total suspended solids) from aquaculture facilities, which become anoxic or hypoxic below hatchery outfalls, may adversely affect listed snails. To determine the effects of sediment on aquatic life, USEPA will conduct a study below the largest production aquaculture facilities in receiving waters. Chemicals in discharges from aquaculture facilities may include disease control chemicals, drugs, or disinfectants. Examples include: antibiotics (Romet-30 and terramycin); algicide (copper sulfate); FDA approved drugs (Parasite-S or formalin, potassium permanganate); disinfectants (chlorine, PVP iodine, Hyamine-3500); FDA unapproved drugs (hydrogen peroxide, salt). These compounds are approved by FDA or USEPA or both depending upon the compound for use in aquaculture, and are used in waters containing trout (except chlorine and Hyamine-3500 which are used on equipment and raceways) which is a sensitive aquatic animal. Chemical pollutants could cause acute or chronic toxicity to aquatic life in the receiving stream depending on the load being delivered. Because no data exist to determine the toxicity of these chemicals to aquatic life, including the endangered snails, USEPA and USFWS have determined that for the present time the discharge of chemicals by the aquaculture facilities may adversely affect the listed snails. Data submitted the first year of the permit by facilities should answer questions about toxicity to aquatic life.

2.3.2.4 HYDROELECTRIC IMPOUNDMENTS AND GENERATION

Hydroelectric projects, whether as impoundments or strict generation without impounding the water, do not supply pollutants to the Middle Snake River or its tributaries. By legal definition, they are defined as nonpoint sources. However, as previously discussed in §2.1.3.2 and §2.2.2.4, hydroelectric impoundments have added to the water quality problems of the river in two ways: (1) the river's capacity to process nutrients has been altered to encourage plant growth through nutrient spiraling, and (2) the reservoirs have created large shallows and areas of sediment deposition that are ideal for aquatic weeds. Additionally, diversion for irrigation reduces the amount of flow at Milner Dam and exacerbates the degraded condition in low flow years through agricultural return flows and tributaries which carry much of the nonpoint source pollutants to the Middle Snake River and to tributaries and reservoirs.

Some hydroelectric industrial power generation projects in Upper Snake Rock have NPDES permits that allow discharges with the following effluent characteristics: temperature, and pH. These type of generation projects normally do not impound water, but rather use the resource and discharge for cooling water concerns. As of this writing, a review of these facilities in Upper Snake Rock (at IDEQ-TFRO) indicates that they are complying with their NPDES permits and, thus, discharging in a non-adverse manner.

Hydroelectric industrial power generation impoundment projects in Upper Snake Rock, on the other hand, have FERC permits that allow discharges with the following efflent characteristics: pH, temperature, and dissolved oxygen. As of this writing, the Middle Snake River projects were undergoing relicensing. A review of these facilities indicates that as "run-of-the-river" systems, they are complying with their FERC permits and, thus, discharging in a non-adverse manner. However, under drought or low flow conditions (due to diversion as irrigation), the potential for low dissolved oxygen and high water temperature is possible.

2.3.2.5 NONPOINT SOURCES

Nonpoint source pollutants are more difficult to control because they don't come from clearly identifiable sources such as a pipe. As described in Table 60, grazing, agriculture, CFOs, and recreation, as nonpoint sources, have some level of effect on the various waterbodies listed. The primary pollutants or stressors for nonpoint sources are: sediment, nutrients, bacteria, organic enrichment, ammonia, oil and grease and other chemicals (pesticides), thermal modification, salt, and flow alteration. Table 64 provides a breakdown of pollutants per nonpoint source activity.

TABLE 64 Nonpoint sources and their pollutant contributions in the Upper Snake Rock sub basin

NONPOINT SOURCES	SEDIMENT	NUTRIENTS	PATHOGENS	BOD5	AMMONIA	OIL & GREASE	PESTICIDES	SALT	THERMAL	FLOW
FERC-type operations									X	X
Agriculture (Irrigated, Dryland)	X	X	X	X	X	X	X	X		X
Confined Feeding Operations	X	X	X	X	X	X	X			
Grazing on private ground, USBLM ground, or USFS ground	X	X	X	X	X				X	X
Forestry-type operations	X	X	X	X	X		X		X	X
Recreation	X	X	X	X	X	X				
Urban Areas	X	X	X	X	X	X	X			
Construction Activities	X	X				X			X	X
Nonpoint Source Industrials (such as fresh pack processors)	X	X	X	X	X	X	X	X		
Suburban "non-farms"	X	X	X	X	X		X	X		

Prepared by IDEQ-TFRO. THERMAL = Thermal Modification; FLOW = Flow Alteration, Diversion. The definition of a "farm" is taken from the USDA, Idaho Agricultural Statistics Service: a farm is any operation that produces an agricultural product in a given year of $1000 or more. IDEQ-TFRO chose this definition over that of the Census Bureau, the Internal Revenue Service, or the Farm Bureau since the dictionary definition stipulates that a farm is a tract of land used under one management for cultivating crops or rearing livestock. Grazing and forestry have the potential for thermal modification and flow alteration as a result of destroyed riparian canopy over a waterbody causing the stream to lose its capacity to ground water recharge, eventually modifying the stream from perennial to intermittent. Construction has the potential for thermal modification and flow alteration as a result of stream bank alteration and stream diversion activities. Agriculture has the potential for flow alteration as a consequence of canal or ditch diversions.

Soil science indicates that if sediment is reduced substantially, nutrients, bacteria, and pesticides will likewise be reduced so that their effect is reduced to the water quality, the fauna, and the habitat. "Through the development of best management practices and the enforcement of water quality standards, nonpoint sources of pollution are to be maintained at a minimum, as close as possible to background levels (IDHW 1998)." Nonpoint source pollution management in Idaho is a process for protecting designated beneficial uses and ambient water quality through the implementation of best management practices (BMPs), which should be designed, implemented, and maintained to provide full protection or maintenance of beneficial uses. As part of this process, the Idaho Nonpoint Source Management Program and the Coordinated Nonpoint Source

Water Quality Monitoring Program for Idaho were developed under the requirements of Section 319 of the Clean Water Act. The Nonpoint Source Management Program is based on the concept of a feedback loop where BMPs are identified through a planning process and applied by land managers to site-specific conditions. The effectiveness of the BMPs in protecting water quality is evaluated through instream water quality monitoring and BMPs monitoring. Ineffective BMPs are required to be replaced.

CATTLE AND CALVES

The tri-county area (Gooding, Jerome, Twin Falls) estimated number of cattle and calves and their manure output is summarized in Table 65 for 1990 through 1998 for total number of 1,000 pound live animals, manure output (tons/day), total solids output (tons/day), total nitrogen output (tons/day), and total phosphorus output (tons/day). As can be seen the number of dairy animals has increased by 2.6 times (162,000/62,000=2.6) for the period described. Beef animals have decreased by 0.8 times (50,500/62,000=0.8). And, "other" animals (cow-calf operations) have increased by 1.4 times (185,000/137,000=1.4). As a whole, the total number of cattle increased by 1.5 times (397500/261000 = 1.5). Although the number of animals along with their generated manure may be estimated on an annual basis, an estimate of the amount that is discharged to rivers and streams is unknown since it is assumed that all manure is land applied at proper agronomic rates. The CFO industry is committed to "zero discharge" for nutrients and sediment.

TABLE 65 Tri-county area cattle and calves: Gooding, Jerome, and Twin Falls counties

YEAR	BEEF	DAIRY	OTHER	TOTAL
TOTAL NUMBER OF 1000 lb LIVE ANIMALS				
1990	62000	62000	137000	261000
1991	58800	72000	146200	277000
1992	60600	75000	162400	298000
1993	53000	85000	164000	302000
1994	50500	92500	173500	316500
1995	51000	115000	189000	355000
1996	52500	133500	190000	376000
1997	50500	149000	182500	382000
1998	50500	162000	185000	397500
MANURE OUTPUT (tons/day)				
1990	1992.0	2635.0	3842.9	8399.9
1991	1822.8	3060.0	4100.9	8983.7
1992	1878.6	3187.5	4555.3	9621.4
1993	1643.0	3612.5	4600.2	9855.7
1994	1565.5	3931.3	4866.7	10363.4
1995	1581.0	4887.5	5301.5	11770.0
1996	1627.5	5673.8	5329.5	12630.8

YEAR	BEEF	DAIRY	OTHER	TOTAL
1997	1565.5	6332.5	5119.1	13017.1
1998	1565.5	6885.0	5189.3	13639.8
TOTAL SOLIDS OUTPUT (tons/day)				
1990	275.9	288.3	417.9	982.1
1991	261.7	334.8	445.9	1042.4
1992	269.7	348.8	495.3	1113.7
1993	235.9	395.3	500.2	1131.3
1994	224.7	430.1	529.2	1184.0
1995	227.0	534.8	576.5	1338.2
1996	233.6	620.8	579.5	1433.9
1997	224.7	692.9	556.6	1474.2
1998	224.7	753.3	564.3	1542.3
TOTAL NITROGEN OUTPUT (tons/day)				
1990	13.3	11.5	16.4	41.2
1991	12.6	13.3	17.5	43.5
1992	13.0	13.9	19.5	46.4
1993	11.4	15.7	19.7	46.8
1994	10.9	17.1	20.8	48.8
1995	11.0	21.3	22.7	54.9
1996	11.3	24.7	22.8	58.8
1997	10.9	27.6	21.9	60.3
1998	10.9	30.0	22.2	63.0
TOTAL PHOSPHORUS OUTPUT (tons/day)				
1990	2.8	2.1	3.2	8.1
1991	2.6	2.5	3.4	8.5
1992	2.7	2.6	3.7	9.0
1993	2.4	2.9	3.8	9.1
1994	2.3	3.2	4.0	9.5
1995	2.3	4.0	4.3	10.6
1996	2.4	4.6	4.4	11.3
1997	2.3	5.1	4.2	11.6

YEAR	BEEF	DAIRY	OTHER	TOTAL
1998	2.3	5.6	4.3	12.1

Prepared by IDEQ-TFRO. Number of animals derived from the Idaho Agricultural Statistics Service. Output values for manure, total solids, total nitrogen, and total phosphorus from the *Idaho Waste Management Guidelines for Confined Feeding Operations* (IDHW 1993c) and *Livestock Waste Facilities Handbook* (Mid-West Plan Service 1985). "Other" animals represents cow-calf operations and is a conservative estimate.

As previously referenced in §2.3.1, IDEQ-TFRO has inventoried 779 CFOs (dairies, feedlots, cow-calf operations) in the tri-county are: 309 in Twin Falls County, 258 in Gooding County, and 212 in Jerome County. Of these, 122 dairies are in Twin Falls County, 126 dairies are in Gooding County, and 92 dairies are in Jerome County, or a total of 340 dairies in Upper Snake Rock. Because no factual information is available to describe the percent of CFO discharge to rivers and/or streams, and because the CFO industry claims "zero discharge," it is assumed at this time that the majority of generated manure is contained and does not discharge to receiving streams or rivers. However, it should be stated that a major portion of this generated manure is land applied throughout Upper Snake Rock at supposed proper agronomic rates. Where those agronomic rates have been exceeded, and where the potential for erosion and water runoff is great, discharge to rivers and streams is very possible. Thus, agricultural runoff, including nutrients from animal waste, may be a large contributor to pollution of the rivers and streams that are identified as "impaired" (Harkin 1998).

SHEEP AND LAMBS

The tri-county area (Gooding, Jerome, Twin Falls) estimated number of sheep and lambs (head) and their manure output is summarized in Table 66 for 1990 through 1998 for total number of 100 pound live animals, manure output (tons/day), total solids output (tons/day), total nitrogen output (tons/day), and total phosphorus output (tons/day). As can be seen, the total number of live animals has increased and decreased dramatically such that a comparison of 1998 to 1990 indicates that the total number has stayed about the same.

TABLE 66 Tri-county area sheep and lambs (head): Gooding, Jerome, and Twin Falls counties

YEAR	GOODING	JEROME	TWIN FALLS	TOTAL	MANURE OUTPUT	TOTAL SOLIDS	TOTAL N	TOTAL P
1990	19000	14000	16000	49000	882.0	232.8	9.8	1.8
1991	16500	11000	15500	43000	774.0	204.3	8.6	1.6
1992	27500	11000	15500	54000	972.0	256.5	10.8	2.0
1993	20500	10500	11000	42000	756.0	199.5	8.4	1.6
1994	18500	8000	10500	37000	666.0	175.8	7.4	1.4
1995	19000	8700	10500	38200	687.6	181.5	7.6	1.4
1996	20000	10900	12900	43800	788.4	208.1	8.8	1.6
1997	25000	8000	14800	47800	860.4	227.1	9.6	1.8
1998	27000	8000	14800	49800	896.4	236.6	10.0	1.9
			MEAN =	44956	809.2	213.5	9.0	1.7

Prepared by IDEQ-TFRO. Number of animals derived from the Idaho Agricultural Statistics Service. Output values for manure, total solids, total nitrogen, and total phosphorus from the *Idaho Waste Management Guidelines for Confined Feeding Operations* (IDHW 1993c) and *Livestock Waste Facilities Handbook* (Mid-West Plan Service 1985).

WATERFOWL

As previously noted in §2.1.4.3, as many as half million ducks migrate through the Snake River Canyon each winter, primarily between the Hagerman Wildlife Management Area and the Minidoka National Wildlife Refuge (*FERC, 1997*). Mid-winter waterfowl counts done by IDFG are summarized in Table 67 for the Hagerman Wildlife Management Area (WMA) and the Middle Snake River from 1990 to 1998. Additional information going back to 1954 is available for the Middle Snake River, and to 1971 for the Hagerman Wildlife Management Area. These represent the best available information on waterfowl counts in the Upper Snake Rock for effects on the Middle Snake River. Affects to tributaries is unknown at this time due to lack of information. Overall, it may be concluded that ducks account for the greatest source of waterfowl pollutants to the Middle Snake River, when compared to geese and swans.

TABLE 67 Mid-winter waterfowl count summary for 1990-1998

YEAR	HAGERMAN WMA				MIDDLE SNAKE RIVER				TOTAL			
	Ducks	Geese	Swans	Total	Ducks	Geese	Swans	Total	Ducks	Geese	Swans	TOTAL
1990	46731	3427	0	50158	24610	3208	0	27818	71341	6635	0	77976
1991	19280	1138	0	20418	20390	2096	153	22639	39670	3234	153	43057
1992	13758	4117	0	17875	54509	8526	43	63078	68267	12697	43	81007
1993	19703	298	0	20001	45456	5917	32	51405	65159	6215	32	71406
1994	55652	1686	3	57341	41170	12957	15	54142	96822	14643	18	111483
1995	58993	2794	0	61787	27007	5088	17	32112	86000	7882	17	93899
1996	7545	98	0	7643	16452	8976	21	25449	23997	9074	21	33092
1997	12344	4014	2	16360	9662	8064	3	17729	22006	12078	5	34089
1998	35614	3861	0	39475	19853	10111	6	29970	55467	13972	6	69445
MEAN	29958	2381	1	32340	28790	7216	32	36038	58748	9603	33	68384
Prepared by IDEQ-TFRO. Values provided by IDFG-Jerome. Mean values calculated by IDEQ for 1990-1998 as a 9-year mean.												

The data indicate that ducks represent 92.6% of the total waterfowl counted in the Hagerman WMA and 79.9% of the total waterfowl counted in the Middle Snake River, or 85.9% overall of the total waterfowl counted as a 9-year average. Table 68 shows the pollutant loadings (in lbs/day) for total solids output, N, and P.

TABLE 68 Estimated waterfowl total loadings to the Middle Snake River system

YEAR	TOTAL NUMBERS, count				TOTAL GENERATED OUTPUT FOR ALL WATERFOWL, lbs/day			
	Ducks	Geese	Swans	TOTAL	Total Solids*	Total Volatile Solids	Total N as N	Total P as P
1990	71341	6635	0	77976	1176.1	1226.9	120.1	52.5
1991	39670	3234	153	43057	645.6	673.4	66.0	28.8
1992	68267	12697	43	81007	1303.1	1359.3	133.1	58.1
1993	65159	6215	32	71406	1079.4	1126.0	110.3	48.1
1994	96822	14643	18	111483	1753.4	1829.1	179.1	78.2

YEAR	TOTAL NUMBERS, count				TOTAL GENERATED OUTPUT FOR ALL WATERFOWL, lbs/day			
	Ducks	Geese	Swans	TOTAL	Total Solids*	Total Volatile Solids	Total N as N	Total P as P
1995	86000	7882	17	93899	1415.0	1476.1	144.6	63.1
1996	23997	9074	21	33092	586.4	611.7	59.9	26.2
1997	22006	12078	5	34089	641.8	669.5	65.6	28.6
1998	55467	13972	6	69445	1159.8	1209.6	118.5	51.7
MEAN	58748	9603	33	68384	1084.5	1131.3	110.8	48.4

Prepared by IDEQ-TFRO. Ducks based on production figures per 1000 ducks and assuming an average weight of 4 pounds per duck on swim water. The ducks Total Solids based on total suspended solids as 13.9 lb/day/1000 ducks; 14.5 lb volatile solids/day/1000 ducks; 1.42 lb nitrogen/day/1000 ducks; and, 0.62 lb phosphorus/day/1000 ducks (*IDHW 1993c [p. 71]*). Geese and swans were estimated at twice the rate as ducks, since little research has been done in this area. Therefore: total solids = 27.8 lb/day/1000 geese or swan; volatile solids = 29.0 lb volatile solids/day/1000 geese and swan; nitrogen = 2.84 lb/day/1000 geese and swan; and, phosphorus = 1.24 lb/day/1000 geese and swan. Total Generated Output for all waterfowl was determined by summing the output values for ducks, geese, and swans.

HUMAN POPULATION

The tri-county area (Gooding, Jerome, Twin Falls) estimated number of human population and their manure output is summarized in Table 69 for 1990 through 2010 for total number of people, manure output (tons/day), total solids output (tons/day), total nitrogen output (tons/day), and total phosphorus output (tons/day). As can be seen, the total number of human population is expected to increase from 1990 to 2010 by 1.1 times (89574/80351=1.1). These loads are generally accounted for by the various municipalities as urban loadings with the exception of those rural and localized urban areas that are not hooked up to a sewage system, but rather to independent septic systems. See §2.2.3.7 for septic tank system estimates on a per county basis.

TABLE 69 Tri-county human population: Gooding, Jerome, and Twin Falls counties

YEAR	POPULATION	MANURE OUTPUT	TOTAL SOLIDS OUTPUT	TOTAL N OUTPUT	TOTAL P OUTPUT
1990	80351	1253.5	136.6	8.0	1.0
1991	80812	1260.7	137.4	8.1	1.0
1992	81273	1267.9	138.2	8.1	1.0
1993	81734	1275.1	138.9	8.2	1.0
1994	82195	1282.2	139.7	8.2	1.0
1995	82656	1289.4	140.5	8.3	1.0
1996	83117	1296.6	141.3	8.3	1.0
1997	83578	1303.8	142.1	8.4	1.0
1998	84039	1311.0	142.9	8.4	1.0
2010	89574	1397.4	152.3	9.0	1.1
1990-1998 MEAN	82281	1282.3	139.7	8.2	1.0

Prepared by IDEQ-TFRO. Population estimates based on Idaho Department of Commerce 1993 report as land use values in number of persons. Manure and pollutant estimates based on *Idaho Waste Management Guidelines for Confined Feeding Operations* (IDHW 1993c). Manure output estimates based on interpolation of yearly estimates over a 20-year period from 1990 to 2010.

Comparison analysis of manure output of the human population versus cattle and calves, and sheep and lambs, is shown in Table 70. As can be seen, waterfowl provide the least (although most direct because their discharge is directly into the stream) "pollutant outputs," followed by human, sheep and lambs, and finally cattle and calves (which indirectly discharge).

TABLE 70 Comparison of 9-year means per species of animal or human

ANIMAL SPECIES	*TOTAL SOLIDS tons/day*	*TOTAL N tons/day*	*TOTAL P tons/day*
Cattle and Calves	1249.1	51.5	10.0
Sheep and Lambs	213.5	9.0	1.7
Ducks, Geese, and Swans	0.5423	0.0554	0.0242
Human	139.7	8.2	1.0
Prepared by IDEQ-TFRO.			

One particular item that has given the public a misunderstanding of the effects from waterfowl, is the Total P (TP) output from their manure and its effect on the TP concentration in a stream. Based on Tables 67 and 68, the TP load (tons/day) is 0.0242 (see Table 70) or 48.4 lbs/day (0.0242 tons/day x 2,000 lbs/ton = 48.4 lbs/day). If this load were completely watersoluble, and, if it was discharged directly to a stream at any one time, then, Table 71 shows what the TP concentration levels would be in the stream (assuming proper mixing at various stream flows without taking into account disturbances in the streamload by the animal). Table 71 shows that on an average basis waterfowl provide "background" (0.0051 mg/L or less) since they are at the method detection level (MDL) of 0.0050 mg/L TP (based on USEPA Test Method 365.4, Storet No. 00665).

TABLE 71 Estimated TP concentrations at various flows from various direct waterfowl inputs

FLOW, cfs	*TP, mg/L*	*TP LOAD, lbs/day*
500	0.0180	48.4
1,000	0.0090	48.4
5,000	0.0018	48.4
10,000	0.0009	48.4
15,000	0.0006	48.4
20,000	0.0004	48.4
MEAN	0.0051	48.4

Prepared by IDEQ-TFRO. Concentration (mg/L) = Load (lbs/day) / [(Flow, cfs) x (5.39)]. When discussing nutrient loading from waterfowl a large portion of the load attributed to waterfowl is materials re-suspended within the water column. As waterfowl forage on macroinvertebrates and aquatic vegetation, sediments and plant materials are disturbed and intrained within the water column. This theoretically improves assimilation of the in-stream nutrients and sediment loads. Interactions between waterfowl and nutrient processing dynamics are not well understood or documented. Input from wild waterfowl should be considered part of the "natural background load." One problem to be noted in thecalculation of estimated TP concentrations at various flows is the assumption that the number of waterfowl within the sub basin is constant over any year. IDFG counts are from January mid-winter waterfowl counts. IDFG inventories waterfowl along the Snake River annually during this timeframe because that's the peak of waterfowl migration along the U.S./Canada flyway into the Mid-Snake River area. Waterfowl from the flyway probably spend two months or less within the Mid-Snake Reach. Resident waterfowl population numbers are several magnitudes less than the January counts.

2.3.3 GROUND WATER CONCERNS

"A combination of natural and man-made factors determine the potential for ground water contamination within a given area. Natural factors, attributable to climate and geologic history, include the thickness and nature of the unsaturated zone, depth to ground water, and ground water movement. Qualitative measures of some combination of natural factors is often called 'hydrogeologic susceptibility.' Man-induced factors include water withdrawal, wastewater disposal, hazardous material handling and disposal practices, and other land use practices. Qualitative evaluation of man-induced factors combined with hydrogeologic susceptibility is often termed 'ground water vulnerability' or 'potential for contamination' (USEPA 1990)." Within the Eastern Snake River Plain, the aquifer supplies 100% of the drinking water consumed. Further, no alternative source or combination of sources can economically supply all those who obtain drinking water from the Eastern Snake River Aquifer. Therefore, the Eastern Snake River Plain Aquifer has the potential for contamination based on the following:

1. Hydrogeologic susceptibility varies considerably within the Eastern Snake River Plain. Significant differences in the thickness and nature of the unsaturated root zone accounts for much of the variation. Areas where fractured basalt crops out at the land surface are more susceptible to ground water contamination than areas where thick deposits of clay rich soil provide a degree of natural protection.

2. Some practices, such as the use of injection wells or inadvertent use of leaking underground storage tanks, partly or entirely override whatever degree of natural protection is afforded by the unsaturated zone. This is of particular concern in the Eastern Snake River Plain because of the widespread use of drain wells (Class V injection wells) to dispose of excess irrigation water, urban storm runoff, and onsite sewage system effluent. In the Upper Snake Rock subbasin Table 72 summarizes the underground storage tanks in the tri-county area (Gooding, Jerome, Twin Falls counties) and the leaking underground storage tanks. Most of the tanks have the ability to impact groundwater.

TABLE 72 Summary of underground and leaking storage tanks in the Upper Snake Rock sub basin

CITY	*TOTAL*	*CLOSED*	*ACTIVE*	*LEAKING*
GOODING COUNTY				
Bliss	10	9	1	3
Gooding	27	15	12	9
Hagerman	16	10	6	3
Wendell	13	7	6	5
			ACTIVE + LEAKING TANKS =	45
JEROME COUNTY				
Eden	10	7	3	1
Hazelton	16	9	7	3
Jerome	56	35	21	21
			ACTIVE + LEAKING TANKS =	56

CITY	TOTAL	CLOSED	ACTIVE	LEAKING
TWIN FALLS COUNTY				
Buhl	29	18	11	7
Castleford	2	2	0	0
Filer	17	11	6	2
Hansen	13	9	4	1
Hollister	1	1	0	1
Kimberly	22	17	5	3
Murtaugh	17	10	7	4
Rogerson	3	1	2	0
Twin Falls	210	147	63	49
ACTIVE + LEAKING TANKS =				165
TRI-COUNTY GRAND TOTAL =				266
Prepare by IDEQ-TFRO. Data compiled annually as of February 1998 by IDEQ-Central Office. It should be noted that the table reflects only the regulated underground storage tanks. Heating oil tanks, farm or residential tanks less than 1100 gallons are not UST regulated.				

As of this writing, the IDWR estimates that in the tri-county area there are approximately 215 injection wells: 57 in Jerome County, 107 in Gooding County, and 51 in Twin Falls County. These represent the active wells only and not the ones that have been capped.

3. Plumes of dissolved contaminants within the basalt tend to spread laterally, in the direction of ground water flow, within zones of high hydraulic conductivity. Interflow zones of fine grained sediment may almost entirely prevent vertical migration on a local scale.

4. Open-hole well construction is a common practice in the Eastern Snake River Plain which may have ground water quality impacts. When much of the borehole is uncased, water can mingle freely between producing zones. This could be a significant concern wherever hydraulic head relationships are such that a stratigraphic interval of poor quality water could contaminate zones of high quality water.

5. IDEQ has ranked most known and potential sources of ground water contamination (statewide) on the basis of human health risk. From greatest risk to least risk, the ranking is as follows: petroleum handling and storage; feedlots and dairies; landfills and hazardous waste sites; land application of wastewater hazardous material handling; pesticide handling and use; land spreading of sludge and solid or liquid septic tank pumpage; surface runoff; pits, ponds and lagoons; radioactive substances; fertilizer application; septic tank systems; mining, including oil and gas drilling; wells (injection, geothermal, and domestic); and forestry practices.

Tables 73, 74, and 75 are purposely excluded due to additional information that was unavailable at the time of finalization of this document. That information will added at a later time.

3.0 TMDL DEVELOPMENT: STREAM CORRIDOR, SYNERGISMS, EVALUATION & ASSESSMENT

31 water quality limited stream segments are identified in the Upper Snake Rock subbasin, and are listed in the 1996 303(d) list for a variety of pollutants, inclusive of sediment, nutrients (phosphorus and nitrogen), dissolved oxygen, ammonia, pathogens, pesticides, temperature, oil and grease, and flow alteration. Individually, a stream segment may be listed for at least one of these pollutants or a combination of them. Although 303(d) listed streams have high priority in pollution reduction management strategies, all waterbodies (tributaries and irrigation return flows) were identified and considered in the overall TMDL as a consequence of accumulative effect. Where streams or waterbodies are meeting the proposed targets, "the existing instream beneficial uses of each waterbody and the level of water quality necessary to protect those uses shall be maintained and protected (Idaho Code 39-3603)." Once the Upper Snake Rock TMDL is approved by USEPA, the TMDL will be adopted as part of the State's water quality management plan such that the provisions of the TMDL shall be enforced through normal enforcement practices of IDEQ and other designated agencies (for BMPs) as set forth in the State's water quality management plan (Idaho Code 39-3612).

3.0.1 ORGANIZATION OF STREAMS INTO WATERSHEDS, COMPLEXES, AND STREAM CORRIDORS

Allocation of loadings was considered on a 5th field HUC (watershed) basis for each water quality limited stream segment. Where one watershed was involved, the HUC was called a watershed. Where more than one watershed was involved, the HUC was called a complex. This process allows for responsible land managing agencies to readily assist in resolving pollution problems on a watershed/complex basis, particularly in defining critical acres that directly impact the waterbody. Table 76 describes the organization of streams into watersheds and complexes.

Table 76 Organization of 1996 water quality stream segments of Upper Snake Rock

Watershed/Complex	*5th Field Watersheds Involved*	*Stream Segments Involved*
Shoshone Falls Watershed	Shoshone Falls	Alpheus Creek
Billingsley Creek Watershed	Hagerman	Billingsley Creek, Riley Creek
Box Canyon Complex	Wendell,Wendell South,Jerome	Blind Canyon Creek, Clear Springs, Thousand Springs Creek
Clover Creek Complex	Lower Clover Creek, Dry Creek, Upper Clover Creek, Calf-Clover	Clover Creek
Dry Creek Complex	Lake Murtaugh, Lower Dry Creek, Dry Creek	Dry Creek (three segments)
Rock Creek Complex	Upper Rock Creek, Rock Creek, North Cottonwood-McMullen, Hub Butte, Lower Rock Creek	Rock Creek, Cottonwood Creek, McMullen Creek
Cedar Draw Complex	Canyon, Hollister, Filer	Crystal Springs
Middle Snake River Corridor	5th Field HUCs boundarying the Middle Snake River and reservoirs	Middle Snake River & associated reservoirs
Prepared by IDEQ-TFRO. Reservoirs were grouped with Middle Snake River System segments as part of the river system. 5th Field HUC names based on 1998 USGS-GIS coverages		

3.0.2 THE STREAM CORRIDOR APPROACH MODEL

Recognizing that stream ecosystems may be disrupted by a variety of processes, such as water diversion, impoundment and flow regulation, channel alteration, destruction of riparian habitat, soil erosion (especially from outside the stream/riparian corridor), and cumulative impacts; and, recognizing that within any subbasin or watershed the effect on any water quality limited stream segment is dependent on soil, slope, topography, rainfall, etc.; each stream was reviewed for the development of a stream corridor that focused on the stream channel, the flood plain, and a portion of the transitional upland fringe. Stream corridors are complex ecosystems that perform a number of ecological functions amongst which is removing harmful materials from the water and supporting a higher level of species diversity, species density, and rates of biological productivity than most other landscape elements. "Over the years, human activities have contributed to changes in the dynamic equilibrium of stream corridors. These activities center on manipulating stream corridor systems for a wide variety of purposes, including domestic and industrial water supplies, irrigation, transportation, hydropower, waste disposal, mining, flood control, timber management, recreation, aesthetics, and fish and wildlife. Increases in human population and industrial, commercial, and residential development place heavy demands on stream corridors (USDA, USEPA, USBLM, *et al.* 1998 [p 1-2])." "The cumulative effects of these activities result in significant changes, not only to stream corridors, but also to the ecosystems of which they are a part. These changes include degradation of water quality, decreased water storage and conveyance capacity, loss of habitat for recreational and aesthetics value (National Research Council 1992)."

For purposes of allocating loads to nonpoint sources, and taking into account that upland disturbances may not necessarily directly affect the delivery of pollution to a stream, a "stream corridor" of 2 miles wide was used as a reasonable preliminary approach such that the greatest impact to any stream would be coming from this 2 mile transect (1 mile per side of stream). Various sources indicate that riparian areas which are found within the stream corridor and are beneficial for wildlife and domesticated animals are usually too small and narrow, but should have a range greater than 0.5 miles but less than 5.0 miles (Kindschy et al. 1982; Van Dyke et al. 1983; Platts 1990; USDA, USEPA, USBLM, *et al.* 1998). A one-mile per side of stream seemed a reasonable preliminary approach to use. The stream corridor approach model will be used for the allocation of loads on those streams where nonpoint source streams where the allocation of nonpoint source to various industries will be managed by land use. IDEQ-TFRO recognizes that land use is the predominant nonpoint stressor on any watershed. On waterbodies where there wass an absence of water quality information (TSS and TP concentrations), a regional mean estimate developed by IDEQ-TFRO (specifically for the Upper Snake Rock subbasin) was used. See Appendix D, §B. Regional mean estimates were based on the Phase 1 Study and/or IDEQ-TFRO compiled data and are meant only for use in the allocation of load estimates in the Upper Snake Rock subbasin. They are not meant as estimates for use outside of the subbasin load allocation.

REGIONAL MEAN WATER QUALITY ESTIMATES

WATERBODY	TSS, mg/L	TP, mg/L
Springs	1.3	0.020
Natural tributaries	35.7	0.117[1]
Agricultural drains	102.0	0.245[2]
Aquaculture facilities	2.0[3]	0.110[4]
Middle Snake River	NA	0.113

In general the regional mean estimates developed using the Phase 1 Study and/or IDEQ-TFRO compiled data.

1. 0.117 mg/L TP is the overall average of two regional mean estimates: 0.120 mg/L TP for streams on the north side of the Middle Snake River, and 0.156 mg/L TP for streams on the south side of the Middle Snake River.
2. 0.245 mg/L TP is the overall average of two regionl mean estimates: 0.165 mg/L

TP for drains on the north side of the Middle Snake River, and 0.298 mg/L TP for drains on the south side of the Middle Snake River.
3. 2.0 mg/L TP is ½ the MDL (4 mg/L TSS) as reported in the DMRs for aquaculture facilities.
4. 0.110 mg/L TP is the overall average of cold water facilities from the Phase 1 Study.

To derive a stream corridor approach model, an ArcView GIS map was constructed and defined on a land use basis. ArcView is a computer operator program for the ArcInfo system, which is a GIS program that has coverages provided by such agences/organizations as IDEQ, IDWR, USGS, USEPA, NRCS, USBLM, USFS, IASCD, and etc. Within the ArcView coverage a theme is developed with its associated land use and database file. Initially a stream is designated via ArcView with its buffer zone. The Create Buffer function allows ArcView to develop a 1 mile characteristic on each side of the selected stream reach of which land use is one of the characteristics. The result is a shape file with its associated buffer zone on the stream reach. The shape file is used as a template to clip the appropriate land use out of the theme. The result is a new shape file with an associated database. This database is reviewed and summarized by feature (rangeland, agriculture, riparian area, etc.). The result is a consolidation of each type of land use within the buffer zone. Then, a percentage of the features is derived by calculating the total acres within the buffer zone using the Database Editor. A distancing function determines the approximate distance of the stream in meters or miles. The result is another theme which has the percentage of the feature (land use) which becomes the % land use within the buffer zone. This % land use is then applied for nonpoint source load allocation. Table 99 in §3.3.8 provides a summary of the stream corridor approach model on various waterbodies. As an example, the Rock Creek Complex (see §3.3.7 and 3.3.8) is comprised of five 5th field HUCs which total 308.61 square miles (197,510.4 acres) and have a total land use of 5.09% forest, 35.11%, 52.24% rangeland, and 7.53% urban. Applying the stream corridor approach model to Rock Creek (from Rock Creek town to the Middle Snake River) derives an buffer zone that is 46.76 square miles (29,926.4 acres) with land use features that are 84.5% agriculture, 1.8% rangeland, 2.4% riparian area, and 11.4% other (which may include urban). The buffer zone becomes the allocation operator for calculating loads. Table 101 in §3.5.2 based on known information says that Rock Creek discharges 14,363.6 tons/year as TSS. After subtracting out the aquaculture point source TSS inputs (these total 187.2 tons/year for 8 facilities) the total nonpoint source allocation to Rock Creek is 14,176.4 tons/year. This total allocation value is prorated (distributed proportionally) according to the land use percentages within the buffer zone. Therefore, 84.5% agriculture prorates to 11,979.1 tons/year (14,176.4 tons/year x 0.845), 1.8% rangeland prorates to 255.2 tons/year (14,176.4 tons/year x 0.018), 2.4% riparian area prorates to 340.2 tons/year (14,176.4 tons/year x 0.024), and 11.4% "other" prorates to 1,616.1 tons/year. During the implementation phase of the TMDL, it is expected that nonpoint source land management agencies would provide water quality plans that get at reductions by defining natural background (if applicable) and actual land use impacts that link to the parameter and which will be reduced to beneficial use status (which for TSS is interpreted as the 52 mg/L TSS instream target).

For purposes of focusing on the water quality limited stream segments, the stream corridor model was used in a phased-approach for preliminary identification of critical acres in water quality limited streams for pursuit of logistic funding by land management agencies for implementation of BMPs. Land management agencies include: Idaho Soil Conservation Commission for grazing and crop production from irrigated and nonirrigated lands, the Idaho Department of Lands and the Board of Land Commissioners for silviculture and mining, Idaho Department of Transportation for construction sites, Idaho Department of Health and Welfare—District Health for septic tank disposal fields, and the Idaho Department of Agriculture for "other NPDES activities" (Idaho Code §39-3602; IDAPA 16.01.02.350.03). For grazing, Executive Order §98-09 (Allotment Management Plan on Public Lands) allows the Idaho Department of Agriculture through a memorandum of understanding with USFS, USBLM, and University of Idaho to develop, implement, and revise allotment management plans.

Additionally, the USFS and the USBLM in conjunction with the USEPA have developed protocols for addressing water quality limited stream segments "to protect and restore the quality of public waters under their jurisdiction (USFS, USBLM, and USEPA 1999 [p 1])."

An additional criteria that was considered in the stream corridor approach model is slope. Slope and/or slope factors define the transport portion of the erosion process. Slope gradient and slope length influence the flow and velocity of runoff. Soil loss is affected by both length and steepness of slope. These factors affect the capability of runoff to detach and transport soil material. For purposes of the stream corridor approach model, it was determined from professional conversations with the Idaho Soil Conservation Commission and the Twin Falls NRCS group, that slopes from 0 to 10% were more easily adaptable to the stream corridor approach model. This slope range supports Austrialian research that 7° slope is the minimum level at which erosion occurs (See www.bhp.com.au/scienceawards/sawards97/ atwhat.htm). A review of the slopes of the water quality limited stream segments under the stream corridor model/approach indicates that the model could be used since a major portion (about 81.7%) of the slopes fall in the range of 0-10%. This review and assessment is summarized in Table 77.

Table 77 % Slope of water quality limited stream segments in Upper Snake Rock

Watershed/Complex	*Total Area acres*	*% Slope* 0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	> 50
Shoshone Falls (Alpheus Creek)	2,395.59	75.61	8.65	5.78	5.44	3.74	0.65
Rock Creek Complex	29,917.82	95.57	2.70	0.75	0.55	0.39	0.05
Cottonwood Creek	9,728.14	97.43	2.52	0.04	0	0	0
McMullen Creek	20,940.52	65.71	24.28	8.97	1.04	0	0
Billingsley Creek	10,104.19	89.76	8.51	1.38	0.07	0	0
Clear Springs	2,938.29	87.24	11.05	1.66	0.04	0	0
Blind Canyon Creek	2,811.72	83.12	11.68	4.63	0.49	0.05	0.02
Thousand Springs Creek	2,331.47	85.59	7.99	5.11	1.19	0.11	0
Cedar Draw (Crystal Springs)	2,191.73	81.15	6.19	6.16	5.75	0.72	0
Clover Creek	11,060.21	83.89	12.12	8.26	1.86	0.02	0
Dry Creek: Medley Creek	17,933.70	77.73	12.12	8.26	1.86	0.02	0
Dry Creek: West Fork	9,589.34	55.60	26.09	15.53	2.75	0	0
Middle Snake River Corridor	113,888.91	83.12	9.73	4.32	1.80	0.78	0.23
Upper Snake Rock: water quality limited stream segments (mean)		81.66	11.05	5.45	1.76	0.45	0.07

Prepared by IDEQ-TFRO. % Slope should not be construed as indicating identification of critical acres. Rather, the use of % Slope was to demonstrate the useability of the stream corridor approach model to land that covered slopes of 0 to 10%. Identification of critical acres will be decided by the land management agency during the implementation phase of the TMDL. Mean base on N=13 water quality limited stream watersheds/complexes.

3.0.3 EVALUATION AND ASSESSMENT OF 303(D) STREAMS AND POLLUTANTS

This section provides an evaluation and assessment of those streams in the Upper Snake Rock subbasin and their pollutants which should be "de-listed" from the 303(d) list as a steam or pollutant. Two approaches are used: (1) the BURP assessment process which identifies the stream as meeting its beneficial uses, or (2) best professional judgement using water quality data that describes the listed pollutants as meeting water quality standards for a specific beneficial use.

A. EVALUATION OF STREAMS BASED ON BURP ASSESSMENT

Two streams are proposed for "de-listing" based on BURP: Ellison Creek (approximately 0.27 stream miles) and Vinyard Creek (approximately 0.44 stream miles). These are water bodies that BURP has determined meet their beneficial uses and as such should be removed from the 303(d) list. The following tables (78, 79, and 80) summarize the BURP analysis that supports de-listing of these streams.

Table 78 BURP site locations of Ellison and Vinyard Creeks

Tributary	Site No.	Latitude	Longitude	Township/Range/Section
Ellison Creek	95A02	42°38'10.00"	114°33'20.00"	T 09S R 16E S 15
Vinyard Creek	93021	-	-	-
Vinyard Creek	1991-1992	-	-	-
Prepared by IDEQ-TFRO.				

Table 79 Selected stream characteristics from IDEQ-TFRO methodology

WATEBODY NAME	SITE I.D.	FLOW cfs	VALLEY TYPE	SINUOSITY	% FINES	EMBEDDEDNESS	BANK VEGETA	LOWER BANK	ROSGEN TYPE
Ellison Creek	95A02	2.63	VS	Low	31	17	10	10	A
Vinyard Creek	93021	16.30	-	-	11	0-5	10	14	-
Vinyard Creek	1991-92	-	-	-	-	-	-	-	-
Prepared by IDEQ-TFRO. See Table 37 for explanations on ranges. I.D. = Identification.									

Table 80 Bioassessment of BURP data of Ellison and Vinyard Creeks

NAME	SITE	IDEQ MULTIMETRIC INDICES							MBI	HI	SITE SUP STAT	OVER SUP STAT
		HBI	EPT	%E	TAX	%SC	%D	SHW				
Ellison Creek	95A02	0.73	0.47	0.38	0.74	0.47	0.93	0.87	4.578	119	FS	FS
Vinyard Creek	93021	-	-	-	-	-	-	-	-	-	Optimal	FS
Vinyard Creek	91-92	-	-	-	-	-	-	-	3.241	-	FS	

Prepared by IDEQ-TFRO. See Table 39 for abbreviations. HBI =Hilsenhoff Biotic Index; EPT = Ephemeroptera, Plecoptera, and Trichoptera; %E = % EPT; TAX = Taxa Richness; %SC = % Scrapers; %D = % Dominance; SHW = Shannon's H'Diversity Index; MBI = Macroinvertebrate Biotic Index; HI = Habitat Index; Sup Stat = Support Status; Over = Overall.

3.0.2.1 ELLISON CREEK

Table 79 indicates % fines for Ellison Creek are 31, which is in the marginal range. However, since this level of % fines is in a spring-fed creek, the % fines are within acceptable levels. Embeddedness is 17 which is in the optimal range. The creek has a bank vegetation protection score of 10 which is optimal, and it has a lower bank stability score of 10 which is optimal. Table 80 shows a Macroinvertebrate Biotic Index (MBI) score > 3.50, which indicates the water body is Fully Supporting (FS) its beneficial uses, and a Habitat Index (HI) score > 66 which indicates the habitat is not impaired. The site and overall support status is Full Support (FS) and should be de-listed from the 303(d) list.

3.0.2.2 VINYARD CREEK

Table 79 shows BURP data for site 93021 indicating that Vinyard Creek has sub-optimal levels of % fines, poor levels of embeddedness (poor = 0 - 5), an optimal score (10) on bank vegetation protection, and an optimal score (14) on lower bank stability. However, since this level of % fines and embeddedness in in a spring-fed creek, the % fines and embeddedness are within acceptable levels. The site support status at the time was defined as "optimal" based the 1993 Habitat Assessment Field Data Sheet Riffle/Run Prevalence (which scored 77 optimal, 11 sub-optimal, 5 marginal, and 6 poor). Fish data collected from IDFG from 1991 and 1992 indicated an average MBI of 3.241 (the average of four values: 3.229, 3.417, 3.181, 3.135). IDEQ assessed the stream as Full Support in 1998.

According to the IDEQ-TFRO BURP assessment in 1998, "Vinyard Creek beneficial uses have been determined to be Not Full Support for primary and secondary contact recreation primarily because of fecal coliform contamination. The data for this assessment was collected in 1993. The aquatic life uses, however, were Full Support. The primary source of pollutants to Vinyard Creek was an agricultural return canal. Idaho Power Company, in compliance with FERC relicensing, has removed this source of pollution from Vinyard Creek. Data from studies conducted by Idaho Power Company 1995-1997, and reported in 1998 (Twin Falls Project fisheries report 1996)" was in compliance with Articles 404 and 405 of the Twin Falls project license (FERC No. 0018) and "indicate increasing trends in the aquatic communities in response to the removal of the canal (Lay 1998)." Additionally, data collected above the return flows indicate "Full Support of beneficial uses. Bacteria data collected from this reach of Vinyard Creek did not indicate exceedence of water quality standards. As a result of the removal of the return canal, bacteria contamination in the lower reach is no longer a problem. The supporting data from the Idaho Power Company studies of the aquatic communities indicate the recovery of the lower reach. As a result, the primary and secondary contact recreation beneficial uses are assessed as Full Support. Vinyard Creek should be de-listed from the 303(d) list.

B. EVALUATION OF STREAMS BASED ON NARRATIVE CRITERIA

Streams considered in this section include Alpheus Creek, Clear Springs, Crystal Springs, and Thousand Springs. These spring sources were originally included in the 303(d) list since 1986 (see §2.2.2.5, Table 29) to protect for endangered snail populations which were presumed to exist in these spring-fed "creeks." Therefore, no BURP data is available (see §2.2.2.6, Table 37) because of endangered species concerns. Legal opinion suggests that sampling in spring-fed areas should be avoided in order to diminish the potential for possible take violations with USFWS. Blind Canyon Creek was once a true spring-fed creek, but this is no longer the situation due to impacts from aquaculture and irrigated agriculture.

3.0.2.3 ALPHEUS CREEK

See §2.3.1.1. This creek is listed for sediment, nutrients, and dissolved oxygen. As previously described Alpheus Creek runs from its spring source headwaters until it reaches the Main Diversion. At the Main Diversion Alpheus Creek ends. Historically (pre-1920), Alpheus Creek discharged directly to the Middle Snake River just downstream of the Main Diversion, but no longer does so because all water is diverted at the Main Diversion. Perrine Ditch, which runs west from the Main Diversion until it discharges to the Middle Snake River, was built as a canal by "Old Man Perrine" (one of the early pioneers to Southern Idaho), and feeds Alpheus Creek water to the Blue Lakes fish farm and the Pristine Springs (Sunnybrook) fish hatchery. Perrine Ditch is currently owned and maintained by Blue Lakes and Pristine Springs fish hatcheries. An exhaustive review of any and all data available on Alpheus Creek within the repository of IDEQ-TFRO and other agencies was conducted. Information collected was divided into six areas: trihelomethanes, volatile organic compounds, soluble organic compounds, turbidity, primary and secondary nutrients, and bacteriology. Data was attained primarily from the City of Twin Falls, which has been monitoring Alpheus Creek since 1986 for the Drinking Water Information Management System (DWIMS) of IDEQ. Monitoring results are as follows:

1. TRIHELOMETHANES

Data collected from 1989 through 1997 shows that Total Trihelomethanes are less than the method detection limit (MDL < 0.5 μg/L) and the maximum contaminant level (MCL). No exceedences were noted.

2. VOLATILE ORGANIC COMPOUNDS (VOCs)

Data collected from 1989 through 1997 shows that VOCs are less than the MDL and the MCL. No exceedences were noted.

3. SOLUBLE ORGANIC COMPOUNDS (SOCs)

Data collected from 1990 through 1994 shows that SOCs are less than the MDL and the MCL. No exceedences were noted.

4. TURBIDITY AND SEDIMENT

Data collected from 1986 through 1992 shows that turbidity (in NTU) met the criteria to avoid filtration (< 5 NTU) according to 40 CFR 141.71. From 1986 through 1987 the values were all less than 0.40 NTU. From 1988 through 1992 the values were all less than 0.10 NTU. Such low values indicates that "turbidity disturbances" are highly uncomnmon on Alpheus Creek. Since measurements of turbidity have been developed to quickly estimate the amount of sediment within a sample of water (see §2.2.3.3, subsection 6), it can be logically argued chemically that turbidity and suspended sediment concentrations are closely related statistically (see §2.2.4.1, subsection 5, and §2.2.4.2, subsection 5). However, the relationship between concentration and turbidity can be highly variable because a natural water or wastewater can have many different sized particles. For this reason particle size analysis is the preferred methodology for interpreting suspended particles when correlating to turbidity. Yet, a rough correlation can be developed between turbidity and the concentration of suspended particles and is applicable for particles below a certain size. The size of the suspended particles is procedural related, which means that the procedure for determination of total suspended solids determines the size of particles. According to Standard Methods (20th Edition), 2540 A, dissolved solids is the portion of solids that passes through a filter of 2.0 μm (or smaller) nominal pore size under specified conditions. Suspended solids is the portion retained on the filter. Therefore, all TSS values refer to particle sizes that are 2.0 μm or larger. A review of influent water from the Blue Lakes Fish Farm (NPDES 000095-7) indicates that total suspended solids from 1991 to 1997 had a mean of 1.2 mg/L (standard deviation = 0.5; CV = 0.38); and, a flow from 1991 to 1997 had a mean of 143.7 cfs (standard deviation = 20.1 cfs; CV = 0.14). From these values a calculated load of 31.3 tons/year (mean from 1991 to 1997; standard deviation = 12.3 tons/year; CV = 0.39) may be used to represent natural background on Alpheus Creek for TSS.

5. PRIMARY AND SECONDARY NUTRIENTS

Data collected from 1975 through 1998 indicate that heavy metals are less than the MDL; total ammonia ranges from <0.010 to 0.070 mg/L; NOX from 1975 to 1978 ranges from 1.590 to 9.800 mg/L; and, NOX from 1979 to 1998 ranges from 0.810 to 3.780 mg/L. Surfactants were < 0.08 mg/L, and color was < 5 CU. No point sources discharge to the creek. Nonpoint source effects are minimal. Aquatic plant growths are minimal, and no algal blooms have ever been noted by the local population. Since Alpheus Creek is spring fed; since minimal plant growths as macrophytes do not exist; since no algal blooms have ever been noted; and, since TSS, primary, and secondary nutrients are low, it may be inferred that total phosphorus is probably low and reflects the average known spring concentration as other similar springs in the watershed at < 0.020 mg/L TP.

6. BACTERIOLOGY

Data collected in 1989 through 1991 showed that giardia was not a problem. No exceedences were noted. Additional analysis for cysts, nematoda, rotifers, insects, algae, and diatoms indicates the following: no cysts were present; nematoda was present; insects were present as small and rare; green and blue-green algae were present; and diatoms were present. Data collected in 1991-1992 showed total coliform levels from 0 to 200 cfu/100 mL, and fecal coliform levels from 0 to 36 cfu/100 mL. Thus, primary and secondary contact recreational standards are being met.

7. DISSOLVED OXYGEN

Data collected by IDEQ-TFRO in 1997 and 1998 indicates that dissolved oxygen is not a problem. 1997 levels ranged from 8.90 to 9.95 mg/L; 1998 levels ranged from 8.95 to 9.95 mg/L. Data was collected at mid-stream just upstream from the main diversion.

Field assessment by IDEQ-TFRO indicates that there are no impacts from point sources and minimal impacts from nonpoint sources. Possibly during storm events it could be shown that elevated levels of TSS might exist due to stormwater runoff, but this is highly unlikely. Also, recreational impacts are minimal from joggers or the on-site golf course. But daily monitoring data from 1986 to 1992 (as previously discussed) shows that exceedences never occurred above the 5.0 mg/L TSS criteria, thus meeting drinking water filtration standards.

Thus, recreation and storm water runoff are not a problem. Exploration of the localized stream bed in the spring, summer, and fall of 1997 and 1998 showed that occlusion of the stream by macrophytes did not exist, and substrate was clean of sedimentation and siltation at all sites visited. Therefore, IDEQ-TFRO concludes that the noted pollutants of sediment, nutrients, and dissolved oxygen are not a hinderance or a problem within Alpheus Creek. IDEQ-TFRO supports the "de-listing" of the pollutants, and consequently that Alpheus Creek should be "de-listed" as a water quality limited stream segment from the 303(d) list. In the event that USEPA rejects the proposed "de-listing," then a proposed antidegradation TMDL will be considered. However, IDEQ-TFRO will not prepare an antidegradation TMDL at this time but will defer the TMDL until such time as funding and resources are made available.

3.0.2.4 CLEAR SPRINGS "CREEK" AND CLEAR SPRINGS LAKE

See §2.3.1.5. As a consequence of manmade diversions, the TMDL for Clear Springs will run from the headwaters to where it discharges into the Middle Snake River, but it will only be for those segments that are in the natural stream channel: CLS-Headwaters, CLS-Lake, and CLS-Confluence. Due to these numerous diversions there is no true Clear Springs "Creek" that runs from the headwaters of Clear Springs to where it discharges into the Middle Snake River. That portion between the headwater and the lake, and the lake and the confluence, are manmade diversions and not subject to the provisions of this TMDL. The "creek" and lake are listed for sediment, nutrients, dissolved oxygen, and ammonia. The "creek" should be listed only for the CLS-Lake and CLS-Confluence segments. The CLS-Headwaters segment should not be included in the listing. Little water quality information is available to characterize the "creek" and lake.

CLS-HEADWATERS SEGMENT

As previously described Clear Springs runs from its spring source headwaters (literally discharging out of the north Snake River canyon wall), under the concrete road, and collects in man-made collection ditches (constructed prior to 1974). Therefore, the natural "creek" exists only from the headwaters until it is collected in the ditches. This will be referenced in this document as CLS-Headwaters and may be considered natural background of water quality parameters for Clear Springs "Creek" and Clear Springs Lake. CLS-Headwaters provides influent water to various aquaculture facilities. A visit of the site indicates that this portion is unaffected from point sources. Nonpoint source effects may occur under stormwater conditions but very minimally. A review of several inspection reports from 1983 through 1998 by USEPA and IDEQ on the Middle Hatchery of Clear Springs Foods, Inc., indicates that TSS was < 4.0 mg/L and settleable solids was < 0.1 mL/L. A review of influent water (Clear Springs; see §3.3.03) from the Clear Springs Foods—Middle Hatchery (NPDES 000101-5) discharge monitoring reports indicates that total suspended solids from 1991 to 1997 had an estimated mean of 0.7 mg/L; and, a flow from 1991 to 1997 had a mean of 191.05 cfs. From these values a calculated mean load of 131.6 tons/year may be used to represent natural background for TSS. Because of minimal point and nonpoint source inpacts to this segment, it is highly unlikely that the water quality is degraded. Rather, the water quality is similar to other spring fed sources and meeting its beneficial uses for the localized area. In the event that USEPA rejects the proposed "de-listing," then a proposed antidegradation TMDL will be considered. However, IDEQ-TFRO will not prepare an antidegradation TMDL at this time but will defer the TMDL until such time as funding and resources are made available.

CLS-LAKE SEGMENT

From the collection ditches the water is diverted through a series of head gates via manmade canals and raceways to various aquaculture facilities and farms. Effluent discharge from these facilities is to an enhanced lake (constructed prior to 1974) called Clear Lakes. Clear Lakes was previously a swampy area (riparian zone) and has been enhanced (developed) by man for various purposes over the last 50 years. This lake is included as part of the natural system for Clear Springs. This will be referenced in this document as CLS-Lake. CLS-Lake is a private lake used primarily for recreational fishing. The Clear Lake Country Club operates a fee-fishing program and stocks it with catchable rainbow trout. Since 1929, there have been no reports of fish kills or fish distress that would suggest existent toxicity or low dissolved oxygen problems. Sediment accumulation in the lake is attributable to a variety of natural and manmade conditions, including modification of the depth and structure of the lake, construction activity (fish farms, processing plants, golf course, residential home development), historic aquaculture practices, and historic grazing and mining practices. Additionally, water fowl maintain a year round population. Historic accumulations of sediment are probably the most significant source of phosphorus. The TMDL for this segment will be summarized in §3.5 for Load Allocation.

CLS-CONFLUENCE SEGMENT

Clear Lakes discharges to a manmade channel, which in turn discharges to the Middle Snake River over the "old stream bed." From the manmade channel a hydropower pipeline transfers water to the Clear Springs H.E. Hydropower facility (owned by Idaho Power Company). The "old stream bed" is located from the penstock of the hydropower facility to where it discharges to the Middle Snake River. This will be referenced in this document as CLS-Confluence. Above the penstock, it is uncertain where the old stream channel exited since it has been displaced by manmade enhancements to the lake. Water quality in this segment is more probably similar and directly affected by the CLS-Lake segment. Therefore, improvements in the CLS-Lake will have an effect on the CLS-Confluence segment. The TMDL for this segment will be summarized in §3.5 for Load Allocation.

3.0.2.5 CRYSTAL SPRINGS "CREEK" AND CRYSTAL LAKE

See §2.1.3.6, §2.2.2.5, and §2.3.1.8. The TMDL for Crystal Springs will run from the headwaters to where it discharges into the Middle Snake River, but as a consequence of manmade diversions the TMDL will only be for those segments that are in the natural stream channel: CRS-Headwaters and CRS-Lake. Crystal Springs "Creek" runs from the headwaters of Crystal Springs through Crystal Lake, and then discharges into the Middle Snake River; however, this is not a true creek, due to a single manmade diversion. The portion between the headwaters and the lake that has a manmade diversion is not subject to the provisions of this TMDL. The "creek" and lake are listed for sediment, nutrients, dissolved oxygen, flow alteration, and ammonia. The "creek" should be listed only for the CRS-Lake segment. The CRS-Headwaters segment should not be included in the listing. IDFG has assessed Crystal Springs Lake and reports that up until the early 1980's, a significant number of wild rainbow trout utilized the base of the springs for spawning purposes. In about 1984, the discharge from Crystal Lake to the Snake River was re-built and the new discharge works became a barrier to fish movement out of the Snake River and into the lake. This barrier resulted in loss of the adfluvial spawning population (IDFG 1999).

CRS-HEADWATERS SEGMENT

As previously described, Crystal Springs runs from its spring source headwaters (much like Clear Springs, literally discharging out of the north Snake River canyon wall) to where it is captured in a large collection ditch. This portion will be referenced in this document as CRS-Headwaters and may be considered natural background of water quality parameters for Crystal Springs "Creek" and Crystal Springs Lake. From the collection ditch it is either (1) pumped across the Middle Snake River to the Magic Valley Steelhead Hatchery degassing tower, or (2) sent along the collection ditch to a head gate which delivers the flow to Crystal Springs

Hatchery. CRS-Headwaters provides influent water to an aquaculture facility. A visit to the site indicates that CRS-Headwaters is unaffected from point sources. Nonpoint source effects may occur under stormwater conditions but very minimally. A review of Crystal Splrings Fish Hatchery inspection reports by USEPA and IDEQ from 1992 to 1997 for the influent spring water used in the hatchery, indicates that ammonia averaged 0.014 mg/L , NOX averaged 3.094 mg/L, TKN averaged 0.09 mg/L, TP averaged 0.035 mg/L, TSS averaged 0.7 mg/L, and settleable solids averaged 0.05 mL/L (estimated from ½ MDL). Additionally, a review of influent water from the Crystal Springs Fish Hatchery (NPDES Permit No. 000089-2) discharge monitoring reports indicates that TSS from 1991 to 1997 had a mean of 0.6 mg/L; and, a flow from 1991 to 1997 had a mean of 207.56 cfs. From these values a calculated load of 122.5 tons/year may be used to represent natural background for TSS. Because of minimal point and nonpoint source inpacts to this segment, and based on monitoring information, it can be shown that the water quality is not degraded for NH3, NOX, TP, and TSS. Like other spring fed sources, the water quality is meeting its beneficial uses for the localized area. Therefore, this segment should be "delisted" from the 303(d) list. In the event that USEPA rejects the proposed "de-listing," then a proposed antidegradation TMDL will be considered. However, IDEQ-TFRO will not prepare an antidegradation TMDL at this time but will defer the TMDL until such time as funding and resources are made available.

CRS-LAKE SEGMENT

Crystal Springs Hatchery currently discharges about 10 cfs into Crystal Lake, which is significantly less than historical discharges of 150 cfs during the 1940s and 1950s. The 10 cfs from the fish hatchery is maintained to facilitate recreational fishing. The remainder is discharged to the Middle Snake River. Crystal Lake, like Clear Lake, is an enhanced lake due to man's intervention for lake enlargement and lake deepening some 30-40 years ago, and is influenced today by an aquaculture facility. From Crystal Lake the water discharges under the road into the Middle Snake River. No fish kills have been observed in Crystal Lake indicating a low probability of un-ionized ammonia problems. The lake is essentially composed of effluent discharge from the aquaculture facility, plus any additional unseen underground seeps that may be entering the lake. The TMDL for this segment will be summarized in §3.5 for Load Allocation.

3.0.2.6 THOUSAND SPRINGS "CREEK" / SAND SPRINGS CREEK

IDEQ-TFRO proposes that the historical record and the limited water quality data support the de-listing of sediment and nutrients as pollutants, and consequently that Thousand Springs Creek should be de-listed as a water quality limited stream segment from the 303(d) list. The listing of flow alteration as a pollutant is beyond the scope of this TMDL at this time.

BACKGROUND AND CURRENT STATUS

It is the professional opinion of IDEQ-TFRO, IDWR-Twin Falls, and USGS-Twin Falls that there is no Thousand Springs "Creek." There are, however, a thousand springs (more or less) that gush out of the Snake River canyon wall from the Snake River Plain Aquifer and eventually discharge to the Middle Snake River. According to IDWR-Twin Falls, prior to man's intervention with flow regulation of the Thousand Springs area, the collection of all the spring sources into one creek was probably more of an estuary area than a creek discharging to the Middle Snake River. In 1986, as part of the Pacific Northwest River Study (PNRS, also known as the Idaho Rivers Study), an assessment of "Thousand Springs Creek" was conducted for a variety of environmental values that might have a bearing on hydropower development in the northwest. Thousand Springs "Creek" was listed as segment 386.00 in HUC 17040212 with an upper boundary as the headwaters and a lower boundary as the Snake River. It was assumed that everything in-between (*sic*) these boundaries was Thousand Springs "Creek" (IDFG 1986). Then, in 1989 a Chairman's Report of the Basin Area Meetings was published and included a more defined description of Thousand Springs "Creek." Thousand Springs "Creek" was defined as PNRS 386.00 and included: Minnie Miller Springs Creek and all the Thousand Springs source water. The primary objective for its inclusion in the Chairman's Report was to maintain water quality (for Minnie Miller Springs Creek) and restore water quality (for Thousand Springs due to flow alteration). At the same time the report stated, "... we are confident the integrity of the Minnie Miller Springs and their creek will be protected by the Nature Conservancy.." However, "... these springs are the ONLY such springs visible from Highway 30 that have not been tampered with by man in some way. Accordingly, we believe it is crucial to afford these springs and their outflow all protection possible". Additionally, Minnie Miller Springs Creek (defined as Thousand Springs "Creek" in the report) has "... a minimum streamflow for the entire discharge ... This spring is a landmark of state and national signficance and its high water quality should be maintained" ("Chairman's Report" 1989 [pp 59-60]. Therefore, the "Thousand Springs Creek" included the Minnie Miller Springs and the Thousand Springs source water. As a result, the eventual listing of the "Thousand Springs Creek" stream in USEPA's 1994 303(d) list (it was not listed in 1992) was not because the water was degraded or of a eutrophic condition (even though it is listed for sediment, nutrients, and flow alteration), but rather because there was public outcry to afford "all protection possible" for a springs source that had not been "tampered with by man." It will be demonstrated in the following paragraphs that flow alteration is the main concern. In effect, beneficial uses and water quality standards on any stream that is not "tampered with by man" and that has "high water quality" cannot be restored beyond their existing "high water quality" condition.

Sand Springs Creek has been erroneously interpreted as being Thousand Springs "Creek" by various sources. Several agency and industry documents appear to support this, but this is erroneous in interpretation. Sand Springs Creek, which is upstream of Thousand Springs (via the Middle Snake River), has a wooden flume diversion pipe that sends a major portion of the water from Sand Springs Creek to the Thousand Springs hydropower facility. Because both waters are combined, it is not unusual to think that Thousand Springs "Creek" and Sand Springs Creek are one in the same creek or "one in the same water." But they are two distinct and separate creeks that have the same aquifer as their source water. Water from Sand Springs Creek provides habitat for the largest population of Shoshone sculpin to be found on private property.

See §2.3.1.16. Thousand Springs "Creek" is listed for sediment, nutrients, and flow alteration. The majority of the spring water is used for hydropower and is unaffected by sediment or the addition of nutrients. In fact, flow alteration due to hydropower generation, constructed before 1974, has altered the nature of this stream. The Idaho Power Company Thousand Springs hydropower facility is located between the Minnie Miller Falls and the manmade Lemmon Falls of the Thousand Springs area. Between these two falls a collection ditch was constructed to collect the outflow from 28 spring sources of Thousand Springs from the tallus walls of the Snake River canyon. Construction of the hydropower facility also included increasing the discharge diameter of the spring sources by boring out a larger hole for the spring water to evacuate into the collection ditch. The collection ditch runs from northwest to southeast towards the powerhouse, and from southeast to northwest towards the powerhouse, and brings all the spring source water to the powerhouse. Discharge from the Thousand Springs hydropower facility is into Ritter Creek. Ritter Creek makes up a portion of the Nature Conservancy Preserve and discharges into the Middle Snake River at approximately RM584.5. The discharge into Ritter Creek is made up of water from the Thousand Springs and from Sand Springs Creek. A review of the influent water (see §3.3.03) from the Blind Canyon Aqua Ranch (or Ten Springs Trout Farm, NPDES No. 002600-0), which is the source water to Thousand Springs, indicates that total suspended solids from 1991 to 1997 had a mean of 0.5 mg/L; and, a flow from 1991 to 1997 had a mean of 28.45 cfs. From these values a calculated load of 14.0 tons/year and may be used to represent natural background for TSS. Additionally, a USEPA Inspection Report of August 18, 1998 indicates that DO = 9.09 mg/L, temperature = 14.2°C, TP =

0.01 mg/L, NOX = 1.07 mg/L, TKN and NH3 were below MDL of 0.4 and 0.1 mg/L, respectively. In IDEQ-TFRO's profession opinion, Ritter Creek is not adversely affected by sediment or nutrients, nor by point sources, and minimally by nonpoint sources of pollution. In NPDES Permit No. 002600-0 it states that the effluent discharge is into Thousand Springs "Creek." This is incorrect as well. A visit to the site by IDEQ-TFRO on May 2, 1999 showed that the discharge is to a manmade channel which goes over a cliff into what is called Lemmon Falls (which is also manmade) which in turn discharges into the Nature Conservancy's Ritter Creek, which then discharges into the Middle Snake River (at RM584.6). Local owners do not consider the discharge from the fish hatchery in combination with spring water as Thousand Springs "Creek." In fact, Lemmon Falls was constructed to collect a number of spring sources and eventually run the spring water through an additional hydropower facility. This hydropower facility was never constructed.

The water as it exists today is affected by flow alteration. It is not affected from point sources and minimally affected from nonpoint sources. As a result, it is highly unlikely that the water quality is degraded for TSS and nutrients. Certainly the USEPA Inspection Report of August 18, 1998 supports this argument. Rather, the water quality is similar to other spring-fed sources in the area and in all likelihood is meeting its beneficial uses. IDEQ-TFRO proposes that this "creek" be "de-listed from the 303(d) list since it is not "tampered with by man" and has "high water quality." In the event that USEPA rejects the proposed "de-listing," then a proposed antidegradation TMDL will be considered. However, IDEQ-TFRO will not prepare an antidegradation TMDL at this time but will defer the TMDL until such time as funding and resources are made available.

3.0.2.7 BLIND CANYON CREEK

Blind Canyon Creek is listed on the 303(d) list from the headwaters to where it discharges into the Middle Snake River. This listing supposes that the headwaters of Blind Canyon Creek is the beginning of Blind Canyon Creek, which is an incorrect assumption. Aquifer discharge into Blind Canyon is downstream (about 0.5 - 1.0 miles) from the discharge waterfall spill of the North Side Canal Company's S-19 and S Coulee drains when diverted into the Blind Canyon area. Normally, the S-19 and S Coulee drains are used as input source water for the Lemmon Hydropower Facility which discharges to the Middle Snake River just upstream of the confluence of Blind Canyon Creek. IDEQ-TFRO proposes that the listing be modified to encompass the waterfall spill in addition to the headwater spring sources so that the entire canyon is included in the listing. As the listing stands currently, it only includes about 60% of Blind Canyon Creek.

BACKGROUND

See §2.1.3.6, §2.2.2.5, and §2.3.1.3. This creek is listed for sediment, nutrients, dissolved oxygen, flow alteration, ammonia, and pathogens. Flow alteration due to the construction of a fish hatchery prior to 1974 has altered the nature of this stream. At one time, prior to human population, it is evident from a visit to the site that Blind Canyon Creek was a spring-fed creek, and probably provided minimal impact to the Middle Snake River, except during stormwater runoff events. But since development by man, both as irrigation canal water and aquaculture facility discharge, Blind Canyon Creek no longer flows as a natural creek. Rather, it flows as an extension of the irrigation canalway for the North Side Canal Company on occasion when meeting water right diversion needs. Canal company ownership of the canalway ends at the discharge waterfall spill above the channel of Blind Canyon Creek. But from this point to where it discharges into the Middle Snake River the water is still irrigation water with inputs from fish hatchery effluent. The use of irrigation water for the fish hatchery may occur only if the spring source water drops in flow. Otherwise, for the most part the fish hatchery utilizes all of the spring source water for its facility operations.

CURRENT STATUS

A field visit by IDEQ-TFRO on May 7, 1999 indicated that the talus slope walls of the canyon had two spring outlets that discharged directly out of the canyon wall into a manmade collection ditch which was piped upstream through a water line to the upper raceway of the Blind Canyon Aqua Ranch (NPDES No. 002599-2 or Domsea Farms Inc.). The spring-fed water runs downstream through a number of raceways into a tail settling pond which then discharges into the Blind Canyon Creek channel. The channel follows the natural contour of Blind Canyon through the old stream bed, but the water is now a combination of aquaculture effluent and irrigation water from the North Side Canal Company's S-19 (which comes from the north side) and S Coulee (which comes from the east side) when irrigation water right diversion needs occur. The irrigation water spills (or creates a waterfall) over the crest of the canyon just upstream of the aquaculture facility (about 0.5-1.0 miles) and follows the natural stream channel as an irrigation return flow until it discharges downstream into the Middle Snake River. Besides the spring sources that are collected for Blind Canyon Aqua Ranch, no other spring sources exist above or below these springs. Some underground seeps do occur upstream of the fish hatchery just below the spillway for irrigation water. In essence, the "headwaters" of Blind Canyon Creek begin at the irrigation waterfall spill. About 1 mile from the waterfall spill the two springs discharge into the manmade collection ditch. A review of the influent water from the Blind Canyon Aqua Hatchery (or Domsea Farms Inc., NPDES No. 002599-2), which is the source water to Blind Canyon Creek, indicates that total suspended solids from 1991 to 1997 had a mean of 0.8 mg/L; and, a flow from 1991 to 1997 had a mean of 7.4 cfs. From these values a calculated load of 5.8 tons/year and may be used to represent natural background for TSS.

It is proposed that the listing of this creek be modified from its headwaters (which is within the creek itself) to where the outfall discharge of S-19/S Coulee occurs, thus taking in all of the canyon of Blind Canyon Creek. The TMDL for this segment will be summarized in §3.5 for Load Allocation.

3.0.2.8 COTTONWOOD CREEK

Cottonwood Creek is listed on the 303(d) list from the headwaters to where it discharges to Rock Creek. This designation is incorrect. Cottonwood Creek (which is approximately 5.7 miles in length) is created from the confluence of North Cottonwood Creek (which is approximately 11.8 miles) and Dry Cottonwood Creek (which is approximately 10.3 miles) in Section 11 of R 17 E and T 12 S on a USGS quadrangle map. The joining of North Cottonwood Creek and Dry Cottonwood Creek to form Cottonwood Creek is known as "the fork" by local citizens. There is no true headwaters area for Cottonwood Creek because the headwaters is "the fork." Thus the headwaters is more appropriate for North Cottonwood Creek and Dry Cottonwood Creek. As described in §2.1.3.6, Cottonwood Creek is described as part of the Rock Creek Complex, but in §3.5.3 it is listed as discharging to Deep Creek. Historically, Cottonwood Creek discharged to Rock Creek, but has since been diverted to the High Line Canal for irrigation purposes. The High Line Canal eventually discharges to Deep Creek. Section 2.2.2.5 states that Cottonwood Creek does not go beyond the High Line Canal. Whatever water appears below the High Line Canal in Cottonwood Creek is due to seeps, springs, and possibly from emergency spills of canal water that the Twin Falls Canal Company may require from time to time. Therefore, IDEQ-TFRO proposes that the designation for Cottonwood Creek be modified as follows: from the fork of North Cottonwood Creek and Dry Cottonwood Creek to where it discharges to the High Line Canal. Additionally, that North Cottonwood Creek be described from its headwaters to where it discharges to Cottonwood Creek; and, that Dry Cottonwood Creek be described from its headwaters to where it discharges to Cottonwood Creek. BURP assessment should be conducted immediately on North Cottonwood Creek and Dry Cottonwood Creek, as has been done on Cottonwood Creek, to ascertain their beneficial support status.

3.0.3 NONPOINT SOURCE DRIVEN STREAMS

As previously noted, the following 12 segments are strictly nonpoint source driven: Alpheus Creek, Clover Creek, Cottonwood Creek (as part of the Rock Creek Complex), Dry Creek (all three segments: Medley Creek to the Snake River, Headwaters to Medley Creek, and Headwaters to Dry Creek), and McMullen Creek (as part of the Rock Creek Complex). The allocation of loadings for these streams will be based on the stream corridor approach model.

3.0.4 POINT AND NONPOINT SOURCE DRIVEN STREAMS

The remainder of the water quality limited stream segments are affected by both point and nonpoint sources. These streams include: Billingsley Creek, Blind Canyon Creek, Clear Springs, Crystal Springs, Riley Creek, Rock Creek, and Thousand Springs Creek. The Middle Snake River and the five reservoirs are affected by both point and nonpoint sources.

3.1 INSTREAM WATER QUALITY TARGET(S)

Instream water quality targets were identified for the pollutants of concern and are defined in the following sections. Pursuant to IDAPA 16.01.02.400(01)(b) for point sources, failure to meet general or specific water quality criteria is a violation of the water quality standards except in an area defined as a mixing zone (IDAPA 16.01.02.003(59): "a defined area ... of the receiving water surrounding or adjacent to a wastewater discharge where the receiving water, as a result of the discharge, may not meet all applicable water quality criteria or standards. It is considered a place where wastewater mixes with receiving water and not as a place where effluents are treated." (See IDAPA 16.01.02.060 for Mixing Zone Policy.) For site-specific surface water quality criteria, IDAPA 16.01.02.275(a)(iv) allows for water quality criteria to be "derived to protect and maintain existing ambient water quality." Surface water quality within any stream segment that can be demonstrated to be below the instream water quality target will be considered for site-specific criteria development after Year 5 of plan implementation. Site-specific criteria "shall not impair designated or existing beneficial uses year-round (or seasonally for seasonal dependent criteria) and shall prevent acute and chronic toxicity outside of approved mixing zones (IDAPA 16.01.02.275(c)."

3.1.1 SUSPENDED SEDIMENTS, LOAD CAPACITY, AND SUBSTRATE SEDIMENTS

This section is about sediment and how IDEQ-TFRO proposes to deal with it in terms of pollution reduction measures. Suspended sediment (as total suspended solids) is defined as an instream target that is correlated to load capacity (or assimilative capacity). Reductions in suspended sediment will lead to attainment of beneficial uses and State water quality standards. A substrate sediment target, although desirable under certain conditions, is not suggested at this time due to a lack of scientific and legally defendable data. Contaminated sediment affected by toxic substances (such as heavy metals) is not known to be a problem in the Middle Snake River or its tributaries, and therefore will not be addressed in this TMDL at this time.

SUSPENDED SEDIMENTS AND LOAD CAPACITY

See Appendix D, *Technical Support Document for the Development of the Upper Snake Rock Watershed Management Plan*, for discussion on instream targets. As discussed in the subbasin assessment (§2.2.3.3, item 5, Sediment and "Settable Substances") sediment is the most common nonpoint source pollutant in the Upper Snake Rock subbasin affecting beneficial uses of salmonid spawning and cold water biota. However, sediment is a narrative standard in the State water quality standards, thus no numeric criteria is cited. A narrative standard for sediment is necessary to accommodate the vast ranges of sediment conditions which exist in various streams. IDEQ researched and selected an instream water quality target of 52 mg/L for use on both tributaries and the Middle Snake River. This is based on the severity of effects of sediment and its relationship to the duration of exposure of TSS to fisheries, and the amount of protection that fish and other aquatic biota are afforded with this concentration. A TSS concentration of < 80 mg/L TSS affords a moderate-to-high protection level with a none-to-slightly reduced fisheries. Target concentrations at 80 mg/L TSS sustained for 30 or more days consecutively may result in lethal or paralethal effects on fisheries. Therefore, IDEQ-TFRO has determined the quantification of the narrative standard by proposing a preliminary instream water quality target of 52 mg/L TSS as a monthly average concentration with a maximum daily concentration of 80 mg/L TSS (see CH2MHILL 1998 for additional information). The 52 mg/L will also serve as the load capacity for any stream in the Upper Snake Rock subbasin. The 52 mg/L TSS instream target is an appropriate preliminary target for protecting fisheries from excessive sediments > 80 mg/L. The 52 mg/L TSS instream target is a preliminary target that will be used to bring all industries into compliance within 5 years of plan effectiveness, and held for an additional 5 years to determine the effects of such reductions. This target supports a "good fishery (EIFAC 1964; NAS/NAE 1973)," and a "regional comparison for a high level of protection for cold water biota (IDHW 1991a [p 13])," thus meeting a quantity for supporting designated beneficial uses and State water quality standards for excess sediment. IDEQ-TFRO considers the 52 mg/L monthly average and the 80 mg/L maximum daily concentrations as a valid interpretation of Idaho's narrative sediment criteria for the Middle Snake River and its surface waterbodies (tributaries and irrigation return flows), and thus meets the requirements of the Clean Water Act.

Application of the load capacity (52 mg/L TSS), the instream target (52 mg/L TSS), and existing conditions to various flow scenarios is summarized below for the various Middle Snake River segments based on the information compiled and summarized in Appendix D. Additionally, it was assessed from statistical analysis of existing data, that unlike total phosphorus which dilutes more readily under high flow conditions, TSS increases substantially. Flow information from USGS was used for design flow analysis in the comparison of low flow, mean flow, and high flow conditions for the development of sediment rating curves.

Segment Site	Minimum Load (based on Low Q)	Mean Load (based on Mean Q)	Maximum Load (based on High Q)
< 52 mg/L TSS as the Instream Target and Load Capacity, tons/year			
Milner Dam	18,721.3	197,443.2	482,457.2
Pillar Falls	58,619.2	242,302.8	544,452.3
Crystal Spgs	94,731.8	281,228.7	583,327.1
Box Canyon	182,762.9	368,901.7	668,749.5
Gridley Bridge	277,699.3	466,140.0	773,609.2
Shoestring	341,382.4	568,186.4	900,157.1
King Hill	377,699.7	583,020.2	924,249.2
Overall Range	358,978.4	385,577.0	441,792.0
Overall Range = (King Hill - Milner Dam). See Appendix D, Technical Support Document, §2.			
Average Conditions Based on 1990-1998 Compiled Data			
Milner Dam	5,261.1	62,491.0	179,994.4
Pillar Falls	13,487.9	71,497.9	218,853.9
Crystal Spgs	24,422.0	102,768.9	314,861.7
Box Canyon	65,133.5	183,773.4	485,883.9

Gridley Bridge	63,620.2	186,809.1	526,709.5
Shoestring	28,297.9	196,950.4	659,509.1
King Hill	110,104.6	300,426.8	819,996.0
Overall Range	104,843.5	237,935.8	640,001.6

Overall Range = (King Hill - Milner Dam) See Appendix D, Technical Support Document, §2.

Estimate % Reduction (% R) Based on Site and Overall Range Basis

Milner Dam	71.9%	68.3%	62.7%
Pillar Falls	77.0%	70.5%	59.8%
Crystal Spgs	74.2%	63.5%	46.0%
Box Canyon	64.4%	50.2%	27.3%
Gridley Bridge	77.1%	59.9%	31.9%
Shoestring	91.7%	65.3%	26.7%
King Hill	70.8%	48.5%	11.3%
Overall Range	70.8%	38.3%	(-44.9%)

In comparing average conditions versus the load capacity targets at Milner Dam there is a 71.9% less TSS under low flow years, a 68.3% less TSS for mean flow years, and a 62.7% less TSS for high flow years. Under low flow conditions the least amount of TSS loads occur in the river system because the TSS concentration stays relatively the same with a range from 4.3 mg/L to 18.5 mg/L (with a mean of 12.8 mg/L and a variance of 14.2 mg/L). Under high flow conditions a worse-case scenario occurs for TSS loads because TSS concentrations increase from upstream to downstream with a range of 19.4 mg/L to 46.1 mg/L (with a mean of 32.3 mg/L and a variance of 26.7 mg/L). This increase in TSS concentration under high flow conditions creates extreme TSS load conditions for the river system. In essence, the condition reflects a saturation of TSS creating high turbidity in the water. Therefore, reductions in TSS load inputs from existing conditions to a level below 52 mg/L TSS will lead to significant load reductions which will reduce the buildup potential for washload (< 0.062 mm particles) in the substrate. If those reductions are reasonably maintained during mean and high flow conditions, then conditions in the river system will improve dramatically, thus leading to attainment of beneficial uses and State water quality standards. However, the impacts from TSS under high flow conditions cannot be dismissed. In a managed system, such as is the case with the Middle Snake River, high flows can be a paradox: on the one hand they are necessary to scour and clean up the system of TSS buildup; on the other hand, they can be potentially detrimental to water quality due to substantial TSS increase. A view of the overall range indicates that TSS reductions occur under low and average flow conditions. But under high flow conditions there is a net increase (-44.9%) in the amount of sediment being transported and stirred up in the water column.

Therefore, IDEQ-TFRO will continue to assess the impacts of TSS under various flow regimes, and will investigate what options may be available in the management of excessive high flows such that TSS does not continue to be an accumulative impactor to the system as evidenced in the data already collected. This does not mean that high flows are the main source of higher TSS values in the downstream reaches of the Middle Snake River. Rather, it indicates that managed high flows will potentially aid in retarding some of the excessive sediments that appear to accumulate in the downstream segments. Reductions from nonpoint source inputs are still a serious consideration and are addressed in the 52 mg/L TSS average monthly limit and the 80 mg/L TSS maximum daily limit.

SUBSTRATE SEDIMENTS

There is no question that fine sediment and its accumulation is detrimental to salmonid spawning since it limits the quality and quantity of inter-gravel spaces that are critical for egg incubation. Fine sediment and availability of living space have direct affects on both fisheries and macroinvertebrates (IDHW 1999 [p 3]). Thus, sediment can impact aquatic environments and species by physically covering their habitat, adding nutrient loading, and potentially creating hypoxic or anoxic conditions. In the Upper Snake Rock subbasin, as previously discussed, the principal sources of total suspended sediment load to the Middle Snake River are surface waterbodies (tributaries and irrigation return drains). IDEQ-TFRO has discussed substrate sediment targets for the Middle Snake River with USEPA to aid with the recovery of the endangered mollusc species. IDEQ-TFRO has also discussed this issue with the Middle Snake River TAC on a number of occasions, with the consensus that little scientific information exists to quantify reasonable substrate targets. USEPA and USFWS are ill-prepared at this time to provide technical guidance in the development of these targets because of insufficient scientific information that is specific for the Middle Snake River and its tributaries, particularly in defining targets that are reasonable and achievable with linkage to the protection of the endangered mollusc species. There is also no current or historical information that can provide direction as to what level or levels of sediment are permissible for the viability of aquatic species and their related environments.

It seems reasonable and prudent that as a consequence of the imposed NPDES permit limits for TSS on aquaculture facilities, municipalities, and food processors, that a regular review of the effectiveness of TSS concentration reductions (and consequently TSS load reductions) under the more stringent TSS limits would provide a pathway for USEPA and USFWS to determine if the implementation of BMPs by point sources will lead to the success of the reduction of TSS loadings to the Middle Snake River and its tributaries. Therefore, IDEQ-TFRO will conduct regular reviews of the effectiveness of TSS reductions for both point source and nonpoint sources, and provide this information to the Middle Snake River TAC and WAG, as well as the USEPA and USFWS.

Substrate sediment targets are inappropriate in the Middle Snake River or its tributaries because fine bedload materials (sands, small gravel, silt, and clay fractions) are derived from largely the same sources as the measured suspended sediment materials. Using TSS is a sufficient "surrogate" for the total sediment load because its true substrate sediment comprises a smaller percentage when compared to TSS. TSS comprises a much larger percentage of the total sediment load. Thus, actions taken to reduce suspended sediment load (as TSS) will also reduce the fine bed material load (or more appropriately the "washload") that is commensurate to or greater than TSS reductions. In the Middle Snake River system there is minimal bedload substrate; washload is predominant. Smaller sediment sizes require less energy to be dis-lodged and transported and are thus less easily trapped or kept in place under average-to-high flow conditions. BMPs will need to be developed (on site specific areas within each surface waterbody) that address surface erosion (comprised mostly of silts and clay) which eventually are transported into the river system.

As previously described in the subbasin assessment (§2.2.3.3, item 5, Sediment and "Settable Substances"), the Falter Study (Falter *et al.* 1995; Falter *et al.* 1996) indicated that the Crystal Springs and Box Canyon sites (limited to depositional sites with weedbeds and deep pools) were dominated by fines (< 0.075 mm). Falter's results can be compared to GeoSea® Consulting's Study (McLaren 1998) which indicate that in 1997 the sediment particle size was mostly sand and gravel (due to high flushing flows in 1996 and 1997), whereas in 1993-1994 it was mostly silt and clay or muddy sediment (due to low flow conditions). USGS's substrate study in 1993-1995 on substrate size, embeddedness, and substrate fines (< 6 mm) (USGS 1997a) showed the similarity between Rock Creek and the Middle Snake River, thus indicating that the substrate character of sediment inputs is similar to the substrate character of the river. A decrease in the suspended sediment (as

TSS) in the surface waterbody inputs will result in a decrease in the fines and embeddedness of such waterbodies. This in turn will also help to reduce the fines and embeddedness of the Middle Snake River. Below is a comparison of these three studies:

1993-1994 FALTER STUDY

YEAR	LOCATION	SAND	SILT	CLAY
1993	Crystal Springs & Box Canyon	56.7%	40.0%	3.3%
1993	Crystal Springs & Box Canyon	53.6-61.4%	36.5-43.6%	2.1-4.5%
1994	Crystal Springs & Box Canyon	53.6%	39.8%	5.5%
1994	Crystal Springs & Box Canyon	51.2-72.1%	25.2-41.2%	2.7-6.2%

1993-1995 USGS STUDY

YEAR	LOCATION	SUBSTRATE	EMBEDD	FINES
1993	Snake River near Buhl	3.1%	80.0%	76.0%
1993	Snake River at King Hill	2.1%	47.0%	38.0%
1994	Snake River at King Hill	2.1%	47.0%	38.0%
1995	Snake River at King Hill	2.1%	47.0%	38.0%
1993	Rock Creek at Twin Falls	3.5%	74.0%	35.0%
1994	Rock Creek at Twin Falls	2.2%	74.3%	29.0%
1995	Rock Creek at Twin Falls	3.3%	90.0%	29.0%

1997 GeoSea® STUDY

YEAR	LOCATION	SAND/GRAVEL	SANDY MUD	MUD
1997	Middle Snake River	45%	47%	8%

These were the only studies that could be found that describe sediment conditions on the Middle Snake River for the period 1990-1998. In effect, macrophyte habitat buildup in the Middle Snake River will increase as flows decrease and fine deposits from tributaries and irrigation returns maintain dominance over the traction transport of the river bed. In conjunction with GeoSea® Consulting's Study, IDEQ-TFRO has also determined the growth of macrophyte habitat can be controlled by periodic flushing of the river. Erosion of the macrophyte habitat appears to begin at an average flow range of 1,000-1,300 cfs, which is typical of river systems that have silt and clay deposits comprising the major sediment fraction. An average flow of 6,000 cfs from June to October would increase velocities sufficiently to reduce macrophytic growth (SRBWC 1994 [p L-1]). At an average of 10,000 cfs erosion of fine grained material (sand, silt, clay fractions) occurs and is added to the river as suspended load.

In addition to these studies, IDEQ-TFRO also confirms GeoSea® Consulting's Study that muddy sediments are most frequently found along the shallow sides of the river. IDEQ-TFRO confirmed this through visitation of 13 monitoring sites on the Middle Snake River. In fact, muddy sediments tend to increase from upstream to downstream as shown in §3.5.07, Table 105, since the TSS increases accordingly. Muddy sediment is carried mostly in suspension and is deposited along the upper levels of the river sides where friction reduces flow velocities. Sandy sediments, on the other hand, appear to be carried by traction along the river bottom in deeper water. Prior to the flushing flows of 1996-1997, the main channel in depths below a few feet was comprised of higher levels of silt and clay. In a rating of proper functioning condition USBLM considers channel bottom silt and clay fractions of wadable streams as: < 10% optimal; 10-30% suboptimal; 30-50% marginal; and, > 50% poor. Discussions with USBLM and USFS suggest that application of this characterization to managed large rivers may have some merit, but there is insufficient information to support this hypothesis. Thus, the Middle Snake River from 1993-1994 (low flow conditions) had 40-43% fines (as silt and clay) which indicate a sub-optimal condition; whereas, in 1997 (high flow conditions) the fines (as silt and clay) were 8% which indicates an optimal condition. Does this mean that <10% fines (as silt and clay) in the Middle Snake River is a reasonable substrate target for protection of aquatic life? Without the additional collection of substrate sediment and macroinvertebrate information it is uncertain at this time if any estimated value (of fines) is scientifically correct and legally defendable. The implication, however, is worth pursuing since Rowe *et al.* suggest that a concentration of subsurface sediment (<0.85 mm) should not exceed 10% (IDEQ 1998e [p 14]).

Therefore, IDEQ-TFRO is not prepared at this time to propose substrate targets for the Middle Snake River or its tributaries because of the managed condition of the river system; the nature of the input sediments; the lack of appropriate substrate sediment research information; and, because IDEQ-TFRO strongly believes that suspended sediment (as TSS) is an appropriate surrogate for substrate sediment reduction. However, IDEQ-TFRO will continue to actively assess and evaluate current and any additional data that defines substrate sediments and will consider a joint-study with USEPA and USFWS so that this issue can be resolved over the next 5 years. In the meantime, monitoring of the Middle Snake River will continue to be a priority of IDEQ-TFRO over the next 10 years of plan implementation, as well as the development and incorporation of a trend monitoring plan which has been developed by the Mid-Snake TAC for periodic ecosystem evaluation as it relates to the TMDL.

3.1.2 TOTAL PHOSPHORUS

See Appendix D for discussion on instream targets. "In streams, phosphorus occurs primarily as phosphate and can be either dissolved, incorporated in organisms, or attached to particles in the water or in bottom sediments (USGS 1994 [chapter 4])." As described in §2.2.3.3, total phosphorus should not exceed 0.05 mg/L TP in streams where it enters a lake or reservoir to prevent the development of biological nuisances and to control accelerated or cultural eutrophication. To prevent plant nuisances in flowing waters not discharging directly to lakes or impoundments, a desired goal of 0.100 mg/L TP is suggested ("Gold Book" and "Blue Book" value). For a lake or a reservoir, the suggested goal is 0.025 mg/L TP. Because of the modified flow regime with run-of-the-river impoundments, the Mid-Snake TMDL uses a water quality target of 0.075 mg/L TP at the Gridley Bridge, Hagerman, Idaho site. This represents a value between 0.050 and 0.100 mg/L TP. Since excess nutrients is a narrative standard in the State Water Quality Standards, no numeric criteria is cited. Therefore, IDEQ selected for TP an instream water quality target of 0.100 mg/L on tributaries and 0.075 mg/L on the Middle Snake River. SRP is not being considered as a separate TMDL since TP accounts for all the phosphorus in the system, implying that reductions in TP will also produce reductions in SRP. *This water quality target (0.075 mg/L TP) is now proposed as a representative average of the whole Middle Snake River system, assuming that the water quality pollution targets by the various water user industries are implemented over a 10-year period*. This water quality target assumes that water pollution targets by the various water user industries will be implemented over a 10-year period. It is not a target that is assumed to be completely protective of the resource or the designated beneficial uses, or the final target in total phosphorus reductions for the Middle Snake River. But it is a target that industries and agencies agreed would be a starting point for targeting of phosphorus reductions to reduce nuisance aquatic plant growth at select portions of the river where most nuisance plant growths are known to exist, and where the swimmability and boatability of the river could be restored.

The instream target of 0.075 mg/L for the Middle Snake River was never suggested or implied for application to tributary waters that feed to the Middle Snake River because it was always assumed that these smaller tributaries were not modified flow regime systems. As previously described, a water quality target of 0.100

mg/L (or less) for all other tributaries throughout their entire length, from their source water (if applicable) to their discharge with the Middle Snake River seems appropriate. Thus, tributaries or streams discharging to the Middle Snake River are to discharge at TP concentrations not exceeding 0.100 mg/L. From upstream to downstream the overall target of the Middle Snake River is 0.075 mg/L. These criteria are preliminary targets that will be used to bring all industries into compliance within 5 years of plan effectiveness, and held for an additional 5 years to determine the effects of such reductions. The 0.100 mg/L instream target is appropriate for the tributaries because the water regimes are flowing systems, and the instream target will prevent nuisance algal growths.

Total phosphorus allocations defined in the Mid-Snake TMDL shall continue to be enforced for those industries that have wasteload or load allocations. For point source industries, such as aquaculture, which have a portion of the facilities defined as TBD (To Be Determined), these wasteload allocations will not be defined until after 3 years of monitoring. Permits for point source industries are described in Table 81 as to when they were signed, when they became effective, and when they will expire. Under the TMDL, a permit may be re-opened to incorporate provisions of the TMDL that better describes the wasteload allocations. This has always been the intent for wasteload allocations for point sources.

Table 81 Permitted industries permit signing, effectiveness, and expiration under the Mid-Snake TMDL

Industry or Facility	*Permit Signed*	*Permit Effectiveness*	*Permit Expiration*
Aquaculture Industry	August 19, 1999	September 10, 1999	September 10, 2004
City of Buhl	July 29, 1999	August 31, 1999	August 31, 2004
City of Filer	July 29, 1999	August 31, 1999	August 31, 2004
City of Hagerman	July 29, 1999	August 31, 1999	August 31, 2004
City of Hansen	July 29, 1999	August 31, 1999	August 31, 2004
City of Jerome	July 29, 1999	August 31, 1999	August 31, 2004
City of Twin Falls	July 29, 1999	August 31, 1999	August 31, 2004
J.R. Simplot-Burley	July 29, 1999	August 31, 1999	August 31, 2004
McCains-Burley	July 29, 1999	August 31, 1999	August 31, 2004

Prepared by IDEQ-TFRO. Permits will be re-opened after 3 years of monitoring for assessment of wasteload allocations and incorporation of those wasteloads as permit limits for the defined parameter.

For nonpoint source industries, like irrigated agriculture, load allocations defined in the Mid-Snake TMDL will continue to be enforced with the provision that if any of the 18 named agricultural drains meets its defined goals for TP reductions but is still above the level imposed by the Upper Snake Rock TMDL, then they will have to reduce additionally to the level defined in the Upper Snake Rock TMDL.

3.1.3 PATHOGENS

For pathogens the development of specific BMPs by the land management agencies during the implementation phase of the TMDL process for Upper Snake Rock will be used to demonstrate reductions towards State Water Quality Standards. The Idaho Rules and Regulations instantaneous limits of 500 and 800 colonies/100 mL (primary and secondary contact recreation) will continue to be used, unless changes in the regulations allow for *E. Coli* to be used instead of fecal coliform. Additionally, reductions in TSS will also show reductions in fecal coliform bacteria levels. See Appendix D. See also §2.2.4.3 of sub basin assessment. Therefore, a TMDL for the Middle Snake River on pathogens will not be proposed at this time since it can be demonstrated that the river is meeting State Water Quality Standards for primary and secondary contact recreation. For tributaries, primary contact recreation exceedences are 430 out of 1878 total samples (or 22.9%), and for secondary contact recreation exceedences are 240 out of 1878 total samples (or 12.8%). Therefore, a TMDL is proposed that brings the percent of samples with fecal coliform bacteria exceedences down to a level that is less than 10.0% of the samples taken during a 30-day period for a particular stream for both primary and secondary contact recreation. This will require the development of a monitoring plan for the tributaries which the Mid-Snake WAG, the Mid-Snake TAC, and IDEQ-TFRO will develop during the implementation phase of the TMDL process. The following list summarizes the recommended actions based on the subbasin assessment §2.2.4.3 tributary fecal bacteria data and assessment. Recommendations are defined as follows: "No action required" means no TMDL or BMP plan will be required; "TMDL required" is specific for natural waterbodies and means that whether listed for bacteria or not, the waterbody needs to have a TMDL for bacteria; "Monitoring required" means that IDEQ-TFRO will conduct monitoring for pathogens within 24 months of TMDL acceptance and as a result of the monitoring will provide a pathogen assessment; and, "Action required" is specific for manmade waterways and implies that a BMP plan will need to be developed for this waterway that specifically looks at pathogen reductions to State water quality standards (an instream target of 400 cfu/100 mL) and that at the point of discharge to the natural waterway will have a TMDL for pathogens.

Surface Waterbody	***Listed for Bacteria?***	***Designation***	***Recommendation***
	303(d) LISTED STREAMS		
Alpheus Creek	No	DW	No action required
Billingsley Creek	No	DW, PCR, SCR	***TMDL required***
Blind Canyon Creek	Yes	SCR	Monitoring required
Clear Springs	No	SCR	Monitoring required
Clover Creek	No	PCR, SCR	***TMDL required***
Cottonwood Creek	Yes	SCR	***TMDL required***
Crystal Springs	No	SCR	Monitoring required
Dry Creek, Medley to SR	Yes	SCR	Monitoring required
Dry Creek, HW to Medley	Yes	SCR	Monitoring required
Dry Creek, West Fork	Yes	SCR	Monitoring required
Ellison Creek	Yes	SCR	No action required
McMullen Creek	Yes	SCR	Monitoring required
Riley Creek	Yes	DW, PCR, SCR	Monitoring required
Rock Creek (**)	Yes	PCR (*),SCR	***TMDL required***
Thousand Springs	No	SCR	Monitoring required
Vinyard Creek	Yes	SCR	No action required
Bliss Reservoir	No	PCR, SCR	No action required
Lower Salmon Falls Reservoir	No	PCR, SCR	No action required
Pioneer Reservoir	Yes	PCR, SCR	Monitoring required
Shoshone Falls Reservoir	No	PCR, SCR	No action required
Upper Salmon Falls Reservoir	No	PCR, SCR	No action required
Middle Snake River,			
Milner to Murtaugh	Yes	PCR, SCR	No action required
Murtaugh to King Hill	No	PCR, SCR	No action required

* = Protected for future use.

Recommendations based on assessments found in §2.2.4.1; 2.2.4.3; 3.0.2.1; 3.0.2.2; 3.0.2.3; 3.5. Where no monitoring information was available, then a monitoring plan will be developed and applied over the next 24 months to assess pathogen impacts.

ADDITIONAL NATURAL SURFACE WATERBODIES NOT ON 303(d) LIST			
Cedar Draw (**)	No	SCR	***TMDL required***
Mud Creek	No	SCR	***TMDL required***
Deep Creek (**)	No	SCR	***TMDL required***
Salmon Falls Creek	No	PCR, SCR	No action required
Malad River	No	PCR, SCR	***TMDL required***

**IDAPA 16.01.02.280 protects for water quality Rock Creek, Cedar Draw, and Deep Creek as used by the Twin Falls Canal Company as spillways, collection and conveyance facilities. This implies that water quality will be protected even under those conditions when the canal company uses it as a manmade conveyance. Thus, natural streams which have canalways that discharge to them shall be water quality protected even during the irrigation season, implying that discharges to them shall meet beneficial uses or State water quality standards. Recommendations based on assessments found in §2.2.4.1; 2.2.4.3; 3.0.2.1; 3.0.2.2; 3.0.2.3; 3.5.

MANMADE WATERBODIES

Drain/(%Exceedence)	*Pathogen Listing?*	*Designation*	*Recommendation*
North Side Canal Company Drains (Phase 1 Study)			
A Drain (16.7%)	No	Manmade Waterway	Action required
C55 Drain (5.6%)	No	Manmade Waterway	No action required
N42 Drain (36.4%)	No	Manmade Waterway	Action required
N42 Drain (Rim) (72.8%)	No	Manmade Waterway	Action required
J8 Drain (18.9%)	No	Manmade Waterway	Action required
S29 Drain (11.8%)	No	Manmade Waterway	Action required
S19/S Drains (36.8%)	No	Manmade Waterway	Action required
W26 Drain (11.1%)	No	Manmade Waterway	Action required
Twin Falls Canal Company Drains (Phase 1 Study)			
A10 Drain (35.3%)	No	Manmade Waterway	Action required
Twin Falls Coulee (33.3%)	No	Manmade Waterway	Action required
East Perrine Coulee (14.8%)	No	Manmade Waterway	Action required
Main Perrine Coulee (11.5%)	No	Manmade Waterway	Action required
West Perrine Coulee (22.2%)	No	Manmade Waterway	Action required
43 Drain (35.7%)	No	Manmade Waterway	Action required
30 Drain (16.7%)	No	Manmade Waterway	Action required
LQ/LS Drains (34.5%)	No	Manmade Waterway	Action required
LS2/39A Drain (33.3%)	No	Manmade Waterway	Action required
39 Drain (27.6%)	No	Manmade Waterway	Action required
I Drain (41.4%)	No	Manmade Waterway	Action required
N Drain (3.6%)	No	Manmade Waterway	No action required

DW = Drinking Water. PCR = Primary contact recreation. SCR = Secondary contact recreation.
Recommendations based on data found in the Phase 1 Study report.

Appendix D provides additional technical information on the linkage between bacteria and TSS. As a consequence of TSS reductions, it is anticipated that fecal coliform will be reduced as well. However, BMPs that specifically look at minimizing fecal coliform impacts due to land use will be assessed by the land management agencies during the implementation phase of the TMDL. These BMPs will be used to help develop specific farm plans that contain a pathogen management component that addresses specific actions for pathogen reduction in conjunction with other nonpoint source reductions. These plans will be developed during the implementation phase of the TMDL. Where land management falls under the authority of the USFS or USBLM, it is expected that appropriate measures will be conducted by those agencies "to protect and maintain water quality where standards are met or surpassed, and restore water quality limited water bodies within their jurisdiction to conditions that meet or surpass standards for designated beneficial uses (USFS & USBLM & USEPA 1999 [p 1]l)." Where the land management falls under the authority of the Idaho Department of Lands (IDL), IDEQ will cooperate with that agency to develop a land management plan that will restore or help to bring restoration to a water quality limited stream. If the land management falls under the authority of private ownership, IDEQ will cooperate with NRCS, the Idaho Soil Conservation Commission, and the local soil conservation districts, and property owners to develop specific BMPs that will remediate the water quality limited stream. IDEQ-TFRO will annually assess all BMPs considered for inclusion for farm and/or allotment plans, and will make such assessments with the various land management agencies. Any BMP that is determined by IDEQ-TFRO in conjunction with the land management agency to be inadequate for water quality protection will be subject to removal from the farm and/or allotment plan, and will be replaced by another BMP that protects the water quality limited stream or stream segment. At all times, IDEQ-TFRO will be subject to all the rules governing nonpoint source activities as defined in IDAPA 16.01.02.350.

3.1.4 UN-IONIZED AMMONIA

See the Appendix D for additional information. No concentration greater than 0.020 mg/L of un-ionized ammonia is recommended at any time or place (USEPA 1972 [p 187]). In terms of assessing un-ionized NH3, IDEQ-TFRO used the total number of samples collected and categorized un-ionized ammonia as follows: (1) if the percent un-ionized ammonia of the total number of samples was zero, this was reported as *No Exceedences Found*; (2) if the percent un-ionized ammonia of the total number of samples was < 10.0, this was reported as *Minor Exceedences Found*; and, (3) if the percent un-ionized ammonia of the total number of samples was 10.0 or more, this was reported as *Major Exceedences Found*. Only stream segments with *Major Exceedences Found* will be considered for a TMDL. Precedence for this assessment approach is in *Guidelines for Preparation of the 1996 State Water Quality Assessments (305(b))* (USEPA 1995d).

For un-ionized NH3 no instream target is proposed at this time on the Middle Snake River. In § 2.2.4.1, item 2, of the sub basin assessment, it was demonstrated that of 1498 samples collected, only 5 samples (or 0.3%) exceeded the protective level (based on State water quality standards) for fisheries. These exceedences occurred in 1991, 1992, and 1995. Additionally, Table 51 summarizes the % Exceedences on a per-reach basis on the Middle Snake River. Only four reaches (Milner Dam, Murtaugh Bridge, Twin Falls Dam, and Crystal Springs) had exceedences but these were well in the minor exceedences level. IDEQ-TFRO proposes no instream target at this time. However, this parameter will continue to be reviewed based on monitoring information and a TMDL may be developed in the future if major exceedences result in the total number of samples collected.

For the tributaries, a summary of un-ionized ammonia exceedences is detailed in §2.2.4.2, item 2. These exceedences represent a fraction of all the tributaries (only 9). Some of the data is not reflective of 9 years, while some is reflective of a smaller portion of a single year. As a whole, the range of exceedences is from 0.0% to 2.4% of un-ionized ammonia. Therefore, in 2212 total samples (for all 9 tributaries) there were 27 un-ionized ammonia exceedences, or 1.2% of the total sample population. Individually and as summarized in Table 55, tributary streams have the following un-ionized ammonia exceedences (as a percent of the total number of samples collected): (Major exceedence tributaries are bolded in black; $\underline{N}_{TOTAL}$ is the total number of samples in the population; and, $\underline{N}_{Un\text{-}ionized}$ is the total number of samples where un-ionized NH3 >= 0.020 mg/L).

DATA AS COLLECTED BY IDEQ-TFRO FROM 1990-1998:

Tributary	N_{TOTAL}	$N_{Un\text{-}ionized}$	% of Total	IDEQ-TFRO Assessment
East Perrine Coulee	278	0	0.0	No exceedences found
Rock Creek	288	2	0.7%	Minor exceedences found
Cedar Draw	277	5	1.8%	Minor exceedences found
Mud Creek	277	4	1.4%	Minor exceedences found
Deep Creek	275	5	1.8%	Minor exceedences found
Salmon Falls Creek	270	0	0.0	No exceedences found
Billingsley Creek	417	10	2.4%	Minor exceedences found
Malad River	88	0	0.0	No exceedences found
Clover Creek	42	1	2.4%	Minor exceedences found
Overall Total	2212	27	1.2%	Minor exceedences found

No un-ionized ammonia TMDL will be done on any tributaries at this time. However, as a consequence of TSS reductions it is expected that acceptable levels of un-ionized ammonia will be reduced as well due to the following:

1. Reduction in TSS levels aids in reduced runoff of associated particulates such as total ammonia nitrogen. Reduction in total ammonia nitrogen will also reduce un-ionized ammonia levels as a consequence. In the Middle Snake River system, a synergistic relationship exists between total ammonia load (in tons/year) and TSS load (in tons/year). That relationship is best described statistically per river segment as follows:

Segment Site	Equation	N	r^2	F-ratio	p value
Milner Dam	TSS=(640.021085xNH3)+17671.5	217	0.662	191.1	0.000000
Pillar Falls	TSS=(83.181116xNH3)+4.9074.1	208	0.325	24.3	0.000002
Crystal Springs	TSS=(682.779413xNH3)-58590.5	300	0.511	105.5	0.000000
Box Canyon	TSS=(834.483746xNH3)-252767.0	176	0.723	190.3	0.000000
Gridley Bridge	TSS=(870.638625xNH3)-172144.0	205	0.762	282.0	0.000000
Shoestring	TSS=(1934.794139xNH3)-301854.0	143	0.884	506.2	0.000000
King Hill	TSS=(754.697364xNH3)+11039.8	161	0.724	175.3	0.000000

TSS = TSSLOAD (tons/year); NH3=NH3LOAD (tons/year)

Since a 33.6% average annual reduction in TSS would be expected in the Middle Snake River system from land use management stgrategies (see §3.5.07 for TSS Loading Analysis Summary), a comparable 10.1% reduction in total ammonia nitrogen would be expected in the Pillar Falls to King Hill area. The Milner Dam to Pillar Falls segment does not have problems with un-ionized ammonia.

2. Typical organic nitrogen content in sediment is about 1.2 mg/g of associated sediment (Calow & Petts 1992 [Volume I, p 92, Table 92]). Since organic nitrogen content (as total organic nitrogen or TON) is the difference between total Kjeldahl nitrogen and total ammonia nitrogen, and since total ammonia will be reduced synergistically as TSS is reduced in the system, it is anticipated that values < 1.2 mg/g organic nitrogen content of associated sediment will be found. Un-ionized values < 0.020 mg/L would be expected to be found at levels < minor-to-none exceedences.

In additon to tributaries, un-ionized ammonia exceedences from irrigation canal drains were also considered.

These drains were monitored in the Phase 1 Study (1990-1991) and are described as follows: (Major exceedence waterbodies are bolded in black).

IRRIGATION CANAL DRAINS FROM PHASE 1 STUDY:

Tributary	N_{TOTAL}	$N_{Un-ionized}$	% of Total	IDEQ-TFRO Assessment
	NORTHSIDE CANAL COMPANY DRAINS			
A Drain	18	0	0.0	No exceedences found
C55 Drain	18	0	0.0	No exceedences found
S29 Drain	17	0	0.0	No exceedences found
N42 Drain	11	0	0.0	No exceedences found
N42 Drain (Canyon)	18	1	5.6	No exceedences found
J8 Drain	16	1	6.3	Minor exceedences found
S19 & S Drains	19	0	0.0	No exceedences found
W26 Drain	18	0	0.0	No exceedences found
Overall Total	135	2	2.7	Minor exceedences found
	TWIN FALLS CANAL COMPANY DRAINS			
A10 Drain	17	0	0.0	No exceedences found
Twin Falls Coulee	18	0	0.0	No exceedences found
Main Perrine Coulee	26	1	3.8	Minor exceedences found
West Perrine Coulee	18	1	5.6	Minor exceedences found
43 Drainage	14	0	0.0	No exceedences found
30 Drain	18	1	5.6	Minor exceedences found
LQ and LS Drains	29	0	0.0	No exceedences found
LS2/39A Drain	27	0	0.0	No exceedences found
39 Drain	29	1	3.4	Minor exceedences found
I Drain	29	5	17.2	***Major exceedences found***
N Drain	28	0	0.0	No exceedences found
Overall Total	253	9	3.6	Minor exceedences found

See Appendix D, Technical Support Document, Sub appendix XIII for calculations for both canal companies.

Manmade waterbodies where un-ionized ammonia have been found as a major exceedence will reduce to a level that when they discharge to a natural waterbody, they will be in the minor or no exceedence category. It is understood that reductions in TSS will produce reductions in total ammonia nitrogen which translates to reductions in un-ionized ammonia.

3.1.5 NOX

Nitrogen as Nitrite+Nitrate (NOX) can be a key eutrophication pollutant in lakes because NOX that enters the waterbody tends to be recycled within the lake and builds up over a period of time. By contrast, the Middle Snake River and its tributaries are flowing systems in which nutrients are always entering or leaving at any given section. Accumulations tend to occur only in sediment or in slack water, and the effects of these accumulations are normally moderated by the periodic flushing action of high flow events (USEPA 1993 [p 13]). In the State of Idaho there is no water quality standard for NOX. Thus, the State can only control it as it relates to nuisance aquatic vegetation as a limiting nutrient. Since NOX is not a limiting nutrient in either the Middle Snake River or its tributaries, and since there is no nuisance aquatic vegetation because of NOX, there is no proposed instream target at this time. However, this parameter will continue to be reviewed based on monitoring information and a TMDL may be developed in the future if mean loads within the river and its tributaries increase significantly above where the current 1990-1998 mean load exists. See Appendix D. See also § 2.2.4.1 (1) of the sub basin assessment. Additionally, NOX is not considered a toxic pollutant on fisheries at current levels.

3.1.6 PESTICIDES

The only water quality limited stream segment listed for pesticide pollutants is Cottonwood Creek, from its headwaters to where it discharges to Rock Creek. A literature survey of work done by various agencies and organizations was conducted, and no anecdotal evidence of pesticides being discharged to the Cottonwood Creek was found. It is possible that the original listing was in error, but there is no way to confirm this. IDEQ-TFRO sampled in 1999 (June, July, and August) when the potential for pesticide impact to Cottonwood Creek was greatest. Two sampling sites were selected: above the area of impact (to serve as background), and immediately below the area of impact (to demonstrate response). Based on the type of pesticides used for land use in the North Cottonwood-McMullen 5th Field HUC (17040212-23), and consulting with the IDHW-Lab in Boise, Idaho, it was determined that three pesticide groups be tested in the receiving water: organochlorine insecticides (USEPA Method 508/8080), herbicides (USEPA Method 505.1/8150), and organophosphates (USEPA Method 507/8140). Laboratory results are noted in Table 82.

Table 82 Pesticide results on Cottonwood Creek instream water

Sites on Cottonwood Creek	*June 1999*	*July 1999*	*August 1999*
Upstream	None Detected	None Detected	None Detected
Downstream	None Detected	None Detected	None Detected

Methods 515.1 (herbicides), 525.2 (Phthalates, PAH), PAH (550.1), 507 (organophosphates) and 508 (organochlorine insecticides) total up to 140 compounds. Site inspection of the zone of impact indicates that the potential for pesticide entry into Cottonwood Creek is minimal. Diverted stream within the zone of impact is used for irrigation and grazing purposes. Cottonwood Creek at the end of zone of impact is plumbed through a riparian area that is filled with a myriad of wildlife.

Instream water quality analysis for pesticides indicates that no pesticides (as herbicides, organophosphates, or organochlorine insecticides) were detected. Therefore, it is recommended that pesticides, as a parameter, be removed as a pollutant from the 303(d) list for Cottonwood Creek.

3.1.7 OIL AND GREASE

Only one stream segment is listed for oil and grease: Rock Creek. This listing was a result of previous historical practices that allowed the discharge of the Twin Falls POTW and various other point sources into Rock Creek. These sources no longer discharge to Rock Creek. Joint monitoring conducted by IDEQ-TFRO and the City of Twin Falls demonstrates that oil and grease is no longer a contaminant of Rock Creek. The monitoring was done on Rock Creek (between the Amalgamated Sugar Company and Rock Creek Park) in 1997. The results indicate that oil and grease levels were always < 4 mg/L. Monitoring at the two sites (and a third site on the 4th Fork of Rock Creek for background) was immediately downstream of two storm drains that would likely show exceedences (> 5 mg/L). The monitoring was bi-monthly for the entire year (1997) and covered the fall and winter quarters when oil and grease would be most prevalent. No oil and grease exceedences were noted. Therefore, IDEQ-TFRO proposes that oil and grease be "de-listed" from the 303(d) list as a pollutant of Rock Creek. No TMDL for oil and grease will be proposed. See §3.2.3, item 3, Facilities that Discharge, Oil and Grease for more information.

3.1.8 TEMPERATURE

There are definite inconsistencies between water temperatures that exceed criteria in the Idaho water quality standards and fish data that indicate viable, self-sustaining assemblages exist. These inconsistencies include a number of physical factors such as regional, climatic and species diversity, and temporal air temperature variations which deter the use of one single temperature value for a large regional area. The National Academy of Sciences (1973) has concluded that "no single temperature requirement can be applied to ... large regional areas; the requirements must be closely related to each body of water and to its particular community of organisms." Because of these inconsistencies or variations, an aquatic life, salmonid spawning, and temperature regime study is to be developed and conducted by IDEQ statewide to comprehensively document the uniform criteria issue, and support development of water quality criteria to protect salmonid spawning that takes into account natural environmental diversity. This issue is complex but a protocol for measuring, reporting, and evaluating stream temperature will be developed to establish a temperature record acceptable for comparison to criteria. The study will be aimed at producing new temperature criteria for proposal in year 2000. Thus, all streams that would be listed for temperature on the 1998 303(d) list, (including carryovers from 1996, and additions), will be placed on a separate list. Therefore, TMDLs will be postponed for streams on this list for 18 to 24 months, to allow for completion of the study and the development of new water quality standards.

3.1.9 DISSOLVED OXYGEN

See Appendix D. Violations in temperature criteria on the Middle Snake River or its tributaries are not necessarily linked to violations in DO. Additionally, under the terms specified in IDAPA 16.01.02.276, waters discharged from dams, reservoirs, and hydropower facilities are not subject to the provisions of subsection 250.02.c.i (DO standard of 6.00 at all times for lakes and reservoirs for cold water biota) or subsection 250.02.d.i (intergravel DO at 5.00 mg/L one day minimum and water column DO at 6.00 mg/L at one day minimum for salmonid spawning). Subsection 276.02 (from June 15 to Oct 15 a 30-day mean of 6.00 mg/L, a 7-day mean minimum of 4.70 mg/L, and an instantaneous minimum of 3.50 mg/L), subsection 276.03 (modified DO periods for certain fisheries), and subsection 276.04 (DO below American Falls Dam) shall apply to all waters below dams, reservoirs, and hydroelectric facilities as far downstream as the point of measurement as defined in subsection 276.05 (a representative, thoroughly mixed area downstream of the discharge but as close to the facility as practical). Downstream of the point of measurement, all discharges to the waters shall be subject to the provisions of subsections 250.02.c.i and subsection 250.02.d.i (as previously cited).

A contract study conducted by ERI in 1996 at three locations on the Middle Snake River demonstrated that within and outside the macrophyte beds there were no violations of the DO standard as had been demonstrated previously by Falter (Falter 1994; Falter 1995; Falter 1996). Falter's work was done during the lowest flow years and within the most dense macrophyte beds, whereas the ERI study was conducted during a high flow event. IDEQ-TFRO personnel indicate that during the 1990-1993 time period, approximately 75% of the localized nuisance areas in the Middle Snake River (not of the entire river system) were covered with heavy dense macrophytes, 20% were least dense, and about 5% had no macrophytes (McMasters 1999). Falter's work showed only two years during which violations occurred: (1) 1992 values showed diel DO within heavily weeded areas to fall below 6.00 mg/L in 5 transects, especially in late summer as the weeds became senescent, although some of the areas demonstrated DO levels > 6.00; (2) 1993 July mean DO values declined to less than 6.30 mg/L with a minimum single value of 5.70 mg/L in one transect; (3) 1994 July mean DO values declined to 8.40 mg/L with a minimum single value of 7.50 mg/L in one transect; and, (4) the lower profile in the water column showed lower DO values than at the surface, indicating that the DO level approximates the level of that DO in the water that is in contact with the atmosphere. The main reason for lower DO levels in the weedbeds versus outside the weedbeds is the decomposition of senescent vegetation and respiration of the plant biomass.

USGS and IDEQ-TFRO non-diehl monitoring studies indicate no violations of the instantaneous water quality standard. Even when the data is statistically segregated for low- versus high-flow years, violations of the DO standard never occurred. It is evident that in the Middle Snake River, and to some extent its tributaries, in the absence of substances that cause the depletion of DO, the DO concentration in stream water approximates the saturation level for oxygen in water in contact with the atmosphere and decreases with increasing water temperature. But these decreases are from about 14 mg/L at freezing to about 7 mg/L at 30°C. This is substantiated to some extent by correlation equations developed from monitoring data from USGS and IDEQ-TFRO. DO estimates at 25°C range from 6.72 - 7.45 mg/L which corresponds closely to the 7mg/L DO level at 30°C.

Thus, it may be concluded that a DO sag < 6.00 mg/L occurs only in the most heavily dense macrophyte beds. These same beds occur in localized areas within the Middle Snake River where the water is most shallow, where the water has minimal velocity, and where the water year is under low flow conditions. 1992 was the most heavily impacted macrophyte year and was also the lowest flow year of record from 1988 to 1995. Thus, macrophyte density and DO sags < 6.00 mg/L may be correlated to flow, implying that under extremely low flow conditions the worst case scenario for DO may potentially occur. A water year of record similar to 1992 may occur once-in-16 years (1983 - 1998) or a 6.3% chance that it would occur within a 16 year period. Since the Middle Snake River was modeled under RBM10 for the worse case scenario, the model predicts that with TP reductions approximating an instream value of 0.075 mg/L TP would result in a DO value of about 8.56 mg/L (See Chapter 4, Table 36, p. 91 of the Mid-Snake TMDL) which is well above the State's water quality standard. It is estimated that imposed TP reductions under the Mid-Snake TMDL will cause plant biomass to decrease between 20-60%, thus leading to levels below those considered to be "nuisance" and will likely restore beneficial uses. Therefore, no TMDL is proposed for DO on the Middle Snake River or its tributaries at this time.

3.2 SUMMARY OF NPDES PERMIT LIMITS ON POINT SOURCES

This section describes the NPDES permit limits for aquaculture, food processors, and municipalities. The State of Idaho under its Administrative Procedures Act has designated uses for a number of waterbodies that the State determines can be attained in the future. "Attainable uses" are those uses (based on the State's system of water use classification) that can be achieved when effluent limits for point sources under the Clean Water Act's Section 301(b)(1)A) and (B) and Section 306 are implemented for point source discharges and when cost-effective and reasonable BMPs are implemented for nonpoint sources (USEPA 1991c [p 29]). Therefore, effluent permit limits are so written to meet designated beneficial uses and/or to meet State water quality standards.

3.2.1 AQUACULTURE

Aquaculture wastes consist of uneaten fish feed, fecal material, and other excretory wastes. The characteristics and impacts of wastes from aquaculture operations vary according to the type and siting of the aquaculture system. Aquaculture systems that are relatively open to natural waters have the greatest potential to cause environmental degradation from waste discharges (Goldburg & Triplett 1997 [p 35-36]).

TOTAL SUSPENDED SOLIDS

Data collected and reported in USEPA's Discharge Monitoring Reports (DMRs) from aquaculture facilities in Upper Snake Rock beginning in 1990 through 1998, indicate that sediment as TSS represents a small portion of the gross total TSS when considering all industries together. In general and depending on the tributary (based on flow), the percent TSS attributable to aquaculture when compared to all other input sources is minor (< 10.0%). Exceedences beyond the NPDES permitted 5 mg/L TSS were few (less that 1% of the total number of samples collected from 1990 through 1998, based on a visual review of 65 facilities' DMRs). According to the aquaculture general permit, net TSS shall have interim effluent limits such that the aquaculture discharge from raceways, and from ponds during non-harvest periods, prior to mixing with any other flows, shall be limited as shown in Table 83:

Table 83 Aquaculture general permit TSS effluent limits

Net Total Suspended Solids Limits for Aquaculture Rearing and Holding Facilities during Non-harvest Periods				
Facility Type	Units	Average Monthly	Maximum Daily	Instantaneous Maximum
Cold Water	mg/L	5	10	15
Warm Water	mg/L	15	25	29
For Off-line Settling Basins or Earthen-bottomed Ponds during a Harvest Period				
Facility Type	Units	Average Monthly	Maximum Daily	% Removal
All Facilities	mg/L	67	100	≥ 90
Prepared by IDEQ-TFRO.				

NITROGEN

The proposed final General Aquaculture NPDES Permit (ID-G13-0000) provides that total ammonia (net NH_3), total nitrate plus nitrite (net NO_3 + NO_2), and total Kjeldahl nitrogen (net TKN) be monitored as part of an effluent characterization study during the first eighteen (18) months after receiving authorization to discharge under the permit during a twelve (12) month consecutive period both for raceways and ponds, and for offline settling basins (USEPA 1999). The study will assess the concentrations and loads during the 12 month period. Based on this characterization study, nitrogen loads may become a part of the permit at the end of year 3 in conjunction with other loadings that may be imposed as a result of the reopening of the permit for this specific purpose. In particular is the concern over un-ionized NH3. This parameter is highly toxic to fisheries at concentrations equal to or greater than 0.020 mg/L. An assessment of the Phase 1 Study aquaculture facilities' gross effluent indicates the following (see Appendix D):

AQUACULTURE FISH HATCHERIES FROM PHASE 1 STUDY:

Aquaculture Facility	N_{TOTAL}	$N_{Un\text{-}ionized}$	*% of Total*	*IDEQ-TFRO Assessment*
FISH PROCESSING PLANTS				
Blue Lakes Process	51	49	96.1	***Major exceedences found***
This processing plant is no longer in operation.				
COLD WATER REARING AND HOLDING FACILITIES				
Blue Lakes Trout	52	0	0.0	No exceedences found
Crystal Springs	54	2	3.7	Minor exceedences found
Magic Valley Fish	54	0	0.0	No exceedences found

Rim View	54	1	1.9	Minor exceedences found
Box Canyon	54	0	0.0	No exceedences found
Buckeye Farm	50	6	12.0	***Major exceedences found***
White Springs	54	1	2.1	Minor exceedences found
Birch Creek	54	11	20.4	***Major exceedences found***
Overall Total	426	21	4.9	Minor exceedences found
WARM WATER REARING AND HOLDING FACILITIES				
Idaho Fish Breeders	52	36	69.2	***Major exceedences found***

The values for un-ionized ammonia indicate that overall cold water facilities (with the exception of certain specific facilities) have minor exceedences. The only warm water facility has almost 3 times more un-ionized ammonia violations than the highest cold water facility. The Phase 1 Study looked only at the effluent discharge and did not account for influent effect, thus indicating that a net for the potential exceedence could not be determined. Also, the receiving stream above and below the discharge point was not monitored to ascertain the un-ionized ammonia effect in the receiving stream. Additionally, section 3.1.4 indicates that Rock Creek, Cedar Draw, Mud Creek, Deep Creek, Billingsley Creek, and the Middle Snake River had none-to-minor exceedences of un-ionized NH3. These tributaries and river contain the greatest concentration of fish hatcheries that discharge to them. The data indicates that some cold water facilities have higher effluent concentrations of un-ionized ammonia than previous considered. Continual monitoring since the Phase 1 Study has not occurred. Therefore, monitoring will be conducted by the aquaculture facilities over the next 3 years for pH, temperature, and total ammonia-N which are used in the algorithmic calculation of un-ionized ammonia. At that time will a TMDL involving the aquaculture industry be considered.

PHOSPHORUS

Total phosphorus will have load limits imposed after three years of monitoring as a result of the Mid-Snake TMDL. According to the proposed final General Aquaculture NPDES Permit (ID-G13-0000), phosphorus effluent limitations shall not exceed 970.2 lbs/day for those facilities listed in Appendix A of the permit. A permittee shall achieve compliance with the TMDL-based phosphorus effluent limitations within five (5) years from the effective date of permit issuance. Sampling frequency will be dependent on facility classification. Net total phosphorus shall have interim effluent limits such that the combined discharges from raceways, ponds, offline settling basins, and all other discharges, prior to mixing with any receiving water flows, shall be limited as shown in Table 84:

Table 84 Net TP limits for aquaculture rearing and holding facilities

Net Total Phosphorus Limits for Aquaculture Rearing and Holding Facilities				
Facility Type	**Units**	**Average Monthly**	**Maximum Daily**	**Instantaneous Maximum**
Cold Water	mg/L	0.100	0.160	0.180
Warm Water	mg/L	0.200	0.320	0.360
Prepared by IDEQ-TFRO.				

TEMPERATURE

There are no interim limits imposed for temperature, but facilities must comply with instream standards. Facilities shall sample at a frequency according to their facility classification. Additionally, the effluent characterization study will also include temperature as a parameter for testing. At the end of three years of monitoring, temperature data will be reviewed by both USEPA and IDEQ-TFRO, and a determination will be made at that time (based on the monitoring data) if limits will be required in the form of a TMDL. If a TMDL is required for temperature, then a permittee shall achieve compliance with the TMDL-based temperature effluent limitations within five (5) years from the permit effective date after reopening, but not before the stream temperature study proposed for protocol development in the subbasin has been completed.

DISSOLVED OXYGEN

There are no interim limits imposed for dissolved oxygen, but facilities must comply with instream standards. Facilities shall monitor for dissolved oxygen as part of an effluent characterization study. At the end of three years dissolved oxygen limits will be reviewed by both USEPA and IDEQ-TFRO, and a determination will be made at that time (based on the data collected from the study) if limits will be required in the form of a TMDL. As previously noted Idaho State Water Quality Standards allow for mixing zones. Unless otherwise noted and in accordance with Idaho Code § 16.01.02.060, the IDEQ may authorize mixing zones for DO for those facilities requesting it so as to ensure compliance with Idaho Water Quality Standards and Wastewater Treatment Requirements, or any TMDL developed that incorporates such water quality parameters. A facility that currently has DO information may apply currently for a mixing zone to IDEQ-TFRO. If a TMDL is required, then a permittee shall achieve compliance with the TMDL-based dissolved oxygen effluent limitations within five (5) years from the effective date of permit issuance.

3.2.2 FOOD PROCESSORS

Two major food processors are located upstream of Milner Dam in HUC 17040209 (Lake Walcott). Their effect on the Middle Snake River is dependent on the amount of water that goes downstream of Milner Dam after all water storage rights have been met. This passage of water downstream of Milner Dam is known as % Passage (or % Pass). Based on USGS flow information from WY1990 through WY1997, an annual average (as a percent) was determined for each year based on a comparison of gages 13087900 (Milner Lake at Milner Dam) against 13090000 (Snake River at Kimberly, ID). Gage 13090000 was selected since gage 13088000 (Snake River at Milner Dam) does not take into account all of the bypass flows that are returned to the system until downstream from this site (Buhidar 1999). Table 85 shows the annual estimates of downstream flows from Milner Dam, and indicates that in low flow years (WY1990 through WY 1995) the amount of water that actually went past Milner Dam averaged less than 4.56%, whereas in high flow years (WY1996 and WY1997) the amount of water averaged 19.40%.

Table 85 Annual flow estimates (in cfs) downstream past Milner Dam

Gage	WY1990	WY1991	WY1992	WY1993	WY1994	WY1995	WY1996	WY1997	WY1998
13087900	26842	26804	25958	35375	35700	35250	37017	38908	37300
13090000	833	716	647	1387	1867	2142	5863	9597	6625
% Pass	3.10	2.67	2.49	3.92	5.23	6.00	15.84	24.67	17.76

Prepared by IDEQ-TFRO. % Pass = percent of flows that pass Milner Dam = (13090000 / 13087900) x 100%. WYs 1990-1995, or the low flow years, averaged 3.90 % Pass, whereas WYs 1996-1998, high flow years, averaged 19.42% Pass. The Overall Average = 9.08%.

The two major food processors are J.R. Simplot Company (located in Heyburn and Burley, and discharging to the Snake River at RM652.2) and McCain Food Service, Inc. (formerly Ore-Ida Foods, Inc., located in Burley and discharging to the Snake River at RM 648.8 and 649.2). Tables 86, 87, and 88 summarize the

% Passage of TSS, N series, and TP that affects the Middle Snake River.

Table 86 TSS % pass for food processors above Milner Dam

Facility Name NPDES No.	*1990-1997 TSS Mean mg/L*	*1990-1997 Flow cfs Outfall*	*Mean TSS Load lbs/day Above Milner*	*% Passage, lbs/day High Flow = 19.4% Low Flow = 3.9%*	*% Pass tons/year*
J.R. Simplot 000066-3	76.58	3.29	1358.00	High Flow = 263.45	48.08
				Low Flow = 52.96	9.67
McCains 000061-2	60.05	5.68	1838.44	High Flow = 356.66	65.09
				Low Flow = 71.70	13.09

Prepared by IDEQ-TFRO. Mean TSS Load, lbs/day = TSS Mean, mg/L x Flow, cfs x 5.39. % Passage, lbs/day, Hi-Flow = Mean TSS Load, lbs/day x 0.1940. % Passage, lbs/day, Low Flow = Mean TSS Load, lbs/day x 0.0456. % Pass, tons/year = % Passage, lbs/day x 0.1825.

Table 87 N-Series (TKN, NOX, NH3) % pass for food processors above Milner Dam

Facility Name NPDES No.	*1990-1997 N Series Mean mg/L TKN NOX NH3*	*1990-1997 Flow cfs Outfall*	*Mean N Load lbs/day Above Milner Dam TKN NOX NH3*	*%Passage,lbs/day High Flow = 19.4% Low Flow = 3.9% TKN NOX NH3*	*% Pass tons/year TKN NOX NH3*
J.R. Simplot 000066-3	7.74 105.45 4.67	3.29	137.25 1869.96 82.81	High Flow: 26.6 362.8 16.1	4.6 66.2 2.9
McCains 000061-2	2.02 62.53 8.68	5.68	61.84 1914.37 265.74	High Flow: 12.00 371.39 51.55	2.2 67.8 9.4

Prepared by IDEQ-TFRO. Mean TSS Load, lbs/day = TSS Mean, mg/L x Flow, cfs x 5.39. % Passage, lbs/day, High Flow = Mean TSS Load, lbs/day x 0.1940. % Passage, lbs/day, Low Flow = Mean TSS Load, lbs/day x 0.0456. % Pass, tons/year = % Passage, lbs/day x 0.1825. High flow conditions were preferred because they gave the higher load values when compared to low flow conditions.

Table 88 TP % pass for food processors above Milner Dam

Facility Name NPDES No.	*1990-1997 TP Mean mg/L*	*1990-1997 Flow cfs Outfall*	*Mean TP Load lbs/day Above Milner*	*% Passage, lbs/day High Flow = 19.4% Low Flow =3.9%*	*% Pass tons/year*
J.R. Simplot 000066-3	25.80	3.29	457.51	High Flow = 88.76	16.20
McCains 000061-2	28.99	5.68	887.53	High Flow = 172.18	31.42

Prepared by IDEQ-TFRO. Mean TSS Load, lbs/day = TSS Mean, mg/L x Flow, cfs x 5.39. % Passage, lbs/day, High Flow = Mean TSS Load, lbs/day x 0.1940. % Passage, lbs/day, Low Flow = Mean TSS Load, lbs/day x 0.0456. % Pass, tons/year = % Passage, lbs/day x 0.1825. High flow conditions were preferred because they gave the higher load values when compared to low flow conditions.

On an average basis, the high flow % passage will be used to describe the background to the Middle Snake River since it would describe the worst-case scenario relative to loadings entering the system. Therefore, TSS has a total load of 113.2 (48.1 + 65.1) tons/year, TKN is 6.8 (4.6 + 2.2) tons/year, NOX is 134.0 (66.2 + 67.8) tons/year, NH_3 is 12.4 (2.9 + 9.4) tons/year, and TP is 47.6 (16.2 + 31.4) tons/year. This is absorbed into the background loading of TSS coming into the Middle Snake River at Milner Dam.

3.2.3 MUNICIPALITIES

Two major municipalities are located upstream of Milner Dam and are also affected by the % Pass of water that discharges past Milner Dam into the Middle Snake River. These municipalities are listed in Table 89, and indicate that in high flow years they contribute 7.0 (5.9 + 1.1) tons TSS/year.

Table 89 TSS % pass for municipalities above Milner Dam

Facility Name NPDES No.	*1990-1997 TSS Mean mg/L*	*1990-1997 Flow cfs Outfall*	*Mean TSS Load lbs/day Above Milner*	*% Passage, lbs/day High Flow = 19.4% Low Flow = 3.9%*	*% Pass tons/year*
Burley 002009-5	16.2	2.2	166.3	High Flow = 32.26	5.9
Heyburn 002094-0	14.1	0.4	31.0	High Flow = 6.01	1.1
Prepared by IDEQ-TFRO. Mean TSS Load, lbs/day = TSS Mean, mg/L x Flow, cfs x 5.39. % Passage, lbs/day, High Flow = Mean TSS Load, lbs/day x 0.1940..% Passage, lbs/day, Low Flow = Mean TSS Load, lbs/day x 0.0456. % Pass, tons/year = % Passage, lbs/day x 0.1825. High flow conditions were preferred because they gave the higher load values when compared to low flow conditions.					

Based on the type of discharge, municipalities in the Upper Snake Rock subbasin may be categorized in one of four areas: (1) total containment/non-discharging (TC/ND), (2) land application/discharging to a land site (LA), (3) pre-treatment agreement with another municipality that treats their sewage (PTA), and (4) NPDES permitted facilities that discharge to surface waters. Within the Upper Snake Rock subbasin, municipalities may be classified according to their mode of discharge. These are described as follows:

1. FACILITIES THAT DO NOT DISCHARGE

These facilities are covered by land application permits, pre-treatment agreements, or total containment. They include: Hazelton (LA-000023), Kimberly (PTA with City of Twin Falls), Eden (TC/ND), Castleford (TC/ND), Wendell (LA-000076), Murtaugh (LA-000147), and Crossroads of Idaho (LA-000096). As part of the Mid-Snake TMDL, total phosphorus loadings (or other parmater loadings) are zero since these facilities do not discharge to waters of the United States or waters of the State of Idaho. Table 90 summarizes these facilities.

Table 90 Description of facilities that do not discharge in Upper Snake Rock

Name of City / County	*NPDES Permit No.*	*Land Application Permit No.*	*Type of Discharge*
Hazelton / Jerome	None	LA-000023	Total containment/non-discharge
Kimberly / Twin Falls	002037-1	None	Pre-treatment agreement
Eden / Jerome	None	None	Total containment/non-discharge
Castleford / Twin Falls	None	None	Total containment/non-discharge
Wendell / Gooding	None	LA-000076	TC in winter; sprinkler disposal in summer on land
Murtaugh / Twin Falls	None	LA-000147	Land application for rapid infiltration basin
Crossroads of Idaho / Jerome	None	LA-000096	TC in winter; summer LA to cropland

Prepared by IDEQ-TFRO. Hazelton previously had an NPDES Permit No. 002118-1. It no longer discharges to an irrigation canal to Wilson Lake Reservoir. City of Kimberly has a pre-treatment agreement with the City of Twin Falls. TC = Total Containment.

2. FACILITIES THAT SEASONALLY DISCHARGE

Only one facility discharges seasonally and that is the City of Filer (002006 + LA 000079). As part of the Mid-Snake TMDL, a TP allocation of 16.4 lbs/day is estimated at the end of five years following plan implementation. In the new 1998-1999 NPDES permit for Filer, a number of changes were incorporated to include effluent limits for parameters listed in Table 91.

Table 91 Description of effluent limits for facilities that seasonally discharge in Upper Snake Rock

BOD5				TSS				Fecal Coliform		TRC	TP
mg/L	lb/day	mg/L	lb/day	mg/L	lb/day	mg/L	lb/day	per 100 mL	Per 100 mL	mg/L	lbs/day
AML		AWL		AML		AWL		AML	AWL	AML	AML
30	58	45	87	30	58	45	87	100	200	0.3	17.0

Prepared by IDEQ-TFRO. Monitoring for NH3, TKN, NOX, and temperature which have no limits imposed at this time. AML = Average Monthly Limit. AWL = Average Weekly Limit. TRC - Total Residual Chlorine.

3. FACILITIES THAT DISCHARGE

These facilities discharge indirectly or directly to the Middle Snake River. Three facilities discharge indirectly to the Middle Snake River: Buhl (002066-4), Hansen (002244-6), and Jerome (020168 + LA-000149). Two facilities discharge directly to the Middle Snake River: Twin Falls (0021270 + pre-treatment agreements) and Hagerman (0025941 + total containment with evaporation ponds). As part of the Mid-Snake TMDL, a TP allocation of 17.4, 3.3, 204.7, 707.0, and 5.7 lbs/day, respectively, is estimated at the end of five years following plan implementation. The Twin Falls municipality has pre-treatment agreements with the following point sources: Lamb Weston (previously Universal Frozen Foods), Independent Meat, Silver Creek Aquaculture Farm, Avonmore West, City of Kimberly POTW, and Gem Linen Supply. In the new 1998-1999 NPDES permits, a number of changes were incorporated to include effluent limits for the parameters listed in Table 92.

Table 92 Description of effluent limits for facilities that discharge in Upper Snake Rock

City of	BOD5				TSS				Fecal Coliform		TRC	TP
	mg/L	lb/day	mg/L	lb/day	mg/L	lb/day	mg/L	lb/day	per 100 mL	Per 100 mL	mg/L	lbs/day
	AML		AWL		AML		AWL		AML	AWL	AML	AML
Buhl	45	390	65	585	70	-	105	-	100	200	0.5	17.4
Jerome	30	375	30	560	30	375	45	560	50	100	0.5	205.0
Hansen	30	40	45	60	30	40	45	60	100	200	0.5	3.3
Hagerman	45	63	65	95	70	-	105	-	100	200	-	5.7
Twin Falls	30	1952	45	2928	30	1952	45	2928	100	200	0.012	710.0

Prepared by IDEQ-TFRO. The average monthly fecal coliform count must not exceed a geometric mean of 200/100 mL based on a minimum of five (5) samples taken oven a 30-day period. The weekly fecal coliform count must not exceed a geometric mean of 200/100 mL based on no more than 1 week's data and a minimum of 5 samples. City of Twin Falls has limits for Total Ammonia as N: May 1 to September 30 at 3.8 mg/L and 247 lbs/day; October 1 to April 30 at 5.2 mg/L and 338 lbs/day. AML = Average Monthly Limit. AWL = Average Weekly Limit.

Loadings for discharging facilities (whether direct or indirect) are summarized in Tables 94 and 95 according to the parameter of concern. The six facilities (1 seasonal and 5 discharge) have their discharges to the outfalls as listed in Table 93.

Table 93 Municipalities that discharge seasonally or year-round to the Middle Snake River

City of	*NPDES Permit No.*	*Type of Facility & Discharge*
Filer	002006-1	Lagoon facility discharging to Cedar Draw
Buhl	002066-4	Lagoon facility discharging to East Fork of Mud Creek
Hansen	002244-6	Treated domestic wastewater discharging to ag drain to Snake River
Jerome	002016-8	Treatment and disinfection discharging to "J" canal to Snake River
Hagerman	002594-1	Lagoon facility discharging to Snake River
Twin Falls	002127-0	Treatment and disinfection discharging to Snake River

Prepared by IDEQ-TFRO. Cedar Draw and Mud Creek are not listed in the 1996 303(d) list and therefore are not a water quality limited stream segment that is considered in the Upper Snake Rock Subbasin Assessment for TMDLing at this time. The 1998 303(d) list will have these two additional streams listed.

TOTAL SUSPENDED SOLIDS

The mean annual loads for TSS (in lbs/day and tons/year) from 1991 through 1997 are summarized in Table 94 for each discharging facility. For each year summarized, a yearly concentration was derived (taking the average of 12 months in a year) and a mean flow (with conversion of mgd to cfs). A mean annual load (lbs/day) was derived as follows: Mean TSS x Mean Flow x 5.39 = Mean Annual Load (lbs/day). The mean annual load (tons/year) was derived as follows: Mean Annual Load (lbs/day) x 0.1825 = Mean Annual Load (tons/year).

Table 94 TSS Loadings for various municipalities

City of	*1991-1997 Mean TSS mg/L*	*1991-1997 Mean Flow cfs*	*Daily Load lbs/day*	*Mean Annual Load tons/year*
Filer	9.06	0.24	11.74	2.14
Buhl	48.38	0.61	157.65	28.77
Jerome	17.47	0.91	87.25	15.92
Hegerman	12.71	0.18	12.66	2.31
Hansen	14.32	0.09	7.02	1.28
Twin Falls	23.65	6.28	805.04	146.92

Prepared by IDEQ-TFRO. cfs = mgd x 1.548.

NITROGEN

Only three municipalities had information on nitrogen forms (either as ammonia, NOX, or total Kjeldahl nitrogen). The City of Buhl began monitoring for all three forms beginning in December 1995. Only two full years (1995-1996) are available for review. The City of Filer began monitoring all three forms in January 1996, but monitored sporadically in 1996 and 1997 since they are a seasonal discharger. Additional information is required. The City of Twin Falls began monitoring in November 1994 but only for ammonia and NOX. Additional information is required. The other cities did not have any monitoring, and thus require it for determination of loadings. Preliminary nitrogen loadings for municipalities are summarized in Table 95.

Table 95 Preliminary nitrogen loadings for various municipalities

Year	Mean Nitrogen, mg/L			Mean Flow	Mean Daily Load, lbs/day			Mean Annual Load, tns/yr		
	NH3	NOX	TKN	cfs	NH3	NOX	TKN	NH3	NOX	TKN
City of Buhl										
1996	17.9	0.12	30.3	0.862	82.54	0.57	140.88	15.06	0.10	25.71
1997	18.3	2.00	30.3	0.749	72.38	6.28	120.77	13.21	1.15	22.04
City of Buhl will continue to collect data under their new permit. Under the Mid-Snake TMDL it was agreed that collecting three years of data would be sufficient to determine if allocations for nitrogen were needed. Therefore, under their new permit, at the end of Year 3 once implementation of the Upper Snake Rock TMDL has occurred, a re-evaluation of the entire wasteload allocation in conjunction with other industries will be done.										
City of Filer (seasonal facility)										
1996	14.4	0.69	20.9	0.135	10.72	0.53	15.08	1.96	0.10	2.75
1997	14.9	0.74	19.5	0.297	9.89	0.47	13.03	1.80	0.09	2.38
City of Filer will continue to collect data under their new permit. Under the Mid-Snake TMDL it was agreed that collecting three years of data would be sufficient to determine if allocations for nitrogen were needed. Therefore, under their new permit, at the end of Year 3 once implementation of the Upper Snake Rock TMDL has occurred, a re-evaluation of the entire wasteload allocation in conjunction with other industries will be done.										
City of Twin Falls										
1995	2.1	13.0	-	9.771	111.92	695.57	-	20.43	126.94	-
1996	4.0	9.98	-	10.793	236.60	579.07	-	43.18	105.68	-
1997	4.8	5.73	-	11.146	292.48	337.85	-	53.38	61.66	-
City of Twin Falls will continue to collect data under their new permit. Under the Mid-Snake TMDL it was agreed that collecting three years of data would be sufficient to determine if allocations for nitrogen were needed. However, other facilities impacting the Middle Snake River have to be considered as well. Therefore, under their new permit, at the end of Year 3 once implementation of the Upper Snake Rock TMDL has occurred, a re-evaluation of the entire wasteload allocation in conjunction with other industries will be done.										
Prepared by IDEQ-TFRO.										

PHOSPHORUS

Total phosphorus as a limiting nutrient will have imposed limits based on the Mid-Snake TMDL and the NPDES permits for point sources will reflect those limits.

TEMPERATURE

See §3.1.8 for temperature considerations. There are no temperature requirements in the permits for effluent monitoring since there is no reasonable potential that an excursion will occur above water quality standards. However, the City of Twin Falls will conduct a receiving water monitoring plan during low flow periods, as established by historical and current data obtained from the USGS gaging station near Kimberly, Idaho (RM 617.5). Monitoring stations shall be established both upstream and downstream of the discharge and sampled concurrently with the effluent for analysis of the listed parameters.

DISSOLVED OXYGEN

A TMDL for DO may be required based on monitoring data that will be collected over the next 36 months. For all industries, DO is linked to TP limits, such that decreases in TP will result in increases in the DO and decreases in aquatic macrophyte growth on tributaries and the Middle Snake River.

OIL AND GREASE

The only tributary that is listed for oil and grease is Rock Creek, from Rock Creek Town to its confluence with the Middle Snake River. The historical perspective on why oil and grease is listed for Rock Creek is that at one time the City of Twin Falls municipality discharged directly to Rock Creek. Historical information from local citizens indicates that raw sewage, slime growths, and oil or grease streaks would float in Rock Creek as a common occurrence prior to 1974. Since 1974, the City of Twin Falls municipality, food processors, and industrials have not discharged to Rock Creek. In 1997, the IDEQ-TFRO and the City of Twin Falls monitored Rock Creek over a period of the entire year and determined that oil and grease were not present in Rock Creek water. The City of Twin Falls Stormwater Management Plan addresses stormwater concerns that might carry oil and grease if proper stormwater management practices are not used in the larger areas of industrial and commerical development. Those areas of concern that may pose a threat to Rock Creek are defined in Table 96. IDEQ-TFRO is not pursuing a TMDL for oil and grease on Rock Creek. Impacts to Rock Creek from stormwater sources (that contain oil and grease components) are minimal (0.009%) when compared to TSS discharges from point and additional nonpoint sources. The recommendations listed in the following table should be sufficient to minimize impacts to Rock Creek.

Table 96 Sub basin areas of Rock Creek that pose an oil & grease threat from the City of Twin Falls

Sub Basin	Land Area	Receiving Water (Total Pollutant Load, tons/year)	Recommendations to Minimize Impact
RC-1	945 acres	City storm drain to Orchalara Tunnel to Rock Creek (0.458 tons/year)	Increased frequency of maintenance practices for unclogging catch basins and inlets. The City will review its policy for street cleaning and gutter maintenance to improve storm drain inlets.
RC-2	280 acres	Rock Creek (0.095 tons/year)	No flooding issues. Maintain proper frequency of street cleaning for sediment removal.
RC-3	245 acres	Rock Creek (0.239 tons/year)	No flooding issues. Maintain proper frequency of street cleaning for sediment removal.
RC-4	285 acres	Rock Creek (0.117 tons/year)	Historical flooding problems. A new storm drain is proposed with maintenance of proper frequency of street cleaning for sediment removal.
RC-5	100 acres	TFCC Lateral 18 & overland flow to Rock Creek (0.070 tons/year)	A sub basin plan is being developed. Current maintenance of borrow ditches is being done.

RC-6	830 acres	TFCC Lateral 18 & overland flow to Rock Creek **(0.299 tons/year)**	A sub basin plan is being developed. Current maintenance via street cleaning policy is being addressed.
TOTAL	2665 acres	(1.278 tons/year)	Pollutant Load includes all stormwater pollutants.
Prepared by IDEQ-TFRO. TFCC = Twin Falls Canal Company. Total Pollutant Load, tons/year calculated from (lbs/year)/2000. Data compiled by IDEQ-TFRO suggests that from 1990-1997, sediment loadings discharging to the Middle Snake River from Rock Creek averaged 15,036.7 tons/year. If stormwater accounts for 1.278 tons/year as drainage to Rock Creek, and a major fraction of this is sediment, the amount of impact to Rock Creek is minimal (0.0085%) when compared to Rock Creek impacting the Middle Snake River.			

PATHOGENS

Municipalities have imposed permit limits for fecal coliform bacteria as previously cited. Their discharge of fecal coliform is summarized in Table 97. From 1990-1997 exceedences occurred as follows:

1. The City of Filer exceeded its seasonal permit in three months over a 96 month period (1990-1997): January 1990, March 1991, and January 1993. No exceedences occurred from 1994 through 1997. (% Exceedences = 3/96x100% = 3.1%)

2. The City of Buhl exceeded its permit limit four times in 96 months for the 30-day geometric mean, and nine times for the 7-day geometric mean. These exceedences were found in 1990, 1991, 1993, and 1997. (% Exceedences = 9/96x100% = 9.4%)

3. The City of Hansen and City of Hagerman never exceeded their permit limit in 96 months. (% Exceedences = 0/96x100% = 0.0%)

4. The City of Jerome exceeded its permit four times in 96 months: April 1993, May 195, February 1996, and January 1997. (% Exceedences = 4/96x100 = 4.2%)

5. The City of Twin Falls exceeded its permit seven times in 96 months: October 1993, June 1994, July and August 1996, and January and February 1997. (% Exceedences = 7/96x100 = 7.3%)

Table 97 30-day geometric mean (on a yearly basis) on municipalities that affect the Upper Snake Rock subbasin

Year (Limit)	*Filer (100)*	*Buhl (100)*	*Hansen (100)*	*Jerome (50)*	*Hagerman (100)*	*Twin Falls (100)*	*Total for Year (550 Limit)*
1990	87	237	11	10	3	14	362
1991	505	37	15	10	0.4	16	583
1992	5	4	23	4	0.8	4	41
1993	159	4	22	22	2	1	210
1994	16	9	25	20	7	1	78
1995	11	4	32	28	4	4	83
1996	8	13	48	16	2	33	120
1997	4	7	33	21	6	70	141

MEAN	99	39	26	16	3	18	202
STDs	173	81	11	8	2	24	184
CV	1.74	2.05	0.44	0.48	0.75	1.34	0.91

Prepared by IDEQ-TFRO. STDs = Standard deviation for a small population. CV = Coefficient of variation.

The table indicates that in 1991 the maximum total exceedence level (550 limit) was exceeded. All other years were well below the exceedence level.

3.2.4 INDUSTRIALS / LAND APPLICATION FACILITIES

Industrial-type facilities that are in Upper Snake Rock include seven (7) non-dischargers and nine (9) who discharge to land application sites. These include:

Non-discharge Facilities
Roast Potato Company (Eden)
IDA-Pride Potatoes (Hazelton)
Schutte Potatoes (Hazelton)
Eagle Snacks, Inc. (Twin Falls)
A.C. Enterprises (Hazelton)
Heitzman Product Co. (Jerome)
J. R. Simplot (Jerome)

Discharge to Land Application Sites
TASCO (Twin Falls, LA-000049; NPDES 000023-0)
Avonmore West (Twin Falls; LA-000022; NPDES 002741-1)
Seneca Foods Corporation (Buhl; LA-000016)
Independent Meat (Twin Falls; NPDES 000038-8; LA-000046)
Jerome Cheese (Jerome; NPDES 002760-0)
Western Idaho Potato (Jerome; NPDES 002679-4; LA-000038)
Russet Valley Marketing (Kimberly; LA-000041; total containment)
Keegan Incorporated (Twin Falls; LA-000044)
A.E. Staley Manufacturing Company (Murtaugh; LA-000045)

These type of NPDES facilities have permits for non-contact cooling water, which is used for cool refrigeration equipment and generally does not come in contact with processed wastewater. Any loads coming from these NPDES-type facilities are extremely low and therefore negligible to the TMDL process at this time. Therefore, the current proposed load allocation to these facilities is zero.

3.3 STREAM CORRIDOR MODEL ON NONPOINT SOURCE STREAMS

USEPA considers that the narrative criteria apply to all designated uses at all flows unless specified otherwise in the State's water quality standards. USEPA also believes that no acutely toxic condition may exist in any State waters regardless of designated use (USEPA 1991c [p 31]; 54 FR 23875). To ensure that narrative criteria for toxicants are attained, the water quality standards regulation requires States to develop implementation procedures (40 CFR 131.11(a)(2)) which address all mechanisms used by the State to ensure that narrative criteria are attained (USEPA 1991c [p 31]). Where insufficient data was available for nonpoint source streams, estimates of existing pollutant loads were based on land use percentages defined by IDWR GIS coverages for ArcView using the stream corridor approach model. Tributaries were classified as previously defined under the 5th field HUCs catergorization: Shoshone Falls Watershed (for Alpheus Creek); Billingsley Creek Watershed (for Billingsley Creek, Riley Creek); Box Canyon Complex (for Blind Canyon Creek, Clear Springs, Thousand Springs Creek); Clover Creek Complex (for Clover Creek); Dry Creek Complex (for the three segments on Dry Creek); Rock Creek Complex (for the Rock Creek, Cottonwood Creek, McMullen Creek); and, Cedar Draw Complex (for Crystal Springs). Reservoirs were combined with Middle Snake River System segments.

It is recognized that riparian zones and wetlands are two distinct vegetative communities. However, riparian zones and wetlands as natural or constructed, if managed properly, have a tremendous impact on reduction of sediment (as TSS) before their discharge enters a stream. Filter or buffer strips are commonly grouped with riparian zones and may also provide a reduction impact on TSS. Literature sites a number of reduction percentages dependent on the type of wetlands used on nonpoint source and point source areas, as shown in Table 98.

Table 98 Natural and constructed riparian zones and wetlands

Type or Location	*%TSS Removal*	*Source*
	Contructed Wetlands	
Swine Lagoon Treatment	97.4% (annual)	Moshiri 1993 [p 345]
Summer Wetland-Pond	99.8% (seasonal)	Moshiri 1993 [p 363]
Fall Wetland-Pond	96.1% (seasonal)	Moshiri 1993 [p 363]
Marsh System	81.4% (annual)	Moshiri 1993 [p 439]
ESTIMATE AVERAGE	89.4% (annual)/98.0% (seasonal) = 93.7% overall mean	
	Constructed Variable Filter Strips	
University of Kentucky, Design 1	87-99% (mean = 93%)	Haan *et al.* 1994
University of Kentucky, Design 2	70-90% (mean = 80%)	Haan *et al.* 1994
Mississippi State University	> 90% (mean = 90%)	Haan *et al.* 1994
Virginia Poly Tech, Design 1	81-91% (mean = 86%)	Haan *et al.* 1994
Virginia Poly Tech, Design 2	70-84% (mean = 77%)	Haan *et al.* 1994
North Carolina State	70%	Haan *et al.* 1994
Maryland KY 31 Fescue	66%	Haan *et al.* 1994
Buffer Strip Restoration	75%	Williams *et al.* 1997
ESTIMATE AVERAGE	79.6%	
	Natural Ecosystems	
Natural Wetlands	67.9%	Moshiri 1993
NCSU Natural Wetlands	> 50.0% (mean = 50.0%)	Haan *et al.* 1994
West Jackson County Wetlands	76.7	USEPA 1993b
Natural grass buffer strips	57%	Williams *et al.* 1997
ESTIMATE AVERAGE	62.9%	

Prepared by IDEQ-TFRO. Note: There is a lot of variability within constructed versus natural wetlands,riparian areas, buffer strips. On an average basis constructed ecosystems have an average TSS reduction of 93.7% whereas natural ecosystems have an average TSS reduction off 62.9%.

In general, natural ecosystems can have a 62.9% TSS reduction potential versus contructed ecosystems (wetlands) which average about 93.7% TSS reduction potential. Constructed filter strips average about 79.6% reduction. These studies were done in select riparian areas where the percent efficiency was high. In the

Middle Snake River the riparian areas do not retard 62.9% of the TSS that comes through their system. Degradation of riparian areas due to human encroachment have reduced the natural ability for these ecosystems to decrease sediment loads in streams by reducing bank erosion and by trapping sediment eroding from hillslopes. Due to population growth and land development, flood plains once normally filled with abundant vegetation are now degraded to the point that hillslopes within the flood plains are encised and cut, thus aiding to the sediment pollution problem. In conversations with USBLM, USFS, and USBOR personnel, it was assessed that an average TSS reduction potential from existing riparian areas was more like 30% (a high average). More seriously degraded riparian areas in agricultural zones may have a TSS reduction potential of 10% or less, depending on the stability of banks and the type of vegetation growing in the riparian area. Areas where only willows are growing may retard TSS in an amount less than those areas with willows and grasses. In this TMDL, riparian areas are grouped with stream erosion as background stream erosion. An assessment of the effect by riparian areas will be done by IDEQ-TFRO, USBLM, USFS, and NRCS as TSS reductions occur within the subbasin. It is expected that as TSS reductions occur, riparian areas will increase by as much as 50%, thus leading to increased TSS reduction from natural ecosystems.

3.3.1 SHOSHONE FALLS WATERSHED (ALPHEUS CREEK)

The Shoshone Falls Watershed has Alpheus Spring and Creek which makes up a small fraction of the entire watershed. Using the stream corridor model (2 mile transect, 1 mile from the stream both ways) gives the following land uses: 36.35% irrigated agriculture (26.73% irrigated-gravity flow and 9.62% irrigated-sprinkler), 36.63% rangeland, and 27.00% riparian zone. Therefore, the nonpoint source allocation for irrigated agriculture and rangeland (grazing) is 36.35% and 36.63%%, respectively. Although several aquaculture facilities divert water from Alpheus Creek none discharge back to Alpheus Creek. Rather, they discharge to the Middle Snake River. See summary Table 99.

3.3.2 BILLINGSLEY CREEK WATERSHED

The Billingsley Creek Watershed (or the Hagerman Watershed) has Billingsley Creek and Riley Creek. Total land use in the Hagerman watershed is made up of 65.73% irrigated agriculture (27.43% irrigated-gravity flow and 28.30% irrigated-sprinkler), 31.76% rangeland, 12.33% riparian, and 0.16% open water. Total acreage is 31961.6 acres or 49.94 square miles. Looking at Billingsley Creek using the stream corridor model (2 mile transect, 1 mile from the stream both ways) gives the following land uses: 10118.4 acres (or 15.81 square miles) for 23.08% riparian area, 14.67% rangeland, and 62.23% irrigated agriculture (24.54% irrigated-gravity flow and 37.69% irrigated-sprinkler). Therefore, the nonpoint source allocation for irrigated agriculture and rangeland (grazing) is 62.23% and 14.67%, respectively. See summary Table 99.

3.3.3 BOX CANYON COMPLEX

The Box Canyon Complex is made up of 136236.8 acres or 212.87 square miles. Total land use is made up of 68.95% irrigated agriculture (26.99% irrigated-gravity flow, 41.96% irrigated-sprinkler), 25.48% rangeland, 3.30% riparian, and 2.25% urban. Looking at the Box Canyon Creek using the stream corridor model (2 mile transect, 1 mile from the stream both ways) gives the following land uses:

1. Clear Springs has a total area of 2937.6 acres (4.59 square miles) with land use being made up of 61.21% irrigated agriculture (30.93% irrigated-gravity flow and 30.28% irrigated-sprinkler), 4.79% rangeland, and 33.98% riparian zone. The nonpoint source allocation will follow the land use percentages. See summary Table 99.

2. Blind Canyon Creek has a total area of 2816.0 acres (4.4 square miles) with land use being made up of 73.40% irrigated agriculture (16.18% irrigated-gravity flow and 57.27% irrigated-sprinkler), 9.54% rangeland, and 17.04% riparian zone. The nonpoint source allocation will follow the land use percentages. See summary Table 99.

3. Thousand Springs Creek has a total area of 2323.2 acres (3.63 square miles) with land use being made up of 52.60% irrigated agriculture (19.00% irrigated-gravity flow and 33.60% irrigated-sprinkler), 16.25% rangeland, and 31.12% riparian zone. The nonpoint source allocation will follow the land use percentages. See summary Table 99.

3.3.4 CEDAR DRAW COMPLEX

The Cedar Draw Complex has Crystal Springs and Lake which up a small fraction of the entire complex, and more specifically a small fraction of the Canyon Watershed (which is one of three watersheds in the Cedar Draw Complex). Crystal Lake is a small 8 acre shallow lake. Looking at Crystal Springs and Crystal Lake using the stream corridor model (2 mile transect, 1 mile from the stream both ways) gives the following land uses: 2188.8 acres (3.42 square miles) is 81.28% irrigated agriculture (38.01% irrigated-gravity flow and 43.27% irrigated-sprinkler), 1.16% rangeland, and 17.54% riparian zone. The nonpoint source allocation will follow the land use percentages. See summary Table 99.

3.3.5 CLOVER CREEK COMPLEX

Four 5th field HUCs (or watersheds) make up the Clover Creek Complex: watershed Lower Clover Creek (1704021201), watershed Dry Creek (1704021202), watershed Upper Clover Creek (1704021203), and Calf-Clover (1704021204). Total area of the four watersheds is 280.79 square miles (or 185932.8 acres). Of this, total rangeland makes up 91.99%; total irrigated-gravity flow makes up 0.34%; total irrigated-sprinkler makes up 3.51%; total dryland agriculture makes up 0.68%; and, total riparian area makes up 3.46%. Looking at Clover Creek (from Pioneer Reservoir to where it discharges into the Middle Snake River) using the stream corridor model (2 mile transect, 1 mile from the stream both ways) gives the following land uses: 12211.2 acres (or 19.08 square miles) for 82.18% rangeland, and 17.81% irrigated agriculture (0.26% irrigated-gravity flow and 17.55% irrigated-sprinkler). Therefore, the nonpoint source allocation for irrigated agriculture and rangeland (grazing) is 17.81% and 82.18%, respectively. The nonpoint source allocation will follow the land use percentages. See summary Table 99.

3.3.6 DRY CREEK COMPLEX

Three 5th field HUCs (or watersheds) make up the Dry Creek Complex: watershed Dry Creek (1704021220), watershed Lower Dry Creek (1704021219), and watershed Lake Murtaugh (1704021218). Total area of the three watersheds is 151.04 square miles (or 96,665.6 acres). Of this, total rangeland makes up 43.14%; total irrigated-gravity flow makes up 53.35%; and, total irrigated-sprinkler makes up 3.49%. Looking at Dry Creek using the stream corridor model (2 mile transect, 1 mile from the stream both ways) gives the following land uses:

1. For the West Fork of Dry Creek: 9590.17 acres (14.98 square miles) is 100.00% Rangeland. The nonpoint source allocation will follow the land use percentages. See summary Table 99.

2. For the Dry Creek headwaters to Medley Creek, and Medley Creek to the Snake River:

17939.2 acres (28.03 square miles) is 56.40% irrigated agriculture (53.69% irrigated-gravity flow and 2.71% irrigated-sprinkler), 40.49% rangeland, and 3.10% riparian. The nonpoint source allocation will follow the land use percentages. See summary Table 99.

3.3.7 ROCK CREEK COMPLEX

The Rock Creek Complex is comprised of five 5th field HUCs. These are: Upper Rock Creek (17040212021), Rock Creek (17040212022), Hub Butte (17040212029), Lower Rock Creek (17040212030), and North Cottonwood-McMullen (17040212023). Watershed "021" drains into Watershed "022," which drains into Watershed "029," and finally into Watershed "030" which discharges to the Middle Snake River. Watershed "023" drains into Watershed "029." Total land use of the Rock Creek Complex is: 5.09% forest, 34.60% irrigated-gravity flow, 0.51% irrigated-sprinkler, 52.24% rangeland, and 7.53% urban. The total area is 308.61 square miles or 197510.4 acres. Looking at Rock Creek using the stream corridor model (2 mile transect, 1 mile from the stream both ways) gives the following land uses for the water quality limited stream segments of the complex:

1. Rock Creek (Rock Creek Town to Middle Snake River): 29926.4 acres (46.76 square miles) is 84.45% irrigated-gravity flow, 1.75% rangeland, 11.44% urban, and 2.35% riparian. As recognized in §2.2.2.5 Rock Creek is a "spillway, collection and conveyance facility" for the Twin Falls Canal Company from the intersection with the High Line Canal to the mouth. The nonpoint source allocation will follow the land use percentages. See summary Table 99.

2. McMullen Creek (Headwaters to Cottonwood Creek): 21420.8 acres (33.47 square miles) is 19.59% irrigated agriculture (18.46% irrigated-gravity flow and 1.13% irrigated-sprinkler) and 80.40% rangeland. McMullen Creek discharges to the High Line Canal of the Twin Falls Canal Company. The nonpoint source allocation will follow the land use percentages. See summary Table 99.

3. Cottonwood Creek (Headwaters to Rock Creek): 9734.4 acres (15.21 square miles) is 57.19% irrigated agriculture (56.73% irrigated-gravity flow and 0.46% irrigated-sprinkler), 33.33% rangeland, and 9.46% riparian zone. It discharges to the High Line Canal of the Twin Falls Canal Company. Whatever water appears below the High Line Canal is from seeps and springs. The nonpoint source allocation will follow the land use percentages. See summary Table 99.

3.3.8 MIDDLE SNAKE RIVER SEGMENTS AND RESERVOIRS

Pioneer Reservoir is included in the Clover Creek Complex. Applying the 2-mile stream corridor to the overall Middle Snake River segments and reservoirs: 117273.6 acres (183.24 square miles) is 49.54% irrigated agriculture (33.56% irrigated-gravity flow and 15.98% irrigated-sprinkler), 31.32% rangeland, 18.05% riparian, 0.22% urban, 0.03% forest, and 0.80 water. The nonpoint source allocation will follow the land use percentages as an overall average. See summary Table 99.

The Middle Snake River may be divided into six segments. These segments may be extrapolated by the stream corridor approach model for land use load allocation. The segments are: (1) Milner Dam to Pillar Falls (34,765.0 acres = 54.3 square miles) with 52.8% irrigated (gravity flow) agriculture, 11.4% irrigated (sprinkler) agriculture, 11.4% rangeland, and 24.3% riparian zone; (2) Pillar Falls to Crystal Springs (17,007.3 acres = 26.6 square miles) with 53.7% irrigated (gravity flow) agriculture, 13.0% irrigated (sprinkler) agriculture, 13.1%

rangeland, 18.6% riparian zone, and 1.6% urban; (3) Crystal Springs to Box Canyon (19,931.5 acres = 31.1 square miles) with 40.1% irrigated (gravity flow) agriculture, 27.0% irrigated (sprinkler) agriculture, 11.6% rangeland, and 21.2% riparian zone; (4) Box Canyon to Gridley Bridge (97,791.4 acres = 152.8 square miles) with 18.9% irrigated (gravity flow) agriculture, 30.4% irrigated (sprinkler) agriculture, 29.2% rangeland, 20.8% riparian zone, and 0.7% water; (5) Gridley Bridge to Shoestring Bridge (22,488.7 acres = 35.1 square miles) with 18.8% irrigated (gravity flow) agriculture, 11.5% irrigated (sprinkler) agriculture, 55.4% rangeland, 14.1% riparian, and 0.2% water; and, Shoestring Bridge to King Hill (27,132.3 acres = 42.4 square miles) with 2.7% irrigated (gravity flow) agriculture, 19.2% irrigated (sprinkler) agriculture, 65.3% rangeland, 9.4% riparian zone, 3.3% water, and 0.1% forest. The nonpoint source allocation will follow the land use percentages as an average for each segment. See summary Table 99.

Table 99 Summary of stream corridor approach model for allocation of nonpoint sources

WATERSHED OR COMPLEX	*SPRING OR CREEK*	*% LAND USE ≈ LOAD ALLOCATION*			
		Ag	*Grazing*	*Riparian*	*Other*
Shoshone Falls	Alpheus Spring and Creek	36.4	36.6	27.0	0.0
Billingsley Creek	Billingsley Creek	62.2	14.7	23.1	0.0
	Riley Creek	65.7	31.8	12.3	0.2
Box Canyon	Box Canyon "Creek"	73.4	9.5	17.0	0.0
	Clear Springs	61.2	4.8	34.0	0.0
	Thousand Springs Creek	52.6	16.3	31.1	0.0
Cedar Draw	Crystal Springs and Lake	81.3	1.2	17.5	0.0
Clover Creek	Pioneer Reservoir	14.6	85.2	0.2	0.0
	Clover Creek	17.8	82.2	0.0	0.0
Dry Creek	West Fork Dry Creek	0.0	100.0	0.0	0.0
	Dry Creek, headwaters to Medley to the Snake River	56.4	40.5	3.1	0.0
Rock Creek	Rock Creek, Rock Creek town to the Snake River	84.5	1.8	2.4	11.4
	McMullen Creek	19.6	80.4	0.0	0.0
	Cottonwood Creek	57.2	33.3	9.5	0.0
Middle Snake River	Middle Snake River and reservoirs (Overall)	49.5	31.3	18.1	1.1
	Segment 1: Milner Dam to Pillar Falls	64.2	11.4	24.3	0.0
	Segment 2: Pillar Falls to Crystal Springs	66.7	13.1	18.6	1.6
	Segment 3: Crystal Springs to Box Canyon	67.1	11.6	21.2	0.0
	Segment 4: Box Canyon to Gridley Bridge	49.3	29.2	20.8	0.7
	Segment 5: Gridley Bridge to Shoestring Bridge	30.3	55.4	14.1	0.2
	Segment 6: Shoestring Bridge to King Hill	21.9	65.3	9.4	3.4

Prepared by IDEQ-TFRO. Ag = Agriculture. Grazing = Rangeland. Riparian = Riparian zone. Other = water, urban, or both.

3.4 MARGIN OF SAFETY (MOS), THE LOAD CAPACITY, & FUTURE GROWTH

The Clean Water Act requires that each TMDL be established with a margin of safety (MOS). The statutory requirement that the Upper Snake Rock TMDL incorporate a MOS is intended to account for uncertainty in available data or in the actual effect that controls will have on loading reductions and receiving water quality. The MOS may be implicit, as in conservative assumptions used in calculating the loading capacity, wasteload allocations, and load allocations. The MOS is not meant to compensate for a failure to consider known sources.

MARGIN OF SAFETY (MOS) AND LOAD CAPACITY

It is apparent that past and, to some extent, current levels of sediment production in the Middle Snake River and its tributaries are "excessive" based on the lack of support status of the lower reaches. However, the degree of excess sediment is difficult to quantify or define. In order to establish a MOS it was necessary, then, to use implicit characteristics that get at conservative estimates by using background estimates for surface erosion (due to agricultural and grazing production) and minimal mass wasting (because the annual rainfall does not provide a significant basis for mass wasting) which are characteristic of the sub basin, while at the same time linking sediment reductions to beneficial use and water quality standard attainment. Therefore, instream targets are fairly conservative due to the use of background that includes surface erosion. These targets will require that the land management agencies within the subbasin (and on a watershed basis) meet an annual load (tons/year) that reflects surface erosion specific to the particular watershed.

The implicit conservative assumptions include the following:

1. The design flow was based on low flow conditions (WY1992 for the period of record WY1983-1998) and is applicable to all flow conditions in a similar scenario as a 7Q10 flow condition. The actual low flow hydrograph for WY1992 was used to account for seasonal and daily variability and incorporates an implicit MOS. At this time a true reflection of what actually occurs under high flow conditions is unknown. What is apparent is that the levels of TSS are "excessive" under high flow conditions, but the degree of excess sedimentation is difficult to quantify. As more data is collected over the next 3-5 years, a better understanding of the impact under high flow conditions will be assessed, thus providing a better direction for determining the upper limits of excess TSS levels. Thus, a 52 mg/L TSS instream target will be used as the monthly average limit (which has in it an implicit MOS) and an 80 maximum daily limit. See Appendix D.

2. Since excess sediment is a narrative water quality standard, TSS instream concentration targets were based on protection of salmonids, other fish, and aquatic communities as suggested in 1965 by the European Inland Fisheries Advisory Commission (EIFAC) and in 1973 by the Committee on Water Quality Criteria (CWQC) from the Environmental Studies Board of the National Academy of Science for meeting of designated beneficial uses for cold water biota and salmonid spawning. Designated beneficial uses support the "fishable/swimmable" goal of Section 101(a)(2) of the Clean Water Act where such uses are attainable. Their recommendations included the following:

TSS Range, mg/L	EIFAC Fisheries Effect	CWQC Protection Level	Beneficial Use
>= 401	Poor	Very low	Bad
81 - 400	Significantly Reduced	Low	Poor
<= 80	None to Slight	Moderate to High	Good

Thus, 52 mg/L is the load capacity (dependent on the flow) for any stream in the Upper Snake Rock subbasin. This instream target of 52 mg/L TSS has in it an implicit margin of safety. It was selected as a preliminary water quality target as an average monthly limit (AML). It is 35.8% below the lower 81 mg/L level and 87% below the upper 400 mg/L level for low protection of the fisheries. A maximum daily limit of 80 mg/L will be used to account for seasonality. The 52 mg/L TSS is a preliminary conservative water quality instream target that has an implicit margin of safety. At 52 mg/L there is a none-to-slight effect on the fisheries, which provides a moderate-to-high protection level of the fisheries, and a good restoration effect on the designated beneficial uses.

3. For permitted industries in the Upper Snake Rock subbasin the following describes the targets used based on permit requirements. An AML was selected over the Average Weekly Limit because it was lower.

Permitted Industry/Facility	Target	Interpretation
Aquaculture General Permit	5 mg/L TSS	AML
	0.100 TP	AML
Twin Falls POTW	30 mg/L TSS	AML
	707.0 lbs/day	AML
Hagerman POTW	70 mg/L TSS	AML
	5.7 lbs/day	AML

Other municipalities are described in Appendix D, §XIV.

4. Where no information was available for TSS on a water quality limited stream segment, the stream corridor approach model was used as the method of allocation. Various sources indicate that stream corridors are protective of beneficial uses for wildlife and should have a range greater than 0.5 miles but less than 5.0 miles (Kindschy et al. 1982; Van Dyke et al. 1983; Platts 1990; USDA, USEPA, USBLM, *et al.* 1998). A one-mile per side of stream seemed reasonable to use with an implicit margin of safety within the recommended range of 0.5 to 5.0 miles. Assumptions for unknown TSS data is discussed in Appendix D, §VII. For TP, assumptions are discussed in Appendix D, §XIV, relative to irrigation return flows, natural tributaries, the Middle Snake River, springs, and aquaculture facilities. Therefore, within each for TSS and TP there is an implicit MOS that is understood based on the above conservative assumptions. The load capacity was previously discussed in §3.1.1 for instream targets.

5. For pathogens, fecal coliform bacteria levels based on the State water quality standards for primary contact recreation will be used with an instream instantaneous water column target of 500 cfu/100 mL. A margin of safety of 100 cfu/100 mL will be used to account for uncertainly. Thus, the final instream target will be 400 cfu/100 mL. This will be applicable only to those streams that have known data where exceedences have been measured.

Streams that are listed on the 303(d) list but without pathogen data will be monitored over the next two years to ascertain their status. See §3.5 for a discussion on the pathogen TMDL.

6. For total phosphorus the 0.100 mg/L instream target has an implicit MOS to account for the uncertainty and the lack of basic water quality information. This allocation will notd be completed until 3 year of monitoring for the point sources, at which time a reallocation of TP target loads will be done based on the current monitoring information. By default, one of the implicit traits is the design flow which was accounted for under low flow conditions (the worst case scenario for TP).

FUTURE GROWTH

States must include an allowance for future loading in their TMDL that accounts for reasonably foreseeable increases in pollutant loads with careful documentation of the decision-making process. This allowance is based on existing and readily available data at the time the TMDL is established. "Smart Growth" policies and requirements are encouraged if USEPA and IDEQ agree that their adoption and implementation will reduce future loadings in an appropriate amount that equates to the estimate allowance for future growth. However, under the current database for TSS and the other pollutants, and after some discussion with the water user industries and Mid-Snake TAC, it was decided that an allowance for future growth was not recommended until such time as reductions indicated that beneficial uses or State water quality standards had been restored. Therefore, an allowance for growth at this time is zero, such that any growth is only permitted under the following auspices: (1) pollutant trading set to the instream target parameters, (2) not net increase set to the instream target parameters; and, (3) no discharge where land application is the preferred option.

The Upper Snake Rock Watershed Management Plan supports the growth and responsible resource development scenario described in the Mid-Snake TMDL (§1.06). Where growth by any industry becomes a concern, the Mid-Snake TAC and WAG, in conjunction with IDEQ-TFRO, will provide advice as it relates to water quality concerns within the sub basin. Public comment will be encouraged so that responsible economic growth is a serious consideration in the planning process for all industries.

3.5 ALLOCATION AND ASSESSMENT OF PATHOGENS, TSS, TP

Allocation tables for TSS and TP will have the following column headings: WY1990-1991 Baseline Mean Load, tons/year; WY2004 Target Mean LA, tons/year; WY2009 Target Mean LA, tons/year; and Load Reduction. The WY1990-1991 Baseline Mean Load is an estimate of conditions as they occured in the baseline years 1990-1991. WY2004 and WY2009 are short-term and long-term target years, respectively, for having load reductions reach load capacity goals. WY2004 is the short-term goal for getting to the load capacity. Then, maintaining the load capacity through WY2009 is the long-term goal. Load Reduction is the estimate percent reduction that will occur from the baseline years through WY2009. Load Reduction will be summarized for each general pollutant source as a group: point sources discharging to the Middle Snake River, spring sources, surface waterbodies (natural and canalways), the Middle Snake River corridor, and other water user industries (CFOs and/or CAFOs, hydroelectric power, and land application facilities. Within each major TMDL, based on the Middle Snake River segments, there are TMDLs written for each tributary as subcomponents of the overall Upper Snake Rock TMDL. These have their listed pollutant sources with similar baseline loads, target goals, and load reductions. The stream corridor approach model will utilize Table 99 for allocation of pollutant loads based on land use as described in §3.0.2.

3.5.1 PATHOGENS

Fecal coliform bacteria problems were assessed in §2.2.4.1, item 6, for the Middle Snake River and in §2.2.4.3 for its tributaries. The assessment for the Middle Snake River indicates that the river is meeting State water quality standards for primary contact recreation and secondary contact recreation though minor exceedences of the instantaneous fecal coliform standard (500 cfu/100 mL and 800 cfu/100 mL, respectively) occur infrequently. IDEQ-TFRO proposes that those segments of the Middle Snake River listed on the 303(d) list for pathogens be de-listed. Those segments include: Bliss Reservoir (waterbody 2370); Snake River from Milner Dam to Murtaugh (waterbody 2378); and, Snake River from Murtaugh to Twin Falls Reservoir (waterbody 2377).

Several waterbodies at the time of data collection on the sub basin assessment were found to not have any pathogen information. IDEQ-TFRO will be sampling these and making an assessment on their pathogen status over the next 12-24 months. Those waterbodies include: Pioneer Reservoir; Riley Creek; Blind Canyon Creek; McMullen Creek; Dry Creek, West Fork to Murtaugh Lake; and, Dry Creek, from the headwaters to Dry Creek main stem. Several waterbodies at the time of data assessment on the sub basin assessment were discovered to have major exceedences in fecal coliform bacteria. However, these waterbodies are not listed for pathogens in the 303(d) list. IDEQ-TFRO will submit these to USEPA for addition of the pathogen pollutant to the waterbody which are already listed. These waterbodies include: Billingsley Creek and Clover Creek. The remainder of the waterbodies include those which are listed (in the 1996 and 1996 303(d) lists) for pathogens and which had information on fecal coliform bacteria. Billingsley Creek and Clover Creek are included in this group for TMDL development. These waterbodies include: Billingsley Creek, Clover Creek, Rock Creek, Cotonwood Creek, Cedar Draw Creek, Mud Creek, Deep Creek, and the Malad River. Although the Malad River will be considered here because it is a tributary to the Middle Snake River, it will have its TMDL development in the Year 2001 when the Big Wood River sub basin has its TMDL developed. Its sub basin assessment will commence in the Year 2000.

IDEQ-TFRO chose to protect for primary contact recreation (or < 500 cfu/100 mL instantaneous fecal coliform bacteria). This is the load capacity. By selecting the primary contact recreation target, it will protect for secondary contact recreation. Within the guidelines established for bacteria assessment in the 1996 305(b) report, the overall goal is to reduce bacteria to a level that is < 10% of the total number of samples taken in a single year. The overall endpoint of the pathogen TMDL for natural tributaries will be to reduce the percent of samples over the applicable criteria by 63.9% (as an overall average) to achieve an instream target of 400 cfu/100 mL (which is well below the criteria of 500 cfu/100 mL). Thus, the MOS is 100 cfu/100 mL. Because the major exceedences occur principally during the irrigation season (March through October), monitoring of the waterbodies will occur year-round so that comparisons between irrigation versus non irrigation season can be assessed. The monitoring protocol for this TMDL is a monthly sample on a yearly basis. If an instantaneous reading exceeds the 400 cfu/100 mL (instream target), then re-sampling of the watebody will occur four more times spread evenly over a 30-day period for the purposes of calculating a geometric mean (to achieve a geometric mean target of 50 cfu/100 mL). As data is collected, seasonality considerations will be defined and potentially established for each season based on TMDL curves developed for each season and further evaluated annually during the Years 2000-2009. During the implementation phase of this TMDL, land management agencies will provide guidance as to site-specific BMPs that will effectively reduce the pathogens, such that in conjunction with TSS reductions, pathogen reductions will occur and eventually reach beneficial uses and/or State water quality standards by Year 2004.

PATHOGEN TMDL: TRIBUTARIES					
	EXISTING CONDITIONS			YEAR 2004	
WATERBODY NAME	%>500 cfu/100 mL	IRRIGATION MEAN, cfu/100 mL	NON IRRIGATION MEAN, cfu/100 mL	TARGET cfu/100 mL	%R
Billingsley Creek	10.5%	511	351	400	21.7%
Clover Creek	11.8%	213	79	400	62.9%*
Rock Creek	28.0%	583	223	400	31.4%
Cottonwood Creek	11.1%	220	43	400	80.5%*
Cedar Draw	35.6%	937	58	400	57.3%
Mud Creek	48.9%	1,006	198	400	90.1%
Deep Creek	16.1%	396	97	400	75.5%*
Malad River	21.7%	4,913	1,382	400	91.9%
Overall Mean	23.0%	1,097	304	400	63.9%

POINT SOURCES

Aquaculture Facilities:	Do not have any permit limits for pathogens at this time. Fecal coliform bacteria is not considered a constituent of the effluent.
City of Twin Falls:	NPDES limit is 100 cfu/100 mL AML and 200 cfu/100 mL average weekly limit.
City of Buhl:	NPDES limit is 200 cfu/100 mL AML and 200 cfu/100 mL average weekly limit.
City of Filer:	NPDES limit is 200 cfu/100 mL AML and 200 cfu/100 mL average weekly limit.
City of Hagerman:	NPDES limit is 200 cfu/100 mL AML and 200 cfu/100 mL average weekly limit: Oct 1 - Apr 30 NPDES limit is 50 cfu/100 mL AML and 200 cfu/100 mL average weekly limit: May 1 - Sep 30
City of Hansen:	NPDES limit is 50 cfu/100 mL AML and 100 cfu/100 mL average weekly limit: May 1 - Sep 30 NPDES limit is 200 cfu/100 mL AML and 200 cfu/100 mL average weekly limit: Oct 1 - Apr 30
City of Jerome:	NPDES liimit is 200 cfu/100 mL AML and 200 cfu/100 mL average weekly limit

*For the manmade waterways, Year 2004 Target of 400 cfu/100 mL is equivalent to <10% of total exceedences being >500 cfu/100 mL. Since the target is to get to <10% (the equivalent of 400 cfu/100 mL), the %R was calculated as: %R = 100 - ((10% / %Exceedences) x 100%). For the natural tribuaries, %>500 = The % of exceedences > 500 cfu/100 mL. %R = % Reduction and is based on Year 2004 Target (400) divided by the irrigation mean value x 100%, except for those %R values with an asterick. These have irrigation values < 400, so their %R was calculated as the non irrigation mean value divided by the irrigation mean value x 100%. The overall Year 2004 target (400) divided by the overall irrigation mean value (1,097) x 100% is equivalent to 63.5% overall %R, which is close to the value 63.9%.

Because IDEQ-TFRO does not have sufficient pathogen data to determine cause-and-effect, and because an assessment has been made that the majority of the pathogen sources are from nonpoint sources, Table 99 shall be used as the allocation method for nonpoint sources. Cedar Draw, Mud Creek, and Deep Creek will be further developed during the implementation phase as to the stream corridor approach model. Other waterbodies (such as manmade canals and agricultural drains) that discharge to a natural tributary are expected to discharge at pathogen levels that do not exceed the instantaneous pathogen limit of 500 cfu/100 mL. Natural streams identified as being protected for irrigation conveyance (such as Rock Creek, Cedar Draw, Deep Creek), shall not exceed the instantaneous pathogen limit of 500 cfu/100 mL. CFOs and/or CAFOs (which shall also include all dairies, all feedlots, and all smaller operations) shall discharge as "zero discharge" as defined in the Mid-Snake TMDL.

3.5.2 SUSPENDED SEDIMENT (AS TSS)

The basic model used in the TSS loading analysis was a mass balance spreadsheet that summarized five general components for each Middle Snake River segment: point sources directly discharging to the Middle Snake River; spring sources (which might also have point source influence as indirect dischargers to the Middle Snake River); surface waterbodies (which includes tributaries and irrigation canal drains); the instream segment on the Middle Snake River; and, other water user industries (CFOs and/or CAFOs, hydropower, and land application facilities). These are labeled as A, B, C, D, and E, respectively. The approach was to consider all streams on a segment-by-segment basis as they discharged into the Middle Snake River. Those segments are more fully described in Appendix D, §VII. As described in the TSD, six major segments were selected based on where the most water quality information was available. The segments cover the entire length of the Middle Snake River and include their respective reservoirs. The seven location sites from Milner Dam to King Hill include: Milner Dam (MD), Pillar Falls (PF), Crystal Springs (CS), Box Canyon (BC), Gridley Bridge (GB), Shoestring Bridge (SB), and King Hill (KH). The six segments derived from these seven sites and their respective land uses according to the stream corridor approach model is summarized as follows:

		% Land Use by Stream Corridor Approach Model				
Segment	Name	Agriculture	Rangeland	Forest	Riparian	Other
1	MD to PF	64.2%	11.4%	0.0%	24.3%	0.1%
2	PF to CS	66.7%	13.1%	0.0%	18.6%	1.6%
3	CS to BC	67.1%	11.6%	0.0%	21.2%	0.1%
4	BC to GB	49.3%	29.2%	0.0%	20.8%	0.7%
5	GB to SB	30.3%	55.4%	0.0%	14.1%	0.2%
6	SB to KH	21.9%	65.3%	0.1%	9.4%	3.3%
	Mean	49.9%	31.0%	0.0%	18.1%	1.0%

Natural background is attributed to riparian areas, forest, and water and includes erosional sediment from the stream corridor. In order to achieve the instream water quality target of < 52.0 mg/L TSS, as well as achieve restoration of beneficial uses and State water quality standards, it is necessary to apply TSS load reductions to the following TSS input sources:

1. SPRING SOURCES

As will be demonstrated in §3.5.7, spring sources provide a small amount of TSS to a number of segments on the Middle Snake River and to a number of tributaries. Their contribution to TSS pollution is based on known TSS data from USGS, IDEQ-TFRO, and ERI; this information was tabulated and averaged to arrive at a mean value of 1.3 mg/L TSS for spring sources. It is recognized that the value of 1.3 mg/L may represent a high TSS value particularly since the values reported as < MDL were divided by 2 to arrive at an estimate value for the individual facility or waterbody. Additionally, the spring sources may be coupled with fish hatchery effluent and dependent on the particular waterbody may have the effluent combined with the overall TSS estimate for the particular spring source. Each section is self-contained and has its own explanation as to how the derivation of the TSS load was achieved. As a whole, known spring sources were included in the calculation for derivation of unknown spring sources. No reductions are proposed for spring sources at this time. Their TSS contributions are considered a part of natural background.

2. POINT SOURCES

As will be demonstrated in §3.5.7, point sources provide a small amount of TSS (as a whole) to any of the segments on the Middle Snake River. Tributaries vary widely in their point source TSS pollution to their associated waterbodies. However, in general, most tributaries provide a small fraction of TSS pollution from point sources. Yet, some tributaries provide a major portion of their TSS pollution from point sources. These are addressed according to individual streams and defined as such in the load analysis. No additional reductions are proposed for any of the point sources discharging directly or indirectly to the Middle Snake River at this time since these have undergone a permit change this year which addresses TSS. As more TSS information is provided by the point sources over the next 3-5 years a re-evaluation of TSS loads may be necessary if exceedences occur beyond the current level of practice. Food processors that impact the Middle Snake River are located above Milner Dam as described in §3.2.2 and are considered a component of the background entering Segment 1 along with water from the Milner Pool area. Other food processors within the boundaries of the Upper Snake Rock sub basin discharge to municipalities or land apply. Muncipalities as described in §3.2.3 discharge into the Milner Pool and are considered background like food processors; or, they discharge to tributaries or directly to the Middle Snake River and are accounted in the table of allocations in §3.5. Aquaculture is described fully in the table of allocations as either discharging directly to the Middle Snake River or discharging to a tributary or spring.

3. NONPOINT SOURCES

The Upper Snake Rock TMDL will follow the same definition of water user nonpoint source industry as described in the Mid-Snake TMDL: CFOs and/or CAFOs, irrigated agriculture, grazing, hydroelectric power, urban runoff, construction, land disposal, silviculture, bank erosion, and recreation. The hydroelectric industry does not contribute nutrients to the Middle Snake River and so carries a zero load. USEPA considers CFOs point sources only if an NPDES permit has been applied for and issued. For CFOs (and/or CAFOs), all processed waste must be contained and discharges are allowed only for runoff exceeding a 25-year, 24-hour storm event or in 1 in 5-year winter precipitation on permitted facilities. All other CFOs (and/or CAFOs) are not allowed to discharge. Penalty for discharge for dairy CFOs is revocation of their milk permit by the IDA who currently inspects the operations under the Idaho Dairy Memorandum of Understanding.

4. SURFACE WATERBODIES

As will be demonstrated in §3.5.7, surface waterbodies (natural tributaries and irrigation return drains) provide a major portion of the TSS pollution. Based on known data, TSS reductions to < 52.0 mg/L are described on a per waterbody basis. Based on this data, an average TSS value for these waterbodies was derived and estimated as 35.7 mg/L for natural tributaries and 102.0 mg/L TSS for seasonal irrigation return drains. When further information is obtained that can better define these estimates, they will be revised. When that occurs load estimates will better approximate the influence of TSS on any specific waterbody in the subbasin. Additionally, all natural surface waterbodies have a shoreline erosional component that is understood but undefined at this time. An effort will be made to get at a value for this component during the implementation phase of the TMDL.

5. MID-SNAKE STREAM SEGMENTS

The TSS instream load was estimated within each of the six segments of the Middle Snake River based on the estimate net load between its upstream and downstream segment sites. It is possible that some accounting of TSS coming from surface waterbodies may be included in this segment. However, this was the best value that could be derived for estimating the instream load of the Middle Snake River segments. It is not possible at this time to derive a truer value of the TSS load. Additionally, a shoreline erosional component of the Middle Snake River is understood but undefined at this time in the loading analysis for TSS. An effort will be made to get at a value for this component during the implementation phase of the TMDL.

3.5.2.1 MILNER DAM TO PILLAR FALLS SEGMENT AND CONNECTING WATERBODIES

All surface waterbodies shall reduce to reach the instream target of < 52.0 mg/L TSS (or 51.9 mg/L). Table 100 describes the TSS load allocation for the Middle Snake River segment from Milner Dam to Pillar Falls and all connecting waterbodies that discharge directly or indirectly to the river. Background load to this segment includes those food processors described in §3.2.2 and those muncipalities described in §3.2.3.

Table 100 TSS load allocation for Segment 1

TSS POLLUTANT SOURCES	WY1990-1991 BASELINE MEAN LOAD, tons/year	WY2004 TARGET MEAN LOAD, tons/year	WY2009 TARGET MEAN LOAD, tons/year	% LOAD REDUCT
Point Sources Discharging Directly to the Middle Snake River				
Hansen POTW[1]	1.3	1.3	1.3	
Sub Total A	1.3	1.3	1.3	0.0%
Spring Sources				
Vinyard Creek	17.1	17.1	17.1	
Devil's Corral Spring	54.0	54.0	54.0	
Unaccounted Springs	652.7	652.7	652.7	
Sub Total B	723.8	723.8	723.8	0.0%
Surface Waterbodies				

Dry Creek (main stem)	56.4% Ag = 1,089.3 40.5% Graze = 782.2 3.1% Backgrd = 59.8 Sub Total = 1,931.3	Agriculture = 195.0 Grazing = 128.5 Background = 22.2 Year 5 Target = 345.7	Agriculture = 195.0 Grazing = 128.5 Background = 22.2 Year 10 = 345.7	
West Fork of Dry Creek	100.0% Graze = 921.4	100.0% Graze = 164.7	Grazing = 164.7	
Sub Total	2,852.7	510.6	510.6	
A Drain	1,427.8	451.2	451.2	
A-10 Drain	209.7	209.7	209.7	
C 55 Drain	342.9	342.9	342.9	
Twin Falls Coulee	1,038.1	444.3	444.3	
Unaccounted Surface	9,523.8	6,785.7	6,785.7	
Sub Total C	15,395.0	8,744.4	8,744.4	43.2%
Segment 1: MD to PF				
Milner Dam to Pillar Falls	64.2% Ag = 5,100.9 11.4% Graze = 905.8 Background = 1,938.7 Sub Total = 7,945.4	Agriculture = 3,402.3 Grazing = 604.2 Background = 1,293.1 Year 5 Target = 5,299.6	Agriculture = 3,402.3 Grazing = 604.2 Background = 1,293.1 Year 10 = 5,299.6	
Sub Total D	7,945.4	5,299.6	5,299.6	33.3%
Other Water User Industries				
CFOs and/or CAFOs[2]	Zero Discharge	Zero Discharge	Zero Discharge	
Hydroelectric Power	0	0	0	
Land Application Facilities	0	0	0	
Sub Total E	0	0	0	0.0%
OVERALL TOTAL (A+B+C+D+E)	STARUP LOAD 24,065.5	LOAD CAPACITY 14,769.0	LOAD CAPACITY 14,769.0	OVERALL 38.6%

Prepared by IDEQ-TFRO. REDUCT = Reduction. TOTAL = Summation of all Sub Totals in the Table. See Appendix D*(Section VII, Segment 1)* for details of derivation and calculations. TSS reductions are: 0.0% for Point Sources, 0.0% for Spring Sources, 43.2% for Surface Waterbodies, and 41.6% for Segment 1, or an Overall TSS reduction of 41.4%. Dry Creek Complex in the ArcView GIS Hydro100 coverage divides the watershed into 10 segments and includes canalways and unnamed streams. Of the overall total length provided in the coverage of all of the stream segments, 24.7% is attributed to Dry Creek main stem and accounts for Dry Creek from headwaters to Medley Creek and from Medley Creek to the Middle Snake River; 11.8% is attributed to the West Fork of Dry Creek from the headwaters to Dry Creek; and, 63.5% is attributed to Medley Creek, Cold Spring Creek, East Fork of Dry Creek, Middle Fork of Dry Creek, Coyote Creek, Pit Creek, Stump Hollow, and unnamed streams. Only the WQLSs of the Dry Creek Complex are included in the above table. Dry Creek main stem and the West Fork of Dry Creek were prorated to 100% of the total load provided as 67.7% and 32.3%, respectively. LA = Load Allocation.

1. Hansen POTW discharges to an irrigation ditch. Assuming the irrigation ditch discharge reaches the Middle Snake River through its myriad winding turns, it would discharge at approximately RM617.9 on the southside. It is uncertain if this ever occurs.
2. CFOs and/or CAFOs also includes smaller dairies, all feedlots, and smaller confined feeding operations that do not have and NPDES stormwater permit.

The antidegradation policy for the State of Idaho (IDAPA 16.01.02.051(01) indicates that "the existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected." The river segment from Milner Dam to Pillar Falls appears to be meeting its narrative standard for sediment although it is listed for sediments in the 1996 303(d) list. Recreation has increased dramatically in the last 5 years due to higher flows and better water quality. In fact, recreation is becoming a growing industry in Segment 1 of the Middle Snake River. Monitoring data confirms that during 1990-1998 of 455 samples taken (247 for Milner Dam and 208 for Pillar Falls) only two samples were > 52 mg/L TSS instream target: 63 mg/L on 6/26/97 and 77 mg/L on 3/25/97. These were found during high flow years in two separate months. Thus, there is a 1.9% chance (2 months in 108 months) that such an event will occur, indicating that even under high flow conditions the water quality entering this segment is probably on an average basis below the instream target for meeting beneficial uses for salmonid spawning and cold water biota. TSS values > 25 mg/L but < 52 mg/L were accounted for in 16.2% of the samples. Thus, 83.8% of the samples were < 25 mg/L TSS. Because of this higher water quality for sediment, this segment (as a whole) will be considered as background (as statutorily defined in IDAPA 16.01.02.003.07; "the [*IDEQ*] will determine where background conditions should be measured") for the entire Middle Snake River for protection at current existing conditions. Current existing conditions are defined in this TMDL as meaning that point and nonpoint source inputs will reduce to levels < 52 mg/L TSS before discharging into this segment of the Middle Snake River. TSS values < 52 mg/L does not imply that degradation by TSS may occur up to 52 mg/L. Rather, TSS values should be < 52 mg/L on an average annual basis which will allow for some exceedences of the instream standard to account of seasonality. Degradation of the water quality beyond these conditions shall not occur but shall be maintained at or below these levels through Year 10 of plan implementation.

However, it is IDEQ's administrative policy under IDAPA 16.01.02.050.01 that "the adoption of water quality standards and the enforcement of such standards is not intended to conflict with the apportionment of water to the state through any of the interstate compacts or court decrees, or to interfere with the rights of Idaho appropriators, either now or in the future, in the utilization of the water appropriations which have been granted to them under the statutory procedure, or to interfere with water quality criteria established by mutual agreement of the participants in interstate water pollution control enforcement procedures." Yet, "wherever attainable, surface waters of the state shall be protected for beneficial uses which for surface waters includes all recreational use in and on the water surface and the preservation and propagation of desirable species of aquatic biota" (IDAPA 16.01.02.050.02.a). Segment 1 of the Middle Snake River will be protected through antidegradation for its recreational value as previously described. "In all cases, existing beneficial uses of the waters of the state will be protected" (IDAPA 16.01.02.050.02.c). Acts of God and/or uncontrollable flood events (as a result of structure failure, environmental terrorism, etc.) and/or drought conditions are exempt during the period of impact until such time that the impact is stabilized and the "imminent and substantial danger to the public health or environment" (IDAPA 16.01.02.350.02.a) is minimized so that the activity may be "conducted in compliance with approved BMPs...to fully protect the beneficial uses" (IDAPA 16.01.02.350.02.b.ii.(2)). Other activities that may cause degradation but which are outside the scope of IDAPA 16.01.02.050.01 and which there is foreknowledge of the event's occurence will require a formal written letter from the individual, organization, or agency to IDEQ-TFRO about the nature of the potential event. If the activity violates IDAPA 16.01.02.350.02.b.i such that it will occur "in a manner not in accordance with approved BMPs, or in a manner which does not demonstrate a knowledgeable and reasonable effort to minimize resulting adverse water quality impacts," then IDEQ-TFRO will seek intervention by the Administrator of IDEQ for preparation of a compliance schedule (as provided in Idaho Code 39-116); and/or institute administrative or civil proceedings including injunctive relief (as provide in Idaho Code 39-108).

3.5.2.2 PILLAR FALLS TO CRYSTAL SPRINGS SEGMENT AND CONNECTING WATERBODIES

All surface waterbodies shall reduce to reach the instream target of < 52.0 mg/L TSS (or 51.9 mg/L). Table

101 describes the TSS load allocation for the Middle Snake River segment from Pillar Falls to Crystal Springs and all connecting waterbodies that discharge directly or indirectly to the river.

Table 101 TSS load allocation for Segment 2

TSS POLLUTANT SOURCES	WY1990-1991 BASELINE MEAN LOAD, tons/year	WY2004 TARGET MEAN LOAD, tons/year	WY2009 TARGET MEAN LOAD, tons/year	% LOAD REDUCT
Point Sources Discharging Directly to the Middle Snake River				
Canyon Springs FH	31.3	31.3	31.3	
Blue Lakes Processing FH	5.6	5.6	5.6	
Blue Lakes FH	1,177.1	1,177.1	1,177.1	
Pristine Springs (+WW)	125.3	125.3	125.3	
City of Twin Falls POTW	146.4	146.4	146.4	
Crystal Springs FH	942.5	942.5	942.5	
Sub Total A	2,428.2	2,428.2	2,428.2	0.0%
Spring Sources				
Ellison Springs	1.6	1.6	1.6	
Crystal Springs[1] and Lake[4]	63.9	63.9	63.9	
Unseen Underground Seeps	165.2	165.2	165.2	
Unaccounted Springs[2]	(191.7)	(191.7)	(191.7)	
Sub Total B	39.0	39.0	39.0	0.0%
Surface Waterbodies				
East Perrine Coulee	3,353.8	1,482.3	1,482.3	
Green's Trout FH	12.0	12.0	12.0	
Sub Total	3,365.8	1,494.3	1,494.3	
Main Perrine Coulee	1,262.7	559.0	559.0	
West Perrine Coulee	555.5	129.2	129.2	
43 Drain	56.6	16.3	16.3	
Warm Creek	341.1	341.1	341.1	
Jerome Golf Course Drain	780.6	397.2	397.2	

Rock Creek Complex: Rock Creek main stem	84.5% Ag = 11,979.1 1.8% Graze = 255.2 Background = 1,942. ub Total = 14,176.4	Ag = 9,328.6 Grazing = 198.7 Background = 1,512.5 Sub Total = 11,039.8	Ag = 9,328.6 Grazing = 198.7 Background = 1,512.5 Sub Total = 11,039.8	
McMullen Creek[3]	See §2.5.03 Deep Draw	0.0	0.0	
Cottonwood Creek[3]	See §2.5.03 Deep Draw	0.0	0.0	
Canyon Trout FH	21.1	21.1	21.1	
Canyon Trout Processing	Total Containment	0.0	0.0	
C&M Farm FH	28.1	28.1	28.1	
Daydream Ranch FH	25.9	25.9	25.9	
Deadman FH	27.5	27.5	27.5	
CSI FH	9.7	9.7	9.7	
Frame FH	35.6	35.6	35.6	
Coats FH	39.3	39.3	39.3	
Sub Total	14,363.6	11,227.0	11,227.0	
30 Drain	2,228.0	311.4	311.4	
LQ/LS Drain	6,379.8	1,500.4	1,500.4	
Rand FH	47.5	47.5	47.5	
Sub Total	6,427.3	1,547.9	1,547.9	
LS2/39 A Drain	1,111.0	269.6	269.6	
N42-N Drain	147.8	147.8	147.8	
N42-NT Drain	321.2	321.2	321.2	
39 Drain	1,997.4	243.5	243.5	
Unaccounted Surface	(2,798.8)	(2,076.4)	(2,076.4)	
Sub Total C	30,159.8	14,929.1	14,929.1	50.5%
Segment 2: PF to CS				
Pillar Falls to Crystal Springs	66.7% Ag = 5,085.0 13.1% Graze = 998.7 Background = 1,540.0 Sub Total = 7,623.7	Agriculture = 3,391.7 Grazing = 666.1 Background = 1,027.2 Sub Total = 5,085.0	Agriculture = 3,391.7 Grazing = 666.1 Background = 1,027.2 Sub Total = 5,085.0	
Sub Total D	7,623.7	5,085.0	5,085.0	66.7%
Other Water User Industries				
CFOs and/or CAFOs[5]	Zero Discharge	Zero Discharge	Zero Discharge	
Hydroelectric Power	0	0	0	
Land Application Facilities	0	0	0	
Sub Total E	0	0	0	0.0%
OVERALL TOTAL (A+B+C+D+E)	STARTUP LOAD 40,250.7	LOAD CAPACITY 22,481.3	LOAD CAPACITY 22,481.3	44.1%

Prepared by IDEQ-TFRO. REDUCT = Reduction. TOTAL = Summation of all Sub Totals in the Table. See Appendix D *(Section VII, Segment 2 and Section X, Segment 2)* for details of derivation and calculations. WW = Warmwater. FH = Fish Hatchery. TSS reductions are 0.0% for point sources, 0.0% for spring sources, 50.5% for surface waterbodies, 33.3% for the instream segment of the Middle Snake River, or an overall 44.1% reduction.
1. Based on 50 cfs that bubbles underneath the lake. 199.6 cfs is accounted for by the Crystal Springs FH.
2. Unaccounted Springs = 153.9 cfs.
3. McMullen Creek and Cottonwood Creek are portions of the Rock Creek Complex and are included in this table as additional streams to Rock Creek. Historically, their discharge was to Rock Creek, but that is no longer the case. Currently, both creeks discharge to the High Line Canal which eventually discharges to Deep Creek.
4. A Crystal Lake remediation plan is proposed by Clear Springs Foods, Inc. In 1991 considerable sediments were removed from Crystal Lake as a result of a dredging effort. Because of lake bottom irregularities not all of the sediments could be removed. It is possible that the remaining sediments are providing sufficient nutrients to support abundant aquatic plant growth. Sufficient time would be needed to diminish these nutrients through natural biological processes. IDEQ-TFRO proposes to do an assessment of the lake within 5 years of plan implementation, and in conjunction with Clear Springs Foods, Inc. to determine the best course to follow to reduce these historical sediments.
5. CFOs and/or CAFOs also includes smaller dairies, all feedlots, and smaller confined feeding operations that do not have and NPDES stormwater permit.

3.5.2.3 CRYSTAL SPRINGS TO BOX CANYON SEGMENT AND CONNECTING WATERBODIES

All surface waterbodies shall reduce to reach the instream target of < 52.0 mg/L TSS (or 51.9 mg/L). Table 102 describes the TSS load allocation for the Middle Snake River segment from Crystal Springs to Box Canyon and all connecting waterbodies that discharge directly or indirectly to the river.

Table 102 TSS load allocation for Segment 3

TSS POLLUTANT SOURCES	*WY1990-1991 BASELINE MEAN LOAD, tons/year*	*WY2004 TARGET MEAN LOAD, tons/year*	*WY2009 TARGET MEAN LOAD, tons/year*	*% LOAD REDUCT*
Point Sources Discharging Directly to the Middle Snake River				
Magic Valley FH	813.2	813.2	813.2	
Rim View FH	606.7	606.7	606.7	
IPC/Niagara Springs FH	108.6	108.6	108.6	
Gary Wright FH	10.8	10.8	10.8	
Catfish FH/FBI	200.8	200.8	200.8	
Kaster Trout FH	96.6	96.6	96.6	
Box Canyon FH	1,712.3	1,712.3	1,712.3	
Briggs Creek FH	47.5	47.5	47.5	
Sub Total A	3,596.5	3,596.5	3,596.5	0.0%
Spring Sources				
Unseen Underground Seeps	141.7	141.7	141.7	
Niagara Springs	38.9	38.9	38.9	
Clear Springs & Lake[1]	180.1	180.1	180.1	
Clear Lakes Trout FH	349.0	349.0	349.0	
Middle Hatchery FH	358.2	358.2	358.2	
Snake River FH	195.8	195.8	195.8	
Clear Springs Processing	4.5	4.5	4.5	
Sub Total	1,087.6	1,087.6	1,087.6	

Banbury Springs	154.3	154.3	154.3	
Briggs Creek Springs	106.6	106.6	106.6	
Box Canyon Springs	83.1	83.1	83.1	
Unaccounted Springs	(236.7)	(236.7)	(236.7)	
Sub Total B	1,375.3	1,375.3	1,375.3	0.0%
Surface Waterbodies				
Cedar Draw	12,066.3	5,721.0	5,721.0	
Filer POTW	2.1	2.1	2.1	
Rainbow (Filer) FH	25.3	25.3	25.3	
Rainbow Processing	0.04	0.04	0.04	
Yoder FH	17.5	17.5	17.5	
SEAPAC Processing	Land Application	0.0	0.0	
Cedar Draw FH	39.6	39.6	39.6	
Olson FH	7.6	7.6	7.6	
Stutzman FH	2.4	2.4	2.4	
Tunnel Creek FH	35.8	35.8	35.8	
Leo Martins FH	29.5	29.5	29.5	
Sub Total	12,226.1	5,880.8	5,880.8	
Mud Creek	5,809.5	5,809.5	5,809.5	
Buhl POTW	28.8	28.8	28.8	
Rainbow (Buhl) FH	16.3	16.3	16.3	
W&W FH	20.0	20.0	20.0	
White's FH	7.9	7.9	7.9	
Buhl Trout Rearing FH	6.7	6.7	6.7	
Buhl Trout FH	9.9	9.9	9.9	
Jukers FH	10.6	10.6	10.6	
RCP FH	3.5	3.5	3.5	
First Ascent FH	35.3	35.3	35.3	
Rock Ridge FH	4.0	4.0	4.0	
Mi Vida Loca VH	7.9	7.9	7.9	
Sub Total	5,960.4	4,965.4	4,965.4	
Deep Creek	5,646.4	4,480.0	4,480.0	
McMullen Creek[3]	Est = 257.9	33.3% R = 172.0	172.0	
Cottonwood Creek[3]	Est = 148.3	33.3% R = 98.9	98.9	
Deep Creek Trout FH	31.1	31.1	31.1	
Boswell Trout FH	33.2	33.2	33.2	
Peter's FH	20.3	20.3	20.3	
Cox FH	30.7	30.7	30.7	
Dolana FH	10.2	10.2	10.2	
Howell FH	19.0	19.0	19.0	
Sub Total	6,197.1	4,895.4	4,895.4	

Blind Canyon Creek	73.4% Ag = 910.8 9.5% Grazing = 117.9 Background = 198.5 BlindCanynFH = 13.7 Sub Total = 1,240.9	32.8% Reduct = 611.7 32.6% Reduct = 79.5 Background = 73.6 BlindCanynFH = 13.7 Sub Total = 778.5	32.8% Reduct = 611.7 32.6% Reduct = 79.5 Background = 73.6 BlindCanynFH = 13.7 Sub Total = 778.5	
S19/S Drain	2,262.2	2,262.2	2,262.2	
Sub Total	3,503.1	3,040.7	3,040.7	
I Drain	1,257.0	1,257.0	1,257.0	
J8 Drain Jerome POTW	349.2 15.9	349.2 15.9	349.2 15.9	
Sub Total	365.1	365.1	365.1	
N Drain[2]	157.8	157.8	157.8	
S29 Drain	30.9	30.9	30.9	
Unaccounted Surface	(3,452.0)	534.6	534.6	
Sub Total C	26,245.6	21,127.7	21,127.7	19.5%
Segment 3: CS to BC				
Crystal Springs to Box Canyon	67.1% Ag = 32,458.1 11.6% Graze = 5,611.2 Backgrund =	Agriculture =21,649.5 Grazing = 3,742.7 Background =	Agriculture =21,649.5 Grazing = 3,742.7 Background =	
Sub Total D	48,372.7	32,264.6	32,264.6	33.3%
Other Water User Industries				
CFOs and/or CAFOs[4]	Zero Discharge	Zero Discharge	Zero Discharge	
Hydroelectric Power	0	0	0	
Land Application Facilities	0	0	0	
Sub Total E	0	0	0	0.0%
OVERALL TOTAL (A+B+C+D+E)	STARTUP LOAD 79,590.1	LOAD CAPACITY 58,364.1	LOAD CAPACITY 58,364.1	26.7%

Prepared by IDEQ-TFRO. TOTAL = Summation of all Sub Totals in the Table. See Appendix D*(Section VII, Segment 3)* for details of derivation and calculations. REDUCT = Reduction. TSS reduction 0.0% for point sources, 0.0% for spring sources, 19.5% for surface waterbodies, 33.3% for the instream portion in the river, or a 26.7% overall reduction.

1. A Clear Lakes Remediation Plan is proposed by Clear Springs Foods, Inc. in collaboration with Idaho Trout Processors, Clear Lakes Trout Company, the Clear Lake Homeowners Association, and the Clear Lake Country Club. A one-time sediment removal effort over a period of several years will be developed and implemented. Based on the NPDES permit requirements for the five aquaculture facilities that discharge to Clear Lakes, there should be no additional need to remove sediments once this project is completed. Once the project is completed, and with the implementation of the Mid-Snake TMDL and the Upper Snake Rock TMDL, re-evaluation of this lake will be done on a regular basis as a component of short-term and long-term goals of the Upper Snake Rock TMDL. An assessment of TSS and TP build up in the lake will be conducted by IDEQ-TFRO within five years of plan implmentation to ascertain if current discharges are contributing to such buildup.
2. Disputed as discharging to Mud Creek rather than the Middle Snake River. It is maintained as a separate discharge to the Middle Snake River to keep continuity with Phase 1 Study.
3. McMullen Creek and Cottonwood Creek have minimal water quality data. Ascertaining the effects from TSS will need to be addressed with a specific monitoring program during the implementation phase of the TMDL. Historically McMullen Creek and Cottonwood Creek discharged to Rock Creek, but have since been diverted to the High Line Canal for irrigation purposes. Both creeks historically have stream water from mid-January to the end of June. After June both creeks are dry (or intermittent). Based on information provided by the Twin Falls Canal Company, flow from McMullen Creek provides an average of 4.0 cfs to the High Line Canal; flow from Cottonwood Creek provides an average of 2.3 cfs to the High Line Canal. Since both waterbodies originally belonged to Rock Creek Complex, ascertaining an approximate load to the High Line Canal was based on known load analysis for Rock Creek. Since Rock Creek averages 219.9 cfs (with a TSS load of 14,176.4 tons/year), the following calculations were used to derive the loads for McMullen Creek and Cottonwood Creek: (1) McMullen Creek = (4.0 cfs/219.9 cfs) x 14,176.4 tons/year = 257.9 tons/year; and, (2) Cottonwood Creek = (2.3 cfs/219.9 cfs) x 14,176.4 tons/year = 148.3 tons/year. Until more current TSS information is obtained, these estimate loads will be used in the Deep Creek calculations.
4. CFOs and/or CAFOs also includes smaller dairies, all feedlots, and smaller confined feeding operations that do not have and NPDES stormwater permit.

3.5.2.4 BOX CANYON TO GRIDLEY BRIDGE SEGMENT AND CONNECTING WATERBODIES

All surface waterbodies shall reduce to reach the instream target of < 52.0 mg/L TSS (or 51.9 mg/L). Table 103 describes the TSS load allocation for the Middle Snake River segment from Box Canyon to Gridley Bridge and all connecting waterbodies that discharge directly or indirectly to the river.

Table 103 TSS load allocation for Segment 4

TSS POLLUTANT SOURCES	*WY1990-1991 BASELINE MEAN LOAD, tons/year*	*WY2004 TARGET MEAN LOAD, tons/year*	*WY2009 TARGET MEAN LOAD, tons/year*	*% LOAD REDUCT*
	Point Sources Discharging Directly to the Middle Snake River			
Blind Canyon Aqua FH	27.9	27.9	27.9	
Pisces Magic Springs FH	83.3	83.3	83.3	
Sub Total A	111.2	111.2	111.2	0.0%
	Spring Sources			
Unseen Underground Seeps	92.1	92.1	92.1	
Thousand Springs	1,575.2	1,575.2	1,575.2	
Ten Springs FH	51.4	51.4	51.4	
Sub Total	1,626.6	1,626.6	1,626.6	
Riley Creek	734.1	734.1	734.1	
USFSW-FH	95.9	95.9	95.9	
IDFG-FH	142.2	142.2	142.2	
Sub Total	972.2	972.2	972.2	
Sand Springs Creek	117.2	117.2	117.2	
Unaccounted Springs	(92.8)	(92.8)	(92.8)	

Sub Total B	2,715.3	2,715.3	2,715.3	0.0%
Surface Waterbodies				
Salmon Falls Creek	5,966.6	5,966.6	5,966.6	
W26 Drain	1,093.3	927.1	927.1	
Unaccounted Surface	(1,355.5)	(2,461.4)	(2,461.4)	
Sub Total C	5,704.4	4,432.2	4,432.2	22.3%
Segment 4: BC to GB				
Box Canyon to Gridley Bridge	49.3% Ag = 15,696.7 29.2% Graze= 9,297.0 Background = 6,845.4 Sub Total = 31,839.1	Ag = 9,258.4 Graze = 5,483.7 Background = 6,494.6 Sub Total = 21,236.7	Ag = 9,258.4 Grazing = 5,483.7 Background= 6,494.6 Sub Total = 21,236.7	
Sub Total[1] D	31,839.1	21,236.7	21,236.7	33.3%
Other Water User Industries				
CFOs and/or CAFOs[2]	Zero Discharge	Zero Discharge	Zero Discharge	
Hydroelectric Power	0	0	0	
Land Application Facilities	0	0	0	
Sub Total E	0	0	0	0.0%
OVERALL TOTAL (A+B+C+D+E)	STARTUP LOAD 40,369.9	LOAD CAPACITY 28,495.4	LOAD CAPACITY 28,495.4	29.4%

Prepared by IDEQ-TFRO. REDUCT = Reduction. TOTAL = Summation of all Sub Totals in the Table. See Appendix D*(Section VII, Segment 4)* for details of derivation and calculations. TSS reductions are 0.0% for point sources, 0.0% for springs, 22.3% for surface waterbodies, 33.3% for the instream segment of the river, or an overall 29.4%.
1. Sub Total values taken as worst case scenario such that the absolute value of the load is used instread of the negative value. See Section X, Segment 4 of Appendix D.
2. CFOs and/or CAFOs also includes smaller dairies, all feedlots, and smaller confined feeding operations that do not have and NPDES stormwater permit.

3.5.2.5 GRIDLEY BRIDGE TO SHOESTRING BRIDGE SEGMENT AND CONNECTING WATERBODIES

All surface waterbodies shall reduce to reach the instream target of < 52.0 mg/L TSS (or 51.9 mg/L). Table 104 describes the TSS load allocation for the Middle Snake River segment from Gridley Bridge to Shoestring Bridge and all connecting waterbodies that discharge directly or indirectly to the river.

Table 104 TSS load allocation for Segment 5

TSS POLLUTANT SOURCES	*WY1990-1991 BASELINE MEAN LOAD, tons/year*	*WY2004 TARGET MEAN LOAD, tons/year*	*WY2009 TARGET MEAN LOAD, tons/year*	*% LOAD REDUCT*
Point Sources Discharging to the Middle Snake River				
Henslee FH (Irrigation Ditch)	16.7	16.7	16.7	

Buckeye FH	446.8	446.8	446.8	
Big Bend FH(Big Bend Ditch)	8.5	8.5	8.5	
Lemmon FH (Buckeye Ditch)	7.9	7.9	7.9	
Eckles FH (Billingsley Creek)	36.5	36.5	36.5	
Dunn FH (Billingsley Creek)	71.2	71.2	71.2	
Barret FH	19.8	19.8	19.8	
White Springs FH	118.0	118.0	118.0	
Mike Flemming FH	11.2	11.2	11.2	
Smith FH	17.9	17.9	17.9	
Woods FH	24.4	24.4	24.4	
Slane FH	8.2	8.2	8.2	
John Flemming FH	17.7	17.7	17.7	
Stevenson FH	15.8	15.8	15.8	
City of Hagerman POTW	1.4	1.4	1.4	
Sub Total A	822.0	822.0	822.0	0.0%
Spring Sources				
Birch Creek[1]	1.3	1.3	1.3	
Birch Creek FH	87.4	87.4	87.4	
C.J. Simms FH	10.4	10.4	10.4	
Sub Total	99.1	99.1	99.1	
Stoddard Creek[2]	Utilized by FHs	0.0	0.0	
Bell FH	7.4	7.4	7.4	
Standal FH	9.7	9.7	9.7	
White Water FH	22.0	22.0	22.0	
Sub Total	39.1	39.1	39.1	
Decker Springs Creek[3]	Utilized by FH	0.0	0.0	
Decker Springs FH	24.4	24.4	24.4	
Sub Total	24.4	24.4	24.4	
Unaccounted Springs	208.6	208.6	208.6	
Sub Total B	371.2	371.2	371.2	0.0%
Surface Waterbodies				
Malad River	3,753.7	3,753.7	3,753.7	
Malad River Power Flume	23,606.6	23,606.6	23,606.6	

Billingsley Creek[4]	181.5	181.5	181.5	
Rangen's FH	38.3	38.3	38.3	
Jones FH	59.5	59.5	59.5	
McFadden FH	13.7	13.7	13.7	
Idaho Springs FH	106.2	106.2	106.2	
Hidden Springs FH	22.8	22.8	22.8	
Schrank Springs Creek FH	6.2	6.2	6.2	
Fisheries Development FH	001A + 003A = 190.3	190.3	190.3	
2 Non-permitted FH (T & J)	No permit = 9.8	9.8	9.8	
Boyer FH (Billingsley Creek)	22.8	22.8	22.8	
Talbot FH (Billingsley Creek)	22.2	22.2	22.2	
Sub Total	673.3	673.3	673.3	
Unaccounted Surface	3,044.7	(156.4)	(156.4)	
Sub Total C	31,078.3	27,877.2	27,877.2	10.3%
Segment 5: GB to SB				
Gridley Bridge to Shoestring Bridge	30.3% Ag = 3,326.1 55.4% Graze= 6,081.4 Background = 1,569.7 Sub Total = 10,977.2	Ag = 2,218.5 Grazing = 4,056.3 Background = 1,047.0 Sub Total = 7,321.8	Ag = 2,218.5 Grazing = 4,056.3 Background = 1,047.0 Sub Total = 7,321.8	
Sub Total D	10,977.2	7,321.8	7,321.8	33.3%
Other Water User Industries				
CFOs and/or CAFOs[2]	Zero Discharge	Zero Discharge	Zero Discharge	
Hydroelectric Power	0	0	0	
Land Application Facilities	0	0	0	
Sub Total E	0	0	0	0.0%
OVERALL TOTAL (A+B+C+D+E)	STARTUP LOAD 43,248.7	LOAD CAPACITY 36,392.3	LOAD CAPACITY 36,392.3	15.9%

Prepared by IDEQ-TFRO. REDUCT = Reduction. S & J = Tupper Ponds & Johnson Farm Ponds. FH = Fish Hatcheries. TOTAL = Summation of all Sub Totals in the Table. See Appendix D*(Section VII, Segment 5)* for details of derivation and calculations. TSS reductions are 0.0% for point sources, 0.0% for spring sources, 0.0% for surface waterbodies since the data indicates they are well below the 52.0 mg/L TSS instream standard, 33.3% for the instream portion of the Middle Snake River, or an overall 8.5% TSS reduction.

1. Birch Creek is listed as two separate entries in Appendix D *(Section VII, Segment 5)*: one with an aquaculture facility and one without an aquaculture facility. Total Q is estimated at 11.03 cfs. Q running thru the FH is estimated at 9.98 cfs. The remainder (11.03 cfs - 9.98 cfs) represents what is contributed by the spring source only (or 1.05 cfs).
2. Stoddard Creek needs to have a nonpoint source assessment done for TSS to ascertain the impact from nonpoint sources versus the aquaculture facilities. This assessment will be conducted by IDEQ-TFRO after during the TMDL implementation phase.
3. Decker Springs Creek needs to have a nonpoint source assessment done for TSS to ascertain the impact from nonpoint sources versus the aquaculture facilities. This assessment will be conducted by IDEQ-TFRO after during the TMDL implementation phase.
4. Billingsley Creek: 73% of TSS is attributed to the fish hatcheries. The remaining 27% is attributed to nonpoint sources. The average flow is still 39.3 cfs because fish hatcheries re-use the same water from the headwaters to where it discharges to the Middle Snake River.
5. CFOs and/or CAFOs also includes smaller dairies, all feedlots, and smaller confined feeding operations that do not have and NPDES stormwater permit.

3.5.2.6 SHOESTRING BRIDGE TO KING HILL SEGMENT AND CONNECTING WATERBODIES

All surface waterbodies shall reduce to reach the instream target of < 52.0 mg/L TSS (or 51.9 mg/L). Table 105 describes the TSS load allocation for the Middle Snake River segment from Shoestring Bridge to King Hill and all connecting waterbodies that discharge directly or indirectly to the river.

Table 105 TSS load allocation for Segment 6

TSS POLLUTANT SOURCES	WY1990-1991 BASELINE MEAN LOAD, tons/year	WY2004 TARGET MEAN LOAD, tons/year	WY2009 TARGET MEAN LOAD, tons/year	% LOAD REDUCT
Point Sources Discharging Directly to the Middle Snake River				
None	0.0	0.0	0.0	
Sub Total A	0.0	0.0	0.0	0.0%
Spring Sources				
Unaccounted Springs	317.5	317.5	317.5	
Sub Total B	317.5	317.5	317.5	0.0%
Surface Waterbodies				
Clover Creek (+ Pioneer Reservoir)	17.8% Agriculture = 69.2 82.2% Grazing =	Agriculture = 69.2 Grazing = 319.6 Sub Total = 388.8	Agriculture = 69.2 Grazing = 319.6 Sub Total = 388.8	
Unaccounted Surface	4,632.0	3,336.0	3,336.0	
Sub Total C	5,020.8	3,725.4	3,725.4	25.8%
Segment 6: SB to KH				
Shoestring Bridge to King Hill	21.9% Ag = 19,312.9 65.3% Graze= 57,585.8 Background = 11,287.8 Sub Total = 88,186.6	Ag = 12,881.7 Graze = 38,409.8 Background = 7,529.0 Sub Total = 58,820.5	Ag = 12,881.7 Graze = 38,409.8 Background = 7,529.0 Sub Total = 58,820.5	
Sub Total D	88,186.6	58,820.5	58,820.5	33.3%
Other Water User Industries				
CFOs and/or CAFOs[2]	Zero Discharge	Zero Discharge	Zero Discharge	
Hydroelectric Power	0	0	0	
Land Application Facilities	0	0	0	
Sub Total E	0	0	0	0.0%
OVERALL TOTAL (A+B+C+D+E)	STARTUP LOAD 93,524.9	LOAD CAPACITY 62,863.4	LOAD CAPACITY 62,863.4	32.8%

Prepared by IDEQ-TFRO. REDUCT = Reduction. TOTAL = Summation of all Sub Totals in the Table. See Appendix D*(Section VII, Segment 6)* for details of derivation and calculations. TSS reductions are 0.0% for point sources, 0.0% for spring sources, 25.8% for surface waterbodies, 33.3% for the instream portion of the Middle Snake River, or an overall 32.8% TSS reduction.
1. CFOs and/or CAFOs also includes smaller dairies, all feedlots, and smaller confined feeding operations that do not have and NPDES stormwater permit.

3.5.2.7 TSS LOADING ANALYSIS SUMMARY AND ASSESSMENT

Table 106 summarizes the loading analysis per segment input into the Middle Snake River system. The summary is based on gross totals for the specific input sources defined. All surface waterbodies shall reduce to reach the instream target of < 52.0 mg/L TSS (or 51.9 mg/L). Other water user industries (CFOs and/or CAFOs, hydroelectric power, and land application facilities) have a load of zero and are not listed in Table 106.

Table 106 TSS loading analysis summary for the Middle Snake River system

Segment	Point Sources (A)	Spring Sources (B)	Surface Waterbodies (C)	Snake River Segment (D)	TOTAL (A+B+C+D)
WY1990-1991 BASELINE MEAN LOAD, tons/year					
1: MD to PF	1.3	723.8	15,395.0	7,945.4	24,065.5
2: PF to CS	2,428.2	39.0	30,159.8	7,623.7	40,250.7
3: CS to BC	3,596.5	1,375.3	26,245.6	48,372.7	79,590.1
4: BC to GB	111.2	2,715.3	5,704.4	31,839.1	40,369.9
5: GB to SB	822.0	371.2	31,078.3	10,977.2	43,248.8
6: SB to KH	0.0	317.5	5,020.8	88,186.6	93,524.9
Total	6,959.2	5,542.1	113,603.9	194,944.7	321,049.9
WY2004 & WY2009 MEAN LOAD ALLOCATION, tons/year					
1: MD to PF	1.3	723.8	8,744.4	5,299.6	14,769.0
2: PF to CS	2,428.2	39.0	14,929.1	5,085.0	22,481.3
3: CS to BC	3,596.5	1,375.3	21,127.7	32,264.6	58,364.1
4: BC to GB	111.2	2,715.3	4,432.3	21,236.7	28,495.4
5: GB to SB	822.0	371.2	27,877.2	7,321.8	36,392.3
6: SB to KH	0.0	317.5	3,725.4	58,820.5	62,863.4
Total	6,959.2	5,542.1	80,836.1	130,028.1	223,365.6
% Reduction	0.0%	0.0%	28.8%	33.3%	30.4%

Prepared by IDEQ-TFRO. TSS source contributions may be categorized as follows: Before Reduction---2.2% point sources, 1.7% spring sources, 35.4% surface waterbodies, and 60.7% Middle Snake River instream segment; After Reduction---3.1% point sources, 2.5% spring sources, 36.2% surface waterbodies, and 58.2% Middle Snake River instream segment. The overall categorization of each segment in the Middle Snake River for TSS is: Before Reduction---7.5% MD to PF, 12.5% PF to CS, 24.8% CS to BC, 12.6% BC to GB, 13.5% GB to SB, 29.1% SB to KH; After Reduction---6.6% MD to PF, 10.1% PF to CS, 26.1% CS to BC, 12.8% BC to GB, 16.3% GB to SB, and 28.1% SB to KH.

The Upper Snake Rock Watershed Management Plan's TSS loading analysis accounts for point sources, spring sources, surface waterbodies (tributaries and irrigation return flows), and the Middle Snake River segment that receives these various inputs. Point sources (which account for 2.2% before reduction and 3.1% after reduction of the total mean load) already have imposed NPDES permit limits which will be reviewed at the end of Year 5 of plan implementation. Spring sources (which account for 1.7% before reduction and 2.5% after reduction of the total mean load) are probably at the highest level of TSS based on the mean value taken for various known springs (or 1.3 mg/L TSS) for estimated TSS values. The values are probably less than what is indicated because a greater portion of the values were much less than 1.3 mg/L TSS. Surface waterbodies (which account for 35.4% before reduction and 36.2% after reduction of the total mean load) include tributaries and irrigation return flows and will reduce to instream target values < 52.0 mg/L TSS. These reductions will meet beneficial uses and State water quality standards for sediment. The Middle Snake River segments (which account for 60.7% before reduction and 58.2% after reduction of the total mean load) will also have reductions based on land use estimation from the stream corridor approach model for nonpoint sources. These reductions will meet beneficial uses and State water quality standards for sediment.

An assessment of Table 106 indicates that the overall TSS from the various sources ranks as follows:

	TSS Reductions		
Waterbody	Before	After	Mean
Snake River Segment	60.7%	58.2%	59.4%
Surface Waterbodies	35.4%	36.2%	35.8%
Point Sources	2.2%	3.1%	2.7%
Spring Sources	1.7%	2.5%	2.1%

Point Sources = Fish Hatcheries and Municipalities
Spring Sources may include some fish hatcheries not directly discharging to the river.

For each segment within the Middle Snake River, the categorization and ranking of TSS is as follows:

Segment	TSS % of Total		
Rank Order	Before	After	Mean
SB to KH	29.1%	28.1%	28.6%
CS to BC	24.8%	26.1%	25.5%
GB to SB	13.5%	16.3%	14.9%
BC to GB	12.6%	12.8%	12.7%
PF to CS	12.5%	10.1%	11.3%
MD to PF	7.5%	6.6%	7.1%

CS to BC is known to have the greatest macrophyte nuisance vegetation growing under low flow conditions. SB to KH is known to have the greatest level of TSS under high flow conditions. The greatest impact from TSS to the Middle Snake River appears to come from the Middle Snake River corridor, followed by surface waterbodies. Point sources and spring sources appear to be the lowest impactor to the system. This does not necessarily hold true for smaller waterbodies when comparing point versus nonpoint sources as is described as follows:

	TSS Impact Estimates	
Waterbody	Point Sources	Nonpoint Sources
Rock Creek	1.3%	98.7%
Clear Springs and Lake	83.4%	16.6%

Cedar Draw	1.3%	98.7%
Mud Creek	2.5%	97.5%
Deep Creek	2.3%	97.7%
Blind Canyon Creek	0.4%	99.6%
J8 Drain	4.4%	95.6%
East Perrine Coulee	0.4%	99.6%
Thousand Springs	3.2%	96.8%
Riley Creek	24.5%	75.5%
Birch Creek	98.7%	1.3%
Stoddard Creek	Unknown	Unknown
Decker Springs Creek	Unknown	Unknown
Billingsley Creek	73.0%	27.0%

Based on the loading analysis in Table 103. Stoddard Creek and Decker Springs Creek have aquaculture facilities that utilized and discharge to these creeks.

From this assessment it can be surmised that any cleanup plan will necessitate addressing the specific sources of pollution. For the Middle Snake River the nonpoint sources for land uses affecting the corridor and for surface waterbodies transporting TSS to the river appear to be the greatest source of TSS pollution. On the other hand, for each surface waterbody (other than the Middle Snake River itself) it may be that nonpoint sources may not necessarily be the major source of TSS. Depending on the stream, point sources may comprise a greater impact than nonpoint sources. Therefore, the development of implementation plans that are specifically designed for the particular waterbody is critical to the success of the Upper Snake Rock TMDL. In the case of some waterbodies, an implementation plan may already be developed but not yet fully applied. For example, Billingsley Creek had a preliminary nonpoint source and point source implementation plan developed by a steering committee in the early 1990s for the reduction of pollutants that could easily be adapted to current needs. It may necessitate updating BMPs, but it could readily be applied with some minor updating. Others are already in progress with the intercession of a land management agency (such as NRCS, the SCC, and the ISCDs) as in the case of Rock Creek, Mud Creek, and Deep Creek. Others, such as Clear Springs and Lake, are in the development phase and involve particular facilities that already have permit restrictions imposed. Still others have some work already done, as in the case of East Perrine Coulee, but necessitate further development and a more holistic approach to include urban concerns from stormwater impacts. Then there are those that will require new work because little has been done to date to curb pollution concerns. The division of a waterbody into segments so as to target various types of BMPs may be necessary for success on some streams. As a consequence of all these variables, IDEQ-TFRO will review and assess all implementation plans in a coordinated effort with the appropriate land management agency and provide necessary updates to the Mid-Snake WAG and USEPA on a regular basis. See §3.6.1 and §3.6.2.

3.5.3 TOTAL PHOSPHORUS (TP)

The basic model used in the TP loading analysis was a mass balance spreadsheet that summarized five general components for each Middle Snake River segment: point sources directly discharging to the Middle Snake River; spring sources (which might also have point source influence as indirect dischargers to the Middle Snake River); surface waterbodies (which includes tributaries and irrigation canal drains); the instream segment on the Middle Snake River; and, other water user industries (CFOs and/or CAFOs, hydropower, and land application facilities). These are labeled as A, B, C, D, and E, respectively. The approach was similar to that of TSS (see §3.5.2). However, the allocation is incomplete as it currently stands due to the lack of sufficient TP information. Yet, as it stands it provides the basis by which meeting the instream water quality target will meet the load capacity for reduced eutrofication of aquatic plant growths in meeting the narrative standard for excess nutrients. The logic and approach of an instream target of 0.100 mg/L for all tributaries flowing to the Middle Snake River is as follows:

(1) The Mid-Snake TMDL's water quality target of 0.075 mg/L was established from RBM10 Model simulations using the flow data from 1930-1939 which represented the lowest flow years on the hydrologic record. Model simulation results gave a value of 0.0728 mg/L at Gridley Bridge, thus the Mid-Snake WAG agreed to a target of 0.075 mg/L for the Middle Snake River for meeting beneficial uses to control excess nuisance aquatic plant growth (which does not mean that 100% of the macrophytes will be reduced). This was the initial startup target over a 10-year period with the provision that if beneficial uses were not met, then TP reductions would be more stringently refined.

(2) The Middle Snake River has an estimated 26% reservoir-like water; the remaining 74% being riverine-like. However, because of flow management the Middle Snake River has altered streamflow dynamics. The Middle Snake River has 5 reservoirs which are often confused as true reservoirs and lakes. In fact, they are not. According to the State of Idaho's (IDEQ's) 1998 BURP Lake and Reservoir Workplan [p 8] waterbodies that have a residence time > 14 days are candidates for using lake and reservoir BURP. The reservoirs of Bliss, Lower Salmon Falls, Upper Salmon Falls, Shoshone Falls, and Twin Falls all have residence times < 14 days and are operated as "run-of-the-river" by Idaho Power Company (IPC). Milner Dam is operated as an irrigation diversion and its reservoir is in the Lake Walcott reach and being addressed by the Lake Walcott TMDL. As defined by IPC, "run-of-the-river means that the volume of inflow to the reservoir is equal to the volume of outflow within a 24 hour period." Therefore applying water quality criteria that is applicable to lakes or reservoirs is not applicable to the Middle Snake River reservoirs.

(3) The Gold Book "standard" (USEPA Quality Criteria for Water 1986) has the following criteria for TP (as "phosphate phosphorus") to prevent the development of biological nuisances and to control accelerated or cultural eutrophication: TP should not exceed 0.050 mg/L "in any stream at the point where it enters any lake or reservoir;" nor 0.025 mg/L "within the lake or reservoir;" and, "a desired goal for the prevention of plant nuisances in streams or other flowing waters not discharging directly to lakes or impoundments" of 0.100 mg/L.

The conclusion from the logic and approach used for an instream wate quality target of 0.100 mg/L TP is that the 0.075 mg/L TP instream target is specific to the Middle Snake River, and under the Mid-Snake TMDL has a compliance point at Gridley Bridge. This compliance point is now superceded by the Upper Snake Rock TMDL such that the entire stretch from Milner Dam to King Hill is the compliance point. Since 74% of the Middle Snake River is riverine-like, and since its reservoirs are currently and historically operated as "run-of-the-river," the entire system may be considered "like a managed river." Application of the 0.100 mg/L is not applicable to the Middle Snake River since it was decided that 0.075 mg/L TP was applicable. However, the 0.075 mg/L TP instream target was never meant as a carryover to its tributaries. Therefore, the application of the 0.100 mg/L TP as an instream target for other tributaries is appropriate and reasonable at this time, and will meet beneficial uses to control excess nuisance aquatic plant growth. This is the initial startup target that will be used for all natural tributaries over a 10-year period with the provision that if beneficial uses are not met, then TP reductions will be more stringently refined. Manmade waterways that discharge to natural waterways shall meet the same instream target of 0.100 mg/L at the point where they discharge to the natural tributary.

3.5.3.1 MILNER DAM TO PILLAR FALLS SEGMENT AND CONNECTING WATERBODIES

All surface waterbodies shall reduce to reach the instream target of < 0.010 mg/L TP, except for the Middle Snake River which has a target of 0.075 mg/L TP. Table 107 describes the TP load allocation for the Middle Snake River segment from Milner Dam to Pillar Falls and all connecting waterbodies that discharge directly or indirectly to this segment.

Table 107 TP load allocation for Segment 1

TSS POLLUTANT SOURCES	WY1990-1991 BASELINE MEAN LOAD, lbs/day	WY2004 TARGET MEAN LOAD, lbs/day	WY2009 TARGET MEAN LOAD, lbs/day	% LOAD REDUCT
Point Sources Discharging Directly to the Middle Snake River: MEET PERMIT LIMIT WHICH IS LOAD CAPACITY				
Hansen POTW[1]	5.1	3.3	3.3	
Sub Total A	5.1	3.3	3.3	35.3%
Spring Sources: MEET LOAD CAPACITY AND DON'T REDUCE				
Vinyard Creek	1.4	1.4	1.4	
Devil's Corral Spring	4.6	4.6	4.6	
Unaccounted Springs	55.0	55.0	55.0	
Sub Total B	61.0	61.0	61.0	0.0%
Surface Waterbodies: Includes Natural Tributaries and Manmade Canals				
Dry Creek (main stem)	8.4	5.4	5.4	
A Drain	11.1	4.7	4.7	
A-10 Drain	4.0	2.6	2.6	
C 55 Drain	5.5	4.0	4.0	
Twin Falls Coulee	11.5	4.7	4.7	
Unaccounted Surface	358.1	146.2	146.2	
Sub Total C	398.7	167.6	167.6	58.0%
Segment 1: MD to PF				
MD to PF	534.2	472.7	472.7	
Sub Total D	534.2	472.7	472.7	11.5%
Other Water User Industries: MEET LOAD CAPACITY WITH ZERO DISCHARGE				
CFOs and/or CAFOs[2]	Zero Discharge	Zero Discharge	Zero Discharge	
Hydroelectric Power	0	0	0	
Land Application Facilities	0	0	0	

Sub Total E	0	0	0	0.0%
OVERALL TOTAL (A+B+C+D+E)	STARTUP LOAD 998.9	LOAD CAPACITY 704.6	LOAD CAPACITY 704.6	29.5%

Prepared by IDEQ-TFRO. REDUCT = Reduction. OVERALL TOTAL = Summation of all Sub Totals in the Table. See Appendix D, Section XIV for details of derivation and calculations. Explanations in Appendix D are similarly applicable in this table.
1. The load capacity target for the Hansen POTW is the NPDES permit limit: 3.3 lbs/day average monthly limit.
2. CFOs and/or CAFOs also includes smaller dairies, all feedlots, and smaller confined feeding operations that do not have and NPDES stormwater permit.

3.5.3.2 PILLAR FALLS TO CRYSTAL SPRINGS SEGMENT AND CONNECTING WATERBODIES

All surface waterbodies shall reduce to reach the instream target of < 0.010 mg/L TP, except for the Middle Snake River which has a target of 0.075 mg/L TP. Table 108 describes the TP load allocation for the Middle Snake River segment from Pillar Falls to Crystal Springs and all connecting waterbodies that discharge directly or indirectly to this segment.

Table 108 TP load allocation for Segment 2

TSS POLLUTANT SOURCES	WY1990-1991 BASELINE MEAN LOAD, lbs/day	WY2004 TARGET MEAN LOAD, lbs/day	WY2009 TARGET MEAN LOAD, lbs/day	% LOAD REDUCT
Point Sources Discharging Directly to the Middle Snake River: MEET PERMIT LIMIT WHICH IS LOAD CAPACITY				
Canyon Springs FH	9.5	5.7	5.7	
Blue Lakes Processing	IN DEVELOPMENT			
Blue Lakes FH	90.1	54.1	54.1	
Pristine Springs FH (+WW)	38.0	22.8	22.8	
City of Twin Falls POTW	1071.2	707.0	707.0	
Crystal Springs FH	122.7	73.6	73.6	
Sub Total A	1331.5	863.2	863.2	35.2%
Spring Sources: MEET LOAD CAPACITY AND DON'T REDUCE				
Ellison Springs	0.1	0.1	0.1	
Crystal Springs Lake	5.4	5.4	5.4	
Unseen Underground Seeps	13.9	13.9	13.9	
Unaccounted Springs	16.2	16.2	16.2	
Sub Total B	35.6	35.6	35.6	0.0%
Surface Waterbodies: Includes Natural Tributaries and Manmade Canals				
East Perrine Coulee	31.4	15.8	15.8	
Main Perrine Coulee	11.7	5.9	5.9	
West Perrine Coulee	4.2	1.4	1.4	

43 Drain	0.4	0.2	0.2	
Warm Creek (springfed)	7.0	2.3	2.3	
Jerome Golf Course Drain	6.9	4.2	4.2	
Rock Creek	184.9	118.5	118.5	
30 Drain	16.1	3.3	3.3	
LQ/LS Drain	50.0	16.3	16.3	
LS2/39A Drain	9.7	2.8	2.8	
N42 Drain	5.4	4.8	4.8	
N42 Drain (Rim)	8.3	5.5	5.5	
39 Drain	19.5	2.6	2.6	
Unaccounted Surface	105.2	43.0	43.0	
Sub Total C	460.8	226.5	226.5	50.8%
Segment 2: PF to CS				
Pillar Falls to Crystal Spring	470.8	416.6	416.6	
Sub Total D	470.8	416.6	416.6	11.5%
Other Water User Industries: MEET LOAD CAPACITY WITH ZERO DISCHARGE				
CFOs and/or CAFOs[2]	Zero Discharge	Zero Discharge	Zero Discharge	
Hydroelectric Power	0	0	0	
Land Application Facilities	0	0	0	
Sub Total E	0	0	0	0.0%
OVERALL TOTAL (A+B+C+D+E)	STARTUP LOAD 2298.7	LOAD CAPACITY 1542.0	LOAD CAPACITY 1542.0	32.9%

Prepared by IDEQ-TFRO. REDUCT = Reduction. OVERALL TOTAL = Summation of all Sub Totals in the Table. See Appendix D, Section XIV for details of derivation and calculations. Explanations in Appendix D are similarly applicable in this table.
1. CFOs and/or CAFOs also includes smaller dairies, all feedlots, and smaller confined feeding operations that do not have and NPDES stormwater permit.

3.5.3.3 CRYSTAL SPRINGS TO BOX CANYON SEGMENT AND CONNECTING WATERBODIES

All surface waterbodies shall reduce to reach the instream target of < 0.010 mg/L TP, except for the Middle Snake River which has a target of 0.075 mg/L TP. Table 109 describes the TP load allocation for the Middle Snake River segment from Crystal Springs to Box Canyon and all connecting waterbodies that discharge directly or indirectly to this segment.

Table 109 TP load allocation for Segment 3

TSS POLLUTANT SOURCES	WY1990-1991 BASELINE MEAN	WY2004 TARGET MEAN LOAD,	WY2009 TARGET MEAN LOAD,	% LOAD REDUCT

Point Sources Discharging Directly to the Middle Snake River: MEET PERMIT LIMIT WHICH IS LOAD CAPACITY				
Magic Valley FH	43.7	26.2	26.2	
Rim View FH	81.0	48.6	48.6	
IPC/Niagara Springs FH	33.0	19.8	19.8	
Gary Wright FH	3.3	2.0	2.0	
Catfish/FBI FH	10.7	6.4	6.4	
Kaster Trout FH	29.3	17.6	17.6	
Box Canyon FH	177.4	106.5	106.5	
Briggs Creek FH	13.6	8.2	8.2	
Sub Total A	392.0	235.3	235.3	40.0%
Spring Sources: MEET LOAD CAPACITY AND DON'T REDUCE				
Unseen Underground Seeps	11.9	11.9	11.9	
Niagara Springs	3.3	3.3	3.3	
Clear Lakes Springs Snake River FH Clear Lakes Process Middle FH Clear Lakes FH	5.6 59.4 IN DEVELOPMENT 108.7 96.3 Sub Total = 270.0	5.6 35.7 IN DEVELOPMENT 65.2 57.8 Sub Total = 164.3	5.6 35.7 IN DEVELOPMENT 65.2 57.8 Sub Total = 164.3	
Banbury Springs	13.0	13.0	13.0	
Briggs Creek Springs	9.0	9.0	9.0	
Box Canyon Springs	7.0	7.0	7.0	
Unaccounted Springs	20.0	20.0	20.0	
Sub Total B	334.2	228.5	228.5	31.6%
Surface Waterbodies: Includes Natural Tributaries and Manmade Canals				
Cedar Draw	119.8	62.1	62.1	
Mud Creek	94.4	52.4	52.4	
Deep Creek	78.6	51.7	51.7	
Blind Canyon Creek	36.6	23.4	23.4	
I Drain	12.8	6.2	6.2	
J8 Drain	6.4	4.9	4.9	
N Drain	2.7	2.4	2.4	
S29 Drain	2.3	1.4	1.4	

S19/S Drain	69.7	28.6	28.6	
Unaccounted Surface	129.8	53.0	53.0	
Sub Total C	553.1	286.0	286.0	48.3%
Segment 3: CS to BC				
CS to BC	1061.0	938.9	938.9	
Sub Total D	1061.0	938.9	938.9	11.5%
Other Water User Industries: MEET LOAD CAPACITY WITH ZERO DISCHARGE				
CFOs and/or CAFOs[2]	Zero Discharge	Zero Discharge	Zero Discharge	
Hydroelectric Power	0	0	0	
Land Application Facilities	0	0	0	
Sub Total E	0	0	0	0.0%
OVERALL TOTAL (A+B+C+D+E)	STARTUP LOAD 2340.3	LOAD CAPACITY 1688.7	LOAD CAPACITY 1688.7	27.8%

Prepared by IDEQ-TFRO. REDUCT = Reduction. OVERALL TOTAL = Summation of all Sub Totals in the Table. See Appendix D, Section XIV for details of derivation and calculations. Explanations in Appendix D are similarly applicable in this table.
1. CFOs and/or CAFOs also includes smaller dairies, all feedlots, and smaller confined feeding operations that do not have and NPDES stormwater permit.

3.5.3.4 BOX CANYON TO GRIDLEY BRIDGE SEGMENT AND CONNECTING WATERBODIES

All surface waterbodies shall reduce to reach the instream target of < 0.010 mg/L TP, except for the Middle Snake River which has a target of 0.075 mg/L TP. Table 110 describes the TP load allocation for the Middle Snake River segment from Box Canyon to Gridley Bridge and all connecting waterbodies that discharge directly or indirectly to this segment.

Table 110 TP load allocation for Segment 4

TSS POLLUTANT SOURCES	*WY1990-1991 BASELINE MEAN LOAD, lbs/day*	*WY2004 TARGET MEAN LOAD, lbs/day*	*WY2009 TARGET MEAN LOAD, lbs/day*	*% LOAD REDUCT*
Point Sources Discharging Directly to the Middle Snake River: MEET PERMIT LIMIT WHICH IS LOAD CAPACITY				
Blind Canyon Aqua FH	15.6	9.4	9.4	
Pisces Magic Springs FH	72.3	43.4	43.4	
Sub Total A	87.9	52.8	52.8	39.9%
Spring Sources: MEET LOAD CAPACITY AND DON'T REDUCE				
Unseen Underground Spgs	7.8	7.8	7.8	
Thousand Springs	137.1	137.1	137.1	
Riley Creek	18.0	7.2	7.2	

Sand Springs Creek	9.9	9.9	9.9	
Unaccounted Springs	7.8	7.8	7.8	
Sub Total B	180.6	169.8	169.8	6.0%
Surface Waterbodies: Includes Natural Tributaries and Manmade Canals				
Salmon Falls Creek	81.3	80.5	80.5	
W26 Drain	13.9	9.8	9.8	
Unaccounted Surface	51.0	20.8	20.8	
Sub Total C	146.2	111.1	111.1	24.0%
Segment 4: BC to GB				
BC to GB	1038.8	919.3	919.3	
Sub Total D	1038.8	919.3	919.3	11.5%
Other Water User Industries: MEET LOAD CAPACITY WITH ZERO DISCHARGE				
CFOs and/or CAFOs[2]	Zero Discharge	Zero Discharge	Zero Discharge	
Hydroelectric Power	0	0	0	
Land Application Facilities	0	0	0	
Sub Total E	0	0	0	0.0%
OVERALL TOTAL (A+B+C+D+E)	STARTUP LOAD 1453.5	LOAD CAPACITY 1253.0	LOAD CAPACITY 1253.0	13.8%

Prepared by IDEQ-TFRO. REDUCT = Reduction. OVERALL TOTAL = Summation of all Sub Totals in the Table. See Appendix D, Section XIV for details of derivation and calculations. Explanations in Appendix D are similarly applicable in this table.
1. CFOs and/or CAFOs also includes smaller dairies, all feedlots, and smaller confined feeding operations that do not have and NPDES stormwater permit.

3.5.3.5 GRIDLEY BRIDGE TO SHOESTRING BRIDGE SEGMENT AND CONNECTING WATERBODIES

All surface waterbodies shall reduce to reach the instream target of < 0.010 mg/L TP, except for the Middle Snake River which has a target of 0.075 mg/L TP. Table 111 describes the TP load allocation for the Middle Snake River segment from Gridley Bridge to Shoestring Bridge and all connecting waterbodies that discharge directly or indirectly to this segment.

Table 111 TP load allocation for Segment 5

TSS POLLUTANT SOURCES	WY1990-1991 BASELINE MEAN LOAD, lbs/day	WY2004 TARGET MEAN LOAD, lbs/day	WY2009 TARGET MEAN LOAD, lbs/day	% LOAD REDUCT
Point Sources Discharging Directly to the Middle Snake River: MEET PERMIT LIMIT WHICH IS LOAD CAPACITY				
Buckeye FH	12.2	7.3	7.3	
Barret FH	6.0	3.6	3.6	

White Springs FH	18.7	11.2	11.2	
Mike Flemming FH	3.4	2.0	2.0	
Smith FH	5.4	3.3	3.3	
Woods FH	7.4	4.4	4.4	
Slane FH	2.5	1.5	1.5	
John Flemming FH	5.4	3.2	3.2	
Stevenson FH	4.8	2.9	2.9	
City of Hagerman POTW	8.6	5.7	5.7	
Henslee FH	5.1	3.0	3.0	
Big Bend FH	2.6	1.6	1.6	
Lemmon FH	2.4	1.4	1.4	
Eckles FH	11.1	6.7	6.7	
Dunn FH	13.7	8.2	8.2	
Sub Total A	109.3	66.0	66.0	39.6%
Spring Sources: MEET LOAD CAPACITY AND DON'T REDUCE				
Birch Creek (w/o FH) Birch Creek FH CJ Simms FH Sub Total =	0.1 5.4 3.2 8.7	0.1 3.3 1.9 5.3	0.1 3.3 1.9 5.3	
Stoddard Creek (w/o FH) Bell FH Standal FH White Water FH Sub Total FH =	0.0 2.3 3.0 6.7 12.0	0.0 1.4 1.8 4.0 7.2	0.0 1.4 1.8 4.0 7.2	
Decker Springs Ck (w/o FH) Decker Springs FH Sub Total =	0.0 7.4 7.4	0.0 4.4 4.4	0.0 4.4 4.4	
Unaccounted Springs	17.6	17.6	17.6	
Sub Total B	45.7	34.5	34.5	24.5%
Surface Waterbodies: Includes Natural Tributaries and Manmade Canals				
Malad River	75.7	75.7	75.7	
Malad River Power Flume	475.9	475.9	475.9	

Billingsley Creek	24.1	21.2	21.2	
Rangens-Woods FH	7.4	4.4	4.4	
Jones FH	26.9	16.1	16.1	
McFadden FH	3.9	2.3	2.3	
Idaho Springs FH	80.6	48.4	48.4	
Hidden Springs FH	9.9	5.9	5.9	
Schrank FH	1.5	0.9	0.9	
Fish Develop FH	69.3	38.0	38.0	
Boyer FH	6.9	4.2	4.2	
Talbot FH	6.7	4.0	4.0	
Sub Total =	237.2	145.4	145.4	
Unaccounted Surface	114.5	46.7	46.7	
Sub Total C	897.3	743.7	743.7	17.1%
Segment 5: GB to SB				
GB to SB	1118.3	989.6	989.6	
Sub Total D	1118.3	989.6	989.6	11.5%
Other Water User Industries: MEET LOAD CAPACITY WITH ZERO DISCHARGE				
CFOs and/or CAFOs[2]	Zero Discharge	Zero Discharge	Zero Discharge	
Hydroelectric Power	0	0	0	
Land Application Facilities	0	0	0	
Sub Total E	0	0	0	0.0%
OVERALL TOTAL (A+B+C+D+E)	STARTUP LOAD 2170.6	LOAD CAPACITY 1833.8	LOAD CAPACITY 1833.8	15.5

Prepared by IDEQ-TFRO. REDUCT = Reduction. OVERALL TOTAL = Summation of all Sub Totals in the Table. See Appendix D, Section XIV for details of derivation and calculations. Explanations in Appendix D are similarly applicable in this table.
1. CFOs and/or CAFOs also includes smaller dairies, all feedlots, and smaller confined feeding operations that do not have and NPDES stormwater permit.

3.5.3.6 SHOESTRING BRIDGE TO KING HILL SEGMENT AND CONNECTING WATERBODIES

All surface waterbodies shall reduce to reach the instream target of < 0.010 mg/L TP, except for the Middle Snake River which has a target of 0.075 mg/L TP. Table 112 describes the TP load allocation for the Middle Snake River segment from Shoestring Bridge to King Hill and all connecting waterbodies that discharge directly or indirectly to this segment.

Table 112 TP load allocation for Segment 6

TSS POLLUTANT SOURCES	*WY1990-1991 BASELINE MEAN LOAD, lbs/day*	*WY2004 TARGET MEAN LOAD, lbs/day*	*WY2009 TARGET MEAN LOAD, lbs/day*	*% LOAD REDUCT*
Point Sources Discharging Directly to the Middle Snake River: MEET PERMIT LIMIT WHICH IS LOAD CAPACITY				
None	0.0	0.0	0.0	
Sub Total A	0.0	0.0	0.0	0.0%

Spring Sources: MEET LOAD CAPACITY AND DON'T REDUCE				
Unaccounted Springs	26.8	26.8	26.8	
Sub Total B	26.8	26.8	26.8	0.0%
Surface Waterbodies: Includes Natural Tributaries and Manmade Canals				
Clover Creek	67.9	22.0	22.0	
Unaccounted Surface	174.2	71.1	71.1	
Sub Total C	242.1	93.1	93.1	61.6%
Segment 6: SB to KH				
SB to KH	256.4	226.9	226.9	
Sub Total D	256.4	226.9	226.9	11.5%
Other Water User Industries: MEET LOAD CAPACITY WITH ZERO DISCHARGE				
CFOs and/or CAFOs[2]	Zero Discharge	Zero Discharge	Zero Discharge	
Hydroelectric Power	0	0	0	
Land Application Facilities	0	0	0	
Sub Total E	0	0	0	0.0%
OVERALL TOTAL (A+B+C+D+E)	STARTUP LOAD 525.2	LOAD CAPACITY 346.7	LOAD CAPACITY 346.7	34.0%

Prepared by IDEQ-TFRO. REDUCT = Reduction. OVERALL TOTAL = Summation of all Sub Totals in the Table. See Appendix D, Section XIV for details of derivation and calculations. Explanations in Appendix D are similarly applicable in this table.
1. CFOs and/or CAFOs also includes smaller dairies, all feedlots, and smaller confined feeding operations that do not have and NPDES stormwater permit.

3.5.3.7 TP LOADING ANALYSIS AND ASSESSMENT

Table 113 summarizes the TP loading analysis per segment input into the Middle Snake River system. The summary is based on gross totals for the specific input sources defined. All surface waterbodies shall reduce to reach the instream target of < 0.100 mg/L TP, except for the Middle Snake River which has a target of 0.075 mg/L TP. Other water user industries (CFOs and/or CAFOs, hydroelectric power, and land application facilities) have a load of zero and are not listed in Table 113.

Table 113 TP loading analysis summary for the Middle Snake River system

Segment	*Point Sources (A)*	*Spring Sources (B)*	*Surface Waterbodies (C)*	*Snake River Segment (D)*	*TOTAL (A+B+C+D)*
WY1990-1991 BASELINE MEAN LOAD, lbs/day					
1: MD to PF	5.1	61.0	398.7	534.2	998.9
2: PF to CS	1,331.5	35.6	460.8	470.8	2,298.7

3: CS to BC	392.0	334.2	553.1	1,061.0	2,340.3
4: BC to GB	87.9	180.6	146.2	1,038.8	1,453.5
5: GB to SB	109.3	45.7	897.3	1,118.3	2,170.6
6: SB to KH	0.0	26.8	242.1	256.4	525.2
Total	1,925.8	683.9	2,698.2	4,479.5	9,787.2
WY2004 & WY2009 MEAN LOAD ALLOCATION, lbs/day					
1: MD to PF	3.3	61.0	167.6	472.7	704.6
2: PF to CS	863.2	35.6	226.5	416.6	1,542.0
3: CS to BC	235.3	228.5	286.0	938.9	1,688.7
4: BC to GB	52.8	169.8	111.1	919.3	1,253.0
5: GB to SB	66.0	34.5	743.7	989.6	1,833.8
6: SB to KH	0.0	26.8	93.1	226.9	346.7
Total	1,220.6	556.2	1,628.0	3,964.0	7,368.8
% Reduction	36.6%	18.7%	39.7%	11.5%	24.7%
Prepared by IDEQ-TFRO. % Reduction is calculated as: 100% - ((Mean Load Allocation / Baseline Mean Load) x 100%).					

Although incomplete due to additional monitoring that will be done by point sources over a 3 year period before final wasteload allocations are finished, Table 113 summarizes that the greatest source of TP is coming from the Middle Snake River corridor itself and the surface waterbodies (natural tributaries and manmade waterbodies). The composition of pollutant sources indicates that by Years 2004 through 2009, with an overall reduction of 24.7%, the TP sources will be 16.6% point sources, 7.5% spring sources, 22.1% surface waterbodies, and 53.8% the Middle Snake River corridor. The greater reductions in surface waterbodies (39.%) and point sources (36.6%) will go along ways to achieving beneficial uses and State water quality standards in the Middle Snake River and its tributaries.

3.6 REASONABLE ASSURANCES AND IMPLEMENTATION SCHEDULE

The objective of the Upper Snake Rock TMDL is to allocate allowable loads among different pollutant sources so that the appropriate control actions can be taken and water quality standards achieved. The total pollutant load to a waterbody is derived from point, nonpoint, and background sources. The Upper Snake Rock TMDL has attempted to consider the effect of all activities or processes that cause or contribute to the water quality limited conditions of not just the 31 waterbodies listed on the 1996 303(d) list, but rather all potential sources. Control measures to implement this TMDL are not limited to NPDES authorities, but are based on the reasonable assurance that State and local authorities and actions to reduce nonpoint source pollution will also occur. "There must be assurances that nonpoint source control measures will achieve expected load reductions in order to allocate a wasteload to a point source with a TMDL that also allocates expected nonpoint source load reductions (USEPA 1991a [p 22])." The Upper Snake Rock TMDL has load allocations and wasteload allocations calculated with margins of safety to meet water quality standards. However, the allocations are based on estimates which have used available data and information. Therefore, monitoring for the collection of new data is necessary and required. For the Upper Snake Rock TMDL the reasonable assurance that it will meet its goal of water quality standards is based on three components: (1) point source NPDES permits that will require monitoring for generation of new data that will be used for wasteload allocation concerns; (2) nonpoint source implementation of BMPs that will be based on land management agencies' assurances that reductions will occur; and, (3) a trend monitoring plan that will be used to document relative changes in various aquatic organism populations, and in physical and chemical water quality parameters over a 10-year period in conjunction with data from various agencies, organizations, and water user industries to assess overall progress towards attainment of water quality standards and related beneficial uses. These components are further defined as follows.

3.6.1 POINT SOURCE

"Both technology-based and water quality-based controls are implemented through the NPDES permitting process. Permit limits based on TMDLs are called water quality-based limits. Wasteload allocations establish the level of effluent quality necessary to protect water quality in the receiving water and ensure attainment of water quality standards. Once allowable loadings have been developed through wasteload allocations for specific pollution sources, limits are incorporated into NPDES permits (USEPA 1991a [p 23])."

In the Upper Snake Rock TMDL a description of actions (control actions and/or management measures) that will be implemented to achieve the TMDL for point sources was previously summarized in §3.2 for aquaculture, food processors, municipalities, and industrials. For the Upper Snake Rock subbasin Table 114 describes the short-term and long-term goals that are prescribed for point source industries and IDEQ-TFRO that will reasonably assure that point sources will comply with their reduction plans per pollutant.

Table 114 Short- and long-term goals for point sources and IDEQ-TFRO on a pollutant basis

Pollutant	*Industry/Agency*	*Year 1 (2000)*	*Year 3 (2002)*	*Year 5 (2004)*	*Year 8 (2007)*	*Year 10 (2009)*
TP	Aquaculture	Permit Issued	Re-allocation of TP loads per industry per facility	Meet target reductions & maintain for additional 5 years	Maintain permit	Possible re-allocation of TP loads per industry based on new data
	Food Processors	Permit Issued			Maintain permit	
	Municipalities	Permit Issued			Maintain permit	
	Industrials	LA & NPDES Permits maintained & reviewed by IDEQ				
	IDEQ	Maintain data base; review LA and NPDES permits	Re-allocates TP loads to industry	Reviews all reductions & determines if on target	Commences intensive study for possible re-allocation	Re-allocates TP loads to industry based on new data
TSS Pathogens	Aquaculture	Permit Issued	TMDL will be based on maintaining permit effluent limits			
	Food Processors	Permit Issued	TMDL will be based on maintaining permit effluent limits			
	Municipalities	Permit Issued	TMDL will be based on maintaining permit effluent limits			
	Industrials	LA & NPDES Permits maintained & reviewed by IDEQ				
	IDEQ	Maintain data base; review LA and NPDES permits				
TKN Pesticides Oil & Grease	A TMDL is not anticipated for any of the nonpoint source industries. Pesticide sampling on Cottonwood Creek will occur in 1999 to ascertain removal of pesticide as pollutant. City of Twin Falls & IDEQ-TFRO will jointly support removal of Oil & Grease as pollutant.					

<table>
<tr><td rowspan="5">NOX
NH_3</td><td>Aquaculture</td><td colspan="2">No TMDL anticipated.
Monitoring being done.</td><td colspan="3">Re-evaluation of TMDL potential.
If needed, it will startup in Year 5.</td></tr>
<tr><td>Food Processors</td><td colspan="2">Uncertain about a TMDL.
Monitoring being done.</td><td colspan="3">Re-evaluation of TMDL potential.
If needed, it will startup in Year 5.</td></tr>
<tr><td>Municipalities</td><td colspan="2">Uncertain about a TMDL.
Monitoring being done.</td><td colspan="3">Re-evaluation of TMDL potential.
If needed, it will startup in Year 5.</td></tr>
<tr><td>Industrials</td><td colspan="5">No TMDL is anticipated for the industry</td></tr>
<tr><td>IDEQ</td><td>Maintain data base</td><td>Evaluate TMDL potential</td><td colspan="3">Re-evaluate the potential for a TMDL based on industry monitoring</td></tr>
<tr><td rowspan="5">DO</td><td>Aquaculture</td><td colspan="2">DO linked to TP Permit limits</td><td colspan="2">Maintain TP Permit limits</td><td>Re-evaluation</td></tr>
<tr><td>Food Processors</td><td colspan="2">DO linked to TP Permit limits</td><td colspan="2">Maintain TP Permit limits</td><td>Re-evaluation</td></tr>
<tr><td>Municipalities</td><td colspan="2">DO linked to TP Permit limits</td><td colspan="2">Maintain TP Permit limits</td><td>Re-evaluation</td></tr>
<tr><td>Industrials</td><td colspan="5">No TMDL is anticipated for the industry</td></tr>
<tr><td>IDEQ</td><td colspan="2">Maintain data base and provide technical assistance to industries on meeting permit limits to cause DO levels to respond appropriately</td><td>Meet target reductions & maintain for additional 5 years</td><td colspan="2">Re-evaluate process; begin to make recommendations on beneficial uses and water quality standards recovering</td></tr>
<tr><td>Temperature</td><td colspan="6">Re-evaluation of temperature criteria via project study by IDEQ-State Office</td></tr>
<tr><td>Flow</td><td colspan="6">No Flow TMDL; Conservation flows encouraged</td></tr>
<tr><td>Industry Plans</td><td colspan="6">Each industry will be responsible for the development of an annual summary review of assessment of water quality goals and targets for the Upper Snake Rock sub basin. Plans developed under the Mid-Snake TMDL will be revised and applied on the Upper Snake Rock TMDL specific for the water quality limited streams.</td></tr>
<tr><td colspan="7">A data base of each industry will be maintained by IDEQ-TFRO. TP = total phosphorus, TSS = total suspended solids, TKN = total Kjeldahl nitrogen, NOX = nitrate+nitrite, NH_3 = ammonia, DO = dissolved oxygen, LA = Land Applicaiton. The feedback loop is an important component in all short-term and long-term goals.</td></tr>
</table>

3.6.2 NONPOINT SOURCE

"When establishing permits for point sources in the watershed, the record should show that in the case of any credit for future nonpoint source reductions, (1) there is reasonable assurance that nonpoint source controls will be implemented and maintained or (2) that nonpoint source reductions are demonstrated through an effective monitoring program (USEPA 1991a [p 24])." Essentially, reasonable assurance for nonpoint sources means that nonenforceable actions will result in load allocations for nonpoint sources required by the Upper Snake Rock TMDL. At a minimum, this includes:

1. "Demonstration of the availability of funds to implement the nonenforceable actions (USEPA 1998d [p 39])." The Mid-Snake WAG has formed a Funding Committee that will evaluate and seek after the funding of implementation projects to clean up the 31 water quality listed streams initially, as well as other streams that may later be deemed to have water quality problems. IDEQ-TFRO supports the Idaho Nonpoint Source Management Plan, which during the public comment period, was undergoing updating and revision to reflect new policies and direction for TMDLs and implementation of TMDLs in Idaho post-1999. As part

of that revision, a list of programs was identified in Appendix D of its Final Draft (dated September 1999) that can be sought for implementation of nonenforceable actions for nonpoint sources. Those programs include: USEPA's National Nonpoint Source Program (Section 319, requires a 60/40 federal/local cost share match); USEPA's Clean Water State Revolving Loan Fund (SRF, requires an 80/20 federal/state cost share match for initial grants); USEPA's Drinking Water SRF (requires an 87.5/12.5 federal/local cost share match); NRCS' EQIP (requires a 75/25 federal/local cost share match); NRCS FSA's CRP (requires a 50/50 federal/local cost share match); NRCS FSA's CREP (State provides significant cost share, about 20% of project cost); NRCS' WRP (requires a 100/0 or 75/25 federal/local cost share match depending on length of easement); NRCS' WHIP (requires a 75/25 federal/local cost share match); and USFWS' Partners for Fish and Wildlife Program (requires a 50/50 federal/local cost share match). There are other programs which the Funding Committee will identify and pursue over the life of the watershed management plan.

2. "Description of the process for entering into any necessary agreements (such as with various federal, State, and local agencies/entities, private landowners, others) to carry out such nonenforceable actions and the probability of success in achieving such agreements (USEPA 1998d [p 39])." IDEQ-TFRO is prepared to discuss with any federal, State, or local agency/entity, private landowners, the possibility of carrying out such nonenforceable actions through the signing of necessary agreements to achieve success on the 31 water quality limited water bodies. Such agreements will be pertinent to the restoration of beneficial uses and water quality standards and may include water quality monitoring. Additionally, IDEQ-TFRO supports the *Forest Service and Bureau of Land Management Protocol for Addressing Clean Water Act Section 303(d) Listed Waters* (USFS & USBLM & USEPA 1999) which is to "protect and maintain water quality where standards are met or surpassed, and restore water-quality-limited waterbodies within their jurisdiction to conditions that meet or surpass standards for designated beneficial uses."

3. "An assessment of the likelihood of continuation of governmental programs (e.g., Conservation Reserve Program) that are planned to assist in implementation (USEPA 1998d [p 40])." According to the most recent survey by the U.S. Department of Commerce on the availability of funds over the next 15-20 years for environmental projects, it is estimated that the national budget will be increased to 10-15% from the current 5-10%. State funding in Idaho is ongoing due to Idaho Code §39-3601 *et seq.* which relates to point and nonpoint source industries. Current programs, like CRP and EQIP, will continue to be funded as long as they meet the full purposes for which they were funded. However, no funding program is long-lived and is highly dependent on changes in administrative opinion.

4. "An analysis of the anticipated effectiveness of the management measures (a demonstration of how, if implemented, they will actually lead to desired reductions; an evaluation of the success of existing/prior programs calling for similar controls in the watershed or a similar watershed may be used in this analysis) (USEPA 1998d [p 40])." CRP is not a new program, and as previously noted, has an erosion reduction potential of 19 tons/year/acre. Its viability is dependent on the number of new highly erodible acres that are available in the area of concern. EQIP, on the other hand, is a new program and is evolving yearly to include new acreages that are directed at water quality limited stream segments. Currently, the SCC, and NRCS, in conjunction with local SCDs, are looking at funding sources for BMP development on several water quality limited stream segments. Each

segment will be assessed more fully after implementation of the TMDL with the express purpose of ascertaining if proposed instream targets are stringent enough to meet beneficial uses and State water quality standards. This assessment will occur over the next 5-10 years as part of implementation.

5. "An estimate of the time required to attain applicable water quality standards and a demonstration that the standards will be met as expeditiously as practicable (USEPA 1998d [p 40])." It is expected that management actions and control actions called for to implement the Upper Snake Rock TMDL will begin immediately after approval of the TMDL submittal to USEPA. However, some industries have taken a more proactive approach by already beginning their management actions and control actions as part of the Mid-Snake TMDL and the Billingsley Creek TMDL. The Upper Snake Rock TMDL is designed with the goal of expeditiously attaining compliance with water quality standards, particularly in defining and repairing water quality impairments through the stream corridor approach. It is the belief of IDEQ-TFRO that attainment of water quality standards and beneficial uses will be met as expeditiously as practicable within the 10-year alloted time frame with implementation of management and control actions. However, in the event that beneficial uses are not attained, then the feedback loop as a component of adaptive management in conjunction with monitoring will be used for re-evaluation for implementation of more stringent measures if needed. The following describes the proposed phased approach at achieving beneficial uses and State water quality standards:

PHASE 1

Year 1-5

In the first phase, the stream corridor (within the 2 miles) would be reviewed over a 5 year period for the development of critical acres that directly impact the stream. These critical acres would be defined by the land management agency during the implementation phase of the TMDL. Critical acres could include acreages outside the stream corridor if a portion of the area included the stream corridor. Within the first 5 years, all 31 water quality limited stream segments would have land management plans developed that specifically targeted the reduction of listed pollutants. These land management plans become the critical focus of the implementation plan for nonpoint sources. Monitoring would be specifically defined to determine if BMPs were functional and the overall goals of the Upper Snake Rock TMDL were met.

Year 3

In year 3, a preliminary evaluation of the 31 water quality limited stream segments for BMP implementation via funding will be conducted by the land management agencies and IDEQ so that the goals of the Upper Snake Rock TMDL are being met.

Year 5

In year 5, a re-evaluation of the land management plans and their funding will be conducted by the land management agencies and IDEQ, so that goals of the Upper Snake Rock TMDL are in compliance and being met.

PHASE 2

Years 5-10

In the second phase, or in years 5-10, critical acres would be defined for areas outside the stream corridor but within the 5th field watersheds-of-concern that affect the 31 water quality limited stream segments. These critical acres would be defined similarly as in the first phase and according to the engineering design(s) of the land management agencies. Critical acres could include acreages within the stream corridor if a portion of the acres were included outside the stream corridor. Land management plans would also be developed and included as addendums to the particular water quality limited stream segment.

Year 8

In year 8, a preliminary evaluation of additional segments in the watersheds-of-concern will be conducted by the land management agencies, the Mid-Snake WAG, and IDEQ for compliance with the Upper Snake Rock TMDL.

Year 10

In year 10, a re-evaluation of the land management plans and their funding will be conducted by the land management agencies and IDEQ. Under the provisions of the Upper Snake Rock TMDL, the Mid-Snake TAC in conjunction with IDEQ would review the land management plans and the monitoring data to ascertain if beneficial uses and water quality standards have been met.

Years 10-15

If it is ascertained in year 10 that beneficial uses and water quality standards are met, then the Upper Snake Rock TMDL will be maintained for an additional 5 years. If at the end of the additional 5 years beneficial uses and water quality standards are met by any or all water quality limited stream segments, then IDEQ with support of the industries will seek for de-listing of those streams (assuming that imposed measures are continued and maintained). If it is determined in year 10 that beneficial uses and water quality standards are not met, then a re-evaluation and re-allocation of more stringent permit limits for point sources will be conducted by USEPA and IDEQ, and more effective BMPs will be sought, defined, and implemented in the defined critical acres or in those areas that are causing the most damage to water quality by nonpoint sources.

6. Measurable milestones for determining whether the implementation plan is being properly executed, and for determining whether applicable water quality standards are being achieved (USEPA 1998d [p 40])." Short-term and long-term milestones are defined for point sources (see Table 107) and nonpoint sources (see Table 108) and are sufficient to demonstrate adherence to the implementation plan. The measureable milestones include maintaining and meeting target reductions as defined in effluent permit limits for point sources, and maintaining and meeting target best management plans as defined by the land management agencies, the Mid-Snake WAG, and IDEQ. Quantification of goals are further defined in the overall trend monitoring plan (which will eventually include monitoring for tributaries as well). As explained above in item 5, the Upper Snake Rock TMDL includes a phased approach over a 10-year period for attainment of beneficial uses and State water quality standards by nonpoint source industries.

7. In accordance with §319 (a)(1)(C) of the Clean Water Act, IDEQ in conjunction with land management agencies is prepared to identify additional BMPs and measures to control nonpoint sources causing or contributing to nonattainment of water quality standards, and provide for these sources to reduce, to the maximum extent practicable, the level of pollution they contribute (USEPA 1998d [pp 42-43])." In conjunction with this provision, IDEQ with land management agencies shall:

a. Review the BMPs and measures that were identified for nonpoint sources and revise them as necessary to assure that they continue to produce the maximum practicable pollution reduction;

b. Identify any additional nonpoint sources (or classes of nonpoint sources) that should participate in achieving the goals of the Upper Snake Rock TMDL;

c. Identify any additional management measures and/or controls that, to the maximum extent practicable, will reduce the pollution of concern from nonpoint sources in the affected water; and,

d. Exercise or seek after any additional legal authorities to address nonpoint sources, as necessary, beyond those defined in the Idaho Agricultural Pollution Abatement Plan for irrigated agriculture, or the specific best management plans defined for rangeland, forestry, CFOs, and/or stormwater.

A description of actions (control actions and/or management measures) that will be implemented to achieve the TMDL for nonpoint sources was previously summarized in §3.3 for irrigated agriculture, rangeland (grazing), CFOs, riparian area, and urban stormwater on a per watershed/complex basis. For the Upper Snake Rock subbasin Table 115 describes the short-term and long-term goals that are prescribed for nonpoint source industries and IDEQ-TFRO that will insure reasonable assurance that nonpoint sources will comply with their reduction plans per pollutant.

Table 115 Short- and long-term goals for nonpoint sources and IDEQ-TFRO on a pollutant basis

Pollutant	*Industry*	*Year 1 (2000)*	*Year 3 (2002)*	*Year 5 (2004)*	*Year 8 (2007)*	*Year 10 (2009)*
TP	CFOs	Zero Discharge		Evaluation	Zero Discharge	Re-evaluation
	Irrigated Ag	Continue Mid-Snake TMDL Reductions		Meet Target BMP reductions	Maintain for 5 more years	Re-evaluation
	Grazing	Start BMPs	Review target BMP reductions	Meet target BMP reductions	Maintain for 5 more years	Re-evaluation
	Stormwater (Twin Falls)	Implementation of Stormwater Management Plan (1999)		Evaluation	Maintain for 5 more years	Re-evaluation
	IDEQ & Land Mgmt Agency	Maintain data base; review NPS efficacy data; seek funding		Review target BMP reductions	Review BMP maintenance	Review & evaluate BMPs

TSS Pathogens	CFOs	Zero Discharge		Evaluation	Zero Discharge	Re-evaluation
	Irrigated Ag	BMP Implementation along with some efficacy monitoring		Evaluation	Maintain for 5 more years	Re-evaluation
	Grazing	Start BMPs	Review target BMP reductions	Evaluation	Maintain for 5 more years	Re-evaluation
	Stormwater (Twin Falls)	Implementation of Stormwater Management Plan (1999)		Evaluation	Maintain for 5 more years	Re-evaluation
	IDEQ & Land Mgmt Agency	Maintain data base; review NPS efficacy data; seek funding		Review target BMP reductions	Review BMP maintenance	Review & evaluate BMPs
TKN Pesticides Oil & Grease	A TMDL is not anticipated for any of the nonpoint source industries. Pesticide sampling on Cottonwood Creek will occur in 1999 to ascertain removal of pesticides as a pollutant. City of Twin Falls & IDEQ-TFRO will jointly support removal of Oil & Grease as a pollutant.					
NOX NH_3	CFOs	No TMDL anticipated. Zero Discharge.		Evaluation	Zero Discharge	Re-evaluation
	Irrigated Ag	Uncertain about a TMDL. Monitoring being done.		Re-evaluation of TMDL potential. If needed, startup in Year 5.		
	Grazing	Uncertain about a TMDL. Monitoring being done.		Re-evaluation of TMDL potential. If needed, startup in Year 5.		
	Stormwater (Twin Falls)	No TMDL anticipated. Implementation of Stormwater Management Plan (1999)		Evaluation	Maintain for 5 more years	Re-evaluation
	IDEQ & Land Mgmt Agency	Maintain data base; review NPS efficacy data; seek funding		Review target BMP reductions	Review BMP maintenance	Review & evaluate BMPs
DO	CFOs	Zero Discharge		Evaluation	Zero Discharge	Re-evaluation
	Irrigated Ag	DO linked to BMP Implementation		Evaluation	Maintain BMPs	Re-evaluation
	Grazing	DO linked to BMP Implementation		Evaluation	Maintain BMPs	Re-evaluation
	Stormwater (Twin Falls)	DO linked to implementation of Stormwater Mgmt Plan (1999)		Evaluation	Maintain BMPs	Re-evaluation
	IDEQ & Land Mgmt Agency	Evaluation of industries & BMPs being applied and reductions		Evaluation of industries	Evaluation of BMPs	Review & evaluate BMPs
Temperature	Re-evaluation of temperature criteria via project study by IDEQ-State Office					
Flow	No Flow TMDL; Conservation flows encouraged					
Industry Plans	Each industry will be responsible for the development of an annual summary review of assessment of water quality goals and targets for the Upper Snake Rock sub basin. Plans developed under the Mid-Snake TMDL will be revised and applied on the Upper Snake Rock TMDL specific for the water quality limited streams.					

A data base of each industry will be maintained by IDEQ-TFRO. TP = total phosphorus, TSS = total suspended solids, TKN = total Kjeldahl nitrogen, NOX = nitrate+nitrite, NH_3, DO = dissolved oxygen, LA = Land Application, NPS = Nonpoint source. Land management agencies in conjunction with IDEQ-TFRO will review BMP maintenance periodically. The feedback loop is an important component in all short-term and long-term goals.

3.6.3 TREND MONITORING PLAN

Idaho Code 39-3621 provides that "the designated agencies, in cooperation with the appropriate land management agency and the IDEQ shall ensure BMPs are monitored for their effect on water quality. The monitoring results shall be presented to the IDEQ on a schedule agreed to between the designated agency and the IDEQ." "Where no monitoring program exists, or where additional assessments are needed, it is necessary for States to design and implement a monitoring plan. The objectives of monitoring include the assessment of water quality standards attainment, verification of pollution source allocations, calibration or modification of selected models, calculation of dilutions and pollutant mass balances, and evaluation of point and nonpoint source control effectiveness. In their monitoring programs, States should include a description of data collection methodologies and quality assurance/quality control procedures, a reveiw of current discharger monitoring reports, and be integrated with volunteer and cooperative monitoring programs where possible. The monitoring program will result in a sufficient data base for assessment of water quality standard attainment and additional predictive modeling if necessary (USEPA 1991a [p 22])." Monitoring provides the information needed to evaluate management. Trend monitoring in conjunction with implementation of BMPs will be used to determine which management measures and BMPs are being implemented, whether management measures and BMPs are being implemented as designed, and the need for increased efforts to promote or induce use of management measures and BMPs. It may be necessary to modify current or proposed monitoring programs to those that are more inline with an adaptive management style for the watershed. See §3.6.5 on Feedback Loop and Adaptive Management. Data from implementation monitoring, used in combination with trend monitoring, will be useful in meeting the following objectives:

1. <u>To evaluate BMP effectiveness for protecting soil and water resources.</u>
This is critical to the efficacy monitoring that will be conducted by all industries, IDEQ, and the trend monitoring plan, so as to meet the goals and demands of the Upper Snake Rock TMDL in meeting beneficial uses and water quality standards. Idaho Code 39-3603 provides that "the existing instream beneficial uses of each waterbody and the level of water quality necessary to protect those uses shall be maintained and protected." Only through water quality monitoring and BURP assessment can achievement of water quality goals be determined.

2. <u>To identify areas in need of further investigation.</u>
This is a requirement of the stream corridor model in identifying critical acres by areas within the corridor that need work but are not critical acres, and areas outside the corridor that may or may not have a direct impact on the water quality limited stream segment.

3. <u>To establish a reference point of overall compliance with BMPs.</u>
Efficacy monitoring will be the responsibility of all industries, IDEQ, and the trend monitoring plan. The establishment of a reference point to bring about comparison statistics is critical to the success of the trend monitoring plan, or any monitoring plan that supports the Upper Snake Rock TMDL. Such compliance points on the Middle Snake River will include the following: Milner Dam, Pillar Falls, Crystal Springs, Box Canyon, Gridley Bridge, Shoestring Bridge, and King Hill. Compliance points for all tributaries and irrigation return flows will be at the confluence where they discharge to the Middle Snake River, or where any stream or irrigation return flow discharges to a water quality limited stream segment.

4. <u>To determine whether farmers are aware of BMPs.</u>
Farmers includes farm sites (irrigated ag) and ranchers (grazing). Understanding and

applying the correct BMPs is not only the responsibility of the farmer, but the land management agency. Only those BMPs described as "authorized BMPs" will be considered, unless the land management agency promotes and supports a BMP that is not listed or authorized. IDEQ will support BMPs that are defined in the Idaho Agricultural Pollution Abatement Plan according to the NRCS, SCC, and the IDL, as well as grazing BMPs that are defined by the NRCS, the USBLM, the USFS, and the IDL.

5. To identify any BMP implementation problems specific to a category of farm.
This is critical to the flexibility of BMPs. If a BMP is found to be inadequate for the purposes of the Upper Snake Rock TMDL, then the land management agency has the right to encourage the farmer to modify the practice for one that is more effective. It is the responsibility of the farmer to make the change, as long as it is voluntary, economically feasible, and still flexible to allow for additional changes if necessary.

6. To evaluate whether any agricultural practices cause environmental damage.
Time constraints were previously identified in §3.6.1 (point sources) and §3.6.2 (nonpoint sources). Any nonpoint source practice causing damage to the environment will not be supported by the Upper Snake Rock TMDL. IDEQ will hold individual nonpoint sources liable for damage to the environment due to improper application of BMPs, or where BMPs are applied without the support or approval of the proper land management agency.

7. To compare the effectiveness of alternative BMPs.
Various facilities, ranches, and farms will be assessed by their associated land management agency and described according to the type of BMP applied and the results of such applications. Such comparisons will be submitted to the authorizing land management agency for their approval and comment.

8. To assess if allocations are sufficient to attain water quality standards and beneficial uses
This will be done yearly through industry annual reports, but also at the 5-year and 10-year milestone.

9. To assess if short-term and long-term milestones are being met.
This assessment will have oversight by IDEQ for all industries on an annual basis.

10. To describe who will carry out and finance the monitoring activities.
Each industry will be responsible for its own level of compliance monitoring that defends its short-term and long-term goal attainment. IDEQ is committed to continue monitoring the Middle Snake River for water quality. The trend monitoring plan proposed by the Mid-Snake TAC will be utilized by IDEQ, various other agencies, and organizations various industries, agencies, and organizations. Tributary monitoring will be continued as needed in support of the Upper Snake Rock TMDL by IDEQ.

3.6.4 LEGAL AUTHORITIES THAT DEFEND CONTROL AND MANAGEMENT ACTIONS

For point sources, IDEQ operates under the auspices of the NPDES federal permit program which is under the primacy of USEPA for aquaculture, food processors, and municipalities. USEPA operates and enforces the permit, while IDEQ assists with inspections, compliance monitoring, and technical assistance. IDEQ, however, has statutory rights over the NPDES permits through its §401 Water Quality Certification for specific parameters. Under this certification, IDEQ can impose more stringent limits or monitoring requirements than what USEPA would request. For FERC licensed facilities, FERC has primacy for its permits. IDEQ provides technical assistance. However, like the NPDES program, IDEQ has §401, §402, and §404 Water Quality Certification for specific parameters, design modifications, or stream alterations that the FERC facility may require or request.

For nonpoint source CFOs (or CAFOs by USEPA), an NPDES stormwater permit is secured by facilities that allows for discharge on a once-per-24-hours every 25 years. For cases of inspection for dairy operations, the Idaho Dairy Pollution Prevention Initiative Memorandum of Understanding signed by ISDA, IDEQ, IDA, and USEPA allows for ISDA to conduct the inspections. ISDA has the statutory authority to revoke milk permits for recalcitrant operators. Feedlots are not part of the Idaho MOU and are administered to by IDEQ and have a zero discharge. All CFOs or CAFOs have zero discharge. For nonpoint sources such as irrigated agriculture and grazing, no NPDES permits are required for discharging to canals, waters of the State, or waters of the United States. BMPs are supported and encouraged by IDEQ according to the recognized land management agencies that provide guidance and technical assistance as summarized in Table 116.

Table 116 Recognized land management agencies in TMDL process

Nonpoint Source Activity/BMPs	*Land Management Agency*	*Code/Regulations*
Grazing with approved BMPs	Idaho Soil Conservation Commission; Idaho Board of Land Commissioners	IC §39-3602; IDAPA §16.01.02.003.62; IDAPA §16.01.02.350.03
Grazing for development, implementation, and revision of allotment management plan	Idaho Department of Agriculture	Grazing MOU (USFS, USBLM, U of I, IDA); Executive Order 98-09 (Allotment Management Plan on Public Lands)
Crop production with BMPs from Idaho Agriculture Pollution Abatement Plan	Idaho Soil Conservation Commission	IC §39-3602; IDAPA §16.01.02.003.62; IDAPA §16.01.02.350.03; IDAPA §16.01.02.054.07.
Silviculture with approved BMPs	Idaho Department of Lands; Idaho Board of Land Commissioners	IC §39-3602; IDAPA §16.01.02.003.62; IDAPA §16.01.02.350.03
Construction sites with approved BMPs	Idaho Department of Transportation	IC §39-3602; IDAPA §16.01.02.003.62; IDAPA §16.01.02.350.03
Septic tank disposal fields with approved BMPs	Idaho Department of Health & Welfare (District Health)	IC §39-3602; IDAPA §16.01.02.003.62; IDAPA §16.01.02.350.03
Mining with approved BMPs	Idaho Department of Lands; Idaho Board of Land Commissioners	IC §39-3602; IDAPA §16.01.02.003.62; IDAPA §16.01.02.350.03
Dairy Operations	Idaho Department of Agriculture	Dairy MOU of 1995 (ISDA, IDEQ, USEPA, and IDA)
Backwaters of reservoirs	Idaho Department of Lands	Lake Protection Act for boat docks, ramps and streambank protection by all landowners
"Other NPDES activities" (aquaculture)	Idaho Department of Agriculture	IC §39-3602; IDAPA §16.01.02.003.62; IDAPA §16.01.02.350.03
Prepared by IDEQ-TFRO.		

It is evident from an historical perspective that to some extent nonpoint source pollution is the result of activities essential to the economic and social welfare of the state. It is recognized that the real extent of most nonpoint source activities prevents the practical application of conventional wastewater treatment technologies. However, "nonpoint source pollution management, including BMPs, is a process for protecting the designated beneficial uses and ambient water quality. BMPs should be designed, implemented and maintained to provide full protection or maintenance of beneficial uses. Violations of water quality standards which occur in spite of implementation of BMPs will not be subject to enforcement action. However, if subsequent water quality monitoring and surveillance [by IDEQ] based on the criteria listed in §200 and §250, indicate water quality standards are not met due to nonpoint source impacts, even with the use of current BMPs, the practices will be evaluated and modified as necessary by the appropriate agencies in accordance with the provisions of the Administrative Procedures Act. If necessary, injunctive or other judicial relief may be initiated against the operator of a nonpoint source activity in accordance with the [Administrator of IDEQ's] authorities provided in §39-108 Idaho Code. In certain cases, revision of the water quality standards may be appropriate (IDAPA §16.01.02.350.01.a)."

As long as a nonpoint source activity "is being conducted in accordance with applicable rules, regulations and BMPs ... or in the absence of referenced applicable BMPs, conducted in a manner that demonstrates a knowledgeable and reasonable effort to minimize resulting adverse water quality impacts, the activity will not be subject to conditions or legal actions ... In all cases, if it is determined by the [Administrator of IDEQ] that imminent and substantial danger to the public health or environment is occurring, or may occur as a result of a nonpoint source by itself or in combination with other point or nonpoint source activities, then the [Administrator of IDEQ] may seek immediate injunctive relief to stop or prevent that danger as provided in §39-108 Idaho Code (IDAPA §16.01.02.350.02.a)." Other pertinent nonpoint source restrictions may be found in IDAPA §16.01.02.350.02 & 03.

3.6.5 CONNECTIVITY EFFECT

Pollution reduction management actions and control actions that occur in the Upper Snake Rock subbasin over the next 10 years will have a direct effect on subbasins downstream of King Hill. In like fashion, subbasins upstream of Milner Dam will have a direct effect on the Upper Snake Rock subbasin. This connectivity effect of a subbasin upon its downstream neighbor subbasins, as well as from its upstream neighbors, is a hydrological linkage that TMDLs do not normally address.

The Upper Snake Rock subbasin instream targets for the Middle Snake River will have a direct effect on subbasins draining into the Middle Snake River; namely, the Salmon Falls Creek subbasin and the subbasins draining into the Malad River. These drainages will not be addressed for TMDLs until the year 2005 (Salmon Falls Creek), 2003 (Camas Creek & Little Wood River), and 2001 (Big Wood River). Also, the Upper Snake Rock subbasin will also have an effect on its downstream neighbor, the Bruneau subbasin (which has a TMDL slated for the year 2000).

Connectivity is an issue that has been discussed by the Mid-Snake TAC, particularly as to what effects loadings on the Middle Snake River will have on downstream subbasins. One of those concerns deals with algal growth between King Hill and Brownley Reservoir and its linkage to instream total phosphorus concentrations. Implications are that instream total phosphorus concentrations at King Hill are not stringent enough to effectively reduce excess algal growth that appears downstream of King Hill. On February 17, 1999, the Mid-Snake TAC recommended that a letter be drafted to the Upper Snake BAG that would address the concerns of the Mid-Snake WAG on this issue, but in particular as it affected the most immediate subbasins both upstream and downstream of the Upper Snake Rock subbasin. During public comment of the subbasin assessment and the TMDL development section, various members of the Mid-Snake WAG specifically suggested that the assessment and TMDL development section address this concern. Therefore, on or about the date of implementation of the Upper Snake Rock TMDL, the Mid-Snake TAC will continue to have discussions that address the issue of connectivity. Where management actions have been demonstrated through monitoring to not assist the stream in meeting its designated beneficial ues or water quality standards, then more stringent loadings will be imposed until uses and standards are met.

3.6.6 FEEDBACK LOOP AND ADAPTIVE MANAGEMENT

The feedback loop is a component of the Upper Snake Rock TMDL strategy that provides for accountability of plan goals for various pollutants. As part of the TMDL process, the Upper Snake Rock TMDL will use adaptive management as a style and process whereby: (1) management of the watershed is initiated by the State, federal agencies, and the water user industries; (2) an evaluation process will ascertain the direction in which the reductions are progressing; and, (3) based on monitoring information collected from various agencies, organizations, and water users the goals, targets, and BMPs will be refined based on short-term and long-term objectives for ecosystem management of the Upper Snake Rock watershed. Past management experiences may be used to evaluate both success and failure and to explore new management options where necessary. By learning from both successes and failures, the Upper Snake Rock TMDL will be iterative to allow implementation of those techniques which may be most useful and helpful, as well as gain insights into which practices best promote recovery for restoration of beneficial uses and State water quality standards (Williams et al. 1997).

For the Upper Snake Rock subbasin the goal is to reach the preliminary instream water quality target of 52 mg/L TSS for all tributary and irrigation return flows and to maintain the <52.0 mg/L TSS annual mean value already existing in the Middle Snake River. An additonal goal for the Upper Snake Rock is to reach the preliminary instream water quality target of 0.100 mg/L TP for tributary and irrigation return flows. The Middle Snake River also has a preliminary instream water quality target of 0.075 mg/L TP. These preliminary targets are set up in this way to allow for modifications in the targets over the next 10-15 years to attain beneficial uses and State water quality standards, which is the purpose for the goals.

In order for the feedback loop to be successful in the Upper Snake Rock TMDL, a concrete mechanism has been designed with short-term and long-term goals for the IDEQ-TFRO, industries, and the Middle Snake River WAG to regularly review progress on implementation, review monitoring results, and evaluate plan effectiveness, sufficient flexibility in management plans to allow for corrections in management strategies that may not be effective in achieving beneficial uses or State water quality standards. Both point and nonpoint source industries will follow the feedback loop under the following provisions: (1) identification of critical water quality parameter(s); (2) development of site-specific BMPs; (3) application and monitoring of BMPs; and, (4) effectiveness evaluations of BMPs by comparing established water quality standards and then modifying the BMPs where needed to achieve water quality goals.

The IDEQ-TFRO will review all monitoring results for point and nonpoint sources, and will provide an opportunity for the Mid-Snake WAG and USEPA to review and comment on an annual basis. Each industry will provide an annual summary review/report to the IDEQ-TFRO on its monitoring efforts, strategies, and on-going reduction mechanisms. Each industry will provide its own data in their annual report. Based on these reports and other data, the Upper Snake Rock TMDL will be revised accordingly as an iterative plan. All industry plans will also be iterative and further developed through adaptive management as new knowledge and technology is discovered for pollution reduction efforts.

Because of the diverse nature of the partnerships and commitments within the Middle Snake River WAG from various agencies, organizations, and water users, and, because adaptive management is inherently a characteristic of the Upper Snake Rock Watershed Management Plan, restoration and education efforts will be guided by IDEQ-TFRO via the WAG through technical and education committees. These committees will take advantage of the partner's technical knowledge, experience, existing management plans, and resources in determining which types of activities are appropriate for continued implementation of the Upper Snake Rock TMDL. The Mid-Snake WAG will continue to meet as prescribed in their bylaws and to ensure good communication with its partners though monthly newsletters and or minutes of their meetings. Through its TAC, the WAG will have available the technical expertise of biologists, hydrologists, range conservationists, foresters, and other water quality and watershed specialists. Monitoring done by the various agencies, organizations, and water users will be evaluated by IDEQ-TFRO and results provided to the TAC and WAG as a feedback mechanism that is science based; and, through adaptive management such scientific knowledge will be adapted to the task of watershed restoration almost immediately.

4.0 SUMMARY OF PAST/PRESENT POLLUTION CONTROL EFFORTS

Past and present pollution control efforts in Upper Snake Rock include a number of point and nonpnoint source projects on various tributaries and are described in the following sections.

4.1 NONPOINT SOURCE PAST/PRESENT POLLUTION CONTROL EFFORTS

In 1979 as a part of a 208 Study conducted by IDEQ on the Snake River from the Idaho-Wyoming border to Weiser, it was stated that a "general increase in nutrient concentrations from upstream to downstream stations exceeded the recommended criteria over most of the river a majority of the time (IDHW 1979a). It was stated that "in most Snake River segments and major tributaries, point sources are not major contributors of nutrients." In fact, "the major reduction in nutrient loadings will come from nonpoint source controls (IDHW 1979a). It was recommended at that time that the nutrient control plan for the Snake River should be implemented in two phases: Phase I would concentrate on control of phosphorus sources, and Phase II would focus on nitrogen sources. As part of the study, the Middle Snake River (from Milner Dam to King Hill) was defined as the segment most affected by upstream segments and upstream controls. "In addition, the springs entering this portion of the river and nonpoint sources on the three major tributaries also contribute a major portion of the phosphorus load. The nonpoint sources on both sides of the Snake River should be reduced by implementation of the Agriculture Pollution Abatement Plan (IDHW 1979a)." The Rock Creek drainage was defined as one of the major tributaries and was being considered for a special Rural Clean Water Program project (which later occurred in the 1980s). Since that time, the Idaho Agriculture Pollution Abatement Plan has been referenced in Idaho Code §39-3601 *et seq.* as the source of BMPs for agricultural sources. IDEQ anticipates that agriculture as part of the nonpoint source portion of the TMDL will adopt and implement those BMPs (where applicable) as defined in the Pollution Abatement Plan and that the feedback loop will be used to identify non-functioning BMPs. These will be modified so that functional BMPs will be applied for the reduction of sediment and nutrients, as well as other parameters linked to the sediment. Precedence for this has been set by the Mid-Snake TMDL (IDEQ 1997b) in which a portion of irrigated agriculture selected site-specific canal drains to apply BMPs for specific total phosphorus reductions. Still to be defined are: (1) tributary reduction efforts from various nonpoint sources; (2) grazing reduction efforts for public and private lands; and, (3) additional agricultural drains that may have significant impact to receiving streams.

4.1.1 WATER QUALITY PROJECTS

The Idaho State Agricultural Water Quality Plan (or SAWQP) has undergone major revisions in its funding since it was developed as a partnership between the "participant", the technical agency, the soil conservation district, and the IDEQ. SAWQP conducted in Upper Snake Rock has included some of the following projects as described in Table 117. Additionally, the federal Rural Clean Water Program has been used on one water quality project and is also described.

TABLE 117 SAWQP projects of IDEQ-TFRO

NAME OF PROJECT	ACREAGE AFFECTED	WATER QUALITY PROJECT TYPE & PROBLEM ASSESSMENT
Vinyard Creek	9,890	A SAWQP Project. Vinyard Creek watershed has a serious erosion problem on irrigated cropland, especially during spring runoff of winter snows and furrow irrigation of row crops.

NAME OF PROJECT	ACREAGE AFFECTED	WATER QUALITY PROJECT TYPE & PROBLEM ASSESSMENT
East Upper Deep Creek	5,079	A SAWQP Project. The land is primarily agricultural in nature, intensively farmed, and severely impacted by livestock operations thus contributing to inefficient water management and soil erosion via sediment and associated nutrients and pathogens. The two critical water quality problems are erosion from irrigated cropland and inadequate animal wate management handling systems. Riparian areas are primarily pastures along canals and irrigation waterways.
West Upper Deep Creek	4,079	
Scotts Pond	58,674	A SAWQP Project. Surface water pollution includes sediment erosion from irrigated cropland and from winter/spring runoff as the greatest source of sediment, and numerous dairies and feedlots which contribute organic and inorganic pollutants. Ground water pollution is possibly due to CFO concentration of animal wastes in improperly engineered containment facilities.
Rock Creek	202,000	A Rural Clean Water Program (RCWP). Water quality problems from both point (sugar company, concrete mining, processed foods, aquaculture) and nonpoint source (forestry, road construction, urban runoff, grazing, pasture, irrigated cropland) industries. The creek is used as well for recreation and industrial water supply. Unstable streambanks are a major problem on Rock Creek.
Cedar Draw	15,665	Water quality problems primarily from critical erosion sites and irrigated cropland.
Mud Creek		Similar to Deep Creek. A SAWQP planning project.
Perrine Coulee	27,552	The major water quality problems include excessive sediment loads, excessive nutrient levels, and excessive bacteria levels which are largely from agricultural sources (irrigated cropland, occasional animal feeding operations, pastures draining directly into drainage channels). Urban runoff is also a priority. A SAWQP planning project.

Prepared by IDEQ-TFRO.

Although, in general the SAWQP and RCWP projects were successful, sediment still continues to be a major problem year-after-year in the Upper Snake Rock subbasin. Sediment is a complex problem requiring a complex solution. Yet, the key to reducing sediment on the Middle Snake River is to reduce the sediment in the individual tributaries and agricultural returns through reductions in sediment at individual farm sites. When this is accomplished, the overall water quality on the Middle Snake River and its associated tributaries and agricultural returns will greatly improve. It is anticipated that with decreases in sediment (as total suspended solids) over a ten year period, bacterial contamination, excess nutrients, and excessive macrophytes will be substantially reduced. Key considerations in developing a functional and workable sediment reduction strategy for the Upper Snake Rock subbasin include public education; application of functional, voluntary, and cost-effective BMPs; effectiveness monitoring for the short- and long-term; and, constant vigilance of the applied BMPs through the feedback loop.

4.1.2 FERC RELICENSING PROCESS

One of the issues for relicensing of the Idaho Power Company (IPC) Mid-Snake hydropower facilities (Bliss Dam, FERC No. 1975; Lower Salmon Falls Dam, FERC No. 2061; Upper Salmon Falls Dam, FERC No. 2777; Shoshone Falls, FERC No. 2778) is §401 Water Quality Certification by IDEQ. IDEQ is the designated water quality agency for the State of Idaho and administratively issues §401 Water Quality Certification for FERC projects to meet state water quality standards. In December 1995, IPC submitted applications to FERC for relicensing for three hydropower facilities (Bliss, Lower Salmon Falls, Upper Salmon Falls) located near Hagerman and Bliss. The IPC also submitted a request for federal Clean Water Act §401 Water Quality Certification. In May 1997, IPC filed an application with FERC to relicense its Shoshone Falls hydropower facility (near Twin Falls) and applied for a request with IDEQ for §401 Water Quality Certification for this facility.

The IDEQ has conducted settlement discussions and negotiations with IPC concerning protection, mitigation, and enhancement (PM&E) measures and actions that address water quality in the Middle Snake River. A formal and legally enforceable Consent Order (dated May 22, 1998) was entered into with IPC with terms and conditions that address water quality issues, concerns, measures, and actions to be taken by IPC to protect, mitigate, and enhance water quality in the Middle Snake River. PM&E measures to address the effects of the four hydropower facilities on water quality in the Middle Snake River were proposed by IPC in their license applications to FERC. These PM&Es were evaluated by IDEQ and are included as specific actions or activities by IPC and considered as mitigation for water quality impacts. The physical characteristics (such as dam design and impoundments), as well as the operations of the individual hydropower facility, make it very difficult to protect, mitigate, or enhance water quality short of removal of the dams and returning the river to its natural free-flowing state. The ability of IPC to incorporate operational changes is limited and IDEQ included specific activities which would result in improving water quality and enhancing the beneficial uses of the Middle Snake River.

IDEQ PM&E measures and actions include: protection of spring habitats; off-site measures to limit sediment and nutrient pollution loadings; and, water quality monitoring. IPC PM&E measures and actions include: continued active participation in the Middle Snake River Watershed Management Plan; aquatic macrophyte harvest; minimum flow in the north channel at Upper Salmon Falls; and, temperature and dissolved oxygen monitoring. The IDEQ entered into a consent order agreement with IPC to the §401 Water Quality Certification that addresses terms and conditions agreed to by both IDEQ and IPC relative to activities or actions to meet water quality standards. The goal of the §401 Water Quality Certification action is to ensure that water quality values affected by the four hydropower facilities' operations result in appropriate PM&Es for the benefits of the State of Idaho as well as maintaining the facilities as cost-effective power generators and electric suppliers for the State.

VINYARD CREEK

One particular FERC environmental project that has been used to assist in the recovery of certain trout species is the Vinyard Creek Diversion Project (NPW No. 963200350) as part of the Twin Falls Project (FERC No. 0018). License Article 405 required IPC to implement aquatic habitat enhancement. For the Vinyard Creek Diversion Project, the primary purpose was to divert agricultural drain return water out of Vinyard Creek and into the Twin Falls Reservoir so as to improve the aquatic habitat of lower Vinyard Creek and the fisheries in the Twin Falls Reservoir. The specific fisheries are cutthroat trout and rainbow/cutthroat trout hybrids in the Twin Falls Reservoir. The irrigation return drain conveys irrigation wastewater and suspended sediments into Vinyard Creek. The diversion project (dike, pipeline, and outfall) would intercept this wastewater flow and sediment before it entered the lower portion of Vinyard Creek. The diverted flow would be discharged into the Twin Falls Reservoir below the outlet of Vinyard Creek. (See IDEQ 1996b, DOA-COE 1996, and IPC 1997b for additional information.)

4.1.3 IDAHO DEPARTMENT OF LANDS (IDL)

On April 17, 1998 a memorandum was jointly signed by IDEQ and IDL which attempted to clarify roles and ensure coordination of efforts in development of TMDLs for forested portions of TMDLs. As previously described, only 3% of the land use in Upper Snake Rock is forested making the overall effects from forested ground minimal. (See §2.1.2.3) At this time, forestry is not included as a major component of the TMDL process for Upper Snake Rock since its land use comprises a smaller fraction when compared to rangeland and agriculture. At a future date, forestry will be addressed if necessary.

4.1.4 IRRIGATION COMPANY POLLUTION CONTROL EFFORTS

In addition to water quality monitoring being contracted by The North Side and Twin Falls Canal Companies, both have constructed sediment retention ponds at selected sites on their canal systems. A summary of these retention ponds is found in Appendix B. The irrigation agricultural community will continue to monitor as described in the industry plan on selected agricultural return drains.

The Twin Falls and Northside Canal Companies, as part of the Irrigators Water Quality Committee, have set a goal of reducing sediment by 27% and phosphorus by 10% by the Year 2000. These goals are part of irrigated agriculture industry's nutrient management plan submitted to IDEQ in the Mid-Snake TMDL (1997b). Baseline loads were determined to be the 1990-91 load base. As part of their management actions and their specific watershed reduction plan, the canal companies jointly contracted with the University of Idaho for an initial two-year period (beginning July 1, 1992) during which time a water quality monitoring network was developed on the return flows in order to determine the 1995 irrigation season loads. Significant amounts of sediment are removed from the drains resulting in expensive cleaning costs. Although irrigation diversions benefit the Middle Snake River as far as their water quantity is concerned, their pollutant concentrations result in elevated concentrations of pollutants in the Middle Snake River. However, the 1995 suspended solids and total phosphorus loading results showed a general decreasing trend from the 1990-91 loading results and indicate that the proposed goals of the Mid-Snake TMDL (IDEQ 1997b) can be achieved (Barry 1996).

4.1.5 319 PROJECTS

Only one project was funded through the 319 Program in Upper Snake Rock, and this was a full time CFO position at IDEQ-TFRO. The position was funded in 1993, 1995, and 1996, and was instrumental in developing a database that located dairies and feedlots in the region. Additionally, it was beneficial for inspection of CFOs, prevention of discharges, and providing technical assistance to operators.

4.1.6 104(b) PROJECTS

One 104(b) project was funded by USEPA at the IDEQ-TFRO as an aquaculture basic research study on offline settling ponds for the development of BMPs in 1995-1998.

4.1.7 WATER QUALITY 106

One water quality 106 project funded by USEPA for monitoring on Billingsley Creek commenced in the late 1980s and is on-going for monitoring of various water quality parameters.

4.1.8 GROUND WATER

The eastern Snake River Plain is underlain predominantly by a series of vesicular and broken basalt flows with regional water flows in the aquifer that move from northeast to southwest. Ground water is discharged from the eastern Snake River Plain aquifer as spring flow and seepage to the Snake River between Milner Dam and King Hill. Discharge to the entire reach was about 6000 cfs in 1980 (USGS 1997c). As previously stated in §2.1.3.4, the average discharge at Thousands Springs was about 4000 cfs in the early 1900s and increased to almost 7000 cfs in the 1950s. It has since decreased to about 5000 cfs (USBOR 1996-1997).

NO2+NO3 as N (or NOX) in ground water is a result of nitrogen input from many difference sources. The proportions of nitrogen supplied by the various sources depend on land use practices. For instance, most nitrogen in the A&B area of Burley-Rupert is from inorganic fertilizer and legume crops. In the Jerome-Gooding study area, a greater percentage of nitrogen is from cattle manure because of the large number of dairies, particularly in Gooding county (USGS 1997c). USGS estimated the amount of nitrogen supplied by cattle manure, domestic septic systems, inorganic fertilizer, legume crops (alfalfa and beans), and precipitation for each countin in the Upper Snake River Basin. They concluded that domestic septic systems provided minimal amounts of nitrogen input (less than 1 percent) and that precipitation provided only 6 percent of the nitrogen input to the basin as a whole. The remaining 93% was provided by cattle manure (29%), fertilizer (45%), and legume crops (19%). Additionally, the greatest amount of mean residual total nitrogen input of all 24 counties in the basin occurs in Cassia, Gooding, and Twin Falls counties. Gooding and Twin Falls are in Upper Snake Rock (USGS 1996b).

As previously noted in §2.1, excessive aquatic plant growth in surface water is a major concern in the Middle Snake River, particularly during low flow/drought years. Ground water adds nitrogen and phosphorus to surface water where ground water discharges to the Middle Snake River. Water from more than 78% of the regional wells contained NOX concentrations higher than 0.3 mg/L, which is the critical limit for stimulation of aquatic plant growth in surface water in the presence of adequate phosphorus. According to USGS, this suggests that nitrogen is not a limiting factor for aquatic plant growth in most streams that receive ground water (USGS 1997c).

4.2 POINT SOURCE POLLUTION CONTROL EFFORTS

At the time of this writing, the food processors, municipalities, and aquaculture permits were undergoing public comment for reissuance or modification of their individual permits.

4.2.1 AQUACULTURE GENERAL PERMIT

Aquaculture facilities and associated, on-site fish processors had a public comment period from April 10, 1998 to June 9, 1998 on a proposed general NPDES permit (No. ID-G13-0000). As of this writing (December 1999) the USEPA is still considering changes to the permit. The general NPDES permit contains technology-based limitations for sediment based upon the same effluent guidelines as previous NPDES permits for Idaho's aquaculture industry. The general NPDES permit contains technology-based limitations for BOD_5, and oil and grease, based upon the same effluent guidelines as previous NPDES permits for Idaho's fish processors.

The aquaculture facilities authorized to discharge under this general permit raise fish: rainbow trout, steelhead trout, chinook salmon, catfish, tilapia, and others. These fish are produced for market as food products or for the enhancement of salmonid populations. They discharge rearing wastewater containing fish excreta, excess fish feed, dissolved and suspended soild biological pollutants, oxygen demanding materials, nutrients, and residual disease control chemicals or therapeutics. The aquaculture facilities are required to develop BMP plans supported by mass balance assessments of their operations and to restrict their discharges below specific technology-based limitations on total suspended solids and settleable solids and specific water quality-based limitations on total phosphorus, dissolved oxygen, and pH.

The fish processors authorized to discharge under this general permit butcher fish: rainbow trout, steelhead trout, chinook salmon, catfish, tilapia, and others. These are butchered for food products, thus discharging processing wastewater containing dissolved and suspended solid biological pollutants, oxygen demanding materials, nutrients, and residual disinfectants. The fish processors are required to develop BMP plans supported by mass balance assessments of their operations and to restrict their discharges below specific technology-based limitations on total suspended solids, biochemical oxygen demand, oil and grease, and pH and specific water quality-based limitations on total residual chlorine and pH.

4.2.2 FOOD PROCESSORS INDIVIDUAL PERMITS

The food processors have individual NPDES permits which had a public comment period from September 24, 1997 to November 10, 1997. These permits are for J.R. Simplot Company (which is a permit modification) and McCain Foodservice, Inc. (which is a permit modification) to incorporate the conditions of total phosphorus limits established by the Mid-Snake TMDL (IDEQ 1997b).

The J.R. Simplot Company processes raw potatoes into frozen potato products (french fries) and dehydrofrozen potato products. Final effluent is discharged into the Snake River at RM 652.2. The proposed permit modification will retain the 1994 permit conditions and further improve water quality by reducing total phosphorus loads to the Middle Snake River (downstream of HUC 17040209), which will in turn reduce eutrophication. The 1994 permit established both ambient and effluent monitoring of nutrients including total phosphorus and dissolved ortho-phosphate (USEPA 1997c).

The McCain Foodservice, Inc. food processor processes raw potatoes, manufacturing frozen potato products. Process wastewater is treated prior to discharge into the Snake River (mid-channel) at RM 648.8. The proposed permit modification will retain the 1994 permit conditions and further improve water quality by reducing total phosphorus loads to the Middle Snake River (downstream of HUC 17040209), which will in turn reduce eutrophication. Effluent monitoring is done at a weekly frequency while ambient monitoring is required twice per year (USEPA 1997b).

4.2.3 MUNICIPALITY INDIVIDUAL PERMITS

The municipalities have individual NPDES permits which had their public comment period from September 24, 1997 to November 10, 1997. These permits are for the cities of Buhl (permit reissuance, USEPA 1997e), Filer (permit reissuance, USEPA 1997f), Hagerman (permit reissuance, USEPA 1997d), Hansen (permit reissuance, USEPA 1997h), Jerome (permit reissuance, USEPA 1997g), and Twin Falls (permit modification, 1997i). The USEPA is reissuing and modifying the existing permits in order to incorporate the wasteload allocations of the Mid-Snake TMDL (IDEQ 1997b). Only the permits for the cities of Jerome and Buhl allow for alternatives to their current practices of handling treated sewage sludge (biosolids). Under the proposed permit, treated sewage sludge from the City of Jerome may be distributed and spread on the land as a fertilizer in western Jerome county. Under the proposed permit, the City of Buhl is allowed to spread small amounts of treated sewage sludge on agricultural test plots of up to 2 acres, encouraging the City to consider beneficial use in the future. The proposed permits will improve water quality by significantly reducing phosphorus loads to the Middle Snake River, which in turn will reduce eutrophication. In addition, the permits include water quality-based limits on residual chlorine and ammonia. These limits will ensure that water quality standards are met at the edge of the mixing zone (USEPA 1997i).

4.3 MID-SNAKE TMDL

The Mid-Snake TMDL (IDEQ 1997b) was accepted by the EPA on April 25, 1997 as a TMDL for total phosphorus for both point and nonpoint sources in the Upper Snake Rock watershed. Although the TMDL does not bring new enforcement authority, it does provide wasteload allocations for total phosphorus limits for point source permits for food processors, municipalities, and aquaculture. Specific commitments have been entered into by nonpoint source industries relative to BMPs. Violations of state water quality standards and BMPs by any industry on the Middle Snake River (to which all tributaries in Upper Snake Rock discharge) would be inconsistent with the Mid-Snake TMDL and therefore could result in statutory enforcement by the IDEQ, specifically IDAPA §16.01.02.080, where "no pollutant shall be discharged from a single source or in combination with pollutants discharged from other sources in concentrations or in a manner that will or can be expected to result in violation of water quality standards applicable to the receiving waterbody or downstream waters; or will injure designated or existing beneficial uses; or is not authorized by the appropriate authorizing agency for those discharges that require authorization;" and, Idaho Code §39-3603, where "the existing instream beneficial uses of each waterbody and the level of water quality necessary to protect those uses shall be maintained and protected." See also the Mid-Snake TMDL (IDEQ 1997b) for a summary of industry reduction goals, management actions, compliance actions, and implementation.

4.3.1 MONITORING IN UPPER SNAKE ROCK

Monitoring of Upper Snake Rock tributaries and the Middle Snake River will continue to occur with the resources from various agencies, organizations, and groups. As of this writing, a trend monitoring plan was being reviewed by the Mid-Snake TAC for purposes of documenting relative changes in various aquatic organism populations, and in physical and chemical water quality parameters over a ten year period during the implementation of the Mid-Snake TMDL (or Middle Snake River Watershed Management Plan). Monitoring by IDEQ-TFRO on the various tributaries and additional sites on the Middle Snake River will be incorporated as funds become more available. A draft of the *Trend Monitoring Plan* is found in Appendix A.

4.3.2 BURP MONITORING

BURP monitoring will continue annually within the subbasin to verify if beneficial use support status has been changed or achieved as necessary. For wadable streams, large rivers, lakes and reservoirs, the following parameters in Table 118 may be used to decide assessment of their beneficial uses. These reflect the minimum number of parameters needed to adequately surmise the level of beneficial use support status (either as full support or not full support). It is highly unlikely that any one parameter will have sufficient sensitivity to be useful in all circumstances.

TABLE 118 BURP monitoring protocols

PARAMETER	*WADABLE STREAMS*	*LARGE RIVERS*	*LAKES & RESERVOIRS*
PHYSICAL/CHEMICAL PARAMETERS			
Bathymetry or Depth			X
Canopy Closure (Shade)	X		
Channel Alterations		X	
Conductivity		X	X
Discharge	X	X	
Dissolved Oxygen		X	X
Flood plain Disturbance		X	
Habitat Distribution	X	X	
pH		X	X
Large Organic Debris	X		
Nutrients			X
Photo Documentation & Diagrammatic Mapping	X	X	X
Pool Quality	X		
Riparian Vegetation		X	
Stream-Channel Classification	X		
Streambank Condition & Material Types	X	X	
Substrate and Embeddedness	X	X	X

PARAMETER	WADABLE STREAMS	LARGE RIVERS	LAKES & RESERVOIRS
Temperature	X	X	X
Water Clarity		X	X
Width and Depth	X	X	
BIOLOGICAL PARAMETERS			
Aquatic Macrophytes		X	X
Fecal Coliform		X	X
Fish	X	X	X
Macroinvertebrates	X	X	X
Periphyton		X	X
Phytoplankton/Chlorophyll *a*		X	
Prepared by IDEQ-TFRO.			

4.4 NO-NET INCREASE POLICY ON TMDLs

On May 7, 1998, a No-Net Increase (NNI) Policy was made effective by IDEQ. When a stream is designated as not fully meeting its designated or existing beneficial uses, an interim of time exists until the stream has a TMDL developed or the stream is de-listed because its beneficial uses have returned to full support. During that interim of time, the NNI Policy (IDEQ 1998d), the provisions of IDAPA §16.01.02.054.04 (High Priority Provision) and IDAPA §16.02.02.054.05 (Medium and Low Priority Provisions) are to be utilized. The NNI Policy may not be interpreted as requiring BMPs for nonpoint source operations unless they are voluntary or unless they are outlined in applicable federal or state statute or IDAPA 16 Tital 01 Chapter 02. For agriculture, the *Idaho Agriculture Pollution Abatement Plan* has been referenced (IDAPA §16.01.02.054.07) as "the source for BMPs for the control of nonpoint sources of pollution for agriculture." Although the policy does not generally pertain to accidental spills or unauthorized releases that may occur on listed waters, IDEQ must ensure that human health along with the appropriate beneficial uses are protected in the case of accidental spills or unauthorized releases, and could, depending on the spill or release, require clean up. Provisions of the NNI Policy include nonpoint source, point source, and general provisions.

4.4.1 NONPOINT SOURCE PROVISION OF NNI POLICY

It is the responsibility of the designated agency to ensure that cost effective BMPs or knowledgeable and reasonable control measures, including pollution trading, have been or are properly implemented for all nonpoint source activities on federal, state, or private lands.

1. Where approved BMPs do not exist, the landowner should be assisted by the designated agency in using knowledgeable and reasonable control measures to ensure no further impairments of beneficial uses on low and medium priority waters, and that the load remains constant or decreases on high priority waters.

2. IDEQ recommends monitoring as a component of application of BMPs or other control measures.

3. If monitoring indicates that approved BMPs or other control measures are not maintaining or protecting beneficial uses, then additional restrictions or modified control measures may be imposed.

4.4.2 POINT SOURCE (NPDES PERMIT) PROVISION OF NNI POLICY

The Clean Water Act requires all point source dischargers to have an NPDES permit. In the event that USEPA cannot or does not issue a permit on a §303(d) listed water body, IDEQ will notify the discharger of the applicable provisions specified in the High Priority Provision (IDAPA §16.01.02.054.04), the Medium and Low Priority Provision (IDAPA §16.01.02.054.05), and the Violation of Water Quality Standards (IDAPA §16.01.02.080). Additionally,

1. A facility will be allowed to discharge to its existing maximum NPDES permit limit without being considered in violation of the High Priority and the Medium and Low Priority Provisions. However, dischargers of listed pollutants to §303(d) waters should be aware that interim increases in existing loads may result in the need for greater load reduction once a TMDL is developed and implemented.

2. A facility operating within its permitted discharge limits will not have to change its discharge limit while the TMDL is being developed. The NPDES permit and associated discharge limit will be examined and modified, if necessary, by USEPA at the time of permit reissuance.

3. When reviewing and approving plans under Idaho Code §39-118, including facility plans and specifications, written or verbal communication to the facility should emphasize that additional load reductions from the facility may be likely or required once the TMDL has been developed.

4. When meeting the provisions of the NNI policy, an NPDES permittee should address new or increased discharge of listed pollutants in terms of mass per unit time, toxicity, or other appropriate measures. However, IDAPA §16.01.02.054.04 specifies that for high priority waters, the total load must remain constant or decrease within the watershed.

5. To develop a TMDL, IDEQ will establish loads based upon available information. However, where information is lacking, facilities will be allowed to establish baseline data for the listed pollutants using standard analytical methods. IDEQ regions shall issue a letter to each facility detailing that if baseline information is not established by the discharger by a certain date, IDEQ will proceed to establish baseline information necessary for the development of a TMDL.

6. In situations where dischargers apply to exceed their maximum permit limits, provisions of IDAPA §16.01.02.054 shall apply. For high priority waters, new or increased discharge of pollutants of concern above permitted limits may be allowed if the total load to the watershed remains constant or decreases. For medium and low priority waters, IDEQ may require changes in loads and/or concentrations of pollutants of concern that prevent further impairment of beneficial uses. In either case, it is incumbent on the facility to provide loading calculations based on sound and accepted engineering practices which demonstrate the applicable provisions of IDAPA §16.01.02.054. However, dischargers of listed pollutants to §303(d) waters should be aware that interim increases in existing loads may result in the need for greater load reduction once a TMDL is developed and implemented.

7. Unpermitted facilities wishing to expand their facility operations will be required to acquire an NPDES permit from USEPA and meet all applicable provisions of IDAPA §16.01.02.054.04 or IDAPA §16.01.02.054.05.

4.4.3 GENERAL PROVISION OF NNI POLICY

The following general provisions apply on the NNI Policy:

1. If IDEQ determines, based on reliable and verifiable water quality information, that a specific listed pollutant is not impairing the §303(d) waterbody, then de-listing will be recommended and a TMDL will not be developed for that pollutant and waterbody.

2. Any facility or operation implementing control measures after WAG (if applicable) or BAG (in the absence of a WAG) review of the subbasin assessment, and before USEPA's approval of the TMDL that results in a verifiable reduction of listed pollutant(s) to a §303(d) water quality limited water body, will be credited with the appropriate load reduction during the allocation phase of the TMDL. However, this does not guarantee that additional load reductions by the facility will not be required in order to meet water quality goals necessary to obtain beneficial uses.

3. All activities related to stream channel alteration permit applications must comply with IDWR's Rules and Minimum Standards for Stream Channel Alteration. IDEQ shall give IDWR written notice if a §303(d) stream will be impacted, and caution that additional measures may need to be taken to later address water quality once the immediate threat has passed. In any situation, stream alteration activities shall not violate Idaho Water Quality Standards except as outlined in IDAPA §167.01.02.080.02 (Short Term Activity Exemptions).

In order to ensure that water quality is protected, the following conditions may be included by IDEQ in the final stream channel alteration permit:

a. Construction shall be conducted in such a manner so as to minimize turbidity and comply with the Idaho Water Quality Standards and Wastewater Treatment Requirements.

b. Work shall be conducted during low flows and heavy equipment shall operate from the bank.

c. All fuel, oil and other hazardous materials, shall be stored and equipment refueled and serviced away from the stream to ensure that a spill cannot enter the waterway.

d. All areas subject to erosion as a result of the construction shall be protected with rock riprap or other suitable methods of erosion protection meeting IDWR minimum standards.

e. Disturbed areas shall be revegetated and/or seeded with perennial vegetation.

f. All temporary structures, excavated material or construction debris resulting from the construction shall be disposed of out of the stream channel so it cannot reenter at high flows.

g. Materials excavated from the construction site shall be discharged in an upland area so it cannot reenter the stream channel at high flows.

h. Sand bags or other methods of coffer damming shall be utilized to minimize working in the flowing water.

Provided that these inclusions and IDWR minimum construction standards are included in the final permit, water quality impacts should be minimal.

Additionally, for suction dredging operations in Idaho, USEPA has provided the following guidelines (USEPA 1998c) if an NPDES permit strategy was developed:

a. For new large-scale commercial operations, individual NPDES permits would be required prior to beginning operations.

b. For moderately sized operations (with intakes greater than 5 inches and over 15 horse power), consideration would be given to issuing a general NPDES permit. The state of Idaho would have the flexibility, through their 401 certification program, to determine which stream segments would be off limits to dredging due to water quality concerns (such as segments on the 303(d) list).

c. For small-scale, recreational dredging operations which are adequately regulated under state programs (such as the "one stop" permit), or other federal programs (by the Corps of Engineers CWA 404 program), the USEPA could consider either a general permit or, with respect to unpermitted discharges, enforcement discretion if the discharges did not result in violations of state water quality standards.

4. All NEPA related activities are subject to compliance with all applicable rules and regulations. During the formal NEPA public comment period, IDEQ shall notify the designated agency when activities may impact a listed water. It is incumbent on the designated agency to demonstrate that the activity under consideration will result in no further impairments of the beneficial uses on low and medium priority waters, and that the total load of listed pollutants remains constant or decreases on high priority waters.

5. IDEQ has the authority to review storm water pollution prevention plans for adequacy and compliance with the provisions of IDAPA §16.01.02.054. Should these plans be deemed inadequate, IDEQ will notify USEPA who is responsible for enforcement and/or corrective actions.

6. Pollution trading to reduce the effects of increasing the load to a high priority water will be allowed as long as the total load remains constant or decreases within the watershed. Pollution trading will be permitted in accordance with the provisions of the Mid-Snake TMDL, §3.02 (Wasteload and Load Allocation Tables) and §3.04 (Enforcement Mechanisms). Any facility desiring a modification in their wasteload allocation through effluent trading must receive approval from IDEQ and USEPA. Facilities that were not currently in production (since April 25, 1997 when the Mid-Snake TMDL was approved) but have current NPDES permits will receive an allocation in Year 3 provided they are in production and have monitoring data sufficient to demonstrate their phosphorus contribution to the Middle Snake River.

4.5 POLLUTION PREVENTION

The U.S. Pollution Prevention Act of 1990 defines source reduction as any practice that reduces the amount of any hazardous substance, pollutant or contaminant entering any waste stream or otherwise released into the environment prior to recycle, treatment or disposal. Pollution prevention includes reduction of pollution at the source (source reduction), and increased efficiency in the use of raw materials and natural resources, such that the emphasis on end-of-pipe control (for point sources) as a continuing exclusive reliance by regulatory agencies for realizing environmental goals is deemphasized by augmenting attention to reducing the sources of environmental pollution through changes in processes, operations and the use of materials; placing the focus for identifying opportunities for such changes on the owners and managers of commercial, transportation, agricultural and industrial operations who best know and understand them; and, encouraging an emphasis not just on achieving regulatory compliance, but on achieving the best possible environmental results which will often substantially surpass compliance requirements and generally yield economic benefits. IDEQ and USEPA promote and support this change of emphasis and are working with other stakeholder state and federal agencies to develop a range of incentives and recognition programs for companies, farmers, or other entities to improve their environmental performance by focusing generally on environmental improvements or targeting on particular environmental problems (IDEQ 1998a). At the present time, IDEQ is in the process of building a framework for an Idaho Pollution Prevention Incentive program. When this program is in place, IDEQ will promote and support it by encouraging superior environmental management and beyond-compliance environmental performance with appropriate stakeholders.

5.0 PUBLIC PARTICIPATION

Part of the process in the development of the Upper Snake Rock sub basin assessment was public participation through the Middle Snake River WAG. Key to this was the involvement of the Middle Snake River TAC, which represented various scientists and technical specialists from the water user industries and from governmental agencies and organizations. Their review of the sub basin assessment, along with their technical comments, provided a vehicle for IDEQ-TFRO to develop a document consisting of the necessary information from which to eventually derive a TMDL for the water quality limited waterbodies in the Upper Snake Rock sub basin. The Upper Snake Rock Watershed Management Plan is an iterative document that will be modified with better and more current information as it becomes available. At that time when the document is modified, the Middle Snake River TAC and WAG will be instrumental in providing additional public comments for IDEQ-TFRO who will be responsible for updating of the plan. Assessment of pollutant reduction measures by the various water user industries will follow the perscribed measures as defined in §3.0 and as described in Tables 106 and 107, and will also be subject to public comment from the Middle Snake River TAC and WAG.

5.1 UPPER SNAKE BASIN ADVISORY GROUP

The Upper Snake BAG as part of their statutory stewardship under §39-3601 *et seq.*, provided guidance and advice to the Mid-Snake WAG, the Mid-Snake TAC, and IDEQ-TFRO in the final development of the sub basin assessment. Part of that stewardship was to review the document after formal presentation and provide their comments and assessment. The sub basin assessment was presented by IDEQ-TFRO to the Upper Snake BAG on September 2, 1998 with comments being solicited. The TMDL Development Section 3.0 was presented by IDEQ-TFRO to the BAG on October 6, 1999.

5.2 MIDDLE SNAKE RIVER WATERSHED ADVISORY GROUP

The Mid-Snake WAG, as part of their statutory stewardship under §39-3601 *et seq.*, provided necessary and valuable comments on the sub basin assessment. Each representative industry provided additional insight and comments that helped make the final version of the document a more scientific portrayal of the sub basin. The assessment was presented by IDEQ-TFRO to the Mid-Snake WAG on July 15, 1998 with comments being solicited.

On November 17, 1998, the Mid-Snake WAG was presented with a draft Fact Sheet on Fecal Coliform Bacteria for their review and comment. IDEQ-TFRO had researched and prepared the fact sheet to incorporate it as an educational tool on pathogen concerns on the various tributaries. The comment period lasted through March 2, 1999.

From March through October 1999, various portions of the sub basin assessment and the TMDL development section were presented to the WAG and solicited for comment. Comments were incorporated into the body of this document prior to the official public comment period.

5.3 MIDDLE SNAKE RIVER TECHNICAL ADVISORY COMMITTEE

The Mid-Snake TAC was the scientific arm of the Mid-Snake WAG and provided technical assistance to IDEQ in the development of the final version of the sub basin assessment and the TMDL development section. They helped to review all technical databases, sources, and references and provided guidance on the technical aspects of the assessment. Various governmental agencies, organizations, and industry representatives (previously defined in §2.0 of this assessment) provided their expertise in the final version of the document. The Mid-Snake TAC commenced review of the sub basin assessment on June 17, 1998.

Beginning January 1, 1999, the technical specialists for the various industries were contacted so they would be prepared to review and make comments on the TMDL Development Section 3.0 of the TMDL. At the beginning of the TMDL development process, IDEQ-TFRO met individually with each industry and provided the necessary data for use in the TMDL development. On March 17, 1999, the Mid-Snake TAC was provided a general overview of the TMDL development phase and updated on industries' review process. Following the March meeting, TAC meetings provided an opportunity for continued discussion and comments from the TAC on the TMDL Development Section.

5.4 PUBLIC NOTICE ON THE SUB BASIN ASSESSMENT

Although no official public notice and comment were advertised for the Upper Snake Rock Sub Basin Assessment, public review of the document commenced on June 17, 1998 and ended on September 17, 1998. Additional comments that came in during this period were incorporated into the document. After a second review by IDEQ-Central Office, the document was proposed as a final draft on December 31,1998. TMDL development commenced January 1, 1998. A proposed TMDL development draft was completed on October 4, 1999. The WAG received this copy on October 20, 1999 at their regularly scheduled WAG meeting. Official public notice commenced on November 1, 1999 and lasted 30 days. Comments received were incorporated into the document where appropriate. The final Upper Snake Rock Watershed Management Plan was submitted to USEPA-Boise on December 20, 1999.

6.0 SOURCES AND REFERENCES

A conscientious effort was made to maintain a list of all references used in the development of the subbasin assessment and the TMDL. Every document reviewed, whether identified in the document or not, was included in this list of sources and references. Additionally, the bibliography noted in the *Trend Monitoring Plan* is included in this list of sources and references. The format used is that of the Name-Year System as described in the CBE Manual (6th edition) and is a system widely known as the "Harvard system." The listing is alphabetical by author surname, organization/agency name, or computer program name. Sources and references may be located at IDEQ-TFRO, IDEQ-State Office, Boise State University library, Idaho State University library, or as a download of information from the internet website where available, or from the specific agency or organization that publishes the document.

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A TREND MONITORING PLAN FOR THE MIDDLE SNAKE RIVER TO DEFINE RELATIVE CHANGES IN VARIOUS AQUATIC LIFE; CHEMICAL, PHYSICAL, AND WATER QUALITY PARAMETERS OVER A TEN YEAR PERIOD

by the

Technical Advisory Committee of the
Middle Snake River Watershed Advisory Group
June 2, 1998

I. INTRODUCTION

The purpose of this trend monitoring plan for the Middle Snake River is to help document relative changes in various aquatic organism populations, and in physical and chemical water quality parameters over a ten year period during the implementation of the Middle Snake River Watershed Management Plan. The river system-of-interest is the Middle Snake River. Tributaries to the Middle Snake River will be considered at a later time. The parameters defined in this plan summarize the minimal number of parameters that should be considered when developing other monitoring plans in the Middle Snake River by various agencies and organizations. Additionally, the data collected in this trend monitoring plan will be used in conjunction with other data from various agencies, organizations, and water user industries to assess if progress is being made on the Middle Snake River towards attainment of state water quality standards and its beneficial uses.

Various agencies and organizations have been involved in the collection of aquatic organisms and of physical and chemical water quality data over a number of years. In addition, point source industries have been involved in effluent monitoring of which their effluent either directly or indirectly discharges to the Middle Snake River. Collectively, this information will provide a substantial database from which to assess the overall condition of the Middle Snake River. The proposed trend monitoring plan is but one component in the overall database for assessment of the Middle Snake River. As of this writing, the IDEQ-TFRO has developed and will continue to develop a multi-agency/multi-organization monitoring database on the Middle Snake River as resources permit. All data collected through monitoring by IDEQ-TFRO will be made available on its www/Internet site as it becomes available.

On April 25, 1997 the Middle Snake River Watershed Management Plan containing the Mid-Snake TMDL for total phosphorus was approved by the U.S. Environmental Protection Agency (EPA). Implementation of this plan with its point and nonpoint source pollutant limitations is likely to bring the Middle Snake River into compliance with state water quality standards and allow the water body to meet its beneficial use requirements. Refining initial control strategies, additions and refinements to allocations, and use of the feedback loop to identify if other adjustments to the plan are necessary are dependent on effective monitoring. The trend monitoring described below is an integral part of this effort.

On September 4, 1997 the Middle Snake River Technical Advisory Committee (TAC), representing various scientists from agencies and water user industries agreed that the following parameters be included as "minimal water quality parameters" for the initial water quality testing in the trend monitoring plan: total phosphorus (TP), dissolved ortho-phosphate (DOP), total Kjeldahl nitrogen (TKN), ammonia (NH3), nitrite+nitrate (NO2+NO3), sediment (as suspended sediment), dissolved oxygen (DO), temperature, turbidity (NTU), pH, specific conductance (SC), and water velocity (as a subcomponent of flow). Minimal parameters that will be used in mass balance determinations include: TP, DOP, TKN, NH3, NO2+NO3, and sediment.

Additionally, the TAC considered various aquatic organisms and physical parameters, and these will be monitored as well.

One additional consideration was the need to use the same laboratory for the trend monitoring over the ten year period. This was agreed to by the TAC so as to reduce the variability that exists if multiple laboratories are used within the scope of the time frame. Therefore, the TAC strongly suggests that one laboratory be used throughout the life of the monitoring plan.

II. LITERATURE SURVEY

A literature survey of sampling procedures, analytical procedures, and quality control/quality assurance protocols was previously conducted by the Idaho Division of Environmental Quality (IDEQ) for the express purpose of formulating "minimal requirements" for a variety of trend monitoring plans. The results of that survey are included in this document as cited references, and listed in §6.0, Sources and References.

III. DESCRIPTION OF LOCATION AND SAMPLING SITES

The objective of the trend monitoring plan is to assess and report the existing condition of the Middle Snake River, to determine the long term trends, and to evaluate compliance with the state's water quality standards. Trend monitoring requires repeated sampling at a few key locations for a number of years. A monthly sampling frequency at these stations is the minimum needed to adequately assess long term trends in water quality. Special and more intensive surveys may be performed to provide the more detailed data needed to determine changes throughout a stream (or stream segment) in a short period of time (for cause and effect studies), or to detect the water quality changes over time at a series of closely related points. Ideally, all major surface waters (like the Middle Snake River) should undergo special or intensive water quality surveys on a periodic basis (such as three or four years).

The TAC determined that a less aggressive but overall comprehensive trend monitoring plan that incorporates monthly trend monitoring (for water chemistry parameters) and annual monitoring of aquatic biota would be suitable for defining a "skeletal framework" that could be built upon over the next ten years by the various agencies and organizations. The trend monitoring will also survey loads, concentrations, and changes in flow. Biological and habitat assessments will be conducted during summer low flow conditions (July-August) annually. This comprehensive approach of collecting multiple lines of evidence including chemical, physical, and biological parameters will provide a more robust trend monitoring approach which can accurately assess beneficial use attainment resulting from long-term management activities.

Therefore, the following describes the location and the sites to be considered for the trend monitoring of the Middle Snake River over the next ten years.

1. Three monitoring sites on the Middle Snake River have been selected. These sites are in the Milner area, the Buhl area, and the King Hill area. Their selection is due primarily to already existing USGS gaging stations for flow determination and ongoing National Water Quality Assessment (NAWQA) activities at selected sites. Additional sites (inclusive of tributaries) may be considered by IDEQ-TFRO if resources become.

2. At each site, water chemistry parameters will be monitored on a monthly basis. In conjunction with this, flows will be determined as well. Water chemistry parameters will include total phosphorus (TP), dissolved ortho-phosphate (DOP), total Kjeldahl nitrogen (TKN), ammonia (NH_3), nitrite+nitrate

(NO_2+NO_3), sediment (as suspended sediment), dissolved oxygen (DO), turbidity (NTU), pH, specific conductance (SC). Continuous summer water temperature will be monitored at each site. Additionally, chlorophyll *a* and pheophytin will be collected as part of the water chemistry parameters.

3. Within the vicinity of the three selected sites, biological species will be monitored annually for richness, diversity, and their functional attributes. These sites will be selected based on areas that are conducive to macrophyte growths. The biologicals will include fish, macroinvertebrates, macrophytes, and algae (periphyton and phytoplankton). Associated instream and riparian habitat reach characteristics will be assessed annually at each site. In order to maintain consistency and comparability with ongoing programs, NAWQA protocols will be used when possible for aquatic life and habitat assessments.

a. HABITAT CHARACTERISTICS

The following physical, hydrologic, and physiochemical habitat characteristics will be monitored: reach length, width, depth, width/depth ratio, velocity, discharge, discharge as percent coefficient of variation (CV), specific conductivity, water temperature, pH, dissolved oxygen, percent dissolved oxygen saturation, substrate size, percent embeddedness, percent substrate fines, percent cover, and percent open canopy.

HABITAT CHARACTERISTIC PARAMETERS-OF-CONCERN

PARAMETERS	*MONITORING FREQUENCY*	*COMMENTS*
Reach length, ft	Annual	Physical characteristic
Width, ft	Annual	Physical characteristic
Depth, ft	Annual	Physical characteristic
Width/Depth Ratio	Annual	Physical characteristic
Velocity, ft/s	Annual	Hydrologic characteristic
Discharge, cfs	Annual	Hydrologic characteristic
Discharge, % CV	Annual	Hydrologic characteristic
SC	Annual	Physiochemical characteristic
Temperature, °C	Annual	Physiochemical characteristic
pH	Annual	Physiochemical characteristic
DO, mg/L	Annual	Physiochemical characteristic
% DO Saturation	Annual	Physiochemical characteristic
Substrate size, inches	Annual	Physical characteristic
Percent Embeddedness	Annual	Physical characteristic
Percent substrate fines	Annual	Physical characteristic
Percent cover	Annual	Physical characteristic
Percent open canopy	Annual	Physical characteristic

b. FISH METRICS

Fish metrics will be determined for: number of fish collected, number of fish per minute of electrofishing, number of species, number of native species, percent anomalies, percent introduced species, percent common carp, percent cottids, percent salmonids, percent juvenile salmonids (less than 4 inches in length), percent adult salmonids (greater than 8 inches in length), number of intolerant species, percent omnivores, and percent coldwater adapted.

BIOLOGICAL PARAMETERS-OF-CONCERN FOR FISHERIES

PARAMETER	*MONITORING FREQUENCY*	*COMMENTS*
Number of fish collected	Annual	
Number of fish/min. Electrofishing	Annual	In an upstream direction
Number of species	Annual	
Number of native species	Annual	
Percent anomalies	Annual	
Percent introduced species	Annual	
Percent common carp	Annual	
Percent cottids	Annual	
Percent salmonids	Annual	
Percent juvenile salmonids	Annual	< 4 inches length
Percent adult salmonids	Annual	> 8 inches length
Number of intolerant species	Annual	
Percent omnivores	Annual	
Percent coldwater adapted	Annual	

The Reconnaissance Index of Biotic Integrity (RIBI), as developed by the IDEQ, will be used as an analytical tool for assessing the aquatic life beneficial use status determinations for the wadable stream portions of the Middle Snake River. The minimum collection effort must include the core methods defined in the IDEQ's Water Body Assessment Guidance.

c. MACROINVERTEBRATES

Macroinvertebrates will be collected from both natural riffle substrate (semi-quantitative) and from all habitats (qualitative) found within each reach. Microhabitat measures of depth, velocity, and substrate quality will be made for each riffle collection.

The Macroinvertebrate Biotic Index (MBI), as developed by the IDEQ, will be used as an analytical tool for assessing cold or warm water biota in wadable stream portions of the

Middle Snake River. The MBI consists of seven (7) metrics which are described in the following table:

THE METRICS OF THE MACROINVERTEBRATE BIOTIC INDEX.

METRIC COMPONENT	DESCRIPTION
EPT%	A measure of the proportion of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) to the rest of the macroinvertebrates in the sample.
HBI	A measure of organic pollution and its effect on the macroinvertebrates.
Scrapers %	A measure of a functional feeding group as an indicator of the riffle community food base based on their relative abundance.
Dominance %	A measure of the contribution of the numerically dominant taxon to the total number of individuals in the community.
EPT Index	A measure of a groups sensitive to pollution by measuring the taxa richness for the three major groups.
Taxa Richness	A measure of the health of the community through a measure of the variety of taxa present.
Shannon's H'Diversity Index	A measure of species diversity or the evenness of the distribution of individuals in a community and their response to pollution.

d. MACROPHYTES

Macrophyte mapping will be done annually on the Middle Snake River with a minimal evaluation of habitat for flow, velocities, and specific macrophytes and/or algae. Additionally, macropohytes (including filamentous algae) will be assessed annually within each reach at each site. Species composition and biomass will be determined for primary species and major groups (i.e., rooted vascular, filamentous algae, and floating). Fly-over mapping of macrophytes will also be made to supplement reach data and to characterize the aerial extent of plant growth. Ground truthing will be used to confirm habitat conditions and species composition.

e. ALGAE

Algae samples will be collected from natural substrate (periphyton) and from water column (phytoplankton) samples. Samples will be analyzed for chlorophyll-a and pheophytin, and taxonomic composition and densities per unit area and/or volume determined. Biomass estimates will be determined for periphyton.

IV. MATERIALS AND METHODS

In general, the trend monitoring plan will use those protocols for materials and methods as defined by the IDEQ and USGS/NAWQA and will follow the standard USEPA protocols for QA/QC and sampling and parameter testing.

A. QUALITY ASSURANCE AND QUALITY CONTROL

The primary objective of the trend monitoring plan's quality assurance and quality control (QA/QC) is to generate high quality data in an efficient and cost effective manner under a planned and documented quality system. Corollary 1 describes some of the more pertinent considerations for QA/QC. The TAC will review and make suggestions on all QA/QC procedures relevant to the testing laboratory. At least 10% of all samples taken during each sampling event will have QA/QC checks for blanks, spikes, and duplicates where appropriate.

B. PARAMETERS-OF-CONCERN

The testing laboratory will provide to the TAC the method detection limit (MDL) for each parameter so the TAC can make suggestions on the applicability of the appropriate MDL. As part of the overall effort and purpose of the trend monitoring plan, the TAC will provide scientific recommendations to the laboratory on the MDL for each parameter to be tested. Those recommendations may include the following MDL levels and minimum reportable values (MRV) for selected parameters as described by the IDHW-Lab in Boise, Idaho:

RECOMMENDED METHOD DETECTION LIMITS FOR SELECTED PARAMETERS TO BE TESTED.

PARAMETER	*METHOD DETECTION LIMIT*	*MINIMUM REPORTABLE VALUE*
TP, mg/L	0.002	0.005
DOP, mg/L	0.0004	0.005
TKN, mg/L	0.03	0.05
NH3, mg/L	0.004	0.005
NO2+NO3, mg/L	0.004	0.005
Suspended Sediment, mg/L	1.0 mg/L	NA

Water quality sampling will follow standard protocols and methods as defined by the TAC for the Middle Snake River. Corollary 1, at the end of this appendix, is included as a basis from which the TAC may wish to resolve technical issues.

C. EQUIPMENT AND MATERIALS

All equipment and materials used for field and laboratory preparatory procedures will be reviewed by the TAC relative to sampling of water chemistry, macroinvertebrates, fisheries, macrophytes, and phytoplankton. The TAC will determine if the equipment and materials for sampling and preparation of field parameters for testing is appropriate.

A modified slack sampler (425 micron) will be used in riffle habitats for semi-quantitative collections and multiple gear (Ponar dredge, d-frame net, hand-picking, etc. used to collect qualitative samples within each reach). Samples will be composited to represent the overall reach conditions and to reduce costs.

All fish would be sampled using standard electrofishing techniques (developed by either the Idaho Fish and Game, the IDEQ, or NAWQA protocols) including both boat and backpack equipment. All habitats and species will be sampled within each reach and standard units of effort recorded. Multiple gear will be used if conditions warrant their use. All species will be enumerated and game species will be measured for weight and length. Composite weights will be taken for biomass estimates for all nongame species. Each fish will be checked for external anomalies.

Periphyton samples will be taken from natural substrate in the same area where macroinvertebrate samples are taken in riffle habitat. Collections will be made with a standard collection device used in the NAWQA program of a known area and samples composited for an overall reach condition.

D. STATISTICAL ANALYSIS OF DATA

Statistical analysis of data will be based on a seasonal Kendall-tau test that is detrended for flow to analyze the water quality data for monotonic trends. This nonparametric procedure is suitable for application to water quality data which are often skewed, serially correlated, and seasonality affected. Additionally, missing values, or values defined as "less than" the laboratory detection limit present no problems. The test also provides a "slope estimator" for the average rate of change over the whole test period. Examples of the application of the seasonal Kendall test include analyses of U.S. nationwide stream-sampling data, Swedish and Latvian river water quality data, estuarine data sets, and long-term trends in Pamlico River estuary nutrients for watershed nutrient production.

If a *post hoc* or *ad hoc* test is warranted, then it will be done based on current accepted *post hoc* statistical test procedures. Nonparametric summaries will be performed on all metrics. The IDEQ and the TAC will review and make suggestions on all statistical analysis of the data.

Species composition and functional attributes will be summarized and comparisons made to expected conditions or upstream reference site(s). Salmonids size classes and biomass will be evaluated to determine attainment of salmonid spawning and to assess the quality of the sport-fishery at each site.

All data will be considered for STORET databasing by the TAC, or an appropriate database system that allows for retrieval of the data for future use. Initially, the reporting laboratory will provide the preliminary electronic database for readily available access.

An annual progress review will be instituted and prepared by the TAC. As part of that review, the TAC will review other monitoring that supports the trend monitoring plan but is independent of the plan. Other monitoring may include data from point source industries, nonpoint source industries, agencies, and organizations that specifically monitor the Middle Snake River.

As part of the statistical analysis, the TAC will provide some direction on conclusions to be drawn from the trend monitoring. Such interpretive analysis shall be based on relative changes that may occur in the river system from year-to-year. The trend monitoring plan does not proport to demonstrate cause and effect relationships; rather, it is designed to quantitatively measure changes over time.

V. CONCLUSION

The proposed trend monitoring plan for the Middle Snake River is but one component in assessing if its beneficial uses have attained state water quality standards. It is important to understand that this plan has its limits. Although some parameters (such as total phosphorus and total suspended solids) have extensive databases since 1990, other parameters (such as plant species composition and macroinvertebrates) have received less attention and thus are less definable. Additionally, normal variation within any parameter is difficult to estimate unless extensive data is collected. Thus, the plan calls for minimal trend monitoring (on a monthly basis) of three selected sites for water chemistry parameters, and a special, more intensive annual survey of the three near-the-selected sites for biological species (inclusive of habitat, fisheries, macrophytes, macroinvertebrates, and phytoplankton). Additional monitoring being done by various agencies and organizations on the Middle Snake River, as well as point source effluent monitoring, will be used to assess the river for a fuller understanding of its nutrient processing, ecosystem metabolism, organic carbon dynamics, and other processes to determine if its beneficial uses have been met. And, if resources become available to IDEQ-TFRO, additional sites (inclusive of the tributaries) will be considered.

VI. SOURCES

All sources and references are included in §6.0 of the Upper Snake Rock Subbasin Assessment.

COROLLARY 1. QUALITY CONTROL AND QUALITY ASSURANCE

As part of a QA/QC system, quality improvement objectives may include the following:

- To demonstrate that the quality control operations are, in fact, being carried out both in the field and in the laboratory, and maintain a continuing assessment of the accuracy and precision of data generated by analysts within the laboratory group.
- To assure the accountability and traceability of field samples, their transport to the laboratory, their testing and reporting within the laboratory, and to help ensure that the analytical work will withstand legal scrutiny.
- To identify any weakness and problems in the field and in the laboratory and provide immediate preventive and corrective actions.
- To detect training needs and concerns within the whole system when they are warranted.

The *Idaho Bureau of Laboratories'* Policy Statement Number 1-91 (Appendix A) states: "there shall be sufficient QA activities conducted to ensure that all data generated and processed will be scientifically valid." As part of this policy, it is assumed that QA will include a set of operating principles that, if strictly followed during sample collection and analysis, will produce data of known and defensible quality. Thus, as a consequence of this QA the accuracy of the analytical result can be stated with a high level of confidence. Included in QA are two critical components: QC (or internal QC) and quality assessment (or external QC).

The testing laboratory shall have a QC program which shall include at a minimum the following: certification of operator/analyst competence, recovery of known additions, analysis of externally supplied standards, analysis of reagent blanks, calibration with standards, analysis of duplicates, and control charts. *Standard Methods*, 19th Edition 1995, §1020 B is referenced for further consideration.

The testing laboratory will have a quality assessment program that will use external and internal quality control measures to determine the quality of the data produced by the laboratory. It will include at a minimum the following: performance evaluation samples, performance audits, and laboratory intercomparison samples. *Standard Methods*, 19th Edition 1995, §1020 C is referenced for further consideration.

The following specifies the minimum criteria for sampling and laboratory analysis within the confines of this trend monitoring plan:

1. SPECIMEN/SAMPLE CUSTODY

The testing laboratory will have a specimen/sample custody process that will provide a clear description of specimen/sample (and container) traceability from the point of origin through final specimen/sample disposition. It will also identify all responsible persons involved in the laboratory procedures and a brief description of their duties with respect to specimen/sample custody. Documentation will be provided and maintained by the laboratory to establish legal chain of custody and will include: specimen/sample transmittal/submission forms, laboratory specimen/sample logs, specimen/sample preparation and analysis logs, specimen/sample storage logs, and specimen/sample disposition logs.

2. LABORATORY CUSTODY

The testing laboratory will provide laboratory custody and will include the following:

a. SPECIMEN/SAMPLE RECEIPT

This describes the activities involved with initial specimen/sample receipt and includes: specimen/sample acceptability; verification of specimen/sample integrity through correct identification of submitted specimen/sample, requisition form, fixation, promptness of delivery to the laboratory, and specimen/sample preservation; and, complete specimen/sample documentation and identification.

b. SPECIMEN/SAMPLE LOG IN

This describes how specimens/samples are logged, the information that is entered in a specimen/sample log book, and how samples are identified. At a minimum, specimen/sample logs must include the following: date of receipt in lab, specimen/sample collection date, lab identification number, field identification number, requested analyses, and initials of logger.

c. SPECIMEN/SAMPLE STORAGE AND SECURITY

This describes specimen/sample storage, accessibility, and supporting documentation. It should include discussions of security for sample digestates and extracts.

d. SPECIMEN/SAMPLE DISTRIBUTION AND TRACKING

This describes the procedures used to identify incoming samples, work assignments, and how the samples are tracked through sample preparation and sample analysis.

e. SPECIMEN/SAMPLE DISPOSITION

This describes how specimen/sample disposition is documented.

f. OTHER LABORATORIES

This describes the procedures used to transport samples and/or sample extracts to another laboratory. It includes a discussion of documentation, and the information that is transmitted with the sample(s).

3. ANALYTICAL PROCEDURES

The testing laboratory will be an EPA certified laboratory with approved EPA procedures that are documented in the Code of Federal Regulations (CFR). Not all procedures, however, are EPA certified, but may be adopted by EPA as "alternative methods." Therefore, as a minimum, the following requirements should embrace all analytical procedures by the testing laboratory:

a. All procedures should be based on EPA approved procedures. The procedures should be identified by component name, EPA method number, and source.

b. Where a procedure is not found in an EPA approved procedures source but may be considered as an alternative method, or where an EPA procedure is modified, documentation of the alternative method or of the modified EPA procedure will be referenced accordingly.

c. Laboratory glassware including cleaning procedures (appropriate detergents, rinses with tap water and lab grade water, and acid or solvent rinses/soaks) and storage operating procedures will be referenced accordingly.

d. Reagent storage (for all reagents and chemicals other than standards) and their documentation will be referenced accordingly.

4. MAINTENANCE LOG OF PRINCIPAL EQUIPMENT

The testing laboratory will maintain a list of principal equipment and instrument (including manufacturer's name and model number) and the name of the person designated to maintain them. As part of this maintenance log, the following will be included:

a. STANDARD RECEIPT

This will include the standard operating procedures on how the standards are received, stored, logged, and documented for the internal laboratory use, and how records of manufacturer's certification and traceability statements are maintained.

b. STANDARD SOURCES AND PREPARATION

This will include procedures used to prepare working standards and the internal documentation that traces internal working standards to primary standards or purchased stocks. Additionally, this will also include standard sources and preparation protocols including instrument group, source of primary standards and traceability of sources, frequency of standard preparation, and how the primary and working standards are stored.

c. STANDARD OPERATING PROCEDURES FOR EQUIPMENT CALIBRATION

This will include the specific calibration procedures for each instrument group with a list of the minimum or routine calibration procedures. This includes: instrument group or analysis type; initial calibration requirements such as the number of standards used for calibration, the frequency of initial calibration, how a calibration curve is generated (linear or logarithmic), and what criteria is used for acceptance or rejection; QC checks standards used for initial calibration and acceptance or rejection criteria; continuing calibration standards such as the number of standards used, the frequency of use, the concentration range, and the criteria for acceptance and rejection; and, equipment monitoring/calibration activities such as balances for accuracy checks, ovens for temperature monitoring, refrigerators for temperature monitoring, and incubators for temperature monitoring.

d. STANDARDIZATION OF TITRATION SOLUTION

This will include the information pertaining to standardization of titrating solutions, including solution(s) that require standardization, the source of the primary standards used for standardization, and the frequency of standardization.

5. LABORATORY QUALITY CONTROL CHECKS

The testing laboratory will follow the minimum quality control specified by each method. If no quality control requirements are listed in the method, the laboratory will follow its internal requirements with a description of the details of those internal requirements. Additional QC checks will be included, if specified by the approved method, and may be reagent purity checks, internal standards, and surrogate spikes.

6. DATA PROCEDURES AND RESULT REPORTING

The laboratory will list its method detection limits, accuracy, precision targets for different equipment and analytical procedures. Additionally, there will be a description of how to assess precision and accuracy within the laboratory, how data integrity can be assured, how raw data are reduced to reportable values (including notebook, worksheet or spreadsheet used to calculate values and the formulas), the types of forms and records that are routinely printed for verification and signatures, how data entry into computer and paper records (by identified person), and how data are transferred.

DOCUMENT SOURCE: Principle writer Dr. Balthasar B. Buhidar, Ph.D., DEQ-TFRO, October 15, 1997. Additional comments incorporated from the Mid-Snake TAC representing water user industries, organizations, and agencies, and the Mid-Snake WAG through public comment from October 15, 1997 to November 15, 1997. Previous to October 15, the TAC had met and preliminarily began developing a plan for the Mid-Snake River. The plan was incorporated into the Upper Snake Rock Subbasin Assessment . Official public comment (November 3, 1999 through December 3, 1999) were incorporated into this document. Final plan will be presented to the Mid-Snake WAG for approval after a monitoring plan is developed for the tributaries.

TAIL SPILLS, WATER QUALITY PONDS, AND BEST MANAGEMENT PRACTICES OF THE TWIN FALLS AND NORTH SIDE CANAL COMPANIES

TWIN FALLS CANAL COMPANY TAIL SPILLS.

[Source: Stan Haye III, Field Supervisor, Twin Falls Canal Company, P.O. Box 326, Twin Falls, Idaho 83303]

1. ROCK CREEK TAIL SPILLS

NAME OF CONVEYANCE	*TAIL SPILL LOCATION*	*COMMENTS*
Rock Creek	*4450N 2600E Twin Falls*	*Rock Creek spills into the Middle Snake River.*
High Line Canal	*3010N 3825E Hansen*	*High Line Canal goes over Rock Creek.*
McMullen Creek	*2950N 3460E Kimberly*	*McMullen Creek spills into both the High Line Canal and Rock Creek. This water enters the High Line Canal, flows downstream to 3350E 2975N Twin Falls, where it is diverted into Cottonwood Creek. This water is also supplemented from seeps and water from Coyote Creek that drains to the north into Rock Creek.*
Cottonwood Creek	*3320E 3310N Twin Falls*	*Cottonwood Creek drains under the High Line Canal which flows northeast into Rock Creek at 3110N 3450E Kimberly.*
Low Line Canal siphon	*3360E 3310N Twin Falls*	*The Low Line Canal crosses Rock Creek through a siphon.*
Lateral 30	*3310E 3400N Twin Falls*	*Lateral 30 spills to Rock Creek.*
Lateral 31	*3550N 3220E Twin Falls*	*Lateral 31 spills to Rock Creek.*
Lateral 7A	*3650N 3165E Twin Falls*	*Lateral 7A spills to Rock Creek.*
Lateral 32		*This lateral does not spill into Rock Creek.*
Lateral 7	*3670N 3130E*	*Spills into Rock Creek.*
Lateral 12	*3680N 3050E*	*This also collects water from Laterals 14, 9, Coulees "H", "I."*
Lateral 36EXT	*3730N 3030E*	*Spills into Rock Creek.*
Lateral 36B	*3010E 3760N Twin Falls*	*Spills into Rock Creek.*
"K" Coulee	*3880N 2820E Twin Falls*	*There are a number of seeps that supplement this coulee.*
"L" Coulee	*3910N 2780E*	*There are many seeps along this drain.*
"OI" Coulee	*3925N 2765E Twin Falls*	*Seep streams are the main source on this drain.*
"PI" Coulee	*4020N 2660E*	*This return flow is a natural draw.*
"P" Coulee	*4030N 2640E*	*Flows both return and seep & spills to Rock Creek.*
Lateral 38	*4070N 2650E*	*Lateral 38 is a waste water return & spills to Rock Creek.*
"P2" Coulee	*4080N 2630E*	*A seep flow with some return flows discharges to Rock Creek.*
"Q2" Coulee	*4270N 2600E*	*A return flow with Lateral 30 meeting on Rock Creek.*
Lateral 30	*4270N 2600E*	*A return flow with "Q2" Coulee meeting on Rock Creek.*

2. CEDAR DRAW TAIL SPILLS

NAME OF CONVEYANCE	TAIL SPILL LOCATION	COMMENTS
Cedar Draw	1920E 4550N	Cedar Draw spills into the Middle Snake River. Its return spill is from farmland.
Lateral 42	2120E 4010N	Waste water with some live water returns.
"E" Coulee	4200N 2050E	Seep water and waste water returns.
Lateral 11A	4275N 2030E	Mostly waste water. A little live water.
"F" Coulee	4360N 1960E	Mostly waste water returns with some live water.
"I 10" Coulee	1950E 4460N	Majority is waste water returns with some live water.

3. DEEP CREEK TAIL SPILLS

NAME OF CONVEYANCE	TAIL SPILL LOCATION	COMMENTS
High Line Canal	3150N 960E	High Line Canal spills into the upper end of Deep Creek, south of Castleford. Live water flows and numerous waste water returns. It feeds Laterals 1, 2, 4, 5, 7, 9, and 10..
Low Line Canal	3920N 1070E	Low Line Canal spills into Deep Creek. Waste water is from farmland.
Lateral 1		Dissipates over pasture ground at 3700N 600E.
Lateral 2		Becomes Lateral 3 west of Castleford. Enters Salmon Falls Creek.
Lateral 76	3300N 975E	Some live water, little waste water.
Lateral 75	3340N 950E	Made up of little live water, some waste water.
Lateral 73	3500N 940E	Some live water and some waste water.
"I" Coulee	940E 3540N	This is primarily a waste water return from farm ground. Farmers use up most of returns.
Lateral 69C	1000E 3620N	Some live water with little waste water.
Lateral 69 becomes "S 1" Coulee	1050E 3610N	"S 1" enters Deep Creek. Mostly waste water and some live water returns.
Laterals 65 & 65B, "R" and "S" Coulees	1090E 3680N	Enter Deep Creek above the head of Lateral 7. Mostly waste water returns.
Lateral 7 becomes Lateral 7A	3900N 1060E	Lateral 7 located at 1090E 3680N. Is mostly supplied by upper waste water returns. Enters Deep Creek as Lateral 7A and continues as Lateral 6 towards Salmon Falls Creek.
Lateral 61	3700N 1090E	Made up of some waste water returns with little live water.

NAME OF CONVEYANCE	TAIL SPILL LOCATION	COMMENTS
Lateral 63	3800N 1090E	Made up of some waste water returns and little live water.
"Hp" Coulee	3850N 1080E	Mostly made up of seep water exiting some fish ponds & waste water returns.
"Lp" Coulee	3925N 1060E	This is the tail end of the Low Line Canal. Primarily made up of live water to make deliveries to Laterals 9 and 10.
Lateral 9A	4050N 1030E	[No information available]
Lateral 57 A1	1030E 4050N	Some waste water and little live water.
Lateral 9C	4280N 1030E	Runs mainly over pasture ground on the tail end.
Lateral 60A	4200N 1020E	Some waste water and little live water.
Lateral 10B	4410N 1040E	Mostly waste water and some live water.
"N2" Coulee		This is the lower half of 44A. Water sometimes enters Deep Creek when not used up by pasture ground.

4. MUD CREEK TAIL SPILLS

NAME OF CONVEYANCE	TAIL SPILL LOCATION	COMMENTS
"N" Coulee	1350E 4040N	Made up of mostly waste water. Can supplement from Low Line Canal.
Lateral 41	4040N 1350E	Mostly waste water with a little live water.
"O" Coulee	4110N 1240E	Made up mostly of seep flows and some waste returns.
Lateral 44	1110E 4460N	Turns into "N1" Coulee. Mostly waste water with little live water.
Lateral 40B	4190N 1105E	Runs mainly over pasture ground then into Mud Creek.
Lateral 40A	4205N 1105E	Runs mainly over pasture ground before entering Mud Creek.
"L" Coulee		Becomes Laterals 40, 40A, 40B.
"K" Coulee	4330N 1240E	Made up of seep flow and waste water.
"J" Coulee	1300E 4425N	Made up of seep flows and waste water.
"I 1" Coulee	4330N 1310E	Made mostly of seep water, some live water, & waste water returns.
"N 1" Coulee		This is the lower half of Mud Creek. This catches a lot of waste water drainages.

5. SALMON FALLS CREEK TAIL SPILLS

NAME OF CONVEYANCE	TAIL SPILL LOCATION	COMMENTS
Lateral 1		Dissipates over pasture ground at 3700N 600E. Any return flows would enter Salmon Falls Creek.

NAME OF CONVEYANCE	TAIL SPILL LOCATION	COMMENTS
Lateral 3		*From Lateral 2 being fed by High Line Canal. It enters Salmon Falls Creek.*
Lateral 4	*690E 3950N*	*Some live water with lots of waste water.*
Lateral 5	*850E 4080N*	*This is a mix of live water and waste water.*
Lateral 7 becomes Lateral 7A and then becomes Lateral 6	*3900N 1060E Deep Creek* *840E 4080N Salmon Falls*	*Lateral 7 located at 1090E 3680N. Is mostly supplied by upper waste water returns. Enters Deep Creek as Lateral 7A and continues as Lateral 6 towards Salmon Falls Creek where it finally discharges. Made up of waste water returns.*
Lateral 9		*Rarely enters Salmon Falls Creek since all the water is dispersed across pasture ground.*
Lateral 10	*4600N 790E*	*Mostly live water when a spill is present.*

TWIN FALLS CANAL COMPANY WATER QUALITY PONDS.
[Source: Stan Haye III, Field Supervisor, Twin Falls Canal Company, P.O. Box 326, Twin Falls, Idaho 83303]

NUMBER	*NAME*	*YEAR*	*ACRES INVOLVED*
1	Oregon Trail	1993	0.5, Lateral 31
2	Ballard	1993	0.25, Lateral 33
3	Norris #1 Pond	1993	1.50, Laterals 35/34 TFC
4	Summer Camp	1995	0.25, Perrine
5	Summer Camp	1995	0.25, Perrine
6	Spear Ponds	1994	0.5, Main
7	Spear Ponds	1994	0.5, Main
8	KIEM Ponds	1994	0.5, Perrine 3, Lateral 49
9	KIEM Ponds	1995	0.75, Perrine 3, Lateral 49
10	College of Southern Idaho Ponds	1993	1.0, Main Perrine
11	University of Idaho	1993	0.5, TFC
12	Walt Jones	1995	1.0, 2LL/Lateral 8
13	[No name provided]	1995	0.15
14	Filer Ponds	1995	S Coulee
15	Blass	1995	S-2 Coulee
16	Steward's	1996	[No information provided]
17	Steward's	1996	[No information provided]
18	Smutny	1996	Took over Lateral 4, E Coulee

NUMBER	NAME	YEAR	ACRES INVOLVED
19	Norris Pond 2	1996	TFC 3 + PR1
20	Ballard Pond 2	1993	TFC
21	K-2 Ponds	1996	1.5, K-2
22	Cedar Draw	1995	5.5
23	Sharp Ponds	1994	0.25, Laterals 30A & Q-2
24	McDonards Ponds	1994	0.5
25	Armatage	1995	0.25, Lateral 30
26	Fleming	1994	I 10
27	Van Winkle	1996	1.5, K-2
28	Kincade	1996	0.25, Next to Salmon Falls
29	N-Coulee	1996	0.25
30	Lateral 78	1996	0.16
31	I 3 Coulee	1996	0.25
32	Blass/Holms Drain	1996	0.25
33	N Coulee	1996	
34	Kueny	1996	3.0
35	T Coulee		
36	Summer Camp Ponds	1997	5.0
37	Dickerson	97	1.2

NORTH SIDE CANAL COMPANY BEST MANAGEMENT PRACTICES (1982-1997).
[Source: Dennis Heaps, Assistant Manager, North Side Canal Company Ltd., 921 North Lincoln, Jerome, Idaho 83338]

LATERAL	FACILITY	SIZE
A Drain	2 ponds	1 acre/3 acres
C-50	2 ponds	1 acre each
C-55	1 pond	2 acres
C-33	3 ponds	1 acre each
K-Coulee	4 ponds	1-3 acres in size
N-34	1 pond	0.5 acres
J-8	Wetland	40 acres total (under construction)

LATERAL	*FACILITY*	*SIZE*
S-42	*1 pond*	*2 acres*
S-Coulee	*1 pond*	*2 acres*
S-19	*1 pond*	*4 acres*
W-28	*Wetland*	*Nature Conservancy*
W-26	*Pond-wetland*	*20 acres estimated (under construction)*
W-46	*1 pond*	*3 acres*
W	*2 ponds*	*2 acres each*
X-15	*1 pond*	*3 acres*

RIVER MILE INDEX OF THE MIDDLE SNAKE RIVER.

RIGHT BANK IS THE BANK ON THE RIGHT LOOKING UPSTREAM; TH E LEFT BANK IS THE BANK ON THE LEFT LOOKING UPSTREAM. PREPARED BY BALTHASAR B. BUHIDAR, IDEQ-TFRO.

U = Unconnected stream to the Middle Snake River. C = Confluence to the Middle Snake River.

CARTOGRAPHIC RIVER MILE (RM)	RIGHT BANK ("South or West Side")	LEFT BANK ("North or East Side")	ELEVATION feet	QUADRANGLE MAP 1:24,000
544.80		King Hill Creek (C)	2517	Pasadena Valley, Idaho
545.00	KING HILL AREA		2475	
546.00		King Hill, Idaho	2500	King Hill, Idaho
546.30	King Hill Bridge		2500	
546.60		USGS 13154500	2500	
547.00			2500	
547.70		Clover Creek (C)	2533	Pasadena Valley, Idaho
548.00			2525	
549.00			2525	
550.00			2525	
551.00			2525	
552.00			2525	
553.00		Bancroft Springs (3)	2525	
554.00			2550	
554.85	Unnamed stream		2550	
555.00			2550	
555.29	Deer Gulch (C)		2550	
556.00			2550	
556.56	Big Pilgrim Gulch (C)		2575	
556.69	Little Pilgrim Gulch (C)		2575	
557.00			2575	Ticeska, Idaho
558.00			2575	
559.00			2615	
559.92	Bliss Dam		2655	
560.93	Cassia Gulch (C)		2665	
560.00			2675	

CARTOGRAPHIC RIVER MILE (RM)	RIGHT BANK ("South or West Side")	LEFT BANK ("North or East Side")	ELEVATION feet	QUADRANGLE MAP 1:24,000
561.11			2675	
562.00			2675	
562.08	Tuana Gulch (C)		2675	
563.00			2675	
564.00	Unaccounted River Mile: mislabeled on map		2675	
564.00	Unaccounted River Mile: mislabeled on map		2675	Bliss, Idaho
565.00	Aqueduct King Hill Canal		2675	
565.75	Shoestring Road Bridge ("Bliss Grade")		2675	
565.85		Spring (1)	2675	
566.00			2675	
566.33		Unnamed stream (1 Spg)	2675	
567.00			2675	
567.25		Unnamed stream (1 Spg)	2680	
567.73		Unnamed stream (1 Spg)	2690	
568.00			2700	
568.05		Unnamed stream (1 Spg)	2707	
568.51	Unnamed stream		2714	
568.58		Unnamed stream	2421	
568.72	Unnamed stream		2728	
569.00			2735	
569.80		Unnamed stream (1 Spg)	2742	
570.00			2749	
570.04		Unnamed stream (1 Spg)	2756	

CARTOGRAPHIC RIVER MILE (RM)	RIGHT BANK ("South or West Side")	LEFT BANK ("North or East Side")	ELEVATION feet	QUADRANGLE MAP 1:24,000
570.46	Unnamed stream (U)		2763	Hagerman, Idaho
570.71		Unnamed stream	2766	
571.00			2770	
571.19	Unnamed stream	Power Plant Bypass	2773	
571.42		Malad River Gorge (C)	2776	
572.00			2780	
572.28		Birch Creek (C)	2787	
572.41		Unnamed stream	2794	
572.50	USGS 13135000		2798	
572.96	Lower Salmon Falls Power Plant		2801	
573.00			2806	
573.34	Unnamed stream	Unnamed stream	2805	
573.76		Billingsley Creek (C)	2803	
573.97		Unnamed stream	2802	
574.00			2800	
574.27		Unnamed stream (ditch?)	2800	
574.53	Unnamed stream		2800	
575.00			2800	
575.16	Aqueduct	Sands Ditch	2800	
575.41	Fossil Gulch (C)		2800	
575.57	Unnamed stream		2800	
575.83	Unnamed stream	Unnamed stream (ditch?)	2800	
576.00	City of Hagerman POTW		2800	
576.39	Unnamed stream		2800	
576.72		Unnamed stream (ditch?)	2800	
577.00			2800	
577.16	Unnamed stream	Bell Ditch	2800	
577.97	Unnamed stream		2800	
578.00			2800	

CARTOGRAPHIC RIVER MILE (RM)	RIGHT BANK ("South or West Side")	LEFT BANK ("North or East Side")	ELEVATION feet	QUADRANGLE MAP 1:24,000
578.03	Unnamed stream (Peters Gulch)		2800	
578.60	Millet Island		2800	
578.99	Unnamed stream		2800	
579.00			2800	
579.52	Upper Salmon Falls Power Plant		2813	
580.00			2825	
580.12		Buckeye Ditch	2837	
580.30	Dolman Island		2844	
581.00			2850	
581.40	Upper Salmon Falls Dam		2888	
581.72	Owsley Bridge		2890	
582.00	GRIDLEY BRIDGE AREA		2890	
582.30	Gridley Bridge		2890	
582.48	Unnamed stream	Spring (1)	2916	
582.88		Riley Creek (C)	2942	
583.00			2970	Tuttle, Idaho
583.71		Unnamed stream	2942	
583.85		Thousand Springs (12 spg)	2916	
584.00			2890	
584.09	Unnamed stream (U)	Thousand Springs (1 spg)	2908	
584.20	Sliggars Hot Springs	1000 Springs Hydropower	2917	
584.38		Thousand Springs (15 spg)	2926	
584.44		Sand Springs Crk (7 spg)	2944	
584.82		Unnamed stream	2962	
584.87		Unnamed stream (6 spg)	2980	
585.00	Thousand Springs Area		3000	Thousand Springs, Idaho
585.30	Unnamed stream (U)		2998	
585.58	Unnamed stream (U)		2995	

CARTOGRAPHIC RIVER MILE (RM)	RIGHT BANK ("South or West Side")	LEFT BANK ("North or East Side")	ELEVATION feet	QUADRANGLE MAP 1:24,000
585.90		Unnamed stream (1 spg)	2992	
586.00			2990	
586.12	Unnamed stream (U)		2956	
586.50	Salmon Falls Creek (C)		2923	
587.00	BELOW BOX CANYON CREEK		2890	
587.21		Unnamed stream	2890	
587.50		Blue "Heart" Sps (3 spg)	2890	
587.76		Box Canyon Creek (C; 3)	2890	
588.00			2890	
588.06		Blind Canyon Creek (C; 2)	2890	
588.48		Unnamed stream (2 spg)	2890	
588.85		Banbury Springs (19 spg)	2890	
589.00			2890	
589.48	Unnamed stream		2895	
590.00			2900	
590.28		Briggs Creek (C; 5 spg)	2900	
590.33	Unnamed stream		2900	
590.82	Unnamed stream		2900	
591.00			2900	
591.38	Deep Creek (C)		2900	
591.47	Mud Creek (C)		2900	
591.80	Kanaka Rapids		2925	
592.00			2950	
593.00		Clear Lakes (24 spg)	2970	
594.00			2970	

CARTOGRAPHIC RIVER MILE (RM)	RIGHT BANK ("South or West Side")	LEFT BANK ("North or East Side")	ELEVATION feet	QUADRANGLE MAP 1:24,000
595.00			2950	Niagara Springs, Idaho
595.04	Unnamed stream		2955	
596.00			2960	
596.43	Unnamed stream (U)		2965	
596.80	USGS 13094000		2968	
597.00			2970	
597.66	Spring (1 spg)		2975	
598.00			2980	
598.09	Unnamed stream		2980	
598.30	Spring (1 spg)		2980	
599.00		Niagara Sps Ck (C; 5 spg)	2980	
599.12		Spring (1 spg)	2980	
599.14	Cedar Draw (C)		2980	
599.50	Crystal Springs Reach (Downstream Portion)		2980	
600.00			2980	
600.40	CRYSTALSPRINGS AREA	Crystal Springs (14 spg)	2980	
600.92	Unnamed stream		2980	
601.00			2980	
601.30	Crystal Springs Reach (Upstream Portion)		2985	Jerome, Idaho
602.00			2990	
602.15	Unnamed stream		2990	
603.00			2990	
603.17	Springs (8 spg)		2990	
603.39	Unnamed stream		2990	
604.00			2990	
604.07	Unnamed stream		2990	
604.42	Springs (3 spg)		2990	
604.62	Springs (4 spg)		2990	
605.00	Ellison Springs		2990	

CARTOGRAPHIC RIVER MILE (RM)	RIGHT BANK ("South or West Side")	LEFT BANK ("North or East Side")	ELEVATION feet	QUADRANGLE MAP 1:24,000
605.30	Unnamed stream	Spring (1 spg)	2990	
605.43		Unnamed stream	2990	
605.49	Unnamed stream (3 spg)		2990	
605.90		Springs (5 spg)	2990	
606.00			2990	
606.09		Springs (4 spg)	2990	
606.41	Rock Creek (C)		2990	
607.00			3000	
607.15	Auger Falls		3026	
607.54		Unnamed stream	3052	
608.00		Warm Creek	3080	
608.12		Warm Spring Creek (U)	3100	
608.50	City of Twin Falls POTW		3115	Filer, Idaho
609.00			3120	
609.42	Springs (11 spg)		3125	Twin Falls, Idaho
610.00			3130	
610.50		Blue Lakes Spring (1 spg)	3130	
610.86	Main Perrine Coulee (C)		3130	
611.00			3130	
611.10	Springs (11 spg)		3130	
611.53		Unnamed stream (from Bass Lake)	3130	
611.57	Springs (6 spg)		3130	
611.80	Perrine Bridge		3130	
612.00	Springs (5 spg)		3130	
612.50	Springs (1 spg)		3130	
612.60	Unnamed stream		3130	
612.63	Springs (1 spg)		3130	
612.65	East Perrine Coulee (C)		3130	
613.00			3130	

CARTOGRAPHIC RIVER MILE (RM)	RIGHT BANK ("South or West Side")	LEFT BANK ("North or East Side")	ELEVATION feet	QUADRANGLE MAP 1:24,000
613.09	Pillar Falls		3137	
613.37	Springs (4 spg)		3144	
613.67	Springs (4 spg)		3151	
614.00	Springs (3 spg)		3160	
614.70	Shoshone Falls Dam		3204	
614.87		Springs (2 spg)	3248	
615.00			3355	
615.66	Springs (2 spg)		3358	
616.00		Unnamed stream (2 spg)	3360	
616.78		Unnamed stream (5 spg)	3363	
616.90	Spring (1 spg)		3367	
617.00			3370	
617.12	Unnamed stream		3395	
617.20	USGS 13090900		3408	
617.37	Unnamed stream (braided)		3420	
617.50	Twin Falls Dam Spillway		3433	
617.54	Springs (6 spg)		3445	Kimberly, Idaho
617.86	Springs (4 spg)		3470	
617.97		Vinyard Lake Creek	3495	
618.00			3520	
619.00			3520	
619.21	Springs (3 spg)		3527	
619.53	Unnamed stream	Springs (3 spg)	3534	
620.00			3540	
620.17	Springs (3 spg)		3552	
620.75	Springs (3 spg)		3564	
620.88	Spring (1 spg)		3576	
621.00	Hanson Bridge		3590	
622.00			3610	

CARTOGRAPHIC RIVER MILE (RM)	RIGHT BANK ("South or West Side")	LEFT BANK ("North or East Side")	ELEVATION feet	QUADRANGLE MAP 1:24,000
622.10	Spring (1 spg)		3616	
622.15		Spring (1 spg)	3622	
623.00			3630	
623.05	Unnamed stream		3642	
623.12	Spring (1 spg)		3654	
623.39	Spring (1 spg)		3666	
623.75	Spring (1 spg)		3678	Eden, Idaho
624.00			3690	
624.45	Unnamed stream		3700	
625.00			3710	
626.00			3720	
627.00			3780	
627.30		Unnamed stream (U)	3785	
627.65		Unnamed stream (U)	3790	
627.89	Springs (2 spg)		3795	
628.00			3800	
628.29	Unnamed stream (U)		3820	
629.00			3840	
630.00			3840	
630.49	Spring (1 spg)		3850	Murtaugh, Idaho
630.50	Murtaugh Bridge		3855	
630.56	Dry Creek (C)		3860	
631.00			3870	
632.00			3900	Milner Butte, Idaho
632.75	Unnamed stream	Unnamed stream	3905	Milner, Idaho
633.00			3910	
634.00			3920	
635.00			3930	
635.67		Unnamed stream	3933	

CARTOGRAPHIC RIVER MILE (RM)	RIGHT BANK ("South or West Side")	LEFT BANK ("North or East Side")	ELEVATION feet	QUADRANGLE MAP 1:24,000
636.00			3935	
637.00			3940	
638.00			4080	
638.53	Milner Dam		4134	
638.70		USGS 13088000	4135	

Milner Gooding Canal RM639.2

①----USGS GAGE #0880 RM638.7 (Milner)

Milner Dam RM638.53

----Dry Creek RM630.56

----Murtaugh Bridge RM630.50

----Hansen Bridge RM621.00

Vinyard Creek RM 617.97

Twin Falls Dam RM617.4

②----USGS GAGE #0900 RM617.2 (Kimberly)

Shoshone Falls Dam RM614.7

Pillar Falls RM 613.09

----East Perrine Coulee RM612.65

Perrine Bridge RM611.8

----Main Perrine Coulee RM610.86

Blue Lakes Spring RM610.5

----City of Twin Falls POTW RM608.50

Warm Springs Creek RM608.12

Warm Creek RM608.00

----Auger Falls Complex RM607.10

----Rock Creek RM606.41

Ellison Springs RM605.00

Crystal Springs RM600.30

----Cedar Draw RM599.14

Niagara Springs Creek RM599.00

③-----USGS GAGE #0940 RM596.8 (Buhl)

Clear Lakes RM593.00

-----Kanaka Rapids RM591.8

----Mud Creek RM591.47

----Deep Creek RM591.38

Briggs Creek RM590.28

----Banbury Springs RM589.00

Blind Canyon Creek RM588.30

Box Canyon Creek RM588.20

----Salmon Falls Creek RM586.50

Thousand Springs Area RM585.00

Sand Springs Creek RM584.44

Riley Creek RM582.88

-----Gridley Bridge, Hagerman, Idaho RM582.3

Upper Salmon Falls Dam RM581.40

-----Dolman Island RM580.3

<|>-----Millet Island RM578.6

Billingsley Creek RM573.76-------------→|

<|>-----**Lower Salmon Falls Dam RM573.00**

|④----USGS GAGE #1350 RM572.5 (Hagerman)

Birch Creek RM572.28-------------→|

Malad River RM571.42-------------→|

<|>-----Shoestring Bridge, Bliss, Idaho RM565.75

|←----Tuana Gulch RM562.40

|←----Cassia Gulch RM560.93

Bliss Dam RM559.92-------------<|>

|←-----Little Pilgrim Gulch 556.69

|←-----Big Pilgrim Gulch 556.56

|←-----Deer Gulch RM555.29

|←-----Bancroft Springs RM553.00

Clover Creek RM547.70-------------→|

|⑤-----USGS GAGE #1545 RM546.6 (King Hill)

King Hill Bridge RM546.3----------------<|>

King Hill Creek RM544.80-------------→|

Technical Support Document (TSD) for the Development of the Upper Snake Rock Watershed Management Plan

(Upper Snake Rock WMP = Upper Snake Rock TMDL)

Database: 1990 - 1998

analyzed by
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Idaho Rivers United (Robert Lunte)

Data Sources:
Idaho Division of Environmental Quality-Twin Falls Regional Office
University of Idaho-USDA/ARS Kimberly Station
Clear Springs Foods Inc.
United States Geological Survey-Twin Falls Regional Office
Idaho Power Company
Aquaculture Industry
Municipality Industry: City of Twin Falls POTW
Food Processors Industry
United States Environmental Protection Agency

December 20, 1999
Idaho Division of Environmental Quality-Twin Falls Regional Office
Middle Snake River Technical Advisory Committee
Middle Snake River Watershed Advisory Group

Table of Contents

Abbreviations, Calculations, & Explanations

This section is provided at the request of the Mid-Snake WAG to more fully explain details relative to abbreviations, calculations, and definitions used throughout this document. Statistical definitions used in this section were abbreviated and may require further explanation in statistical books by the reader.

ABBREVIATIONS

TSS = Total Suspended Solids, mg/L	TSSLOAD = TSS, tons/year
TP = Total Phosphorus, mg/L	TPLOAD = TP, tons/year
SRP = Soluble Reactive Phosphate, mg/L	SRPLOAD = SRP, tons/year
NH3 = Ammonia-N, mg/L	NH3LOAD = NH3, tons/year
NOX = Nitrite+Nitrate as N, mg/L	NOXLOAD = NOX, tons/year
TKN = Total Kjeldahl Nitrogen, mg/L	TKNLOAD = TKN, tons/year
Q = Flow, cfs	TSD = Technical Support Document

Middle Snake River Segments

MD = Milner Dam (Influent Background)	Segment 1 = MD to PF
PF = Pillar Falls	Segment 2 = PF to CS
CS = Crystal Springs	Segment 3 = CS to BC
BC = Box Canyon	Segment 4 = BC to GB
GB = Gridley Bridge	Segment 5 = GB to SB
SB = Shoestring Bridge	Segment 6 = SB to KH
KH = King Hill Area (Effluent Background)	

CALCULATIONS

Total Nitrogen = TN = TKN + NOX

LOAD = (parameter, mg/L) x (Q, cfs) x (5.39) x (0.1825) = tons/year

5.39 = the factor used to convert concentration & Q to pounds/day load

0.1825 = the factor used to convert pounds/day to tons/year load

Total Accumulative Loadings = MD + PF + CS + BC + GB + SB + KH

Used for Year-to-Year analysis.

Net Accumulative Loadings = KH - MD

Used for Month-to-Month and Seasonal Quarters analysis.

EXPLANATIONS & DEFINITIONS

Database: All data was collected and segregated into 7 SYSTAT (TM) files: MILNER.SYS, PILLAR.SYS, CRYSTAL.SYS, BOXCANYN.SYS, GRIDLEY.SYS, SHOSTRNG.SYS, and KINGHILL.SYS. Each file represents the specific location site where 9 years of water quality data (TSS, TP, SRP, NH3, NOX, and TKN) were present. On the basis of a 9 year period of water quality data, 6 river segments were established. Since the entire stretch of the Middle Snake River is listed in the 1996 & 1998 303(d) list, the 14 303(d) listed segments are blended into the 6 nine year period-of-record segments. Also, because of the enormous amount of data collected for these 7 sites, it was assumed that the database was normally distributed. The 9 year period was from 1990 to 1998.

Year-to-Year: This means Water Year-to-Water Year as defined by USGS.

Baseline, Lo-Flow, and Hi-Flow Years:

WY1990-1991 = These are considered the Baseline Years. This is a carry-over from the Mid-Snake TMDL and will be used in the Upper Snake Rock TMDL.

WY1990-1995 = These are considered the Lo-Flow Years as far as the period of record for water quality data. As far as Q is concerned, the period of record will be for WY1988-WY1995.

WY1996-1998 = These are considered the Hi-Flow Years as far as the period of record for water quality data. As far as Q is concerned, the period of record will be for WY1983-WY1987 and WY1996-WY1998.

Standard, Hydrologic, and Seasonal Quarters:

The determination of quarters is based on one of three systems available to the analyst. In this TSD, seasonal quarters were used in preference to hydrologic or standard quarters.

Standard Quarters: Yearly quarters defined as four 3-month intervals per year and are listed as 1st Quarter (Jan, Feb, Mar), 2nd Quarter (Apr, May, Jun), 3rd Quarter (Jul, Aug, Sep), and 4th Quarter (Oct, Nov, Dec). They are based on the subdivision of a calendar year.

Hydrologic Quarters: These are offset yearly quarters that are established by the USGS water year definition. The quarters are listed as 1st Quarter (Oct, Nov, Dec of the previous year), 2nd Quarter (Jan, Feb, Mar of the current year), 3rd Quarter (Apr, May, Jun of the current year), and 4th Quarter (Jul, Aug, Sep of the current year).

Seasonal Quarters: These are four 3-month intervals that follow the common seasonal calendar: Winter or WINT (Dec of the previous year, Jan, Feb), Spring or SPRG (Mar, Apr, May), Summer or SUMM (June, July, August), and Fall or FALL (September, October, November).

N: This represents the number of samples or observations in a population. The population may be a large population or a small population. Depending on the school of thought (statisticians, mathematicians, chemists versus biologists, physicists, geologists) a small population may be < 30 samples (BPG) or < 50 samples (SMC). In general, two types of Ns are recognized, or two types of populations: small populations (with the symbol n) and large populations (with the symbol N). Another way of labeling a small population is to call it the sample population. Large populations are sometimes called universal populations or just simply populations.

Estimator: This is a mathematical expression that indicates how to calculate an estimate of a parameter from the sample population or sample data. Estimators are necessary because we almost never know the value of the population parameter.

Parameter: A parameter is the true population value of interest, expressed as a number.

Mean: This is also known as the arithmetic mean or average. It is calculated by summing all the individual observations in a small population and dividing it by the total number of observations. For example, a small population of 10 observations which when summed gives a total value of 488, has an average value of 488/10 or 48.8 or 49.

Data used in this TSD was averaged under a variety of methods:

1. Month-to-Month Analysis: All data was summarized for a particular location site on a per month basis.

2. Seasonal Quarters Analysis: All data was summarized for a particular location site on a seasonal quarters basis.

3. Year-to-Year Analysis (Water Years): All data was summarized for a particular location site on a water year basis.

Total Sediment Load: This is all of the sediment that is in the stream transport system. It includes that part that is moving as suspended load plus that part that is moving as bedload. The sediment material may be natural or the result of man's activities.

Washload: That portion of the total stream sediment load composed of particles (< 0.062 mm in diameter) which are found only in relatively small quantities in the bed. The material can be natural or the result of man's activities.

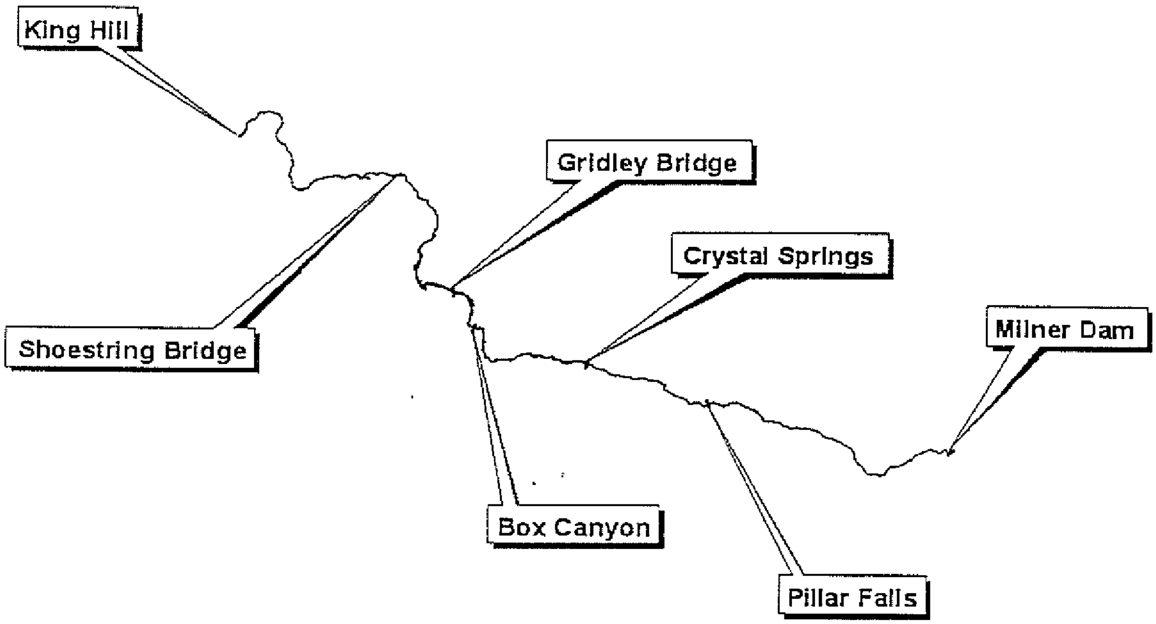
Suspended Load: That portion of the total sediment load which is suspended sediment. It usually is from 0.062 to 0.5 mm in diameter. The material can be natural or the result of man's activities.

Bedload: That material that is moving on or near the stream bed by rolling, sliding, or skipping. It usually is > 0.5 mm in diameter. The material can be natural or the result of man's activites.

Depositional Load: That load that is made up of suspended load and washload that builds up. The Middle Snake River as a sediment-driven system is considered by IDEQ and USGS to be a depositional loading system. It does not have a true bedload partly because it is a managed water system affected by reservoir water and impounded water.

t-Test: The t-Test is a statistical test used to establish the likelihood that a given sample could be a member of a population with specified characteristics about the equivalency of two samples. The two sample t-Test assumes that both samples come at random from normal populations with equal variances. Numerous studies have shown that the t-Test is robust enough to stand considerable departures from its theoretical assumptions, especially if the sample sizes are equal (or nearly equal), and especially when two-tailed hypothesis are considered. If the underlying populations are markedly skewed, then be wary of one-tail testing. If there is considerable nonnormality in the population, then very small significance levels (alpha < 0.01) should not be depended upon.

Segments of the Middle Snake River



	Segment Length
Segment 1 = MD to PF (Milner Dam to Pillar Falls)	25.61 miles (27.3%)
Segment 2 = PF to CS (Pillar Falls to Crystal Springs)	12.69 miles (13.5%)
Segment 3 = CS to BC (Crystal Springs to Box Canyon)	13.40 miles (14.3%)
Segment 4 = BC to GB (Box Canyon to Gridley Bridge)	05.00 miles (5.3%)
Segment 5 = GB to SB (Gridley Bridge to Shoestring Bridge)	16.25 miles (17.3%)
Segment 6 = SB to KH (Shoestring Bridge to King Hill)	20.75 miles (22.1%)
Total =	93.70 miles

% LAND USE BY STREAM CORRIDOR APPROACH MODEL

Segment	AG	RANGE	FOREST	RIPARIAN	OTHER
1	64.2	11.4	0.0	24.3	0.1
2	66.7	13.1	0.0	18.6	1.6
3	67.1	11.6	0.0	21.2	0.1
4	49.3	29.2	0.0	20.8	0.7
5	30.3	55.4	0.0	14.1	0.2
6	21.9	65.3	0.1	9.4	3.3
MEAN	49.9	31.0	0.0	18.1	1.0

I. ANALYSIS OF PARAMETER CONCENTRATIONS
mean concentration in mg/L

TSS:

1. MONTH-TO-MONTH ANALYSIS (WY1990-1998)

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
MONTH	MD	PF	CS	BC	GB	SB	KH
1	9.5	14.0	14.6	22.1	12.3	15.8	23.9
2	10.3	14.4	17.1	24.0	17.0	21.0	26.8
3	22.2	18.1	19.5	31.1	22.6	25.9	33.5
4	21.4	16.7	20.3	30.8	20.7	29.7	30.2
5	15.9	20.1	22.4	32.6	22.4	22.6	23.8
6	19.8	22.5	24.6	47.2	33.6	47.4	43.6
7	14.4	11.7	15.8	17.8	8.7	12.1	16.7
8	20.0	13.7	18.5	20.8	8.9	13.3	18.1
9	18.6	14.3	15.7	18.6	9.6	15.1	39.0
10	14.1	10.6	11.0	16.1	7.7	13.7	20.0
11	14.2	12.9	15.9	18.0	9.5	9.7	17.6
12	8.7	11.2	12.1	20.0	10.7	10.7	18.0
MEAN	15.8	15.0	17.3	24.9	15.3	19.8	25.9
SPRG/SUMM	19.0	17.1	20.2	30.1	19.5	25.2	27.7
FALL/WINT	12.6	12.9	14.4	19.8	11.1	14.3	24.2

2. SEASONAL QUARTERS ANALYSIS (WY1990-1998)

SEASON	MD	PF	CS	BC	GB	SB	KH
WINT (12,1,2)	9.5	13.2	14.6	22.0	13.3	15.8	22.9
SPRG (3,4,5)	19.8	18.3	20.7	31.5	21.9	26.1	29.2
SUMM (6,7,8)	18.1	16.0	19.6	28.6	17.1	24.3	26.1
FALL (9,10,11)	15.6	12.6	14.2	17.6	8.9	12.8	25.5
MEAN	15.8	15.0	17.3	24.9	15.3	19.8	25.9
SPRG/SUMM	19.0	17.1	20.2	30.1	19.5	25.2	27.7
FALL/WINT	12.6	12.9	14.4	19.8	11.1	14.3	24.2

3. WY-TO-WY ANALYSIS

WY	MD	PF	CS	BC	GB	SB	KH	
1990	14.2	10.5	14.2	18.7	6.3	6.8	13.1	
1991	15.7	11.6	7.1	18.8	7.5	6.5	22.1	
1992	17.1	12.1	17.4	17.8	5.2	3.1	14.7	
1993	14.6	13.2	16.4	21.5	8.3	11.0	20.4	
1994	12.8	13.2	14.8	21.1	8.1	7.4	17.0	
1995	17.8	14.2	18.9	20.1	14.5	13.7	22.4	
1996	14.5	17.2	26.6	27.0	20.9	25.6	30.8	
1997	19.8	21.1	28.7	33.7	29.3	38.7	45.3	
1998	13.4	17.6	23.0	35.5	20.6	26.0	36.2	
1990-1991	15.0	11.1	10.7	18.8	6.9	6.7	17.6	Baseline Years
1990-1995	15.4	12.5	14.8	19.7	8.3	8.1	18.3	Lo-Flow Years
1996-1998	15.9	18.6	26.1	32.1	23.6	30.1	37.4	Hi-Flow Years
1990-1998	15.5	14.5	18.6	23.8	13.4	15.4	24.7	Overall Mean

I. ANALYSIS OF PARAMETER CONCENTRATIONS
mean concentration in mg/L

TP:

1. MONTH-TO-MONTH ANALYSIS (WY1990-1998)

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
MONTH	MD	PF	CS	BC	GB	SB	KH
1	0.126	0.155	0.141	0.112	0.097	0.086	0.082
2	0.109	0.148	0.140	0.113	0.101	0.089	0.088
3	0.184	0.129	0.148	0.115	0.105	0.090	0.090
4	0.113	0.132	0.135	0.110	0.099	0.094	0.091
5	0.071	0.122	0.129	0.116	0.101	0.088	0.085
6	0.080	0.111	0.148	0.123	0.128	0.118	0.122
7	0.086	0.120	0.137	0.105	0.083	0.080	0.074
8	0.109	0.140	0.142	0.108	0.083	0.082	0.072
9	0.135	0.137	0.136	0.110	0.091	0.085	0.100
10	0.132	0.137	0.142	0.102	0.083	0.083	0.074
11	0.169	0.149	0.159	0.109	0.087	0.080	0.073
12	0.136	0.149	0.140	0.117	0.106	0.078	0.079
MEAN	0.121	0.136	0.141	0.112	0.097	0.088	0.086
SPRG/SUMM	0.107	0.126	0.140	0.113	0.100	0.092	0.089
FALL/WINT	0.135	0.146	0.143	0.111	0.094	0.084	0.083

2. SEASONAL QUARTERS ANALYSIS (WY1990-1998)

SEASON	MD	PF	CS	BC	GB	SB	KH
WINT (12,1,2)	0.124	0.151	0.140	0.114	0.101	0.084	0.083
SPRG (3,4,5)	0.123	0.128	0.137	0.114	0.102	0.091	0.089
SUMM (6,7,8)	0.092	0.124	0.142	0.112	0.098	0.093	0.089
FALL (9,10,11)	0.145	0.141	0.146	0.107	0.087	0.083	0.082
MEAN	0.121	0.136	0.141	0.112	0.097	0.088	0.086
SPRG/SUMM	0.107	0.126	0.140	0.113	0.100	0.092	0.089
FALL/WINT	0.135	0.146	0.143	0.111	0.094	0.084	0.083

3. WY-TO-WY ANALYSIS

WY	MD	PF	CS	BC	GB	SB	KH	
1990	0.190	0.132	0.145	0.107	0.086	0.074	0.073	
1991	0.184	0.133	0.137	0.107	0.095	0.074	0.097	
1992	0.264	0.191	0.147	0.107	0.086	0.070	0.064	
1993	0.122	0.183	0.181	0.109	0.089	0.078	0.074	
1994	0.129	0.182	0.133	0.109	0.089	0.074	0.067	
1995	0.169	0.131	0.143	0.109	0.093	0.081	0.074	
1996	0.080	0.113	0.130	0.113	0.102	0.093	0.081	
1997	0.078	0.105	0.117	0.117	0.106	0.110	0.110	
1998	0.100	0.152	0.136	0.119	0.102	0.090	0.088	
1990-1991	0.187	0.133	0.141	0.107	0.091	0.074	0.085	Baseline Years
1990-1995	0.176	0.159	0.148	0.108	0.090	0.075	0.075	Lo-Flow Years
1996-1998	0.086	0.123	0.128	0.116	0.103	0.098	0.093	Hi-Flow Years
1990-1998	0.146	0.147	0.141	0.111	0.094	0.083	0.081	Overall Mean

I. ANALYSIS OF PARAMETER CONCENTRATIONS

mean concentration in mg/L

NOX:

1. MONTH-TO-MONTH ANALYSIS (WY1990-1998)

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
MONTH	MD	PF	CS	BC	GB	SB	KH
1	0.844	1.325	1.529	1.598	1.248	1.026	1.389
2	0.615	1.333	1.444	1.439	1.173	0.970	1.321
3	0.589	1.268	1.643	1.299	1.088	0.905	1.188
4	0.266	1.289	1.314	1.255	1.007	0.856	1.144
5	0.168	1.038	1.151	1.213	0.954	0.899	1.156
6	0.182	0.845	1.238	1.027	0.775	0.802	1.032
7	0.209	1.108	1.277	1.455	1.207	1.032	1.286
8	0.151	1.161	1.501	1.547	1.260	1.041	1.333
9	0.209	1.244	1.511	1.550	1.284	1.009	1.276
10	0.373	1.570	1.919	1.698	1.420	1.007	1.377
11	0.701	1.304	1.755	1.613	1.333	1.021	1.428
12	0.669	1.298	1.569	1.593	1.295	1.053	1.410
MEAN	0.415	1.232	1.488	1.441	1.170	0.968	1.278
SPRG/SUMM	0.261	1.118	1.354	1.299	1.049	0.923	1.190
FALL/WINT	0.569	1.346	1.621	1.582	1.292	1.014	1.367

2. SEASONAL QUARTERS ANALYSIS (WY1990-1998)

SEASON	MD	PF	CS	BC	GB	SB	KH
WINT (12,1,2)	0.709	1.319	1.514	1.543	1.239	1.016	1.373
SPRG (3,4,5)	0.341	1.198	1.369	1.256	1.016	0.887	1.163
SUMM (6,7,8)	0.181	1.038	1.339	1.343	1.081	0.958	1.217
FALL (9,10,11)	0.428	1.373	1.728	1.620	1.346	1.012	1.360
MEAN	0.415	1.232	1.488	1.441	1.170	0.968	1.278
SPRG/SUMM	0.261	1.118	1.354	1.299	1.049	0.923	1.190
FALL/WINT	0.569	1.346	1.621	1.582	1.292	1.014	1.367

3. WY-TO-WY ANALYSIS

WY	MD	PF	CS	BC	GB	SB	KH	
1990	0.517	1.642	1.640	1.810	1.431	1.043	1.046	
1991	0.535	1.660	1.990	1.807	1.344	1.045	1.289	
1992	0.420	1.572	1.868	1.829	1.336	1.065	1.427	
1993	0.432	1.511	1.439	1.747	1.250	1.018	1.379	
1994	0.600	1.515	1.728	1.755	1.258	1.039	1.411	
1995	0.413	1.230	1.500	1.471	1.239	1.002	1.371	
1996	0.250	0.858	1.006	1.238	1.088	0.930	1.324	
1997	0.269	0.685	0.728	0.984	0.813	0.859	0.969	
1998	0.391	1.278	1.254	1.428	0.915	0.929	1.271	
1990-1991	0.526	1.651	1.815	1.809	1.388	1.044	1.168	Baseline Years
1990-1995	0.486	1.522	1.694	1.737	1.310	1.035	1.321	Lo-Flow Years
1996-1998	0.303	0.940	0.996	1.217	0.939	0.906	1.188	Hi-Flow Years
1990-1998	0.425	1.328	1.461	1.563	1.186	0.992	1.276	Overall Mean

I. ANALYSIS OF PARAMETER CONCENTRATIONS
mean concentration in mg/L

NH3:

1. MONTH-TO-MONTH ANALYSIS (WY1990-1998)

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
MONTH	MD	PF	CS	BC	GB	SB	KH
1	0.044	0.291	0.084	0.138	0.078	0.027	0.049
2	0.030	0.240	0.077	0.133	0.073	0.032	0.044
3	0.039	0.183	0.140	0.109	0.078	0.026	0.051
4	0.030	0.143	0.071	0.105	0.063	0.028	0.042
5	0.026	0.174	0.079	0.104	0.069	0.027	0.043
6	0.024	0.167	0.075	0.100	0.057	0.033	0.057
7	0.027	0.160	0.080	0.112	0.060	0.028	0.030
8	0.021	0.199	0.075	0.116	0.066	0.024	0.038
9	0.023	0.198	0.067	0.119	0.059	0.026	0.028
10	0.024	0.200	0.063	0.120	0.068	0.026	0.036
11	0.023	0.216	0.067	0.121	0.067	0.026	0.035
12	0.038	0.216	0.068	0.129	0.078	0.032	0.044
MEAN	0.029	0.199	0.079	0.117	0.068	0.028	0.041
SPRG/SUMM	0.028	0.171	0.087	0.108	0.066	0.028	0.044
FALL/WINT	0.030	0.227	0.071	0.127	0.071	0.028	0.039

2. SEASONAL QUARTERS ANALYSIS (WY1990-1998)

SEASON	MD	PF	CS	BC	GB	SB	KH
WINT (12,1,2)	0.037	0.249	0.076	0.133	0.076	0.030	0.046
SPRG (3,4,5)	0.032	0.167	0.097	0.106	0.070	0.027	0.045
SUMM (6,7,8)	0.024	0.175	0.077	0.109	0.061	0.028	0.042
FALL (9,10,11)	0.023	0.205	0.066	0.120	0.065	0.026	0.033
MEAN	0.029	0.199	0.079	0.117	0.068	0.028	0.041
SPRG/SUMM	0.028	0.171	0.087	0.108	0.066	0.028	0.044
FALL/WINT	0.030	0.227	0.071	0.127	0.071	0.028	0.039

3. WY-TO-WY ANALYSIS

WY	MD	PF	CS	BC	GB	SB	KH	
1990	0.037	0.205	0.086	0.164	0.079	0.026	0.042	
1991	0.043	0.225	0.112	0.164	0.103	0.026	0.046	
1992	0.042	0.368	0.111	0.166	0.076	0.025	0.029	
1993	0.031	0.354	0.058	0.160	0.072	0.026	0.039	
1994	0.020	0.353	0.076	0.160	0.072	0.026	0.032	
1995	0.035	0.132	0.097	0.103	0.067	0.026	0.038	
1996	0.020	0.120	0.051	0.091	0.058	0.028	0.045	
1997	0.023	0.104	0.036	0.068	0.041	0.032	0.040	
1998	0.023	0.290	0.066	0.136	0.055	0.028	0.056	
1990-1991	0.040	0.215	0.099	0.164	0.091	0.026	0.044	Baseline Years
1990-1995	0.035	0.273	0.090	0.153	0.078	0.026	0.038	Lo-Flow Years
1996-1998	0.022	0.171	0.051	0.098	0.051	0.029	0.047	Hi-Flow Years
1990-1998	0.030	0.239	0.077	0.135	0.069	0.027	0.041	Overall Mean

I. ANALYSIS OF PARAMETER CONCENTRATIONS

mean concentration in mg/L

TKN:

1. MONTH-TO-MONTH ANALYSIS (WY1990-1998)

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
MONTH	MD	PF	CS	BC	GB	SB	KH
1	0.27	0.18	0.26	0.41	0.43	0.37	0.31
2	0.34	0.18	0.25	0.41	0.41	0.38	0.31
3	0.69	0.31	0.45	0.43	0.46	0.40	0.31
4	0.49	0.40	0.33	0.43	0.44	0.41	0.35
5	0.34	0.29	0.36	0.45	0.46	0.40	0.32
6	0.34	0.30	0.38	0.50	0.52	0.47	0.42
7	0.36	0.26	0.30	0.40	0.40	0.36	0.30
8	0.48	0.26	0.31	0.41	0.45	0.38	0.32
9	0.44	0.27	0.33	0.40	0.37	0.39	0.36
10	0.43	0.25	0.29	0.40	0.39	0.39	0.32
11	0.46	0.31	0.34	0.45	0.42	0.38	0.29
12	0.37	0.24	0.26	0.43	0.42	0.35	0.31
MEAN	0.42	0.27	0.32	0.43	0.43	0.39	0.33 ←
SPRG/SUMM	0.45	0.30	0.35	0.44	0.46	0.40	0.34
FALL/WINT	0.39	0.24	0.29	0.42	0.41	0.38	0.32

2. SEASONAL QUARTES ANALYSIS (WY1990-1998)

SEASON	MD	PF	CS	BC	GB	SB	KH
WINT (12,1,2)	0.33	0.20	0.26	0.42	0.42	0.37	0.31
SPRG (3,4,5)	0.51	0.33	0.38	0.44	0.45	0.40	0.33
SUMM (6,7,8)	0.39	0.27	0.33	0.44	0.46	0.40	0.35
FALL (9,10,11)	0.44	0.28	0.32	0.42	0.39	0.39	0.32
MEAN	0.42	0.27	0.32	0.43	0.43	0.39	0.33 ←
SPRG/SUMM	0.45	0.30	0.35	0.44	0.46	0.40	0.34
FALL/WINT	0.39	0.24	0.29	0.42	0.41	0.38	0.32

3. WY-TO-WY ANALYSIS

WY	MD	PF	CS	BC	GB	SB	KH	
1990	0.27	0.22	0.12	0.40	0.44	0.35	0.27	
1991	0.36	0.19	0.33	0.40	0.47	0.35	0.27	
1992	0.51	0.11	0.29	0.39	0.41	0.34	0.29	
1993	0.45	0.12	0.28	0.41	0.42	0.36	0.32	
1994	0.33	0.12	0.23	0.40	0.42	0.35	0.30	
1995	0.69	0.39	0.43	0.41	0.39	0.37	0.32	
1996	0.33	0.34	0.40	0.45	0.42	0.41	0.34	
1997	0.41	0.38	0.42	0.47	0.46	0.44	0.43	
1998	0.29	0.20	0.22	0.45	0.44	0.40	0.36	
1990-1991	0.32	0.21	0.22	0.40	0.46	0.35	0.27	Baseline Years
1990-1995	0.44	0.19	0.28	0.40	0.43	0.35	0.30	Lo-Flow Years
1996-1998	0.34	0.31	0.35	0.46	0.44	0.42	0.38	Hi-Flow Years
1990-1998	0.40	0.23	0.30	0.42	0.43	0.37	0.32	Overall Mean

I. ANALYSIS OF PARAMETER CONCENTRATIONS
mean concentration in mg/L

SRP:

1. MONTH-TO-MONTH ANALYSIS (WY1990-1998)

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
MONTH	MD	PF	CS	BC	GB	SB	KH
1	0.090	0.131	0.080	0.088	0.055	0.027	0.049
2	0.073	0.122	0.079	0.081	0.051	0.026	0.045
3	0.075	0.089	0.085	0.067	0.042	0.024	0.040
4	0.036	0.075	0.062	0.066	0.041	0.024	0.037
5	0.024	0.080	0.062	0.069	0.044	0.024	0.044
6	0.049	0.076	0.076	0.064	0.041	0.030	0.054
7	0.041	0.081	0.067	0.073	0.049	0.024	0.040
8	0.050	0.105	0.083	0.080	0.053	0.025	0.039
9	0.051	0.101	0.075	0.082	0.049	0.026	0.058
10	0.060	0.097	0.090	0.080	0.049	0.025	0.042
11	0.098	0.109	0.091	0.078	0.046	0.024	0.038
12	0.072	0.119	0.088	0.088	0.057	0.027	0.041
MEAN	0.060	0.099	0.078	0.076	0.048	0.026	0.044
SPRG/SUMM	0.046	0.084	0.073	0.070	0.045	0.025	0.042
FALL/WINT	0.074	0.113	0.084	0.083	0.051	0.026	0.046

2. SEASONAL QUARTES ANALYSIS (WY1990-1998)

SEASON	MD	PF	CS	BC	GB	SB	KH
WINT (12,1,2)	0.078	0.124	0.082	0.086	0.054	0.027	0.045
SPRG (3,4,5)	0.045	0.081	0.070	0.067	0.042	0.024	0.040
SUMM (6,7,8)	0.047	0.087	0.075	0.072	0.048	0.026	0.044
FALL (9,10,11)	0.070	0.102	0.085	0.080	0.048	0.025	0.046
MEAN	0.060	0.099	0.078	0.076	0.048	0.026	0.044
SPRG/SUMM	0.046	0.084	0.073	0.070	0.045	0.025	0.042
FALL/WINT	0.074	0.113	0.084	0.083	0.051	0.026	0.046

3. WY-TO-WY ANALYSIS

WY	MD	PF	CS	BC	GB	SB	KH	
1990	0.077	0.111	0.084	0.105	0.063	0.024	0.051	
1991	0.080	0.110	0.094	0.105	0.068	0.024	0.066	
1992	0.070	0.167	0.105	0.106	0.052	0.023	0.044	
1993	0.077	0.160	0.090	0.102	0.050	0.024	0.051	
1994	0.074	0.159	0.088	0.102	0.051	0.024	0.046	
1995	0.078	0.075	0.075	0.070	0.047	0.024	0.044	
1996	0.031	0.062	0.054	0.058	0.039	0.026	0.021	
1997	0.032	0.055	0.039	0.046	0.030	0.029	0.029	
1998	0.043	0.131	0.068	0.088	0.041	0.026	0.023	
1990-1991	0.079	0.111	0.089	0.105	0.066	0.024	0.059	Baseline Years
1990-1995	0.076	0.130	0.089	0.098	0.055	0.024	0.050	Lo-Flow Years
1996-1998	0.035	0.083	0.054	0.064	0.037	0.027	0.024	Hi-Flow Years
1990-1998	0.062	0.114	0.077	0.087	0.049	0.025	0.042	Overall Mean

I. ANALYSIS OF PARAMETER CONCENTRATIONS

mean concentration in mg/L

TSS BACKGROUND CONSIDERATIONS

Background levels of TSS were investigated. IDAPA §16.01.02.003.07 defines background as "the biological, chemical, or physical condition of waters measured at a point immediately upstream (up-gradient) of the influence of an individual point or nonpoint source discharge." On the Middle Snake River background was defined as the Milner Dam site (RM638.7) since it is the "water source" that is "immediately upstream of the influence of any individual point or nonpoint source discharge," or any upstream site close to it that did not carry with it point or nonpoint sources of pollution coming from within the watershed. Two data sources were used for comparison purposes to determine a reasonable value for background on TSS: USGS data and IDEQ-TFRO data. The following table shows the average values (on a yearly basis) from 1990 to 1997.

Upstream/background TSS values on the Middle Snake River

Year	*IDEQ-TFRO Data TSS, mg/L*	*USGS Data TSS, mg/L*	*Comments*
1990	23.0	-	Lo-Flow Years: 1990-1995 — Range: IDEQ-TFRO = 16.5 mg/L TSS — 11.7 - 23.0 USGS = 17.2 mg/L TSS — 11.5 - 21.2 x̄ = 16.9 mg/L TSS — 11.5 - 23.0
1991	11.7	18.0	
1992	-	-	
1993	-	11.5	
1994	-	18.0	
1995	14.8	21.2	
1996	17.1	29.6	Hi-Flow Years: 1996-1997 — Range: IDEQ-TFRO = 19.1 mg/L TSS — 17.1 - 21.1 USGS = 30.4 mg/L TSS — 29.6 - 31.2 x̄ = 24.8 mg/L TSS — 17.1 - 31.2
1997	21.1	31.2	
MEAN	17.5	21.6	OVERALL MEAN IDEQ + USGS DATA = 19.7 mg/L

The data indicates that the overall mean TSS value is 19.7 mg/L as background (taking into account both USGS and IDEQ-TFRO data) based on data from 1990-1997. Additional data may indicate otherwise. For IDEQ-TFRO data the value is 17.5 mg/L TSS. For USGS data the value is 21.6 mg/L. Water years 1996-1997 have greater values for USGS when compared to the previous six years (1990-1995). IDEQ-TFRO indicates the opposite.

The data used in this document indicates that the TSS background average is 15.5 mg/L based on data from 1990-1998. Additional information will always change the overall average for the total years of data used.

TP BACKGROUND CONSIDERATIONS

Although it can be shown that % Pass from Milner Dam may impact the Middle Snake River minimally, background levels of total phosphorus (TP) appear to have a significant effect on the water quality of the system. Similar sites and data sources used for TSS were used for TP. The following table shows the average values (on a yearly basis) for background from 1990 to 1997 on the Middle Snake River.

Upstream/background levels on TP in the Middle Snake River

Year	*IDEQ-TFRO Data TP, mg/L*	*USGS Data TP, mg/L*	*Comments*
1990	0.114	-	Lo-Flow Years: 1990-1995 Range: IDEQ-TFRO = 0.120 mg/L TP 0.110 - 0.137 USGS = 0.131 mg/L TP 0.050 - 0.203 x̄ = 0.126 mg/L TP 0.050 - 0.203
1991	0.137	0.203	
1992	-	-	
1993	-	0.138	
1994	-	0.050	
1995	0.110	0.134	
1996	0.087	0.067	Hi-Flow Years: 1996-1997 Range: IDEQ-TFRO = 0.087 mg/L TP 0.087 - 0.087 USGS = 0.063 mg/L TP 0.058 - 0.067 x̄ = 0.075 mg/L TP 0.058 - 0.087
1997	0.087	0.058	
MEAN	0.107	0.108	OVERALL MEAN IDEQ + USGS DATA = 0.108 mg/L

The data indicates that the overall mean TP value is 0.108 mg/L as background (taking into account both USGS and IDEQ-TFRO data). For IDEQ-TFRO data the value is 0.107 mg/L TP. For USGS data alone the value is 0.108 mg/L TP. Water years 1996-1997 have lesser values for USGS when compared to the previous six years (1990-1995) thus indicating a reduction in TP since 1990-1991. IDEQ-TFRO data indicates the same. Therefore, the overall mean TP value was used as a reasonable background value.

II. ANALYSIS OF PARAMETER LOADS
mean loads in annual tons or tons/year

TSS LOADS:

1. MONTH-TO-MONTH ANALYSIS (WY1990-1998)

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
MONTH	MD	PF	CS	BC	GB	SB	KH
1	32,150.7	75,725.7	94,700.1	130,869.2	78,487.4	210,300.2	299,390.8
2	50,795.6	116,835.7	171,690.4	252,850.1	165,308.1	415,397.2	456,947.7
3	153,997.4	220,853.9	223,262.4	474,931.9	293,061.3	566,666.5	695,146.0
4	169,219.0	132,706.2	204,274.6	398,568.3	229,935.1	628,503.5	567,990.8
5	53,507.0	110,855.3	146,028.9	275,364.1	158,790.5	395,434.4	326,071.9
6	247,691.3	304,696.5	244,262.5	881,860.4	494,573.1	1,379,222.9	1,184,589.6
7	31,148.0	36,755.7	69,433.6	94,696.2	59,004.9	160,475.0	188,276.0
8	21,388.8	34,173.5	56,689.7	90,996.2	44,253.1	132,523.5	162,085.5
9	30,355.0	43,814.0	62,474.2	96,197.0	53,644.7	178,540.6	379,612.6
10	11,470.8	18,916.5	28,025.1	64,184.0	30,061.1	136,637.9	191,885.5
11	12,046.6	30,215.7	47,427.3	71,374.6	40,918.2	83,473.8	156,406.6
12	9,939.3	39,744.5	52,746.4	105,490.9	50,198.8	113,887.1	180,032.6
MEAN	68,642.5	97,107.8	116,751.3	244,781.9	141,519.7	366,755.2	399,036.3
SPRG/SUMM	112,825.3	140,006.9	157,325.3	369,402.9	213,269.7	543,804.3	520,693.3
FALL/WINT	24,459.7	54,208.7	76,177.3	120,161.0	69,769.7	189,706.1	277,379.3

2. SEASONAL QUARTERS ANALYSIS (WY1990-1998)

SEASON	MD	PF	CS	BC	GB	SB	KH
WINT (12,1,2)	30,961.9	77,435.3	106,379.0	163,070.1	97,998.1	246,528.2	312,123.7
SPRG (3,4,5)	125,574.5	154,805.1	191,188.6	382,954.8	227,262.3	530,201.5	529,736.2
SUMM (6,7,8)	100,076.0	125,208.6	123,461.9	355,850.9	199,277.0	557,407.1	511,650.4
FALL (9,10,11)	17,957.5	30,982.1	45,975.5	77,251.9	41,541.3	132,884.1	242,634.9
MEAN	68,642.5	97,107.8	116,751.3	244,781.9	141,519.7	366,755.2	399,036.3
SPRG/SUMM	112,825.3	140,006.9	157,325.3	369,402.9	213,269.7	543,804.3	520,693.3
FALL/WINT	24,459.7	54,208.7	76,177.3	120,161.0	69,769.7	189,706.1	277,379.3

3. WY-TO-WY ANALYSIS

WY	MD	PF	CS	BC	GB	SB	KH
1990	6,526.1	10,899.2	33,112.9	52,614.9	32,060.5	50,763.2	104,453.7
1991	6,087.4	12,045.6	16,884.9	53,748.6	35,961.9	48,932.8	182,245.0
1992	3,675.1	15,371.7	33,021.5	45,364.4	19,018.9	20,804.8	104,063.7
1993	26,534.5	41,432.0	53,323.1	107,108.0	30,444.4	137,092.9	218,176.5
1994	13,915.4	31,720.3	42,906.5	77,101.4	29,395.9	56,719.8	133,223.8
1995	26,412.8	52,451.8	87,216.1	146,188.8	117,537.6	158,994.8	240,432.4
1996	90,638.4	146,022.5	218,739.6	286,968.1	200,887.9	441,462.9	472,963.6
1997	208,887.1	283,212.2	423,316.2	591,736.8	407,503.8	916,944.5	1,066,244.4
1998	56,670.5	136,616.1	203,539.4	336,916.0	75,286.8	417,993.6	575,595.1
1990-1991	6,306.8	11,472.4	24,998.9	53,181.8	34,011.2	49,848.0	143,349.4
1990-1995	13,858.6	27,320.1	44,410.8	80,354.4	44,069.9	78,884.7	163,765.9
1996-1998	118,732.0	188,616.9	281,865.1	405,207.0	227,892.8	592,133.7	704,934.4

II. ANALYSIS OF PARAMETER LOADS
mean loads in annual tons or tons/year

TP LOADS:

1. MONTH-TO-MONTH ANALYSIS (WY1990-1998)

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
MONTH	MD	PF	CS	BC	GB	SB	KH
1	300.2	654.5	670.7	721.6	571.1	975.0	917.3
2	450.7	687.2	850.3	1,057.8	738.3	1,321.6	1,268.9
3	459.3	751.0	732.8	1,332.6	975.0	1,490.2	1,434.1
4	500.0	523.7	717.5	1,075.3	783.1	1,578.3	1,426.7
5	200.0	506.9	612.3	841.3	572.0	1,179.2	1,013.2
6	749.0	892.6	823.7	1,801.5	1,248.6	2,702.9	2,478.7
7	184.6	304.3	483.6	503.5	443.7	791.6	736.4
8	109.5	308.2	397.0	434.4	382.6	716.1	622.6
9	115.6	330.8	461.6	509.8	432.4	884.8	989.7
10	73.0	214.4	351.4	354.8	317.6	731.9	680.5
11	120.3	329.2	458.0	433.9	364.1	668.9	636.1
12	154.2	473.7	520.6	588.8	459.3	769.0	740.7
MEAN	284.7	498.0	590.0	804.6	607.3	1,150.8	1,078.7
SPRG/SUMM	367.1	547.8	627.8	998.1	734.2	1,409.7	1,285.3
FALL/WINT	202.3	448.3	552.1	611.1	480.5	891.9	872.2

2. SEASONAL QUARTERS ANALYSIS (WY1990-1998)

SEASON	MD	PF	CS	BC	GB	SB	KH
WINT (12,1,2)	301.7	605.1	680.5	789.4	589.6	1,021.9	975.6
SPRG (3,4,5)	386.4	593.9	687.5	1,083.1	776.7	1,415.9	1,291.3
SUMM (6,7,8)	347.7	501.7	568.1	913.1	691.6	1,403.5	1,279.2
FALL (9,10,11)	103.0	291.5	423.7	432.8	371.4	761.9	768.8
MEAN	284.7	498.0	590.0	804.6	607.3	1,150.8	1,078.7
SPRG/SUMM	367.1	547.8	627.8	998.1	734.2	1,409.7	1,285.3
FALL/WINT	202.3	448.3	552.1	611.1	480.5	891.9	872.2

3. WY-TO-WY ANALYSIS

WY	MD	PF	CS	BC	GB	SB	KH
1990	63.7	149.5	333.6	297.6	424.8	536.6	577.3
1991	50.5	161.0	316.4	302.7	446.6	530.6	733.3
1992	44.9	237.3	293.8	267.0	314.8	441.8	452.8
1993	134.2	391.4	532.4	425.5	326.2	696.6	741.6
1994	117.3	427.4	378.5	393.0	325.2	554.2	524.3
1995	150.9	296.3	408.2	544.1	472.6	765.1	764.0
1996	372.2	599.0	796.3	919.3	725.5	1,256.3	1,179.3
1997	686.1	1,042.4	1,325.7	1,665.5	1,228.6	2,226.7	2,304.1
1998	373.5	1,002.9	1,065.9	1,036.0	371.1	1,279.6	1,362.8
1990-1991	57.1	155.3	325.0	300.2	435.7	533.6	655.3
1990-1995	93.6	277.2	377.2	371.7	385.0	587.5	632.2
1996-1998	477.3	881.4	1,062.6	1,206.9	775.1	1,587.5	1,615.4

II. ANALYSIS OF PARAMETER LOADS
mean loads in annual tons or tons/year

NOX LOADS:

1. MONTH-TO-MONTH ANALYSIS (WY1990-1998)

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
MONTH	MD	PF	CS	BC	GB	SB	KH
1	2,006.7	5,023.9	6,529.2	9,002.6	6,861.6	11,051.0	14,279.5
2	3,189.6	5,707.2	6,542.5	9,367.3	7,401.4	11,981.8	14,699.4
3	2,636.7	5,045.2	5,219.4	8,924.0	7,238.8	11,666.1	13,882.5
4	1,387.3	3,020.2	4,451.7	7,565.6	5,665.2	11,112.2	13,494.2
5	353.5	3,154.7	4,317.8	6,866.5	4,783.2	9,850.9	12,008.5
6	1,540.0	3,936.1	4,409.5	8,511.9	5,147.0	11,507.5	13,564.3
7	687.7	2,012.0	3,942.3	5,772.0	5,486.2	8,523.9	10,276.4
8	82.2	2,214.4	3,899.3	5,916.7	5,739.5	8,627.3	11,098.9
9	95.9	2,407.4	4,614.4	6,486.3	5,953.4	9,807.9	12,196.4
10	163.6	2,045.3	4,730.0	5,619.2	5,525.7	8,617.2	12,313.7
11	425.6	2,679.2	4,861.3	6,308.6	5,728.9	8,400.2	12,368.0
12	910.1	3,994.5	5,532.5	7,491.7	6,055.9	10,240.1	12,925.1
MEAN	1,123.2	3,436.7	4,920.8	7,319.4	5,965.6	10,115.5	12,758.9
SPRG/SUMM	1,114.6	3,230.4	4,373.3	7,259.5	5,676.7	10,214.7	12,387.5
FALL/WINT	1,131.9	3,642.9	5,468.3	7,379.3	6,254.5	10,016.4	13,130.4

2. SEASONAL QUARTERS ANALYSIS (WY1990-1998)

SEASON	MD	PF	CS	BC	GB	SB	KH
WINT (12,1,2)	2,035.5	4,908.5	6,201.4	8,620.5	6,773.0	11,091.0	13,968.0
SPRG (3,4,5)	1,459.2	3,740.0	4,663.0	7,785.4	5,895.7	10,876.4	13,128.4
SUMM (6,7,8)	770.0	2,720.8	4,083.7	6,733.5	5,457.6	9,552.9	11,646.5
FALL (9,10,11)	228.4	2,377.3	4,735.2	6,138.0	5,736.0	8,941.8	12,292.7
MEAN	1,123.2	3,436.7	4,920.8	7,319.4	5,965.6	10,115.5	12,758.9
SPRG/SUMM	1,114.6	3,230.4	4,373.3	7,259.5	5,676.7	10,214.7	12,387.5
FALL/WINT	1,131.9	3,642.9	5,468.3	7,379.3	6,254.5	10,016.4	13,130.4

3. WY-TO-WY ANALYSIS

WY	MD	PF	CS	BC	GB	SB	KH
1990	252.2	1,535.7	3,760.3	4,990.6	7,281.2	7,556.0	11,090.4
1991	202.9	1,583.3	4,671.7	5,067.0	6,224.5	7,498.8	9,709.0
1992	128.6	1,965.1	3,679.6	4,551.7	4,878.4	6,686.8	10,007.7
1993	459.0	3,231.6	4,121.3	5,855.7	4,566.0	8,230.5	11,893.4
1994	592.5	3,565.0	4,751.7	6,286.1	4,594.6	7,707.8	10,945.5
1995	328.7	1,878.6	3,346.6	5,532.1	4,772.7	8,852.6	12,856.1
1996	1,618.8	3,784.6	4,909.8	7,528.3	5,911.5	10,534.9	15,300.0
1997	2,716.3	5,701.8	6,613.0	10,439.8	7,860.4	14,123.1	16,241.9
1998	1,581.5	8,363.3	9,166.0	11,207.3	3,339.5	11,975.6	17,187.7
1990-1991	227.6	1,559.5	4,216.0	5,028.8	6,752.9	7,527.4	10,399.7
1990-1995	327.3	2,293.2	4,055.2	5,380.5	5,386.2	7,755.4	11,083.7
1996-1998	1,972.2	5,949.9	6,896.3	9,725.1	5,703.8	12,211.2	16,243.2

II. ANALYSIS OF PARAMETER LOADS
mean loads in annual tons or tons/year

NH3 LOADS:

1. MONTH-TO-MONTH ANALYSIS (WY1990-1998)

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
MONTH	MD	PF	CS	BC	GB	SB	KH
1	86.3	973.0	343.9	697.4	409.6	302.8	498.6
2	210.1	938.4	376.9	844.6	489.3	482.9	641.0
3	100.8	695.9	372.3	667.9	473.9	384.3	716.1
4	124.7	521.4	273.3	663.1	365.6	429.0	663.8
5	56.5	642.5	289.9	604.5	363.6	329.7	534.7
6	262.2	885.6	279.2	998.8	524.9	718.1	1,286.2
7	70.8	334.6	247.4	452.4	278.5	257.5	262.1
8	13.5	421.6	197.9	427.9	302.1	197.1	306.0
9	20.5	443.6	208.4	475.5	244.6	261.6	275.2
10	13.7	365.3	166.9	414.2	268.0	225.9	338.7
11	23.0	481.2	190.0	456.7	284.9	215.9	304.2
12	54.8	680.3	243.3	597.1	370.8	320.5	410.1
MEAN	86.4	615.3	265.8	608.3	364.7	343.8	519.7
SPRG/SUMM	104.8	583.6	276.7	635.8	384.8	386.0	628.2
FALL/WINT	68.1	647.0	254.9	580.9	344.5	301.6	411.3

2. SEASONAL QUARTERS ANALYSIS (WY1990-1998)

SEASON	MD	PF	CS	BC	GB	SB	KH
WINT (12,1,2)	117.1	863.9	321.4	713.0	423.2	368.7	516.6
SPRG (3,4,5)	94.0	619.9	311.8	645.2	401.0	381.0	638.2
SUMM (6,7,8)	115.5	547.3	241.5	626.4	368.5	390.9	618.1
FALL (9,10,11)	19.1	430.0	188.4	448.8	265.8	234.5	306.0
MEAN	86.4	615.3	265.8	608.3	364.7	343.8	519.7
SPRG/SUMM	104.8	583.6	276.7	635.8	384.8	386.0	628.2
FALL/WINT	68.1	647.0	254.9	580.9	344.5	301.6	411.3

3. WY-TO-WY ANALYSIS

WY	MD	PF	CS	BC	GB	SB	KH
1990	15.7	250.7	196.4	453.3	401.0	186.4	331.5
1991	21.0	294.7	254.7	460.3	497.6	184.6	349.4
1992	11.6	458.9	212.9	412.7	278.0	159.2	205.7
1993	51.2	749.9	171.5	544.9	262.1	222.5	423.6
1994	21.6	826.7	218.4	574.1	263.5	191.3	251.5
1995	34.7	301.8	209.9	417.4	291.9	242.1	419.7
1996	113.5	608.8	304.5	617.8	339.2	348.2	732.5
1997	213.0	827.8	373.3	789.8	463.5	630.3	901.4
1998	98.4	1,905.7	483.5	1,080.7	199.5	389.3	905.3
1990-1991	18.4	272.7	225.6	456.8	449.3	185.5	340.5
1990-1995	26.0	480.5	210.6	477.1	332.4	197.7	330.2
1996-1998	141.6	1,114.1	387.1	829.4	334.1	455.9	846.4

TKN LOADS:

1. MONTH-TO-MONTH ANALYSIS (WY1990-1998)

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
MONTH	MD	PF	CS	BC	GB	SB	KH
1	906.6	1,095.5	1,388.9	2,573.9	2,309.8	4,128.8	3,636.0
2	1,598.5	1,832.5	2,204.7	3,716.2	2,675.6	5,276.5	4,525.5
3	2,108.3	3,058.4	2,735.2	4,893.0	4,002.1	6,276.8	4,985.2
4	2,873.7	2,098.2	2,557.6	4,348.3	3,387.1	6,549.9	5,398.6
5	864.6	1,552.6	2,005.4	3,352.2	2,701.6	5,187.1	3,836.6
6	3,169.2	3,808.9	2,930.6	7,310.1	5,003.3	9,785.7	8,154.7
7	693.0	714.9	1,089.5	1,888.4	1,989.7	3,294.3	2,807.8
8	422.6	599.5	838.1	1,693.4	2,134.4	3,253.5	2,784.3
9	580.6	807.4	1,213.7	1,906.0	1,796.0	3,980.1	3,598.9
10	344.5	299.2	665.9	1,366.8	1,498.4	3,411.0	2,933.6
11	514.7	768.5	965.1	1,822.5	1,775.5	3,137.4	2,580.9
12	520.2	861.5	1,030.2	2,158.9	1,952.8	3,339.9	2,929.8
MEAN	1,216.4	1,458.1	1,635.4	3,085.8	2,602.2	4,801.8	4,014.3
SPRG/SUMM	1,688.6	1,972.1	2,026.1	3,914.2	3,203.0	5,724.6	4,661.2
FALL/WINT	744.2	944.1	1,244.8	2,257.4	2,001.4	3,879.0	3,367.5

2. SEASONAL QUARTERS ANALYSIS (WY1990-1998)

SEASON	MD	PF	CS	BC	GB	SB	KH
WINT (12,1,2)	1,008.4	1,263.2	1,541.3	2,816.3	2,312.7	4,248.4	3,697.1
SPRG (3,4,5)	1,948.9	2,236.4	2,432.7	4,197.8	3,363.6	6,004.6	4,740.1
SUMM (6,7,8)	1,428.3	1,707.8	1,619.4	3,630.6	3,042.5	5,444.5	4,582.3
FALL (9,10,11)	479.9	625.0	948.2	1,698.4	1,690.0	3,509.5	3,037.8
MEAN	1,216.4	1,458.1	1,635.4	3,085.8	2,602.2	4,801.8	4,014.3
SPRG/SUMM	1,688.6	1,972.1	2,026.1	3,914.2	3,203.0	5,724.6	4,661.2
FALL/WINT	744.2	944.1	1,244.8	2,257.4	2,001.4	3,879.0	3,367.5

3. WY-TO-WY ANALYSIS

WY	MD	PF	CS	BC	GB	SB	KH
1990	128.1	169.4	276.0	1,103.0	2,188.0	2,559.8	2,152.3
1991	125.6	148.9	773.4	1,122.0	2,182.0	2,533.4	2,042.3
1992	106.4	135.6	576.0	989.0	1,509.1	2,148.7	2,059.2
1993	785.4	443.5	850.5	1,587.7	1,528.9	3,184.0	3,083.9
1994	359.2	303.6	652.2	1,459.4	1,527.1	2,635.1	2,346.4
1995	628.6	866.2	1,138.2	2,094.4	1,931.9	3,480.5	3,228.5
1996	1,581.0	2,264.8	2,734.9	3,644.0	2,919.7	5,362.2	4,737.6
1997	3,088.0	4,436.0	5,392.0	6,407.3	5,026.7	8,524.4	8,402.7
1998	1,512.4	1,570.7	2,032.3	3,892.3	1,606.8	5,542.8	5,469.5
1990-1991	126.9	159.2	524.7	1,112.5	2,185.0	2,546.6	2,097.3
1990-1995	355.6	344.5	711.1	1,392.6	1,811.2	2,756.9	2,485.4
1996-1998	2,060.5	2,757.2	3,386.4	4,647.9	3,184.4	6,476.5	6,203.3

SRP LOADS:

1. MONTH-TO-MONTH ANALYSIS (WY1990-1998)

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
MONTH	MD	PF	CS	BC	GB	SB	KH
1	156.3	468.3	337.0	457.5	296.4	294.2	469.5
2	190.0	481.9	375.8	496.2	333.9	365.0	501.2
3	135.5	341.3	252.1	430.9	254.1	375.6	496.7
4	83.9	248.6	240.1	397.3	212.0	354.3	442.9
5	58.3	304.9	253.4	394.5	220.6	300.7	449.3
6	570.5	421.2	300.0	622.0	334.5	642.2	977.4
7	79.5	177.0	215.8	291.0	238.0	227.1	333.3
8	41.7	216.8	220.8	298.4	246.7	211.7	320.2
9	36.6	225.6	234.9	334.0	223.6	258.1	527.6
10	28.5	168.8	226.5	273.7	197.3	216.6	373.1
11	46.8	227.5	253.4	293.6	191.0	201.2	320.1
12	80.7	366.5	311.7	415.4	271.9	269.6	353.5
MEAN	125.7	304.0	268.5	392.0	251.7	309.7	463.7
SPRG/SUMM	161.6	285.0	247.0	405.7	251.0	351.9	503.3
FALL/WINT	89.8	323.1	289.9	378.4	252.4	267.5	424.2

2. SEASONAL QUARTERS ANALYSIS (WY1990-1998)

SEASON	MD	PF	CS	BC	GB	SB	KH
WINT (12,1,2)	142.3	438.9	341.5	456.4	300.7	309.6	441.4
SPRG (3,4,5)	92.6	298.3	248.5	407.6	228.9	343.5	463.0
SUMM (6,7,8)	230.6	271.7	245.5	403.8	273.1	360.3	543.6
FALL (9,10,11)	37.3	207.3	238.3	300.4	204.0	225.3	406.9
MEAN	125.7	304.0	268.5	392.0	251.7	309.7	463.7
SPRG/SUMM	161.6	285.0	247.0	405.7	251.0	351.9	503.3
FALL/WINT	89.8	323.1	289.9	378.4	252.4	267.5	424.2

3. WY-TO-WY ANALYSIS

WY	MD	PF	CS	BC	GB	SB	KH
1990	37.2	128.2	193.4	289.8	327.3	171.9	405.6
1991	29.9	138.9	220.8	294.3	331.1	170.2	504.0
1992	19.1	207.3	202.6	263.6	191.8	146.6	311.9
1993	62.4	338.2	258.0	352.4	183.4	205.8	510.7
1994	58.0	372.6	247.4	368.0	184.1	176.4	361.1
1995	63.9	158.7	188.1	279.3	197.4	224.0	457.7
1996	115.1	293.2	261.4	367.2	201.8	323.9	313.1
1997	314.6	463.3	394.8	530.5	325.2	549.1	622.2
1998	130.5	862.2	511.6	710.3	150.4	350.6	361.8
1990-1991	33.6	133.6	207.1	292.1	329.2	171.1	454.8
1990-1995	45.1	224.0	218.4	307.9	235.9	182.5	425.2
1996-1998	186.7	539.6	389.3	536.0	225.8	407.9	432.4

II. ANALYSIS OF PARAMETER LOADS
mean loads in annual tons or tons/year

SUMMARY OF ESTIMATED TOTAL MONITORED LOADS

1. MONTH-TO-MONTH ANALYSIS: NET ACCUMULATIVE LOADS = KH - MD

MONTH	TSS	TP	SRP	NH3	NOX	TKN
1	267,240.1	617.1	313.2	412.3	12,272.8	2,729.4
2	406,152.1	818.2	311.2	430.9	11,509.8	2,927.0
3	541,148.6	974.8	361.2	615.3	11,245.8	2,876.9
4	398,771.8	926.7	359.0	539.1	12,106.9	2,524.9
5	272,564.9	813.2	391.0	478.2	11,655.0	2,972.0
6	936,898.3	1,729.7	406.9	1,024.0	12,024.3	4,985.5
7	157,128.0	551.8	253.8	191.3	9,588.7	2,114.8
8	140,696.7	513.1	278.5	292.5	11,016.7	2,361.7
9	349,257.6	874.1	491.0	254.7	12,100.5	3,018.3
10	180,414.7	607.5	344.6	325.0	12,150.1	2,589.1
11	144,360.0	515.8	273.3	281.2	11,942.4	2,066.2
12	170,093.3	586.5	272.8	355.3	12,015.0	2,409.6
MEAN	330,393.8	794.0	338.0	433.3	11,635.7	2,798.0
SPRG/SUMM	407,868.1	918.2	341.7	523.4	11,272.9	2,972.6
FALL/WINT	252,919.6	669.9	334.4	343.2	11,998.4	2,623.3

2. SEASONAL QUARTERS ANALYSIS: NET ACCUMULATIVE LOADS = KH - MD

SEASON	TSS	TP	SRP	NH3	NOX	TKN
WINT (12,1,2)	281,161.8	673.9	299.1	399.5	11,932.5	2,688.7
SPRG (3,4,5)	404,161.8	904.9	370.4	544.2	11,669.2	2,791.3
SUMM (6,7,8)	411,574.3	931.5	313.1	502.6	10,876.6	3,154.0
FALL (9,10,11)	224,677.4	665.8	369.6	287.0	12,064.3	2,557.9
MEAN	330,393.8	794.0	338.0	433.3	11,635.7	2,798.0
SPRG/SUMM	407,868.1	918.2	341.7	523.4	11,272.9	2,972.6
FALL/WINT	252,919.6	669.9	334.4	343.2	11,998.4	2,623.3

3. WY-TO-WY ANALYSIS: TOTAL ACCUMULATIVE LOADS = MD+PF+CS+BC+GB+SB+KH

WY	TSS	TP	SRP	NH3	NOX	TKN
1990	290,430.5	2,383.1	1,553.4	1,835.0	36,466.4	8,576.6
1991	355,906.2	2,541.1	1,689.2	2,062.3	34,957.2	8,927.6
1992	241,320.1	2,052.4	1,342.9	1,739.0	31,897.9	7,524.0
1993	614,111.4	3,247.9	1,910.9	2,425.7	38,357.5	11,463.9
1994	384,983.1	2,719.9	1,767.6	2,347.1	38,443.2	9,283.0
1995	829,234.3	3,401.2	1,569.1	1,917.5	37,567.4	13,368.3
1996	1,857,683.0	5,847.9	1,875.7	3,064.5	49,587.9	23,244.2
1997	3,897,845.0	10,479.1	3,199.7	4,199.1	63,696.3	41,277.1
1998	1,802,617.5	6,491.8	3,077.4	5,062.4	62,820.9	21,626.8
1990-1991	323,168.4	2,462.1	1,621.3	1,948.7	35,711.8	8,752.1
1990-1995	452,664.3	2,724.3	1,638.9	2,054.4	36,281.6	9,857.2
1996-1998	2,519,381.8	7,606.3	2,717.6	4,108.7	58,701.7	28,716.0

COMPARISON OF USGS VERSUS IDEQ-TFRO TSS DATA

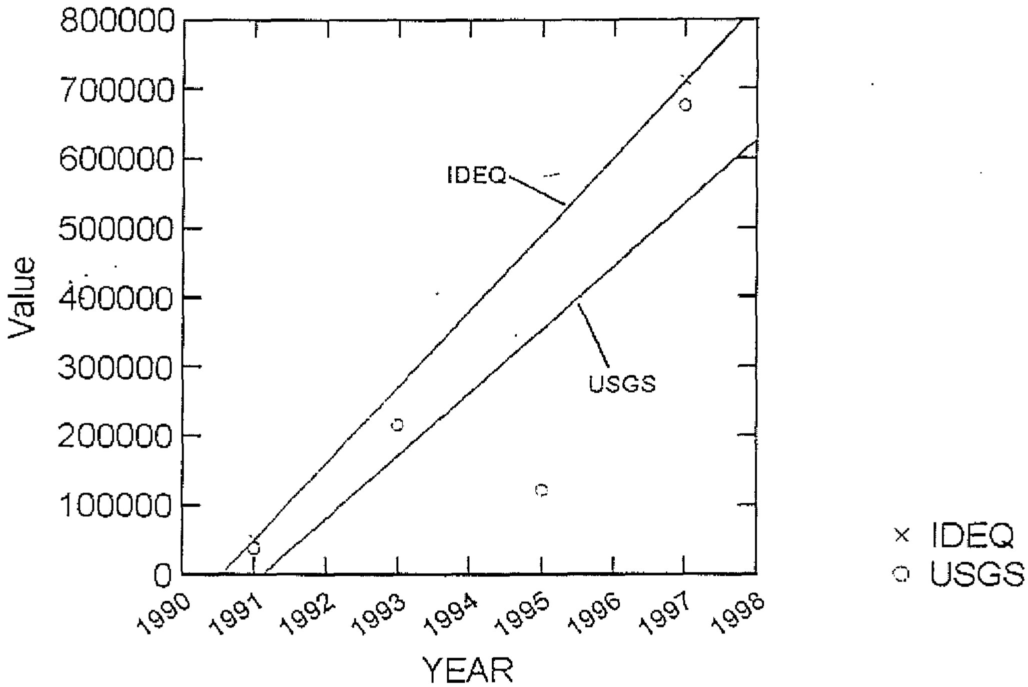
TSS data comparison of USGS and IDEQ data (1991, 1993, 1995, and 1997) provides a reputable estimate of TSS loading variations between Milner Dam and King Hill, as an estimate of the TSS loading being delivered to the entire Middle Snake River system. A comparison of both data sets indicates that IDEQ data is higher than USGS, but within comparable limits for TSS (allowing for natural variability).

Year	*USGS TSS Load tons/year*	*IDEQ TSS Load tons/year*
1991	37,470.90	49,797.48
1993	215,623.75	234,551.73*
1995	121,132.55	136,564.36*
1997	675,547.31	711,316.71
Mean	262,443.63	283,057.57
STDs	284,855.70	295,312.96
CV	1.09	1.04

*Based on comparison estimates of USGS versus IDEQ TSS loads: IDEQ=(1.037xUSGS)+10949.905.

One of the main reasons why WY1991 was lowest in TSS loads is because it was the lowest year for flow past Milner Dam. Conservation flows were practiced more readily by all interested parties. In fact, average flows past Milner Dam for 1991, 1993, 1995, and 1997 were 388, 400, 754, and 5384 cfs, respectively. Average flows past King Hill were 7929, 8299, 8906, and 16,920, respectively; or a variance of 7541, 7899, 8152, and 11,536 cfs for the same years. Thus, the higher TSS loads occured in 1997 when compared to 1991, but with an overall average of 262,443.63 - 283,057.57 tons/year TSS.

1991-1997 IDEQ versus USGS TSS data.



SELECTION OF A SEDIMENT INSTREAM TARGET

The effects of suspended sediment (as TSS) on fisheries vary with life stage, species, concentration of TSS, duration of exposure, particle size, and angularity. Most published studies have only reported concentration without consideration of the severity of effects as related to duration of exposure. Duration of exporsure plays a more dominant role than concentration (CH2MHILL 1998 [p 1]).

Idaho State Water Quality Standards (IDAPA 16.01.02.200.08) state that sediment shall not exceed quantities specified in Section 250, or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. No specific criteria are given for sediment. Therefore, IDEQ-TFRO conducted a literature survey to determine if any specific criteria had been developed that were applicable to the Upper Snake Rock subbasin streams. It was determined that no such assessment had been done to determine specific criteria. Therefore, as a result of the Idaho State Water Quality Standards (IDAPA 16.01.02.200.08, sentence 2), IDEQ-TFRO determined impairment based on water quality monitoring and surveillance information that had been collected on the Middle Snake River and other tributaries. This is summarized in the Upper Snake Rock subbasin assessment. Additionally, IDEQ-TFRO researched other state TMDLs where sediment criteria was a necessary constituent in order to ascertain short-term and long-term goals for agencies. Existing or suggested mass-based TSS criteria for protection of salmonids, other fish, and aquatic communities are based on the European Inland Fisheries Advisory Commission (EIFAC 1965) and the Committee on Water Quality Criteria from the Environmental Studies Board of the National Academy of Sciences (NAS 1973), and their recommendations are as follows:

TSS Range		EIFAC	CWQC
mg/L	mg/L	1965	1973
> 400	> 400.4	Poor fisheries	Very low protection level
81 - 400	80.5-400.4	Significant reduced fisheries	Low protection level
25 - 80	25.0-80.4	Slightly reduced fisheries	Moderate protection level
< 25	< 25.0	No effect on fisheries	High protection level

Only four states have numeric criteria for TSS in the water column:

State	TSS mg/L
Nevada	25 & 80, for Upper and Lower reaches
New Jersey	25 - 40, for specific streams
South Dakota	30, maximum limit for cold water biota
West Virginia	30, maximum limit for receiving waters
Overall Conclusions	25, 25, 30, 30 = 27.5 mg/L mean for Upper Reaches 40, 80 = 60 mg/L mean for Lower Reaches & Receiving Streams

The practical range of protection for the Middle Snake River and its tributaries and irrigation return flows is somewhere between 25.0 and 80.0 mg/L TSS. A low level of 25.0 mg/L affords a high protection level, whereas a high level of 80.0 mg/L TSS affords the high range of moderate protection. The midrange "mean" is approximately 52.5 mg/L, or 52.0 mg/L as the midrange instream target. The criteria 52.0 mg/L TSS is midrange for moderate protection of fisheries with slightly reduced fisheries, and below the 60.0 mg/L for lower reaches and receiving streams when compared to other states.

SELECTION OF A SEDIMENT INSTREAM TARGET
(continued)

EIFAC (1965) has suggested that 80.0 mg/L was the upper limit associated with a "slight effect on production" and the lower limit associated with a "significant reduction in fisheries."

NAS (1973) recommended 80.0 mg/L as the maximum concentration of TSS for moderate protection of aquatic communities.

Therefore, based on these two suggested recommendations, 80.0 mg/L will be used as the maximum concentration not to be exceeded for protection of the aquatic community.

Relative to duration of exposure, the life stage of the aquatic organism needs to be considered. For example,

At 35.0 mg/L for 7 days duration the severity-of-ill-effect is 0 to 20% mortality of eggs and larvae of salmonids and nonsalmonids.
At 35.0 mg/L for 7 days duration the survival rates for larval smallmouth bass is less than 50% under laboratory conditions.
At 76.0 mg/L for 14 days duration the percent mortality is 20 to 40% for larval bluegill.
At 76.0 mg/L for 14 days duration the survival rates for larval bluegill is < 50%.

The selection of a duration target is based on the premise that the target would need to be protective over a duration equal to the maximum probable length of time for which an elevated TSS concentration would be sustained. This would rely on seasonal variation in flow regimes and land use practices to avoid having to select a duration that continues indefinitely, or even annually. Yet, it would be protective for a duration equal to the maximum probable length of time for which elevated TSS concentrations would be sustained.

In the Upper Snake Rock subbasin, and at Milner Dam, high flow conditions (as evaluated for the WY1984 such that Q > 7629 cfs, or the maximum value of MEAN Q) occur seasonally at two distinct times of the water year: (1) the first one begins at Day 13, or October 13, and runs through Day 131, or February 8, for a total of 118 days; and, (2) the second one begins Day 180, or March 28, and runs through Day 283, or July 9, or a total of 103 days. The TSS concentration on these days when compared to MEAN Q and Low Q is summarized in the following table.

	Fall/Winter Range of TSS Days 13 - 131	Spring/Summer Range of TSS Days 180 - 283
High Q, WY1984	16.5 - 22.2 = 19.4 mg/L	18.2 - 25.3 = 21.8 mg/L
MEAN Q	16.1 - 17.1 = 16.6 mg/L	15.2 - 18.4 = 16.8 mg/L
Low Q, WY1992	14.6 - 15.1 = 14.9 mg/L	14.4 - 14.5 = 14.5 mg/L

As can be seen, all instream values are < 52.0 mg/L TSS. Therefore, a protective but not overly conservative duration would be a third of each of the two hydrologic seasons: 118 days/3 = 39.3 days, and 103 days/3 = 34.3 days. Or, (118 + 103 days)/(3 + 3) = 36.8 days, or a little over a month. Thus, a month seems appropriate for maximum duration, or 30 days.

Therefore, 52.0 mg/L TSS is the instream target for a duration of 30 days (1 month).
Maximum daily value will be 80 mg/L TSS for protection of egg and larvae of salmonids and nonsalmonids.

SELECTION OF A SEDIMENT INSTREAM TARGET

Applying the 80 mg/L load capacity and the 52 mg/L instream target to various flow scenarios on the Middle Snake River is summarized as follows:

Flow data per stream segment from design flow study on the Middle Snake River:

Segment Site	Lo-Q cfs	Mean Q cfs	Hi-Q cfs
Milner Dam	366.0	3,860.0	9,432.0
Pillar Falls	1,146.0	4,737.0	10,644.0
Crystal Springs	1,852.0	5,498.0	11,404.0
Box Canyon	3,573.0	7,212.0	13,074.0
Gridley Bridge	5,429.0	9,113.0	15,124.0
Shoestring	6,674.0	11,108.0	17,598.0
King Hill	7,384.0	11,398.0	18,069.0

Expected load at Load Capacity (80 mg/L):

Segment Site	Lo-Q tons/year	Mean Q tons/year	Hi-Q tons/year
Milner Dam	28,802.0	303,758.8	742,241.8
Pillar Falls	90,183.3	372,773.5	837,618.9
Crystal Springs	145,741.3	432,659.6	897,426.4
Box Canyon	281,173.7	567,541.1	1,028,845.4
Gridley Bridge	427,229.7	717,138.4	1,190,168.1
Shoestring	525,203.8	874,133.0	1,384,857.0
King Hill	581,076.5	896,954.2	1,421,921.9

Expected load at Instream Target (52 mg/L):

Segment Site	Lo-Q tons/year	Mean Q tons/year	Hi-Q tons/year
Milner Dam	18,721.3	197,443.2	482,457.2
Pillar Falls	58,619.2	242,302.8	544,452.3
Crystal Springs	94,731.8	281,228.7	583,327.1
Box Canyon	182,762.9	368,901.7	668,749.5
Gridley Bridge	277,699.3	466,140.0	773,609.2
Shoestring	341,382.4	568,186.4	900,157.1
King Hill	377,699.7	583,020.2	924,249.2

Estimated Margin of Safety due to Instream Target below Load Capacity:

Segment Site	Lo-Q % Reduction	Mean Q % Reduction	Hi-Q % Reduction
Milner Dam	35.0	35.0	35.0
Pillar Falls	35.0	35.0	35.0
Crystal Springs	35.0	35.0	35.0
Box Canyon	35.0	35.0	35.0
Gridley Bridge	35.0	35.0	35.0
Shoestring	35.0	35.0	35.0
King Hill	35.0	35.0	35.0

II. ANALYSIS OF PARAMETER LOADS

mean loads in annual tons or tons/year

SELECTION OF A SEDIMENT INSTREAM TARGET

Average conditions are estimated based on sediment rating curves derived for each segment site based on actual water quality data collected over a 9 year period of record (1990-1998). These rating curves are summarized as follows:

Segment Site	TSS:Q Rating Equation	r^2	F-ratio	p value
Milner Dam	TSS = (0.000528 x Q) + 14.419982	0.334	30.8	0.000000
Pillar Falls	TSS = (0.000941 x Q) + 10.886472	0.726	229.6	0.000000
Crystal Springs	TSS = (0.001535 x Q) + 10.562829	0.637	203.6	0.000000
Box Canyon	TSS = (0.002026 x Q) + 11.292988	0.767	249.2	0.000000
Gridley Bridge	TSS = (0.002423 x Q) - 1.241410	0.871	639.3	0.000000
Shoestring	TSS = (0.003093 x Q) - 16.332292	0.916	739.5	0.000000
King Hill	TSS = (0.002899 x Q) - 6.247515	0.614	96.4	0.000000

The estimated existing condition for TSS concentration on a per-segment site basis is as follows:

Segment Site	Lo-Q TSS mg/L	Mean Q TSS mg/L	Hi-Q TSS mg/L
Milner Dam	14.6	16.5	19.4
Pillar Falls	12.0	15.3	20.9
Crystal Springs	13.4	19.0	28.1
Box Canyon	18.5	25.9	37.8
Gridley Bridge	11.9	20.8	35.4
Shoestring	4.3	18.0	38.1
King Hill	15.2	26.8	46.1

The estimated existing condition for TSS loads on a per-segment site basis is summarized as follows:

Segment Site	Lo-Q TSS mg/L	Mean Q TSS mg/L	Hi-Q TSS mg/L
Milner Dam	5,261.1	62,491.0	179,994.4
Pillar Falls	13,487.9	71,497.9	218,853.9
Crystal Springs	24,422.0	102,768.9	314,861.7
Box Canyon	65,133.5	183,773.4	485,883.9
Gridley Bridge	63,620.2	186,809.1	526,709.5
Shoestring	28,297.9	196,950.4	659,509.1
King Hill	110,104.6	300,426.8	819,996.0

Estimated % Load Reduction as compared to Expected Load as a result of Instream Target:

Segment Site	Lo-Q % Reduction	Mean Q % Reduction	Hi-Q % Reduction
Milner Dam	71.9	68.3	62.7
Pillar Falls	77.0	70.5	59.8
Crystal Springs	74.2	63.5	46.0
Box Canyon	64.4	50.2	27.3
Gridley Bridge	77.1	59.9	31.9
Shoestring	91.7	65.3	26.7
King Hill	70.8	48.5	11.3
OVERALL MEAN	75.3	60.9	38.0

III. ANALYSIS OF FLOWS
Q, mean flow in cfs

1. MONTH-TO-MONTH ANALYSIS (WY1990-19991)

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
MONTH	MD	PF	CS	BC	GB	SB	KH
10	182	1,352	2,252	4,173	6,158	9,056	8,959
11	994	1,896	2,696	4,406	6,334	8,314	8,638
12	1,016	1,749	2,506	4,142	6,044	7,851	8,286
1	1,111	1,854	2,588	4,202	6,085	7,756	8,441
2	711	1,366	2,075	3,696	5,576	7,182	7,799
3	89	703	1,417	3,029	4,887	6,452	7,121
4	7	667	1,393	3,041	4,935	6,633	7,237
5	6	869	1,626	3,396	5,300	7,015	7,464
6	7	992	1,767	3,607	5,490	7,255	7,392
7	414	1,314	2,071	3,845	5,642	7,068	7,348
8	412	1,427	2,209	4,036	5,868	7,606	8,010
9	159	1,431	2,290	4,226	6,175	8,331	8,894
MEAN	426	1,302	2,074	3,817	5,708	7,543	7,966 ←
SPRG/SUMM	156	995	1,747	3,492	5,354	7,005	7,429
FALL/WINT	696	1,608	2,401	4,141	6,062	8,082	8,503

2. SEASONAL QUARTERS ANALYSIS (WY1990-1991)

SEASON	MD	PF	CS	BC	GB	SB	KH
WINT (12,1,2)	946	1,656	2,390	4,013	5,902	7,596	8,175
SPRG (3,4,5)	34	746	1,479	3,155	5,041	6,700	7,274
SUMM (6,7,8)	278	1,244	2,016	3,829	5,667	7,310	7,583
FALL (9,10,11)	445	1,560	2,413	4,268	6,222	8,567	8,830
MEAN	426	1,302	2,074	3,817	5,708	7,543	7,966 ←
SPRG/SUMM	156	995	1,747	3,492	5,354	7,005	7,429
FALL/WINT	696	1,608	2,401	4,141	6,062	8,082	8,503

3. WY-TO-WY ANALYSIS

WY	MD	PF	CS	BC	GB	SB	KH	
1983	7,988	8,666	9,403	11,097	12,982	15,713	15,850	
1984	9,432	10,644	11,404	13,074	15,124	17,598	18,069	(High Q)
1985	6,470	7,519	8,339	10,082	11,989	14,186	14,207	
1986	6,925	7,900	8,759	10,522	12,440	15,041	15,464	
1987	3,439	4,431	5,309	7,058	8,949	10,793	11,023	
1988	528	1,385	2,230	3,952	5,832	7,521	7,680	
1989	498	1,363	2,116	3,861	5,743	7,525	7,875	
1990	462	1,338	2,111	3,837	5,730	7,724	8,004	
1991	388	1,265	2,038	3,798	5,687	7,366	7,929	
1992	366	1,146	1,852	3,573	5,429	6,674	7,384	(Low Q)
1993	1,017	1,842	2,524	4,209	6,083	7,590	8,299	
1994	1,508	2,329	2,997	4,689	6,558	7,970	8,149	
1995	1,740	2,628	3,329	5,036	6,917	8,547	8,906	
1996	5,360	6,247	6,950	8,593	10,483	12,467	12,625	
1997	9,296	10,011	10,789	12,517	14,444	17,203	16,922	
1998	6,325	7,069	7,816	9,494	11,416	13,826	13,989	
1990-1991	425	1,302	2,075	3,818	5,709	7,545	7,967 ←	
Low Q Mean	813	1,662	2,400	4,119	5,997	7,615	8,028	
High Q Mean	6,904	7,811	8,596	10,305	12,228	14,603	14,769	

TN:TP Ratios, mg/L:mg/L

TN:TP Ratio Analysis:

TN:TP >= 16, P is considered limiting to algal growth.

TN:TP < 10, N is considered limiting to algal growth

1. MONTH-TO-MONTH ANALYSIS:

TKN, mg/L:

MONTH	MD	PF	CS	BC	GB	SB	KH
1	0.27	0.18	0.26	0.41	0.43	0.37	0.31
2	0.34	0.18	0.25	0.41	0.41	0.38	0.31
3	0.69	0.31	0.45	0.43	0.46	0.40	0.31
4	0.49	0.40	0.33	0.43	0.44	0.41	0.35
5	0.34	0.29	0.36	0.45	0.46	0.40	0.32
6	0.34	0.30	0.38	0.50	0.52	0.47	0.42
7	0.36	0.26	0.30	0.40	0.40	0.36	0.30
8	0.48	0.26	0.31	0.41	0.45	0.38	0.32
9	0.44	0.27	0.33	0.40	0.37	0.39	0.36
10	0.43	0.25	0.29	0.40	0.39	0.39	0.32
11	0.46	0.31	0.34	0.45	0.42	0.38	0.29
12	0.37	0.24	0.26	0.43	0.42	0.35	0.31

NOX, mg/L:

MONTH	MD	PF	CS	BC	GB	SB	KH
1	0.844	1.325	1.529	1.598	1.248	1.026	1.389
2	0.615	1.333	1.444	1.439	1.173	0.970	1.321
3	0.589	1.268	1.643	1.299	1.088	0.905	1.188
4	0.266	1.289	1.314	1.255	1.007	0.856	1.144
5	0.168	1.038	1.151	1.213	0.954	0.899	1.156
6	0.182	0.845	1.238	1.027	0.775	0.802	1.032
7	0.209	1.108	1.277	1.455	1.207	1.032	1.286
8	0.151	1.161	1.501	1.547	1.260	1.041	1.333
9	0.209	1.244	1.511	1.550	1.284	1.009	1.276
10	0.373	1.57	1.919	1.698	1.420	1.007	1.377
11	0.701	1.304	1.755	1.613	1.333	1.021	1.428
12	0.669	1.298	1.569	1.593	1.295	1.053	1.410

TN = TKN + NOX

MONTH	MD	PF	CS	BC	GB	SB	KH
1	1.114	1.507	1.784	2.008	1.678	1.396	1.699
2	0.955	1.509	1.695	1.849	1.583	1.350	1.631
3	1.279	1.576	2.095	1.729	1.548	1.305	1.498
4	0.756	1.691	1.643	1.685	1.447	1.266	1.494
5	0.508	1.332	1.511	1.663	1.414	1.299	1.476
6	0.522	1.149	1.619	1.527	1.295	1.272	1.452
7	0.569	1.366	1.575	1.855	1.607	1.392	1.586
8	0.631	1.416	1.810	1.957	1.710	1.421	1.653
9	0.649	1.513	1.837	1.950	1.654	1.399	1.636
10	0.803	1.815	2.212	2.098	1.810	1.397	1.697
11	1.161	1.617	2.090	2.063	1.753	1.401	1.718
12	1.039	1.541	1.833	2.023	1.715	1.403	1.720

TN:TP Ratios, mg/L:mg/L

TP,mg/L:

MONTH	MD	PF	CS	BC	GB	SB	KH
1	0.126	0.155	0.141	0.112	0.097	0.086	0.082
2	0.109	0.148	0.140	0.113	0.101	0.089	0.088
3	0.184	0.129	0.148	0.115	0.105	0.090	0.090
4	0.113	0.132	0.135	0.110	0.099	0.094	0.091
5	0.071	0.122	0.129	0.116	0.101	0.088	0.085
6	0.080	0.111	0.148	0.123	0.128	0.118	0.122
7	0.086	0.120	0.137	0.105	0.083	0.080	0.074
8	0.109	0.140	0.142	0.108	0.083	0.082	0.072
9	0.135	0.137	0.136	0.110	0.091	0.085	0.100
10	0.132	0.137	0.142	0.102	0.083	0.083	0.074
11	0.169	0.149	0.159	0.109	0.087	0.080	0.073
12	0.136	0.149	0.140	0.117	0.106	0.078	0.079

TN:TP Ratio:

MONTH	MD	PF	CS	BC	GB	SB	KH
1	9	10	13	18	17	16	21
2	9	10	12	16	16	15	19
3	7	12	14	15	15	15	17
4	7	13	12	15	15	13	16
5	7	11	12	14	14	15	17
6	7	10	11	12	10	11	12
7	7	11	11	18	19	17	21
8	6	10	13	18	21	17	23
9	5	11	14	18	18	16	16
10	6	13	16	21	22	17	23
11	7	11	13	19	20	18	24
12	8	10	13	17	16	18	22
MEAN	7	11	13	17	17	16	19
SD-s	1.1	1.1	1.3	2.2	3.3	2.1	3.6
CV	0.17	0.10	0.10	0.13	0.20	0.13	0.19

2. SEASONAL QUARTERS ANALYSIS:

SEASON	MD	PF	CS	BC	GB	SB	KH
WINT	8	10	13	17	16	16	20
SPRG	7	12	13	15	14	14	17
SUMM	6	11	12	16	17	15	19
FALL	6	12	14	19	20	17	21
MEAN	7	11	13	17	17	16	19
SD-s	1.1	0.9	1.0	1.8	2.3	1.2	1.8
CV	0.16	0.08	0.08	0.11	0.14	0.08	0.10

3. WY-TO-WY ANALYSIS:

TKN, mg/L:

WY	MD	PF	CS	BC	GB	SB	KH
1990	0.27	0.22	0.12	0.40	0.44	0.35	0.27
1991	0.36	0.19	0.33	0.40	0.47	0.35	0.27
1992	0.51	0.11	0.29	0.39	0.41	0.34	0.29
1993	0.45	0.12	0.28	0.41	0.42	0.36	0.32
1994	0.33	0.12	0.23	0.40	0.42	0.35	0.30
1995	0.69	0.39	0.43	0.41	0.39	0.37	0.32
1996	0.33	0.34	0.40	0.45	0.42	0.41	0.34
1997	0.41	0.38	0.42	0.47	0.46	0.44	0.43
1998	0.29	0.20	0.22	0.45	0.44	0.40	0.36
1990-1991	0.32	0.21	0.22	0.40	0.46	0.35	0.27
1990-1995	0.44	0.19	0.28	0.40	0.43	0.35	0.30
1996-1998	0.34	0.31	0.35	0.46	0.44	0.42	0.38

NOX, mg/L:

WY	MD	PF	CS	BC	GB	SB	KH
1990	0.517	1.642	1.64	1.81	1.431	1.043	1.046
1991	0.535	1.660	1.990	1.807	1.344	1.045	1.289
1992	0.420	1.572	1.868	1.829	1.336	1.065	1.427
1993	0.432	1.511	1.439	1.747	1.250	1.018	1.379
1994	0.600	1.515	1.728	1.755	1.258	1.039	1.411
1995	0.413	1.230	1.500	1.471	1.239	1.002	1.371
1996	0.250	0.858	1.006	1.238	1.088	0.930	1.324
1997	0.269	0.685	0.728	0.984	0.813	0.859	0.969
1998	0.391	1.278	1.254	1.428	0.915	0.929	1.271
1990-1991	0.526	1.651	1.815	1.809	1.388	1.044	1.168
1990-1995	0.486	1.522	1.694	1.737	1.310	1.035	1.321
1996-1998	0.303	0.940	0.996	1.217	0.939	0.906	1.188

TN, mg/L:

WY	MD	PF	CS	BC	GB	SB	KH
1990	0.787	1.862	1.757	2.210	1.871	1.393	1.316
1991	0.895	1.850	2.321	2.207	1.814	1.395	1.559
1992	0.930	1.682	2.162	2.219	1.746	1.405	1.717
1993	0.882	1.631	1.717	2.157	1.670	1.378	1.699
1994	0.930	1.635	1.960	2.155	1.678	1.389	1.711
1995	1.103	1.620	1.926	1.881	1.629	1.372	1.691
1996	0.580	1.198	1.403	1.688	1.508	1.340	1.664
1997	0.679	1.065	1.147	1.454	1.273	1.299	1.399
1998	0.681	1.478	1.477	1.878	1.355	1.329	1.631
1990-1991	0.841	1.856	2.039	2.209	1.843	1.394	1.438
1990-1995	0.921	1.713	1.974	2.138	1.735	1.389	1.616
1996-1998	0.647	1.247	1.342	1.673	1.379	1.323	1.565

IV. TN:TP RATIOS AND LIMITING NUTRIENTS

TN:TP Ratios, mg/L:mg/L

TP, mg/L:

WY	MD	PF	CS	BC	GB	SB	KH
1990	0.190	0.132	0.145	0.107	0.086	0.074	0.073
1991	0.184	0.133	0.137	0.107	0.095	0.074	0.097
1992	0.264	0.191	0.147	0.107	0.086	0.070	0.064
1993	0.122	0.183	0.181	0.109	0.089	0.078	0.074
1994	0.129	0.182	0.133	0.109	0.089	0.074	0.067
1995	0.169	0.131	0.143	0.109	0.093	0.081	0.074
1996	0.080	0.113	0.130	0.113	0.102	0.093	0.081
1997	0.078	0.105	0.117	0.117	0.106	0.110	0.110
1998	0.100	0.152	0.136	0.119	0.102	0.090	0.088
1990-1991	0.187	0.133	0.141	0.107	0.091	0.074	0.085
1990-1995	0.176	0.159	0.148	0.108	0.090	0.075	0.075
1996-1998	0.086	0.123	0.128	0.116	0.103	0.098	0.093

TN:TP Ratio:

WY	MD	PF	CS	BC	GB	SB	KH
1990	4	14	12	21	22	19	18
1991	5	14	17	21	19	19	16
1992	4	9	15	21	20	20	27
1993	7	9	9	20	19	18	23
1994	7	9	15	20	19	19	26
1995	7	12	13	17	18	17	23
1996	7	11	11	15	15	14	21
1997	9	10	10	12	12	12	13
1998	7	10	11	16	13	15	19
1990-1991	4	14	14	21	20	19	17
1990-1995	5	11	13	20	19	18	22
1996-1998	8	10	11	14	13	14	17

CONCLUSIONS ON TN:TP RATIOS:

1. Month-to-month analysis indicates that ratios increase from upstream to downstream. Box Canyon area appears to have ratios > 16, whereas Pillar Falls and Crystal Springs areas have ratios > 10.

2. Seasonal Quarters Analysis indicates that ratios increase from upstream to downstream. Box Canyon area appears to have ratios > 16, whereas Pillar Falls and Crystal Springs areas have ratios > 10.

3. Year-to-year analysis indicates that ratios increase from upstream to downstream. Box Canyon area appears to have ratios > 16, whereas Pillar Falls and Crystal Springs areas have ratios > 10.

4. TP as a limiting nutrient appaears to increase from upstream to downstream.

MEAN	MD	PF	CS	BC	GB	SB	KH
Month-to-Month	7	11	13	17	17	16	19
Seasonal Quarters	7	11	13	17	17	16	19
WY-to-WY:							
WY1990-WY1991	4	14	14	21	20	19	17
WY1990-WY1995	5	11	13	20	19	18	22
WY1996-WY1998	8	10	11	14	13	14	17
Mean of All Values	6	11	13	18	17	17	19
TN:TP Range	4 to 8	10 to 14		13 to 22			
Mean of Range	6	$\bar{x}$ = 13		$\bar{x}$ = 18			

MD discharge has TP:TN ratios < 10, indicating that TN may be limiting other than TP. This discharge is affected by input sources coming from American Falls Reservoir and the Lake Walcott sub basin. It is highly unlikely that the Upper Snake Rock sub basin reduction goals will have any effect on MD unless the Lake Walcott sub basin reduction goals are developed and applied to the Milner Pool, which feeds the MD discharge into the Middle Snake River.

Growth-limiting Concentrations and Ratios of N and P

Many studies have identified N and P as the nutrients in short supply for benthic algal communities. Fewer studies have quantified the N and P concentrations that are growth-limiting. In studies of benthic algae, a range of ambient or cellular N:P ratios has been used as the transition between N and P limitation. Ambient N:P ratios > 20:1 are considered P-limited, < 10:1 N-limited, and between 10:1 and 20:1 the distinction is equivocal. Nutrient enrichment studies have corroborated that in broad terms these ratios represent transitions between N and P limitation. Nutrient ratios are useful for assessing limitation insofar as ambient concentrations are near growth-limiting levels. When nutrients are in excess, the supply ratio becomes irrelevant. Moreover, because the uptake rates of two nutrients may differ, the ambient ratio may not reflect the cellular ratio relevant to the physiological processes of growth. Hence, cellular ratios should be used when feasible. (Stevenson et al. 1996 [p 206]).

V. N VALUES
WY-to-WY, Month-to-month, Season-to-season

1. WY-TO-WY ANALYSIS

1990	MD	PF	CS	BC	GB	SB	KH
NH3	14	24	12	12	27	12	27
NOX	14	24	12	12	27	12	27
TKN	14	24	12	12	27	12	27
TP	14	24	12	12	27	12	27
SRP	14	24	12	12	27	12	27
TSS	14	24	12	12	27	12	27
Q	14	24	12	12	27	12	27

1991	MD	PF	CS	BC	GB	SB	KH
NH3	17	26	64	12	26	12	30
NOX	17	26	64	12	26	12	30
TKN	17	26	64	12	26	12	30
TP	17	26	64	12	26	12	30
SRP	17	26	64	12	26	12	30
TSS	17	26	64	12	26	12	30
Q	17	26	64	12	26	12	30

1992	MD	PF	CS	BC	GB	SB	KH
NH3	21	12	24	12	12	12	12
NOX	21	12	24	12	12	12	12
TKN	21	12	24	12	12	12	12
TP	21	12	24	12	12	12	12
SRP	21	12	24	12	12	12	12
TSS	21	12	24	12	12	12	12
Q	21	12	24	12	12	12	12

1993	MD	PF	CS	BC	GB	SB	KH
NH3	28	12	47	12	12	12	12
NOX	28	12	47	12	12	12	12
TKN	28	12	47	12	12	12	12
TP	28	12	47	12	12	12	12
SRP	28	12	47	12	12	12	12
TSS	28	12	47	12	12	12	12
Q	28	12	47	12	12	12	12

1994	MD	PF	CS	BC	GB	SB	KH
NH3	26	12	31	12	12	12	12
NOX	26	12	31	12	12	12	12
TKN	26	12	31	12	12	12	12
TP	26	12	31	12	12	12	12
SRP	26	12	31	12	12	12	12
TSS	26	12	31	12	12	12	12
Q	26	12	31	12	12	12	12

1995	MD	PF	CS	BC	GB	SB	KH
NH3	37	39	39	33	33	12	12
NOX	37	39	39	33	33	12	12
TKN	37	39	39	33	33	12	12
TP	37	39	39	33	33	12	12
SRP	37	39	39	33	33	12	12
TSS	37	39	39	33	33	12	12
Q	37	39	39	33	33	12	12

1996	MD	PF	CS	BC	GB	SB	KH
NH3	23	36	36	36	36	12	12
NOX	23	36	36	36	36	12	12
TKN	23	36	36	36	36	12	12
TP	23	36	36	36	36	12	12
SRP	23	36	36	36	36	12	12
TSS	23	36	36	36	36	12	12
Q	23	36	36	36	36	12	12

1997	MD	PF	CS	BC	GB	SB	KH
NH3	60	35	35	35	35	38	35
NOX	60	35	35	35	35	38	35
TKN	60	35	35	35	35	38	35
TP	60	35	35	35	35	38	35
SRP	60	35	35	35	35	38	35
TSS	60	35	35	35	35	38	35
Q	60	35	35	35	35	38	35

1998	MD	PF	CS	BC	GB	SB	KH
NH3	21	12	12	12	12	18	9
NOX	21	12	12	12	12	18	9
TKN	21	12	12	12	12	18	9
TP	21	12	12	12	12	18	9
SRP	21	12	12	12	12	18	9
TSS	21	12	12	12	12	18	9
Q	21	12	12	12	12	18	9

2. AVERAGE FOR LO-FLOW & HI-FLOW YEARS COMBINED

JAN		MD	PF	CS	BC	GB	SB	KH	JUN		MD	PF	CS	BC	GB	SB	KH
	NH3	18	13	15	11	13	6	12		NH3	21	17	34	15	17	6	13
	NOX	18	13	15	11	13	6	12		NOX	21	17	34	15	17	6	13
	TKN	18	13	15	11	13	6	12		TKN	21	17	34	15	17	6	13
	TP	18	13	15	11	13	6	12		TP	21	17	34	15	17	6	13
	SRP	18	13	15	11	13	6	12		SRP	21	17	34	15	17	6	13
	TSS	18	13	15	11	13	6	12		TSS	21	17	34	15	17	6	13
	Q	18	13	15	11	13	6	12		Q	21	17	34	15	17	6	13

FEB		MD	PF	CS	BC	GB	SB	KH	JUL		MD	PF	CS	BC	GB	SB	KH
	NH3	18	14	15	12	14	6	13		NH3	23	22	32	17	21	6	16
	NOX	18	14	15	12	14	6	13		NOX	23	22	32	17	21	6	16
	TKN	18	14	15	12	14	6	13		TKN	23	22	32	17	21	6	16
	TP	18	14	15	12	14	6	13		TP	23	22	32	17	21	6	16
	SRP	18	14	15	12	14	6	13		SRP	23	22	32	17	21	6	16
	TSS	18	14	15	12	14	6	13		TSS	23	22	32	17	21	6	16
	Q	18	14	15	12	14	6	13		Q	23	22	32	17	21	6	16

MAR		MD	PF	CS	BC	GB	SB	KH	AUG		MD	PF	CS	BC	GB	SB	KH
	NH3	29	18	26	16	18	6	15		NH3	20	17	34	15	21	6	14
	NOX	29	18	26	16	18	6	15		NOX	20	17	34	15	21	6	14
	TKN	29	18	26	16	18	6	15		TKN	20	17	34	15	21	6	14
	TP	29	18	26	16	18	6	15		TP	20	17	34	15	21	6	14
	SRP	29	18	26	16	18	6	15		SRP	20	17	34	15	21	6	14
	TSS	29	18	26	16	18	6	15		TSS	20	17	34	15	21	6	14
	Q	29	18	26	16	18	6	15		Q	20	17	34	15	21	6	14

APR		MD	PF	CS	BC	GB	SB	KH	SEP		MD	PF	CS	BC	GB	SB	KH
	NH3	21	24	24	16	18	6	14		NH3	22	17	19	15	17	6	14
	NOX	21	24	24	16	18	6	14		NOX	22	17	19	15	17	6	14
	TKN	21	24	24	16	18	6	14		TKN	22	17	19	15	17	6	14
	TP	21	24	24	16	18	6	14		TP	22	17	19	15	17	6	14
	SRP	21	24	24	16	18	6	14		SRP	22	17	19	15	17	6	14
	TSS	21	24	24	16	18	6	14		TSS	22	17	19	15	17	6	14
	Q	21	24	24	16	18	6	14		Q	22	17	19	15	17	6	14

MAY		MD	PF	CS	BC	GB	SB	KH	OCT		MD	PF	CS	BC	GB	SB	KH
	NH3	24	18	21	16	18	6	14		NH3	19	17	34	15	17	7	12
	NOX	24	18	21	16	18	6	14		NOX	19	17	34	15	17	7	12
	TKN	24	18	21	16	18	6	14		TKN	19	17	34	15	17	7	12
	TP	24	18	21	16	18	6	14		TP	19	17	34	15	17	7	12
	SRP	24	18	21	16	18	6	14		SRP	19	17	34	15	17	7	12
	TSS	24	18	21	16	18	6	14		TSS	19	17	34	15	17	7	12
	Q	24	18	21	16	18	6	14		Q	19	17	34	15	17	7	12

V. N VALUES

WY-to-WY, Month-to-month, Season-to-season

NOV		MD	PF	CS	BC	GB	SB	KH
	NH3	17	16	28	14	15	7	12
	NOX	17	16	28	14	15	7	12
	TKN	17	16	28	14	15	7	12
	TP	17	16	28	14	15	7	12
	SRP	17	16	28	14	15	7	12
	TSS	17	16	28	14	15	7	12
	Q	17	16	28	14	15	7	12

DEC		MD	PF	CS	BC	GB	SB	KH
	NH3	15	15	18	14	16	7	12
	NOX	15	15	18	14	16	7	12
	TKN	15	15	18	14	16	7	12
	TP	15	15	18	14	16	7	12
	SRP	15	15	18	14	16	7	12
	TSS	15	15	18	14	16	7	12
	Q	15	15	18	14	16	7	12

3. SEASONAL QUARTERS ANALYSIS

WINT (MONTHS 1, 2, 12):

	MD	PF	CS	BC	GB	SB	KH
NH3	51	42	48	37	43	19	37
NOX	51	42	48	37	43	19	37
TKN	51	42	48	37	43	19	37
TP	51	42	48	37	43	19	37
SRP	51	42	48	37	43	19	37
TSS	51	42	48	37	43	19	37
Q	51	42	48	37	43	19	37

SPRG (MONTHS 3, 4, 5):

	MD	PF	CS	BC	GB	SB	KH
NH3	74	60	71	48	54	18	43
NOX	74	60	71	48	54	18	43
TKN	74	60	71	48	54	18	43
TP	74	60	71	48	54	18	43
SRP	74	60	71	48	54	18	43
TSS	74	60	71	48	54	18	43
Q	74	60	71	48	54	18	43

SUMM (MONTHS 6, 7, 8):

	MD	PF	CS	BC	GB	SB	KH
NH3	64	56	100	47	59	18	43
NOX	64	56	100	47	59	18	43
TKN	64	56	100	47	59	18	43
TP	64	56	100	47	59	18	43
SRP	64	56	100	47	59	18	43
TSS	64	56	100	47	59	18	43
Q	64	56	100	47	59	18	43

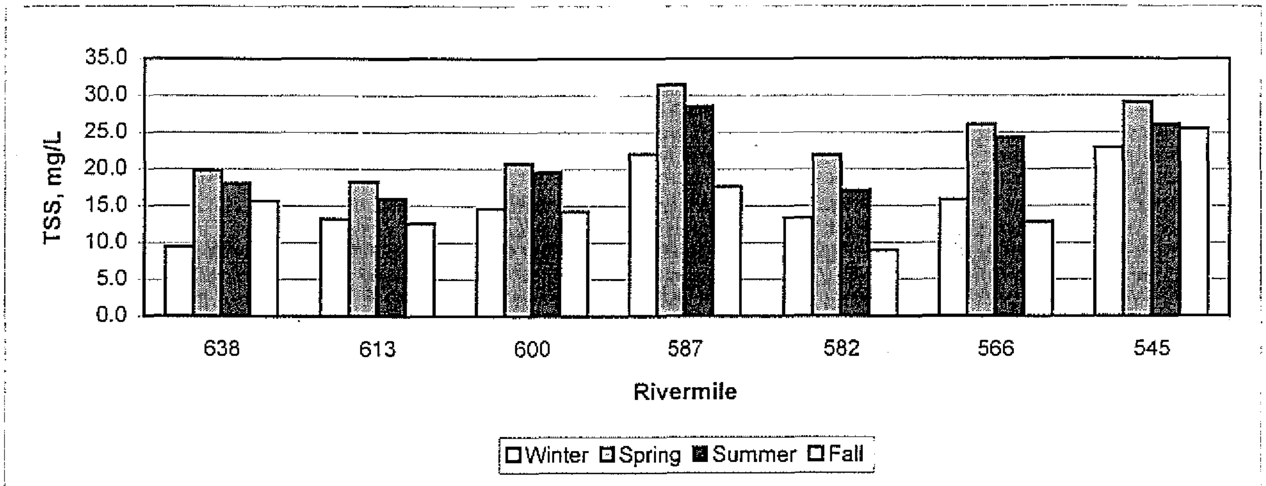
FALL (MONTHS 9, 10, 11):

	MD	PF	CS	BC	GB	SB	KH
NH3	58	50	81	44	49	20	38
NOX	58	50	81	44	49	20	38
TKN	58	50	81	44	49	20	38
TP	58	50	81	44	49	20	38
SRP	58	50	81	44	49	20	38
TSS	58	50	81	44	49	20	38
Q	58	50	81	44	49	20	38

VI. SEASONALITY GRAPHS OF INDICATED PARAMETERS PER SEGMENT
Concentration (mg/L), Q, Load (tons/year)

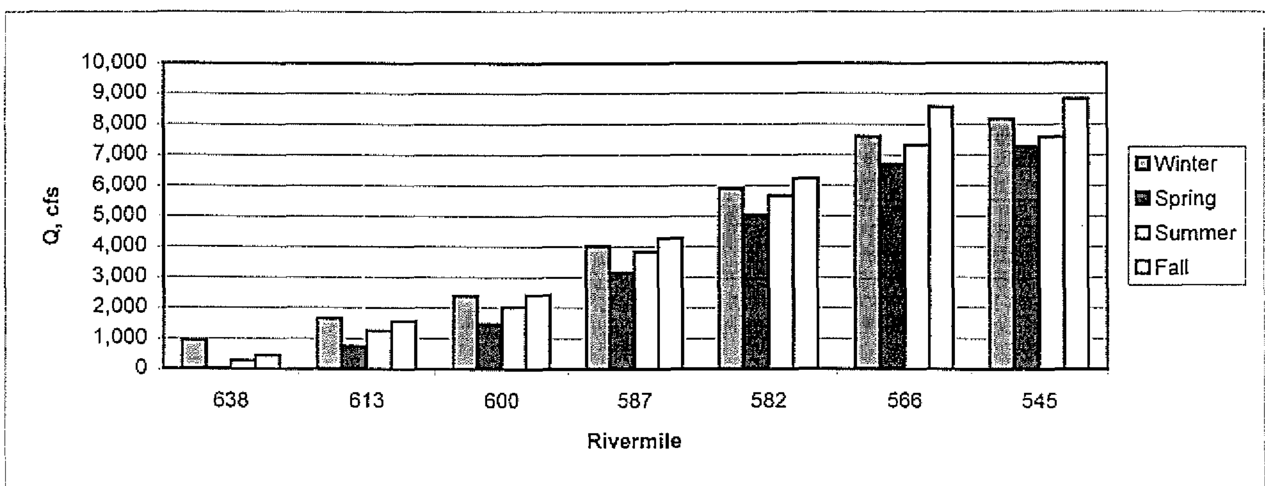
TSS, mg/L (WY1990-1998):

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
WINT (12,1,2)	9.5	13.2	14.6	22.0	13.3	15.8	22.9
SPRG (3,4,5)	19.8	18.3	20.7	31.5	21.9	26.1	29.2
SUMM (6,7,8)	18.1	16.0	19.6	28.6	17.1	24.3	26.1
FALL (9,10,11)	15.6	12.6	14.2	17.6	8.9	12.8	25.5
SPRG/SUMM	19.0	17.1	20.2	30.1	19.5	25.2	27.7
FALL/WINT	12.6	12.9	14.4	19.8	11.1	14.3	24.2



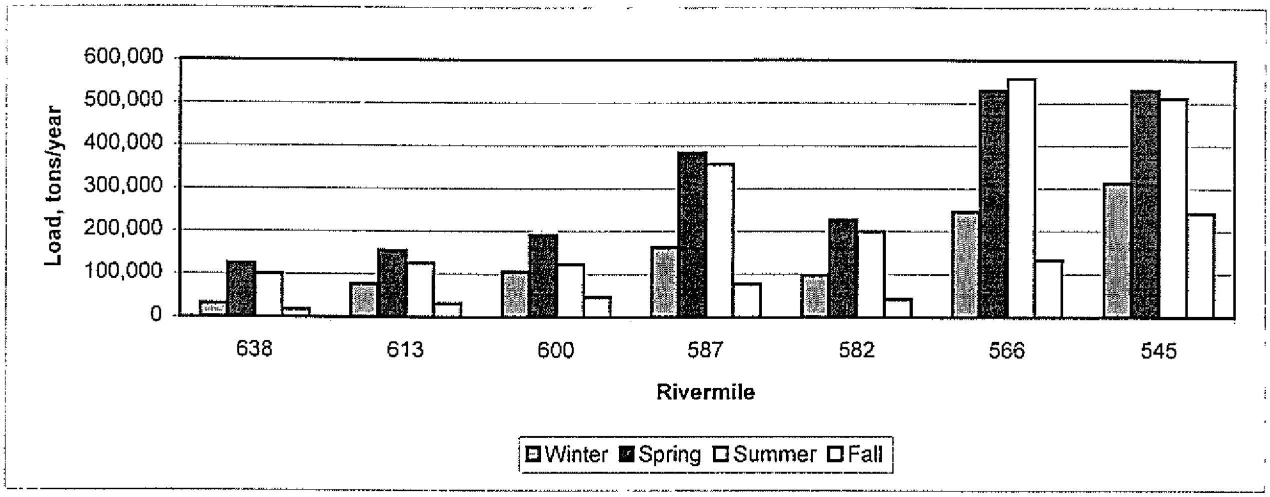
TSS, Q (WY1990-1991):

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
WINT (12,1,2)	946	1,656	2,390	4,013	5,902	7,596	8,175
SPRG (3,4,5)	34	746	1,479	3,155	5,041	6,700	7,274
SUMM (6,7,8)	278	1,244	2,016	3,829	5,667	7,310	7,583
FALL (9,10,11)	445	1,560	2,413	4,268	6,222	8,567	8,830
SPRG/SUMM	156	995	1,747	3,492	5,354	7,005	7,429
FALL/WINT	696	1,608	2,401	4,141	6,062	8,082	8,503



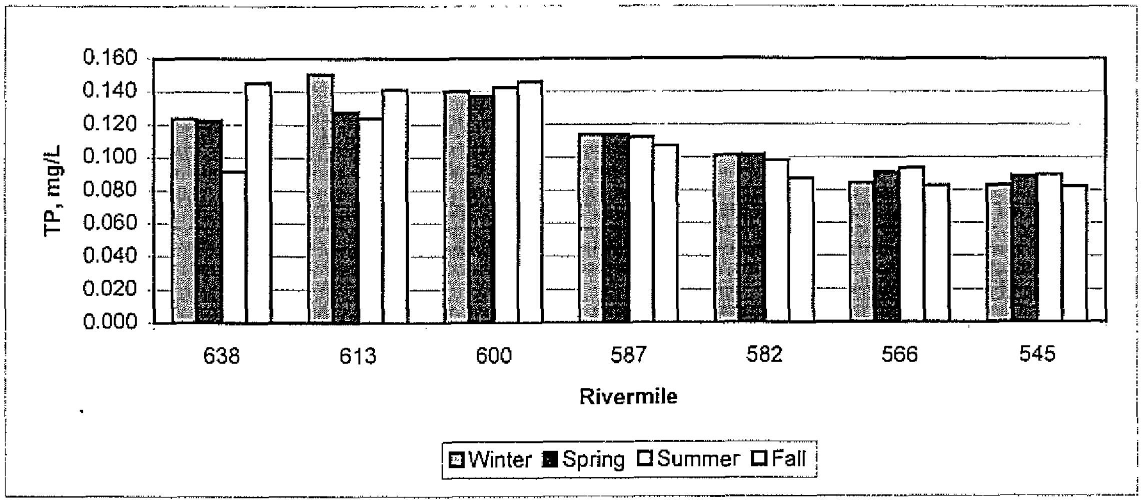
TSS, tons/year (WY1990-1991):

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
WINT (12,1,2)	30,961.9	77,435.3	106,379.0	163,070.1	97,998.1	246,528.2	312,123.7
SPRG (3,4,5)	125,574.5	154,805.1	191,188.6	382,954.8	227,262.3	530,201.5	529,736.2
SUMM (6,7,8)	100,076.0	125,208.6	123,461.9	355,850.9	199,277.0	557,407.1	511,650.4
FALL (9,10,11)	17,957.5	30,982.1	45,975.5	77,251.9	41,541.3	132,884.1	242,634.9
SPRG/SUMM	112,825.3	140,006.9	157,325.3	369,402.9	213,269.7	543,804.3	520,693.3
FALL/WINT	24,459.7	54,208.7	76,177.3	120,161.0	69,769.7	189,706.1	277,379.3



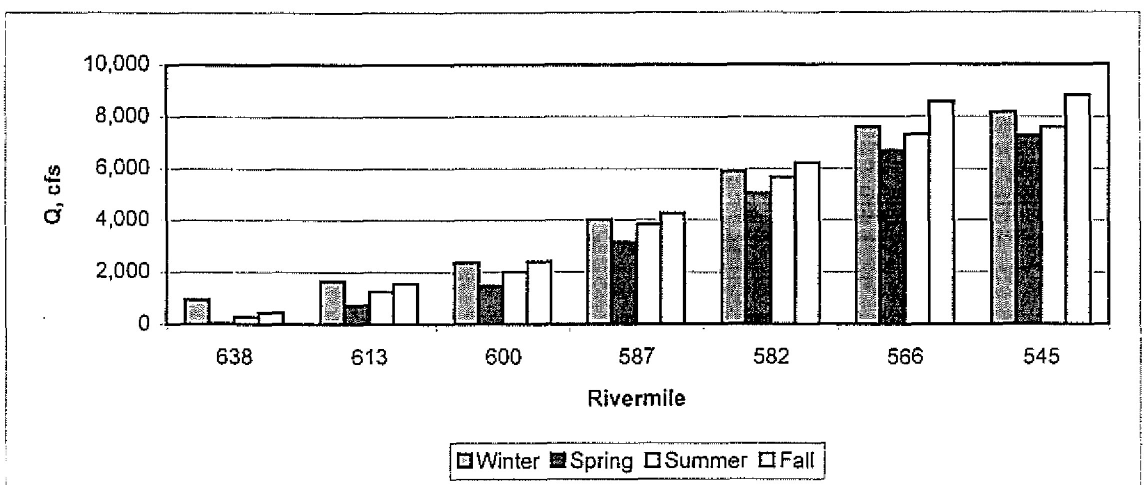
TP, mg/L (WY1990-1998):

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
WINT (12,1,2)	0.124	0.151	0.140	0.114	0.101	0.084	0.083
SPRG (3,4,5)	0.123	0.128	0.137	0.114	0.102	0.091	0.089
SUMM (6,7,8)	0.092	0.124	0.142	0.112	0.098	0.093	0.089
FALL (9,10,11)	0.145	0.141	0.146	0.107	0.087	0.083	0.082
SPRG/SUMM	0.107	0.126	0.140	0.113	0.100	0.092	0.089
FALL/WINT	0.135	0.146	0.143	0.111	0.094	0.084	0.083



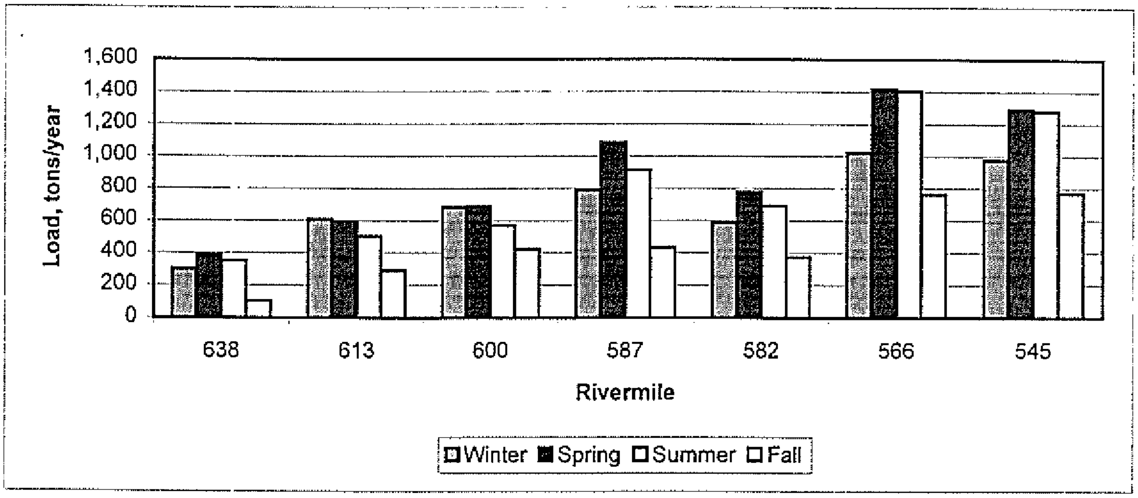
TP, Q (WY1990-1991):

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
WINT (12,1,2)	946	1,656	2,390	4,013	5,902	7,596	8,175
SPRG (3,4,5)	34	746	1,479	3,155	5,041	6,700	7,274
SUMM (6,7,8)	278	1,244	2,016	3,829	5,667	7,310	7,583
FALL (9,10,11)	445	1,560	2,413	4,268	6,222	8,567	8,830
SPRG/SUMM	156	995	1,747	3,492	5,354	7,005	7,429
FALL/WINT	696	1,608	2,401	4,141	6,062	8,082	8,503



TP, tons/year (WY1990-1991):

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
WINT (12,1,2)	301.7	605.1	680.5	789.4	589.6	1021.9	975.6
SPRG (3,4,5)	386.4	593.9	687.5	1083.1	776.7	1415.9	1291.3
SUMM (6,7,8)	347.7	501.7	568.1	913.1	691.6	1403.5	1279.2
FALL (9,10,11)	103.0	291.5	423.7	432.8	371.4	761.9	768.8
SPRG/SUMM	367.1	547.8	627.8	998.1	734.2	1409.7	1285.3
FALL/WINT	202.3	448.3	552.1	611.1	480.5	891.9	872.2

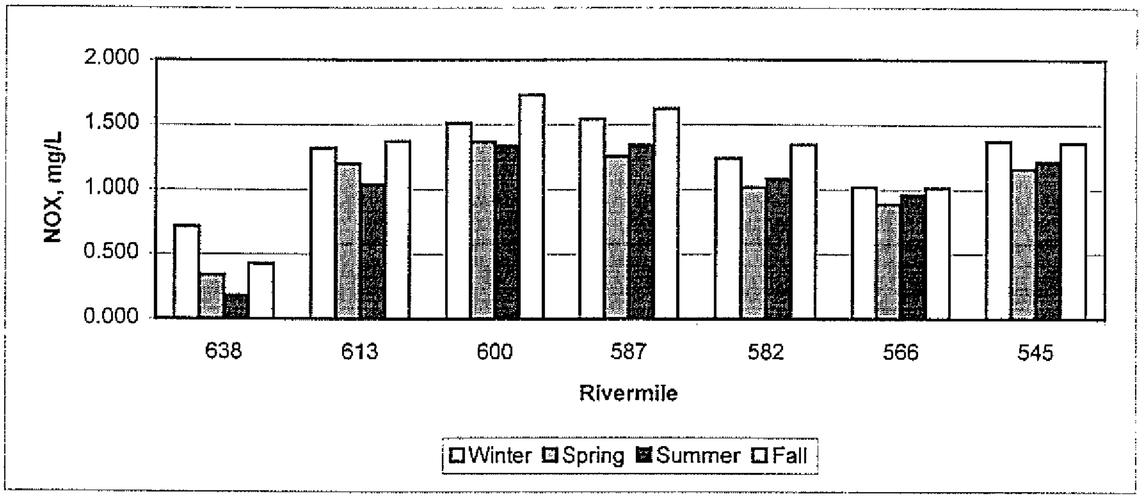


VI. SEASONALITY GRAPHS OF INDICATED PARAMETERS PER SEGMENT

Concentration (mg/L), Q, Load (tons/year)

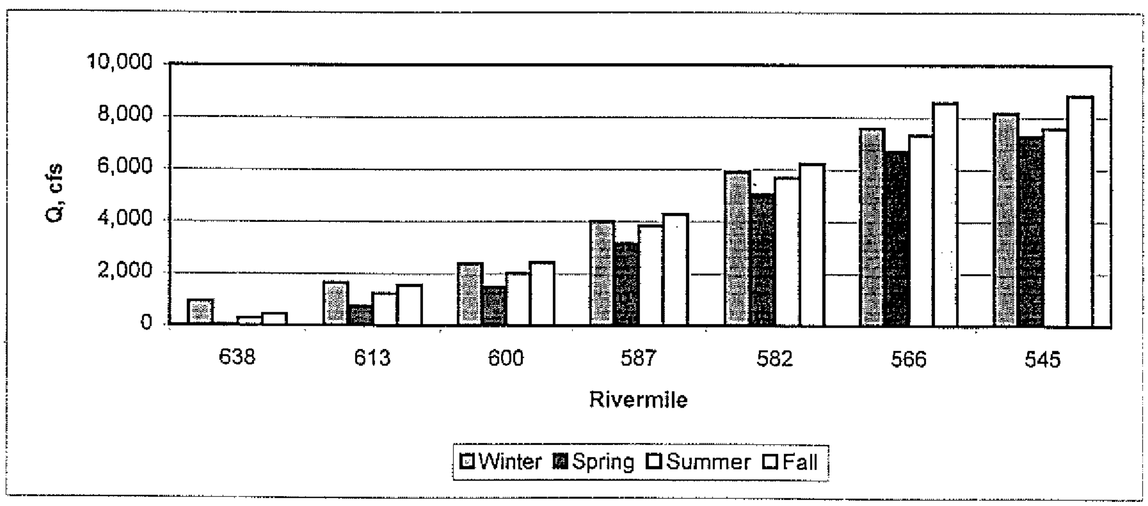
NOX, mg/L (WY1990-1998):

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
WINT (12,1,2)	0.709	1.319	1.514	1.543	1.239	1.016	1.373
SPRG (3,4,5)	0.341	1.198	1.369	1.256	1.016	0.887	1.163
SUMM (6,7,8)	0.181	1.038	1.339	1.343	1.081	0.958	1.217
FALL (9,10,11)	0.428	1.373	1.728	1.620	1.346	1.012	1.360
SPRG/SUMM	0.261	1.118	1.354	1.299	1.049	0.923	1.190
FALL/WINT	0.569	1.346	1.621	1.582	1.292	1.014	1.367



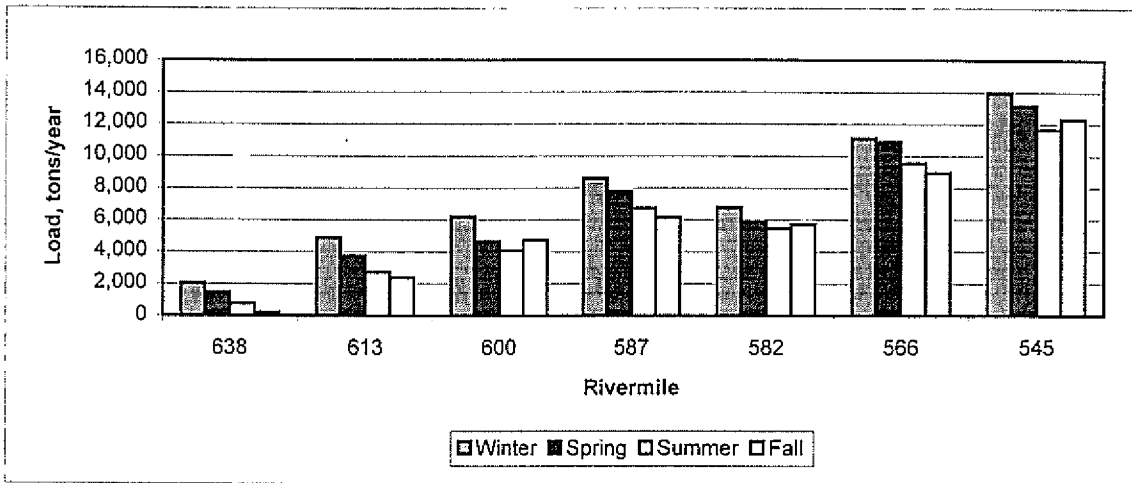
NOX, Q:

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
WINT (12,1,2)	946	1,656	2,390	4,013	5,902	7,596	8,175
SPRG (3,4,5)	34	746	1,479	3,155	5,041	6,700	7,274
SUMM (6,7,8)	278	1,244	2,016	3,829	5,667	7,310	7,583
FALL (9,10,11)	445	1,560	2,413	4,268	6,222	8,567	8,830
SPRG/SUMM	156	995	1,747	3,492	5,354	7,005	7,429
FALL/WINT	696	1,608	2,401	4,141	6,062	8,082	8,503



NOX, tons/year:

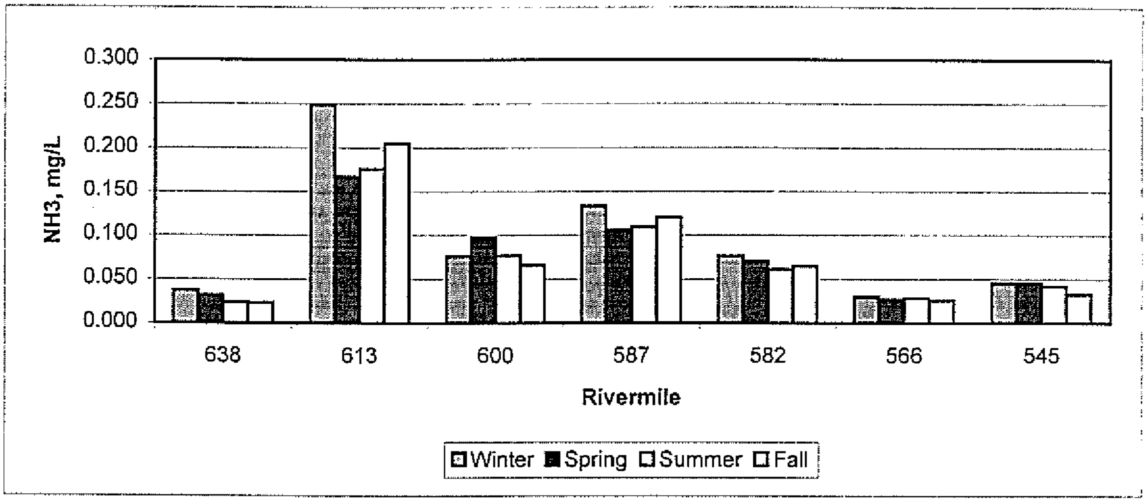
Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
WINT (12,1,2)	2,035.5	4,908.5	6,201.4	8,620.5	6,773.0	11,091.0	13,968.0
SPRG (3,4,5)	1,459.2	3,740.0	4,663.0	7,785.4	5,895.7	10,876.4	13,128.4
SUMM (6,7,8)	770.0	2,720.8	4,083.7	6,733.5	5,457.6	9,552.9	11,646.5
FALL (9,10,11)	228.4	2,377.3	4,735.2	6,138.0	5,736.0	8,941.8	12,292.7
SPRG/SUMM	1,114.6	3,230.4	4,373.3	7,259.5	5,676.7	10,214.7	12,387.5
FALL/WINT	1,131.9	3,642.9	5,468.3	7,379.3	6,254.5	10,016.4	13,130.4



VI. SEASONALITY GRAPHS OF INDICATED PARAMETERS PER SEGMENT
Concentration (mg/L), Q, Load (tons/year)

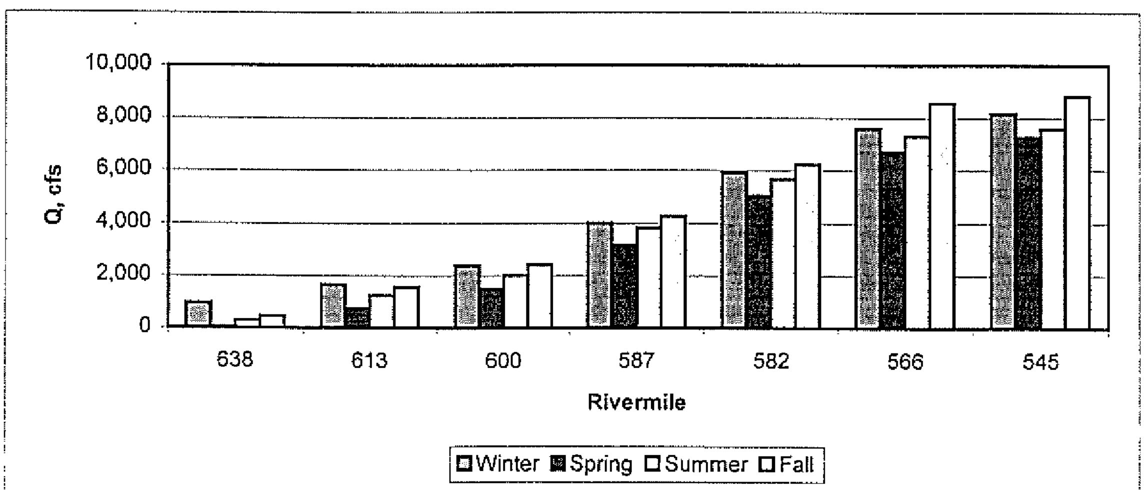
NH3, mg/L (WY1990-1998):

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
WINT (12,1,2)	0.037	0.249	0.076	0.133	0.076	0.030	0.046
SPRG (3,4,5)	0.032	0.167	0.097	0.106	0.070	0.027	0.045
SUMM (6,7,8)	0.024	0.175	0.077	0.109	0.061	0.028	0.042
FALL (9,10,11)	0.023	0.205	0.066	0.120	0.065	0.026	0.033
SPRG/SUMM	0.028	0.171	0.087	0.108	0.066	0.028	0.044
FALL/WINT	0.030	0.227	0.071	0.127	0.071	0.028	0.039



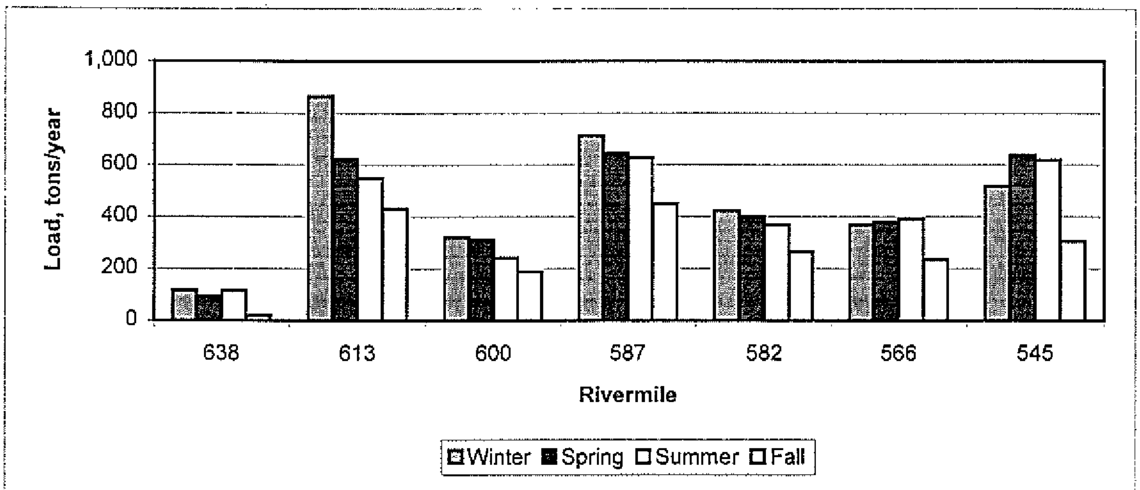
NH3, Q:

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
WINT (12,1,2)	946	1,656	2,390	4,013	5,902	7,596	8,175
SPRG (3,4,5)	34	746	1,479	3,155	5,041	6,700	7,274
SUMM (6,7,8)	278	1,244	2,016	3,829	5,667	7,310	7,583
FALL (9,10,11)	445	1,560	2,413	4,268	6,222	8,567	8,830
SPRG/SUMM	156	995	1,747	3,492	5,354	7,005	7,429
FALL/WINT	696	1,608	2,401	4,141	6,062	8,082	8,503



NH3, tons/year:

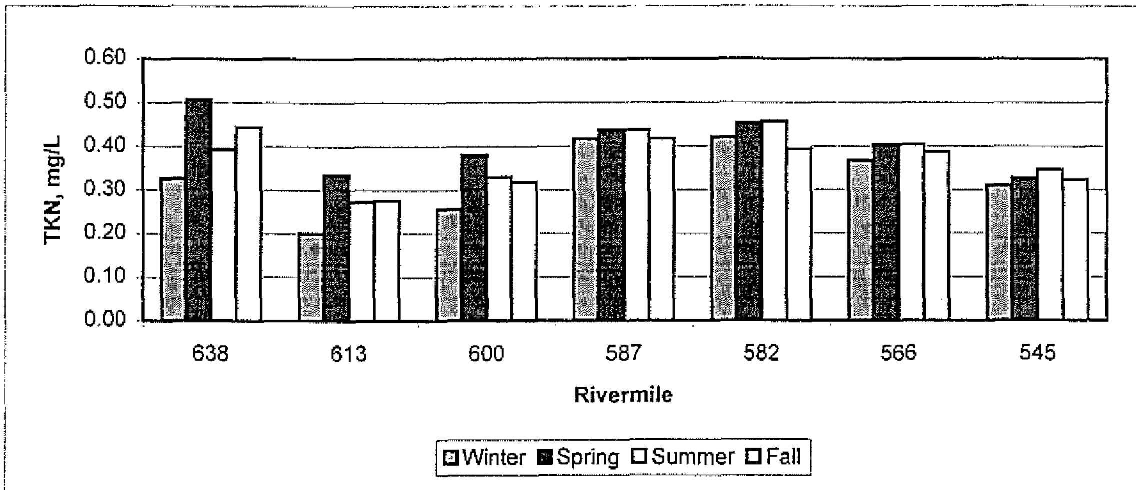
Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
WINT (12,1,2)	117.1	863.9	321.4	713.0	423.2	368.7	516.6
SPRG (3,4,5)	94.0	619.9	311.8	645.2	401.0	381.0	638.2
SUMM (6,7,8)	115.5	547.3	241.5	626.4	368.5	390.9	618.1
FALL (9,10,11)	19.1	430.0	188.4	448.8	265.8	234.5	306.0
SPRG/SUMM	104.8	583.6	276.7	635.8	384.8	386.0	628.2
FALL/WINT	68.1	647.0	254.9	580.9	344.5	301.6	411.3



VI. SEASONALITY GRAPHS OF INDICATED PARAMETERS PER SEGMENT
Concentration (mg/L), Q, Load (tons/year)

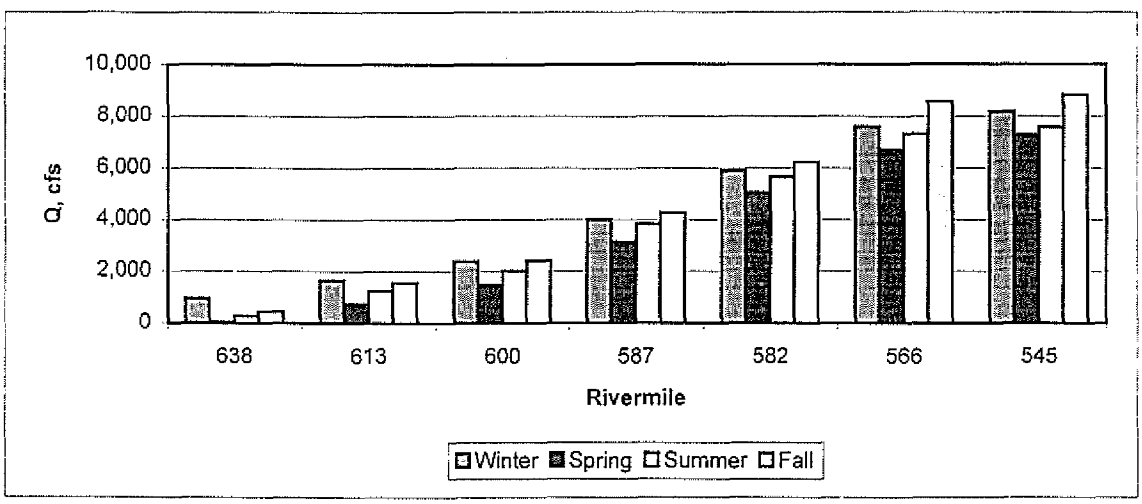
TKN, mg/L (WY1990-1998):

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
WINT (12,1,2)	0.33	0.20	0.26	0.42	0.42	0.37	0.31
SPRG (3,4,5)	0.51	0.33	0.38	0.44	0.45	0.40	0.33
SUMM (6,7,8)	0.39	0.27	0.33	0.44	0.46	0.40	0.35
FALL (9,10,11)	0.44	0.28	0.32	0.42	0.39	0.39	0.32
SPRG/SUMM	0.45	0.30	0.35	0.44	0.46	0.40	0.34
FALL/WINT	0.39	0.24	0.29	0.42	0.41	0.38	0.32



TKN, Q:

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
WINT (12,1,2)	946	1,656	2,390	4,013	5,902	7,596	8,175
SPRG (3,4,5)	34	746	1,479	3,155	5,041	6,700	7,274
SUMM (6,7,8)	278	1,244	2,016	3,829	5,667	7,310	7,583
FALL (9,10,11)	445	1,560	2,413	4,268	6,222	8,567	8,830
SPRG/SUMM	156	995	1,747	3,492	5,354	7,005	7,429
FALL/WINT	696	1,608	2,401	4,141	6,062	8,082	8,503

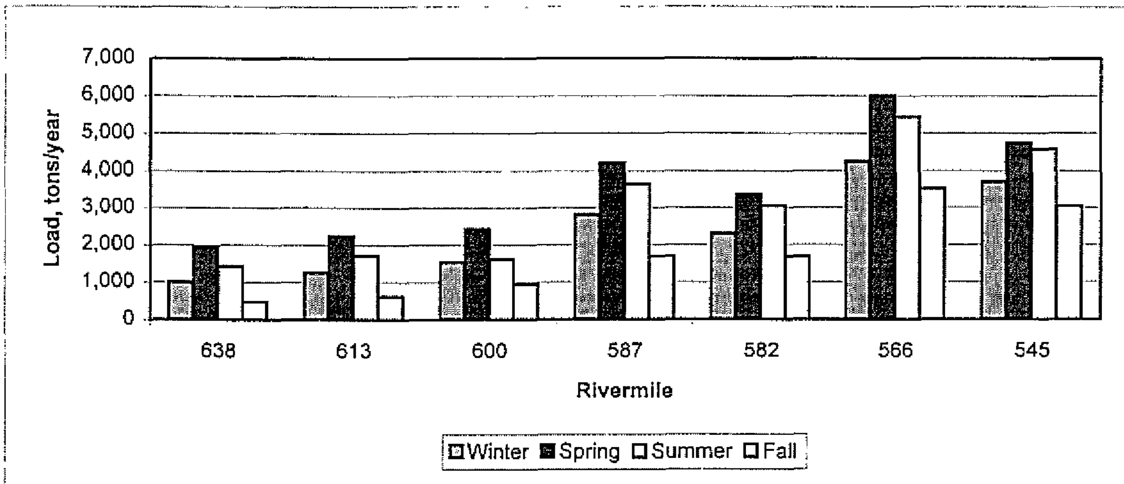


VI. SEASONALITY GRAPHS OF INDICATED PARAMETERS PER SEGMENT

Concentration (mg/L), Q, Load (tons/year)

TKN, tons/year:

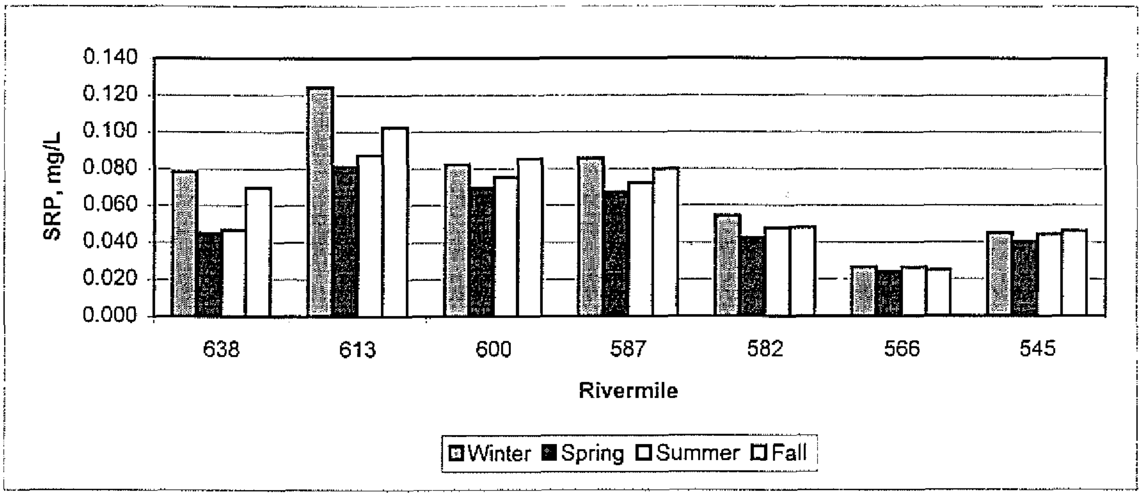
Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
WINT (12,1,2)	1,008.4	1,263.2	1,541.3	2,816.3	2,312.7	4,248.4	3,697.1
SPRG (3,4,5)	1,948.9	2,236.4	2,432.7	4,197.8	3,363.6	6,004.6	4,740.1
SUMM (6,7,8)	1,428.3	1,707.8	1,619.4	3,630.6	3,042.5	5,444.5	4,582.3
FALL (9,10,11)	479.9	625.0	948.2	1,698.4	1,690.0	3,509.5	3,037.8
SPRG/SUMM	1,688.6	1,972.1	2,026.1	3,914.2	3,203.0	5,724.6	4,661.2
FALL/WINT	744.2	944.1	1,244.8	2,257.4	2,001.4	3,879.0	3,367.5



VI. SEASONALITY GRAPHS OF INDICATED PARAMETERS PER SEGMENT
Concentration (mg/L), Q, Load (tons/year)

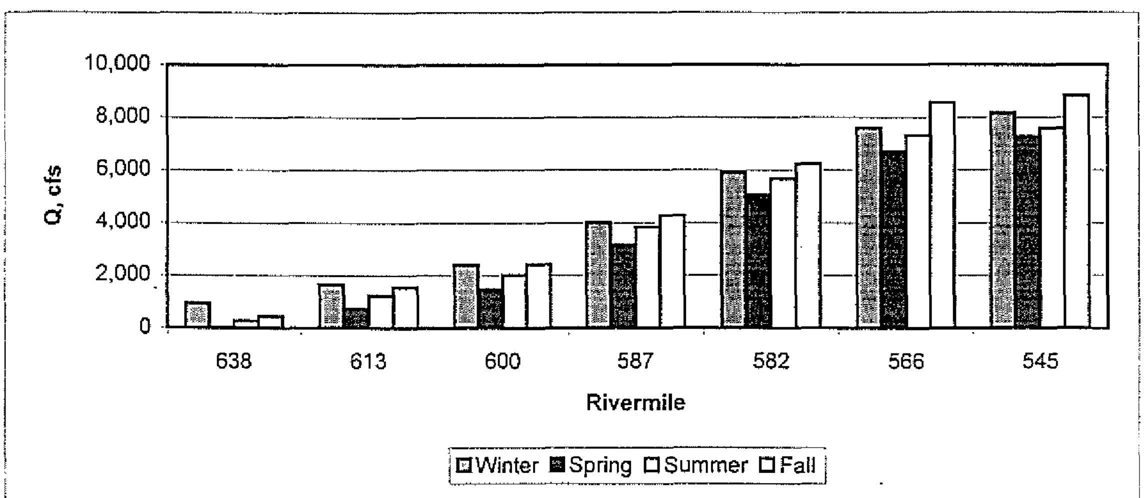
SRP, mg/L (WY1990-1998)

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
WINT (12,1,2)	0.078	0.124	0.082	0.086	0.054	0.027	0.045
SPRG (3,4,5)	0.045	0.081	0.070	0.067	0.042	0.024	0.040
SUMM (6,7,8)	0.047	0.087	0.075	0.072	0.048	0.026	0.044
FALL (9,10,11)	0.070	0.102	0.085	0.080	0.048	0.025	0.046
SPRG/SUMM	0.046	0.084	0.073	0.070	0.045	0.025	0.042
FALL/WINT	0.074	0.113	0.084	0.083	0.051	0.026	0.046



SRP, Q:

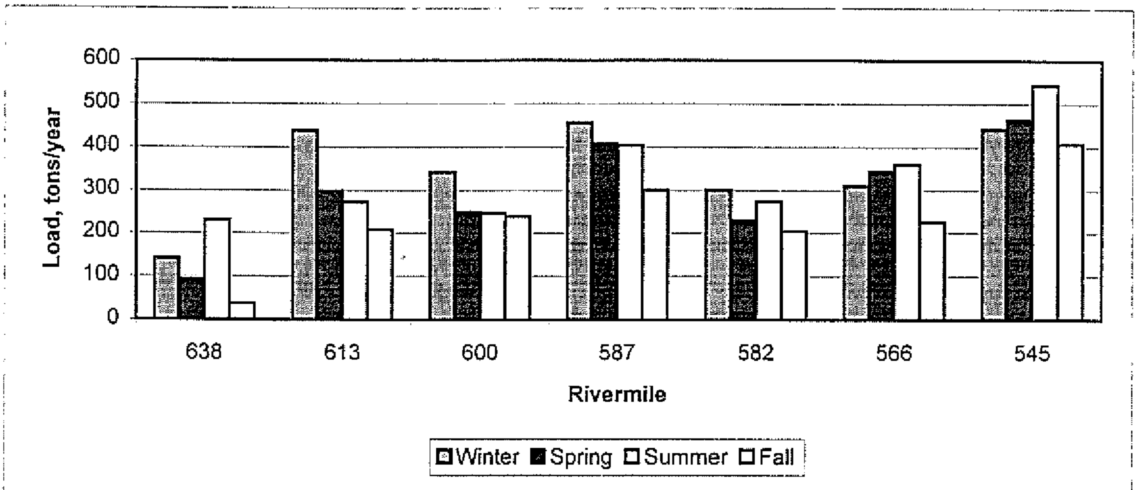
Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
WINT (12,1,2)	946	1,656	2,390	4,013	5,902	7,596	8,175
SPRG (3,4,5)	34	746	1,479	3,155	5,041	6,700	7,274
SUMM (6,7,8)	278	1,244	2,016	3,829	5,667	7,310	7,583
FALL (9,10,11)	445	1,560	2,413	4,268	6,222	8,567	8,830
SPRG/SUMM	156	995	1,747	3,492	5,354	7,005	7,429
FALL/WINT	696	1,608	2,401	4,141	6,062	8,082	8,503



VI. SEASONALITY GRAPHS OF INDICATED PARAMETERS PER SEGMENT
Concentration (mg/L), Q, Load (tons/year)

SRP, tons/year:

Rivermile:	638.00	613.09	600.40	587.00	582.00	565.75	545.00
WINT (12,1,2)	142.3	438.9	341.5	456.4	300.7	309.6	441.4
SPRG (3,4,5)	92.6	298.3	248.5	407.6	228.9	343.5	463.0
SUMM (6,7,8)	230.6	271.7	245.5	403.8	273.1	360.3	543.6
FALL (9,10,11)	37.3	207.3	238.3	300.4	204.0	225.3	406.9
SPRG/SUMM	161.6	285.0	247.0	405.7	251.0	351.9	503.3
FALL/WINT	89.8	323.1	289.9	378.4	252.4	267.5	424.2



SUMMARY ANALYSIS: PAIRED t-TEST TO ASCERTAIN DIFFERENCES BETWEEN SEASONS WITHIN EACH LOCATION SITE

(1) Q, cfs (for all parameters):

Rivermile:	638	613	600	587	582	566	545
WINT (12,1,2)	946	1,656	2,390	4,013	5,902	7,596	8,175
SPRG (3,4,5)	34	746	1,479	3,155	5,041	6,700	7,274
SUMM (6,7,8)	278	1,244	2,016	3,829	5,667	7,310	7,583
FALL (9,10,11)	445	1,560	2,413	4,268	6,222	8,567	8,830

t-Test Results:	638	613	600	587	582	566	545
WINT (12,1,2)	ac	a	a	a	a	a	a
SPRG (3,4,5)	b	b	ab	ab	b	ab	ab
SUMM (6,7,8)	bc	ac	c	ac	ac	ab	ac
FALL (9,10,11)	d	d	cd	cd	ad	d	cd

(2A) TSS, mg/L:

Rivermile:	638	613	600	587	582	566	545
WINT (12,1,2)	9.5	13.2	14.6	22.0	13.3	15.8	22.9
SPRG (3,4,5)	19.8	18.3	20.7	31.5	21.9	26.1	29.2
SUMM (6,7,8)	18.1	16.0	19.6	28.6	17.1	24.3	26.1
FALL (9,10,11)	15.6	12.6	14.2	17.6	8.9	12.8	25.5

t-Test Results:	638	613	600	587	582	566	545
WINT (12,1,2)	a	a	a	a	a	a	a
SPRG (3,4,5)	b	b	ab	b	b	b	abd
SUMM (6,7,8)	b	ab	ab	ab	b	ab	abc
FALL (9,10,11)	ad	ad	d	ad	abd	abd	acd

(2B) TSS Load, tons/year:

Rivermile:	638	613	600	587	582	566	545
WINT (12,1,2)	30,961.9	77,435.3	106,379.0	163,070.1	97,998.1	246,528.2	312,123.7
SPRG (3,4,5)	125,574.5	154,805.1	191,188.6	382,954.8	227,262.3	530,201.5	529,736.1
SUMM (6,7,8)	100,076.0	125,208.6	123,461.9	355,850.9	199,277.0	557,407.1	511,650.4
FALL (9,10,11)	17,957.5	30,982.1	45,975.5	77,251.9	41,541.3	132,884.1	242,634.9

t-Test Results:	638	613	600	587	582	566	545
WINT (12,1,2)	a	a	a	a	a	ad	ac
SPRG (3,4,5)	b	b	ab	b	b	b	abd
SUMM (6,7,8)	b	ab	ab	ab	bc	abd	bc
FALL (9,10,11)	ad	ad	d	ad	acd	d	cd

VI. SEASONALITY GRAPHS OF INDICATED PARAMETERS PER SEGMENT
Concentration (mg/L), Q, Load (tons/year)

(3A) TP, mg/L:

Rivermile:	638	613	600	587	582	566	545
WINT (12,1,2)	0.124	0.151	0.140	0.114	0.101	0.084	0.083
SPRG (3,4,5)	0.123	0.128	0.137	0.114	0.102	0.091	0.089
SUMM (6,7,8)	0.092	0.124	0.142	0.112	0.098	0.093	0.089
FALL (9,10,11)	0.145	0.141	0.146	0.107	0.087	0.083	0.082

t-Test Results:	638	613	600	587	582	566	545
WINT (12,1,2)	a	ac	a	a	a	b	a
SPRG (3,4,5)	ab	abd	bd	b	b	b	ab
SUMM (6,7,8)	bc	bc	bc	b	b	b	bd
FALL (9,10,11)	abc	cd	cd	ad	ad	b	ad

(3B) TP, tons/year:

Rivermile:	638	613	600	587	582	566	545
WINT (12,1,2)	301.7	605.1	680.5	789.4	589.6	1,021.9	975.6
SPRG (3,4,5)	386.4	593.9	687.5	1,083.1	776.7	1,415.9	1,291.3
SUMM (6,7,8)	347.7	501.7	568.1	913.1	691.6	1,403.5	1,279.2
FALL (9,10,11)	103.0	291.5	423.7	432.8	371.4	761.9	768.8

t-Test Results:	638	613	600	587	582	566	545
WINT (12,1,2)	a	a	a	a	a	a	a
SPRG (3,4,5)	ab	ab	ab	ab	b	ab	ab
SUMM (6,7,8)	ab	ab	bd	ab	ab	ab	ab
FALL (9,10,11)	d	d	d	d	ad	d	d

RM	SITE DESCRIPTION	REFERENCE and LOGIC	ITEMIZATION AND ACCOUNTING OF INPUT SOURCES	Load, tons/year	Q, cfs
638.70	USGS 13088000	USGS 13088000	Instream Load for 1990-1991(Baseline Years):		
638.53	Milner Dam	IDEQ-TFRO Monitoring Data	Accounted Q: PF (1990-1991) = 1302 cfs		
635.67	1 Unnamed Stream	USGS Milner, ID Quadrangle Map + Assumption 3	MD (1990-1991) = 425 cfs		
632.75	2 Unnamed Streams	USGS Milner, ID Quadrangle Map + Assumption 3	Difference = 877 cfs Net Q in Segment 1 — Accounted	-7,945 4	877.0
630.56	**Dry Creek**	Schaeffer & Bauer Report 1979	Accounted TSS: PF (1990-1991) = 11.1 mg/L Mean: 1302 cfs x 11 1 mg/L x 5.39 x 0.1825 = 14,216.3 tons/year		
630.50	Murtaugh Bridge	USGS Murtaugh, ID Quadrangle Map	MD (1990-1991) = 15 0 mg/L Mean: 425 cfs x 15 0 mg/L x 5.39 x 0 1825 = 6,270.9 tons/year		
630.49	1 Spring	USGS Murtaugh, ID Quadrangle Map + Assumption 2	Difference = PF - MD = 14,216.3 - 6,270.9 = 7,945 4 tons/year Net Load in Segment 1		
627.89	2 Springs	USGS Eden, ID Quadrangle Map + Assumption 2	OVERALL TOTAL (Sub Total D) =	(7,945.4)	877.0
627.60	***Northside A Drain (IR02N)***	Phase 1 Study 1992			
624.45	1 Unnamed Stream	USGS Eden, ID Quadrangle Map + Assumption 3	Unaccounted Q = 877.0 cfs - (Known Springs + Known Surface + Point Sources)		
623.75	1 Spring	USGS Eden, ID Quadrangle Map + Assumption 2	Unaccounted Q = 877 0 cfs - (55.6 cfs + 39.7 cfs + 0 1 cfs) = 781.6 cfs		
623.39	1 Spring	USGS Kimberly, ID Quadrangle Map + Asumption 2	Unaccounted Springs = 65.3%: 781.6 cfs x 0.653 = 510.4 cfs		
623.12	1 Spring	USGS Kimberly, ID Quadrangle Map + Assumption 2	Unaccounted Surface = 34.7%: 781.6 cfs x 0.347 = 271.2 cfs		
623.05	1 Unnamed Stream	USGS Kimberly, ID Quadrangle Map + Assumption 3			
622.15	1 Spring	USGS Kimberly, ID Quadrangle Map + Assumption 2			
622.10	1 Spring	USGS Kimberly, ID Quadrangle Map + Assumption 2	Springs for 1990-1991:		
621.00	Hansen Bridge	USGS Kimberly, ID Quadrangle Map	Vinyard Creek: 13.38 cfs x 1.3 mg/L TSS x 5.39 x 0.1825 =	-17.1	-13.4
620.88	1 Spring	USGS Kimberly, ID Quadrangle Map + Assumption 2	Devils Corral Spring: 42.23 cfs x 1.3 mg/L TSS x 5.39 x 0.1825 =	-54.0	-42.2
620.75	3 Springs	USGS Kimberly, ID Quadrangle Map + Assumption 2		(71.1)	(55.6)
620.17	3 Springs	USGS Kimberly, ID Quadrangle Map + Assumption 2			
619.53	***Southside A10 Drain (IR03S)***	Phase 1 Study 1992	Unaccounted Springs 510.4 cfs x 1.3 mg/L TSS x 5.39 x 0.1825 =	-652.7	-510.4
619.53	3 Springs	USGS Kimberly, ID Quadrangle Map + Assumption 2			
619.21	3 Springs	USGS Kimberly, ID Quadrangle Map + Assumption 2	All Springs (Sub Total B) =	(723 8)	(566 0)
619.00	***Northside C55 Drain (IR04N)***	Phase 1 Study 1992			
618.00	***Southside Twin Falls Coulee (IR07S)***	Phase 1 Study 1992	Surface Waters for 1990-1991:		
617.97	**Vinyard Creek (Devils Washbowl Spring)**	USGS 13089500 + Assumption 2	Dry Creek 10.0 cfs x 290.0 mg/L x 5.39 x 0.1825 =	-2,852 7	-10 0
617.90	***Hansen POTW***	Assuming it reaches the Snake River.	Northside A Drain (IR02N) 8.8 cfs x 164.2 mg/L x 5.39 x 0.1825 =	-1,427 8	-8 8
617.86	4 Springs	USGS Kimberly, ID Quadrangle Map + Assumption 2	Southside A10 Drain (IR03S) 4.8 cfs x 44.5 mg/L x 5.39 x 0.1825 =	-209.7	-4 8
617.54	6 Springs	USGS Kimberly, ID Quadrangle Map + Assumption 2	Northside C55 Drain (IR04N) 7.4 cfs x 47 3 mg/L x 5.39 x 0.1825 =	-342.9	-7 4
617.50	Twin Falls Dam Spillway	USGS Kimberly, ID Quadrangle Map	Southside TF Coulee (IR07S) 8.7 cfs x 121 3 mg/L x 5.39 x 0.1825 =	-1,038.1	-8.7
617.37	1 Unnamed Stream	USGS Kimberly, ID Quadrangle Map + Assumption 3		(5,871.2)	(39.7)
617.20	USGS 13090000, Kimberly	USGS 13090900			
617.12	**Devils Corral Spring**	USGS 13090100 + Assumption 2	Unaccounted Surface: 271.2 cfs x 35.7 mg/L TSS x 5 39 x 0 1825 =	-9,523 8	-271.2
616.90	1 Spring	USGS Kimberly, ID Quadrangle Map + Assumption 2			
616.78	5 Springs	USGS Kimberly, ID Quadrangle Map + Assumption 2	All Surface (Sub Total C) =	(15,395.0)	(310 9)
616.00	2 Springs	USGS Twin Falls, ID Quadrangle Map + Assumption 2			
615.66	2 Springs	USGS Twin Falls, ID Quadrangle Map + Assumption 2	Point Sources for 1990-1991 Directly Discharging to Mid-Snake:		
614.87	2 Springs	USGS Twin Falls, ID Quadrangle Map + Assumption 2	Hansen POTW 0.09 cfs x 14.3 mg/L TSS x 5.39 x 0.1825 =	-1.3	-0.1
614.70	Shoshone Falls Dam	USGS Twin Falls, ID Quadrangle Map	Point Sources (Sub Total A) =	(1 3)	(0 1)
614.00	3 Springs	USGS Twin Falls, ID Quadrangle Map + Assumption 2			
613.67	4 Springs	USGS Twin Falls, ID Quadrangle Map + Assumption 2			
613.37	4 Springs	USGS Twin Falls, ID Quadrangle Map + Assumption 2	WITHOUT MID-SNAKE RIVER: TOTAL (A+B+C) =	(16,120.1)	(877.0)
613.09	Pillar Falls	USGS Twin Falls, ID Quadrangle Map + IDEQ Data	ACCOUNTING FOR FLOW: (A+B+C) - (D) =	0.0	0.0%
			WITH MID-SNAKE RIVER: TOTAL (A+B+C+D) =	(24,065.5)	(1,754 0)

SEGMENT 1: MD to PF (RM638.53 to RM613.09)

RM	SITE DESCRIPTION	REFERENCE and LOGIC
613.09	Pillar Falls	USGS Twin Falls, ID Quadrangle Map + IDEQ Data
612.65	*East Perrine Coulee (IR11S)*	Phase 1 Study 1992; Upper Snake Rock SBA
612.63	1 Spring	USGS Twin Falls, ID Quadrangle Map + Assumption 2
612.60	1 Unnamed Stream	USGS Twin Falls, ID Quadrangle Map + Assumption 3
612.60	*Green's Trout Farm FH*	USEPA DMRs; Phase 1 Study 1992
612.50	1 Spring	USGS Twin Falls, ID Quadrangle Map + Assumption 2
612.00	5 Springs	USGS Twin Falls, ID Quadrangle Map + Assumption 2
611.80	Perrine Bridge	USGS Twin Falls, ID Quadrangle Map
611.57	6 Springs	USGS Twin Falls, ID Quadrangle Map + Assumption 2
611.53	1 Unnamed Stream	USGS Twin Falls, ID Quadrangle Map + Assumption 3
611.10	11 Springs	USGS Twin Falls, ID Quadrangle Map + Assumption 2
610.86	*Main Perrine Coulee (IR12S)*	Phase 1 Study 1992
610.50	**Blue Lakes Spring**	USGS 13091000
610.10	*Canyon Springs FH*	USEPA DMRs; Phase 1 Study 1992
610.00	*Blue Lakes Processing FH*	USEPA DMRs; Phase 1 Study 1992
609.90	*Blue Lakes FH*	USEPA DMRs; Phase 1 Study 1992
609.42	11 Springs	USGS Twin Falls, ID Quadrangle Map + Assumption 2
609.10	*Southside West Perrine Coulee (IR16S)*	Phase 1 Study 1992
608.90	*Pristine Springs FH (+WW)*	USEPA DMRs; Phase 1 Study 1992
608.50	*City of Twin Falls*	USEPA DMRs; Phase 1 Study; SBA
608.30	*Southside 43 Drainage (IR17S)*	Phase 1 Study 1992
608.00	**Warm Creek (TS18N)**	Phase 1 Study 1992; USGS 13091700
607.54	**Jerome Golf Course Drain**	USGS Jerome, ID Quadrangle Map + Assumption 3
607.15	Auger Falls	USGS Jerome, ID Quadrangle Map
606.41	**Rock Creek**	Phase 1 Study 1992; Upper Snake Rock SBA
606.09	4 Springs	USGS Jerome, ID Quadrangle Map + Assumption 2
605.90	5 Springs	USGS Jerome, ID Quadrangle Map + Assumption 2
605.49	3 Springs	USGS Jerome, ID Quadrangle Map + Assumption 2
605.43	1 Unnamed Stream	USGS Jerome, ID Quadrangle Map + Assumption 2
605.30	*Southside 30 Drain (IR20S)*	Phase 1 Study 1992
605.30	1 Spring	USGS Jerome, ID Quadrangle Map + Assumption 2
605.00 or 604.62	Ellison Springs (3 Springs)	USGS Jerome, ID Quadrangle Map + Assumption 2
604.42	4 Springs	USGS Jerome, ID Quadrangle Map + Assumption 2
604.07	1 Unnamed Stream	USGS Jerome, ID Quadrangle Map + Assumption 3
603.39 or 603.60	*Pigeon Cove: LQ/LS Drains (IR21S)*	Phase 1 Study 1992
603.17	8 Springs	USGS Jerome, ID Quadrangle Map + Assmplion 2
602.15 or 602.20	*Southside LS2/39A Drain (IR22S)*	Phase 1 Study 1992
600.92 or 601.40	*Northside N42 Drain (IR23N)*	Phase 1 Study 1992
601.40	*Northside N42 Drain (IR23NT)*	Phase 1 Study 1992
600.90	*Southside 39 Drain (IR24S)*	Phase 1 Study 1992
600.50	*Crystal Springs FH*	USEPA DMRs; Phase 1 Study 1992
600.40	Crystal Springs (14 Springs)	USGS 13093400
600.40	Crystal Springs Area	

Note: RM603.60 for LQ/LS Drain has Rand FH included in its discharge.

Note: RM606.41 for Rock Creek also has the following fish hatcheries that are included in the TSS load: Canyon Trout FH, Canyon Trout Processing, C&M Farm FH, Daydream Ranch FH, Deadman FH, CSI FH, Frame FH, & Coats FH. It does not include the discharges from McMullen Creek and Cottonwood Creek because they discharge to the High Line Canal, which eventually discharges to Deep Creek: Canyon Trout FH (21.1 tons/year), Canyon Trout Processing = Total Containment, C&M FH (28.1 tons/year), Daydream Ranch FH (25.9 tons/year), Deadman FH (27.5 tons/year), CSI FH (9.7 tons/year), Frame FH (35.6 tons/year), and Coats FH (39.3 tons/year)

Note: Green's Trout FH (12.0 tons/year) is accounted for in the East Perrine Coulee drain.

ITEMIZATION AND ACCOUNTING OF INPUT SOURCES

Item	Calculation	Load, tons/year	Q, cfs
Instream Load for 1990-1991 (Baseline Years):			
Accounted Q	CS (1990-1991) = 2075 cfs		
	PF (1990-1991) = 1302 cfs		
	Difference = 773 cfs Net Q in Segment 2 — Accounted:	-7,623.7	773.0
Accounted TSS	PF (1990-1991) = 11.1 mg/L Mean: 1302 cfs x 11.1 mg/L x 5.39 x 0.1825 = 14,216.3 tons/year		
	CS (1990-1991) = 10.7 mg/L Mean: 2075 cfs x 10.7 mg/L x 5.39 x 0.1825 = 21,840.0 tons/year		
	Difference = CS - PF = 21,840.0 - 14,216.3 = 7,623.7 tons/year		
	OVERALL TOTAL (Sub Total D) =	(7,623.7)	773.0
	Unaccounted Q = 773.0 cfs - (Known Springs + Known Surface + Point Sources)		
	Unaccounted Q = 773.0 cfs - (180.5 cfs + 357.9 cfs + 464.2 cfs) = (229.6 cfs)		
	Unaccounted Springs = 65.3%: (229.6 cfs) x 0.653 = (149.9 cfs)		
	Unaccounted Surface = 34.7%: (229.6 cfs) x 0.347 = (79.7 cfs)		
Springs for 1990-1991:			
Unseen Underground Seeps:	129.2 cfs x 1.3 mg/L TSS x 5.39 x 0.1825 =	-165.2	-129.2
Ellison Springs:	1.25 cfs x 1.3 mg/L TSS x 5.39 x 0.1825 =	-1.6	-1.3
Crystal Springs Lake:	50 cfs bubbles underneath the lake. The rest used by FH:		
	50 cfs x 1.3 mg/L TSS x 5.39 x 0.1825 =	-63.9	-50.0
		(230.7)	(180.5)
Unaccounted Springs:	(149.9) cfs x 1.3 mg/L TSS x 5.39 x 0.1825 =	191.7	149.9
	Springs (Sub Total B) =	(39.0)	(30.6)
Point Sources for 1990-1991 Directly Discharging to the Mid-Snake River:			
Canyon Springs FH:	15.93 cfs x 2.0 mg/L TSS x 5.39 x 0.1825 =	-31.3	-15.9
Blue Lakes Processing FH:	0.097 cfs x 58.9 mg/L x 5.39 x 0.1825 =	-5.6	-0.1
Blue Lakes FH:	178.60 cfs x 6.7 mg/L TSS x 5.39 x 0.1825 =	-1,177.1	-178.6
Pristine Springs FH (+WW):	63.70 cfs x 2.0 mg/L TSS x 5.39 x 0.1825 =	-125.3	-63.7
City of Twin Falls POTW:	6.28 cfs x 23.7 mg/L TSS x 5.39 x 0.1825 =	-146.4	-6.3
Crystal Springs FH:	199.61 cfs x 4.8 mg/L TSS x 5.39 x 0.1825 =	-942.5	-199.6
	Point Sources (Sub Total A) =	(2,428.2)	(464.2)
Surface Waters for 1990-1991:			
East Perrine Coulee:	29.27 cfs x 116.9 mg/L TSS x 5.39 x 0.1825 =	-3,365.6	-29.3
Main Perrine Coulee:	10.95 cfs x 117.2 mg/L TSS x 5.39 x 0.1825 =	-1,262.7	-11.0
West Perrine Coulee:	2.53 cfs x 223.2 mg/L TSS x 5.39 x 0.1825 =	-555.5	-2.5
43 Drainage:	0.32 cfs x 179.7 mg/L TSS x 5.39 x 0.1825 =	-56.6	-0.3
Warm Creek:	21.67 cfs x 16.0 mg/L TSS x 5.39 x 0.1825 =	-341.1	-21.7
Jerome Golf Course Drain:	7.78 cfs x 102.0 mg/L TSS x 5.39 x 0.1825 =	-780.6	-7.8
Rock Creek:	219.91 cfs x 66.4 mg/L TSS x 5.39 x 0.1825 =	-14,363.6	-219.9
30 Drain:	6.10 cfs x 371.3 mg/L TSS x 5.39 x 0.1825 =	-2,228.0	-6.1
LQ/LS Drains:	30.32 cfs x 215.5 mg/L TSS x 5.39 x 0.1825 =	-6,427.3	-30.3
LS2/39A Drain:	5.28 cfs x 213.9 mg/L TSS x 5.39 x 0.1825 =	-1,111.0	-5.3
N42 Drain (IR23N):	8.84 cfs x 17.0 mg/L TSS x 5.39 x 0.1825 =	-147.8	-8.8
N42 Drain (IR23NT):	10.14 cfs x 32.2 mg/L TSS x 5.39 x 0.1825 =	-321.2	-10.1
39 Drain:	4.77 cfs x 425.7 mg/L TSS x 5.39 x 0.1825 =	-1,997.4	-4.8
		(32,958.6)	(357.9)
Unaccounted Surface:	(79.7) cfs x 35.7 mg/L TSS x 5.39 x 0.1825 =	2,798.8	79.7
	Surface (Sub Total C) =	(30,159.8)	(278.2)
	WITHOUT MID-SNAKE RIVER: TOTAL (A+B+C) =	(32,627.0)	(773.0)
	ACCOUNTING FOR FLOW: (A+B+C) - (D) =	0.0	0.0%
	WITH MID-SNAKE RIVER: TOTAL (A+B+C+D) =	(40,250.7)	

SEGMENT 2: PF to CS (RM613.09 to RM600.40)

RM	SITE DESCRIPTION	REFERENCE and LOGIC
600.40	Crystal Springs Area	Niagara Springs Quadrangle Map
600.00	*Magic Valley FH*	Phase 1 Study 1992; USEPA DMR Sheets
599.50	Crystal Springs: downstream portion	Niagara Springs Quadrangle Map
599.14	**Cedar Draw**	Upper Snake Rock SBA; Phase 1 Study 1992
599.12	1 Spring	Niagara Springs Quadrangle Map + Assumption 2
599.00	**Niagara Springs (5 springs)**	ERI Study; USGS 13093700
599.00	*Niagara Springs FH*	IDEQ-TFRO; USEPA DMR Sheets
598.70	*Rim View FH*	Phase 1 Study 1992; USEPA DMR Sheets
598.30	1 Spring	Niagara Springs Quadrangle Map + Assumption 2
598.09 or 598.00	*Southside I Drain (IR29S)*	Phase 1 Study 1992
597.66	1 Spring	Niagara Springs Quadrangle Map + Assumption 2
596.80	USGS 13094000	Niagara Springs Quadrangle Map; USGS
595.04 or 595.10	*Northside J8 Drain (IR30N)*	Phase 1 Study 1992
593.00	**Clear Lakes (24 springs)**	USGS 13094500; Phase 1 Study 1992
592.50	*Gary Wright FH*	IDEQ-TFRO; USEPA DMR Sheets
591.80	Kanaka Rapids	Niagara Springs Quadrangle Map
591.50	*Southside N Drain (IR35S)*	Phase 1 Study 1992
591.50	*Catfish FH/FBI*	Phase 1 Study 1992; USEPA DMR Sheets
591.47	**Mud Creek**	Upper Snake Rock SBA; Phase 1 Study 1992
591.38	**Deep Creek**	Upper Snake Rock SBA; Phase 1 Study 1992
590.82	1 Unnamed Stream	Thousand Springs Quadrangle Map + Assumption 3
590.33	1 Unnamed Stream	Thousand Springs Quadrangle Map + Assumption 3
590.28	**Briggs Creek (6 springs)**	Covington & Weaver
590.28	*Briggs Creek FH*	IDEQ-TFRO; USEPA DMR Sheets
589.48 or 589.50	*Northside S29 Drain (IR36N)*	Phase 1 Study 1992
588.65	**Banbury Springs (19 springs)**	USGS 13095300
588.80	*Kaster Trout FH*	IDEQ-TFRO; USEPA DMR Sheets
588.48	2 Springs	Thousand Springs Quadrangle Map + Assumption 2
588.40	*Northside S19/S Drains (IR39N)*	Phase 1 Study 1992
588.40	*Box Canyon FH*	Phase 1 Study 1992, USEPA DMR Sheets
588.06	**Blind Canyon Creek (2 springs)**	USGS
588.06	*Blind Canyon FH (within the canyon)*	IDEQ-TFRO; USEPA DMR Sheets
587.76	**Box Canyon Creek (3 springs)**	Covington & Weaver
587.50	Blue Heart Springs (3 springs)	Thousand Springs Quadrangle Map + Assumption 2
587.21	1 Unnamed Stream	Thousand Springs Quadrangle Map + Assumption 3
587.00	Below Box Canyon Ck	Thousand Springs Quadrangle Map
587.00	Below Box Canyon Ck Area	

Note. Niagara Springs inputs are categorized as follows. impacts from the Niagara Springs FH and impacts from the Niagara Springs "creek" area Both are 108.6 and 38 9 tons/year, respectively, or a total of 147.5 tons/year.

Note. Clear Springs & Lake inputs are categorized as follows. impacts from Clear Lakes Trout FH (349.0 tons/year), Middle Hatchery FH (353 2 tons/year), Snake River FH (195.8 tons/year), Clear Springs Processing (4 5 tons/year), and impacts from the Clear Springs & Lake "area" (180.1 tons/year), or a total of 1,087.8 tons/year.

Note Blind Canyon Creek inputs are categorized as follows: impacts from the Blind Canyon FH (13.7 tons/year) with impacts from agriculture, grazing, and riparian areas. S19/S Drain traditionally discharged to the Blind Canyon Creek canyon but is now diverted to the Lemmon Hydropower Facility which discharges just upstream of the Blind Canyon Creek confluence with the Middle Snake River Occasionally, the owner may discharge to Blind Canyon Creek to meet water right needs for iriation and possibly fish propagation.

Note: Cedar Draw inputs are categorized as follows; impacts from the Filer POTW (2.1 tons/year), Rainbow (Filer) FH (25 3 tons/year), Rainbow Processing (0.04 tons/year), Yoder FH (17.5 tons/year), SEAPAC Processing (Land Application), Cedar Draw FH (39 6 tons/year), Olson FH (7 6 tons/year), Stutzman FH (2 4 tons/year), Tunnel Creek FH (35 8 tons/year), Leo Martins FH (29 5 tons/year), and from the Cedar Draw watershed (12,066 3 tons/year), or a total of 12,226 1 tons/year.

Note. Mud Creek inputs are categorized as follows: impacts from the Buhl POTW (28.8 tons/year), Rainbow (Buhl) FH (16.3 tons/year), W&W FH (20 0 tons/year), White's FH (7.9 tons/year), Buhl Trout Rearing FH (6.7 tons/year), Buhl Trout FH (9 9 tons/year), Jukers FH (10 8 tons/year), RCP FH (3 5 tons/year), First Ascent FH (35.3 tons/year), Rock Ridge FH (4 0 tons/year), Mi Vida Loca FH (7 9 tons/year), and from the Mud Creek watershed (5,809.5 tons/year), or a total of 5,950.4 tons/year

Note Deep Creek inputs are categorized as follows McMullen Creek and Cottonwood Creek which discharge into the High Line Canal which discharges to Deep Creek, Deep Creek Trout FH (31.1 tons/year), Boswell Trout FH (33 2 tons/year), Peter's FH (20.3 tons/year), Cox FH (30.7 tons/year), Dolana FH (10.2 tons/year), Howell FH (19.0 tons/year); and, from the Deep Creek watershed, for a total of 6,197.1 tons/year.

ITEMIZATION AND ACCOUNTING OF INPUT SOURCES

Instream Load for 1990-1991 (Baseline Years):

Accounted Q BC (1990-1991) = 3817 cfs
CS (1990-1991) = 2075 cfs
Difference = 1742 cfs Net Q in Segment 3

Accounted TSS BC (1990-1991) = 18 8 mg/L Mean. 3817 cfs x 18.7 mg/L x 5.39 x 0 1825 = 70,588.1 tons/year
CS (1990-1992) = 10 7 mg/L Mean: 2075 cfs x 10 7 mg/L x 5 39 x 0 1825 = 21,840 0 tons/year
Difference = BC - CS = 70,212.7 - 21,840 0 = 48,372 7 tons/year

		Load, tons/year	Q, cfs
Accounted		-48,372 7	1,742.0
	OVERALL TOTAL (Sub Total D) =	-48,372.7	1,742 0

Unaccounted Q = 1,742 0 cfs - (Known Springs + Known Surface + Point Sources)
Unaccounted Q = 1,742 0 cfs - (905.4 + 432.3 + 687.7) = (283 4)
Unaccounted Springs = 65 3% (283.4 cfs) x 0.653 = (185 1 cfs)
Unaccounted Surface = 34 7%: (283.4 cfs) x 0.347 = (98 3 cfs)

Source	Calculation	Load, tons/year	Q, cfs
Point Sources:			
Magic Valley FH:	111.72 cfs x 7.4 mg/L TSS x 5 39 x 0 1825 =	-813.2	-111.7
Rim View FH:	134.07 cfs x 4.6 mg/L TSS x 5.39 x 0 1825 =	-606 7	-134.1
IPC/Niagara Springs FH:	55.19 cfs x 2.0 mg/L TSS x 5.39 x 0.1825 =	-108 6	-55.2
Gary Wright FH:	5.50 cfs x 2.0 mg/L TSS x 5 39 x 0.1825 =	-10 8	-5 5
Catfish FH/FBI:	12.92 cfs x 15.8 mg/L TSS x 5.39 x 0 1825 =	-200 8	-12 9
Kaster Trout FH:	49.12 cfs x 2.0 mg/L TSS x 5.39 x 0.1825 =	-96 6	-49 1
Box Canyon FH:	295.03 cfs x 5 9 mg/L TSS x 5.39 x 0.1825 =	-1,712 3	-295 0
Briggs Creek FH:	24.15 cfs x 2.0 mg/L TSS x 5.39 x 0.1825 =	-47 5	-24 2
	Point Sources (Sub Total A) =	(3,596.5)	(667.7)
Spring Sources:			
Unseen Underground Seeps:	110.8 cfs x 1.3 mg/L TSS x 5 39 x 0.1825 =	-141 7	-110 8
Niagara Springs:	30.4 cfs x 1.3 mg/L TSS x 5 39 x 0.1825 =	-38.9	-30 4
Clear Lakes Springs (TS32N):	52.31 cfs x 3.5 mg/L TSS x 5 39 x 0.1825 =	-180 1	-52 3
Snake River FH:	99.5 cfs x 2.0 mg/L TSS x 5.39 x 0 1825 =	-195.8	-99 5
Clear Springs Processing:	0.05 cfs x 90.9 mg/L TSS x 5 39 x 0.1825 =	-4 5	-0 1
Middle FH:	182.06 cfs x 2.0 mg/L TSS x 5 39 x 0.1825 =	-358 2	-182 1
Clear Lakes Trout FH:	161.25 cfs x 2.2 mg/L TSS x 5 39 x 0.1825 =	-349 0	-161 3
TSS from Clear Lakes FHs are based on 1991 DMR gross effluent.			
Banbury Springs:	120.67 cfs x 1.3 mg/L TSS x 5 39 x 0.1825 =	-154 3	-120.7
Briggs Creek Springs:	83.35 cfs x 1.3 mg/L TSS x 5.39 x 0.1825 =	-106.6	-83.4
Box Canyon Springs:	64.97 cfs x 1.3 mg/L TSS x 5.39 x 0.1825 =	-83 1	-65 0
		(1,612.0)	(905 4)
Unaccounted Springs	(185.1 cfs) x 1.3 mg/L TSS x 5 39 x 0.1825 =	236.7	185.1
	Spring Sources (Sub Total B) =	(1,375.3)	(720 3)
Surface Stream Sources:			
Cedar Draw (TS27S):	115.19 cfs x 107.9 mg/L TSS x 5.39 x 0.1825 =	-12,226.1	-115 2
Mud Creek (TS33S):	97.26 cfs x 62.3 mg/L TSS x 5 39 x 0 1825 =	-5,960 4	-97 3
Deep Creek (TS34S).	95.89 cfs x 65.7 mg/L TSS x 5.39 x 0.1825 =	-6,197 1	-95 9
Blind Canyon Creek (TS40N):	43.50 cfs x 29.0 mg/L TSS x 5 39 x 0.1825 =	-1,240.9	-43 5
Southside I Drain (IR29S):	11.42 cfs x 111.9 mg/L TSS x 5.39 x 0.1825 =	-1,257.0	-11 4
Northside J8 Drain (IR30N):	9.03 cfs x 41.1 mg/L TSS x 5 39 x 0 1825 =	-365 1	-9 0
Southside N Drain (IR35S):	4.36 cfs x 36.8 mg/L TSS x 5 39 x 0.1825 =	-157 8	-4 4
Northside S29 Drain (IR36N):	2.64 cfs x 11.9 mg/L TSS x 5 39 x 0.1825 =	-30 9	-2.6
Northside S19/S Drain (IR39N):	52.99 cfs x 43.4 mg/L TSS x 5 39 x 0 1825 =	-2,262.2	-53 0
		(29,697.6)	(432.3)
Unaccounted Surface:	(98.3 cfs) x 35.7 mg/L TSS x 5 39 x 0.1825 =	3,452 0	98 3
	Surface Sources (Sub Total C) =	(26,245.6)	(334.0)
	WITHOUT MID-SNAKE RIVER: TOTAL (A+B+C) =	(31,217.4)	(1,741.9)
	ACCOUNTING FOR FLOW: (A+B+C) - (D) =	0.1	0.0%
	WITH MID-SNAKE RIVER. TOTAL (A+B+C+D) =	(79,590 1)	

Note. J8 drain includes the Jerome POTW

Note. Blind Canyon Creek includes Blind Canyon FH.

SEGMENT 3: CS to BC (RM600.40 to RM587.00)

RM	SITE DESCRIPTION	REFERENCE and LOGIC
587.00	Below Box Canyon Creek Area	Thousand Springs Quadrangle Map
586.50	Salmon Falls Creek (USGS 13108150)	ERI Study; USGS; Phase 1 Study 1992
585.90	1 Spring	Thousand Springs Quadrangle Map + Assumption 2
585.50	1000 Springs USGS 13132800	USGS
585.00	Thousand Springs Area: Upper End	Thousand Springs Quadrangle Map
584.87	6 Springs	Thousand Springs Quadrangle Map + Assumption 2
584.82	1 Unnamed	Thousand Springs Quadrangle Map + Assumption 3
584.50	***Blind Canyon Aqua Ranch FH***	IDEQ-TFRO; USEPA DMRs
584.44	Sand Springs Creek (7 springs; USGS 13132600	USGS
584.38	Thousand Springs (15 springs): Lower End	USGS
584.20	Sliggars & 1000 Springs Hydropower Facility	Thousand Springs Quadrangle Map
584.09 or 584.30	***Northside W26 Drain (IR42N)***	Phase 1 Study 1992
584.09	Bickel Springs (1 spring)	USGS
583.85	Mini-Miller (12 springs)	ERI Study
583.80	***Pisces Magic Springs FH***	IDEQ-TFRO; USEPA DMRs; Consent Order data
583.71	1 Unnamed	Thousand Springs Quadrangle Map + Assumption 3
582.88	Riley Creek (USGS 13133800)	USGS
582.48	1 Unnamed	Thousand Springs Quadrangle Map + Assumption 3
582.48	Magic Springs (1 Spring)	Covington & Weaver
582.30	Gridley Bridge	Hagerman Quadrangle Map
582.00	Gridley Bridge Area	Hagerman Quadrangle Map

Note: Thousand Springs "watershed" includes the following inputs: Ten Springs FH (51.4 tons/year); Thousand Springs watershed inputs (1,575.2 tons/year); for a total of 1,626.6 tons/year.

Note: Riley Creek "watershed" includes the following inputs: USFWS-FH (95.9 tons/year), IDFG-FH (142.2 tons/year); Riley Creek watershed inputs (734.1 tons/year); for a total of 972.2 tons/year.

ITEMIZATION AND ACCOUNTING OF INPUT SOURCES

Instream Load for 1990-1991 (Baseline Years):

Accounted Q: GB (1990-1991) = 5709 cfs
BC (1990-1991) = 3817 cfs
Difference = 1892 cfs in Segment 4

Accounted TSS. GB (1990-1991) = 6.9 mg/L Mean. 5709 cfs x 6.9 mg/L x 5.39 x 0.1825 = 38,749.0 tons/year
BC (1990-1991) = 18.8 mg/L Mean: 3817 cfs x 18.8 mg/L x 5.39 x 0.1825 = 70,588.1 tons/year
Difference = BC - GB = 70,588.1 - 38,749.0 = 31,839.1 tons/year

Unaccounted Q = 1705.5 cfs - (Known Springs + Known Surface + Point Sources)
Unaccounted Q = 1705.5 cfs - (1502.4 cfs + 167.6 cfs + 146.7 cfs) = (111.2 cfs)
Unaccounted Springs = 65.3%: (111.2 cfs) x 0.653 = (72.6 cfs)
Unaccounted Surface = 34.7%: (111.2 cfs) x 0.347 = (38.6 cfs)

			Load, tons/year	Q, cfs
Accounted:			-31,839.1	1,705.5
		OVERALL TOTAL (Sub Total D) =	(31,839.1)	1,705.5
Point Sources:	Blind Canyon Aqua Ranch FH:	25.74 cfs x 1.1 mg/L TSS x 5.39 x 0.1825 =	-27.9	-25.7
	Pisces Magic Springs FH:	120.99 cfs x 0.7 mg/L TSS x 5.39 x 0.1825 =	-83.3	-121.0
		Point Sources (Sub Total A) =	(111.2)	(146.7)
Spring Sources:				
	Unseen Underground Springs:	72.0 cfs x 1.3 mg/L TSS x 5.39 x 0.1825 =	-92.1	-72.0
	Thousand Springs:	1272.0 cfs x 1.3 mg/L TSS x 5.39 x 0.1825 =	-1,626.6	-1,272.0
	Riley Creek:	66.78 cfs x 14.8 mg/L TSS x 5.39 x 0.1825 =	-972.2	-66.8
	Sand Springs Creek:	91.65 cfs x 1.3 mg/L TSS x 5.39 x 0.1825 =	-117.2	-91.7
			(2,808.1)	(1,502.4)
	Unaccounted Springs:	(72.6 cfs) x 1.3 mg/L TSS x 5.39 x 0.1825 =	92.8	72.6
		Spring Sources (Sub Total B) =	(2,715.3)	(1,429.8)
Surface Stream Sources:				
	Salmon Falls Creek:	149.40 cfs x 40.6 mg/L TSS x 5.39 x 0.1825 =	-5,966.6	-149.4
	Northside W26 Drain (IR42N):	18.16 cfs x 61.2 mg/L TSS x 5.39 x 0.1825 =	-1,093.3	-18.2
			(7,059.9)	(167.6)
	Unaccounted Surface:	(38.6 cfs) x 35.7 mg/L TSS x 5.39 x 0.1825 =	1,355.5	38.6
		Surface Streams (Sub Total C) =	(5,704.4)	(129.0)
		WITHOUT MID-SNAKE RIVER: TOTAL (A+B+C) =	(8,530.8)	(1,705.5)
		ACCOUNTING FOR FLOW: (A+B+C) - (D) =	0.0	0.0%
		WITH MID-SNAKE RIVER: TOTAL (A+B+C+D) =	(40,369.9)	

SEGMENT 4: BC TO GB (RM587.00 to RM582.00)

RM	SITE DESCRIPTION	REFERENCE and LOGIC
582.00	Gridley Bridge Area	Hagerman Quadrangle Map
581.72	Owsley Bridge	Hagerman Quadrangle Map
581.40	Upper Salmon Falls Dam	Hagerman Quadrangle Map
580.30	Dolman Island	Hagerman Quadrangle Map
580.20	*Hensiee FH (Irrigation Ditch)*	Phase 1 Study 1992; USEPA DMRs
580.12	Buckeye Ditch	Hagerman Quadrangle Map + Assumption 3
580.12	Hunt Ditch	Hagerman Quadrangle Map + Assumption 3
579.52	Upper Salmon Falls Power Plant	Hagerman Quadrangle Map
578.99	1 Unnamed Stream	Hagerman Quadrangle Map + Assumption 3
578.60	Millet Island	Hagerman Quadrangle Map
578.60	*Buckeye FH*	Phase 1 Study 1992; USEPA DMRs
578.03	1 Unnamed (Peters Gulch)	Hagerman Quadrangle Map + Assumption 3
577.97	1 Unnamed Stream	Hagerman Quadrangle Map + Assumption 3
577.20	*Big Bend Trout FH (Big Bend Ditch)*	Phase 1 Study 1992; USEPA DMRs
577.16	1 Unnamed Stream	Hagerman Quadrangle Map + Assumption 3
577.16	Bell Ditch	Hagerman Quadrangle Map + Assumption 3
576.72	1 Unnamed Stream	Hagerman Quadrangle Map + Assumption 3
576.39	1 Unnamed Stream	Hagerman Quadrangle Map + Assumption 3
576.00	*City of Hagerman*	USEPA DMRs; Upper Snake Rock SBA
575.90	Bell Ditch	Hagerman Quadrangle Map + Assumption 3
575.90	Big Bend Ditch	Hagerman Quadrangle Map + Assumption 3
575.90	Buckeye Ditch	Hagerman Quadrangle Map + Assumption 3
575.90	*Lemmon FH (Buckeye Ditch)*	
575.83	2 Unnamed Streams	Hagerman Quadrangle Map + Assumption 3
575.57	1 Unnamed Stream	Hagerman Quadrangle Map + Assumption 3
575.41	Fossil Gulch	Hagerman Quadrangle Map + Assumption 3
575.16 = 575.20	Sands Ditch	Hagerman Quadrangle Map + Assumption 3
575.16	Bell Rapids USGS 1313457010 Diversion	Hagerman Quadrangle Map + Assumption 3
574.53	1 Unnamed Stream	Hagerman Quadrangle Map + Assumption 3
574.27	1 Unnamed Stream	Hagerman Quadrangle Map + Assumption 3
573.97	1 Unnamed Stream	Hagerman Quadrangle Map + Assumption 3
573.76	Billingsley Creek	USGS; IDEQ-TFRO; Upper Snake Rock SBA
573.34	2 Unnamed Streams	Hagerman Quadrangle Map + Assumption 3
573.30	*Eckles FH (Billingsley Creek)*	USEPA DMRs; Upper Snake Rock SBA
573.30	*Dunn FH (Billingsley Creek)*	USEPA DMRs; Upper Snake Rock SBA
573.00	*Barret Farm Pond FH*	USEPA DMRs; Upper Snake Rock SBA
572.96	Lower Salmon Falls Power Plant	Hagerman Quadrangle Map
572.50	USGS 13135000	Hagerman Quadrangle Map
572.41	1 Unnamed Stream	Hagerman Quadrangle Map + Assumption 3
572.40	*White Springs FH*	Phase 1 Study 1992; USEPA DMRs
572.28	Birch Creek	Hagerman Quadrangle Map; USGS
572.20	*Birch Creek FH*	Phase 1 Study 1992; USEPA DMRs
572.2	*Mike Flemming FH*	IDEQ-TFRO; Upper Snake Rock SBA
571.42	Malad River (USGS 13153500)	Upper Snake Rock SBA; USGS
571.19	Power Plant Bypass (USGS 13152940)	Hagerman Quadrangle Map; USGS
571.19	1 Unnamed Stream	Hagerman Quadrangle Map + Assumption 3
570.71	1 Unnamed Stream	Hagerman Quadrangle Map + Assumption 3
570.04 = 570.10	Stoddard Creek (1 Spring)	Bliss Quadrangle Map + Assumption 2
569.80	Decker Springs Creek (1 Spring)	Bliss Quadrangle Map + Assumption 2
569.60	*Smith Farm Ponds FH*	USEPA DMRs; Upper Snake Rock SBA
568.72	1 Unnamed Stream	Bliss Quadrangle Map + Assumption 3
568.58	1 Unnamed Stream	Bliss Quadrangle Map + Assumption 3
568.51	1 Unnamed Stream	Bliss Quadrangle Map + Assumption 3
568.40	*Woods Farm Ponds FH*	USEPA DMRs; Upper Snake Rock SBA
568.05	1 Spring	Bliss Quadrangle Map + Assumption 2
568.00	*Slane Ponds FH*	USEPA DMRs; Upper Snake Rock SBA
567.73	1 Spring	Bliss Quadrangle Map + Assumption 2
567.25	1 Spring	Bliss Quadrangle Map + Assumption 2
567.70	*John Flemming Ponds FH*	USEPA DMRs; Upper Snake Rock SBA
566.80	*Stevenson Ponds FH*	USEPA DMRs; Upper Snake Rock SBA

ITEMIZATION AND ACCOUNTING OF INPUT SOURCES

Instream Load for 1990-1991 (Baseline Years):

Accounted Q. SB (1990-1991) = 7545 cfs
GB (1990-1991) = 5709 cfs
Difference = 1836 cfs in Segment 5 — Accounted -10,977.2 | 1,836 0

Accounted TSS. SB (1990-1991) = 6.7 mg/L Mean. 7545 cfs x 6 7 mg/L x 5 39 x 0 1825 = 49,726.2 tons/year
GB (1990-1991) = 6.9 mg/L Mean: 5709 cfs x 6 9 mg/L x 5.39 x 0 1825 = 38,749 0 tons/year
Difference = SB - GB = 49,726 2 - 38,749 0 = 10,977.2 tons/year

OVERALL TOTAL (Sub Total D) = -10,977.2 | 1,836 0

Unaccounted Q = 1836 0 cfs - (Known Springs + Known Surfaces + Point Sources)
Unaccounted Q = 1836 0 cfs - (48.7 cfs + 1,351 3 cfs + 186 1 cfs) = 249 9 cfs
Unaccounted Springs = 65 3% 249.9 cfs x 0.653 = 163 2 cfs
Unaccounted Surface = 34 7%: 249 9 cfs x 0.347 = 86.7 cfs

Point Sources for 1990-1991 Directly Discharging to the Mid-Snake:			
Buckeye FH (FH46N):	25.81 cfs x 17.6 mg/L TSS x 5.39 x 0 1825 =	-446 8	-25 8
Barret FH:	10.06 cfs x 2.0 mg/L TSS x 5.39 x 0.1825 =	-19 8	-10.1
White Springs (FH48N):	30.0 cfs x 4.0 mg/L TSS x 5.39 x 0.1825 =	-118.0	-30 0
Mike Flemming FH:	5.71 cfs x 2.0 mg/L TSS x 5.39 x 0.1825 =	-11.2	-5.7
Smith FH:	9.11 cfs x 2.0 mg/L TSS x 5.39 x 0.1825 =	-17.9	-9 1
Woods FH:	12.38 cfs x 2.0 mg/L TSS x 5.39 x 0 1825 =	-24.4	-12 4
Slane FH:	4.18 cfs x 2.0 mg/L TSS x 5.39 x 0.1825 =	-8.2	-4 2
John Flemming FH:	8 97 cfs x 2.0 mg/L TSS x 5.39 x 0.1825 =	-17.7	-9 0
Stevenson FH:	8.04 cfs x 2.0 mg/L TSS x 5.39 x 0.1825 =	-15 8	-8 0
City of Hagerman POTW:	0.27 cfs x 5.1 mg/L TSS x 5.39 x 0.1825 =	-1 4	-0 3
Hensiee FH (Irrigation Ditch):	8.51 cfs x 2.0 mg/L TSS x 5.39 x 0.1825 =	-16 7	-8 5
Big Bend FH (Big Bend Ditch):	4.34 cfs x 2.0 mg/L TSS x 5.39 x 0.1825 =	-8 5	-4 3
Lemmon FH (Buckeye Ditch):	4.03 cfs x 2.0 mg/L TSS x 5.39 x 0.1825 =	-7 9	-4 0
Eckles FH (Billingsley Creek):	18 56 cfs x 2.0 mg/L TSS x 5.39 x 0.1825 =	-36 5	-18 6
Dunn FH (Billingsley Creek):	36.20 cfs x 2.0 mg/L TSS x 5.39 x 0.1825 =	-71.2	-36 2
	Point Sources (Sub Total A) =	(822 0)	(186 1)
Springs for 1990-1991 (+ FHs which utilize and discharge indirectly to the Mid-Snake:			
Birch Creek (excluding FH):	1.05 cfs x 1.3 mg/L TSS x 5.39 x 0.1825 =	-1 3	-1 1
Birch Creek FH:	9.98 cfs x 8.9 mg/L TSS x 5.39 x 0.1825 =	-87 4	-10.0
C.J.Simms FH:	5.3 cfs x 2.0 mg/L TSS x 5.39 x 0.1825 =	-10 4	-5 3
Stoddard Creek (excluding FH):	Utilized completely by FHs = 0.0 cfs	0 0	0 0
Bell FH:	3.8 cfs x 2.0 mg/L TSS x 5.39 x 0.1825 =	-7.4	-3.8
Standal FH:	5.0 cfs x 2.0 mg/L TSS x 5.39 x 0.1825 =	-9.7	-5 0
White Water FH:	11.2 cfs x 2.0 mg/L TSS x 5.39 x 0.1825 =	-22 0	-11.2
Decker Springs Creek (-FH):	Utilized completely by FHs = 0.0 cfs	0.0	0 0
Decker Springs FH:	12.4 cfs x 2.0 mg/L TSS x 5.39 x 0.1825 =	-24.4	-12.4
		(162.6)	(48 7)
Unaccounted Springs:	163.2 cfs x 1.3 mg/L TSS x 5.39 x 0.1825 =	-208 7	-163 2
	All Springs (Sub Total B) =	(371 3)	(211 9)
Surface Streams for 1990-1991:			
Malad River:	180.0 cfs x 21.2 mg/L TSS x 5.39 x 0 1825 =	-3,753 7	-180 0
Malad River Power Flume:	1132.0 cfs x 21.2 mg/L TSS x 5.39 x 0.1825 =	-23,606 6	-1,132 0
Billingsley Creek:	39.25 cfs x 4.7 mg/L TSS x 5 39 x 0.1825 =	-181 5	-39 3
FHs that Discharge to Billingsley Creek	Rangen's FH: 19.5 cfs	-38 3	
	Jones FH: 30.3 cfs	-59.5	
	McFadden FH: 7.0 cfs	-13 7	
	Idaho Springs: 54.0 cfs	-106 2	
	Hidden Springs: 11.6 cfs	-22.8	
	Schrank FH: 3.2 cfs	-6 2	
	Fisheries Development: 96.7 cfs	-190.3	
	2-non permitted facilities: 5 0 cfs	-9 8	
	Boyer FH: 11.6 cfs	-22 8	
	Talbot FH: 11.3 cfs	-22 2	
		(28,033.6)	(1,351 3)
Unaccounted Surface:	86.7 cfs x 35.7 mg/L TSS x 5 39 x 0 1825 =	-3,044 7	-86.7

RM	SITE DESCRIPTION	REFERENCE and LOGIC	ITEMIZATION AND ACCOUNTING OF INPUT SOURCES		
566.33	1 Spring	Bliss Quadrangle Map + Assumption 2	All Surface (Sub Total C) =	(31,078.3)	(1,438.0)
565.85	1 Spring	Bliss Quadrangle Map + Assumption 2			
565.75	Shoestring Bridge	Bliss Quadrangle Map	WITHOUT MID-SNAKE RIVER: TOTAL (A+B+C) =	(32,271.6)	(1,836.0)
			ACCOUNTING FOR FLOW: (A+B+C) - (D) =	0.0	0.0%
			WITH MID-SNAKE RIVER: TOTAL (A+B+C+D) =	(43,248.8)	
			DIVERSIONS: Bell Rapids (USGS 1313457010) 104.77 cfs x 17.2 mg/L TSS x 5.39 x 0.1825 =	-1,772.6	-104.8
			(17.2 mg/L TSS is instream value at GB to SB) All Diversions =	(1,772.6)	(104.8)
			Instream Effect	(41,476.2)	1,731.2

COMMENTS ON SEGMENT 5:

Note: Bell Ditch and Buckeye Ditch begin at Billingsley Creek about 0.8 miles upstream from the confluence with the Snake River.
Big Bend Ditch starts at Tucker Springs and at the Idaho State Fish Hatchery and Game Preserve.
Bell Ditch, Buckeye Ditch, and Big Bend Ditch are integrated west of the Hageman POTW Sewage Disposal Ponds.

Note: The Lemmon FH discharges to Curren Ditch which eventually winds up in Buckeye Ditch and then discharges to the Snake River.

Note: Stoddard Creek discharges to the Snake River at RM570.1 (or RM570.04). The following FHs discharge to Stoddard Creek:
Bell FH (7.4 tons/year), Standal FH (9.7 tons/year), and White Water FH (22.0 tons/year) for a total of 39.1 tons/year.
It appears that Stoddard Creek Spring(s) are completely utilized by the FHs.

Note: Birch Creek discharges to the Snake River at RM572.28. The following FHs discharge to Birch Creek: Birch Creek FH (87.4 tons/year),
C.J. Simms FH (10.4 tons/year); the Birch Creek "watershed" contributes about 1.3 tons/year, for a total of 99.1 tons/year.

Note: Billingsley Creek discharges to the Snake River at RM573.76. The following FHs discharge to Billingsley Creek: Rangen's FH (38.3 tons/year), Jones FH (59.5 tons/year), McFadden FH (13.7 tons/year), Idaho Springs FH (106.2 tons/year), Hidden Springs (22.8 tons/year), Schrank Springs Creek FH (6.2 tons/year), Fisheries Development FH (190.3 tons/year for the two discharge points), two non-permitted FH (9.8 tons/year), Boyer FH (22.8 tons/year), Talbot FH (22.2 tons/year); the Billingsley Creek "watershed" contributes about 181.5 tons/year, for a total of 673.3 tons/year. Unlike other tributaries, Billingsley Creek is a sediment loader within the creek itself. Data obtained from the Idaho Springs FH showed that an accumulation of very fine instream sediment (appears to be Yahoo Clay) filled in the upper part of the raceways to an approximate loading of 167 truckloads in one "season." Inspection of the stream bed in Billingsley Creek noted that a washload is created from these suspended particulates and appears to settle on the bedload (made up of cobbles and some fine grains) and is very slow moving from upstream to downstream. Billingsley Creek does not have flushing flows and is highly influenced by flow diversions, so it is quite possible that any movement of the washload occurs very slowly from upstream to downstream. The macrophytes also form a tight cover of the washload and bedload so upstream to downstream movement of the washload and bedload is retarded. For this reason, a true indication of the sediment loading in Billingsley Creek is best summarized by combining the approximate loads from all the FHs with the discharge value obtained from Billingsley Creek as it discharges to the Middle Snake River. However, the FHs utilize and re-utilize the same water throughout the creek such that the average discharge to the Middle Snake River best describes Billingsley Creek. Thus, the flow from the FHs is not included in the total flow from Billingsley Creek.

SEGMENT 5: GB to SB (RM582.00 to RM565.75): COMMENTS

RM	SITE DESCRIPTION	REFERENCE and LOGIC
565.75	Shoestring Bridge	Bliss Quadrangle Map
565.00	Aqueduct Wiley Pumps = USGS 1315377299	Bliss Quadrangle Map + Assumption 3
562.03	Tuana Gulch	Ticeska Quadrangle Map + Assumption 3
560.93	Cassia Gulch	Ticeska Quadrangle Map + Assumption 3
559.92	Bliss Dam	Ticeska Quadrangle Map
556.69	Little Pilgrim Gulch	Pasadena Valley Quadrangle Map + Assumption 3
556.56	Big Pilgrim Gulch	Pasadena Valley Quadrangle Map + Assumption 3
555.29	Deer Gulch	Pasadena Valley Quadrangle Map + Assumption 3
554.85	1 Unnamed Stream	Pasadena Valley Quadrangle Map + Assumption 3
553.00	Bancroft Springs (3 springs)	Pasadena Valley Quadrangle Map + Assumption 2
552.50	Black Mesa Pumps (USGS 13153778)	USGS
547.70	Clover Creek (USGS 13154400)	Upper Snake Rock SBA; USGS
546.60	USGS 13154500	King Hill Quadrangle Map; USGS
546.30	King Hill Bridge	King Hill Quadrangle Map
546.00	King Hill town site	King Hill Quadrangle Map
545.00	King Hill Area	King Hill Quadrangle Map

ITEMIZATION AND ACCOUNTING OF INPUT SOURCES

Instream Load for 1990-1991 (Baseline Years):			
Accounted Q: KH (1990-1991) = 7966 cfs			
SB (1990-1991) = 7545 cfs			
Difference = 421 cfs	Accounted	-88,186.6	421.0
Accounted TSS: KH (1990-1991) = 17.6 mg/L Mean: 7966 cfs x 17.6 mg/L x 5.39 x 0.1825 = 137,912.6 tons/year			
SB (1990-1991) = 6.7 mg/L Mean: 7545 cfs x 6.7 mg/L x 5.39 x 0.1825 = 49,726.2 tons/year			
Difference = KH - SB = 137,912.8 - 49,726.2 = 88,186.6 tons/year			
	OVERALL TOTAL (Sub Total D) =	-88,186.6	421.0
Unaccounted Q = 421.0 cfs - (Known Springs + Known Surface + Point Sources)			
Unaccounted Q = 421.0 cfs - (0.0 cfs + 40.8 cfs + 0.0 cfs) = 380.2 cfs			
Unaccounted Springs = 65.3%: 380.2 cfs x 0.653 = 248.3 cfs			
Unaccounted Surface = 34.7%: 380.2 cfs x 0.347 = 131.9 cfs			
Point Sources for 1990-1991 Discharging Directly to the Mid-Snake River:			
None		0.0	0.0
	Point Sources (Sub Total A) =	0.0	0.0
Springs for 1990-1991:			
Unaccounted Springs:	248.3 cfs x 1.3 mg/L TSS x 5.39 x 0.1825 =	-317.5	-248.3
	All Springs (Sub Total B) =	(317.5)	(248.3)
Surface Waters for 1990-1991:			
Clover Creek:	40.75 cfs x 9.7 mg/L TSS x 5.39 x 0.1825 =	-388.8	-40.8
		(388.8)	(40.8)
Unaccounted Surface:	131.9 cfs x 35.7 mg/L TSS x 5.39 x 0.1825 =	-4,632.0	-131.9
	All Surface (Sub Total C) =	(5,020.8)	(172.7)
	WITHOUT MID-SNAKE RIVER: TOTAL (A+B+C) =	(5,338.3)	(421.0)
	ACCOUNTING FOR FLOW: (A+B+C) - (D) =	0.0	0.0%
	WITH MID-SNAKE RIVER: TOTAL (A+B+C+D) =	(93,524.9)	
DIVERSIONS: Black Mesa Pumps (diversion):	63.59 cfs x 23.2 mg/L TSS x 5.39 x 0.1825 =	-1,451.2	-63.6
Wiley Pumps (diversion)	19.29 cfs x 23.2 mg/L TSS x 5.39 x 0.1825 =	-440.2	-19.3
(23.2 mg/L TSS = instream value at SB to KH)	All Diversions =	(1,891.4)	(82.9)
	Instream Effect	-95,416.3	338.1

SEGMENT 6: SB to KH (RM565.75 to RM545.00)

RM	SITE DESCRIPTION	REFERENCE and LOGIC	ITEMIZATION AND ACCOUNTING OF INPUT SOURCES

ASSUMPTIONS & DEFINITIONS

Note: Some rivermiles are repeated to separate out a stream source from a spring source.
Calculation: Load, tons/year = Concentration (mg/L) x Flow (cfs) x 5.39 x 0.1825

Assumption 1: Not all Q is accounted for because not all springs and surface streams were monitored. According to USGS-Boise & USGS-Twin Falls, it is not possible to account for all input and output flows, because of unknown seeps & underground springs. However, a reasonable estimate can be derived that accounts for at least 90% or more of the instream Q by making several assumptions:

1. Accounted Q can be estimated within a stream reach based on USGS flow information.
2. Unaccounted Q can be estimated by subtracting the known Point Source Q, the known Surface Q, and the known Spring Q, from the Accounted Q.
3. Total Q = Accounted Q + Unaccounted Q.

4. Spring discharges from the Eastern Snake Plain Aquifer from Milner Dam to King Hill increased from 4200 cfs in the early 1900s to more than 6500 cfs in the mid-1950s, after which declines began to occur (Kjelstrom 1986; IDWR 1997). Early 1990s data indicate Milner Dam to King Hill spring discharges in the range of 5200 cfs (IDWR 1997). In this inventory of sources, the following summarizes the estimated Q on a per-segment basis:

Segment Reach	USGS Mapped Springs	% of Total	Estimated Q, cfs	Accumulative Q, cfs
Segment 1: MD to PF	57	22.5%	1,170.0	1,170.0
Segment 2: PF to CS	77	30.4%	1,580.8	2,750.8
Segment 3: CS to BC	66	26.1%	1,357.2	4,108.0
Segment 4: BC to GB	43	17.0%	884.0	4,992.0
Segment 5: GB to SB	7	2.8%	145.6	5,137.6
Segment 6: SB to KH	3	1.2%	62.4	5,200.0
	253	100.0%	5,200.0	5,200.0

5. 5200 cfs represents a gross total of the springs from Milner Dam to King Hill. The gross average flow at King Hill from WY1990-1991 = 7966 cfs. Approximately 6% of the gross flow is attributable to seeps and unseen underground springs (or 5200 cfs x 0.06 = 312 cfs) (IDWR 1997; IDWR Personal Communication), and most of this comes in from Pillar Falls to Gridley Bridge. Therefore:

% Spring Q (Milner Dam to King Hill) = (5200 cfs x 100%) / 7966 cfs = 65.3%, which is attributed to all springs in the Middle Snake River
% Surface Q (Milner Dam to King Hill) = 7966 cfs - 5200 cfs = 2766 cfs = (2766 cfs x 100%) / 7966 cfs = 34.7%, attributed to surface Q

312 cfs of seeps and unseen underground springs:
Segment 2 = 77 known springs = (77 x 100%) / 186 = 41.4% = 312 cfs x 0.414 = 129.2 cfs
Segment 3 = 66 known springs = (66 x 100%) / 186 = 35.5% = 312 cfs x 0.355 = 110.8 cfs
Segment 4 = 43 known springs = (43 x 100%) / 186 = 23.1% = 312 cfs x 0.231 = 72.0 cfs
Total Springs in Segments 2 - 4 = 186 springs
(= 312 cfs)

Note also that springs are either utilized by fish hatcheries or not utilized whatsoever. Based on the information in this section:

Segment	Known Springs +	Utilized by FH	+ Unseen Underground Seeps	+ Unaccounted Springs Q	=	Total Q, cfs
Segment 1: MD to PF	55.6	0.0	0.0	510.5		566.1
Segment 2: PF to CS	51.3	463.9	129.2	153.9 *		798.3
Segment 3: CS to BC	351.7	871.8	110.8	185.0 *		1,519.3
Segment 4: BC to GB	1,430.5	146.7	72.0	72.6 *		1,721.8
Segment 5: GB to SB	1.1	82.7	0.0	231.0		314.8
Segment 6: SB to KH	0.0	0.0	0.0	248.3		248.3
Total	1,890.2	1,565.1	312.0	1,401.3		5,168.6

* These values are calculated as negative values within the TSD. It is evidence that more data is required in knowing the true Q values of springs within the Middle Snake River corridor.
** Total Q as calculated within the segments is much lower than here because of the accounting for Unaccounted Springs, Unseen Seeps, Springs Utilized by Fish Hatcheries, and Known Springs. Thus,

Total Spring Q = Unaccounted Springs + Unseen Seeps + Fish Hatchery Utilization + Known Springs

It can be stated that overall when comparing the Estimated Total Q (5200.0 cfs) to the Total Q (5168.6) there is confidence that these gross estimates are fairly close to each other. However, within each specific segment much research still needs to be done to better define the flow estimates (as evidenced by the wide standard deviation and the coefficient of variation:

	Estimated Q, cfs	Total Q, cfs	Standard Deviation	Mean	Coefficient of Variation
	1,170.0	566.1	427.0	1,375.4	0.310
	1,580.8	798.3	553.3	1,469.0	0.377
	1,357.2	1,519.3	114.6	1,120.6	0.102
	884.0	1,721.8	592.4	514.8	1.151
	145.6	314.8	119.6	104.0	1.150
	62.4	248.3	131.5	2,631.2	0.050
Overall Estimates:	5,200.0	5,168.6	22.2	#REF!	#REF!

RM	SITE DESCRIPTION	REFERENCE and LOGIC	ITEMIZATION AND ACCOUNTING OF INPUT SOURCES

ASSUMPTIONS & DEFINITIONS (continued)

Assumption 2. Unnamed Spring is estimated on a river gain bases per USGS data. TSS is estimated 1.3 mg/L TSS (USGS, ERI, IDEQ). Spring sources identified on USGS topographic maps.

Assumption 3: Unknown streams are estimated at 35.7 mg/L TSS. This is based on natural streams only. When irrigation ditches are combined with natural streams, TSS = 107.3 mg/L mean. Flow is estimated on a per reach basis. Unknown streams are identified from USGS topographic maps. TSS load gains per segment are summarized as follows:

Segment Reach	TSS Load, tons/year (Input Unaccountability)	Possible Segment Action
Segment 1: MD to PF	(8,173.5)	Passes Thru
Segment 2: PF to CS	(24,936.4)	Passes Thru
Segment 3: CS to BC	17,155.2	Depositional
Segment 4. BC to GB	(40,369.9)	Passes Thru
Segment 5: GB to SB	(20,172.6)	Passes Thru
Segment 6: SB to KH	82,848.3	Depositional
	6,351.1	

Passes Thru =	(93,652.4)	tons/year	48.4%
Depositional =	100,003.5	tons/year	51.6%
Gross Total TSS =	193,655.9	tons/year	

Assumption 4: For fish hatcheries (FH) without monitoring data, it is estimated that the effluent TSS concentration is 1/2 MDL = 1/2 (4 mg/L) = 2.0 mg/L TSS.

VIII. DESIGN FLOW ANALYSIS AND LOGIC

. Design flow analysis is based on USGS data for known sites on the Middle Snake River.

1. Baseline Years = WY1990-WY1991, which was also within a low flow period.

2. IDEQ-TFRO included the low flow years most recent to WY1990-WY1991 Baseline since the Baseline fell in the middle of the low flow period.

   Therefore, low flow years ranged from WY1988-WY1995, or 8 years.

3. Recent high flow years since Baseline are WY1996-WY1998, or 3 years. IDEQ-TFRO expanded high flow year coverage to include most recent high flow years prior to Baseline.

Therefore, high flow years ranged from WY1983-WY1987 to WY1996-WY1998, or 8 years.

Therefore,	High Flow Years = WY1983-WY1987, WY1996-1998	= 8 years
	MEAN Flow Years = WY1983-WY1998	= 16 years total
	Low Flow Years = WY1988-WY1995	= 8 years

4. Within the WY1983-WY1998, it was determined that the highest flow WY was WY1984. This was used as the high flow water year or High Q.

   At Milner Dam the Mean Q of WY1984 = 9432 cfs +/- 604 cfs (95% CL)

5. Within the WY1983-WY1998, it was determined that the lowest flow WY was WY1992. This was used as the low flow water year or Low Q.

   At Milner Dam the Mean Q of WY1992 = 366 cfs +/- 45 cfs (95% CL)

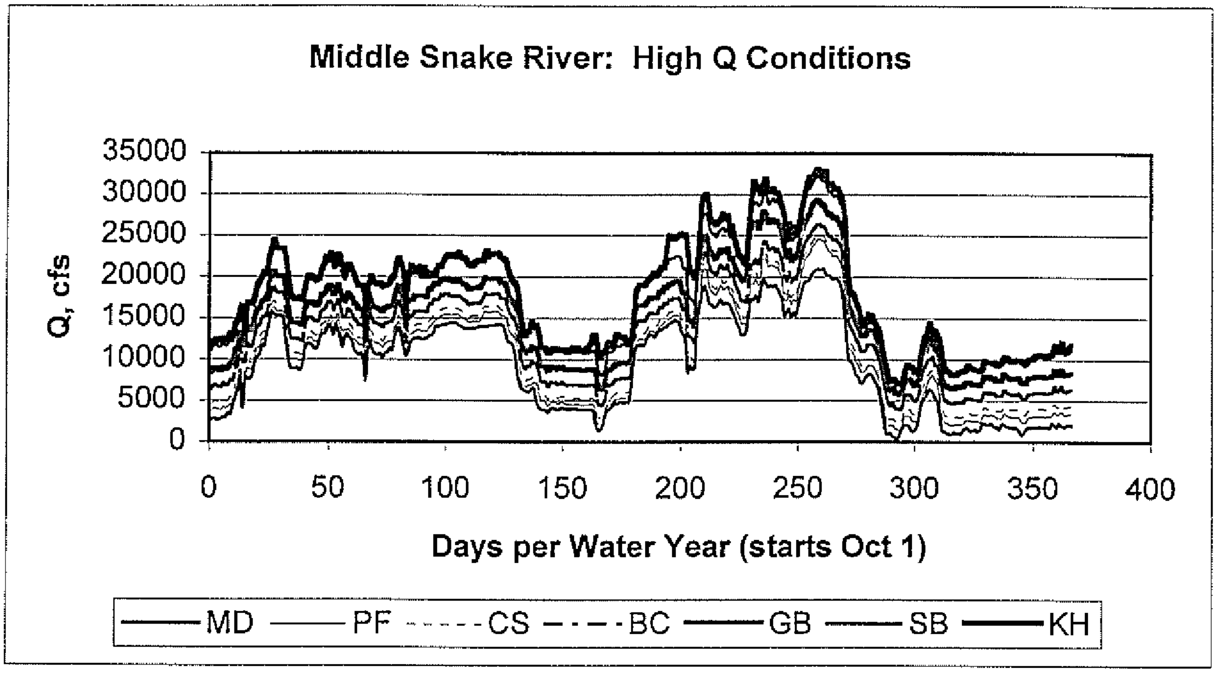
6. Within the WY1983-WY1998, it was determined that the daily average of all flows for any specific USGS site would be the MEAN Q.

   At Milner Dam, MEAN Q of WY1983-WY1998 = 3860 cfs +/- 183 cfs (95% CL)

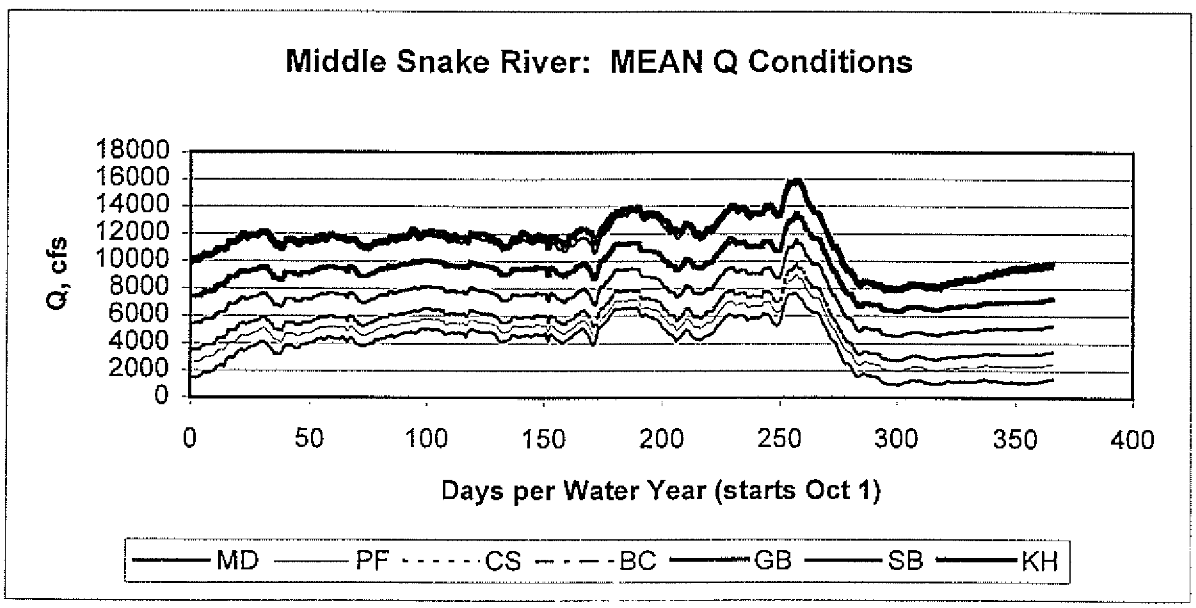
7. So,	Highest Q Year =	WY1984 =	9432 +/- 604 cfs
	MEAN Q =	WY1983-WY1998 =	3860 +/- 183 cfs
	Lowest Q Year =	WY1992 =	366 +/- 45 cfs

Middle Snake River Flows:

1. WY1984: High Q Conditions

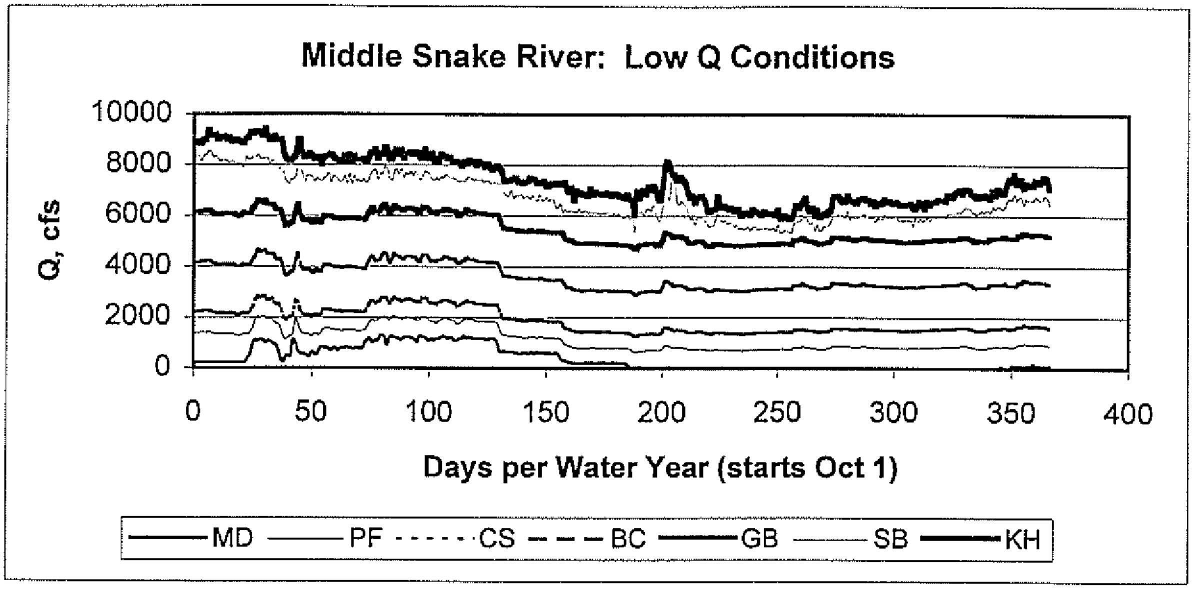


2. WY1983-WY1998 = MEAN Q Conditions:



Middle Snake River Flows:

3. WY1992 = Low Q Conditions:



IX. TSS MID-SNAKE INSTREAM LOADING ANALYSIS

SEGMENT	RM	WY1984 High Flow Conditions Q cfs	TSS mg/L	TSS Load tons/year	MEAN Flow Conditions Q cfs	TSS mg/L	TSS Load tons/year	WY1992 Low Flow Conditions Q cfs	TSS mg/L	TSS Load tons/year
Milner Dam	638.43	9,432	19.4	197,999.1	3,860	16.5	64,131.7	366	14.6	5,364.7
Pillar Falls	613.09	10,644	20.9	254,219.9	4,737	15.3	74,130.1	1,146	12.0	13,668.7
Crystal Springs	600.40	11,404	28.1	371,618.9	5,498	19.0	106,909.1	1,852	13.4	24,748.1
Box Canyon	587.00	13,074	37.8	558,102.0	7,212	25.9	188,852.8	3,573	18.5	65,586.9
Gridley Bridge	582.00	15,124	35.4	620,382.7	9,113	20.8	193,004.5	5,429	11.9	64,306.7
Shoestring Bridge	565.75	17,598	38.1	789,778.7	11,108	18.0	206,695.4	6,674	4.3	30,590.4
King Hill	545.00	18,069	46.1	953,355.6	11,398	26.8	309,662.6	7,384	15.2	112,646.4

NET TSS LOADING ANALYSIS:		Range			Range			Range	
MD to PF (PF - MD)	1,212	19.4 - 20.9	56,220.8	877	15.3 - 16.5	9,998.4	780	12.0 - 14.6	8,304.0
PF to CS (CS - PF)	760	20.9 - 28.1	117,399.0	761	15.3 - 19.0	32,779.0	706	12.0 - 13.4	11,079.4
CS to BC (BC - CS)	1,670	28.1 - 37.8	186,483.1	1,714	19.0 - 25.9	81,943.7	1,721	13.4 - 18.5	40,838.8
BC to GB (GB - BC)	2,050	35.4 - 37.8	62,280.7	1,901	20.8 - 25.9	4,151.7	1,856	11.9 - 18.5	-1,280.2
GB to SB (SB - GB)	2,474	35.4 - 38.1	169,396.0	1,995	18.0 - 20.8	13,690.9	1,245	4.3 - 11.9	-33,716.3
SB to KH (KH - SB)	471	38.1 - 46.1	163,576.9	290	18.0 - 26.8	102,967.2	710	4.3 - 15.2	82,056.0
TOTAL	8,637		755,356.5	7,538		245,530.9	7,018		107,281.7

% VALUES >= 52 mg/L:	High	Mean	Low
MD	0.00%	0.00%	0.00%
PF	0.00%	0.00%	0.00%
CS	0.00%	0.00%	0.00%
BC	13.90%	0.00%	0.00%
GB	15.30%	0.00%	0.00%
SB	25.40%	0.00%	0.00%
KH	42.30%	0.00%	0.00%

TSS information based on rating curved established between known Q and known TSS at each location site.
Q information based on USGS sites.

X. TSS REDUCTION TARGETS ON THE MID-SNAKE RIVER SURFACE WATERBODIES
YEAR 2004 YEAR 2009 TARGETS

A. KNOWN SURFACE SOURCES: TARGET = 52.0 mg/L TSS (or less = 51.9 mg/L)

Segment Name	Surface Stream	Q, cfs	Mean TSS mg/L	Reduce to < 52.0 mg/L	% Reduction
1: MD to PF	Dry Creek	10.0	290.0	51.9	82.1
	A Drain	8.8	164.2	51.9	68.4
	A10 Drain	4.8	44.5	44.5	0
	C55 Drain	7.4	47.3	47.3	0
	TF Coulee	8.7	121.3	51.9	57.2
	Sub Total/Mean =	39.7			
2: PF to CS	East Perrine Coulee	29.3	116.9	51.9	55.6
	Main Perrine Coulee	11.0	117.2	51.9	55.7
	West Perrine Coulee	2.5	223.2	51.9	76.7
	43 Drain	0.3	179.7	51.9	71.1
	Warm Creek	21.7	16.0	16.0	0.0
	Jerome Golf Course	7.8	35.7	35.7	0.0
	Rock Creek	219.9	66.4	51.9	21.8
	30 Drain	6.1	371.3	51.9	86.0
	LQ/LS Drains	30.3	215.5	51.9	75.9
	LS2/39A Drains	5.3	213.9	51.9	75.7
	N42 Drain (N)	8.8	17.0	17.0	0.0
	N42 Drain (NT)	10.1	32.2	32.2	0.0
	39 Drain	4.8	425.7	51.9	87.8
	Sub Total/Mean =	357.9			
3. CS to BC	Cedar Draw	115.2	107.9	51.9	51.9
	Mud Creek	97.3	62.3	51.9	16.7
	Deep Creek	95.9	65.7	51.9	21.0
	Blind Canyon Creek	43.5	29.0	29.0	0.0
	I Drain	11.4	111.9	51.9	53.6
	J8 Drain	9.0	41.1	41.1	0.0
	N Drain	4.4	36.8	36.8	0.0
	S29 Drain	2.6	11.9	11.9	0.0
	S19/S Drain	53.0	43.4	43.4	0.0
	Sub Total/Mean =	432.3			
4. BC to GB	Salmon Falls Creek	149.4	40.6	40.6	0
	W26 Drain	18.2	61.2	51.9	15.2
	Sub Total/Mean =	167.6			
5. GB to SB	Malad River	180.0	21.2	21.2	0.0
	Malad Power Flume	1132.0	21.2	21.2	0.0
	Billingsley Creek	39.3	4.7	4.7	0.0
	Birch Creek	11.0	1.3	1.3	0.0
	Sub Total/Mean =	1312.0	21.2	21.2	0.0
6. SB to KH	Clover Creek	40.8	9.7	9.7 0	0.0
	Sub Total/Mean =	40.8			0.0
Segs 1 to 7	Overall Total/Mean =	2350.2	96.8	38.8	27.0

X. TSS REDUCTION TARGETS ON THE MID-SNAKE RIVER SURFACE WATERBODIES
YEAR 2004 YEAR 2009 TARGETS

B. ACCOUNTING FOR UNKNOWN SOURCES:

Segment Name	Surface Stream	Q, cfs	Mean TSS mg/L	Reduce to < 52.0 mg/L	% Reduction
1: MD to PF	Dry Creek	10.00	290.0	51.9	82.1
	A Drain	8.80	164.2	51.9	68.4
	A10 Drain	4.80	44.5	44.5	0.0
	C55 Drain	7.40	47.3	47.3	0.0
	TF Coulee	8.70	121.3	51.9	57.2
	Unknown Surface	271.20	107.3	51.9	51.6
	Sub Total/Mean =	310.90	129.1	49.9	43.2
2: PF to CS	East Perrine Coulee	29.3	116.9	51.9	55.6
	Main Perrine Coulee	11.0	117.2	51.9	55.7
	West Perrine Coulee	2.5	223.2	51.9	76.7
	43 Drain	0.3	179.7	51.9	71.1
	Warm Creek	21.7	16.0	16.0	0.0
	Jerome Golf Course	7.8	102.0	51.9	49.1
	Rock Creek	219.9	66.4	51.9	21.8
	30 Drain	6.1	371.3	51.9	86
	LQ/LS Drains	30.3	215.5	51.9	75.9
	LS2/39A Drains	5.3	213.9	51.9	75.7
	N42 Drain (N)	8.8	17.0	17.0	0.0
	N42 Drain (NT)	10.1	32.2	32.2	0.0
	39 Drain	4.8	425.7	51.9	87.8
	Unknown Surface	-81.8	107.3	51.9	51.6
	Sub Total/Mean =	276.1	157.5	45.4	50.5
3. CS to BC	Cedar Draw	115.2	107.9	51.9	51.9
	Mud Creek	97.3	62.3	51.9	16.7
	Deep Creek	95.9	65.7	51.9	21.0
	Blind Canyon Creek	43.5	29.0	29.0	0.0
	I Drain	11.4	111.9	51.9	53.6
	J8 Drain	9.0	41.1	41.1	0.0
	N Drain	4.4	36.8	36.8	0.0
	S29 Drain	2.6	11.9	11.9	0.0
	S19/S Drain	53.0	43.4	43.4	0.0
	Unknown Surface	-98.3	107.3	51.9	51.6
	Sub Total/Mean =	334.0	61.7	42.2	19.5
4. BC to GB	Salmon Falls Creek	149.4	40.6	40.6	0.0
	W26 Drain	18.2	61.2	51.9	15.2
	Unknown Surface	-38.6	107.3	51.9	51.6
	Sub Total/Mean =	129.0	69.7	48.1	22.3
5. GB to SB	Malad River	180.0	21.2	21.2	0.0
	Malad Power Flume	1132.0	21.2	21.2	0.0
	Billingsley Creek	39.3	4.7	4.7	0.0
	Birch Creek	11.0	1.3	1.3	0.0
	Unknown Surface	122.8	107.3	51.9	51.6
	Sub Total/Mean =	1485.1	31.1	20.1	10.3
6. SB to KH	Clover Creek	40.8	9.7	9.7	0.0
	Unknown Surface	131.9	107.3	51.9	51.6
	Sub Total/Mean =	172.7	58.5	30.8	25.8
Segs 1 to 7	Overall Total/Mean =	2707.7	102.0	41.6	33.3

X. TSS REDUCTION TARGETS ON THE MID-SNAKE RIVER SURFACE WATERBODIES YEAR 2004 YEAR 2009 TARGETS

SEGMENT 1: MD to PF (RM638.53 to RM613.09)

(1) Determine % Reduction of Surface Source Inputs

TSS Sources	TSS Load, tons/year	% Reduction	Equivalent Load	Load After Reduction	
Point Sources (A)	1.3	0.0%	0.0	1.3	
All Springs (B)	723.8	0.0%	0.0	723.8	
All Surface (C)	15,395.0	43.2%	6,650.6	8,744.4	
Total Load (A+B+C)	16,120.1		6,650.6	9,469.5 =	Inputs %R 41.3

(2) Surface Stream TSS Reduction Effect on Mid-Snake River Segment 1

	Net Q, cfs	Net Load	% Red	Net Load	
Instream Net (D)	877.0	7,945.4	33.3%	5,299.6 =	Instream %R 33.3%
Segment 1:		Before		After	
Point Sources (A)	0.1	1.3	0.0%	1.3	
All Springs (B)	566.0	723.8	0.0%	723.8	
All Surface (C)	310.9	15,395.0	43.2%	8,744.4	
Total Inputs (A+B+C)	877.0	16,120.1	41.3	9,469.5	
TOTAL (A+B+C+D)	1,754.0	24,065.5		14,769.0 =	Instream %R 38.6
TSS, mg/L		13.9		8.6 =	38.6

NOTES:

1. TSS Load for Point Sources, All Springs, and All Surface from Section VII, Segment 1.
2. Instream Net Load from Section VII, Segment I, Overall Total.
3. 43.2% All Surface Reduction obtained from Section X. B. Segment 1, % Reduction.
4. 33.3% Instream Reduction obtained from Section X. B. Overall Total/Mean to reduce to < 52.0

X. TSS REDUCTION TARGETS ON THE MID-SNAKE RIVER SURFACE WATERBODIES
YEAR 2004 YEAR 2009 TARGETS

SEGMENT 2: PF to CS (RM613.09 to RM600.40)

(1) Determine % Reduction of Surface Sources

TSS Sources	TSS Load, tons/year	% Reduction	Equivalent % Load	Load After Reduction	
Point Sources (A)	2,428.2	0.0%	0.0	2,428.2	
All Springs (B)	39.0	0.0%	0.0	39.0	
All Surface (C)	30,159.8	50.5%	15,230.7	14,929.1	
Total Load (A+B+C)	32,627.0		15,230.7	17,396.3 =	Inputs %R 46.7

(2) Surface Stream TSS Reduction Effect on Mid-Snake River Segments 2

	Net Q, cfs	Before Reduction Net Load	% Red	After Reduction Net Load	
Instream Seg 2 (D)	773.0	7,623.7	33.3%	5,085.0	
Total Segs 2	773.0	7,623.7		5,085.0	Instream %R 33.3
Segment 2:		Before		After	
Point Sources (A)	464.2	2,428.2	0.0%	2,428.2	
All Springs (B)	30.6	39.0	0.0%	39.0	
All Surface (C)	278.2	30,159.8	50.5%	14,929.1	
Total Inputs (A+B+C)	773.0	32,627.0		17,396.3	
TOTAL (A+B+C+D)	1,546.0	40,250.7		22,481.3	Instream %R 44.1
TSS, mg/L		26.5		14.8	44.1

NOTES:

1. TSS Load for Point Sources, All Springs, and All Surface from Section VII, Segment 2.
2. Instream Net Load from Section VII, Segment 2, Overall Total.
3. 50.5% All Surface Reduction obtained from Section X. B. Segment 2, % Reduction.
4. 33.3% Instream Reduction obtained from Section X. B. Overall Total/Mean to reduce to < 52.0

X. TSS REDUCTION TARGETS ON THE MID-SNAKE RIVER SURFACE WATERBODIES
YEAR 2004 YEAR 2009 TARGETS

SEGMENT 3: CS to BC (RM600.40 to RM587.00)

(1) Determine % Reduction of Surface Sources

TSS Sources	TSS Load, tons/year	% Reduction	Equivalent % Load	Load After Reduction	
Point Sources (A)	3,596.5	0.0%	0.0	3,596.5	
All Springs (B)	1,375.3	0.0%	0.0	1,375.3	
All Surface (C)	26,245.6	19.5%	5,117.9	21,127.7	
Total Load (A+B+C)	31,217.4		5,117.9	26,099.5 =	Inputs %R 16.4

(2) Surface Stream TSS Reduction Effect on Mid-Snake River Segment 3

	Net Q, cfs	Before Net Load	% Red	After Net Load	
Instream Seg 3 (D)	1,742.0	48,372.7	33.3%	32,264.6	
Total Segs 3	1,742.0	48,372.7		32,264.6	Instream %R 33.3
Segment 3:		Before		After	
Point Sources (A)	687.7	3,596.5	0.0%	3,596.5	
All Springs (B)	720.3	1,375.3	0.0%	1,375.3	
All Surface (C)	334.0	26,245.6	19.5%	21,127.7	
Total Inputs (A+B+C)	1,742.0	31,217.4		26,099.5	
TOTAL (A+B+C+D)	3,484.0	79,590.1		58,364.1	Instream %R 26.7
TSS, mg/L		22.5		16.5	26.7

NOTES:

1. TSS Load for Point Sources, All Springs, and All Surface from Section VII, Segment 3.
2. Instream Net Load from Section VII, Segment 3, Overall Total.
3. 19.5% All Surface Reduction obtained from Section X. B. Segment 3, % Reduction.
4. 33.3% Instream Reduction obtained from Section X. B. Overall Total/Mean to reduce to < 52.0

X. TSS REDUCTION TARGETS ON THE MID-SNAKE RIVER SURFACE WATERBODIES
YEAR 2004 YEAR 2009 TARGETS

SEGMENT 4: BC to GB (RM587.00 to RM582.00)

(1) Determine % Reduction of Surface Sources

TSS Sources	TSS Load, tons/year	% Reduction	Equivalent % Load	Load After Reduction	
Point Sources (A)	111.2	0.0%	0.0	111.2	
All Springs (B)	2,715.3	0.0%	0.0	2,715.3	
All Surface (C)	5,704.3	22.3%	1,272.1	4,432.2	
Total Load (A+B+C)	8,530.8		1,272.1	7,258.7 =	Inputs %R 14.9

(2) Surface Stream TSS Reduction Effect on Mid-Snake River Segment 4

	Net Q, cfs	Before Net Load	% Red	After Net Load	
Instream Seg 4 (D)	1,705.5	31,839.1	33.3%	21,236.7	Instream %R 33.3
Instream Net	1,705.5	31,839.1		21,236.7	
Segment 4:		Before		After	
Point Sources (A)	146.7	111.2	0.0%	111.2	
All Springs (B)	1,429.8	2,715.3	0.0%	2,715.3	
All Surface (C)	129.0	5,704.3	22.3%	4,432.2	
Total Inputs (A+B+C)	1,705.5	8,530.8		7,258.7	
TOTAL (A+B+C+D)	3,411.0	40,369.9		28,495.4	% Red 29.4
TSS, mg/L		11.6		8.2	29.4

NOTES:

1. TSS Load for Point Sources, All Springs, and All Surface from Section VII, Segment 4.
2. Instream Net Load from Section VII, Segment 4, Overall Total.
3. 22.3% All Surface Reduction obtained from Section X. B. Segment 4, % Reduction.
4. 33.3% Instream Reduction obtained from Section X. B. Overall Total/Mean to reduce to < 52.0

X. TSS REDUCTION TARGETS ON THE MID-SNAKE RIVER SURFACE WATERBODIES
YEAR 2004 YEAR 2009 TARGETS

SEGMENT 5: GB to SB (RM582.00 to RM565.75)

(1) Determine % Reduction of Surface Sources

TSS Sources	TSS Load, tons/year	% Reduction	Equivalent % Load	Load After Reduction	
Point Sources (A)	822.0	0.0%	0.0	822.0	
All Springs (B)	371.3	0.0%	0.0	371.3	
All Surface (C)	31,078.3	10.3%	3,201.1	27,877.2	
Total Load (A+B+C)	32,271.6		3,201.1	29,070.5 =	Inputs %R 9.9

(2) Surface Stream TSS Reduction Effect on Mid-Snake River Segment 5

	Net Q, cfs	Before Net Load	% Red	After Net Load	
Instream Seg 5 (D)	1,836.0	10,977.2	33.3%	7,321.8	Instream %R
Instream Net	1,836.0	10,977.2		7,321.8	33.3
Segment 5:		Before		After	
Point Sources (A)	186.1	822.0	0.0%	822.0	
All Springs (B)	211.9	371.3	0.0%	371.3	
All Surface (C)	1,438.0	31,078.3	10.3%	27,877.2	
Total Inputs (A+B+C)	1,836.0	32,271.6		29,070.5	
TOTAL (A+B+C+D)	3,672.0	43,248.8		36,392.3	% Red 15.9
TSS, mg/L		11.6		9.7	15.9

(3) Diversions

	Net Q, cfs	Before Net Load	% Red	After Net Load	
Bell Rapids	-104.8	-1772.6		-1772.6	
Total Diversion	(104.80)	(1772.6)		(1772.6)	
Instream Effect	3,567.2	41,476.2		34,619.7	% Red 16.5
TSS mg/L		11.4		9.5	16.5

NOTES:

1. TSS Load for Point Sources, All Springs, and All Surface from Section VII, Segment 5.
2. Instream Net Load from Section VII, Segment 5, Overall Total.
3. 10.3% All Surface Reduction obtained from Section X. B. Segment 5, % Reduction.
4. 33.3% Instream Reduction obtained from Section X. B. Overall Total/Mean to reduce to < 52.0

X. TSS REDUCTION TARGETS ON THE MID-SNAKE RIVER SURFACE WATERBODIES
YEAR 2004 YEAR 2009 TARGETS

SEGMENT 6: SB to KH (RM565.75 to RM545.00)

(1) Determine % Reduction of Surface Sources

TSS Sources	TSS Load, tons/year	% Reduction	Equivalent % Load	Load After Reduction	
Point Sources (A)	0.0	0.0%	0.0	0.0	
All Springs (B)	317.5	0.0%	0.0	317.5	
All Surface (C)	5,020.8	25.8%	1,295.4	3,725.4	
Total Load (A+B+C)	5,338.3		1,295.4	4,042.9 =	Inputs %R 24.3

(2) Surface Stream TSS Reduction Effect on Mid-Snake River Segment 1

	Net Q, cfs	Before Net Load	% Red	After Net Load	
Instream Seg 6 (D)	421.0	88,186.6	33.3%	58,820.5	Instream %R
Instream Net	421.0	88,186.6		58,820.5	33.3
Segment 6:		Before		After	
Point Sources (A)	0.0	0.0	0.0%	0.0	
All Springs (B)	248.3	317.5	0.0%	317.5	
All Surface (C)	172.7	5,020.8	25.8%	3,725.4	
Total Inputs (A+B+C)	421.0	5,338.3		4,042.9	
					Instream %R
TOTAL (A+B+C+D)	842.0	93,524.9		62,863.4	32.8
TSS, mg/L		109.3		73.4	32.8

(3) Diversions

	Net Q, cfs	Before Net Load	% Red	After Net Load	
Black Mesa	-63.6	-1,451.2		-1,451.2	
Wiley Pumps	-19.3	-440.2		-440.2	
Total Diversion	(82.9)	(1,891.4)		(1,891.4)	
					% Red
Instream Effect	759.1	91,633.5		60,972.0	33.5
TSS, mg/L		118.7		79.0	33.5

NOTES:

1. TSS Load for Point Sources, All Springs, and All Surface from Section VII, Segment 6.
2. Instream Net Load from Section VII, Segment 6, Overall Total.
3. 25.8% All Surface Reduction obtained from Section X. B. Segment 6, % Reduction.
4. 33.3% Instream Reduction obtained from Section X. B. Overall Total/Mean to reduce to < 52.0

X. TSS REDUCTION TARGETS ON THE MID-SNAKE RIVER SURFACE WATERBODIES
YEAR 2004 YEAR 2009 TARGETS

SUMMARY REVIEW OF SEGMENTS RESPONDING TO TSS REDUCTIONS IN SURFACE SOURCES BASED ON BASELINE FLOW CONDITIONS

BEFORE TSS LOAD REDUCTIONS:

	Segment	Total Inputs tons/year	Instream Net Load tons/year	Instream Total Load tons/year	Total Inputs Q, cfs	Instream Net Load Q, cfs	Instream Total Load Q, cfs
1	MD to PF	16,120.1	7,945.4	24,065.5	877.0	877.0	1,754.0
2	PF to CS	32,627.0	7,623.7	40,250.7	773.0	773.0	1,546.0
3	CS to BC	31,217.4	48,372.7	79,590.1	1742.0	1742.0	3,484.0
4	BC to GB	8,530.8	31,839.1	40,369.9	1705.5	1705.5	3,411.0
5	GB to SB	32,271.6	10,977.2	43,248.8	1836.0	1836.0	3,672.0
6	SB to KH	5,338.3	88,186.6	93,524.9	421.0	421.0	842.0
	Total	126,105.2	194,944.7	321,049.9	7,354.5	7,354.5	14,709.0
	% of Total	39.3	60.7		50.0	50.0	

AFTER TSS LOAD REDUCTIONS:

	Segment	Total Inputs tons/year	Instream Net Load tons/year	Instream Total Load tons/year	Total Inputs Q, cfs	Instream Net Load Q, cfs	Instream Total Load Q, cfs
1	MD to PF	9,469.5	5,299.6	14,769.0	877.0	877.0	1,754.0
2	PF to CS	17,396.3	5,085.0	22,481.3	773.0	773.0	1,546.0
3	CS to BC	26,099.5	32,264.6	58,364.1	1742.0	1742.0	3,484.0
4	BC to GB	7,258.7	21,236.7	28,495.4	1705.5	1705.5	3,411.0
5	GB to SB	29,070.5	7,321.8	36,392.3	1836.0	1836.0	3,672.0
6	SB to KH	4,042.9	58,820.5	62,863.4	421.0	421.0	842.0
	Total	93,337.5	130,028.1	223,365.6	7,354.5	7,354.5	14,709.0
	% of Total	41.8	58.2		50.0	50.0	

OVERALL % REDUCTION:

	Segment	Total Inputs %R	Instream Net Load %R	Instream Total Load %R
1	MD to PF	41.3	33.3	38.6
2	PF to CS	46.7	33.3	44.1
3	CS to BC	16.4	33.3	26.7
4	BC to GB	14.9	33.3	29.4
5	GB to SB	9.9	33.3	15.9
6	SB to KH	24.3	33.3	32.8
	% of Total	26.0	33.3	30.4

X. TSS REDUCTION TARGETS ON THE MID-SNAKE RIVER SURFACE WATERBODIES
YEAR 2004 YEAR 2009 TARGETS

SUMMARY REVIEW OF SEGMENTS RESPONDING TO TSS REDUCTIONS IN SURFACE SOURCES BASED ON BASELINE FLOW CONDITIONS

BEFORE TSS CONCENTRATION REDUCTIONS:

	Segment	Total Inputs mg/L	Insteam Net Load mg/L	Instream Total Load mg/L	Total Inputs Q, cfs	Insteam Net Load Q, cfs	Instream Total Load Q, cfs
1	MD to PF	18.1	8.9	13.5	877.0	877.0	1,754.0
2	PF to CS	41.5	9.7	25.6	773.0	773.0	1,546.0
3	CS to BC	17.6	27.3	22.5	1,742.0	1,742.0	3,484.0
4	BC to GB	4.9	18.4	11.6	1,705.5	1,705.5	3,411.0
5	GB to SB	17.3	5.9	11.6	1,836.0	1,836.0	3,672.0
6	SB to KH	12.5	206.0	109.3	421.0	421.0	842.0
	Total	16.9	26.1	21.5	7,354.5	7,354.5	14,709.0

AFTER TSS CONCENTRATION REDUCTIONS:

	Segment	Total Inputs mg/L	Insteam Net Load mg/L	Instream Total Load mg/L	Total Inputs Q, cfs	Insteam Net Load Q, cfs	Instream Total Load Q, cfs
1	MD to PF	10.6	5.9	8.3	877.0	877.0	1,754.0
2	PF to CS	22.1	6.5	14.3	773.0	773.0	1,546.0
3	CS to BC	14.7	18.2	16.5	1,742.0	1,742.0	3,484.0
4	BC to GB	4.2	12.2	8.2	1,705.5	1,705.5	3,411.0
5	GB to SB	15.6	3.9	9.7	1,836.0	1,836.0	3,672.0
6	SB to KH	9.4	137.4	73.4	421.0	421.0	842.0
	Total	12.5	17.4	14.9	7,354.5	7,354.5	14,709.0

OVERALL % REDUCTION:

	Segment	Total Inputs %R	Insteam Net Load %R	Instream Total Load %R
1	MD to PF	41.3	33.3	38.6
2	PF to CS	46.7	33.3	44.1
3	CS to BC	16.4	33.3	26.7
4	BC to GB	14.9	33.3	29.4
5	GB to SB	9.9	33.3	15.9
6	SB to KH	24.3	33.3	32.8
	% of Total	26.0	33.3	30.4

XI. THE EFFECT OF TSS REDUCTION ON OTHER PARAMETERS:
Prediction Estimates on Parameter Responses

1. Ascertaining the Normality of Raw Data versus Log Transformed Data (Trans Data)

Parameter Format	Q cfs	TSS mg/L	TP mg/L	SRP mg/L	NH3 mg/L	NOX mg/L	TKN mg/L	DO mg/L
1. N	1440	1440	1440	1440	1440	1440	1440	1463
2. CV								
Raw Data	1.02	0.92	0.44	0.74	1.10	0.51	0.49	0.17
Log Data	0.17	0.31	0.18	0.26	0.32	7.67	0.48	-
3. Curve Shape Skewness								
Raw Data	Right	Right	Right	Right	Right	Normal	Normal	Normal
Log Data	Binomial	Normal	Normal	Normal	Normal	Left	Normal	-
4. Mean/Median								
Raw Data	6412/3819	18.6/14.8	0.115/0.108	0.064/0.051	0.080/0.050	1.136/1.237	0.37/0.37	10.0/9.9
Log Data	3.54/3.58	1.14/1.27	-0.97/-0.97	-1.31/-1.29	-1.30/-1.30	-0.05/-0.09	-0.49/-0.43	-
5. Skewness Value								
Raw Data	1.88	5.29	2.27	1.76	2.11	-0.07	1.80	0.35
Log Data	-1.85	-0.87	-0.23	-0.56	0.18	-2.02	-0.82	-
6. Kurtosis Value								
Raw Data	4.05	59.58	11.45	6.76	3.90	-0.51	8.10	-0.14
Log Data	6.52	2.91	2.58	0.49	-0.21	4.90	1.10	-
Conclusion: Which database has a normal distribution?								
Raw Data						X	X	X
Log Data	X	X	X	X	X		X	

Fecal Coliform Bacteria reductions will be assessed separately in item 9, BACTERIA:TSS SYNERGISTIC RELATIONSHIP.

2. Synergistic Relationships Summary Statistics:

	N	r^2	F-ratio	p-value	Equation
TSS:Q	1440	0.252	97.1	0.000000	logTSS=(0.147313 logQ)+0.622362
TP:TSS	1440	0.223	75.3	0.000000	logTP=(0.110944logTSS)-1.101016
SRP:TSS	1440	0.133	26.0	0.000000	logSRP=(-0.127320logTSS)-1.167700
NH3:TSS	1440	0.045	2.9	0.086422	logNH3=(-0.052298logTSS)-1.235676
NOX:TSS	1440	0.315	158.4	0.000000	NOX=(-0.010577TSS)+1.334458
TKN:TSS	1440	0.316	159.2	0.000000	TKN=(0.003342TSS)+0.307932
DO:TSS	1463	0.973	-	-	*Quadratic Equation

NOTE: Biological data cannot always have r^2 values > 0.950. In fact, scientific literature indicates that if a p-value is < 0.050, the relationship is significant no matter how low the r^2 value or the F-ratio are. Transformation of data to arrive at a higher r^2 value will not always provide results with r^2 values > 0.950.

*Quadratic Equation: DO=(logTSS^2x(-0.296809))+(logTSSx0.566078)+9.829993

XI. THE EFFECT OF TSS REDUCTION ON OTHER PARAMETERS:
Prediction Estimates on Parameter Responses

ESTABLISHING WATER QUALITY SYNERGISMS

Based on monitoring data collected by IDEQ-TFRO, other agencies, and organizations, statistical synergisms for total suspended solids were explored for the Middle Snake River and its tributaries. The use of other water quality parameters to describe sediment (as TSS) have been described by various researchers and is the basis for water quality reduction estimates when TSS is reduced on a watershed basis (Truhlar 1976; Schroeder et al. 1981; Earhart 1984; Lloyd 1987a & b). (See §2.2.4.1, §2.2.4.2, §2.2.4.3, and Appendix D.) It was determined that there existed various synergistic relationships that could be correlated statistically to TSS. These are defined in the following tables according to the particular stream segment and followed by an explanation.

MIDDLE SNAKE RIVER SYNERGISMS

Statistical synergisms between TSS and selected water quality parameters

Stream Segment	*TSS Synergistic Equation*	*Criteria Determining Significance* r^2	*F-ratio*	*p*	*Equivalency at 52 mg/L TSS*
Middle Snake River					
Middle Snake River	TP = (0.001 x TSS) + 0.083	0.450	243.4	0.000	TP = 0.135 mg/L
Middle Snake River	NTU = (0.407 x TSS) + 6.032	0.749	1256.2	0.000	NTU = 27.2 NTU
Middle Snake River	SRP = (-0.0001 x TSS) + 0.358	0.114	12.6	0.000	SRP = 0.049 mg/L
Middle Snake River	TKN = (0.003 x TSS) + 0.358	0.389	171.3	0.000	TKN = 0.514 mg/L
Middle Snake River	NOX = (-0.011 x TSS) + 1.247	0.413	197.1	0.000	NOX = 0.675 mg/L
Middle Snake River	Q = (226.518 x TSS) + 3688.583	0.538	401.1	0.000	Q = 15467.5 cfs
Middle Snake River	DO = (0.0001 x Q) + 9.486	0.331	121.5	0.000	DO = 11.03 mg/L

Prepared by IDEQ-TFRO. p values <0.050 were considered significant.

Water quality synergisms in the Middle Snake River for TSS include TP, NTU, TKN, NOX, and Q (as described in item 2 above), such that as TSS is decreased so is the synergistic water quality parameter (or vice versi). On the other hand, SRP and NOX have an inverse relationship. DO does not correlate well with TSS (r2 = 0.062, F-ratio = 3.8, p = 0.051). However, DO does have a statistical correlation to flow (Q), such that as Q increases so does the DO. Higher flows appear to allow the system to aerate better than lower flows.

XI. THE EFFECT OF TSS REDUCTION ON OTHER PARAMETERS:
Prediction Estimates on Parameter Responses

ROCK CREEK SYNERGISMS

Statistical synergisms between TSS and selected water quality parameters on Rock Creek

Stream Segment	*TSS Synergistic Equation*	*Criteria Determining Significance* r^2	*F-ratio*	*p*	*Equivalency at 52 mg/L TSS*
Rock Creek (from Rock Creek Town to confluence with Middle Snake River)					
Rock Creek	TP = (0.001 x TSS) + 0.129	0.420	61.3	0.000	TP = 0.181 mg/L
Rock Creek	NTU = (0.530 x TSS) + 3.535	0.893	1124.3	0.000	NTU = 31.1 NTU
Rock Creek	TKN = (0.0001 x TSS) + 0.561	0.124	4.5	0.035	TKN = 0.566 mg/L
Rock Creek	Q = (0.201 x TSS) + 206.577	0.220	14.5	0.000	Q = 217.0 cfs

Prepared by IDEQ-TFRO. Water quality surrogates that are inversley related to TSS include NOX and DO. The NOX equation includes NOX = (-0.005 x TSS) + 2.448, with a statistical relationship of r^2=0.537, F-ratio=116.0, p = 0.000. The DO equation includes DO = (-0.003 x TSS) + 9.744, with a statistical relationshp, r^2=0.210, F-ratio=13.1, p=0.000. The equivalency at 52 mg/L TSS is 2.188 mg/L NOX and 9.59 mg/L DO, respectively.

Water quality synergisms in Rock Creek for TSS include TP, NTU, TKN, and Q (as described in item 2 above), such that as the TSS is decreased so is the synergistic water quality parameter. On the other hand, NOX and DO have an inverse correlation to TSS, such that as TSS is increased the corresponding water quality synergism is decreased. DO also correlates statistically to Q but as an inverse relationship: DO = (-0.006 x Q) + 10.768 (r2=0.346, F-ratio=38.9, p=0.000). The DO equivalency at 52 mg/L TSS is 9.46 mg/L DO.

A sediment (TSS) rating curve was established for Rock Creek. A high level of variability was noted in the data population, although the log transformation gave a higher correlation value (as expected): logTSS = (1.065 x logQ) - 0.832 (r2 = 0.403, F-ratio = 55.3, p = 0.000).

BILLINGSLEY CREEK SYNERGISMS

Statistical synergisms between TSS and selected water quality parameters on Billingsley Creek

Stream Segment	*TSS Synergistic Equation*	*Parameters of Significance* r^2	*F-ratio*	*p*	*Equivalency at 52 mg/L TSS*
Billinsley Creek					
Billingsley Creek	Q = (1.088 x TSS) + 52.507	0.158	10.5	0.001	109.08 cfs
Billingsley Creek	NTU = (1.031 x TSS) + 1.524	0.746	520.2	0.000	55.1 NTU
Billingsley Creek	NH3 = (0.003 x TSS) + 0.144	0.156	10.3	0.001	0.30 mg/L
Billingsley Creek	NOX = (0.006 x TSS) + 1.047	0.141	8.4	0.004	1.359 mg/L
Billingsley Creek	TKN = (0.013 x TSS) + 0.300	0.385	72.0	0.000	0.976 mg/L
Billingsley Creek	TP = (0.003 x TSS) + 0.098	0.229	22.9	0.000	0.254 mg/L

Prepared by IDEQ-TFRO. Two synergisms were not positively correlated: TEM and RM. Temperature had an equation of TEM = (-0.160 x TSS) + 15.459, with significance at r^2=484, F-ratio=126.6, p = 0.000; River mile had an equation of RM = (-0.054 x TSS) + 4.695, with significance at r^2=0.166, F-ratio=11.8, and p=0.001. The equivalency of 52 mg/L TSS is 7.14 °C and 1.887 mg/L TP, respectively.

XI. THE EFFECT OF TSS REDUCTION ON OTHER PARAMETERS:
Prediction Estimates on Parameter Responses

Water quality synergisms in Billingsley Creek for TSS include Q, NTU, NH3, NOX, TKN, and TP (as described in item 2 above), such that as TSS is reduced so is the Q, NTU, NH3, NOX, TKN, and TP.

A sediment (TSS) rating curve was established for Billingsley Creek. A high level of variability was noted in the data population. The log transformation did not give a higher correlation value as anticipated: logTSS = (0.150 x logQ) + 0.212 (r2 = 0.147, F-ratio = 5.1, p = 0.025).

CLOVER CREEK SYNERGISMS

Statistical synergisms between TSS and selected water quality parameters on Clover Creek

Stream Segment	***TSS Synergistic Equation***	***Parameters of Significance*** *r*	*F-ratio*	*p*	***Equivalency at 52 mg/L TSS***
Billinsley Creek					
Clover Creek	Q = (2.664 x TSS) - 6.521	0.587	21.0	0.000	132.0 mg/L
Clover Creek	DO = (0.083 x TSS) + 8.148	0.407	8.0	0.007	12.5 mg/L
Clover Creek	NTU = (0.663 x TSS) + 6.593	0.408	8.0	0.007	41.1 mg/L
Clover Creek	NH3 = (0.001 x TSS) + 0.011	0.584	20.7	0.000	0.063 mg/L
Clover Creek	NOX = (0.005 x TSS) + 0.015	0.412	8.2	0.007	0.275 mg/L
Prepared by IDEQ-TFRO.					

Water quality synergisms in Clover Creek for TSS include Q, DO, NTU, NH3, and NOX (as described in item 2 above), such that as TSS is reduced so is the Q, DO, NTU, NH3, and NOX. Other parameters are not statistically signficant for determination of synergisms.

A sediment (TSS) rating curve was established for Clover Creek. A high level of variability was noted in the data population. The log transformation did not give a higher correlation value as anticipated: logTSS = (0.157 x logQ) + 0.698 (r2 = 0.309, F-ratio = 4.2, p = 0.047).

XI. THE EFFECT OF TSS REDUCTION ON OTHER PARAMETERS:
Prediction Estimates on Parameter Responses

3. TP:TSS SYNERGISTIC RELATIONSHIP: logTP=(0.110944xlogTSS)-1.101016

R = Reduction		Before R	After R	log TSS		TP mg/L	
Segment	Surface Name	TSS mg/L	TSS mg/L	Before R	After R	Before R	After R
1 - 1	Dry Creek	290.0	51.9	2.462	1.715	0.149	0.123
1 - 2	A Drain	164.2	51.9	2.215	1.715	0.140	0.123
1 - 3	A10 Drain	44.5	44.5	1.648	1.648	0.121	0.121
1 - 4	C55 Drain	47.3	47.3	1.675	1.675	0.122	0.122
1 - 5	TF Coulee	121.3	51.9	2.084	1.715	0.135	0.123
1 - 6	Unknown Surface	107.3	51.9	2.031	1.715	0.133	0.123
2 - 1	East Perrine Coulee	116.9	51.9	2.068	1.715	0.134	0.123
2 - 2	Main Perrine Coulee	117.2	51.9	2.069	1.715	0.134	0.123
2 - 3	West Perrine Coulee	223.2	51.9	2.349	1.715	0.144	0.123
2 - 4	43 Drain	179.7	51.9	2.255	1.715	0.141	0.123
2 - 5	Warm Creek	16.0	16	1.204	1.204	0.108	0.108
2 - 6	Rock Creek	66.4	51.9	1.822	1.715	0.126	0.123
2 - 7	30 Drain	371.3	51.9	2.570	1.715	0.153	0.123
2 - 8	LQ/LS Drains	215.5	51.9	2.333	1.715	0.144	0.123
2 - 9	LS2/39A Drains	213.9	51.9	2.330	1.715	0.144	0.123
2 - 10	N42 Drain (N)	17.0	17	1.230	1.230	0.109	0.109
2 - 11	N42 Drain (NT)	32.2	32.2	1.508	1.508	0.116	0.116
2 - 12	39 Drain	425.7	51.9	2.629	1.715	0.155	0.123
2 - 13	Unknown Surface	107.3	51.9	2.031	1.715	0.133	0.123
3 - 1	Cedar Draw	107.9	51.9	2.033	1.715	0.133	0.123
3 - 2	Mud Creek	62.3	51.9	1.794	1.715	0.125	0.123
3 - 3	Deep Creek	65.7	51.9	1.818	1.715	0.126	0.123
3 - 4	Blind Canyon Creek	29.0	29.0	1.462	1.462	0.115	0.115
3 - 5	I Drain	111.9	51.9	2.049	1.715	0.134	0.123
3 - 6	J8 Drain	41.1	41.1	1.614	1.614	0.120	0.120
3 - 7	N Drain	36.8	36.8	1.566	1.566	0.118	0.118
3 - 8	S29 Drain	11.9	11.9	1.076	1.076	0.104	0.104
3 - 9	S19/S Drain	43.4	43.4	1.637	1.637	0.120	0.120
3 - 20	Unknown Surface	107.3	51.9	2.031	1.715	0.133	0.123
4 - 1	Salmon Falls Creek	40.6	40.6	1.609	1.609	0.120	0.120
4 - 2	W26 Drain	61.2	51.9	1.787	1.715	0.125	0.123
4 - 3	Unknown Surface	107.3	51.9	2.031	1.715	0.133	0.123
5 - 1	Malad River	21.2	21.2	1.326	1.326	0.111	0.111
5 - 2	Malad River Power Flu	21.2	21.2	1.326	1.326	0.111	0.111
5 - 3	Unknown Surface	107.3	51.9	2.031	1.715	0.133	0.123
6 - 1	Clover Creek	9.7	9.7	0.987	0.987	0.102	0.102
6 - 2	Unknown Surface	107.3	51.9	2.031	1.715	0.133	0.123
(n = 37)	MEAN	107.3	43.4	1.857	1.603	0.128	0.120
	% REDUCTION		59.6		13.7		6.7
	t-test (Before versus After): p =		0.000134		0.000002		0.000004
	t-test Bonferroni p =		0.003760		0.000052		0.000102
	Are paired data sets different?		YES		YES		YES

Prediction: A 59.6% TSS reduction will produce a significant decrease in TP by 6.7%.

4. SRP:TSS SYNERGISTIC RELATIONSHIP: logSRP=(-0.127320xlogTSS)-1.167700

	Before R	After R	log TSS		log SRP		SRP mg/L	
Segment	TSS mg/L	TSS mg/L	Before R	After R	Before R	After R	Before R	After R
1 - 1	290.0	51.9	2.462	1.715	-1.481	-1.386	0.033	0.041
1 - 2	164.2	51.9	2.215	1.715	-1.450	-1.386	0.036	0.041
1 - 3	44.5	44.5	1.648	1.648	-1.378	-1.378	0.042	0.042
1 - 4	47.3	47.3	1.675	1.675	-1.381	-1.381	0.042	0.042
1 - 5	121.3	51.9	2.084	1.715	-1.433	-1.386	0.037	0.041
1 - 6	107.3	51.9	2.031	1.715	-1.426	-1.386	0.037	0.041
2 - 1	116.9	51.9	2.068	1.715	-1.431	-1.386	0.037	0.041
2 - 2	117.2	51.9	2.069	1.715	-1.431	-1.386	0.037	0.041
2 - 3	223.2	51.9	2.349	1.715	-1.467	-1.386	0.034	0.041
2 - 4	179.7	51.9	2.255	1.715	-1.455	-1.386	0.035	0.041
2 - 5	16.0	16	1.204	1.204	-1.321	-1.321	0.048	0.048
2 - 6	66.4	51.9	1.822	1.715	-1.400	-1.386	0.040	0.041
2 - 7	371.3	51.9	2.570	1.715	-1.495	-1.386	0.032	0.041
2 - 8	215.5	51.9	2.333	1.715	-1.465	-1.386	0.034	0.041
2 - 9	213.9	51.9	2.330	1.715	-1.464	-1.386	0.034	0.041
2 - 10	17.0	17	1.230	1.230	-1.324	-1.324	0.047	0.047
2 - 11	32.2	32.2	1.508	1.508	-1.360	-1.360	0.044	0.044
2 - 12	425.7	51.9	2.629	1.715	-1.502	-1.386	0.031	0.041
2 - 13	107.3	51.9	2.031	1.715	-1.426	-1.386	0.037	0.041
3 - 1	107.9	51.9	2.033	1.715	-1.427	-1.386	0.037	0.041
3 - 2	62.3	51.9	1.794	1.715	-1.396	-1.386	0.040	0.041
3 - 3	65.7	51.9	1.818	1.715	-1.399	-1.386	0.040	0.041
3 - 4	29.0	29.0	1.462	1.462	-1.354	-1.354	0.044	0.044
3 - 5	111.9	51.9	2.049	1.715	-1.429	-1.386	0.037	0.041
3 - 6	41.1	41.1	1.614	1.614	-1.373	-1.373	0.042	0.042
3 - 7	36.8	36.8	1.566	1.566	-1.367	-1.367	0.043	0.043
3 - 8	11.9	11.9	1.076	1.076	-1.305	-1.305	0.050	0.050
3 - 9	43.4	43.4	1.637	1.637	-1.376	-1.376	0.042	0.042
3 - 20	107.3	51.9	2.031	1.715	-1.426	-1.386	0.037	0.041
4 - 1	40.6	40.6	1.609	1.609	-1.372	-1.372	0.042	0.042
4 - 2	61.2	51.9	1.787	1.715	-1.395	-1.386	0.040	0.041
4 - 3	107.3	51.9	2.031	1.715	-1.426	-1.386	0.037	0.041
5 - 1	21.2	21.2	1.326	1.326	-1.337	-1.337	0.046	0.046
5 - 2	21.2	21.2	1.326	1.326	-1.337	-1.337	0.046	0.046
5 - 3	107.3	51.9	2.031	1.715	-1.426	-1.386	0.037	0.041
6 - 1	9.7	9.7	0.987	0.987	-1.293	-1.293	0.051	0.051
6 - 2	107.3	51.9	2.031	1.715	-1.426	-1.386	0.037	0.041
(n = 37)								
MEAN	107.3	43.4	1.857	1.603	-1.404	-1.372	0.040	0.043
% REDUCTION		59.6		13.7		2.3		-7.1

t-test (Before versus After): p = 0.000001
t-test Bonferroni p = 0.000029
Are paired data sets different? YES

Prediction: A 59.6% TSS reduction will produce a signficant increase in SRP by 7.1%.

XI. THE EFFECT OF TSS REDUCTION ON OTHER PARAMETERS:
Prediction Estimates on Parameter Responses

5. NH3:TSS SYNERGISTIC RELATIONSHIP: logNH3=(-0.052298 x logTSS) - 1.235676

	Before R	After R	log TSS		log NH3		NH3 mg/L	
Segment	TSS mg/L	TSS mg/L	Before R	After R	Before R	After R	Before R	After R
1 - 1	290.0	51.9	2.462	1.715	-1.364	-1.325	0.043	0.047
1 - 2	164.2	51.9	2.215	1.715	-1.352	-1.325	0.045	0.047
1 - 3	44.5	44.5	1.648	1.648	-1.322	-1.322	0.048	0.048
1 - 4	47.3	47.3	1.675	1.675	-1.323	-1.323	0.048	0.048
1 - 5	121.3	51.9	2.084	1.715	-1.345	-1.325	0.045	0.047
1 - 6	107.3	51.9	2.031	1.715	-1.342	-1.325	0.046	0.047
2 - 1	116.9	51.9	2.068	1.715	-1.344	-1.325	0.045	0.047
2 - 2	117.2	51.9	2.069	1.715	-1.344	-1.325	0.045	0.047
2 - 3	223.2	51.9	2.349	1.715	-1.359	-1.325	0.044	0.047
2 - 4	179.7	51.9	2.255	1.715	-1.354	-1.325	0.044	0.047
2 - 5	16.0	16	1.204	1.204	-1.299	-1.299	0.050	0.050
2 - 6	66.4	51.9	1.822	1.715	-1.331	-1.325	0.047	0.047
2 - 7	371.3	51.9	2.570	1.715	-1.370	-1.325	0.043	0.047
2 - 8	215.5	51.9	2.333	1.715	-1.358	-1.325	0.044	0.047
2 - 9	213.9	51.9	2.330	1.715	-1.358	-1.325	0.044	0.047
2 - 10	17.0	17	1.230	1.230	-1.300	-1.300	0.050	0.050
2 - 11	32.2	32.2	1.508	1.508	-1.315	-1.315	0.048	0.048
2 - 12	425.7	51.9	2.629	1.715	-1.373	-1.325	0.042	0.047
2 - 13	107.3	51.9	2.031	1.715	-1.342	-1.325	0.046	0.047
3 - 1	107.9	51.9	2.033	1.715	-1.342	-1.325	0.045	0.047
3 - 2	62.3	51.9	1.794	1.715	-1.330	-1.325	0.047	0.047
3 - 3	65.7	51.9	1.818	1.715	-1.331	-1.325	0.047	0.047
3 - 4	29.0	29.0	1.462	1.462	-1.312	-1.312	0.049	0.049
3 - 5	111.9	51.9	2.049	1.715	-1.343	-1.325	0.045	0.047
3 - 6	41.1	41.1	1.614	1.614	-1.320	-1.320	0.048	0.048
3 - 7	36.8	36.8	1.566	1.566	-1.318	-1.318	0.048	0.048
3 - 8	11.9	11.9	1.076	1.076	-1.292	-1.292	0.051	0.051
3 - 9	43.4	43.4	1.637	1.637	-1.321	-1.321	0.048	0.048
3 - 20	107.3	51.9	2.031	1.715	-1.342	-1.325	0.046	0.047
4 - 1	40.6	40.6	1.609	1.609	-1.320	-1.320	0.048	0.048
4 - 2	61.2	51.9	1.787	1.715	-1.329	-1.325	0.047	0.047
4 - 3	107.3	51.9	2.031	1.715	-1.342	-1.325	0.046	0.047
5 - 1	21.2	21.2	1.326	1.326	-1.305	-1.305	0.050	0.050
5 - 2	21.2	21.2	1.326	1.326	-1.305	-1.305	0.050	0.050
5 - 3	107.3	51.9	2.031	1.715	-1.342	-1.325	0.046	0.047
6 - 1	9.7	9.7	0.987	0.987	-1.287	-1.287	0.052	0.052
6 - 2	107.3	51.9	2.031	1.715	-1.342	-1.325	0.046	0.047
(n = 37)								
MEAN	107.3	43.4	1.857	1.603	-1.333	-1.320	0.047	0.048
% REDUCTION		59.6		13.7		1.0		-3.0

t-test (Before versus After): p =	0.000017
t-test Bonferroni p =	0.000017
Are paired data sets different?	YES

Prediction: A 59.6% TSS reduction will produce a signficant increase in NH3 by 3.0%.

5. NH3:TSS SYNERGISTIC RELATIONSHIP (Continued):

Ammonia is the principle nitrogenous by-product of fish metabolism and is of importance in fish culture because it is toxic to fish in its un-ionized form. Aqueous ammonia occurs in two molecular forms and the equilibrium between them is determined by pH, and to a lesser extent, temperature: $NH_3 = NH_4^+$, and NH_3-N + NH_4^+ -N = Total Ammonia N (TAN). The un-ionized form, NH_3, is a gas and can freely pass the gill membrane. Un-ionized ammonia is toxic to fish while ammonium is relatively non-toxic (Sodereberg 1995 [pp 97-98]). Additionally, un-ionized ammonia is toxic to nitrification bacteria and may inhibit the nitrification process (Sodereberg 1995 [p 114]). Water recirculation in fish production calls for reuse of the water so that maintenance of dissolved oxygen is suitable for efficient respiration, maintenance of safe levels of un-ionized ammonia, and maintenance of water reasonably clear of solid waste. Biological filtration of the recycled water depends upon nitrification, a microbiological process by which autotrophic bacteria oxidize ammonium (NH_4^+) to nitrite (NO_2^-) and then to nitrate (NO_3^-). Ammonium, although relatively nontoxic to fish, when removed from culture water reduces the levels of its equilibrium product, ammonia (NH_3). The intermediate product, NO_2^-, is quite toxic to fish and is an important concern in recirculating aquaculture. Nitrate is essentially nontoxic to fish and is allowed to accumulate in recirculating systems (Sodereberg 1995 [pp 113-114]).

XI. THE EFFECT OF TSS REDUCTION ON OTHER PARAMETERS:
Prediction Estimates on Parameter Responses

NOX:TSS SYNERGISTIC RELATIONSHIP: NOX = (-0.010577 x TSS) + 1.334458

	Before R	After R	log TSS		NOX mg/L		Increase by 3.219	
Segment	TSS mg/L	TSS mg/L	Before R	After R	Before R	After R	Before R	After R
1 - 1	290.0	51.9	2.462	1.715	-1.733	0.786	1.486	4.005
1 - 2	164.2	51.9	2.215	1.715	-0.402	0.786	2.817	4.005
1 - 3	44.5	44.5	1.648	1.648	0.864	0.864	4.083	4.083
1 - 4	47.3	47.3	1.675	1.675	0.834	0.834	4.053	4.053
1 - 5	121.3	51.9	2.084	1.715	0.051	0.786	3.270	4.005
1 - 6	107.3	51.9	2.031	1.715	0.200	0.786	3.419	4.005
2 - 1	116.9	51.9	2.068	1.715	0.098	0.786	3.317	4.005
2 - 2	117.2	51.9	2.069	1.715	0.095	0.786	3.314	4.005
2 - 3	223.2	51.9	2.349	1.715	-1.026	0.786	2.193	4.005
2 - 4	179.7	51.9	2.255	1.715	-0.566	0.786	2.653	4.005
2 - 5	16.0	16	1.204	1.204	1.165	1.165	4.384	4.384
2 - 6	66.4	51.9	1.822	1.715	0.632	0.786	3.851	4.005
2 - 7	371.3	51.9	2.570	1.715	-2.593	0.786	0.626	4.005
2 - 8	215.5	51.9	2.333	1.715	-0.945	0.786	2.274	4.005
2 - 9	213.9	51.9	2.330	1.715	-0.928	0.786	2.291	4.005
2 - 10	17.0	17	1.230	1.230	1.155	1.155	4.374	4.374
2 - 11	32.2	32.2	1.508	1.508	0.994	0.994	4.213	4.213
2 - 12	425.7	51.9	2.629	1.715	-3.168	0.786	0.051	4.005
2 - 13	107.3	51.9	2.031	1.715	0.200	0.786	3.419	4.005
3 - 1	107.9	51.9	2.033	1.715	0.193	0.786	3.412	4.005
3 - 2	62.3	51.9	1.794	1.715	0.676	0.786	3.895	4.005
3 - 3	65.7	51.9	1.818	1.715	0.640	0.786	3.859	4.005
3 - 4	29.0	29.0	1.462	1.462	1.028	1.028	4.247	4.247
3 - 5	111.9	51.9	2.049	1.715	0.151	0.786	3.370	4.005
3 - 6	41.1	41.1	1.614	1.614	0.900	0.900	4.119	4.119
3 - 7	36.8	36.8	1.566	1.566	0.945	0.945	4.164	4.164
3 - 8	11.9	11.9	1.076	1.076	1.209	1.209	4.428	4.428
3 - 9	43.4	43.4	1.637	1.637	0.875	0.875	4.094	4.094
3 - 20	107.3	51.9	2.031	1.715	0.200	0.786	3.419	4.005
4 - 1	40.6	40.6	1.609	1.609	0.905	0.905	4.124	4.124
4 - 2	61.2	51.9	1.787	1.715	0.687	0.786	3.906	4.005
4 - 3	107.3	51.9	2.031	1.715	0.200	0.786	3.419	4.005
5 - 1	21.2	21.2	1.326	1.326	1.110	1.110	4.329	4.329
5 - 2	21.2	21.2	1.326	1.326	1.110	1.110	4.329	4.329
5 - 3	107.3	51.9	2.031	1.715	0.200	0.786	3.419	4.005
6 - 1	9.7	9.7	0.987	0.987	1.232	1.232	4.451	4.451
6 - 2	107.3	51.9	2.031	1.715	0.200	0.786	3.419	4.005
(n = 37)								
MEAN	107.3	43.4	1.857	1.603			3.419	4.094
% REDUCTION		59.6		13.7				-19.8

t-test (Before versus After): p =	0.000134
t-test Bonferroni p =	0.000134
Are paired data sets different?	YES

Prediction: A 59.6% TSS reduction will produce a significant increase in NOX by 19.8%.

XI. THE EFFECT OF TSS REDUCTION ON OTHER PARAMETERS:
Prediction Estimates on Parameter Responses

NOX:TSS SYNERGISTIC RELATIONSHIP: UNDERSTANDING NOX IN ECOLOGICAL SYSTEMS

"Ecological concern about high concentrations of nitrate in streams stems from its potential for contributing to eutrophication, which is the excessive growth of aquatic plants that can impart unpleasant odors and tastes to water and reduce its clarity, and upon dying, can lower the DO concentrations (USGS 1994 [Chapter 4])." It has not been possible to establish an applicable threshold concentration for nitrate to protect against eutrophication because the effects of nitrate concentration are highly variable from place to place, and are greatest in coastal waters that are far removed from inland nitrate sources. Historically, government standards and eutrophication-control strategies for inland waters have focused on phosphorus concentration rather than on nitrate concentration, because phosphorus usually is depleted more rapidly by the growth of aquatic plants than is nitrate, and, therefore, frequently is the limiting factor in eutrophication. Yet, a water quality concentration target of 0.300 mg/L NOX is considered the limit for preventing the development of biological nuisances and the acceleration of cultural eutrophication. Agricultural return flows as well as samples from the Milner Pool often exceed the 0.300 mg/L criterion. NOX concentrations at or below 90 mg/L should be protective of warmwater fishes, while concentrations at or below 0.060 mg/L should be protective for salmonid fish. However, NOX concentrations as found in the Middle Snake River and its tributaries does no toxic harm to fisheries.

Although it can be shown that % Pass from Milner Dam may impact the Middle Snake River minimally, background levels of nitrate+nitrite (NOX) appear to have a significant effect on the water quality of the system. Similar sites and data sources used for TSS were used for NOX. The following table shows the average values (on a yearly basis) for background from 1990 to 1997 on the Middle Snake River.

Upstream/background NOX values in the Middle Snake River

Year	*IDEQ-TFRO Data NOX, mg/L*	*USGS Data NOX, mg/L*	*Comments*
1990	1.377	-	Lo-Flow Years: 1990-1995 — Range: IDEQ-TFRO = 1.201 mg/L NOX — 0.806 - 1.420 USGS = 0.500 mg/L NOX — 0.025 - 0.883 x̄ = 0.851 mg/L NOX — 0.025 - 1.420
1991	1.420	0.883	
1992	-	-	
1993	-	0.640	
1994	-	0.025	
1995	0.806	0.451	
1996	0.527	0.148	Hi-Flow Years: 1996-1997 — Range: IDEQ-TFRO = 0.449 mg/L NOX — 0.370 - 0.527 USGS = 0.137 mg/L NOX — 0.126 - 0.148 x̄ = 0.293 mg/L NOX — 0.126 - 0.527
1997	0.370	0.126	
MEAN	0.900	0.385	OVERALL MEAN IDEQ + USGS DATA = 0.617 mg/L

Prepared by IDEQ-TFRO. IDEQ data from monitoring conducted in 1990, 1995-1997. USGS data from WY1991, 1993-1997. USGS WY1996-1997 looked at gage 13087995. Other years were gage 13088000. TSS values for IDEQ-TFRO based on surface grab samples. IDEQ-TFRO values decreased by 62.6% from Lo-Flow Years to Hi-Flow Years, whereas USGS values decreased by 72.6%, or an overall average of 65.5% decrease in NOX. The t-test (paired samples on IDEQ versus USGS) indicates that the sample populations are from different populations (Ho: μ1≠μ2) and may be considered distnct and separate.

The data indicates that the overall mean NOX value is 0.617 mg/L as background (taking into account both USGS and IDEQ-TFRO data). For IDEQ-TFRO data alone the value is 0.900 mg/L TP. For USGS data alone the value is 0.385 mg/L NOX. Water years 1996-1997 have lesser values for USGS when compared to the previous six years (1990-1995) thus indicating a reduction in NOX since 1990-1991. IDEQ-TFRO data indicates the same. Therefore, the overall mean NOX value was used as a reasonable background value, although within a specific year this value could reasonably be less. This background value (0.617 mg/L NOX) is two times greater than the recommended value of 0.300 mg/L NOX which is the limit for preventing the development of biological nuisances and the acceleration of cultural eutrophication. Additionally, some influent sources (such as tributaries or canals) exceed the average 0.617 mg/L NOX at Milner Dam. The following tables show the average values for NOX for various tributaries and the Middle Snake River in Upper Snake Rock. None of the NOX values cause toxicity to fisheries.

Mean NOX values as annual, irrigation, and non-irrigation seasons per tributary, mg/L

Tributary	Annual Value	Irrigation Season Value	Non-Irrigation Season Value
East Perrine Coulee	2.466	1.743	4.245
Rock Creek	2.144	1.808	2.755
Cedar Draw	2.299	1.584	3.668
Mud Creek	2.787	2.228	3.857
Deep Creek	2.747	2.169	3.895
Salmon Falls Creek	2.597	2.161	3.500
Billingsley Creek	1.084	1.080	1.088
Malad River	0.603	0.395	0.930
Clover Creek	0.059	0.056	0.087
Mean	1.865	1.469	2.669

Prepared by IDEQ-TFRO. Irrigation seasonalities appear less than non-irrigation season due to increased flows during irrigation which appear to dilute NOX.

Mean NOX as annual, irrigation, and non-irrigation seasons on the Middle Snake River

Middle Snake River Location	Annual Value	Irrigation Season Value	Non-Irrigation Season Value
Milner Dam "Pass"	0.367	0.140	0.651
Murtaugh Area	1.085	0.765	1.485
Hansen Area	0.592	0.468	0.759
Crystal Springs Area	0.881	0.717	0.940
Box Canyon Area	1.003	0.914	1.113
Gridley Bridge Area	1.067	0.974	1.193
King Hill Area	1.123	1.027	1.251
Mean	0.874	0.715	1.056

Prepared by IDEQ-TFRO.

7. TKN:TSS SYNERGISTIC RELATIONSHIP: TKN = (0.003342 x TSS) + 0.307932

	Before R	After R	log TSS		TKN mg/L		Increase by 1.201	
Segment	TSS mg/L	TSS mg/L	Before R	After R	Before R	After R	Before R	After R
1 - 1	290.0	51.9	2.462	1.715	-0.661	0.481	0.540	1.682
1 - 2	164.2	51.9	2.215	1.715	-0.241	0.481	0.960	1.682
1 - 3	44.5	44.5	1.648	1.648	0.159	0.457	1.360	1.658
1 - 4	47.3	47.3	1.675	1.675	0.150	0.466	1.351	1.667
1 - 5	121.3	51.9	2.084	1.715	-0.097	0.481	1.104	1.682
1 - 6	107.3	51.9	2.031	1.715	-0.051	0.481	1.150	1.682
2 - 1	116.9	51.9	2.068	1.715	-0.083	0.481	1.118	1.682
2 - 2	117.2	51.9	2.069	1.715	-0.084	0.481	1.117	1.682
2 - 3	223.2	51.9	2.349	1.715	-0.438	0.481	0.763	1.682
2 - 4	179.7	51.9	2.255	1.715	-0.293	0.481	0.908	1.682
2 - 5	16.0	16	1.204	1.204	0.254	0.361	1.455	1.562
2 - 6	66.4	51.9	1.822	1.715	0.086	0.481	1.287	1.682
2 - 7	371.3	51.9	2.570	1.715	-0.933	0.481	0.268	1.682
2 - 8	215.5	51.9	2.333	1.715	-0.412	0.481	0.789	1.682
2 - 9	213.9	51.9	2.330	1.715	-0.407	0.481	0.794	1.682
2 - 10	17.0	17	1.230	1.230	0.251	0.365	1.452	1.566
2 - 11	32.2	32.2	1.508	1.508	0.200	0.416	1.401	1.617
2 - 12	425.7	51.9	2.629	1.715	-1.115	0.481	0.086	1.682
2 - 13	107.3	51.9	2.031	1.715	-0.051	0.481	1.150	1.682
3 - 1	107.9	51.9	2.033	1.715	-0.053	0.481	1.148	1.682
3 - 2	62.3	51.9	1.794	1.715	0.100	0.481	1.301	1.682
3 - 3	65.7	51.9	1.818	1.715	0.088	0.481	1.289	1.682
3 - 4	29.0	29.0	1.462	1.462	0.211	0.405	1.412	1.606
3 - 5	111.9	51.9	2.049	1.715	-0.066	0.481	1.135	1.682
3 - 6	41.1	41.1	1.614	1.614	0.171	0.445	1.372	1.646
3 - 7	36.8	36.8	1.566	1.566	0.185	0.431	1.386	1.632
3 - 8	11.9	11.9	1.076	1.076	0.268	0.348	1.469	1.549
3 - 9	43.4	43.4	1.637	1.637	0.163	0.453	1.364	1.654
3 - 20	107.3	51.9	2.031	1.715	-0.051	0.481	1.150	1.682
4 - 1	40.6	40.6	1.609	1.609	0.172	0.444	1.373	1.645
4 - 2	61.2	51.9	1.787	1.715	0.103	0.481	1.304	1.682
4 - 3	107.3	51.9	2.031	1.715	-0.051	0.481	1.150	1.682
5 - 1	21.2	21.2	1.326	1.326	0.237	0.379	1.438	1.580
5 - 2	21.2	21.2	1.326	1.326	0.237	0.379	1.438	1.580
5 - 3	107.3	51.9	2.031	1.715	-0.051	0.481	1.150	1.682
6 - 1	9.7	9.7	0.987	0.987	0.276	0.340	1.477	1.541
6 - 2	107.3	51.9	2.031	1.715	-0.051	0.481	1.150	1.682
(n = 37)								
MEAN	107.3	43.4	1.857	1.603			1.150	1.654
% REDUCTION		59.6		13.7				-43.8

t-test (Before versus After): p =	0.000000
t-test Bonferroni p =	0.000000
Are paired data sets different?	YES

Prediction: A 59.6% TSS reduction will produce a significant increase in TKN by 43.8%.

XI. THE EFFECT OF TSS REDUCTION ON OTHER PARAMETERS:
Prediction Estimates on Parameter Responses

8. DO:TSS SYNERGISTIC RELATIONSHIP: DO=(logTSS^2 x (-0.296809))+(logTSS x 0.566078)+9.829993

	Before R	After R	log TSS		DO mg/L	
Segment	TSS mg/L	TSS mg/L	Before R	After R	Before R	After R
1 - 1	290.0	51.9	2.462	1.715	9.42	9.93
1 - 2	164.2	51.9	2.215	1.715	9.63	9.93
1 - 3	44.5	44.5	1.648	1.648	9.96	9.96
1 - 4	47.3	47.3	1.675	1.675	9.95	9.95
1 - 5	121.3	51.9	2.084	1.715	9.72	9.93
1 - 6	107.3	51.9	2.031	1.715	9.76	9.93
2 - 1	116.9	51.9	2.068	1.715	9.73	9.93
2 - 2	117.2	51.9	2.069	1.715	9.73	9.93
2 - 3	223.2	51.9	2.349	1.715	9.52	9.93
2 - 4	179.7	51.9	2.255	1.715	9.60	9.93
2 - 5	16.0	16	1.204	1.204	10.08	10.08
2 - 6	66.4	51.9	1.822	1.715	9.88	9.93
2 - 7	371.3	51.9	2.570	1.715	9.32	9.93
2 - 8	215.5	51.9	2.333	1.715	9.53	9.93
2 - 9	213.9	51.9	2.330	1.715	9.54	9.93
2 - 10	17.0	17	1.230	1.230	10.08	10.08
2 - 11	32.2	32.2	1.508	1.508	10.01	10.01
2 - 12	425.7	51.9	2.629	1.715	9.27	9.93
2 - 13	107.3	51.9	2.031	1.715	9.76	9.93
3 - 1	107.9	51.9	2.033	1.715	9.75	9.93
3 - 2	62.3	51.9	1.794	1.715	9.89	9.93
3 - 3	65.7	51.9	1.818	1.715	9.88	9.93
3 - 4	29.0	29.0	1.462	1.462	10.02	10.02
3 - 5	111.9	51.9	2.049	1.715	9.74	9.93
3 - 6	41.1	41.1	1.614	1.614	9.97	9.97
3 - 7	36.8	36.8	1.566	1.566	9.99	9.99
3 - 8	11.9	11.9	1.076	1.076	10.10	10.10
3 - 9	43.4	43.4	1.637	1.637	9.96	9.96
3 - 20	107.3	51.9	2.031	1.715	9.76	9.93
4 - 1	40.6	40.6	1.609	1.609	9.97	9.97
4 - 2	61.2	51.9	1.787	1.715	9.89	9.93
4 - 3	107.3	51.9	2.031	1.715	9.76	9.93
5 - 1	21.2	21.2	1.326	1.326	10.06	10.06
5 - 2	21.2	21.2	1.326	1.326	10.06	10.06
5 - 3	107.3	51.9	2.031	1.715	9.76	9.93
6 - 1	9.7	9.7	0.987	0.987	10.10	10.10
6 - 2	107.3	51.9	2.031	1.715	9.76	9.93
(n = 37)						
MEAN	107.3	43.4	1.857	1.603	9.81	9.96
% REDUCTION		59.6		13.7		-1.6

t-test (Before versus After): p =	0.000009
t-test Bonferroni p =	0.000009
Are paired data sets different?	YES

Prediction: A 59.6% TSS reduction will produce a significant increase in DO by 1.6%.

8. DO:TSS SYNERGISTIC RELATIONSHIP (Continued):

It's highly unlikely that a synergistic relationship exists biologically between DO and TSS, unless the organic matter portion of the TSS is significantly high to cause elevated levels of BOD5 in the water. IDEQ-TFRO in their water quality monitoring determined that the organic matter portion of TSS and the BOD5 concentration in the water column were both very low.

Therefore, a stepwise linear regression was perfomed to determine which additional parameters were significant in their relationship to DO.

N = 1464
Dependent Variable = DO
Independent Variables = LOGTSS, TEMP, YEAR, MONTH, LOGQ

Results indicate that:	r	r^2	p-value
62.2% of the variability is attributed to TEMP	0.789	0.622	0.00000
0.6% of the variability is attributed to LOGQ	0.793	0.628	0.01501
0.3% of the variability is attributed to LOGTSS	0.794	0.631	0.02761
0.1% of the variability is attributed to MONTH	0.795	0.632	0.01191
0.2% of the variability is attributed to YEAR	0.796	0.634	0.02096

Therefore, Multiple r = 0.796
Adjusted r^2 = 0.634
F-ratio = 504.7
p-value = 0.000000

Therefore, the following polynomial linear regression equation describes the relationship:
DO=(0.115732LOGQ)+(-0.022829MONTH)+(0.031099YEAR)+(-0.219196TEMP)+(0.130662LOGTSS)-49.655385

From the above results it can be seen that TEMP has the greatest impact on DO than LOGQ, LOGTSS, MONTH, or YEAR, though all of these parameters were significant.

A more logical biological scenario for the above relationships may be summarized as follows:

1..... DO and TEMP are greatly correlated. DO has a characteristic sag that may be seen during the late spring and summer months when compared to fall and winter. TEMP is greatest during the late spring and summer months and lowest during the fall and winter.

2..... TSS or LOGTSS has the greatest loads (tons/year) during the spring and summer when compared to fall and winter. This characteristic is seen in all the river sites.

3..... If TSS loads are reduced we know that TP (as a limiting nutrient) will be reduced as well. Additionally, TP reductions will be occurring in point source facilities.

4..... A reduction in TP will in turn cause a reduction in primary productivity in the river system.

5..... A reduction in primary productivity will cause the DO sag to not be as great during the evening hours. However, it will take a certain period of time for the river to respond.

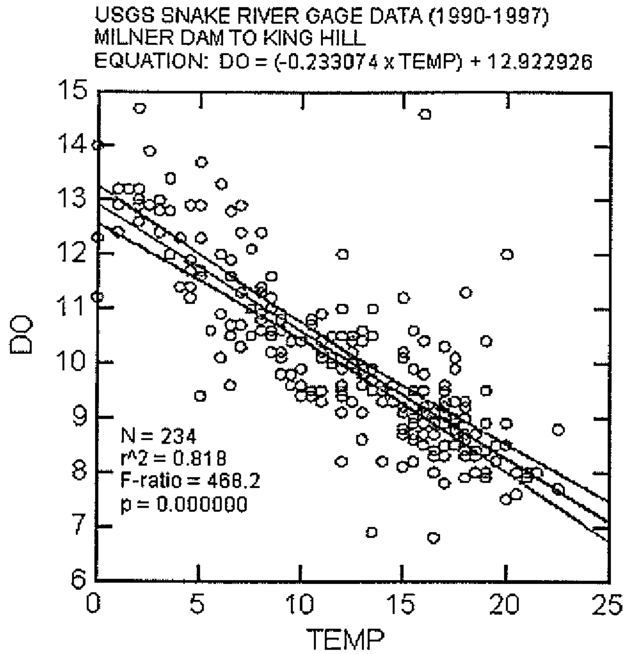
6..... Because TSS, TP, and primary productivity are reduced, it should be expected that some level of macrophyte and algae reduction will occur. However, TSS reductions will incur better clarity of the stream column allowing for light to penetrate deeper. When light begins to penetrate deeper into the water column, macrophyte growth will be increased for a period of time, thus making light a limiting "nutrient." To reduce this effect, sediment reductions need to be revisited and revised to allow the river system to recover and restore beneficial uses.

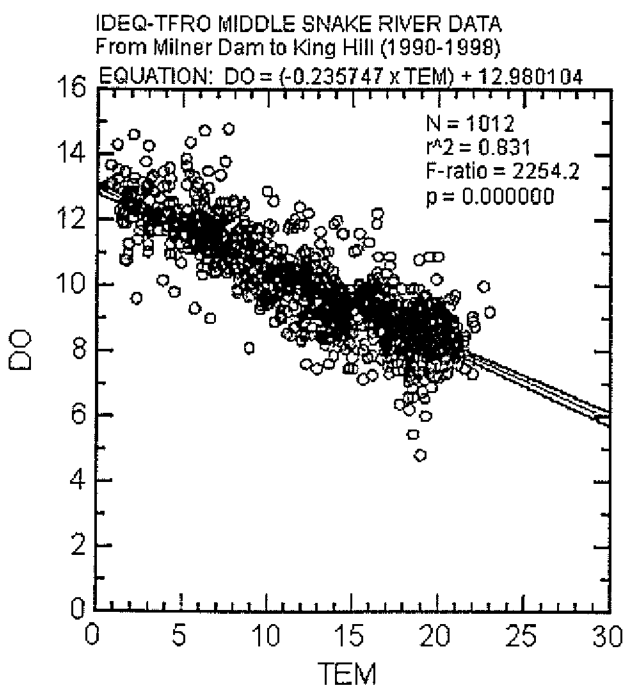
8. DISSOLVED OXYGEN SYNERGISTIC RELATIONSHIP (Continued):

Dissolved oxygen is listed for 18 of the 31 water quality limited stream segments in Upper Snake Rock. The listing is based on the DO sag that occurs pushing the DO below state water quality standards during summer months as a result of nuisance aquatic plant growth from eutrophication. Violations in temperature criteria are intimately linked to violations in DO.

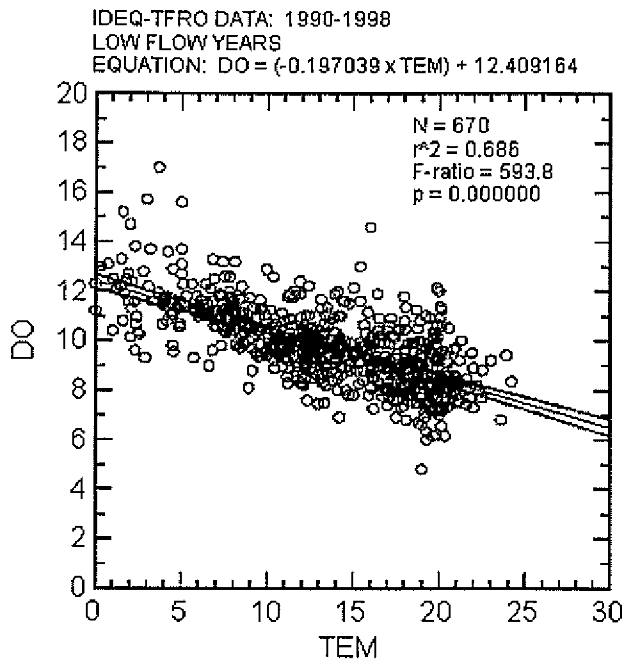
In 1996, IDEQ contracted with ERI to do a productivity and respiration of macrophytes analysis utilizing *in situ* instrumentation at three locations on the Middle Snake River. Instantaneous diehl data for temperature, pH, and DO, as well as macrophyte productivity and respiration were measured. Results were collected in Augus and September within the macrophyte bed and outside the macrophyte bed. Within the macrophyte beds there was never an exceedence (< 6.0 mg/L) for DO, although levels < 7.00 were not uncommon (and did approach 6.00 mg/L). Outside the macrophyte beds, there was never an exceedence for DO below state water quality standards (< 6.00 mg/L), and data generally followed a trend similar to the trend within the macrophytes but above the lowest values (*ERI 1997* [pp 73-83]). Previous non-diehl productivity work don by Falter (*Falter 1994; Falter 1995; Falter 1996*) confirms that within the macrophyte beds DO levels belo 6.00 mg/L occurred only once in three years (during the hottest part of the summer, the lowest flow year, and the slowest moving water).

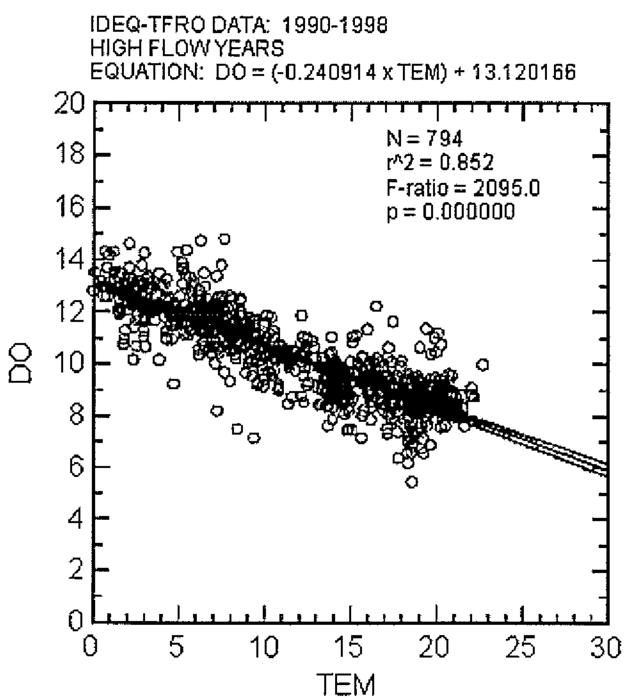
USGS studies for WYs 1990 through 1997 indicate that the non-diehl DO concentrations never fell below 6.0 mg/L. In fact, a statistically significant relationship exists between DO and temperature that can be segregated for low-flow and high-flow years. In each instance, as the temperature increases the DO correspondingly decreases. Data on the Middle Snake River from IDEQ-TFRO from 1990 to 1997 indicates a similar relationship between DO and temperature, and supports the USGS data conclusions. This is shown in the following graphs.


USGS SNAKE RIVER GAGE DATA (1990-1997)
MILNER DAM TO KING HILL
EQUATION: DO = (-0.233074 x TEMP) + 12.922926
N = 234
r^2 = 0.818
F-ratio = 468.2
p = 0.000000
DO
TEMP


IDEQ-TFRO MIDDLE SNAKE RIVER DATA
From Milner Dam to King Hill (1990-1998)
EQUATION: DO = (-0.235747 x TEM) + 12.980104
N = 1012
r^2 = 0.831
F-ratio = 2254.2
p = 0.000000
DO
TEM

XI. THE EFFECT OF TSS REDUCTION ON OTHER PARAMETERS:
Prediction Estimates on Parameter Responses





8. DO:TSS SYNERGISTIC RELATIONSHIP (Continued):

The statistical equations for each graph indicate that as the temperature increases, the DO decreases correspondingly but never below the state water quality standards. Based on these statistical equations, the following DO values correspond to the expected concentration based on the temperature violation for the specific water quality criteria. See §2.2.3.3. Even under low-flow or high-flow years, the DO is never violated regardless of the temperature.

Expected DO concentrations based on temperature violations from statistical analysis of DO and temperature

Water Quality Criteria	***Middle Snake River & Tributaries***	
USGS Overall Graph:	DO = (-0.233 x TEMP) + 12.923	
Cold water biota (22°C/25°C)	22°C = 7.80 mg/L DO	25°C = 7.10 mg/L DO
Salmonid spawning (13°C/16°C)	13°C = 9.89 mg/L DO	16°C = 9.20 mg/L DO
USGS Low-Flow Years (1990-1995):	DO = (-0.197 x TEMP) + 12.371	
Cold water biota (22°C/25°C)	22°C = 8.04 mg/L DO	25°C = 7.45 mg/L DO
Salmonid spawning (13°C/16°C)	13°C = 10.36 mg/L DO	16°C = 9.22 mg/L DO
USGS High-Flow Years (1996-1997):	DO = (-0.269 x TEMP) + 13.444	
Cold water biota (22°C/25°C)	22°C = 7.53 mg/L DO	25°C = 6.72 mg/L DO
Salmonid spawning (13°C/16°C)	13°C = 9.95 mg/L DO	16°C = 9.14 mg/L DO
IDEQ-TFRO Overall Graph:	DO = (-0.236 x TEMP) + 12.980	
Cold water biota (22°C/25°C)	22°C = 7.77 mg/L DO	25°C = 7.08 mg/L DO
Salmonid spawning (13°C/16°C)	13°C = 9.91 mg/L DO	16°C = 9.20 mg/L DO

Prepared by IDEQ-TFRO. Cold water biota has a daily maximum of 22°C and a daily average of 19°C. Salmonid spawning has a daily maximum of 13°C and a daily average of 9°C. Temperatures for cold water biota were taken at 22°C and 25°C based on the monitoring data for both the tributaries and the Middle Snake River. Temperatures for salmonid spawning were taken at 13°C and 16°C based on the monitoring data for both the tributaries and the Middle Snake River.

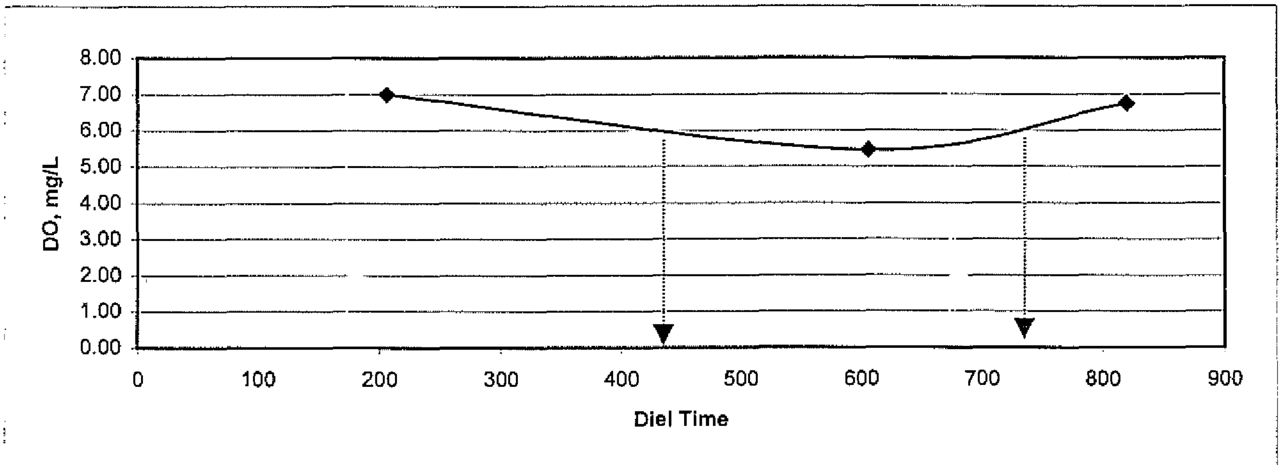
Therefore, it may be concluded that DO values less than 6.00 mg/L are few and seldom discovered. Their appearance only indicates that a minor perturbation of the standard has been violated. Additionally, modeling via USEPA's RBM10 indicates that nutrient reductions of the Mid-Snake TMDL will tentatively reach a mean DO value of 8.56 mg/L over a 10-year period at the Gridley Bridge, Hagerman site (IDEQ 1997b [p 91]). Since the modeling effort was based on a worst-case scenario during low-flow years, it is quite possible that in high flow years attainment of this goal is highly possible. In low flow years, continued nutrient reductions will help considerable with remediation of the Middle Snake River. Additionally, "in the abscence of substances that cause its depletion, the DO concentration in stream water approximates the saturation level for oxygen in water in contact with the atmosphere and decreases with increasing water temperature from about 14 mg/L at freezing to about 7 mg/L at 30°C. For this reason, in ecologically healthy streams, the DO concentration depends primarily on temperature, which varies with season and climate (USGS 1994 [Chapter 4])." DO in tributaries is also affected by a similar scenario as on the Middle Snake River. However, only Rock Creek has shown violations of the water quality standard in 1986: August 4, 5.80 mg/L; August 12, 4.80 mg/L; and, September 3, 6.00 mg/L. At no other times have there been any reported violations. Data collected by USGS at Daydream Ranch, at Poleline Road Crossing, and at the confluence with the Middle Snake River does not indicate that any violations have occurred since WY1990. No data exists that would indicate violations of this standard for any of the other tributaries, whether the data was collected by IDEQ, USGS, or any other agency or organization. If such violations do occur, it may be concluded that these too are minor perturbations of the standard and do not constitute a common problem to any tributary that is water quality limited, *unless serious nuisance aquatic plant growth exist compounded by heavy sediment-laden deposits*. No modeling efforts were attempted on any tributary, but like the Middle Snake River under the worst case scenario (low flow years), violations of the DO standard may possibly occur due to lack of sufficient running water within the tributary systems, which promotes high temperatures of the water, which in turn promotes low concentrations of the DO. High flow years will help promote attainment of the standard if sufficient water exists in the system. Furthermore, "studies cited by the USEPA (USEPA 1986) of the dependence of fresh water biota on DO suggest that streams in which the concentration is less than 6.5 mg/L for more than about 20% of the time generally are not capable of supporting trout or other cold-water fish, and such concentrations could impair population growth among some warm water game fish, such as large mouth bass (USGS 1994 [Chapter 4])."

XI. THE EFFECT OF TSS REDUCTION ON OTHER PARAMETERS:
Prediction Estimates on Parameter Responses

Falter's work for 1992 in very heavy mats of weeds in the Middle Snake River indicates that on an average, abou of the time the diel DO sags below 6.00 mg/L. This sag has a range from 13.9% to 40.6% depending on the loca the depth of the weed mat in the water column, the velocity of the stream immediately adjacent to the weedbed, and the water temperature in the weed mat. Falter's work is summarized as follows:

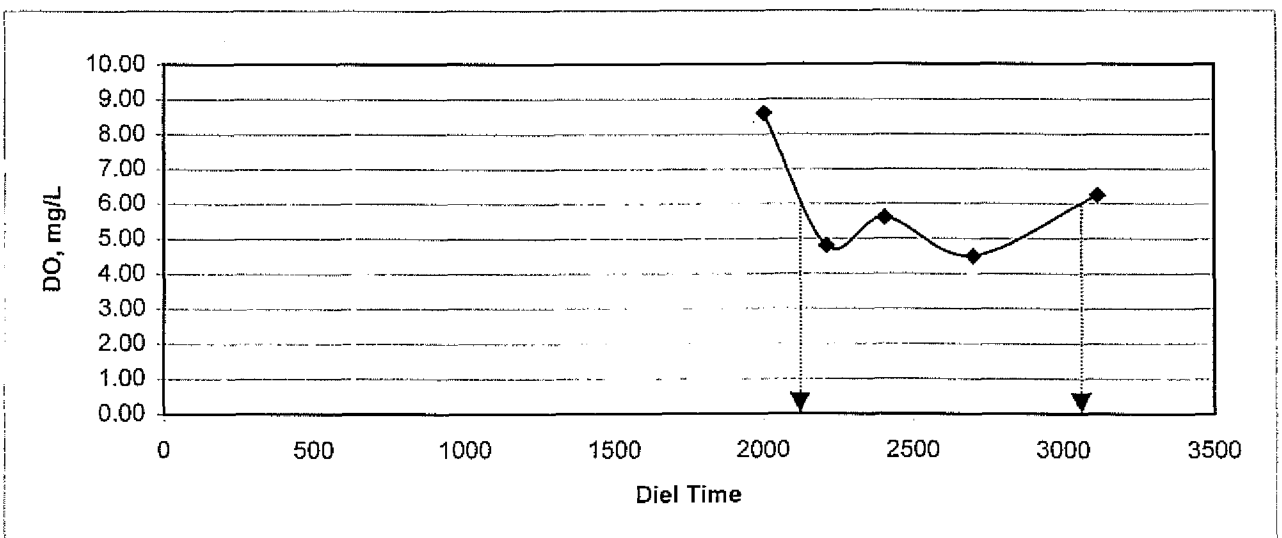
RM588.7	Time	DO
	206	7.00
	606	5.45
	820	6.75

<u>DO Sag Time:</u>
Start Time 4:30
End Time 7:30
Difference = 3:30 Time = 3 hr 20 minutes = 200 min
200 min / 1440 min = 13.9% of diel time



RM599.9	Time	DO
	2004	8.60
	2212	4.80
	2405	5.60
	2702	4.50
	3115	6.25

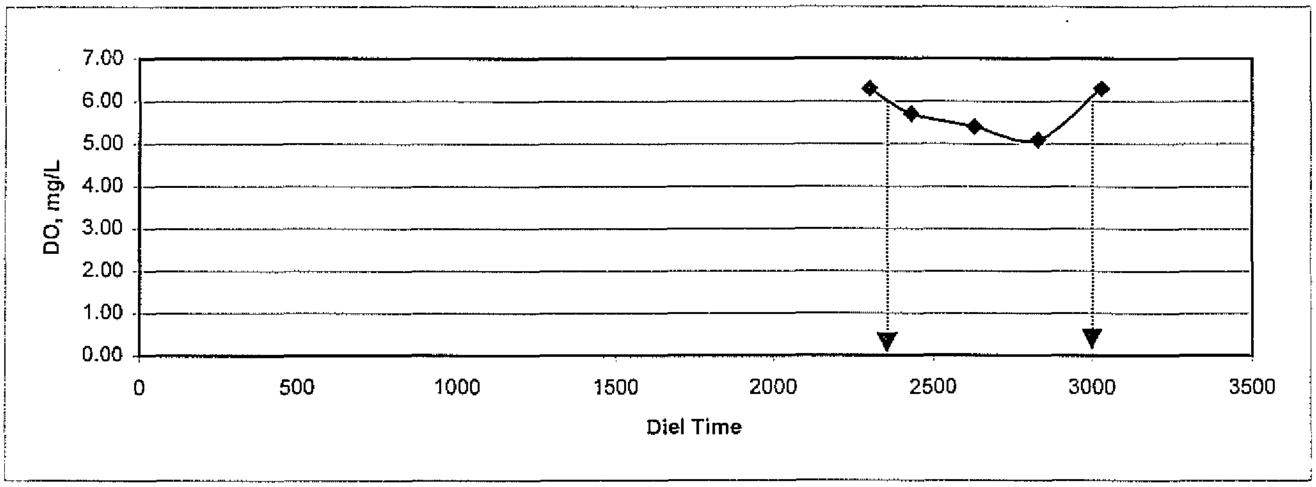
DO Sag Time:
Start Time 21:25
End Time 31:00
Difference = 9.75 Time = 9 hr 45 min = 585 min
585 min / 1440 min = 40.6% of diel time



XI. THE EFFECT OF TSS REDUCTION ON OTHER PARAMETERS:
Prediction Estimates on Parameter Responses

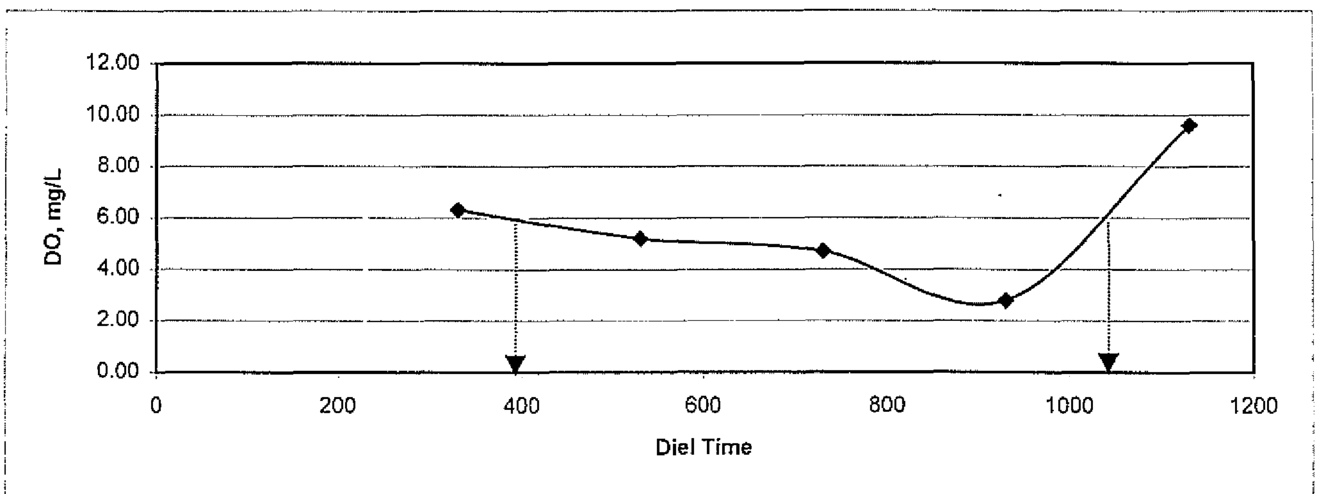
RM599.9	Time	DO
	2300	6.30
	2430	5.70
	2630	5.40
	2830	5.10
	3030	6.30

DO Sag Time:
Start Time 23:50
End Time 30:00
Difference = 6:50 Time = 6 hr 30 min = 390 min
390 min / 1440 min = 27.1% of diel time



RM585.2	Time	DO
	330	6.30
	530	5.20
	730	4.70
	930	2.80
	1130	9.60

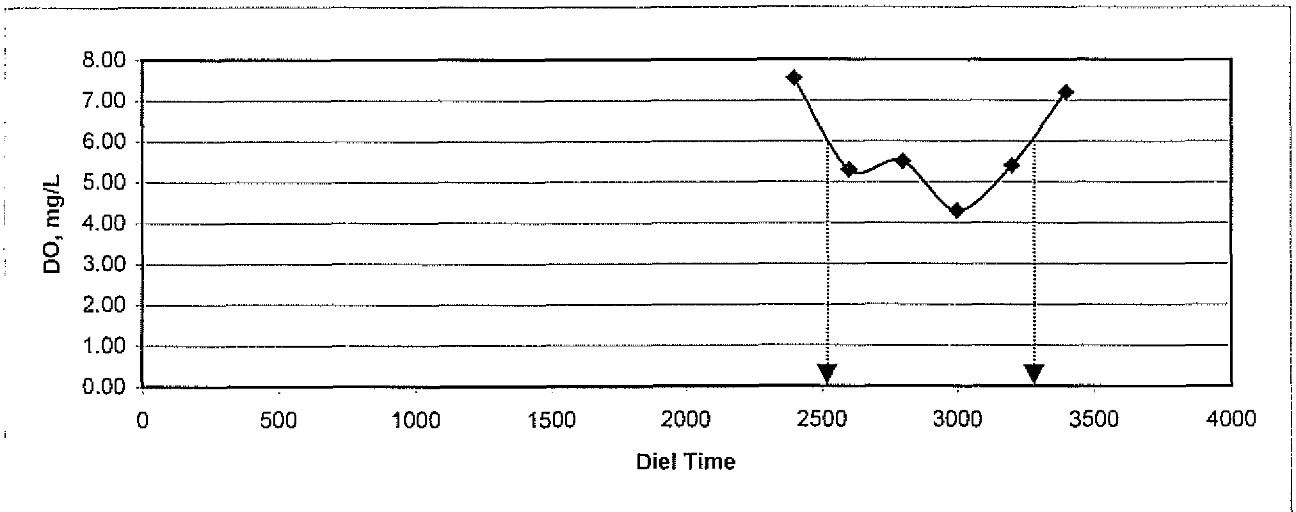
DO Sag Time:
Start Time 3:90
End Time: 10:40
Diffence = 6:50 Time = 6 hr 30 min = 390 min
390 min / 1440 min = 27.1% of diel time



XI. THE EFFECT OF TSS REDUCTION ON OTHER PARAMETERS:
Prediction Estimates on Parameter Responses

RM585.2	Time	DO
	2400	7.55
	2600	5.30
	2800	5.50
	3000	4.30
	3200	5.40
	3400	7.20

DO Sag Time:
Start Time 25:25
End Time 32:75
Difference = 7:50 Time = 7 hr 30 min = 450 min
450 min / 1440 min = 31.3% of diel time



DO Sag Summary Within Macrophyte Mats (Falter 1992 Study):

RM	% of Diel Time
588.7	13.9
599.9	40.6
599.9	27.1
585.2	27.1
585.2	31.3
Mean	28.0
St Dev	9.6
Confidence	8.4
Upper CL	36.4
Lower CL	19.6

Note: Not all macrophyte mats had DO sags that were < 6.00 mg/L. Some ranged between 6.00 and 6.50 mg/L. Others maintained a sag between 6.50 and 7.00 mg/L. It is uncertain what percentage of all the macrophytes within any localized area in the Middle Snake River can be attributed to DO sags that were < 6.00 mg/L. All that can be said at this time is that a small percentage of all the macrophytes within a localized area have DO sags that are < 6.00 mg/L and the sag existed for 28% of the diel time.

9. BACTERIA SYNERGISTIC RELATIONSHIP:

BACKGROUND

Fecal coliform is an indicator of fecal contamination by warmblooded animals and can indicate the presence of pathogenic micro-organisms. In 1986 the USEPA revised the bacterial criteria for recreationa waters recommending the use of *Escherichia coli* (*E. coli*) and *Enterococci*. These recommendations were based on an association established between levels of *E. coli* and *Enterococci* and illness rates in swimmers exposed to these bacteria. 1998 the USEPA requested the Idaho Department of Health and Welfare/Bureau of Laboratories consider modifying its water quality testing for fecal contamination by providing testing for *E. coli*. The laboratory responded by commencing a comparative study to determine the relative statistical association of fecal coliform to *E. coli*. Although the use of total and fecal coliform organisms as indicators of water-borne fecal contamination has served well for protecting public health, watershed-based decision making will require information that is risk-based and can be applied with some consistency for various water uses. And *E. coli* and *Enterococci* are more appropriate bacterial indicators for future use. Therefore, until the Idaho State Water Quality Standards indicate the appropriate levels of *E. coli* and *Enterococci*, based on a comparison study being conducted by the IDHW-Bureau of Laboratories, use of total and fecal coliform as a surrogate indicator for fecal contamination will be continued.

A literature survey was conducted to assess if a linkage between sediment and pathogens (fecal coliform bacteria) had been established or investigated. Several scientific articles suggest that such a linkage does exist (or should exist). For example,

(1) "high concentrations of suspended sediment in streams diminish the recreational use of streams because *pathogens and toxic substances commonly associated with suspended sediment* are threats to public health (USGS 1994 [Chapter 4]);"

(2) fecal coliform bacteria "in aquatic environments *are deposited into the sediment* from surface waters (Tiedemann *et al.* 1987);"

(3) sediment or total suspended solids have a significant effect in pollutant mass loading *"by transporting pollutants such as bacteria* ... to receiving waters," and "... *microorganisms are predominantly sediment-bound pollutants* existing in a chemical equilibrium with their dissolved phase (http://ate.cc.vt.edu/eng/bse/dillaha/bse4324/water_quality.html/);"

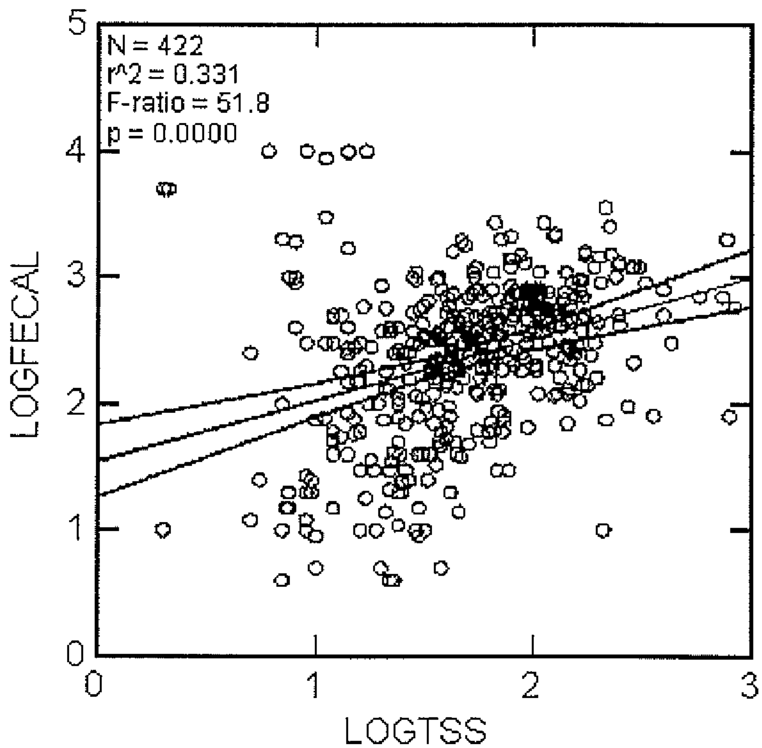
(4) "as much as 95% of deposited *manure will settle to the bottom of the stream* within the first 50 meters (Biskie *et al.* 1988);"

(5) "the bacteria in the sediment may remain alive for several weeks (Sherer *et al.* 1992);" and,

(6) "Heavy livestock trampling of streambanks will reduce water information resulting in greater sediment production and lower herbage yield and cover. The effects to water chemistry are increases in fecal coliform (Shovlin 1984)."

9. BACTERIA SYNERGISTIC RELATIONSHIP (Continued):
Based on this, Rock Creek data from the Rural Clean Water Project (1981-1991) and additional monitoring data from IDEQ-TFRO (1983-1997), a synergistic linkage was developed between fecal coliform and TSS. Fecal coliform levels on the Middle Snake River were also tested for the TSS statistical relationship. IDEQ-TFRO data (1990-1997), USGS data (1990-1997), and RCWP data (1981-1991) indicate that a relationship exists, as shown by the following graph. Variability in the database is principally due to the various sources used (combined as an accumulation of field and lab errors) and the natural variability inherent in bacteriological data in natural streams. A 21.8% TSS reduction in Rock Creek (to achieve 51.9 mg/L TSS) is equivalent to a 10.1% reduction in fecal coliform.

ROCK CREEK DATABASE: 1983-1997
LOGFECAL versus LOGTSS
EQUATION: LOGFECAL=(0.431389xLOGTSS)+1.549894



Additionally, bacteria data from Rock Creek indicates that although at times the primary and secondary contact recreational standards are violated, as a general rule there has been a great reduction in fecal coliform since 1971. On or about 1974 the major point sources no longer discharged to Rock Creek. The following table summarizes this data:

YEARS	MEAN	GEOMEAN	N	COMMENTS
1971-1974	48,788,502	328,442	25	Point Sources + Nonpoint Sources
1975-1989	721	222	86	Point sources no longer discharging to RC.
1990-1998	359	44	97	Nonpoint Source industries increase

9. BACTERIA SYNERGISTIC RELATIONSHIP (Continued):
Sources of fecal coliform in streams are diffuse and varied. The most common is from warm-blooded animals that defecate directly into the stream. Another source is the movement of fecal materials into the stream due to runoff after a heavy rain or over-irrigation. Other sources could include sewage system discharge or septic system failure. The following scenario describes the generic process by which fecal coliforms may enter surface waters and is compiled from a number of scientific sources:

1. A warm-blooded animal defecates on the soil or stream. If the defecation is in the stream, then the water's carrying capacity for fecal coliforms from the manure is immediate and direct. If the defecation is on the soil or land, then the water's carrying capacity for fecal coliforms is diminished until some event occurs that will flush or move the manure (or residue) into the stream.

2. A storm event occurs or improper irrigation of the land creates runoff that carries the manure (or residue) into a receiving stream.

3. The receiving stream becomes the carrier or conduit through which the fecal coliform bacteria are moved. The stream on receiving the fecal coliform bacteria shows an elevated level potentially exceeding primary or secondary contact recreation standards. Fecal coliform bacteria once in the surface water have been shown to survive at least two weeks (or 14 days).

4. Various scientific studies have shown that fecal coliform bacteria in aquatic environments have a tendency to be deposited into the sediment from surface waters. In combination with sediment the fecal coliform bacteria create a sediment bed inoculating reservoir. In this inoculating reservoir, the viability of fecal coliforms could be from 14 days to as much as several months.

5. When the sediment bed inoculating reservoir is disrupted the inoculated coliform mixes with the waterbody's overlying water and quite possibly increases the fecal coliform levels. Several scientific studies have shown that fecal coliform bacteria levels almost double after disruption of a creek's sediment bed.

In the Upper Snake Rock subbasin, pathogens (or fecal coliform bacteria) are listed in 14 of the 31 water quality limited stream segments. As previously mentioned in §2.2.4.3, fecal coliform bacteria in the tributaries indicates that, in general, the irrigation season had higher bacteria counts when compared to the non-irrigation season. Those counts exceeded primary and secondary contact recreational standards. A similar relationship may be seen for TSS (see §2.2.4.1 (4)). Bacteria data collected on the Middle Snake River indicates that fecal coliform exceedences are rarely a problem unless a storm event occurs, or discharge from tributaries during the irrigation season produces sediment deltas and/or alluvial fans and plumes downstream of the discharge confluence. As an example, during the 1996 IDEQ-TFRO monitoring season, one storm event caused fecal coliform levels at the Kanaka Rapids area to exceed primary and secondary contact recreation (2900 colonies/100 mL on September 24, 1996). However, in general, the mean/geomean values for fecal coliform in the Middle Snake River are 40/13 colonies/100 mL. There were no exceedences noted in Bliss Reservoir or in the reach from Milner Dam to Twin Falls Reservoir.

As a threat to human health, fecal levels exceeding primary and/or secondary contact recreation standards could potentially threaten human health. But it is highly unlikely that they pose any threat to endangered snails. There is no information to suggest otherwise on the Middle Snake River. USFWS, in their biological opinion on the reissuance of NPDES permits for six municipal sewage treatment plants, two food processors, and the issuance of a General Permit for 80 aquaculture facilities, says that the "proposed action is not likely

9. BACTERIA SYNERGISTIC RELATIONSHIP (Continued):
to jeopardize the continued existence of the Idaho springsnail, the Snake River physa, the Utahl valvata, and the Bliss Rapids snail. No critical habitat has been designated for these species, therefore, none will be affected (USFWS 1999)." The following table describes the effluent limits for municipalities, food processros, and aquaculture:

Effluent permit limitations for point sources in Upper Snake Rock

City/Company	***NPDES No.***	***Effluent Limitations, colonies/100 mL*** ***Average Monthly Limit*** ***(Geometric Mean)***	***Average Weekly Limit*** ***(Geometric Mean)***	***Daily Maximum Limit***
Municipalities				
Filer	002006-1	200	200	800
Buhl	002066-4	200	200	800
Twin Falls	002127-0	100	200	-
Jerome	002016-8	200	200	800
Hansen May 1 - Sep 30 Oct 1 - Apr 30	002244-6	50 200	100 200	500 800
Hagerman May 1 - Sep 30 Oct 1 - Apr 30	002594-1	50 200	200 200	500 800
Food Processors				
J.R. Simplot	000066-3	No effluent limits. Ambient water quality monitoring during Aug and Nov at 4 river stations. Will conduct a fecal coliform bacteria study within 6 months of permit issuance date on outfall 003.		
McCain Food Service	000061-2	No effluent limits. Ambient water quality monitoring during Aug and Nov at 4 river stations.		
Aquaculture Facilities				
~80 fish hatcheries	NPDES Permitted	The permit authorizes the discharge of fecal coliform and other bacteria suject to the limitations and conditions of effluent limits. Discharges from aquaculture facilities or a associated, on-site fish processors shall not violate Idaho State Water Quality Standards for fecal coliform bacteria.		
Prepared by IDEQ-TFRO.				

XI. THE EFFECT OF TSS REDUCTION ON OTHER PARAMETERS:
Prediction Estimates on Parameter Responses

10. SUMMARY CONCLUSIONS

RELATION	% REDUCE	SYNERGISTIC PREDICTION FROM TSS REDUCTIONS
TP:TSS	6.7	TP will decrease by 6.7%.
SRP:TSS	(7.1)	SRP will increase by 7.1%.
NH3:TSS	(3.00)	NH3 will increase by 3.0%
NOX:TSS	(19.3)	NOX will increase by 19.3%
TKN:TSS	(43.8)	TKN will increase by 43.8%
DO:TSS	(1.6)	DO will increase by 1.6%
Bacteria:TSS	10.1	Bacteria will decrease by 10.1%

TP and Bacteria will most likely be reduced with reductions in TSS.
SRP, NH3, NOX, TKN, and DO will most likely increase with reductions in TSS.

XII. AQUACULTURE WASTELOAD ALLOCATIONS AS DEFINED BY TSS MDL

TOTAL SUSPENDED SOLIDS

Data collected and reported in USEPA's Discharge Monitoring Reports (DMRs) from aquaculture facilities in Upper Snake Rock beginning in 1990 through 1998, indicate that sediment as TSS represents a small portion of the gross total TSS when considering all of the industries together. Exceedences beyond the permitted 5 mg/L TSS were few (less that 1% of the total number of samples collected from 1990 through 1998, based on a visual review of 65 facilities' DMRs). The method detection level (MDL) used in the majority of these facilities was <4 mg/L. (Some facilities reported <5 mg/L or <2 mg/L.) Since the appropriate TSS value at that time was <4 mg/L, a best professional judgement TSS concentration of 2 mg/L (or ½ MDL) was used to estimate the amount of TSS potentially being discharged by any one aquaculture facility regardless of size or flow discharge. IDEQ-TFRO consulted with various fish farmers and fish specialists within the aquaculture industry, and the overall consensus of best professional opinion was that a TSS concentration range of 1.5 to 2.0 mg/L should come fairly close to estimating the amount of TSS discharge occurring on any aquaculture facility. Therefore, 2 mg/L TSS was used as an estimate TSS concentration value for effluent discharge, recognizing that it is probably a high estimate of TSS. The following table shows the estimated TSS discharge on a per watershed complex basis:

Estimated TSS loads for aquaculture facilities in Upper Snake Rock

Facility Name	*NPDES No.*	*Average Annual Flow, cfs*	*TSS, mg/L Estimated ½ MDL*	*Estimated Mean Daily Load lbs/day*	*Estimated Mean Yearly Load tons/year*
Rock Creek Complex (includes Cottonwood Creek, McMullen Creek)					
Canyon Trout Farm	002191-1	10.74	2.0	115.78	21.13
Canyon Trout Farm/Processing Plant	002191-1	Total Containment Fish Processor			
C&M Fish Farm	002714-6	14.26	2.0	153.72	28.05
Daydream Ranch	002680-8	13.18	2.0	142.08	25.93
Deadman Hatchery	002689-1	13.98	2.0	150.70	27.50
CSI Fish Hatchery	002630-1	4.95	2.0	53.36	9.74
Aquaculture Industries/Frame Hatchery	002703-1	18.10	2.0	195.12	35.61
Coats Farm Ponds	002761-8	19.96	2.0	215.17	39.27
			Sub Total =	1025.93	187.23
Billingsley Creek Complex (includes Riley Creek)					
Rangen's Inc.	002303-5	19.45	2.0	209.67	38.27
Jones Fish Hatchery	000086-8	30.25	2.0	326.10	59.51
Donny McFadden Farm Ponds	002612-3	6.96	2.0	75.03	13.69
Idaho Springs/Gold Springs Ponds	000073-6	53.97	2.0	581.80	106.18
Hidden Springs	002440-6	11.57	2.0	124.72	22.76
Springs Creek Springs Hatchery (Shrank)	002497-0	3.16	2.0	34.06	6.22
Fisheries Development	002499-6	001A= 11.05 003A= 85.69	2.0 2.0	119.12 923.74	21.74 168.58
Two Non-permitted Facilities	No Permit	<5.00>	2.0	53.9	9.84
Sub Total for Permitted Facilities Discharging Directly to Billingsley Creek =				2448.14	446.79

Sub Total for Permitted Facilities Discharging Directly to Billingsley Creek =				2448.14	446.79
USFWS/Hagerman National	000082-5	48.72	2.0	525.20	95.85
IDFG/Hagerman State	000080-9	72.28	2.0	779.18	142.20
SubTotal for Permitted Facilities Discharging Directly to Riley Creek =				1304.38	238.05
Sub Total for All Permitted Facilities Discharging into the Billingsley Creek Complex =				3752.52	684.84
Box Canyon Complex (includes Blind Canyon Creek, Clear Springs Creek & Lake, and Sand Springs Creek)					
Blind Canyon Hatchery	002599-2	6.97	2.0	75.14	13.71
Clear Lakes Trout Co.	000101-5	161.25	2.0	1738.28	317.24
Clear Springs Clear Lakes/Middle Hatchry	000093-1	182.06	2.0	1962.61	358.18
Clear Springs/Snake River Hatchery	000075-2	99.50	2.0	1072.61	195.75
Clear Springs Processing Plant	002688-3	0.05	118.33	31.89	5.82
Clear Lakes Trout Co./ID Trout Processor	000101-5	0.02	49.26	5.31	0.97
Ten Springs/Blind Canyon Aqua Ranch	002600-0	26.10	2.0	281.36	51.35
Blind Canyon Creek = 13.71 tons/year Clear Springs & Clear Lakes = 877.96 tons/year Thousand Springs Creek = 51.35 tons/year		Sub Total =		5167.20	943.02
Crystal Springs (part of the Cedar Draw Complex)					
Crystal Springs Trout Farm	000089-2	205.47	2.0	2214.97	404.23
			Sub Total =	2214.97	404.23
Middle Snake River Hatcheries					
Direct Dischargers to the Middle Snake River:					
Barret Farm Pond/Fish Breeders of ID	002718-9	10.06	2.0	108.45	19.79
Birch Creek Trout Inc.	002601-8	9.08	2.0	97.88	17.86
Blue Lakes Trout Farm	000095-7	150.90	2.0	1626.70	296.87
Blue Lakes Processing Plant		0.31	2.0	3.34	0.61
Box Canyon Trout Farm/Clear Springs	002290-0	297.09	2.0	3202.63	584.48
Buckeye Farm Ponds	002611-5	20.42	2.0	220.13	40.17
Canyon Springs (WW)	002731-6	15.93	2.0	171.73	31.34
Catfish Farm (WW)/Fish Breeders of ID	002295-1	17.95	2.0	193.50	35.31
Green's Trout Farm	000096-5	6.10	2.0	65.76	12.00
Mike Flemming Farm Ponds	002732-4	5.71	2.0	61.55	11.23
John Flemming Ponds	002780-4	8.97	2.0	96.70	17.65
Kaster Trout Farm/Sheldon Ponds	002517-8	49.12	2.0	529.51	96.64
Magic Valley Steelhead Hatchery/IDFG	002304-3	73.25	2.0	789.64	144.11
Pisces Investment Inc./Magic Springs	000097-3	120.99	2.0	1304.27	238.03

Pisces Investment Inc./Magic Springs	000097-3	120.99	2.0	1304.27	238.03
Pristine Springs/Sunnybrook Hatchery	002501-1	47.80	2.0	515.28	94.04
Pristine Springs/Warm Water		15.90	2.0	171.40	31.28
Rim View Trout Co.Inc./Wendell Hatchery	000099-0	135.67	2.0	1462.52	266.91
Slane Ponds	002779-1	4.18	2.0	45.06	8.22
Smith Farm Ponds	002687-5	9.11	2.0	98.21	17.92
Stevenson Ponds	002781-2	8.04	2.0	86.67	15.82
White Springs Trout Farm	002580-1	31.34	2.0	337.85	61.66
Woods Farm Ponds/Rangen Inc.	002733-2	12.38	2.0	133.46	24.36
Gary Wright Farm Ponds	002725-1	5.50	2.0	59.29	10.82
Sub Total of Direct Dischargers =				11381.53	2077.12
Indirect Dischargers to the Middle Snake River:					
Bell Fish Ponds (Stoddard Creek)	002491-1	3.77	2.0	40.64	7.42
Briggs Creek Hatchery (Briggs Creek)	002684-1	22.84	2.0	246.22	44.93
CJ Simms Ponds (Birch Creek)	002683-2	5.28	2.0	56.92	10.39
Decker Springs Farm (Decker SpringsCk)	002734-1	12.38	2.0	133.46	24.36
Lemmon Ponds (Curren Ditch)	002668-9	4.03	2.0	43.44	7.93
Niagara Springs Hatchery (Niagara SpCk)	002238-1	55.19	2.0	594.95	108.58
Rand Trout Farm (LQ/LS Drains)	002583-6	24.13	2.0	260.12	47.47
Standal Ponds (Stoddard Creek)	002778-2	4.95	2.0	53.36	9.74
White Water Ranch (Stoddard Creek)	000091-4	11.18	2.0	120.52	22.00
Boyer Farm Ponds (Billingsley Creek)	002704-9	11.60	2.0	125.05	22.82
Big Bend Trout Inc. (Irrigation Ditch)	002532-1	4.34	2.0	46.79	8.54
Eckles Fish Farm (Billingsley Creek)	002676-0	18.56	2.0	200.08	36.51
Henslee Hatchery (Irrigation Ditch)	002762-6	8.51	2.0	91.74	16.74
Rainbow Falls/Dunn (Billingsley Creek)	002675-1	36.20	2.0	390.24	71.22
Talbot Trout Ponds (Billingsley Creek)	002677-8	11.30	2.0	121.81	22.23
Sub Total of Indirect Dischargers =				2525.34	460.88
Sub Total of Direct Dischargers + Indirect Dischargers =				13906.87	2538.00
SUMMARY TOTALS (for 1996 303(d) List)					
Rock Creek Complex Sub Total (Cottonwood Creek, McMullen Creek):			8	1025.93	187.23
Billingsley Creek Complex Sub Total (Riley Creek):			11	3752.52	684.84
Box Canyon Complex Sub Total (Blind Canyon, Clear Springs, Sand Springs):			7	5167.20	943.02
Crystal Springs Sub Total (Cedar Draw Complex):			1	2214.97	404.23

Crystal Springs Sub Total (Cedar Draw Complex):	1	2214.97	404.23
Middle Snake River Sub Total Dischargers:	38	13906.87	2538.00
	TOTAL =	26067.49	4757.32
Other Watersheds/Complexes (1998 303(d) list)	25	-	-

Prepared by IDEQ-TFRO. Numbers after location sites represent number of aquaculture facilities. cfs = 1.548 x mgd. Estimated Daily Load, lbs/day = Flow (cfs) x Concentration (2.0 mg/L TSS) x 5.39. Estimated Yearly Load, tons/year = lbs/day x 365 days/year x 1 ton/2000 lbs = lbs/day x 0.1825 = tons/year. Average annual flow = Operational Average flow. Operational historical mode = 1991 through 1995. Aquaculture facilities located on streams introduced in the 1998 303(d) list are not included in this table. Those streams would include Cedar Draw, Mud Creek, and Deep Creek. Flow information derived from USEPA Permit Compliance System (1996).

TOTAL SUSPENDED SOLIDS (continued)

Other aquaculture facilities that discharge to other streams in the Upper Snake Rock subbasin, but which have direct impact on the water quality conditions of the Middle Snake River include the following: Deep Creek, Mud Creek, Cedar Draw, and Tunnel Creek. These facilities are included in the Mid-Snake TMDL as facilities discharging to "other" streams that are not listed on the 1996 303(d) list. They include:

"Other" aquaculture facilities discharging in the Upper Snake Rock subbasin (1998 303(d) Listed Streams)

Facility Name	***NPDES No.***	***Average Annual Flow, cfs***	***TSS, mg/L Estimated ½ MDL***	***Estimated Daily Load lbs/day***	***Estimated Yearly Load tons/year***
		Deep Creek			
Deep Creek Trout Farm	002515-1	15.83	2.0	170.65	31.14
Boswell Trout Farm	002670-1	16.89	2.0	182.07	33.23
Peter's Farm Pond	002424-4	10.33	2.0	111.36	20.32
Cox Farm Ponds/Harder Livestock	002533-0	15.58	2.0	167.95	30.65
Dolana Farm Ponds	002615-8	5.17	2.0	55.73	10.17
Howell Farm Ponds	002763-4	9.65	2.0	104.03	18.98
			Sub Total of Dischargers to Deep Creek =	791.79	144.49
		Mud Creek			
Rainbow Trout Farm (Buhl)	000103-1	8.26	2.0	89.04	16.25
W&W Trout Farm	002606-9	10.17	2.0	109.63	20.01
White's Trout Farm	002604-2	3.99	2.0	43.01	7.85
Buhl Trout Rearing Facility	002674-3	3.40	2.0	36.65	6.69
Buhl Trout Farm Pond (Blau)	002673-5	5.01	2.0	54.01	9.86
Jukers Ponds (via Silo Creek)	002618-2	5.41	2.0	58.32	10.64
RCP (via Silo Creek)	002752-9	1.78	2.0	19.19	3.50
First Ascent Fish Farm	002777-4	17.95	2.0	193.50	35.31
Rocky Ridge Ranch	002780-4	2.01	2.0	21.67	3.95
Mi Vida Loca (Compton)	002788-0	4.02	2.0	43.34	7.91
			Sub Total of Dischargers to Mud Creek =	668.36	121.97
		Cedar Draw			
Rainbow Trout Farm (Filer)	000102-3	12.85	2.0	138.52	25.28
Yoder's Farm Pond	002423-6	8.90	2.0	95.94	17.51
Cedar Draw Hatchery	002503-8	20.15	2.0	217.22	39.64
Olson Ponds	002592-5	3.87	2.0	41.72	7.61
Stutzman Fish Farm	002730-8	1.24	2.0	13.37	2.44
Rainbow Trout Farm Processing	( )	0.02	2.0	0.22	0.04
SEAPAC	( )	0.00	2.0	0.00	0.00

XII. AQUACULTURE WASTELOAD ALLOCATIONS AS DEFINED BY TSS MDL

SEAPAC	( )	0.00	2.0	0.00	0.00
Tunnel Creek Hatchery (Tunnel)	002292-6	18.22	2.0	196.41	35.85
Leo Martin Fish Hatchery (Tunnel)	002775-8	15.01	2.0	161.81	29.53
Sub Total of Dischargers to Cedar Creek =				865.21	157.90
Total of Deep Creek, Mud Creek, & Cedar Draw Dischargers =				2325.36	424.36

NORTHSIDE = NORTHSIDE CANAL COMPANY
SOUTHSIDE = TWIN FALLS CANAL COMPANY

NORTHSIDE A DRAIN:

	NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L		
	0.017	8.30	23.80	0.0016	0		
	0.032	8.50	25.90	0.0051	0		
	0.037	8.20	23.80	0.0028	0		
	0.058	8.30	26.20	0.0063	0		
	0.107	8.50	19.50	0.0114	0		
	0.080	8.50	19.50	0.0085	0		
	0.062	8.70	16.80	0.0083	0		
	0.140	8.40	19.10	0.0118	0		
	0.037	8.00	11.40	0.0007	0		
	0.027	8.30	10.40	0.0010	0		
	0.095	8.90	5.70	0.0089	0		
	0.081	8.40	11.80	0.0041	0		
	0.059	8.60	10.80	0.0043	0		
	0.033	8.40	12.80	0.0018	0		
	0.110	8.60	13.30	0.0095	0		
	0.047	8.50	16.70	0.0042	0		
	0.003	8.70	17.60	0.0004	0	Exceedences	
	0.023	8.40	21.00	0.0022	0	Number	Percent
Total	18			18	0	0:18	0.00%

SOUTHSIDE A10 DRAIN:

	NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L		
	0.021	7.60	19.40	0.0003	0		
	0.022	7.50	21.00	0.0003	0		
	0.160	7.30	22.60	0.0015	0		
	0.048	7.90	22.80	0.0018	0		
	0.050	8.10	18.00	0.0020	0		
	0.058	8.50	19.00	0.0060	0		
	0.082	8.40	18.00	0.0064	0		
	0.020	7.80	18.40	0.0004	0		
	0.030	7.70	10.90	0.0003	0		
	0.050	8.20	6.00	0.0010	0		
	0.003	8.20	9.40	0.0001	0		
	0.003	8.10	10.50	0.0001	0		
	0.144	8.10	14.00	0.0044	0		
	0.113	7.80	11.90	0.0015	0		
	0.042	7.60	16.40	0.0005	0		
	0.020	7.70	16.90	0.0003	0	Exceedences	
	0.030	7.70	19.80	0.0006	0	Number	Percent
Total	17			17	0	0:17	0.00%

NORTHSIDE C55 DRAIN:

NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L
0.012	7.80	22.50	0.0003	0
0.011	8.00	23.20	0.0005	0

	0.037	8.00	23.30	0.0018	0		
	0.055	7.70	27.20	0.0017	0		
	0.101	8.40	20.00	0.0090	0		
	0.032	8.40	19.00	0.0027	0		
	0.070	8.40	16.50	0.0049	0		
	0.046	8.00	16.30	0.0013	0		
	0.042	7.90	10.70	0.0006	0		
	0.029	7.90	10.00	0.0004	0		
	0.070	9.00	6.80	0.0087	0		
	0.003	8.80	8.90	0.0003	0		
	0.089	8.80	10.80	0.0098	0		
	0.137	8.70	14.60	0.0159	0		
	0.144	8.40	13.40	0.0081	0		
	0.029	8.60	17.40	0.0033	0		
	0.003	8.60	18.10	0.0004	0	Exceedences	
	0.003	8.40	22.00	0.0003	0	Number	Percent
Total	18			18	0	0:18	0.00%

SOUTHSIDE TWIN FALLS COULEE:

	NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L		
	0.015	8.80	19.10	0.0028	0		
	0.021	8.80	24.00	0.0052	0		
	0.035	7.90	24.00	0.0014	0		
	0.037	8.70	19.00	0.0057	0		
	0.033	8.00	21.00	0.0013	0		
	0.089	8.20	21.00	0.0056	0		
	0.086	8.70	18.90	0.0132	0		
	0.026	8.20	19.70	0.0015	0		
	0.032	8.70	12.70	0.0033	0		
	0.003	9.50	10.60	0.0011	0		
	0.129	8.70	8.30	0.0096	0		
	0.003	8.70	8.40	0.0002	0		
	0.003	8.70	11.30	0.0003	0		
	0.006	8.60	15.40	0.0006	0		
	0.003	8.40	16.90	0.0002	0		
	0.036	8.70	23.60	0.0073	0		
	0.003	8.80	24.20	0.0008	0	Exceedences	
	0.025	8.20	21.20	0.0016	0	Number	Percent
Total	18			18	0	0:18	0.00%

SOUTHSIDE MAIN PERRINE COULEE:

NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L
0.042	8.80	21.70	0.0092	0
0.064	8.60	19.70	0.0085	0
0.046	8.10	19.50	0.0021	0
0.047	8.50	17.00	0.0042	0
0.086	8.20	17.00	0.0041	0
0.030	8.40	17.50	0.0023	0
0.240	8.70	15.10	0.0288	1

	0.050	8.60	17.30	0.0057	0		
	0.033	8.50	13.00	0.0023	0		
	0.032	8.70	11.80	0.0031	0		
	0.003	7.90	2.90	0.0000	0		
	0.097	7.80	9.60	0.0011	0		
	0.078	8.80	7.60	0.0068	0		
	0.037	8.80	4.40	0.0025	0		
	0.044	8.90	7.70	0.0048	0		
	0.029	8.60	11.00	0.0021	0		
	0.151	8.90	9.80	0.0189	0		
	0.019	9.00	10.70	0.0031	0		
	0.112	8.80	9.50	0.0112	0		
	0.100	8.60	6.80	0.0054	0		
	0.031	8.50	11.40	0.0019	0		
	0.006	8.50	14.80	0.0005	0		
	0.044	8.70	12.50	0.0044	0		
	0.068	8.50	16.10	0.0058	0		
	0.003	8.90	18.00	0.0006	0	Exceedences	
	0.008	8.70	21.40	0.0014	0	Number	Percent
Total	26			26	1	1:26	3.80%

SOUTHSIDE WEST PERRINE COULEE:

	NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L		
	0.017	8.60	19.70	0.0022	0		
	0.040	8.70	18.00	0.0058	0		
	0.027	7.90	18.00	0.0007	0		
	0.043	8.40	16.50	0.0030	0		
	0.046	8.20	17.00	0.0022	0		
	0.076	8.40	15.50	0.0050	0		
	0.054	8.70	12.60	0.0055	0		
	0.034	8.60	13.10	0.0029	0		
	0.038	8.60	8.80	0.0024	0		
	0.104	8.60	8.00	0.0061	0		
	0.087	8.60	4.90	0.0040	0		
	0.104	8.10	12.50	0.0028	0		
	0.003	8.60	13.90	0.0003	0		
	0.300	8.50	13.50	0.0212	1		
	0.133	8.70	12.80	0.0136	0		
	0.066	8.50	15.80	0.0055	0		
	0.003	8.60	15.40	0.0003	0	Exceedences	
	0.086	8.30	19.50	0.0060	0	Number	Percent
Total	18			18	1	1:18	5.60%

SOUTHSIDE 43 DRAINAGE:

NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L
0.193	8.50	18.80	0.0196	0
0.034	8.90	17.00	0.0068	0
0.020	8.20	18.00	0.0010	0

	0.040	8.70	16.00	0.0051	0	
	0.059	8.20	16.50	0.0027	0	
	0.088	8.60	15.50	0.0088	0	
	0.062	8.60	13.00	0.0052	0	
	0.087	8.60	13.10	0.0074	0	
	0.040	8.50	9.10	0.0021	0	
	0.100	8.60	8.40	0.0060	0	
	0.069	8.50	6.00	0.0028	0	
	0.072	8.10	10.70	0.0017	0	
	0.008	8.50	11.80	0.0005	0	Exceedences
	0.164	8.50	11.60	0.0101	0	Number / Percent
Total	14			14	0	0:14 / 0.00%

SOUTHSIDE 30 DRAIN:

	NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L	Exceedences Number	Exceedences Percent
	0.122	8.10	20.00	0.0057	0		
	0.018	8.00	20.10	0.0007	0		
	0.049	7.80	20.10	0.0012	0		
	0.054	8.40	20.10	0.0049	0		
	0.123	8.50	16.50	0.0107	0		
	0.106	8.50	19.50	0.0113	0		
	0.022	8.50	15.80	0.0018	0		
	0.031	8.10	12.90	0.0009	0		
	0.051	8.00	8.90	0.0008	0		
	0.032	8.00	7.70	0.0005	0		
	0.172	8.70	4.90	0.0099	0		
	0.003	8.60	8.30	0.0002	0		
	0.019	8.60	9.90	0.0013	0		
	0.006	8.40	12.20	0.0003	0		
	0.021	8.40	11.40	0.0010	0		
	0.117	8.40	16.90	0.0085	0		
	0.019	8.30	14.60	0.0009	0		
	0.129	8.10	18.80	0.0056	0		
Total	18			18	0	0:18	0.00%

NORTHSIDE S29 DRAIN:

NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L
0.034	8.90	25.70	0.0108	0
0.131	8.10	27.40	0.0101	0
0.058	8.20	23.80	0.0044	0
0.061	8.90	22.00	0.0161	0
0.140	8.40	17.50	0.0106	0
0.026	8.20	19.00	0.0014	0
0.025	8.40	16.60	0.0018	0
0.162	8.40	13.60	0.0093	0
0.119	8.10	7.00	0.0021	0
0.177	8.70	11.50	0.0166	0
0.034	8.50	13.10	0.0023	0
0.020	8.70	12.30	0.0020	0

	NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L	Exceedences Number	Exceedences Percent
	0.051	8.60	16.50	0.0055	0		
	0.087	8.60	16.10	0.0091	0		
	0.062	8.30	17.60	0.0038	0		
	0.009	8.50	17.40	0.0008	0		
	0.104	8.40	20.50	0.0096	0		
Total	17			17	0	0:17	0.00%

SOUTHSIDE PIGEON COVE HYDRO PLANT: LQ AND LS DRAINS:

	NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L	Exceedences Number	Exceedences Percent
	0.037	7.90	18.90	0.0010	0		
	0.041	7.80	19.50	0.0010	0		
	0.119	7.50	18.40	0.0013	0		
	0.043	8.10	17.20	0.0017	0		
	0.056	8.20	15.50	0.0024	0		
	0.060	8.20	18.00	0.0030	0		
	0.046	8.20	14.60	0.0018	0		
	0.029	8.10	12.10	0.0008	0		
	0.065	7.90	10.80	0.0010	0		
	0.233	7.70	13.20	0.0027	0		
	0.243	8.20	12.00	0.0080	0		
	0.195	7.80	10.30	0.0023	0		
	0.591	7.80	11.20	0.0074	0		
	0.440	8.10	10.90	0.0106	0		
	0.316	8.40	10.10	0.0140	0		
	0.308	8.20	11.10	0.0095	0		
	0.462	8.30	11.20	0.0179	0		
	0.283	8.20	9.20	0.0075	0		
	0.423	8.10	10.90	0.0102	0		
	0.333	8.00	11.30	0.0066	0		
	0.102	8.50	9.00	0.0052	0		
	0.067	8.40	7.00	0.0023	0		
	0.012	8.40	12.70	0.0006	0		
	0.084	8.30	10.50	0.0031	0		
	0.127	8.20	12.60	0.0044	0		
	0.117	8.30	12.00	0.0048	0		
	0.067	8.30	16.40	0.0038	0		
	0.015	8.30	15.00	0.0008	0		
	0.104	8.10	18.60	0.0044	0		
Total	29			29	0	0:29	0.00%

NORTHSIDE N42 DRAIN:

NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L
0.051	8.30	19.50	0.0036	0
0.030	8.20	17.00	0.0014	0
0.079	8.20	15.50	0.0034	0
0.035	7.90	20.00	0.0011	0
0.021	8.50	15.60	0.0017	0
0.033	8.40	13.10	0.0018	0
0.030	8.30	10.70	0.0011	0

	0.037	8.10	13.60	0.0011	0		
	0.078	6.60	11.90	0.0001	0		
	0.031	7.70	7.60	0.0002	0	Exceedences	
	0.215	8.60	7.90	0.0125	0	Number	Percent
Total	11			11	0	0:11	0.00%

SOUTHSIDE LS2/39A DRAIN:

	NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L		
	0.032	8.00	19.50	0.0012	0		
	0.049	7.80	21.30	0.0013	0		
	0.068	7.70	19.10	0.0012	0		
	0.064	8.00	21.20	0.0026	0		
	0.065	8.40	17.00	0.0047	0		
	0.129	8.40	20.00	0.0115	0		
	0.049	7.80	12.80	0.0007	0		
	0.019	7.90	10.70	0.0003	0		
	0.028	7.90	10.50	0.0004	0		
	0.028	8.40	9.80	0.0012	0		
	0.003	8.30	4.90	0.0001	0		
	0.113	8.30	6.60	0.0031	0		
	0.035	8.80	3.40	0.0022	0		
	0.026	8.60	5.80	0.0013	0		
	0.031	8.60	7.10	0.0017	0		
	0.041	8.50	6.30	0.0017	0		
	0.152	8.40	7.10	0.0054	0		
	0.056	8.40	10.40	0.0025	0		
	0.042	8.40	9.10	0.0017	0		
	0.096	8.50	7.60	0.0044	0		
	0.057	8.60	12.60	0.0047	0		
	0.053	8.50	10.60	0.0030	0		
	0.101	8.30	12.50	0.0043	0		
	0.003	8.40	10.70	0.0001	0		
	0.064	8.40	15.80	0.0043	0		
	0.020	8.40	15.30	0.0013	0	Exceedences	
	0.143	8.20	18.10	0.0073	0	Number	Percent
Total	27			27	0	0:27	0.00%

NORTHSIDE N42 DRAIN ON CANYON RIM:

	NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L
	0.035	8.50	19.20	0.0037	0
	0.044	8.60	18.50	0.0054	0
	0.078	8.60	19.00	0.0099	0
	0.085	8.30	21.00	0.0066	0
	0.069	8.60	15.50	0.0069	0
	0.195	8.00	19.50	0.0071	0
	0.022	8.50	15.60	0.0018	0
	0.094	8.80	11.90	0.0111	0
	0.043	8.40	10.20	0.0019	0
	0.317	8.60	9.40	0.0206	1

	0.120	8.40	6.50	0.0040	0		
	0.045	8.60	12.60	0.0037	0		
	0.277	8.50	11.40	0.0168	0		
	0.039	8.40	12.30	0.0020	0		
	0.026	8.40	13.20	0.0014	0		
	0.100	8.30	19.30	0.0069	0		
	0.050	8.40	16.90	0.0036	0	Exceedences	
	0.112	8.40	21.70	0.0112	0	Number	Percent
Total	18			18	1	1:18	5.60%

NORTHSIDE J8 DRAIN:

	NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L		
	0.037	8.70	28.10	0.0096	0		
	0.069	10.40	23.50	0.0640	1		
	0.029	8.60	21.00	0.0042	0		
	0.055	8.30	23.00	0.0049	0		
	0.054	7.90	17.00	0.0013	0		
	0.089	8.10	22.00	0.0048	0		
	0.022	8.80	17.10	0.0037	0		
	0.021	10.20	14.40	0.0169	0		
	0.030	8.50	10.00	0.0016	0		
	0.109	8.50	10.30	0.0061	0		
	0.024	8.50	13.30	0.0017	0		
	0.055	8.60	13.00	0.0046	0		
	0.035	8.60	14.80	0.0033	0		
	0.003	8.50	16.70	0.0003	0		
	0.114	8.60	22.50	0.0179	0	Exceedences	
	0.043	8.50	23.90	0.0061	0	Number	Percent
Total	16			16	1	1:16	6.30%

SOUTHSIDE 39 DRAIN:

NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L
0.041	8.10	22.30	0.0023	0
0.078	8.00	22.40	0.0035	0
0.045	8.00	20.50	0.0018	0
0.058	8.40	18.70	0.0048	0
0.051	8.50	18.00	0.0049	0
0.104	8.50	21.00	0.0122	0
0.028	8.40	15.70	0.0019	0
0.034	7.90	13.10	0.0006	0
0.104	7.80	9.70	0.0012	0
0.170	7.50	12.90	0.0012	0
0.011	8.50	12.10	0.0007	0
0.003	8.20	7.70	0.0001	0
0.127	8.20	8.90	0.0033	0
0.158	8.70	5.80	0.0098	0
0.040	8.80	5.00	0.0029	0
0.042	8.70	7.40	0.0029	0
0.030	8.60	8.10	0.0018	0

	0.036	8.70	6.10	0.0023	0		
	0.292	8.50	7.50	0.0133	0		
	0.044	8.50	10.50	0.0025	0		
	0.003	8.60	9.50	0.0002	0		
	0.150	8.70	8.90	0.0117	0		
	0.003	8.70	12.30	0.0003	0		
	0.082	8.60	10.90	0.0060	0		
	0.240	8.50	13.30	0.0167	0		
	0.430	8.50	13.30	0.0300	1		
	0.051	8.30	18.40	0.0033	0		
	0.101	8.60	16.60	0.0109	0	Exceedences	
	0.151	8.30	20.20	0.0111	0	Number	Percent
Total	29			29	1	1:29	3.40%

SOUTHSIDE I DRAIN:

	NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L		
	0.039	8.70	19.70	0.0063	0		
	0.033	8.80	20.50	0.0067	0		
	0.040	8.60	18.00	0.0047	0		
	0.058	8.50	18.90	0.0059	0		
	0.044	8.20	15.50	0.0019	0		
	0.013	7.90	20.00	0.0004	0		
	0.022	8.60	16.50	0.0024	0		
	0.283	9.90	12.70	0.1818	1		
	0.029	8.40	11.40	0.0014	0		
	0.144	8.60	13.60	0.0127	0		
	0.045	6.90	12.20	0.0001	0		
	0.003	8.20	7.20	0.0001	0		
	0.219	9.40	8.10	0.0622	1		
	0.137	8.10	7.00	0.0024	0		
	0.292	8.80	6.90	0.0242	1		
	0.222	8.80	9.10	0.0216	1		
	0.098	8.60	12.20	0.0078	0		
	0.337	8.80	7.30	0.0288	1		
	0.236	8.60	9.70	0.0157	0		
	0.062	8.80	12.50	0.0076	0		
	0.036	8.70	11.20	0.0033	0		
	0.141	8.60	12.50	0.0115	0		
	0.025	8.60	8.00	0.0015	0		
	0.023	8.70	13.20	0.0024	0		
	0.092	8.50	11.60	0.0057	0		
	0.105	8.60	17.20	0.0118	0		
	0.058	8.60	19.90	0.0078	0		
	0.014	6.80	17.80	0.0000	0	Exceedences	
	0.021	8.70	20.00	0.0034	0	Number	Percent
Total	29			29	5	5:29	17.20%

SOUTHSIDE N DRAIN PRIOR TO IDAHO FISH BREEDERS:

NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L

	0.034	7.90	16.60	0.0008	0		
	0.069	7.80	17.50	0.0014	0		
	0.033	8.10	15.30	0.0011	0		
	0.087	8.50	18.20	0.0085	0		
	0.059	8.20	17.80	0.0030	0		
	0.014	8.10	17.00	0.0005	0		
	0.029	8.10	14.50	0.0009	0		
	0.017	8.00	11.80	0.0004	0		
	0.031	7.90	12.00	0.0005	0		
	0.042	8.00	11.80	0.0009	0		
	0.090	8.30	11.50	0.0036	0		
	0.032	8.50	8.20	0.0015	0		
	0.026	8.60	6.40	0.0014	0		
	0.066	8.50	6.30	0.0027	0		
	0.087	8.60	7.50	0.0049	0		
	0.090	8.50	10.00	0.0049	0		
	0.180	8.40	8.80	0.0072	0		
	0.115	8.40	11.30	0.0056	0		
	0.040	8.20	14.40	0.0016	0		
	0.090	8.40	13.00	0.0049	0		
	0.049	8.50	15.30	0.0039	0		
	0.064	8.40	13.60	0.0037	0		
	0.026	8.40	15.70	0.0017	0		
	0.155	8.40	15.40	0.0101	0		
	0.035	8.40	15.20	0.0023	0		
	0.056	8.30	14.30	0.0027	0		
	0.155	8.30	15.40	0.0081	0	Exceedences	
	0.048	8.10	16.80	0.0018	0	Number	Percent
Total	28			28	0	0:28	0.0%

NORTHSIDE S19/S DRAINS:

NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L
0.044	8.90	24.30	0.0131	0
0.054	8.70	24.50	0.0115	0
0.028	8.40	22.50	0.0030	0
0.047	8.40	22.00	0.0048	0
0.050	8.10	17.50	0.0020	0
0.158	7.80	20.50	0.0039	0
0.025	8.70	16.00	0.0032	0
0.035	8.50	9.50	0.0018	0
0.051	8.50	5.90	0.0020	0
0.061	8.40	8.80	0.0025	0
0.224	8.70	8.10	0.0164	0
0.152	8.60	9.70	0.0101	0
0.003	8.30	9.70	0.0001	0
0.040	8.50	12.10	0.0026	0
0.076	8.30	17.20	0.0045	0
0.031	8.50	14.30	0.0023	0
0.081	8.80	21.30	0.0173	0

	0.018	8.70	17.70	0.0026	0	Exceedences	
	0.056	8.70	20.60	0.0095	0	Number	Percent
Total	19			19	0	0:19	0.00%

NORTHSIDE W26 DRAIN:

	NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L		
	0.03	9.20	25.00	0.0141	0		
	0.02	8.70	25.50	0.0045	0		
	0.02	8.50	23.00	0.0027	0		
	0.05	8.40	23.00	0.0057	0		
	0.05	8.20	9.50	0.0014	0		
	0.10	8.20	19.00	0.0056	0		
	0.02	8.60	15.30	0.0015	0		
	0.06	8.40	11.60	0.0027	0		
	0.07	8.60	8.50	0.0044	0		
	0.11	8.70	9.30	0.0085	0		
	0.10	8.70	15.10	0.0116	0		
	0.00	8.40	13.00	0.0002	0		
	0.06	8.50	9.60	0.0033	0		
	0.10	8.50	18.10	0.0099	0		
	0.15	8.60	14.20	0.0138	0		
	0.04	8.70	21.80	0.0077	0		
	0.00	8.60	16.20	0.0003	0	Exceedences	
	0.05	6.80	19.90	0.0001	0	Number	Percent
Total	18			18	0	0:18	0.00%

END OF IRRIGATION RETURN DRAINS

XIII. UN-IONIZED AMMONIA CONSIDERATIONS FROM PHASE 1 STUDY (1990-1991)

AQUACULTURE FISH HATCHERIES

BLUE LAKES TROUT FARM FISH PROCESSING PLANT:

NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L
35.1	6.70	20.60	0.0718	1
27.2	6.60	19.80	0.0417	1
33.9	6.30	19.60	0.0257	1
31.7	6.30	19.90	0.0246	1
42.0	6.60	20.90	0.0698	1
44.1	6.50	20.20	0.0553	1
42.5	6.80	19.20	0.0988	1
16.8	6.80	19.00	0.0385	1
13.8	6.90	17.00	0.0343	1
24.9	6.90	16.50	0.0596	1
23.4	6.70	18.50	0.0410	1
27.8	6.70	20.00	0.0544	1
21.5	7.10	17.50	0.0877	1
44.3	6.60	17.60	0.0578	1
35.8	7.50	16.40	0.3362	1
43.6	6.70	13.00	0.0505	1
46.8	6.70	12.30	0.0514	1
38.7	7.80	12.20	0.5244	1
30.2	7.10	8.10	0.0599	1
29.4	7.40	7.40	0.1098	1
18.4	7.40	6.20	0.0624	1
11.6	7.50	4.00	0.0414	1
1.3	7.40	4.10	0.0038	0
9.8	7.50	2.90	0.0321	1
5.0	8.00	4.60	0.0588	1
12.6	7.50	8.00	0.0621	1
14.1	7.60	5.30	0.0704	1
9.14	8.10	5.10	0.1405	1
10.90	7.80	8.10	0.1075	1
9.68	7.50	8.60	0.0500	1
14.90	7.30	8.80	0.0494	1
10.60	7.50	9.90	0.0607	1
15.40	7.40	8.60	0.0633	1
9.90	7.50	9.90	0.0566	1
11.40	7.40	9.60	0.0507	1
13.90	7.40	11.90	0.0739	1
13.10	7.40	10.30	0.0615	1
11.80	7.50	11.70	0.0776	1
14.40	7.50	13.60	0.1096	1
1.48	7.70	10.50	0.0140	0
18.90	7.40	14.90	0.1262	1
19.00	7.50	14.90	0.1595	1
10.90	7.30	14.30	0.0553	1
15.90	7.30	16.80	0.0974	1
11.70	7.20	18.90	0.0666	1

	17.50	7.30	20.50	0.1406	1		
	12.20	7.10	17.90	0.0513	1		
	18.90	7.10	20.00	0.0927	1		
	22.40	7.10	18.60	0.0991	1		
	23.60	7.20	22.90	0.1793	1	Exceedences	
	23.10	7.00	23.30	0.1143	1	Number	Percent
Total	51			51	49	49:51	96.1%

BLUE LAKES TROUT FARM HATCHERY:

NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L
0.013	7.90	18.70	0.0004	0
0.161	7.80	17.00	0.0031	0
0.150	7.40	16.20	0.0011	0
0.154	7.30	16.80	0.0009	0
0.117	7.30	17.10	0.0007	0
0.288	7.40	18.80	0.0026	0
0.208	7.90	16.90	0.0050	0
0.133	8.10	16.50	0.0049	0
0.143	8.00	16.00	0.0040	0
0.276	8.10	16.00	0.0098	0
0.205	8.10	17.00	0.0078	0
0.287	8.00	18.00	0.0094	0
0.298	8.00	15.90	0.0084	0
0.175	8.00	17.10	0.0054	0
0.217	7.90	15.70	0.0048	0
0.240	7.80	14.20	0.0038	0
0.219	7.80	14.80	0.0036	0
0.140	7.70	14.80	0.0018	0
0.263	7.80	15.30	0.0045	0
0.189	5.80	13.60	0.0000	0
0.164	7.80	14.10	0.0026	0
0.205	7.80	12.60	0.0029	0
0.279	7.70	13.30	0.0033	0
0.376	7.60	13.60	0.0036	0
0.271	7.60	13.20	0.0025	0
0.121	8.10	14.00	0.0037	0
0.246	8.10	13.80	0.0074	0
0.295	8.10	14.10	0.0091	0
0.243	8.20	13.20	0.0087	0
0.282	8.10	14.30	0.0088	0
0.160	8.10	14.20	0.0050	0
0.395	8.00	14.50	0.0100	0
0.455	8.00	14.50	0.0115	0
0.396	7.80	13.30	0.0058	0
0.410	7.90	14.20	0.0081	0
0.240	7.90	14.10	0.0047	0
0.147	8.10	14.70	0.0047	0
0.113	8.00	14.00	0.0028	0
0.270	8.00	14.70	0.0069	0

	0.129	8.00	15.30	0.0035	0		
	0.126	8.20	14.10	0.0048	0		
	0.119	7.90	14.80	0.0025	0		
	0.133	8.10	16.40	0.0048	0		
	0.145	7.90	15.20	0.0031	0		
	0.385	8.00	15.70	0.0106	0		
	0.221	7.90	16.20	0.0051	0		
	0.242	7.90	17.70	0.0062	0		
	0.115	8.00	15.70	0.0032	0		
	0.125	7.90	15.80	0.0028	0		
	0.196	7.90	16.10	0.0045	0		
	0.070	8.00	16.80	0.0021	0	Exceedences	
	0.182	7.90	16.30	0.0042	0	Number	Percent
Total	52			52	0	0:52	0.0%

CRYSTAL SPRINGS FISH HATCHERY:

NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L
0.329	8.10	16.20	0.0118	0
0.416	8.30	15.50	0.0220	1
0.332	8.30	15.00	0.0170	0
0.305	6.60	15.00	0.0003	0
0.303	7.70	15.00	0.0040	0
0.332	8.20	16.00	0.0146	0
0.287	8.10	15.50	0.0098	0
0.276	8.20	15.50	0.0117	0
0.885	7.30	14.50	0.0046	0
0.418	8.10	16.50	0.0153	0
0.403	7.40	17.50	0.0033	0
0.342	8.00	16.50	0.0100	0
0.362	8.10	15.70	0.0125	0
0.228	7.90	16.60	0.0054	0
0.324	8.10	14.30	0.0101	0
0.354	7.80	13.90	0.0055	0
0.378	8.10	13.80	0.0114	0
0.357	7.70	13.70	0.0043	0
0.313	8.00	15.20	0.0083	0
0.331	7.80	13.10	0.0048	0
0.338	6.60	14.80	0.0004	0
0.377	7.90	13.60	0.0071	0
0.284	7.80	12.20	0.0038	0
0.452	7.90	13.10	0.0082	0
0.475	8.60	12.10	0.0376	1
0.454	7.70	12.40	0.0050	0
0.325	7.10	13.80	0.0010	0
0.328	8.20	13.70	0.0122	0
0.319	8.30	13.00	0.0141	0
0.284	8.20	12.70	0.0098	0
0.344	8.00	13.50	0.0081	0
0.180	8.10	14.00	0.0055	0

	0.142	8.20	13.80	0.0053	0		
	0.421	8.00	14.40	0.0106	0		
	0.388	6.80	13.10	0.0006	0		
	0.505	8.00	12.90	0.0113	0		
	0.329	7.90	13.00	0.0059	0		
	0.210	7.90	13.50	0.0039	0		
	0.271	8.10	15.10	0.0090	0		
	0.267	8.00	14.00	0.0065	0		
	0.260	8.00	14.20	0.0064	0		
	0.423	8.10	15.10	0.0140	0		
	0.239	7.60	15.20	0.0026	0		
	0.322	8.00	14.30	0.0080	0		
	0.100	8.10	14.00	0.0031	0		
	0.390	7.90	15.50	0.0085	0		
	0.559	8.00	16.00	0.0158	0		
	0.310	8.00	16.30	0.0090	0		
	0.276	8.00	17.70	0.0088	0		
	0.328	8.00	16.00	0.0093	0		
	0.308	7.90	16.50	0.0072	0		
	0.304	8.00	16.40	0.0088	0		
	0.369	7.90	17.60	0.0094	0	Exceedences	
	0.346	7.90	16.80	0.0083	0	Number	Percent
Total	54			54	2	2:54	3.7%

MAGIC VALLEY FISH HATCHERY:

NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L
0.135	7.90	17.80	0.0035	0
0.093	7.80	16.60	0.0018	0
0.065	7.70	16.90	0.0010	0
0.062	7.80	16.80	0.0012	0
0.040	7.80	16.40	0.0007	0
0.074	7.80	15.80	0.0013	0
0.090	7.80	16.80	0.0017	0
0.033	8.30	15.50	0.0017	0
0.098	8.10	15.50	0.0033	0
0.142	8.20	16.50	0.0065	0
0.106	8.10	15.50	0.0036	0
0.134	8.10	16.00	0.0047	0
0.106	8.10	15.10	0.0035	0
0.064	7.40	15.20	0.0004	0
0.117	8.10	14.10	0.0036	0
0.063	8.00	14.10	0.0015	0
0.082	7.90	14.30	0.0016	0
0.123	7.70	14.40	0.0016	0
0.203	7.80	14.60	0.0033	0
0.144	7.90	13.50	0.0027	0
0.097	8.10	14.50	0.0031	0
0.126	7.80	14.00	0.0020	0
0.151	7.80	13.40	0.0022	0

	0.247	7.60	14.30	0.0025	0		
	0.260	7.80	13.80	0.0040	0		
	0.182	7.60	13.60	0.0017	0		
	0.122	8.10	13.90	0.0037	0		
	0.182	8.10	14.00	0.0056	0		
	0.164	8.20	13.80	0.0062	0		
	0.182	8.10	13.20	0.0052	0		
	0.241	8.00	14.10	0.0059	0		
	0.268	8.00	14.40	0.0067	0		
	0.250	8.10	14.40	0.0079	0		
	0.321	7.70	14.20	0.0040	0		
	0.193	8.10	13.10	0.0055	0		
	0.214	8.00	13.60	0.0051	0		
	0.283	7.90	14.20	0.0056	0		
	0.401	7.90	13.90	0.0077	0		
	0.090	8.00	14.70	0.0023	0		
	0.131	8.10	14.50	0.0041	0		
	0.020	8.10	14.40	0.0006	0		
	0.142	8.10	15.20	0.0047	0		
	0.100	8.40	15.60	0.0066	0		
	0.112	8.10	14.20	0.0035	0		
	0.125	8.50	14.10	0.0092	0		
	0.221	8.00	14.40	0.0056	0		
	0.135	8.60	15.90	0.0139	0		
	0.139	8.40	16.50	0.0098	0		
	0.102	8.20	17.10	0.0049	0		
	0.138	8.40	15.30	0.0089	0		
	0.057	8.30	16.00	0.0031	0		
	0.054	8.20	15.40	0.0023	0		
	0.106	8.00	16.60	0.0031	0	Exceedences	
	0.086	8.10	15.50	0.0029	0	Number	Percent
Total	54			54	0	16:54	0.0%

RIM VIEW HATCHERY:

NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L
0.374	8.30	14.90	0.0190	0
0.326	8.30	15.20	0.0169	0
0.341	10.10	14.50	0.2611	1
0.330	7.70	15.00	0.0044	0
0.360	7.80	15.00	0.0060	0
0.283	8.10	16.00	0.0100	0
0.344	8.00	15.50	0.0094	0
0.286	8.30	14.70	0.0143	0
0.381	7.50	14.50	0.0031	0
0.406	8.00	15.50	0.0111	0
0.295	7.30	17.00	0.0018	0
0.271	7.90	16.00	0.0061	0
0.508	7.90	15.50	0.0111	0
0.338	7.80	15.90	0.0060	0

	0.334	8.00	14.60	0.0085	0		
	0.313	7.70	14.00	0.0039	0		
	0.389	7.90	14.10	0.0076	0		
	0.266	7.60	13.80	0.0026	0		
	0.529	7.90	14.50	0.0107	0		
	0.528	7.90	13.40	0.0098	0		
	0.396	6.50	14.70	0.0003	0		
	0.300	7.80	13.60	0.0045	0		
	0.378	7.90	9.60	0.0053	0		
	0.288	7.60	13.60	0.0028	0		
	0.494	8.00	12.80	0.0110	0		
	0.313	7.60	13.30	0.0029	0		
	0.277	7.10	13.20	0.0008	0		
	0.260	8.00	13.70	0.0062	0		
	0.338	8.10	12.50	0.0092	0		
	0.299	8.00	12.70	0.0066	0		
	0.328	6.70	14.00	0.0004	0		
	0.180	8.00	14.20	0.0045	0		
	0.368	7.90	14.00	0.0072	0		
	0.451	7.90	14.30	0.0090	0		
	0.370	8.10	12.10	0.0098	0		
	0.367	7.80	13.20	0.0054	0		
	0.496	7.90	13.40	0.0092	0		
	0.286	7.70	13.30	0.0034	0		
	0.325	7.90	14.90	0.0068	0		
	0.148	7.90	13.70	0.0028	0		
	0.277	7.50	14.50	0.0023	0		
	0.369	8.00	14.90	0.0096	0		
	0.242	7.80	15.00	0.0040	0		
	0.265	7.90	14.30	0.0053	0		
	0.337	7.90	14.20	0.0067	0		
	0.409	7.80	15.20	0.0069	0		
	0.315	7.90	15.60	0.0069	0		
	0.276	7.90	15.90	0.0062	0		
	0.386	7.70	16.00	0.0055	0		
	0.153	7.80	15.30	0.0026	0		
	0.377	7.40	15.30	0.0026	0		
	0.356	7.80	15.30	0.0061	0		
	0.513	7.70	16.00	0.0074	0	Exceedences	
	0.295	7.70	15.20	0.0040	0	Number	Percent
Total	54			54	1	1:54	1.9%

IDAHO FISH BREEDERS (N DRAIN WITH GEOTHERMAL WATER):

NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L
0.700	7.60	27.60	0.0183	0
0.747	7.50	27.50	0.0155	0
0.853	7.40	27.20	0.0138	0
0.764	7.60	25.60	0.0174	0
0.844	7.90	25.80	0.0380	1

	0.787	8.10	29.40	0.0689	1		
	0.626	8.00	27.00	0.0380	1		
	0.602	8.10	27.20	0.0459	1		
	0.686	8.00	27.00	0.0416	1		
	0.732	7.90	26.50	0.0345	1		
	0.594	8.00	25.50	0.0326	1		
	0.778	8.10	24.80	0.0507	1		
	0.735	7.90	26.70	0.0352	1		
	0.522	7.80	22.60	0.0151	0		
	0.668	8.00	22.80	0.0306	1		
	0.685	7.80	22.10	0.0192	0		
	0.675	7.70	23.00	0.0161	0		
	0.560	7.90	23.20	0.0211	1		
	0.558	7.70	20.60	0.0112	0		
	0.900	7.70	22.40	0.0205	1		
	0.947	7.50	22.60	0.0139	0		
	0.966	7.90	21.10	0.0315	1		
	1.060	7.50	21.10	0.0140	0		
	0.975	7.30	21.50	0.0084	0		
	0.617	8.00	20.30	0.0237	1		
	0.680	7.90	22.50	0.0244	1		
	0.731	7.90	20.20	0.0224	1		
	0.727	7.90	18.00	0.0190	0		
	0.821	7.80	21.90	0.0226	1		
	0.622	7.70	24.70	0.0167	0		
	1.080	7.70	23.70	0.0270	1		
	1.080	7.70	25.00	0.0295	1		
	1.260	7.70	22.30	0.0286	1		
	1.210	7.80	22.70	0.0353	1		
	0.937	7.60	25.10	0.0206	1		
	0.665	7.80	23.60	0.0206	1		
	0.794	8.00	25.60	0.0439	1		
	0.857	7.70	25.40	0.0241	1		
	0.570	7.80	25.90	0.0207	1		
	0.662	7.80	27.70	0.0272	1		
	0.534	8.00	24.20	0.0269	1		
	0.419	7.90	24.40	0.0172	0		
	0.539	7.90	24.90	0.0228	1		
	1.150	7.80	26.30	0.0430	1		
	0.615	7.80	26.70	0.0236	1		
	0.735	7.70	27.90	0.0245	1		
	0.895	7.70	25.80	0.0259	1		
	0.437	7.80	25.00	0.0149	0		
	1.110	7.70	27.10	0.0350	1		
	0.425	7.80	26.40	0.0160	0		
	0.724	7.90	26.80	0.0349	1	Exceedences	
	0.679	7.70	27.20	0.0216	1	Number	Percent
Total	52			52	36	52:52	69.2%

BOX CANYON FISH HATCHERY

NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L
0.552	7.00	16.00	0.0016	0
0.498	7.40	17.10	0.0039	0
0.537	7.10	16.00	0.0020	0
0.540	6.90	17.00	0.0013	0
0.566	7.20	16.20	0.0026	0
0.485	7.20	15.70	0.0022	0
0.581	7.80	17.20	0.0114	0
0.535	7.80	16.50	0.0100	0
0.544	7.90	16.30	0.0126	0
0.695	7.80	16.00	0.0125	0
0.585	7.70	16.10	0.0085	0
0.482	7.90	16.00	0.0109	0
0.700	7.80	15.90	0.0125	0
0.536	7.70	16.50	0.0080	0
0.652	7.50	14.50	0.0053	0
0.553	7.50	14.90	0.0046	0
0.540	7.50	14.00	0.0042	0
0.664	7.40	14.70	0.0044	0
0.569	7.60	14.50	0.0058	0
0.529	7.50	13.40	0.0040	0
0.667	7.90	14.10	0.0131	0
0.665	7.70	13.90	0.0082	0
0.735	7.70	11.70	0.0076	0
0.652	7.50	13.20	0.0048	0
0.452	7.80	9.90	0.0051	0
0.601	7.40	13.40	0.0036	0
0.518	7.40	9.70	0.0023	0
0.524	7.90	13.80	0.0101	0
0.478	7.90	11.70	0.0078	0
0.443	8.00	12.10	0.0094	0
0.424	7.80	12.50	0.0059	0
0.301	7.80	14.50	0.0049	0
0.494	7.80	15.00	0.0083	0
0.620	7.70	14.50	0.0080	0
0.745	6.70	12.60	0.0008	0
0.684	7.90	13.30	0.0126	0
0.477	7.80	13.90	0.0074	0
0.565	7.70	13.50	0.0067	0
0.537	7.50	15.10	0.0046	0
0.475	7.80	14.80	0.0078	0
0.481	7.70	14.90	0.0064	0
0.692	7.80	16.30	0.0128	0
0.487	7.80	15.30	0.0083	0
0.478	7.80	14.20	0.0075	0
0.443	7.70	16.30	0.0065	0
0.714	7.70	15.30	0.0097	0

	0.532	7.80	16.20	0.0097	0		
	0.535	7.70	16.10	0.0077	0		
	0.541	7.80	16.80	0.0103	0		
	0.481	7.80	15.40	0.0083	0		
	0.502	7.80	14.40	0.0080	0		
	0.409	7.70	15.80	0.0058	0		
	0.572	7.90	17.30	0.0142	0	Exceedences	
	0.547	7.70	17.70	0.0089	0	Number	Percent
Total	54			54	0	0:54	0.0%

BUCKEYE FARM FISH HATCHERY:

NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L
0.103	8.90	24.30	0.0307	1
0.013	8.90	25.70	0.0041	0
0.003	8.20	26.00	0.0002	0
0.022	7.20	22.00	0.0002	0
0.014	8.50	23.00	0.0019	0
0.023	8.90	25.00	0.0071	0
0.035	8.90	21.00	0.0088	0
0.033	8.20	19.50	0.0019	0
0.108	8.90	22.00	0.0286	1
0.098	8.50	24.50	0.0143	0
0.039	9.00	21.00	0.0116	0
0.130	9.00	16.70	0.0305	1
0.017	8.90	21.60	0.0044	0
0.040	8.80	13.60	0.0053	0
0.034	8.10	10.00	0.0008	0
0.031	8.70	11.80	0.0030	0
0.010	8.70	9.70	0.0008	0
0.062	8.80	11.90	0.0073	0
0.137	8.40	7.90	0.0051	0
0.104	6.30	9.20	0.0000	0
0.125	8.50	8.60	0.0062	0
0.205	8.00	2.70	0.0021	0
0.199	8.30	5.20	0.0048	0
0.445	8.70	5.80	0.0275	1
0.217	8.40	2.80	0.0055	0
0.243	6.80	2.10	0.0001	0
0.278	8.50	3.60	0.0093	0
0.176	8.80	3.40	0.0112	0
0.231	8.40	8.60	0.0092	0
0.068	8.70	9.90	0.0057	0
0.099	8.60	8.40	0.0060	0
0.053	8.70	10.10	0.0045	0
0.281	8.60	6.30	0.0145	0
0.091	8.80	8.60	0.0085	0
0.072	8.90	10.70	0.0096	0
0.076	8.90	9.80	0.0095	0
0.114	8.10	12.50	0.0031	0

	0.090	9.10	10.30	0.0172	0		
	0.074	9.40	13.80	0.0283	1		
	0.065	9.10	16.10	0.0175	0		
	0.537	8.70	13.70	0.0586	1		
	0.061	9.00	16.60	0.0142	0		
	0.046	9.20	14.30	0.0133	0		
	0.029	9.20	16.80	0.0095	0		
	0.003	9.00	16.20	0.0006	0		
	0.036	9.20	21.10	0.0145	0		
	0.067	6.90	20.40	0.0002	0		
	0.034	9.00	17.30	0.0083	0		
	0.153	6.70	19.40	0.0003	0	Exceedences	
	0.049	6.70	27.90	0.0002	0	Number	Percent
Total	50			50	6	6:50	12.0%

WHITE SPRINGS FISH HATCHERY:

NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L
0.419	8.30	15.60	0.0223	1
0.267	8.40	15.80	0.0179	0
0.201	7.90	15.00	0.0042	0
0.258	7.20	15.00	0.0011	0
0.394	7.60	15.00	0.0042	0
0.237	7.80	15.50	0.0041	0
0.447	7.70	16.90	0.0069	0
0.283	7.90	16.00	0.0064	0
0.411	7.10	16.30	0.0015	0
0.436	7.70	16.50	0.0065	0
0.439	7.30	17.00	0.0027	0
0.182	7.90	16.00	0.0041	0
0.376	7.80	16.00	0.0068	0
0.207	7.70	17.10	0.0032	0
0.367	7.70	15.90	0.0052	0
0.301	7.70	14.50	0.0039	0
0.372	7.50	15.30	0.0032	0
0.196	7.50	15.20	0.0017	0
0.239	7.70	15.20	0.0032	0
0.217	7.60	15.00	0.0023	0
0.514	7.60	15.00	0.0055	0
0.380	7.60	15.20	0.0041	0
0.585	7.70	14.30	0.0074	0
0.349	7.30	15.10	0.0019	0
0.332	7.70	13.30	0.0039	0
0.296	7.40	14.40	0.0019	0
0.269	7.70	13.10	0.0031	0
0.162	8.00	15.10	0.0043	0
0.398	7.70	13.30	0.0047	0
0.343	8.00	14.10	0.0084	0
0.539	7.60	14.90	0.0057	0
0.170	7.70	15.40	0.0023	0

	0.670	7.60	14.90	0.0071	0	
	0.318	7.70	15.60	0.0045	0	
	0.813	7.70	13.90	0.0101	0	
	0.392	7.80	14.60	0.0064	0	
	0.156	7.70	15.20	0.0021	0	
	0.384	7.50	14.70	0.0032	0	
	0.485	7.40	16.00	0.0036	0	
	0.176	7.80	15.30	0.0030	0	
	0.421	7.70	15.70	0.0060	0	
	0.333	7.70	16.20	0.0049	0	
	0.544	7.60	16.30	0.0064	0	
	0.350	7.60	15.40	0.0039	0	
	0.563	7.60	16.40	0.0067	0	
	0.467	7.80	16.30	0.0087	0	
	0.777	7.70	16.10	0.0114	0	
	0.355	7.70	17.30	0.0057	0	
	0.600	7.70	16.00	0.0087	0	
	0.321	7.80	16.80	0.0062	0	
	0.400	7.70	15.20	0.0055	0	
	0.292	7.70	16.70	0.0045	0	
	0.617	7.60	17.00	0.0077	0	Exceedences
	0.318	7.70	17.30	0.0051	0	Number / Percent
Total	54			54	1	1:54 / 2.1%

BIRCH CREEK FISH HATCHERY:

NH3	pH	TEM	NH3o	NH3o>=0.020 mg/L
0.329	8.60	15.80	0.0340	1
0.311	8.50	16.60	0.0276	1
0.387	8.00	15.50	0.0107	0
0.484	7.70	18.20	0.0083	0
0.412	7.90	16.00	0.0094	0
0.316	8.10	16.50	0.0117	0
0.325	8.00	18.10	0.0108	0
0.387	8.00	17.00	0.0119	0
0.407	7.60	18.50	0.0057	0
0.302	8.20	17.50	0.0150	0
0.517	7.50	19.00	0.0059	0
0.386	8.20	15.00	0.0160	0
0.446	8.20	16.60	0.0207	1
0.317	8.00	18.50	0.0109	0
0.137	8.10	14.90	0.0045	0
0.321	7.90	13.60	0.0061	0
0.343	8.00	3.40	0.0037	0
0.365	7.80	13.60	0.0056	0
0.152	8.10	13.90	0.0047	0
0.396	7.90	12.20	0.0068	0
0.268	7.80	13.10	0.0039	0
0.262	8.00	12.20	0.0056	0
0.371	7.80	11.00	0.0046	0

	0.211	7.80	11.10	0.0027	0		
	0.264	8.10	8.80	0.0055	0		
	0.418	7.90	9.90	0.0060	0		
	0.215	7.60	8.00	0.0013	0		
	0.324	8.20	12.00	0.0108	0		
	0.354	8.20	9.50	0.0097	0		
	0.329	8.40	9.50	0.0141	0		
	0.422	6.70	12.90	0.0005	0		
	0.256	8.30	12.30	0.0109	0		
	0.475	8.10	11.40	0.0121	0		
	0.604	8.20	13.40	0.0223	1		
	0.614	6.70	10.00	0.0006	0		
	0.485	8.10	11.50	0.0124	0		
	0.424	8.10	15.10	0.0142	0		
	0.337	7.70	11.80	0.0036	0		
	0.384	7.80	16.90	0.0075	0		
	0.263	8.20	13.10	0.0095	0		
	0.586	8.00	17.00	0.0180	0		
	0.408	8.20	15.60	0.0177	0		
	0.484	8.00	16.70	0.0146	0		
	0.367	8.00	16.70	0.0110	0		
	0.807	8.00	18.90	0.0284	1		
	0.771	8.00	19.50	0.0283	1		
	0.819	8.00	16.70	0.0246	1		
	0.757	8.10	18.60	0.0326	1		
	0.659	8.10	15.90	0.0234	1		
	0.433	8.10	18.20	0.0181	0		
	0.765	8.00	18.20	0.0256	1		
	0.541	8.00	18.20	0.0181	0		
	0.708	8.00	19.80	0.0266	1	Exceedences	
	0.542	6.70	20.20	0.0011	0	Number	Percent
Total	54			54	11	11:54	20.4%

END OF FISH HATCHERIES

XIV. TOTAL PHOSHPORUS TMDL CALCULATIONS

ASSUMPTIONS ON TP WHEN DATA IS NOT AVAILABLE

IRRIGATION RETURN FLOWS (Phase 1 Study)

North Side Canal Company	TP	SRP	Twin Falls Canal Company	TP	SRP
A	0.234	0.041	A 10	0.153	0.077
C 55	0.139	0.044	TF Coulee	0.246	0.063
N 42	0.113	0.092	E Perrine	0.199	0.064
N 42 (Rim)	0.151	0.071	Main Per	0.198	0.046
J 8	0.131	0.054	W Perrine	0.309	0.066
S 29	0.165	0.114	43	0.257	0.059
S 19/S	0.244	0.11	30	0.491	0.06
W 26	0.142	0.055	LQ/LS	0.306	0.071
			LS2 / 39A	0.342	0.057
			39	0.757	0.063
			I	0.208	0.103
			N	0.115	0.071
MEAN	0.165	0.073	MEAN	0.298	0.067

OVERALL MEAN 0.245 0.069 = to be used on Unaccounted Surface streams

NATURAL TRIBUTARIES (Phase 1 Study)

North Side of Snake River Canyon	TP	SRP	South Side of Snake River Canyon	TP	SRP
Vinyard	0.093	0.029	Rock Ck	0.156	0.086
Warm	0.06	0.038	Cedar Dr	0.193	0.082
Clear Lake	0.138	0.127	Mud Ck	0.18	0.114
Banbury	0.05	0.031	Deep Ck	0.152	0.063
Blind Can	0.156	0.109	Salmon F	0.101	0.048
Riley	0.05	0.059			
Malad	0.078	0.037			
MEAN	0.089	0.061	MEAN	0.156	0.079

OVERALL MEAN 0.117 0.069

UNCERTAIN HOW MUCH MIXING OF THE AQUIFER IS OCCURING WITH THE TRIBUTARIES AND SNAKE RIVER. THEREFORE, USE THE OVERALL MEAN OF 0.117 mg/L TP AS THE REGIONAL AVERAGE FOR NORTH SIDE OF CANYON.

MIDDLE SNAKE RIVER

TP data was taken from the IDEQ-TFRO databases from 1990-1998. An overall average was taken and them segregated for each segment in the river system.

The Phase 1 Database was also looked at individually and compared to the IDEQ-TFRO database

	IDEQ-TFRO TP	Phase 1 TP
Segment 1	0.126	0.115
Segment 2	0.126	0.139

Segment 3	0.111	0.130
Segment 4	0.101	0.087
Segment 5	0.099	0.088
Segment 6	0.116	0.084
MEAN	0.113	0.107

It was decided to used the IDEQ-TFRO database and to specifically use the overall mean (0.113 mg/L) as representative of all locations in the river system on an average basis. The IDEQ-TFRO database has 22 sites that easily provided more than 1 site location per segment, thus providing a better average than the Phase 1 Study which accounts for less sites (13) on the river.

SPRINGS

Based on USGS and IDEQ-TFRO, a TP value of 0.020 mg/L was accepted as average for springs in the Upper Snake Rock subbasin. IDEQ-TFRO reviewed various spring information collected by USGS and IDEQ, and determined that over 95% of the TP data was at or near (but below) 0.020 mg/L. Springfed tributaries without point source inputs by default are impacted by nonpoint sources, unless the groundwater emanating from the spring is already impacted from unknown sources. Since the mean regional value is 0.020 mg/L TP, values > 0.020 mg/L would be considered impacted from unknown sources (i.e., nonpoint sources). The antidegradation policy protects water-bodies for existing beneficial uses and water quality conditions. Therefore, stream water quality will be protected at 0.020 mg/L TP (or less) unless it can be demonstrated with substantiating information that values > 0.020 mg/L TP but < 0.100 mg/L TP are from the effects of natural background.

AQUACULTURE FACILITIES

Very little information is known for the majority of the industry, although large production facilities have a fairly large database in certain case. The Phase 1 Study was reviewed along with data held by IDEQ-TFRO and USEPA. It was determined that in order to provide a baseline load allocation, an estimate of target goals (as defined in the Mid-Snake TMDL), it was necessary to estimate the wasteload allocations per facility on a prorate basis using flow information. We are uncertain at this time what the final wasteload allocation process will be because permitting has allowed for three years of monitoring to occur (based on the Mid-Snake TMDL) before a final allocation is presented. However, IDEQ-TFRO used a predictive allocation for spreadsheet purposes and prorated the 970.2 lbs/day (from the Mid-Snake TMDL final target for TP) to all facilities based on flow. ***This should not be construed as the method by which IDEQ-TFRO or USEPA may allocate flows after three years of monitoring because flow information may be incorrect***. It is used here to estimate an allocation to achieve load capacity goals for the Middle Snake River and its tributaries and will be modified after 3 years of monitoring. Regardless of the final allocation procedure, aquaculture as a whole will need to reduce to a final target of 970.2 lbs/day (as defined in the Mid-Snake TMDL. Flow information is from USEPA and is defined as an "operational average" from 1991 to 1995. No gaurantee is made that the flow information is correct. In all likelihood there are errors in the averaging. Also, warm water is included. Fish food processing facilities are not a part of the 970.2 lbs/day, but are additional to this target. Therefore,

TP water quality goal = 970.2 lbs/day (for cold water & warm water FH)
% Reduction = 40% (imposed on aquaculture in Mid-Snake TMDL)
Baseline Estimate = (970.2 lbs/day / 0.60) = 1617.0 lbs/day estimate

	Facility	Q. cfs	Est 1990-91 lbs/day 1617.0	Est 2004-09 lbs/day 970.2	% Reduction
1	Canyon Springs	15.93	9.5	5.7	40.0
2	Blue Lakes FH	150.9	90.1	54.1	40.0
3	Pristine Springs(+ww)	63.7	38.0	22.8	40.0
4	Crystal Springs	205.47	122.7	73.6	40.0
5	Canyon Trout FH	10.74	6.4	3.8	40.0
6	C&M Farm FH	14.26	8.5	5.1	40.0
7	Daydream Ranch FH	13.18	7.9	4.7	40.0
8	Deadman FH	13.98	8.3	5.0	40.0
9	CSI FH	4.95	3.0	1.8	40.0
10	Frame FH	18.1	10.8	6.5	40.0
11	Coats FH	19.96	11.9	7.2	40.0
12	Green's Trout FH	6.1	3.6	2.2	40.0
13	Magic Valley Steel	73.25	43.7	26.2	40.0
14	Rim View FH	135.67	81.0	48.6	40.0
15	IPC/Niagara Springs	55.19	33.0	19.8	40.0
16	Gary Wright FH	5.5	3.3	2.0	40.0
17	Catfish FH	17.95	10.7	6.4	40.0
18	Kaster Trout FH	49.12	29.3	17.6	40.0
19	Box Canyon FH	297.09	177.4	106.5	40.0
20	Briggs Creek FH	22.84	13.6	8.2	40.0
21	Snake River FH	99.5	59.4	35.7	40.0
22	Middle FH	182.06	108.7	65.2	40.0
23	Clear Lakes Trout FH	161.25	96.3	57.8	40.0
24	Blind Canyon FH	6.97	4.2	2.5	40.0
25	Rainbow Filer FH	12.85	7.7	4.6	40.0
26	Yoder FH	8.9	5.3	3.2	40.0
27	Cedar Draw FH	20.15	12.0	7.2	40.0
28	Olson FH	3.87	2.3	1.4	40.0
29	Stutzman FH	1.24	0.7	0.4	40.0
30	Tunnel Creek FH	18.22	10.9	6.5	40.0
31	Leo Martins FH	15.01	9.0	5.4	40.0
32	Rainbow Buhl FH	8.26	4.9	3.0	40.0
33	W&W FH	10.17	6.1	3.6	40.0
34	White's FH	3.99	2.4	1.4	40.0
35	Buhl Trout (Blau)	5.01	3.0	1.8	40.0
36	Buhl Trout Rearing	3.4	2.0	1.2	40.0
37	Jukers FH	5.41	3.2	1.9	40.0
38	RCP FH	1.78	1.1	0.6	40.0
39	First Ascent FH	12.07	7.2	4.3	40.0
40	Rocky Ridge FH	2.01	1.2	0.7	40.0

41	Mi Vida Loca FH	4.02	2.4	1.4	40.0
42	Deep Creek Trout	15.83	9.5	5.7	40.0
43	Boswell Trout FH	16.89	10.1	6.1	40.0
44	Peter's FH	10.33	6.2	3.7	40.0
45	Cox FH	15.58	9.3	5.6	40.0
46	Dolana FH	5.17	3.1	1.9	40.0
47	Howell FH	9.65	5.8	3.5	40.0
48	Blind Canyon Aqua (1	26.1	15.6	9.4	40.0
49	Pisces Magic Spring	120.99	72.3	43.4	40.0
50	USFWS-FH	48.72	29.1	17.5	40.0
51	IDFG-FH	72.28	43.2	25.9	40.0
52	Buckeye FH	20.42	12.2	7.3	40.0
53	Barret FH	10.06	6.0	3.6	40.0
54	White Springs FH	31.34	18.7	11.2	40.0
55	Mike Flemming FH	5.71	3.4	2.0	40.0
56	Smith FH	9.11	5.4	3.3	40.0
57	Slane FH	4.18	2.5	1.5	40.0
58	John Flemming FH	8.97	5.4	3.2	40.0
59	Stevenson FH	8.04	4.8	2.9	40.0
60	Henslee (FBI) FH	8.51	5.1	3.0	40.0
61	Big Bend FH	4.34	2.6	1.6	40.0
62	Lemmon FH	4.03	2.4	1.4	40.0
63	Eckles FH	18.56	11.1	6.7	40.0
64	Dunn FH	23	13.7	8.2	40.0
65	Birch Creek FH	9.08	5.4	3.3	40.0
66	CJ Simms FH	5.28	3.2	1.9	40.0
67	Bell FH	3.77	2.3	1.4	40.0
68	Standal FH	4.95	3.0	1.8	40.0
69	White Water FH	11.18	6.7	4.0	40.0
70	Decker/Rangens	12.38	7.4	4.4	40.0
71	Woods/Rangens	12.38	7.4	4.4	40.0
72	Jones FH	45	26.9	16.1	40.0
73	McFadden FH	6.5	3.9	2.3	40.0
74	Idaho Spring FH	135	80.6	48.4	40.0
75	Hidden Springs FH	16.5	9.9	5.9	40.0
76	Schrank FH	2.5	1.5	0.9	40.0
77	Fisheries Dev FH	106	63.3	38.0	40.0
78	Boyer FH	11.6	6.9	4.2	40.0
79	Talbot FH	11.3	6.7	4.0	40.0
80	Silver Creek*	0	0.0	0.0	0.0
81	Rainbow Falls	36.2	21.6	13.0	40.0
		2707.45	1617.0	970.2	40.0

*Silver Creek discharges to the City of Twin Falls POTW.

Additional aquaculture facilities:

82	Blue Lakes Process	0.31	IN DEVELOPMENT
83	Idaho Trout Process	0.02	IN DEVELOPMENT

84	Fish Breeders Proces	0	IN DEVELOPMENT
85	SEAPAC Processing	0	IN DEVELOPMENT
86	Rainbow Processing	0.02	IN DEVELOPMENT
87	Clear Springs Proces	0.05	IN DEVELOPMENT
88	Canyon Trout Proces	0	IN DEVELOPMENT
89 +	Unpermitted Facilities	?	NOT CONSIDERED IN TMDL

It is uncertain how many unpermitted facilities (< 20,000 lbs annual production) exist in the Upper Snake Rock subbasin, but estimates from a number of state agency sources suggest about 50 more may exist. These facilities are currently outside the provisions of the Mid-Snake TMDL since they are unpermitted through the NPDES permitting process. However, USEPA has the option at any time to designate them as a "significant contributor of pollution" when taking into account the location and quality of the receiving water, the capabilities of the facility, the quantity and nature of the pollutants discharged, and other relevant factors, such as TMDL determinations for watersheds and Clean Water Act 401 certified stipulations by the State of Idaho (40 CFS 122.24).

MUNICIPALITES

Estimates of baseline conditions based on Mid-Snake TMDL values:

		Baseline TP, lbs/day	Target TP, lbs/day
City of Hansen	[pp 62-63 of Mid-Snake TMDL]	5.1	3.3
City of Filer	[pp 62-63 of Mid-Snake TMDL]	24.9	16.4
City of Hagerman	[pp 62-63 of Mid-Snake TMDL]	8.6	5.7
City of Jerome	[pp 62-63 of Mid-Snake TMDL]	310.1	204.7
City of Buhl .	[pp 62-63 of Mid-Snake TMDL]	26.3	17.4
City of Twin Falls	[pp 62-63 of Mid-Snake TMDL]	1071.2	707.0

ASSUMPTIONS ESTABLISHED FOR ALLOCATION OF TP LOADINGS

ASSUMPTION 1: Where no data exists to estimate baseline conditions,

	TP, mg/L	
Unaccounted Surface Waterbodies	0.245	Overall Mean
Irrigation Return Flows	0.165	North Side
Irrigation Return Flows	0.298	South Side
Named Tributaries	0.117	North Side
Named Tributaries	0.156	South Side
Middle Snake River	0.113	Overall Mean
Aquaculture Facilities	Flow Predictive Value	
Springfed tributaries	0.020	Overall Mean

ASSUMPTION 2: Stream discharge is constant

XIV. TOTAL PHOSHPORUS TMDL CALCULATIONS

SEGMENT 1: MILNER DAM TO PILLAR FALLS

	Q cfs	TP mg/L	1990-1991 Load lbs/day	LC 0.1 mg/L Load lbs/day	% Reduction	% R by Group
Point Sources (A):						
Hansen POTW			5.1	3.3		
Total Load			5.1	3.3	35.3	35.3
Spring Sources (B): ***SPRING SOURCES IN GENERAL MEET LC & DON'T REDUCE***						
Vinyard Creek	13.4	***0.020***	1.4	1.4	0.0	
Devil's Corral Spring	42.2	***0.020***	4.6	4.6	0.0	
Unaccounted Springs	510.4	***0.020***	55.0	55.0	0.0	
Total Load			61.0	61.0		0.0
Surface Waterbodies (C):						
Dry Creek (main stem)	10.0	***0.156***	8.4	5.4	35.9	
A Drain	8.8	0.234	11.1	4.7	57.3	
A-10 Drain	4.8	0.153	4.0	2.6	34.6	
C 55 Drain	7.4	0.139	5.5	4.0	28.1	
Twin Falls Coulee	8.7	0.246	11.5	4.7	59.3	
Unaccounted Surface	271.2	***0.245***	358.1	146.2	59.2	
Total Load			398.7	167.6		58.0
Segment 1 (D):						
MD to PF	877.0	***0.113***	534.2	472.7	11.5	
Total Load	877.0		534.2	472.7	11.5	11.5
OVERALL TOTAL LOAD			998.9	704.6		29.5

XIV. TOTAL PHOSHPORUS TMDL CALCULATIONS

SEGMENT 2: PILLAR FALLS TO CRYSTAL SPRINGS

	Q cfs	TP mg/L	1990-1991 Load lbs/day	LC 0.1 mg/L Load lbs/day	% Reduction	% R by Group
Point Sources (A):						
Canyon Springs FH			9.5	5.7	40.0	
Blue Lakes Processing FH	IN DEVELOPMENT					
Blue Lakes FH			90.1	54.1	40.0	
Pristine Springs FH (+WW)			38.0	22.8	40.0	
City of Twin Falls POTW			1071.2	707.0	34.0	
Crystal Springs FH			122.7	73.6	40.0	
Total Load			1331.5	863.2		35.2
Spring Sources (B): ***SPRING SOURCES IN GENERAL MEET LC & DON'T REDUCE***						
Ellison Springs	1.25	***0.020***	0.1	0.1	0.0	
Crystal Springs Lake	50	***0.020***	5.4	5.4	0.0	
Unseen Underground Seeps	129.2	***0.020***	13.9	13.9	0.0	
Unaccounted Springs	149.9	***0.020***	16.2	16.2	0.0	
Total Load			35.6	35.6		0.0
Surface Waterbodies (C):						
East Perrine Coulee	29.27	0.199	31.4	15.8	49.7	
Main Perrine Coulee	10.95	0.198	11.7	5.9	49.5	
West Perrine Coulee	2.53	0.309	4.2	1.4	67.6	
43 Drain	0.32	0.257	0.4	0.2	61.1	
Warm Creek (spring fed)	21.67	0.060	7.0	2.3	66.7	
Jerome Golf Course Drain	7.78	***0.165***	6.9	4.2	39.4	
Rock Creek	219.91	0.156	184.9	118.5	35.9	
30 Drain	6.1	0.491	16.1	3.3	79.6	
LQ/LS Drain	30.32	0.306	50.0	16.3	67.3	
LS2/39A Drain	5.28	0.342	9.7	2.8	70.8	
N42 Drain	8.84	0.113	5.4	4.8	11.5	
N42 Drain (Rim)	10.14	0.151	8.3	5.5	33.8	
39 Drain	4.77	0.757	19.5	2.6	86.8	
Unaccounted Surface	79.7	***0.245***	105.2	43.0	59.2	
Total Load			460.8	226.5		50.8
Segment 1 (D):						
PF to CS	773.0	***0.113***	470.8	416.6	11.5	
Total Load			470.8	416.6		11.5
OVERALL TOTAL LOAD			2298.7	1542.0		32.9

XIV. TOTAL PHOSHPORUS TMDL CALCULATIONS

SEGMENT 3: CRYSTAL SPRINGS TO BOX CANYON

	Q cfs	TP mg/L	1990-1991 Load lbs/day	LC 0.1 mg/L Load lbs/day	% Reduction	% R by Group
Point Sources (A):						
Magic Valley FH			43.7	26.2	40.0	
Rim View FH			81.0	48.6	40.0	
IPC/Niagara Springs FH			33.0	19.8	40.0	
Gary Wright FH			3.3	2.0	39.4	
Catfish/FBI FH			10.7	6.4	40.2	
Kaster Trout FH			29.3	17.6	39.9	
Box Canyon FH			177.4	106.5	40.0	
Briggs Creek FH			13.6	8.2	39.7	
Total Load			392.0	235.3		40.0
Spring Sources (B): ***SPRING SOURCES IN GENERAL MEET LC & DON'T REDUCE***						
Unseen Underground Seeps	110.8	***0.020***	11.9	11.9	0.0	
Niagara Springs	30.4	***0.020***	3.3	3.3	0.0	
Clear Lakes Springs	52.31	***0.020***	5.6	5.6	0.0	
Snake River FH			59.4	35.7	39.9	
Clear Springs Proces	IN DEVELOPMENT					
Middle FH			108.7	65.2	40.0	
Clear Lakes Trout FH			96.3	57.8	40.0	
Banbury Springs	120.67	***0.020***	13.0	13.0	0.0	
Briggs Creek Springs	83.35	***0.020***	9.0	9.0	0.0	
Box Canyon Springs	64.97	***0.020***	7.0	7.0	0.0	
Unaccounted Springs	185.1	***0.020***	20.0	20.0	0.0	
Total Load			334.2	228.5		31.6
Surface Waterbodies (C):						
Cedar Draw	115.19	0.193	119.8	62.1	48.2	
Mud Creek	97.26	0.180	94.4	52.4	44.4	
Deep Creek	95.89	0.152	78.6	51.7	34.2	
Blind Canyon Creek	43.5	0.156	36.6	23.4	35.9	
I Drain	11.42	0.208	12.8	6.2	51.9	
J8 Drain	9.03	0.131	6.4	4.9	23.7	
N Drain	4.36	0.115	2.7	2.4	13.0	
S29 Drain	2.64	0.165	2.3	1.4	39.4	
S19/S Drain	52.99	0.244	69.7	28.6	59.0	
Unaccounted Surface	98.3	***0.245***	129.8	53.0	59.2	
Total Load			553.1	286.0		48.3
Segment 1 (D):						
CS to BC	1742.0	***0.113***	1061.0	938.9	11.5	
Total Load			1061.0	938.9		11.5
OVERALL TOTAL LOAD			2340.3	1688.7		27.8

XIV. TOTAL PHOSHPORUS TMDL CALCULATIONS

SEGMENT 4: BOX CANYON TO GRIDLEY BRIDGE

	Q cfs	TP mg/L	1990-1991 Load lbs/day	LC 0.1 mg/L Load lbs/day	% Reduction	% R by Group
Point Sources (A):						
Blind Canyon Aqua FH			15.6	9.4	39.7	
Pisces Magic Springs FH			72.3	43.4	40.0	
Total Load			87.9	52.8		39.9
Spring Sources (B): ***SPRING SOURCES IN GENERAL MEET LC & DON'T REDUCE***						
Unseen Underground Springs	72.0	***0.020***	7.8	7.8	0.0	
Thousand Springs	1272.0	***0.020***	137.1	137.1	0.0	
Riley Creek	66.8	0.050	18.0	7.2	60.0	
Sand Springs Creek	91.7	***0.020***	9.9	9.9	0.0	
Unaccounted Springs	72.6	***0.020***	7.8	7.8	0.0	
Total Load			180.6	169.8		6.0
Surface Waterbodies (C):						
Salmon Falls Creek	149.4	0.101	81.3	80.5	1.0	
W26 Drain	18.16	0.142	13.9	9.8	29.6	
Unaccounted Surface	38.6	***0.245***	51.0	20.8	59.2	
Total Load			146.2	111.1		24.0
Segment 1 (D):						
BC to GB	1705.5	***0.113***	1038.8	919.3	11.5	
Total Load			1038.8	919.3		11.5
OVERALL TOTAL LOAD			1453.5	1253.0		13.8

XIV. TOTAL PHOSHPORUS TMDL CALCULATIONS

SEGMENT 5: GRIDLEY BRIDGE TO SHOESTRING BRIDGE

	Q cfs	TP mg/L	1990-1991 Load lbs/day	LC 0.1 mg/L Load lbs/day	% Reduction	% R by Group
Point Sources (A):						
Buckeye FH			12.2	7.3	40.2	
Barret FH			6.0	3.6	40.0	
White Springs FH			18.7	11.2	40.1	
Mike Flemming FH			3.4	2.0	41.2	
Smith FH			5.4	3.3	38.9	
Woods FH			7.4	4.4	40.5	
Slane FH			2.5	1.5	40.0	
John Flemming FH			5.4	3.2	40.7	
Stevenson FH			4.8	2.9	39.6	
City of Hagerman POTW			8.6	5.7	33.7	
Henslee FH			5.1	3.0	41.2	
Big Bend FH			2.6	1.6	38.5	
Lemmon FH			2.4	1.4	41.7	
Eckles FH			11.1	6.7	39.6	
Dunn FH			13.7	8.2	40.1	
Total Load			109.3	66.0		39.6
Spring Sources (B): ***SPRING SOURCES IN GENERAL MEET LC & DON'T REDUCE***						
Birch Creek (w/o FH)	1.05	***0.020***	0.1	0.1	0.0	
Birch Creek FH			5.4	3.3	38.9	
CJ Simms FH			3.2	1.9	40.6	
Stoddard Creek (w/o FH)	0.0	***0.020***	0.0	0.0	0.0	
Bell FH			2.3	1.4	39.1	
Standal FH			3.0	1.8	40.0	
White Water FH			6.7	4.0	40.3	
Decker Springs CK (w/o FH)	0.0	***0.020***	0.0	0.0	0.0	
Decker Springs FH			7.4	4.4	40.5	
Unaccounted Springs	163.2	***0.020***	17.6	17.6	0.0	
Total Load			45.7	34.5		24.5
Surface Waterbodies (C):						
Malad River	180.0	0.078	75.7	75.7	0.0	
Malad River Power Flume	1132.0	0.078	475.9	475.9	0.0	
Billingsley Creek*	39.25	0.114	24.1	21.2	12.3	
Rangen's FH/Woods			7.4	4.4	40.5	
Jones FH			26.9	16.1	40.1	
McFadden FH			3.9	2.3	41.0	
Idaho Springs FH			80.6	48.4	40.0	
Hidden Springs FH			9.9	5.9	40.4	
Schrank FH			1.5	0.9	40.0	
Fisheries Development FH			63.3	38.0	40.0	
Boyer FH			6.9	4.2	39.1	
Talbot FH			6.7	4.0	40.3	
Unaccounted Surface	86.7	***0.245***	114.5	46.7	59.2	

Total Load			897.3	743.7		17.1

*Billingsley Creek TP value is average of data collected by IDEQ-TFRO.

Segment 5 (D):

GB to SB	1836.0	***0.113***	1118.3	989.6	11.5	
Total Load			1118.3	989.6		11.5
OVERALL TOTAL LOAD			2170.6	1833.8		15.5

XIV. TOTAL PHOSHPORUS TMDL CALCULATIONS

SEGMENT 6: SHOESTRING BRIDGE TO KING HILL

	Q cfs	TP mg/L	1990-1991 Load lbs/day	LC 0.1 mg/L Load lbs/day	% Reduction	% R by Group
Point Sources (A):						
None			0.0	0.0	0.0	
Total Load			0.0	0.0		0.0
Spring Sources (B): ***SPRING SOURCES IN GENERAL MEET LC & DON'T REDUCE***						
Unaccounted Springs	248.3	***0.020***	26.8	26.8	0.0	
Total Load			26.8	26.8		0.0
Surface Waterbodies (C):						
Clover Creek*	40.75	0.309	67.9	22.0	67.6	
Unaccounted Surface	131.9	***0.245***	174.2	71.1	59.2	
Total Load			242.1	93.1		61.6

*Clover Creek data collected by IDEQ-TFRO: Estimated TP Load in 1990-1991 = 11.8 & 13.0, or 12.4 tons/year, which is the equivalent of 67.9 lbs/day at a concentration of 0.309 mg/L TP.

	Q cfs	TP mg/L	1990-1991 Load lbs/day	LC 0.1 mg/L Load lbs/day	% Reduction	% R by Group
Segment 6 (D):						
SB to KH	421.0	***0.113***	256.4	226.9	11.5	
Total Load			256.4	226.9		11.5
OVERALL TOTAL LOAD			525.2	346.7		34.0

XIV. TOTAL PHOSHPORUS TMDL CALCULATIONS

TP LOADING ANALYSIS SUMMARY FOR THE MIDDLE SNAKE RIVER SYSTEM

Baseline 1990-1991 Estimates, lbs/day

Segment	A	B	C	D	Total
1	5.1	61.0	398.7	534.2	998.9
2	1,331.5	35.6	460.8	470.8	2,298.7
3	392.0	334.2	553.1	1,061.0	2,340.3
4	87.9	180.6	146.2	1,038.8	1,453.5
5	109.3	45.7	897.3	1,118.3	2,170.6
6	0.0	26.8	242.1	256.4	525.2
Total	1,925.8	683.9	2,698.2	4,479.5	9,787.2

Targets for 2004 and 2009, lbs/day

Segment	A	B	C	D	Total
1	3.3	61.0	167.6	472.7	704.6
2	863.2	35.6	226.5	416.6	1,542.0
3	235.3	228.5	286.0	938.9	1,688.7
4	52.8	169.8	111.1	919.3	1,253.0
5	66.0	34.5	743.7	989.6	1,833.8
6	0.0	26.8	93.1	226.9	346.7
Total	1,220.6	556.2	1,628.0	3,964.0	7,368.8
%R	36.6	18.7	39.7	11.5	24.7

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8.0 PUBLIC COMMENT RESPONSES

The official public comment period lasted 30 days from November 3, 1999 through December 3, 1999. Comments provided by the public are summarized in this section with appropriate responses from IDEQ-TFRO. Those who commented are listed in the following table. Comments are divided into two areas: those who commented requiring a reponse from IDEQ-TFRO; those who commanded and conveyed knowledege, sentiments, or feelings that IDEQ-TFRO felt did not require a response; and, those comments which were received after the public comment period. Responses were done as they were received in the IDEQ-TFRO office (by mail or e-mail) on a chronological basis.

NAMED USED AS SOURCE	***LOCATION OF SOURCE***
U of I -1	Dr. Richard G. Allen, Professor, Department of Civil Engineering, University of Idaho Research and Extension Center, Kimberly, Idaho (U of I)
IDEQ-LRO-2	Nicholas Bugosh, IDEQ-LRO, Lewiston, Idaho (IDEQ-LRO)
CSF, Inc.-3	John R. MacMillan, Ph.D., Vice President Research and Environmental Affairs, Clear Springs Foods, Inc., Buhl, Idaho (CSF, Inc)
NSCC-4	Ted Diehl, North Side Canal Company, Jerome, Idaho (NSCC)
IDEQ-TFRO-5	Mike Etcheverry, IDEQ-TFRO, Twin Falls, Idaho (IDEQ-TFRO)
U of I -6	Clarence Robison, PE, Research Associate, University of Idaho, Kimberly Research & Extension Center, Kimberly, Idaho (U of I)
USBOR-7	Jerrold D. Gregg, USDI Bureau of Reclamation, Snake River Area Office, Boise, Idaho (USBOR)
USFS-8	Valdon Hancock, Hydrologist, USDA Forest Service, Sawtooth National Forest, Twin Falls, Idaho (USFS)
IWP-9	Jon Marvel, President, Idaho Watersheds Project, Hailey, Idaho (IWP)
IDL-10	Howard K. Kestie, Area Supervisor - South Central Idaho, Idaho Department of Lands, Gooding, Idaho (IDL)
USBLM-11	Theresa M. Hanley, Field Office Manager, USDI Bureau of Land Management, Upper Snake River District, Burley, Idaho (USBLM)
U of I -12	Gary Fornshell, University of Idaho Cooperative Extension System, Twin Falls County Office, Twin Falls, Idaho (U of I)
IDEQ-TFRO-13	Rob Sharpnack, IDEQ-TFRO, Twin Falls, Idaho (IDEQ-TFRO)
Technical Edit-14	Ruth Watkins, c/o Shelly Gilmore, Resource Planning Unlimited, Moscow, Idaho (Techical Edit)
IDEQ-State-15	Gary Daily, IDEQ-State Office, Boise, Idaho (IDEQ-State)
PUBLIC COMMENTS RECEIVED AFTER THE CLOSE OF THE PUBLIC COMMENT PERIOD	

IDFG-16	Idaho Fish and Game, Magic Valley Region, Jerome, Idaho: received draft comments by e-mail on December 9, 1999.
USEPA-17	U.S. Environmental Protection Agency, Idaho Operations Office, Boise, Idaho: Received comments by e-mail on December 10, 1999.
USBLM-11	USDI Bureau of Land Management, Upper Snake River District, Burley, Idaho: Discussion comment of December 16, 1999.
Prepared by IDEQ-TFRO.	

A. Public Comments that require a response from IDEQ-TFRO and received before December 3, 1999.

SOURCE	QUESTION / RESPONSE
U of I -1A	*QUESTION*: P.164, line 39, I believe the "99.43" value should be 0.57. In other words, it should read "it was demonstrated that 0.57% of the samples collected (5 out of N = 884) exceeded the protective level..." The latter part of this phrase needs a little work also.
	REPONSE: IDEQ-TFRO respectfully submits that based on your comments and the comments from our technical editor, we have changed the sentence to read: "In § 2.2.4.1 (2) of the subbasin assessment, it was demonstrated that of 884 samples collected, only 5 samples (or 0.6%) exceeded the protective level (based on State water quality standards) for fisheries."
U of I -1B	*QUESTION*: P.164, lines 31-35. I have difficulty in following the wording/terminology. As worded, for example: "(1) if the percent unionized ammonia of the total number of samples was zero," this phrase when read literally, indicates that you are talking about percent ammonia (i.e., concentration or mass fraction) in the samples. I believe that less confusing wording for this same phase might be: "(1) if the percent total samples that exceeded 0.02 mg/L was zero." In the same way, the two subsequent expressions can be modified so that lines 31-35 read: "(1) if the percent total samples that exceeded 0.02 mg/L was zero," then this was reported as No Exceedences Found, (2) if the percent total samples that exceeded 0.02 was <10.0, then this was reported as Minor Exceedences Found; and (3) if the percent total samples that exceeded 0.02 mg/L was 10.0 or more, then this was reported as Major Exceedences Found." Not that I also included an item "(3)." Including the 0.02 mg/L benchmark in the paragraph helps to define more clearly what the decision parameter was indetermining exceedences.
	REPONSE: IDEQ-TFRO respectfully agrees and has made appropriate changes to reflect your comments. The corrected phrases now read: In terms of assessing un-ionized NH3, IDEQ-TFRO used the total number of samples collected and categorized un-ionized ammonia as follows: (1) if the percent un-ionized ammonia of the total number of samples was zero, this was reported as *No Exceedences Found*; (2) if the percent un-ionized ammonia of the total number of samples was < 10.0, this was reported as *Minor Exceedences Found*; and, (3) if the percent un-ionized ammonia of the total number of samples was 10.0 or more, this was reported as *Major Exceedences Found*. Only stream segments with *Major Exceedences Found* will be considered for a TMDL. Precedence for this assessment approach is in *Guidelines for Preparation of the 1996 State Water Quality Assessments (305(b))* (USEPA 1995d).
IDEQ-LRO-2A	*QUESTION*: P.158-I am lost. Paragraph 3 (line 34), says there is a 71.9% TSS reduction, but the table shows existing TSS is less than the target and load capacity. How can there be a reduction? The existing value is 28.1% of the target; can this be a math mix up?

	REPONSE: IDEQ-TFRO respectfully agrees with your assessment. The existing condition is really the average conditions in the Middle Snake River based on 1990-1998 compiled data as described in Appendix D, Technical Support Document, §2. We have modified the title accordingly. We have also added a table of % reductions (or % less sediment) to better describe the conditions in the river on a per site basis. The comparison is meant to describe the average condition versus the load capacity. In general, the Middle Snake River has less sediment load under average conditions for low, mean, and high flow conditions, which implies that management schemes should be based on the low flow condition because of the greater probability that beneficial uses will be attained under all flow conditions. The table also indicates that the high flow scenario (when comparing the overall range) will require additional measures from land use managers in the application of site specific (or segment specific) measures to retard the effects from sediment. The comparison is between average conditions in the river and the load capacity target of 52 mg/L.
IDEQ-LRO-2B	*QUESTION*: P.158-Paragraph 3 (line 42), "...creating turbidity in the clarity of the water." Suggestion: delete the clarity of.
	REPONSE: IDEQ-TFRO respectuflly agrees and has made the appropriate change to reflect the proposed suggestion.
IDEQ-LRO-2C	*QUESTION*: P. 158-Paragraph 3 (line 42), The reductions in TSS inputs to below 52 mg/L are instream values; how can they lead to significant reductions in the instream TSS concentration? If it is 51 mg/L, it is 51 mg/L, period.
	REPONSE: IDEQ-TFRO respectfully agrees and the sentence has been modified.
IDEQ-LRO-2D	*QUESTION*: P. 158-Paragraph 3 (line 44), "...washload in the substrate." By definition washload is transported out of the system and does not appear in the pan (at the bottom of the seive stack), i.e. it was washed away. Suggestion: Specify the particle size you are talking about, e.g., less than 2 mm, etc.
	REPONSE: IDEQ-TFRO respectfully agrees and made the appropriate change to reflect the proposed suggestion. As defined in the Technical Support Document under definitions, washload represents those particles that are < 0.062 mm in diameter.
IDEQ-LRO-2E	*QUESTION*: I noticed typos, grammatical problems (e.g., number and agreement - _riteria is._ etc.) in several places. You might find the Grammatik feature on Word Perfect (set for technical papers) useful for catching these.
	REPONSE: We have used the services of a technical editor to resolve this and other grammatical and punctuation problems. Changes have been appropriately made in the document to reflect these changes.
IDEQ-LRO-2F	*QUESTION*: P.185, line 13-The daily maximum value of 80 mg/L TSS to account for seasonality spikes is not consistent with EPA's Benchmark Values for stormwater discharges that recognize 100 mg/L as an acceptable nationwide value for TSS in stormwater discharges. Site-specific stormwater values for erodible fine textured soils in semi-arid areas with short-duration, high-intensity storms can be in the 500 to 50,000 mg/L range. Suggestion: Revise the daily maximum value to account for seasonality, i.e., peak flow, storms, upward.

	REPONSE: The 52 mg/L instream target is a IDEQ-TFRO interpretation of the narrative standard for excess sediment and is an average monthly limit (AML) value. In order to provide uniformity in expressing average monthly values, USEPA has a system that converts an AML to a MDL. That system is found in the Technical Support Document for Water Quality-based Toxics Control (USEPA 1991) and considers monthly averages as appropriate time frames for target organism protection. The statistically based method for pollutant limit derivation results in an MDL that does not depend on the monitoring frequency. However, the AML decreases as the monitoring frequency increases. Therefore, since TSS is greatly influenced by seasonality (it is greatest during the irrigation season), IDEQ-TFRO chose an n=8 as the number of months of concern (March through October) with a 30% TSS coefficient of variation that reflected the irrigation season for the Upper Snake Rock subbasin. The statistic that was interpolated as a multiplier for the AML is 1.60. This value defines the average at the 95th percentile and the maximum at the 99th percentile. Thus, 52 mg/L x 1.60 = 83 mg/L TSS for a MDL and is an average value as well. However, as described in the Appendix D (Technical Support Document) 80 mg/L is preferred instead of 83 mg/L because 80 mg/L is the upper boundar for moderate protection of the fisheries. 83 mg/L is in the lower level of "signficantly reduced fisheries" level and would provide a low protection level. Thus, a benchmark level of 100 mg/L would be significantly higher in the low protection level that what should be allowed for beneficial use protection. IDEQ-TFRO feels that the 52 mg/L TSS AML and the 80 mg/L TSS MDL are stringent and account for seasonality as an AML and a MDL. For the Middle Snake River this shouldn't be problematic since the AML is well below 52 mg/L. But certain tributaries will need some substantial TSS reductions in order to meet the AML because their MDL is well above 80 mg/L. These same tributaries are recognized by the community of water users as needing the most work with appropriate land management practices because current practices are unsound or insufficient to allow for appropriate seasonal spikes that come as a result of short-duration, high-intensity storms. The Upper Snake Rock subbasin has about 82% of the water quality limited streams (or segments of the streams) with slopes that are < 10%. For fine textured soils in semi-arid areas this is not considered highly erodible, which implies that best management practices can be applied effectively for retarding sediment erosion. Slopes >10% may require additional measures. Thus, any stream that has a characteristic sediment loss > 83 mg/L with a slope of < 10% has insufficient land management mechanisms in place for retarding the sediment.
IDEQ-LRO-2G	*QUESTION*: P.188, line 39-The antidegradation reference is to the Tier 1 level of protection. Are you sure this is the correct level? Most streams are Tier 2, that is, the water quality on 28 November 1975 was greater than the level needed to achieve the standard.
	REPONSE: The antidegradation reference is found in Idaho's State water quality standards, IDAPA 16.01.02.051(01) which USEPA has interpreted as acceptable. We are not trying to protect for a Tier 1 level as defined by USEPA. We are protecting for antidegradation as defined in the State regulations as "the existing instream water uses and the level of water quality necessary to protect the existing uses." We do not want degradation to exceed 52 mg/L as an average monthly limit or 80 mg/L as a maximum daily limit.
CSF, Inc.-3A	*QUESTION*: P. 152, line 2-3. The draft TMDL proposes that the Clear Springs "Creek" headwaters should be considered natural background for Clear Lake. Natural background has a specific connotation and purpose in Idaho State Water Quality Standards (IDAPA 16.01.02.070.06). We do not believe that the intent of the statement in the draft final TMDL is to suggest the headwaters represent Clear Lake's physical or biological natural background conditions. However, if the intent is indeed to suggest the headwaters represent natural background conditions for the lake then we are strongly opposed to this suggestion. It is inappropriate to use a spring condition as a standard for a lake condition. Biological conditions vary considerably between the relatively slower flowing, deeper waters of Clear Lake. The headwaters may indeed represent much of the natural chemical background condition, but they cannot represent the entire ecosystem natural condition and should not be referred to as natural background without clarification.

	REPONSE: As referenced in IDAPA 16.01.02.070.06, natural background means any physical, chemical, biological, or radiological condition existing in a water body before any human-caused influence on, discharge to, or addition of material to, the water body. Also, in IDAPA 16.01.02.003.07, background is the biological, chemical or physical condition of waters measured at a point immediately upstream (up-gradient) of the influence of an individual point or nonpoint source discharge. The key word in these definitions is the word "or," which when used in logic sentential connectives implies a truth when at least one of its constituents is true. Unlike the word "and" which implies a truth only when all of its constituents are true. Based on both these legal definitions, the use of "natural background" on p.152, lines 2-3, is correct as used, because the intent was not to suggest that the headwaters represent Clear Lake's physical or biological conditions nor the entire ecoystem condition of Clear Lake. Rather, it was to emphasize the chemical condition of the water body. That is why immediately after the use of the term "natural background," reference is made to inspection reports and NPDES discharge monitoring reports that had TSS information that got at the "natural background" conditon for TSS. Even though our intent was not to describe the "natural background of the ecosystem," and even though the use of the term "natural background" is legally correct, we have opted to clarify the sentence more fully by saying: This ... may be considered natural background of certain water quality parameters for Clear Springs "Creek" and Clear Springs Lake.
CSF, Inc.-3B	*QUESTION*: P.153, line 16. Crystal Springs "Creek."
	REPONSE: A similar action as in Response 3A has been done on p.153, line 16 for Crystal Springs "Creek" so that it says: This ... may be considered natural background of certain water quality parameters for Crystal Springs "Creek" and Crystal Springs Lake.
CSF, Inc.-3C	*QUESTION*: P.152, line 31. It is stated that aquaculture effluent is one of the several causes of sediment accrual in Clear Lake. We believe this should be clarified to emphasize historic aquaculture practices. With technologies currently in place and the TSS limitations established by NPDES permit, today's aquaculture practices are not likely to contribute to sediment accrual in Clear Lake. Indeed, a lake remediation program has begun to eliminate historic sediments.
	REPONSE: We have opted to make the suggested change to "historic aquaculture practices" in lieu of "historic aquaculture effluent" so as to stay in conformity with "historic grazing and mining practices. You are correct in the assessment that if the NPDES permit effluent limits for TSS are maintained, we should see minimal sediment contribution from aquaculture facilities to Clear Lake or to any water body in the subbasin.
CSF, Inc.-3D	*QUESTION*: P.153, line 42. The draft TMDL states that Crystal Lake is "enhanced" by modification with an aquaculture facility. We disagree. While Crystal Lake is influenced by an aquaculture facility, Crystal Lake was enhanced by human factors of lake enlargement and deepening that occurred at least 30-40 years ago.
	REPONSE: We contacted IDWR-Twin Falls, USGS-Twin Falls & Boise, and ACOE-Walla Walla and none could substantiate or deny the claim that Crystal Lake was an enhanced lake due to man's intervention for hatchery development. However, the human factors of lake enlargement and lake deepeing probably had a greater effect on enhancement than the aquaculture facility itself. Therefore, the sentence was modified to say: Crystal Lake, like Clear Lake, is an enhanced lake due to man's intervention for lake enlargement and lake deepening some 30-40 years ago, and is influenced today by an aquaculture facility.
CSF, Inc.-3E	*QUESTION*: P.153, line 43. It is stated that no fish kills have been observed "since" 1940. Fish kills have never been observed in Crystal Lake.

	REPONSE: The statement "since 1940" was provided by IDWR-Twin Falls based on photographs and institutional knowledge they had of the activities known on Crystal Lake "since 1940." The statement as it is written is correct, but the probability that someone could infer that fish kills were present "before 1940" is equally incorrect and potentially damaging and libelous. To state that "fish kills have never been observed in Crystal Lake" is in general a truthful statement, but the possibility that someone could infer that "there have never been fish kills in Crystal Lake," whether they have been observed or not, is equally incorrect but not necessarily potentially damaging or libelous. IDFG-Jerome agrees that in all probability there have never been fish kills in Crystal Lake. We have concluded that the sentence will be modified to say: No fish kills have been observed in Crystal Lake indicating a low probability of un-ionized ammonia problems.
CSF, Inc.-3F	*QUESTION*: We provide evidence that the un-ionized ammonia calculations used on Page 165 are in error and in fact the concentration of un-ionized ammonia actually present is at least ten times less [*then*] that identified in the proposed final TMDL draft.
	REPONSE: The sentence concludes that fish kills have not been observed ("since 1940") "indicating a low probability of un-ionized ammonia problems." This latter portion of the sentence is correct as it stands and will not be modified. However, the issue of un-ionized ammonia calculations being in error is discussed and summarized in Response 3N.
CSF, Inc.-3G	*QUESTION*: P.157, line 33. IDEQ has selected 52 mg/L TSS as an instream target for TSS as the means of controlling sediment. No sediment target has been identified and we do not see the need to do so. We support the approach proposed by IDEQ but highlight the iterative nature of this and other TMDLs in this area.
	REPONSE: IDEQ-TFRO went beyond the research done by its Sediment Committee and looked at managed waterways and the resonable and practical method for getting at sediment reductions. Since sediment is a narrative standard in Idaho's regulations, IDEQ-TFRO elected to use an instream target (as a concentration) to get at the beneficial uses and/or State water quality standards. Substrate targets are inappropriate for reasons cited in §3.1.1. Any target for the Middle Snake River and its tributaries would be at this time unscientifically sound and not legally defendable. The concentration target of 52 mg/L can be defended both legally and scientifically because the data collected is based on the water column concentration as suspended sediments (total suspended solids).
CSF, Inc.-3H	*QUESTION*: Part of P.157, line 33: For many of the pollutants for which TMDLs are being developed, there are no state or federal standards. Additionally, many of the pollutants can only be addressed on a site-specific basis. Considerably more data is needed before site-specific criteria or standards can be determined.
	REPONSE: The reason why many of the pollutants for which TMDLs are being developed have no state or federal standards is because it is necessary and desirable to accommodate the vast range of conditions which occur in nature. Although it is true that site-specific standards are encouraged, the Middle Snake River and its tributaries are not ready to define these standards for at least 10 years. Much more information and research needs to be do to specifically define the narrative condition for the Middle Snake River, on a segment-by-segment or reach-by-reach basis. The same holds true for its tributaries.
CSF, Inc.-3I	*QUESTION*: Part of P.157, line 33: Additionally, the over-arching impact of water velocity must be addressed before additional stringency can reasonably be instituted.
	REPONSE: We are currently looking at water velocity, and as you can tell from the subbasin assessment and the TMDL, water velocity is considered a stressor to the system. We certainly have not nor do we intend to ignore it. The issue is one of linkage to beneficial uses, and we feel that this issue has been made in the document.

CSF, Inc.-3J	*QUESTION*: Part of P.157, line 33: We do not believe that even if a sediment target were selected, management efforts to control TSS or sediment would change.
	REPONSE: IDEQ-TFRO is not opposed to substrate sediment targets on the Middle Snake River or its tributaries. However, we don't feel that scientifically or legally we could defend them with the current database that is available to us from various agencies, organizations, or industries. If substrate sediment targets were selected, then management actions would need to be changed to accommodate for those targets particularly in establishing a linkage to the instream standard as it is affected by water flow and water velocity. Without consideration of these two stressors, we are no where near to getting at substrate sediment targets.
CSF, Inc.-3K	*QUESTION*: P.158, line 11. It is stated that TSS proliferates. We question whether TSS can proliferate although we can observe TSS concentration increase.
	REPONSE: The word "proliferate" is a biological term that implies growth by rapid production of new parts, cells, buds, or offspring. An archaic definition describes the term as something that causes abundant growth, generation, or reproduction. In more recent years the term has been used as an adjective for abundant inventiveness or productivity even though biological growth was not involved. The term is used in reference to substantial growth in TSS load as flow increases, thus leading to the use of the term proliferate. The sentence states, "TSS appears to proliferate," which we feel is correct in the way it is used. Our technical editor agrees. However, we will make the change to say that TSS "increases," but the word "appears" will be excluded because TSS no longer appears to increase when in fact it mathematically does. Therefore, the sentence will read: TSS increases substantially.
CSF, Inc.-3L	*QUESTION*: P.159, line 2. Again, how can TSS proliferate? We suggest TSS concentrations can increase but no proliferate.
	REPONSE: The sentence states, "...due to apparent TSS proliferation." Again, and as described previously in Response 3K, the word "proliferate" is used correctly because of the "apparent" nature of TSS under high flow conditions. Our technical editor agrees. However, we will make the change to say that TSS "increases," but the word "apparent" will be excluded because TSS no longer appears to increase when in fact it mathematically does. Therefore, the sentence will read: "...due to substantial TSS increase."
CSF, Inc.-3M	*QUESTION*: P.159, [*Substrate Sediments*]. TSS is suggested as an appropriate surrogate for sediment. We support TSS concentration as an appropriate surrogate. However, as in all TMDLs where little practical experience exists to support a particular concentration or loading, an appropriate monitoring plan and periodic ecosystem evaluation becomes essential.
	REPONSE: IDEQ-TFRO strongly believes that in the Middle Snake River system, and particularly under the current flow management scenario of the system, a TSS concentration is an appropriate surrogate for substrate sediments, particularly as a result of extensive research by IDEQ-TFRO staff in this area. However, your comments provide some additional insights that we have incorporated into the document which are reflected in the last paragraph of the Substrate Sediments subsection. These comments include: "...because IDEQ-TFRO strongly believes that suspended sediment (as TSS) is an appropriate surrogate for substrate sediment reduction"; and, "In the meantime, monitoring of the Middle Snake River will continue to be a priority of IDEQ-TFRO over the next 10 years of plan implementation, as well as the development and incorporation of a trend monitoring plan which has been developed by the Mid-Snake TAC for periodic ecosystem evaluation as it relates to the TMDL."
CSF, Inc.-3N	*QUESTION*: P.170, Nitrogen. The narrative and table starting on line 36 suggests 22-100% of the monitored aquaculture discharges exceeded a 0.02 mg/L un-ionized ammonia concentration. These data are based on the Brockway and Robison 1992 Phase 1 Study. We believe the calculations used to determine the concentration of un-ionized ammonia are in error.

	REPONSE: IDEQ-TFRO conducted an extensive review of ten un-ionized ammonia calculators that are available to the general public from various internet sites that are linked to reputable universities, agencies, and organizations. We have also received the actual algorithm that is used in the various internet calculators and have reviewed their stoichiometric mathematical relationship for un-ionized ammonia. Our review indicates that prior to December 9, 1999, two general categories (or two distinct algorithms) of un-ionized ammonia calculators existed on the internet. However, they were not equivalent in their calculation method for the un-ionized ammonia species (which is based on a relative percentage that equates the stoichiometric relationship of un-ionized ammonia to total ammonia-N as influence by pH and temperature). IDEQ-TFRO used one of these algorithms initially in its determination of un-ionized ammonia in the TMDL and incorrectly assumed that the results were equivalent to the State's water quality standards algorithm. We have also determined that the algorithm used in the standards equated to one of the internet algorithms but not to the other. IDEQ-TFRO made each of the sources aware of the discrepancy and during public comment one of the sources modified their algorithm to equate to the others, such that the internet algorithms are now equivalent and similar to the State's algorithm. Therefore, the Technical Support Document and all calculations previously conducted for the determination of un-ionized ammonia will be modified to reflect the correct value.
CSF, Inc.-3O	*QUESTION*: Reference to State Water Quality Standards (IDAPA 16.01.02) specifically for cold-water biota one hour and four day average un-ionized criteria (250.02.e.iii) indicates that total ammonia concentrations in the range of 2-20 mg/L (one hour) or 1-2 mg/L (4 day) at the temperatures and pH encountered in cold water aquaculture facilities (Brockway and Robison 1992), would be required if the state un-ionized ammonia standards were to be exceeded. The Technical Support Document (TSD; pp. 121-131) describing water quality for fish farms does not present any total ammonia concentrations likely to exceed the State criteria for un-ionized ammonia under a variety of temperature and pH conditions. While the state standards and calculations must apply in this [*T*]MDL, we also examined other sources to calculate un-ionized ammonia concentrations.
	REPONSE: IDEQ-TFRO has determined that the State's algorithm is similar to the algorithms that are found in various calculators on the internet. Under the TMDL, the default for standards is what is found in the State regulations. Since both the internet calculators and the State regulations are equivalent (with the exception of minor rounding errors found when using 3 or more decimal values), the calculation for un-ionized ammonia are the same. See Response 3N for additional information.
CSF, Inc.-3P	*QUESTION*: Reference to the 20th Edition of Standard Methods for the Examination of Water and Wastewater also does not support un-ionized ammonia concentrations as high as identified in the draft TMDL which were based on the total ammonia nitrogen concentrations reported in the TSD. Actual concentrations of un-ionized ammonia are at least ten times less than presented in the TSD. Additionally, published calculations of aqueous ammonia equilibria as impacted by temperature and pH do not support the 1992 Brockway and Robison estimates of un-ionized ammonia. Our re-calculations based on the TSD total ammonia, pH and temperature indicate, with rare exception, that none of the trout farm hatchery effluents exceeded the state standard or a 0.02 mg/L un-ionized ammonia standard. This is also in agreement with more practical observations at fish farms. Un-ionized ammonia concentrations identified in the TSD would not be comatible with rainbow trout survival.
	REPONSE: IDEQ-TFRO used Standard Methods (20th Edition) as one of the referee sources for comparison of un-ionized ammonia determinations from various internet sites and research sources. See Response 3N for additional information. When an algorithm that relates total ammonia-N to pH and temperature for determination of the un-ionized ammonia concentration (mg/L) is unavailable, one can use a table that accounts for the fraction of un-ionized ammonia in aqueous solutions at variable pH's and temperatures (such as Emerson *et al.* 1975) or a table that accounts for the percentage of ammonia un-ionized in distilled water (such as Sillen & Martell 1964) as is used in Standard Methods. Both type of tables will arrive at the same un-ionized ammonia concentration provided in one you don't divide by 100 and in the other you do. The State's algorithm for un-ionized ammonia equates to the table in Standard Methods as well as to the various internet sites that have un-ionized ammonia calculators.

NSCC-4A	*QUESTION*: P.188, line 29 - We feel the Antidegradation TMDL for this reach of the river should be eliminated. The uncertainties (especially flow augmentation or flow shaping) associated with an Antidegradation TMDL are too great at this time to warrant the risk. If the standards assigned to the reach of the river below Pillar Falls are applied to the reach above Pillar Falls, the upper reach will still exceed TMDL standards.
	REPONSE: IDEQ-TFRO submits respectfully that our statutory authority for antidegradation is embodied in IDAPA 16.01.02.051(01) as required under the federal Clean Water Act. The State of Idaho has provided a fairly flexible approach for antidegradation protection assuming beneficial uses are protected and IDEQ-TFRO submits respectfully that it has provided a fairly flexible approach for meeting antidegradation concerns. We have also met with USBOR and explored more flexible language that allows them the opportunity to operate under those conditions that fit our administrative policy under IDAPA 16.01.02.050.01, such that "the adoption of water quality standards and the enforcement of such standards is not intended to conflict with the apportionment of water to the state through any of the interstate compacts or court decrees, or to interfere with the rights of Idaho appropriators, either now or in the future, in the utilization of the water appropriations which have been granted to them under the statutory procedure, or to interfere with water quality criteria established by mutual agreement of the participants in interstate water pollution control enforcement procedures." Yet, "wherever attainable, surface waters of the state shall be protected for beneficial uses which for surface waters includes all recreational use in and on the water surface and the preservation and propagation of desirable species of aquatic biota" (IDAPA 16.01.02.050.02.a). Therefore, IDEQ-TFRO has modified pp.188-189 to reflect this flexibility as well as describe in greater detail certain exemptions that might be covered as Acts of God and/or uncontrollable flood events (as a result of structure failure, environmental terrorism, etc.) and/or drought conditions.
NSCC-4B	*QUESTION*: P.189, line 4 - The sever[e] language in this sentence ("Degradation of the water quality beyond these conditions shall not occur but shall be maintained at or below these prescribed levels through Year 10 of plan implementation.") leaves many diverse avenues of an interpretation, many which are probably not intended, but intent may not be the deciding factor 8 or 10 years into the TMDL. We offer this as another reason for the elimination of the Antidegradation Policy.
	REPONSE: IDEQ-TFRO submits respectfully that it has answered this in Response 4A.
IDEQ-TFRO-5A	*QUESTION*: The Appendix D [*which I have included as an attachment*] comes from the Chicago NP Finance Forum, October 13, 1999, and [*I'm*] suggesting it for inclusion to the reasonable assurances of the Upper Snake Rock TMDL.
	REPONSE: We have modified §3.6.2 of the TMDL to reflect the information provided by the Chicago NP Finance Forum.
U of I -6A	*QUESTION*: A thirty-day comment period is not sufficent for a review and development of comments on these two subbasin assessments and total maximum daily load planning documents [*Upper Snake Rock TMDL and Lake Walcott TMDL*]. I have been involved with the Mid Snake Technical Advisory Committee and am probably up to speed on most of the issues contained in these documents; however, thirty days is not sufficient.
	REPONSE: IDEQ-TFRO has the following policy relative to the 30 day public comment period on TMDLs: Page 16 of the *State of Idaho Guidance for Development of Total Maximum Daily Loads* (IDEQ 1999), "Each TMDL document will go out for formal 30 day public comment as described more fully under public involvement and comment earlier in this policy statement. The package submitted to the EPA will include a summary of public comments received and DEQ's response to those comments." The development of the subbasin assessment allows the public to provide direct comment to IDEQ-TFRO over a 12 month period because no official public comment will occur for this section. Even under the next 12 months during TMDL development, the public has an opportunity to provide public comment and every effort is made to incorporate those comments into the subbasin assessment and the TMDL development section.
U of I -6B	*QUESTION*: I know that Dr. Buhidar has indicated that he would try to incorporate comments, suggestions and corrections after the thirty-day comment period. I will be making comments on both these documents and hope that the comments will be included even if they are received after the thirty day period.

	REPONSE: Any comment that is recived after the 30 day public comment period and prior to IDEQ-TFRO submittal to our State office in Boise, will be included but not necessarily addressed due to the time frame we are under for TMDL submittal to USEPA. However, the iterative nature of the watershed management plan allows us at annual reviews (as part of the adaptive management process) to look at updating the document so it is up-to-date and more correct than in the previous year. IDEQ-TFRO will make every effort to respond to all comments received but comments that are received close to the date that we are to submit to our State office may not get answered initially.
USBOR-7A	*QUESTION*: P.19, line 14. Where is the comparison to water year 1990 in Table 10?
	REPONSE: IDEQ-TFRO respectfully submits that Table 10 has been completely modified to incorporate a comparison between low Q years and high Q years. An overall comparison between low and high Q years is done and shows slight variation between years as a net overall value between Milner Dam and King Hill.
USBOR-7B	*QUESTION*: P. 19, line 16. The values in Table 10 are historic means (1927-1990, 1927-1991, etc) instead of annual means 1990,1991, etc. For Example, the 1994 and 1997 mean annual flows at Milner were1508 cfs and 9296 cfs respectively; at King Hill 8149 cfs and 16,920 cfs respectively; with a net difference from Milner to King Hill of 6641 cfs and 7624 cfs respectively. Historic means do not vary significantly with the addition of one year of data as demonstrated in Table 10.
	REPONSE: IDEQ-TFRO respectfully submits that Response 7A answers this question.
USBOR-7C	*QUESTION*: P.20, line 10. Should be Table "10" instead of Table "9" and the statement that the net difference Milner to King Hill does not vary from year to year is based on historic mean flows presented in Table 10 not annual mean flows for the years presented in Table 10 (see previous comment).
	REPONSE: IDEQ-TFRO respectfully agrees with the numbering of Table 9. It should be Table 10 and it will be modified per your suggestion. The reference to historic mean flows is found in Response 7A.
USBOR-7D	*QUESTION*: P.20, line 12. In the 1987 through 1993 drought period mentioned, the releases below Milner Dam were often zero during the irrigation season. What is the significance of the 2500 cfs mentioned?
	REPONSE: IDEQ-TFRO respectfully submits that the sentence has been modified to reflect releases below Milner Dam were often zero during the irrigation season. IDEQ-TFRO implies no significance to the 2500 cfs mentioned. This has been removed from the sentence for clarification.
USBOR-7E	*QUESTION*: PP.21-22, lines 32-36 & Table 13. After construction of the lower Milner Power plant, USGS reported flows at two gages 13088000 (the original Milner river gage) and 13088001 (Combined flow of the Snake River and the Lower Milner Powerplant). Then starting with water year 1996 USGS switched and started reporting the combined flow under gage 13088000 and the Snake River at Milner as river gage 13087995. Consequently the data in Table13 for 1993 to 1995 shows only the release through Milner Dam and not the total flow below where the Lower Powerplant returns water to the river.
	REPONSE: IDEQ-TFRO respectfully submits that Table 13 will be modified by including your statement as a footnote for clarification. At a future date, a more detailed table will be created to describe in greater detail the information that is lacking.
USBOR-7F	*QUESTION*: P.22, lines 32-33. Storage rights and natural flow rights have distinct priorities. Storage rights are not appurtenant to the lands and do not "provide for the water rights". The stored water supplements natural flow rights when the natural flow rights are not in priority. In general, reservoir storage rights are in priority when there is an excess of natural flow or a lack of diversion demand. Reservoir space is contracted to individuals or irrigation districts for use as a supplemental source of water, even if the primary right does not often yield water and the storage effectively provides the full supply.

	REPONSE: IDEQ-TFRO respectfully submits that you comments will be incorporated into §2.1.3.3 to describe more fully the storage rights issue versus water rights. We have also deleted the "provide for the water rights" from the sentence at lines 33 and 34.
USBOR-7G	*QUESTION*: P.100, line 35. Here a daily maximum of 83 mg/L is used and in other parts of the document (p.185, line 13) 80 mg/L is used.
	REPONSE: IDEQ-TFRO respectfully submits that the daily maximum should be 80 mg/L. It has modified all 83 mg/L to 80 mg/L as described and defined in the Technical Support Document.
USBOR-7H	*QUESTION*: P.104, lines 32-36. From (USGS 1997 [WY 1997]) the 1909-1926 historic annual mean was 5206 cfs. From 1927 to 1997 the historic annual mean was 2750 cfs not "5384 cfs" as stated, thus, the annual average flow has changed since 1906.
	REPONSE: IDEQ-TFRO respectfully agrees, but will modify the values based on the WY1998 by the USGS. Thus, the historic annual mean from 1909-1926 = 5206 cfs; and, the historic annual mean from 1927-1998 = 2799 cfs.
USBOR-7I	*QUESTION*: P.150,Sec. 3.03.03,1. Trihelomethanes MDLs and MCLs are discussed in this section. Inclusion or a reference to the location of the numerical limits in the document for the specific parameters being discussed would be useful.
	REPONSE: IDEQ-TFRO respectfully submits that in an earlier draft of §3.0.2.3, this subsection had an expanded table with a list of over 80 volatile organic compounds with an MDL of 0.5 μg/L and MCLs for various regulated organic species, each with its own MCL. A number of the members of the Mid-Snake WAG and Mid-Snake TAC suggested that although informative, it would be better to just summarize the contents of the table in a simple format that indicated the results of our review. We concurred and made our response as simple and direct: "Data collected from 1989 through 1997 shows that Total Trihelmethanes are less than the MDL and the MCL. No exceedences were noted." We also recommend that a review of 40 CFR §141.61, Maximum Contaminant Levels for Organic Compounds, and 40 CFR §261.24, Toxicity Characteristics, will provide sufficient information on all the MCLs for individual trihelomethanes. We have, though, made an addition to the subsection to include the MDL as a matter of reference based on your suggestion.
USBOR-7J	*QUESTION*: P.150,Sec. 3.03.03, 4. Turbidity and Sediment. A rough correlation exists between turbidity and concentration of suspended particles. A discussion about the size and concentration of the particles and how they influence the measurement of turbidity should be noted. A natural water or wastewater can have many different sized particles, thus the relationship between concentration and turbidity can be highly variable.
	REPONSE: IDEQ-TFRO respectfully agrees that the relationship between concentration and turbidity can be highly variable because a natural water or wastewater can have many different sized particles. For this reason particle size analysis is the preferred methodology for interpreting suspended particles when correlating to turbidity. Yet, a rough correlation can be developed between turbidity and the concentration of suspended particles and is applicable for particles below a certain size. The size of the suspended particles is procedural related, which means that the procedure for determination of total suspended solids determines the size of particles. According to Standard Methods (20th Edition), 2540 A, dissolved solids is the portion of solids that passes through a filter of 2.0 μm (or smaller) nominal pore size under specified conditions. Suspended solids is the portion retained on the filter. Therefore, all TSS values refer to particle sizes that are 2.0 μm or larger. We have amended the subsection in §3.0.2.3 to reflect this suggestion.
USBOR-7K	*QUESTION*: P.150, Sec. 3.03.03, 5. Primary and Secondary Nutrients. Define primary and secondary nutrients.
	REPONSE: IDEQ-TFRO respectfully submits that the use of primary and secondary nutrients are common terms amongst biologists and chemists. We understand that other scientific disciplines may not understand the terms, so we have included these terms in the acronyms section.

USBOR-7L	***QUESTION***: P.159, lines 1 - 9. Clarification, or inclusion in the definitions, is needed to distinguish between total suspended solids, sediment, and suspended sediments. Use of terminology needs to be consistent throughout the document. For example, rather than saying "On the one had they are necessary to scour and clean up the system of TSS buildup." It may be more appropriate to use the term "sediment" rather than "TSS".
	REPONSE: IDEQ-TFRO respectfully agrees and has defined these terms in the acronym section. Additionally, IDEQ-TFRO has used the services of a technical editor to search out inconsistencies and has modified them accordingly within the document.
USBOR-7M	***QUESTION***: P.160, lines 40-44. Need to be specific about location where the 1000-1300 cfs minimum to start the erosion process and the 10,000 cfs to move fine grained material is measured or talk in terms of velocity. The velocity at 1000 cfs at the Milner river gage would be significantly different than the velocity at other river gages downstream at 1000 cfs. Also in line 43 the words "significant movement" should be deleted.
	REPONSE: IDEQ-TFRO respectfully disagrees with the specifying of any stream flow that could be misused to insinuate minimum stream flows for certain sections of the Middle Snake River without taking into account other criteria beyond velocity. The elements of sinuosity, slope, and energy relationships that are linked to flow and velocity need to be considered as well. Our intent was never to imply or solicit implicitly or explicity minimum stream flows for the Middle Snake River. We recognize that there is a preponderance of literature that uses flow values indiscriminantly as a case for minimum stream flows. IDEQ-TFRO respectfully disagrees with such an approach because it is scientifically unsound and legally indefensible. For the Middle Snake River the 1000-1300 cfs flow is meant as an average range for the entire river system. For specific reaches within the river system this range may not be applicable. The 10,000 cfs flow is also meant as an average value for the entire river system that could be modified based reach specificity. We have modified lines 40-44 to reflect the average condition. IDEQ-TFRO respectfully agrees and will modify the words to reflect the term erosion.
USBOR-7N	***QUESTION***: P.162-163, 3.1.03, Table under Pathogens. What is the source of this table? The recommendation column appears to be required recommendations. What does it mean if a stream segment is not listed for bacteria but a TMDL is required (Billingsley Creek)? Additional text is needed for understanding.
	REPONSE: IDEQ-TFRO respectfully submits that the sources for this list have been previously identified in the document. However, IDEQ-TFRO has made notations within each subcomponent of the list to notate the location of the sources. Additionally, IDEQ-TFRO has added language that better describes the recommendation subcomponent of the list.
USBOR-7O	***QUESTION***: P.164, lines 29 - 36. Guidelines are discussed for determining exceedences (no, major, and minor). The protective level for fisheries (0.020mg/L) should be included in the paragraph to give the reader better understanding. As the paragraph is written, it looks like only the number of samples with unionized ammonia is being consider without consideration of the unionized ammonia concentration (10 of 20 may have unionized ammonia but none of those 10 exceed 0.020mg/L, thus no exceedence). This may [*be*] important, especially since an instream target is not being proposed.
	REPONSE: IDEQ-TFRO respectfully agrees and has added the suggested language on the protective level for fisheries (0.020mg/L).
USBOR-7P	***QUESTION***: P.166, lines 7 - 43. Irrigation return drains are being interpreted as tributaries. It is being proposed that TMDLs should be written for the drains (with major exceedences) where unionized ammonia concentrations are exceeding levels that are identified to protect fisheries. Further studies needs to be done to determine if the drains previously existed as intermittent or perennial streams. If the drains were constructed, it may be more appropriate to assign load allocations at the mouth of the drain rather than developing a TMDL.

	REPONSE: IDEQ-TFRO respectfully submits that a re-evaluation of the un-ionized ammonia criteria has been done. See Responses 3N, 3O, and 3P. IDEQ-TFRO also respectfully submits that TMDLs for irrigation return drains are not being proposed. Rather, at the point of discharge into a natural waterway is where the TMDL is proposed for the natural waterwater from the irrigation return drain. The action that is required on the irrigation canal drain will be to minimize impacts from any parameter to the natural waterway through a BMP implementation plan that specifically defines the actions that will cause the reductions for the specific parameter-of-concern. IDEQ-TFRO respectfully agrees that further studies need to be done to determine if the drains previously existed as intermittent or perennial streams. However, at this time all canalways, unless listed as natural waterways in IDAPA 16.01.02.150, are not being submitted for TMDL development until such time as State regulations allow for the TMDL process to include manmade waterways.
USBOR-7Q	*QUESTION*: P.169, Sec. 3.1.09 Will a summary of the results of the RBM10 model be included in the technical appendix?
	REPONSE: IDEQ-TFRO respectfully submits that the RBM-10 model was not used in the development of the Upper Snake Rock TMDL. Therefore, model results will not be used in the technical support document (Appendix D).
USBOR-7R	*QUESTION*: P. 171, Sec. 3.2.01, Nitrogen. In the discussion of unionized ammonia, double check the formula used to calculate unionized ammonia. Is the conversion formula [*algorithm*] correct?
	REPONSE: IDEQ-TFRO respectfully submits that this has been answered in Responses 3N, 3O, and 3P. Appropriate modification to reflect this re-evaluation has been done in the document.
USBOR-7S	*QUESTION*: P.172-173, Tables 86 - 88. Spell out high and low
	REPONSE: IDEQ-TFRO respectfully agrees and has modified the document to reflect your suggestion.
USBOR-7T	*QUESTION*: P.188, lines 29-47. The number of samples seems to change from 455 samples to 469 samples then back to 455 samples.
	REPONSE: IDEQ-TFRO respectfully agrees and has modified the document to reflect your suggestion.
USBOR-7U	*QUESTION*: P.188, lines 39-47. This section proposes to protect TSS values to current existing conditions based on historic occurrence rates for specific periods. Releases from Milner are not mentioned in this section although Milner releases are addressed in other sections of the document as having an influence on TSS concentrations. If point and non-point sources can be above 25 mg/l but below 52 mg/l before discharging into this segment then controlling instream concentrations to below 25 mg/l would have to be regulated by the TSS concentration in water released at Milner Dam. Specifically how does this TMDL propose to controlled TSS concentrations in the water released at Milner and under what legal authority would DEQ or EPA propose to modify river and reservoir management to meet these targets.
	REPONSE: IDEQ-TFRO respectfully submits that it has responded fully in Response 4A.
USBOR-7V	*QUESTION*: Even if TMDLs upstream of Milner clean up the water enough to satisfy these limits, there may be circumstances which cause the TSS concentrations to exceed the 25 mg/l limits during the three month time periods. For example, flooding or flood control releases, or severe drawdown of upstream reservoirs to deliver storage water may cause high TSS levels beyond the control of river managers without limiting the ability to provide flood control or meet contractual obligations to deliver storage water. There could be a direct conflict with the ability to deliver storage water or to meet Endangered Species Act requirements.
	REPONSE: IDEQ-TFRO respectfully submits that it has responded fully in Response 4A.

USBOR-7W	*QUESTION*: The occurrence limits for the three month periods are based on historic levels. Is there a specific relationship between TSS and flows for these three month periods? Please reference where these relationships are developed. TSS data at Milner sent to Reclamation by DEQ on 10/27/99 showed an inconsistency in the way discharge was recorded. After comparison to historic flow data it appeared that the discharge recorded at the time of sampling was sometimes the total flow at Milner (including the Lower Milner Powerplant) and sometimes only the flow in the river before the input of the Lower Milner Powerplant. This inconsistency may alter the computation of the relationship between TSS concentration and flow during these periods as well as the sediment rating curves presented on page 300 of the appendix.
	IDEQ-TFRO respectfully submits that it has responded fully in Response 4A.
USBOR-7X	*QUESTION*: P.189, Table 100. The unaccounted springs are noted as having negative loads. Are these springs actually removing sediment from the water or should they be assigned a zero load?
	REPONSE: IDEQ-TFRO respectfully submits that the use of negative values (referenced in parenthesis) within the allocation tables is to account for a zero (or near zero) load. Unfortunately, when setting up an allocation table for USEPA-Region 10, negative numbers must be accounted for in a spreadsheet even though it makes no realistic sense.
USBOR-7Y	*QUESTION*: P.197, Sec. 3.5.07. Should the load analysis be based on means or medians? Mean values can be skewed by specific, high sediment, events. A median value may more accurately reflect natural conditions.
	REPONSE: IDEQ-TFRO respectfully submits that load analysis values can be defined as means or medians, depending on the parameter <u>and</u> depending on what best suits the water user industry for allocation purposes. Mean values are more easily reflective of nonpoint sources according to land management agencies and we have accommodated their perspective with annual mean values.
USBOR-7Z	*QUESTION*: P.198, Line 16 +. What about shoreline erosion and resuspension of sediments within the river? This should be included in the analysis for a more complete picture of sediment loading in the watershed.
	REPONSE: IDEQ-TFRO respectfully submits that shoreline erosion and resuspension of sediments within the Middle Snake River and its tributaries is accounted for within each load allocation. The exact value of shoreline erosion is yet to be detemined by land management agencies during the implementation phase of the TMDL. We have also modified §3.5 to include a new subsection 4 and 5 so that this aspect is more fully recognized.
USBOR-7AA	*QUESTION*: P.226, lines 9-10. Only section three was made available on October 20, 1999. The full draft TMDL was not distributed until November 2 and was not received by Reclamation until November 8, 1999.
	REPONSE: IDEQ-TFRO respectfully submits that it has fully answered this in Responses 6A and 6B. IDEQ-TFRO has reviewed and incorporated all of USBOR's comments within the TMDL.

USBOR-7BB	*QUESTION*: Cover Letter: Of general concern to Reclamation is the lack of explanation of how continued operation of reservoirs above Milner relates to meeting the TMDL (Total Maximum Daily Load) goals. We appreciate the effort to set criteria consistent with observations made over several years of operation. However, it is unclear under the anti-degradation TMDL outlined on Page 188 as to how the Total Suspended Solid (TSS) concentration of the water released below Milner Dam is to be managed. Does the Antidegradation TMDL assume that existing or historic river management activities are considered "background" or "base condition" and, therefore, limits may be exceeded if the mode of operation remains the same? Does the TMDL propose to change upstream river management to meet the limits presented? During some water years restricting TSS concentrations would limit Reclamations ability to meet flood control objectives, contractual obligations, or Endangered Species Act (ESA) obligations. Many of these commitments were mandated by the Congress and most were established before 1972. Furthermore, since the natural flow of the Snake River is fully appropriated in many seasons, and all storage space is under contract or dedicated to ESA purposes, there is often no water that could be released at Milner to meet water quality targets.
	REPONSE: IDEQ-TFRO respectfully submits that it has responded fully in Response 4A. IDEQ-TFRO respectfully submits that it understands fully USBOR's concern on the antidegradation TMDL and we submit that we have been flexible in our re-evaluation of this approach for protection of existing beneficial uses in Segment 1 of the Middle Snake River.
USFS-8A	*QUESTION*: Dr. Buhidar, as I mentioned yesterday, the one apparent question I have is on Table 60, page 125, for Dry Creek, West Fork. I don't think there are any CFOs or AG in that drainage.
	REPONSE: IDEQ-TFRO has reviewed your comment and respectfully concurs that the West Fork of Dry Creek does not have CFOs or Agriculture as nonpoint sources. This will be modified in Table 60 to reflect "zero" instead of Yes. As a result, the % Streams Affected will also be modified to reflect 84% and 74%, respectively.
IWP-9A	*QUESTION*: The draft TMDLs are deficient in that they do not address all beneficial uses for the waters included within this subbasin area. Even though on Page 2 of the Executive Summary, line 34, the DEQ acknowledges that aesthetics is an applicable designated beneficial use, there has been no effort to determine if it is being met on these water courses or if a TMDL needs to be identified for this particular beneficial use. Considering the extraordinary level of fragmentation and degradation of all tributary watersheds in this document and the Snake River itself, there is no question but that aesthetics needs to be addressed as a beneficial use in nonsupport status. The draft TMDLs go on to describe the designated beneficial uses on page 86, line 25 as not including aesthetics, which is clearly a mistake which needs to be corrected.
	REPONSE: IDEQ-TFRO respectfully submits that in the Executive Summary we have added language that more clearly defines aesthetics as being addressed through IDAPA 16.01.02.250.05, which covers general surface water quality criteria for hazardous materials; toxic substances; deleterious materials; radioactive materials; floating, suspended or submerged matter (does not imply sediment); excess nutrients; oxygen-demanding materials; and sediment. These are being addressed through the NPDES permitting process for point sources and self-imposed BMPs for the nonpoint sources as referenced in Subsection 350.03. We have also added a subsection in §2.2.3.4 entitled Aesthetics. The language defines the extent to which aesthetics will be satisfied under the current regulations point sources and nonpoint sources.
IWP-9B	*QUESTION*: While there is a great deal of useful information in this draft document, the writers fail to address all the pollutants with TMDLs or even those they do address in a way which will ensure recovery and full support of all beneficial uses for these Idaho waters. The main direction from this document appears to be that if sediment loading or total suspended soilds (TSSs) is reduced to a hypothetical level that all other beneficial uses will fall into line and be met with full support. IWP objects to this approach to identifying TMDLs as being inadequate, incomplete, and quite likely illegal.

	REPONSE: IDEQ-TFRO respectfully suggests that you have a misunderstanding of what the Upper Snake Rock Watershed Management Plan is meant to do. Scientifically, we can statisticly verify that a linkage exists between TSS and several of the other listed pollutants. However, we are not suggesting that this linkage is cause-and-effect although there is strong overwhelming evidence to indicate this. The Technical Support Document (Appendix D) provides ample proof that as TSS is reduced so will other pollutants. However, we don't suggest that just reductions in TSS will answer all of the pollutant problems in the subbasin. As an example, the science tells us that flow diversion and flow storage are directly linked to excess sediment levels under high flow conditions, and depending on the amount of water that is diverted for irrigation purposes, determines what will be used in the main stem of the Snake River. The TMDL is also legally defendible because the science stipulates it, and because we have followed the regulations under the TMDL process for both the Clean Water Act, Idaho Code §39-3601 *et seq.*, and Idaho's Nutrient Management Act of 1989. IDEQ-TFRO can do no more than what we are legally bound and allowed to do.
IWP-9C	*QUESTION*: On page 62, lines 25 and 26, IWP objects to the conclusion that manmade waterways will not be considered for TMDL development at this time. The State of Idaho needs to address agricultural conveyances, especially their role in creating nonsupport for various beneficial uses at their point of reintroduction into natural watercourses, but also where such waterways affect the capability of natural streams and other waterbodies to fully support all beneficial uses.
	REPONSE: IDEQ-TFRO respectfully suggests that you have misread what the Upper Snake Rock Watershed Management Plan says about manmade waterways. Indeed, the TMDL process does not allow for the development of TMDLs on canalways because they obviously donot function in the same biological process as natural streams. However, where canalways have developed from natural stream channels (such as the Big Wood River, Mud Creek, Deep Creek, Cedar Draw), then you will see that the waterway will be addressed through the TMDL process. We call your attention to §3.5.1 through §3.5.6 and the listing of various canalways that discharge to the Middle Snake River. These are defined under the TMDL to deliver at their point of reintroduction into the natural watercourse the same water quality target as natural waterways. In this way, IDEQ-TFRO has addressed agricultural conveyances. We respectfully submit that the intent of the law has been satisfied in the natural waterway by defining the discharge limit to it through the instream targets discussed so as to achieve beneficial uses and/or State water quality standards. This is fully described in the document.
IWP-9D	*QUESTION*: On page 104 of the document, the DEQ lists various reasons why variances from state water quality standards are permitted. These permitted variances suggest that virtually no changes in current management of human-caused impacts on beneficial uses need to be addressed. IWP objects to this conclusion and suggests that it's well passed time for the state to step up and acknowledge the problems caused by these human-caused conditions and begin to change them so that recovery of all beneficial uses can be attained regardless of current conditions.

	REPONSE: IDEQ-TFRO respectfully objects to your conclusion and suggestion that "it's well passed time for the state to step up and acknowledge the problems caused by these human-caused conditions and begin to change them so that recovery of all beneficial uses can be attained regardless of current conditions." IDEQ as an agency has always acknowledge the problems caused by any human-caused conditions. But IWP apparently does not understand that "changes in current management" within certain water user industries do not occur over night or even within a 5 year time frame; not because industries refuse to cooperate with environmental stewardship, but because some management changes incur potential economic hardship. For this reason IDAPA 16.01.02.350.01.a states, "nonpoint sources ... are the result of activities essential to the economic and social welfare of the state. The real extent of most nonpoint source activities prevents the practical application of conventional wastewater treatment technologies." The TMDL allows for this by bringing all water user industries into compliance within a five year period, and then maintaining those reductions for an additional five years. IDEQ-TFRO feels this is practical and reasonable. Additionally, your interpretation of pages 104 - 105 is incorrect. IDEQ-TFRO is not suggesting that we pursue variances under IDAPA 16.01.02.260.01 such that "variances from meeting certain water quality standards may be granted" provided they are consistent with certain requirements. Instead we are listing those items that could be used to present a case for variances on the Middle Snake River, implying that attainment of beneficial uses and/or State water quality standards will be long term. However, your point is well taken that as the document reads you could conclude that pursuit of variances is needed. Therefore, we will add additional language to clarify the intent, especially that a TMDL will be established and respected by the water user industries over the next ten years in spite of the possible variances that could be used to defer attainment of the standards or beneficial uses.
IWP-9E	*QUESTION*: IWP objects to the DEQ's position that habitat modification and flow alteration are not pollutants under the Clean Water Act, and that no TMDLs will be developed at this time to address habitat modification or flow alteration. While the document suggests that addressing other listed pollutants like sediment or temperature will address flow alteration or habitat modification concerns, this is clearly not the case where stream dewatering by agriculture or stockwater diversions exist. A recent advisor committee report to the Environmental Protection Agency (EPA) states that there are seven necessary components to the TMDL implementation and development process which include allocation of pollution loads, including assignment of control responsibilities among sources of impairments. A clear "source of impairment" for the various violations of beneficial use achievement in the Upper Snake/Rock Creek watershed is flow alteration and habitat degradation especially from agricultural practices and livestock use.
	REPONSE: IDEQ-TFRO respectfully submits that: (1) The position IDEQ-TFRO has taken on habitat modification and flow alteration is a policy decision statewide. It has also been accepted by USEPA. Be aware that in the new TMDL regulations that are out for public comment, USEPA has defined habitat modification and flow alteration as "pollution" items instead of "pollutant." However, these new TMDL regulations have not been promulgated as regulations yet. (2) The dewatering of a stream to meet water rights is legally allowed under Idaho rules and regulations. If a stream is dewatered, then meeting beneficial uses for water quality is a mute point because no beneficial uses exist where water is absent in the surface water body. IDEQ-TFRO recognizes that a clear "source of impairment" may occur due to flow alteration, particularly if habitat, fisheries, or biota are degraded because of it. The dewatering of a stream to meet water rights, however, is legal in Idaho at the present time. Additionally, IDAPA 16.01.02.050.01 states that "the adoption of water quality standards and the enforcement of such standards is not intended to conflict with the apportionment of water ... through any of the interstate compacts or court decrees, or to interfere with the rights of Idaho appropriators, either now or in the future ..." And, (3) any report from the FACA Committee to USEPA at this time has yet to be promulgated as nationwide regulations through the Code of Federal Regulations. Therefore, the report is not within the boundaries of current existing regulations for TMDLs and therefore irrelevant. However, the seven items that you mention are preliminarily addressed in §3.6 of the TMDL because IDEQ-TFRO chose to focus the involved watershed advisory group for the implementation phase of the TMDL process.
IWP-9F	*QUESTION*: On page 162, lines 34 and 35, the DEQ proposes a draft TMDL that will bring fecal coliform bacteria exceedences down to a level that is less than 5% of the samples for a particular stream for both primary and secondary contact recreation. This level is clearly unacceptable, and probably in violation of the Clean Water Act. Any TMDL proposed for pathogens must result in no exceedence at any time of state water quality standards.

	REPONSE: IDEQ-TFRO's respectfully submits that the basis for using the 10% (not 5% as incorrectly shown in the document) is based on USEPA's *Guidelines for Preparation of the 1996 State Water Quality Assessments (305(b) Reports)*. On page 5-23 of the *Guidelines* it provides an example for "not more than 10 percent of the total samples taken during any 30-day period." Based on the *Guidelines* and your comments, we have modified the statement to read: "Therefore, a TMDL is proposed that brings the percent of samples with fecal coliform bacteria exceedences down to a level that is less than 10.0% of the samples for a particular stream for both primary and secondary contact recreation." Therefore, the *Guidelines* supposes comformity and acceptability with the Clean Water Act thus allowing minor exceedences within reasonably defined levels (< 10%).
IWP-9G	***QUESTION***: On page 164, lines 12 and 13, the document states: "However, BMPs that specifically look at minimizing fecal coliform impacts due to land use will be assessed by the land management agencies during the implementation phase of the TMDLs." Clearly, simply assessing BMPs is an inadequate response to addressing the severe pollution problems which exist in the tributaries of the Snake River which are part of this watershed subbasin. Any TMDLs identified for these waterways must be annually measureable and enforceable as a matter of law. Currently, Idaho permits agricultural activities to meet TMDLs or any Best Management Practice only on a voluntary basis. Without some enforcement requirement and accountability on an annual basis for meeting specific reductions in pollutants, can any TMDL and water pollution abatement program be taken seriously?
	REPONSE: IDEQ-TFRO respectfully agrees with the inference of just assessing BMPs without some level of follow-through on our part. Therefore, we have modified the sentence so that it reads: "However, BMPs that specifically look at minimizing fecal coliform impacts due to land use will be assessed by the land management agencies during the implementation phase of the TMDLs for inclusion in farm and/or allotment plans." We have also added the following footnote in the table that has Additional Surface Waterbodies Not on 303(d) List: "IDAPA 16.01.02.280 protects for water quality Rock Creek, Cedar Draw, and Deep Creek as used by the Twin Falls Canal Company as spillways, collection and conveyance facilities. This implies that water quality will be protected even under those conditions when the canal company uses it as a manmade conveyance. Thus, natural streams which have canalways that discharge to them shall be water quality protected even during the irrigation season, implying that discharges to them shall meet beneficial uses or State water quality standards." Additionally, we have added the following to the last paragraph of §3.1.3: "IDEQ-TFRO will annually assess all BMPs considered for inclusion for farm and/or allotment plans, and will make such assessments with the various land management agencies. Any BMP that is determined by IDEQ-TFRO in conjunction with the land management agency to be inadequate for water quality protection will be subject to removal from the farm and/or allotment plan, and will be replaced by another BMP that protects the water quality limited stream or stream segment. At all times, IDEQ-TFRO will be subject to all the rules governing nonpoint source activities as defined in IDAPA 16.01.02.350."
IWP-9H	***QUESTION***: On page 166, lines 40-43, the document states: "A TMDL for waterbodies where un-ionized ammonia has been found as a major exceedence, will be done." There is no indication of when such a TMDL will be done or whether it is even part of this draft plan. This must be corrected before any final approval by EPA is carried out.
	REPONSE: IDEQ-TFRO has re-evaluated the entire un-ionized ammonia calculations based on the Responses in 3N, 3O, and 3P. Based on this re-evaluation, IDEQ-TFRO respectfully submits that a TMDL for un-ionized ammonia will not be done on the tributaries or the Middle Snake River at this time.
IWP-9I	***QUESTION***: IWP objects to the failure to develop any TMDL for nitrogen as Nitrite+Nitrate (NOX). Such a TMDL should be developed at this time.
	REPONSE: IDEQ-TFRO respectfully believes strongly that the control of NOX at this times based on the most current science is dependent on its relationship to nuisance aquatic vegetation as a limiting nutrient. This is the basis for the TMDL on total phosphorus in the Mid-Snake TMDL. Since NOX is not a limiting nutrient in either the Middle Snake River or its tributaries, and since there is no nuisance aquatic vegetation because of NOX, there is no proposed TMDL at this time. Additionally, NOX is not considered a toxic pollutant on fisheries at current levels. However, IDEQ-TFRO will continue to review NOX as monitoring data is collected on the Middle Snake River and its tributaries. If and when NOX mean loads within the river and its tributaries increase significantly above where the current 1990-1998 mean load exists, then TMDL development for NOX will occur immediately as described in §3.1.5.

IWP-9J	*QUESTION*: IWP objects to the temperature section on page 168 which states that : TMDLs will be postponed for streams on this list for 18-24 months in order for new water quality standards to take effect." IWP is especially concerned that simply quoting a National Academy of Sciences document from 1973; "No single temperature requirement can be applied to large regional areas; the requirements must be closely related to each body of water and to its particular community of organisms," will not relieve the DEQ of its obligation to propose TMDLs which will ensure that waterbodies fully support all beneficial uses under current law. While IWP is aware that the state of Idaho is proposing a "cool water biota" standard to augment the current cold water and warm water biota beneficial uses, such a standard does not exist at this time and certainly if placed into affect and approved by EPA, will be subject to litigation. This paragraph appears to be simply an attempt to delay addressing temperature problems in this subbasin until they can be redefined out of existence. This is simply unacceptable.
	REPONSE: IDEQ-TFRO respecfully submits that §3.1.8 on temperature is a Statewide IDEQ policy approach that we feel is reasonable so as to explore approaches to develop temperature criteria and/or uses which better fit the Middle Snake River and/or its listed tributaries. The quotation from the National Academy of Sciences is as valid today as it was in 1973, so is very appropriate to the Upper Snake Rock subbasin. Any thing less than this would be unscientific and legally indefensible. Therefore, the paragraph is not an attempt to circumvent our statutorily defined authority. And we certainly couldn't comment on any supposed litigation that would result as a consequence of beneficial use and/or water quality standards changes without review of the litigation by the Idaho Office of Attorney General.
IWP-9K	*QUESTION*: IWP objects to the failure to develop any TMDL for dissolved oxygen. While a lot of words are written on pages 168 and 169 in regard to this issue, the reality is that exceedence of this criteria exists in the subbasin and must be addressed in a TMDL.
	REPONSE: IDEQ-TFRO respectfully submits that its discussion in §3.1.9 on dissolved oxygen is sufficient to exclude the need of a TMDL. Therefore, no TMDL is proposed for dissolved oxygen on the Middle Snake River or its tributaries at this time.
IWP-9L	*QUESTION*: IWP objects to the failure to establish any TMDL for nitrogen, especially for aquaculture facilities which provide point load pollutants which result in major exceedences of nitrogen vor various locations as documented on pages 170 and 171. Once again, the document appears to blow off these occurences of pollutants in various ways without beginning to address the fact that they exist and are a violation of state water quality standards.
	REPONSE: IDEQ-TFRO respectfully submits that Responses 3N, 3O, and 3P have answered this issue.
IWP-9M	*QUESTION*: IWP objects to the development of a total suspended solids TMDL of 52 mg/L as the permissible level which includes a margin of safety as required by law. A more suitable TMDL for total suspended solids should be that level which would be expected under natural conditions for this watercourse. It is within the capability of the DEQ to determine what would be the expected background level of TSSs.
	REPONSE: IDEQ-TFRO respectfully submits that §3.1.1, pages 157-159, provides ample scientific and legal rationale for justification of the 52 mg/L (with an imposed margin of safety) as the target for meeting beneficial uses for cold water biota and salmonid spawning, and for meeting the narrative standard for sediment in the State water quality standards. IDEQ-TFRO respectfully submits that rationale for a "natural condition" criteria for TSS is scientifically and legally indefensible for the Upper Snake Rock subbasin for the Middle Snake River and its tributaries.

IWP-9N	*QUESTION*: IWP objects to the trend monitoring plan commencing on page 207 of the document which discusses monitoring of Best Management Practices (BMPs). This section of the draft underlines IWP's concerns about the voluntary nature of BMPs, especially when the greatest source of all nonpoint source pollutants in this subbasin is irrigated and dryland agriculture and livestock grazing. These activities are subject only to voluntary compliance with BMPs under current Idaho law. Lines 43 and 44 on page 208 state: "It is the responsibility of the farmer to make the change, as long as it is voluntary, economically feasible, and still flexible to allow for additional changes if necessary." Clearly, such a system of implementation and change of BMPs will only serve to fail to achieve state water quality standards. On page 210 starting on line 21, the document, states: "Violations of water quality standards which occur in spite of implementation of Best Management Practices will not be subject to enforcement action." This statement makes a joke of the development of any TMDLs or their implementation.
	REPONSE: IDEQ-TFRO respectfully submits that the trend monitoring plan found in Appendix A was a result of a consortium of scientists from various agencies and organizations with knowledge of the Middle Snake River. Section 3.6.3 defines from Idaho Code §39-3621 the cooperation between the IDEQ and the appropriate land management agencies in ensuring BMPs are monitored for their effect on water quality which will be developed more fully during the implementation phase of the TMDL. Lines 43 and 44 of page 208 are correct as they stand so long as IDAPA 16.01.02.350 is not violated. A more fuller explanation is provided in §3.6.4, with an emphasis on the last paragraph of page 210: "So long as a nonpoint source activity 'is being conducted in accordance with applicable rules, regulations and best management practices." Otherwise, lines 32-39 describe the mechanism by which legal action may be pursued. We also respectfully submit that as written, the regulation is not a joke for TMDL development or their implementation. Until such time as the regulation is modified, IDEQ-TFRO is obligated by law to follow its own rules and regulations for nonpoint source implementation of BMPs.
IWP-9O	*QUESTION*: On page 220, Section 4.4 deals with no-net increase policy on TMDLs. This policy was adopted on May 7, 1998 by DEQ in order to address interim management for streams designated as not fully meeting existing beneficial uses and goes on to state: "the NNI Policy may not be interpreted as requiring best management practices for nonpoint source operations unless they are voluntary or unless they are outlined in applicable federal or state statute or IDAPA 16 Title 01 Chapter 02." Again, IWP points out that essentially Idaho has no policy on interim management of 303(d) listed streams for nonpoint source pollutants, either during the period before TMDLs are established or thereafter. This can only be considered to be an attempt to avoid compliance with the Clean Water Act.
	REPONSE: IDEQ-TFRO respectfully diagrees not only with your interpretation of the NNI Policy, but also with your basic misunderstanding of the relationship that exists between the Clean Water Act and Idaho's Administrative Procedures Act. In essence, the act fulfills the requirements of the Clean Water Act by allowing for voluntary practices and by defining the type of recommended practices for nonpoint sources. Under Idaho's statutory rules, regulations, and code, IDEQ-TFRO cannot avoid compliance with the Clean Water Act. If it did it would be illegal. Further proof of this is found in Idaho Code 39-3601 *et seq.* where it specifically states: "It is the intent of the legislature that the State of Idaho fully meet the goals and requirements of the federal Clean Water Act and that the rules promulgated under this act not impose requirements beyond those of the federal Clean Water Act." As such, the IDAPA process formulates and recommends "such rules and standards as may be necessary to deal with the problems related to personal health and water pollution (IDAPA 16.01.02.001)." In effect, IDEQ-TFRO has made no attempt to avoid compliance with the Clean Water Act.
IWP-9P	*QUESTION*: IWP also incorporates into these comments our prior comments on draft TMDLs for the Lemhi River watershed and the North, Middle, and Sourt Forks of the Owyhee River watershed.
	REPONSE: IDEQ-TFRO will not incorporate the comments on draft TMDLs for the Lemhi River watershed and the North, Middle, and Sourt Forks of the Owyhee River watershed because they are totally irrelevant (they are not applicable or pertinent) to the Upper Snake Rock TMDL. Similarities between subbasins do not necessarily imply that the subbasins are the same biologically, chemically, hydrologically,or physically.

IWP-9Q	*QUESTION*: IWP realizes that a lot of time and effort has gone into the preparation of this draft document; however, in most respects, it appears to be an effort to obfuscate, ignore, and deny the need for change to recover clean water in this subbasin. IWP will recommend to EPA denial of this draft TMDL if it is submitted in its current condition.
	REPONSE: IDEQ-TRFRO respectfully submits that you are incorrect in your assessment that IDEQ-TFRO is attempting to obfuscate, ignore, and deny the need for change to recover clean water in this subbasin. Our attempt has been to do exactly the opposite: to educate, to define, and to satisfy the intent of the Clean Water Act, Idaho Code §39-3601 *et seq.* (Idaho's water quality statute), IDAPA 16.01.02 (Idaho's Water Quality Standards and Wastewater Treatment Requirements), and IDAPA 16.01.16 (Idaho's Nutrient Management Act). We feel we have done exactly that, as well as meet the full intent of the legal statutes (both federal and state).
IDL-10A	*QUESTION*: The state owns several scattered state sections, 640 acres, throughout the plan area. Nearly all the state sections are used for grazing livestock. We found one section that was on one of the streams mentioned. It seems our participation in this process would be through cooperative grazing management plans with adjoining private and/or federal land managers.
	REPONSE: IDEQ-TFRO respectfully submits that your comments will be incorporated into the document in §2.1.2.3, Land Use and Ownership. IDEQ-TFRO will also follow-up with a letter within 30 days of plan implementation to the Idaho Department of Lands for a meeting to discuss the location of those state owned lands and the criteria that needs to be addressed in the grazing management plans for TMDL development. As with other land management agencies, any management plan that is written to answer water quality concerns must provide documentation that beneficial uses and/or State water quality standards will be achieved.
IDL-10B	*QUESTION*: The state owns the bed of the Snake River. Also, the state is responsible for the Lake Protection Act. The Lake Protection Act charges the Department of Lands to regulate Lake Encroachments such as boat docks, ramps and streambank protection by all landowners on the backwaters of the reservoirs.
	REPONSE: IDEQ-TFRO respectfully submits that your comments will be incorporated into the document in §2.1.2.3, Land Use and Ownership, §2.1.3.1, The Middle Snake River, and §3.6.4, Legal Authorities. IDEQ-TFRO will also follow-up with a letter within 30 days of plan implementation to the Idaho Department of Lands for a meeting to discuss the Lake Protection Act and its linkage to reservoirs on the Middle Snake River.
USBLM-11A	*QUESTION*: I would like to begin by requesting that our agencies re-establish specific points of contact and a protocol for sharing of information for any future Subbasin Assessments or Total Maximum Daily Load documents. This would make both writing and reviewing of the documents go much smoother and will avoid unneeded confusion. The BLM point of contact will be Jim Tharp, at (208) 677-6621.
	REPONSE: IDEQ-TFRO respectfully agrees on the point of contact and has included Jim Tharp's name to the list of members in the Middle Snake River Technical Advisory Committee.
USBLM-11B	*QUESTION*: P.51 - The boundary descriptions in item 21 and item 23 in Figure 4 need to be changed for the sake of clarification. They should say something similar to the following: (21) Dry Creek from beginning (confluence of West Fork Dry Creek and Middle Fork Dry Creek) to Medley Creek; (23) Cottonwood Creek from beginning (confluence of Dry Cottonwood Creek and North Cottonwood Creek) to Rock Creek.
	REPONSE: IDEQ-TFRO respectfully agrees with your assessment of items 21 and 23 of Figure 4 on page 51. Although we are unable at this time to make the necessary change, we shall do so just as soon as we receive the update on the 303(d) list of water quality limited stream segments in ArcView GIS format. The version we currently have has the listing as found in Figure 4.

USBLM-11C	*QUESTION*: NOTE: If there are other places in "The Upper Snake Rock Watershed Management Plan" where the boundary descriptions for these two weater quality limited segments appear, those descriptions need to be changed to match those above.
	REPONSE: IDEQ-TFRO respectfully submits that appropriate changes have been made in §2.1.3.6, Rock Creek Complex, and §3.0.2.8, Cottonwood Creek, to reflect your suggested changes.
USBLM-11D	*QUESTION*: Also, the map in Figure 14 needs to be changed to reflect
	REPONSE: IDEQ-TFRO respectfully submits that the map in Figure 14 will also be changed to reflect your proposed changes just as soon as we receive the update on the 303(d) list of water quality limited stream segments in ArcView GIS format. The version we currently have has the listing as found in Figure 14.
USBLM-11E	*QUESTION*: P.74, lines 1-47, appear to be explaining the history of conditions along Dry Creek and, one would assume, that conditions have deteriorated due to livestock use according to the way in which the data is interpreted.
	REPONSE: IDEQ-TFRO respectfully submits that your assessment of pages 73-74, and particularly page 74, lines 1-47, is incorrect. IDEQ-TFRO has endeavored to include all the sources of sediment pollution that could potentially exist on Dry Creek so that any inference to just cattle grazing is better qualified so that mis-information is not formulated with the public with the additional information provided by USBLM's early assessments in the 1980s. IDEQ-TFRO has assessed Dry Creek substantially and has concluded that the description of unstable alluvium banks (which potentially may not be stabilized completely), livestock grazing (based on nearby grazing and the "double whammied" effect), high flows (that damaged the creek), an abundant supply of sediment (which we are interpreting as natural background), wild fire, and road exposure to the stream are all contributors to the sediment problems on Dry Creek. Livestock grazing alone, whether on or nearby, is not the single and dominant source of sediment. That is the reason the ISCC 1979 report is quoted: "Historically, agricultural nonpoint sources affect Dry Creek slightly for irrigated cropland and slightly for livestock grazing."
USBLM-11F	*QUESTION*: The data collected by the Montana Riparian and Wetland Association (MRWA) in 1994 cannot and should not be casually compared to cursory, subjective inventory or statements made in the past. The overall riparian health ratings are a compilation of numerous questions dealing not only with vegetation and the quality of it but also with streambank and floodplain characteristics. Specific categories are set up to grade each question in order to eventually arrive at a final score. The earlier information which you have written about is not directly comparable to the 1994 data. This isn't to say that earlier information is incorrect but it certainly is not as thorough.
	REPONSE: IDEQ-TFRO respectfully submits that it views the MRWA as a qualitative assessment of any stream. Certainly, to attempt to quantify the qualitative descriptions is beyond the scientific purpose of MRWA. Table 32 does not attempt to quantify the qualitative assessment of MRWA. Instead it fully describes the intent of the table as the PFC assessment of Dry Creek. We see no where in the table or in the previous paragraph where an attempt is made by IDEQ-TFRO to "casually compare" the MRWA to the "subjective inventory or statements" by USBLM in the 1980s. However, the conditions that existed in the 1980s have had an effect on the present status of Dry Creek, otherwise it's listing on the 303(d) list as a water quality limited stream segment would not have occurred. IDEQ-TFRO respectfully submits that USBLM's interpretation of IDEQ-TFRO's assessment of the MRWA is incorrect.

USBLM-11G	*QUESTION*: Additional to P.74, lines 1-47: One gets a vision, after reading these lines, that what you find along Dry Creek is an unhealthy, poor condition stream with serious livestock grazing problems. On the contrary, Dry Creek has good riparian vegetation (all vegetation scores are either Proper Functioning or Healthy but with problems with no rating less than 71%), including excellent canopy cover of woodies. **Preliminary analysis indicates that since the 1984 flood and 1986 fire vegetation along the creek is improving and there is an apparently healthy cutthroat trout fishery with numerous juvenile and adult fish. Furthermore, as the table on page 75 indicates, channel bottom silt and clay percentages are optimal or near optimal. Livestock grazing practices have been improved with three years of rest during the last eight years. Prior to 1992 the creek received yearly grazing.** We in no way wish to imply that Dry Creek is free of problems, that determination has not been made as yet, but do not want the reader to be misled. (NOTE: Please include a summary statement indicating that shown in bold above.)
	REPONSE: IDEQ-TFRO respectfully submits that this has been answered in Response 11E and 11F. However, IDEQ-TFRO will include the suggested summary statement so as to round out the discussion in the section.
USBLM-11H	*QUESTION*: P.74, lines 23-32, include some quotations mixed in with DEQ statements. The quotations should be clear and complete. *REPONSE*: IDEQ-TFRO and our technical editor respectfully agree with your concern about the quotations and has made the appropriate changes to clear up any mis-interpretations.
USBLM-11I	*QUESTION*: P.74, The sentence on lines 31 and 32 "This development was not attributed to a cattle-caused trauma (USBLM 1986)" is misleading. The BLM report says "This development does not seem to be cattle-caused trauma."
	REPONSE: IDEQ-TFRO respectfully submits that "not attributed to a cattle-caused trauma" and "does not seem to be cattle-caused trauma" are essentially the same statement providing the same conclusion. However, to make it more clear, we have eliminated the "a" and stated: "not attributed to cattle-caused trauma."
USBLM-11J	*QUESTION*: Page 75, Table 32 "Overall Health Ratings" are incorrect. Polygon 9400517 has an overall score of 62% and should read Healthy w/problems. The other scores listed are also several percentage points off.
	REPONSE: IDEQ-TFRO respectfully submits that the scores as listed in Table 32 are correct based on http://www. Rwrp.umt.edu/MapSearch/id.html derived on 9/25/1998 via the Internet for the Snake River area. We derived 247 records (or polygons) of which we used the 11 polygons which are listed in the table. A hard copy is available in our office for your review. If this is in error, please provide substantiating documentation so Table 32 can be rectified.
USBLM-11K	*QUESTION*: P.75 and 76 (McMullen Creek). The same comments given above concerning the MRWA data apply here. The vegetation ratings are very good, shrub canopy cover is excellent and the silt and clay percentages are optimal or near optimal.
	REPONSE: IDEQ-TFRO respectfully submits that this has been answered in Response 11F.
USBLM-11L	*QUESTION*: Additionally, Table 33 "Overall Health Rating" scores are inaccurate and one polygon (9400309) which says "Unhealthy" should say "Healthy w/problems."
	REPONSE: IDEQ-TFRO respectfully submits that Response 11J is applicable here but in respects to McMullen Creek. A hard copy is available in our office for your review. If this is in error, please provide substantiating documentation so Table 33 can be rectified.

USBLM-11M	*QUESTION*: If, indeed, beaver are needed in this system to allow the channel to access its floodplain in some places, the fact that livestock grazing is the predominant use (Table 33) should not be a factor unless livestock are causing the area to deteriorate. **A determination as to whether or not livestock grazing is a problem along McMullen Creek has not been made yet but there are indications that the riparian area along the creek is improving.** (NOTE: Please include a summary statement indicating that specified in the previous bolded sentence.)
	REPONSE: IDEQ-TFRO respectfully submits that it will include the suggested summary statement so as to round out the discussion in the section.
USBLM-11N	*QUESTION*: P.125, Concerning "Dry Creek, West Fork" in Table 60, it should be "No" for "AG" and "No" for "CFOs."
	REPONSE: IDEQ-TFRO respectfully submits that this has been answered in Response 8A.
U of I -12A	*QUESTION*: Page 170 - Nitrogen. Based on your assessment that aquaculture facilities were exceeding the 0.02 mg/L unionized ammonia concentration, I calculated un-ionized ammonia concentrations from data generated by the Brockway and Robison Phase 1 study of 1992 using a table from Emerson et al. (1975) Aqueous ammonia equilibrium calculations: effect of pH and temperature. Journal of Fisheries Res. Board Can. 32:2379-2383; and from an aquaculture web site that does the calculations based on total ammonia, pH and temperature (http://aq.ansc.purdue. edu/aquanic/ images/tools/ammonia.htm). I did not go through all the data from every facility or every facility. However, what I found was that for the vast majority of samples none of the production facilities exceeded 0.02 mg/L and that my calculations were about 10 times less than what was reported in the Technical Support Document. When I went through the data from the Phase 1 study I purposely chose data points that had higher temperatures, pH values and TAN values relative to all the data to find the worst-case situations. Based on this I would suggest that another assessment of the Phase 1 study be made in regard to un-ionized ammonia concentrations from aquaculture facilities.
	REPONSE: See Responses 3N, 3O, and 3P.
U of I -12B	*QUESTION*: P.199 - TSS Impact Estimates. How can a point source contribute 100% of TSS to a creek? There must be some contribution from the watershed and from the creek itself.
	REPONSE: You are correct. We will modify the table to indicate "unknown" for both point and nonpoint sources with a footnote that says that Stoddard Creek and Decker Springs Creek have aquaculture facilities. We will also notate in Table 103 that Stoddard Creek and Decker Springs Creek need to have a loading analysis assessment conducted for TSS to determine the level of nonpoint source impact. This will probably hold true for all spring-fed creeks where little or no imformation is available.
IDEQ-TFRO-13A	*QUESTION*: Schrank sold to Lee this summer, don't know if this requires a correction in the TMDL. There are two dairies in the area along Billingsley Creek. The one on the hill across the road from Thorlief Rangens old house (above the hatchery) and the one near Fisheries Development. Don't know if you purposely omitted these two or not.
	REPONSE: We have made the appropriate change in §2.3.1.2 to reflect your comments.
Technical Edit-14A	*QUESTION*: I have reviewed and edited the Upper Snake Rock Subbasin Assessment and TMDL. I have made proofreading marks in the main document and appendices on things you would want to change, and as you may or may not want to change. We have incorporated about 99.99% of your suggestions.
	RESPONSE: IDEQ-TFRO respectfully submits that it has reviewed all of your comments and proposed changes. We have incorporated into the main document almost 99% of the suggestions. Areas where we have not made the changes deal with stylistic interpretation which we feel are currently correct based on the CBE Manual (6th Edition).

IDEQ-State-15A	*QUESTION*: Ag Weekly Newspaper, Cindy Synder, Ag Weekly Correspondent, November 20-26, 1999: "Gary Daily, the nonpoint source coordinator for the Division of Environmental Quality, said writing TMDLs alone is a huge undertaking for the state. "There is no way we can keep up with the current TMDL development schedule and develop implementation plans." He pointed out to the Mid-Snake/Rock Creek plan that was just written for sediment and other pollutants. That reach of the river had already had a plan approved for phosphorus, still the sediment plan was over 410 pages. "We can't continue to put that much effort in if we're going to stay on schedule," Daily said.
	RESPONSE: IDEQ-TFRO respectfully submits that it would not normally comment on opinions made in newspaper articles. However, a number of telephone calls were received by IDEQ-TFRO during the public comment period requesting clarification (for the public) the intent of IDEQ-TFRO on the Upper Snake Rock TMDL based on comments made which appeared in the Ag Weekly Journal of the Times-News Newspaper. First, IDEQ-TFRO did the bulk of the research and data analysis over a 24 month period. From the beginning of the subbasin assessment, the Mid-Snake TAC and the Mid-Snake WAG were involved in providing advice to IDEQ-TFRO as statutorily defined in Idaho Code 39-3601 *et seq*. Second, the document is 410 pages in length because of the comments provided by the WAG and the TAC, the 31 waterbodies which required site visitation and ground truthing to assess current conditions, and a total of 134 pollutants for the 31 waterbodies which required water quality statistical assessment to ascertain valid biological correlations. IDEQ-TFRO is committed to the TMDL time schedule and is expected to do similar subbasin assessments with future TMDLs.
Prepared by IDEQ-TFRO.	

B. Public comments which IDEQ-TFRO felt did not require a response.

SOURCE	*STATEMENTS NOT REQUIRING A RESPONSE*
U of I -1A	I want to tell you that the draft of section 3.0 reads well. You've done a lot of good work and sleuthing of background information and in making a first stab at management options.
IDEQ-LRO-2A	I think you are on the right track using a load rather than a "surrogate."
CSF, Inc.-3A	[*First Paragraph*] We appreciate the opportunity to provide comment on the Proposed Final Draft (October 4, 1999) of the Upper Snake Rock Watershed Management Plan (Upper Snake Rock TMDL). The proposed TSS TMDL for the Middle Snake River and the remaining TMDLs for various pollutants in 31 tributaries of the Middle Snake River are basically sound and we support the proposals. We do disagree with some of the statements, justification or analysis and offer [*some*] suggestions [*for your consideration*].
CSF, Inc.-3B	[*Final Paragraph*] We appreciate the opportunity to provide comment and believe that the proposed TMDLs with suggested changes are scientifically sound and a significant step towards improving water quality conditions in the Middle Snake River and its tributaries.
CSF, Inc.-3C	We agree with IDEQ that macrophyte habitat buildup is dependent on TSS and sediment deposition. It is also dependent upon water velocity. The greater the water velocity, the greater the sediment or TSS load that can be assimilated. We agree with IDEQ that a water flow of 1000-1300 cfs is needed for periodic movement of accumulated sediments. Flows of 10,000 cfs or more are also needed periodically. This is expected to occur in a natural riverine ecosystem and the Middle Snake River significantly benefits from such flows.

CSF, Inc.-3D	On page 161, lines 24-43, IDEQ discusses target phosphorus concentrations for the tributaries and Middle Snake River. It should be emphasized that in the absence of a State standard, selection of a target for these systems, even for a lake or impoundment, is difficult and subject to a great uncertainty. The EPA Gold Book and Blue Book values are for phytoplankton, speculative and also subject to considerable uncertainty. In the Middle Snake River and its tributaries, rooted and epiphytic macrophytes and filamentous green algae are of primiary concern, not phytoplankton. Various factors including flow and turbidity must be considered in choosing the site-specific criteria. As such, we strongly support the selection of 0.1 mg/L total phosphorus for all tributaries of all types until adequate evaluation of the suitability of this target occurs.
CSF, Inc.-3E	On page 188 IDEQ proposes that in the area between Milner and Pillar Falls, beneficial uses are being met. This is based on various TSS data. We support the suggestion that this stretch of the river not be degraded any further by increased sedimentation. This is particularly important to maintain given the uncertainty of the 52 mg/L TSS concentration criteria proposed for TSS and sediment TMDL. We strongly support IDEQ analysis indicating TSS and sediment contributions from fish farms are not significant factors in the sediments accrued in the Middle Snake River or its tributaries.
USBOR-7A	Cover Letter: As you are aware, the Bureau of Reclamation (Reclamation) owns and operates several storage reservoirs in the upper Snake River system which impact water flows into the Upper Snake Rock Watershed. The upper bound of the subject reach, and the point at which the effects of our operations are felt, is the privately owned and operated Milner Dam. Reclamation's mission is to: **Manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.** To that end Reclamation is committed to help in the process of improving water quality in the Snake River. However, Reclamation is also bound by federal and state law and has contractual commitments to store and deliver water.
USBOR-7B	Cover Letter: The Division of Environmental Quality and the Watershed Advisory Group for the Upper Snake Rock Watershed should be commended for participating as a group to seek resolution of problems that can not be blamed on, or solved by, any one constituent community.
Howard Kestle -10	We have received and reviewed the draft Upper Snake Rock Watershed Management Plan. The document covers several listed streams that may involve state endowment lands.
Technical Edit-14	Thank you for this opportunity to revieew your document. It was very comprehensive, and I wish you success with getting it approved and implemented so that the water resources of the Upper Snake Rock watershed can be improved and protected.
IDFG-16A	We have reviewed the [*Upper Snake Rock Watershed Management Plan*] outlining the current status of water quality and future water quality targets for the area covered by the Upper Snake Rock Subbasin Assessment (USRSA). Overall, your staff should be commended for the level of detail provided and the comprehensive information included within the document.
IDFG-16B	In summary, this assessment is one of the most comprehensive documents we've reviewed covering environmental issues and conditions along the Mid-Snake River.
USEPA-17	EPA agrees that the reductions in phosphorus which should result from the 1997 TMDL will lead to reductions in macrophyte beds and DO problems in areas with historic DO depleted sediment.
Prepared by IDEQ-TFRO.	

3. Public comments received by IDEQ-TFRO after the end of the Public Comment Period on December 3, 1999.

SOURCE	QUESTION / RESPONSE
IDFG-16A	*QUESTION*: 2.1.4.1 FISHERIES - White sturgeon and rainbow trout should be referenced as "introduced" above Shoshone Falls in Table 16 with no footnote. We also recommend the removal of blueback trout, golden trout, and Atlantic salmon from this table. These species have been introduced in the Snake Rive drainage but not in locations that would allow them to enter the USRSA boundaries. Yellow bullhead should also be removed from the table. Only one unsubstantiated report of a Yellow bullhead has been reported in Idaho.
	RESPONSE: We have made the appropriate changes in §2.1.4.1, Table 16, to reflect your comments.
IDFG-16B	*QUESTION*: P.61 - 4. VEGETATION FOR FISH PRODUCTION: We suggest you change this heading to include wildlife. Riparian vegetation is critical to wildlife for several reasons. Riparian areas provide security cover between patches or "islands" of habitat (migratory corridors), foraging areas, nesting habitat for a host of waterfowl along with migratory neotropic birds, and reproductive habitat for small mammals. Riparian areas are also important for larger mammalian species. During periods of extreme hot or cold temperatures within Idaho's high desert ecosystem wildlife use the microclimate created by riparian vegetation for thermo-regulation. By utilizing microclimates, big game reduce energy output necessary to maintain their core body temperature.
	RESPONSE: We have made the appropriate changes in p. 61, item 4, and have relabeled the title to read, VEGETATON FOR FISH AND WILDLIFE PRODUCTION. Additionally, we have added the remainder of your statements into the same item 4 to amplify the description of vegetation.
IDFG-16C	*QUESTION*: P.82-2.2.2.6, BENEFICIAL USE RECONNAISSANCE PROJECT DATA: As we have previously discussed with staff, limitations of BURP should be recognized. From a fisheries perspective, BURP samples an extremely small fraction of a watershed and at only one moment in time - usually during late summer. BURP does not take into account the seasonal importance of the various habitats or migratory requirements to the overall heath of the fish community.
	RESPONSE: IDEQ-TFRO respectfully has reviewed your comment and agrees with your assessment. We have made changes in §2.2.2.6 to reflect your suggestions.
IDFG-16D	*QUESTION*: P.109-RECENT DATA ON THE NORTHERN LEOPARD FROM (RANA PIPIENS): "FROM" needs to be changed to "FROG". Hybridization of Rana pipiens and a Northern leopard would probably have a significant impact on Idaho's recreational use of the river (sorry, Sonny).
	RESPONSE: IDEQ-TFRO respectfully submits that it has responded to this in Response 14A through our technical editor.
IDFG-16E	*QUESTION*: P.140-WATERFOWL: When discussing nutrient loading from waterfowl you should note that a large portion of the load attributed to waterfowl is materials re-suspended within the water column. As waterfowl forage on macroinvertebrates and aquatic vegetation, sediments and plant materials are disturbed and intrained within the water column. This should actually improve assimilation of the in-stream nutrients and sediment loads. We recommend you summarize comments on waterfowl by stating interactions between waterfowl and nutrient processing dynamics are not well understood or documented - to our knowledge. It is our position that input from wild waterfowl should be considered part of the "natural background load" for the USRSA. One problem we noted in your calculation is the assumption that the number of waterfowl within the USRSA is constant over the year. IDFG counts provided to DEQ staff were from our January mid-winter waterfowl counts. We inventory waterfowl along the Snake River annually during this timeframe because that's the peak of waterfowl migration along the U.S./Canada flyway into the Mid-Snake River area. Waterfowl from the flyway probably spend two months or less within the Mid-Snake Reach. Resident waterfowl population numbers are several magnitudes less than the January counts.
	RESPONSE: IDEQ-TFRO respectfully agrees with your suggestions and has incorporated them into Table 71 in §2.3.2.5.

IDFG-16F	*QUESTION*: P.153-3.0 TMDL TARGET, ANALYSIS AND ALLOCATION: When discussing Crystal Springs Lake it should be noted that up until the early 1980's, a significant number of wild rainbow trout utilized the base of the springs for spawning purposes. In about 1984, the discharge from Crystal Lake to the Snake River was re-built and the new discharge works became a barrier to fish movement out of the Snake River and into the lake. This barrier resulted in loss of the adfluvial spawning population.
	RESPONSE: IDEQ-TFRO submits that it has no information to disagree or disqualify IDFG's assessment of Crystal Springs Lake. We have therefore made the necessary modifications in §3.0.2.5 to reflect your comments.
IDFG-16G	*QUESTION*: P.157-3.1.01 SUSPENDED SEDIMENTS, LOAD CAPACITY, AND SUBSTRATE SEDIMENTS: If the goal is to re-establish coldwater salmon spawning within the various reaches, there needs to be a linkage between sediment goals and substrate condition. There are several methods for measuring cobble or substrate embeddedness that can be used. This should part of the monitoring plan in bodies of water designated with a support of "salmonid spawning". Technical personnel should identify suitable spawning and juvenile rearing locations, as part of your "additional data needs," to distinguish appropriate locations for monitoring.
	RESPONSE: IDEQ-TFRO respectfully agrees and has added your comments to §2.2.5 (p.122) as part of the list of data gaps that still exist in the subbasin.
IDFG-16H	*QUESTION*: [*P.157, 3.1.01*] As stated at the end of this section, there is a link between sediment transport, fish and macroinvertebrate habitat suitability, and flow. This appears justification enough to address flow in the TMDL.
	RESPONSE: IDEQ-TFRO respectfully submits that it has responded to the flow issue in Response 9E: "IDEQ-TFRO respectfully states that the position it has taken on habitat modification and flow alteration is a policy decision statewide. It has also been accepted by USEPA. Be aware that in the new TMDL regulations that are out for public comment, USEPA has defined habitat modification and flow alteration as 'pollution' items instead of 'pollutant.' However, these new TMDL regulations have not been promulgated as regulations yet."
IDFG-16 I-(1)	*QUESTION*: [*P.157, 3.1.01*] We also are concerned about your TSS goal of 52 mg/l. The upstream Walcott Subbasin Assessment set their TSS goal at 25 mg/l which is well supported by most biological literature. What is the justification for more than doubling the upstream target?

	RESPONSE A: IDEQ-TFRO respectfully submits that IDFG has incorrectly assessed IDEQ-TFRO's use of the 25 mg/L and 52 mg/L instream TSS targets. First, the scenario of "doubling the upstream target" on the Middle Snake River is non-existent and irrelevant to IDEQ's process of subbasin assessment. No doubling of the instream target has occured nor has IDEQ-TFRO acted capriciously or arbitrarily in this. The 50-52 mg/L TSS instream target has essentially become an IDEQ policy for averaging to cover beneficial uses (cold water biota and salmonid spawning under IDAPA 16.01.02.051.01). Justification for this is in CH2MHILL 1998 report which states on p. 12, "Based on the EIFAC (1965) suggested standards, an appropriate target concentration for protecting fish from excessive suspended sediment might be anywhere from 25 to 80 mg/L. The associated effect at this range of concentration is described as a 'slight effect on production'." IDEQ-TFRO feels that the 52 mg/L instream target satisfies the "appropriate target concentration" for meeting beneficial uses of cold water biota and salmonid spawning for sediment. Additional justification may be found in the 1972 report from the Committee on Water Quality Criteria (CWQC 1973) from the National Academy of Sciences (EPA-R3-73-003), the European Inland Fisheries Advisory Commission (EIFACE 1965) report on working party on water quality criteria on finely divided soils and inland fisheries, and CP Newcombe *et al.* 1996 journal article in the North American Journal of Fisheries Management (16:693-727) on channel suspended sediment and fisheries. USEPA has couched the EIFAC 1965 fisheries report by saying: Although "there is no evidence that concentrations of suspended solids less than 25 mg/L have any harmful effects on fisheries, it should usually be possible to maintain good or moderate fisheries in waters that normally contain 25 to 80 mg/L suspended solids; other factors being equal, however, the yield of fish from such waters might be somewhat lower than from those in the preceding category" (USEPA 1972 [p 128]). From this we may conclude that a good to moderate level of protection of fisheries is protective of existing beneficial uses for cold water biota and salmonid spawning because suspended sediment will act directly on fish swimming in water by no longer killing them or reducing their growth rate and resistance to disease substantially; by no longer substantially preventing the successful development of fish eggs and larvae; by no longer substantially modifying natural movements and migrations of fish; by no longer substantially reducing the food available to fish; and, by no longer substantially affecting efficiency in catching the fish.
IDFG-16 I-(2)	***RESPONSE B***: IDEQ-TFRO respectfully submits that IDFG has incorrectly assessed IDEQ-TFRO's use of the 25 mg/L and 52 mg/L instream TSS targets. Second, the Lake Walcott subbasin and the Upper Snake Rock subbasin are two different and distinct subbasins that have certain similarities but major differences. To suggest that one instream target in one subbasin is applicable in another applies an assumption of similarity to subbasins that is not legally or scientifically defendable. In particular is the flow management of the Snake River in both these reaches. The Lake Walcott reach has an estimate 95% reservoir-like conditons whereas the Middle Snake River has an estimate 26%. Additionally, the historical operation of the Middle Snake River reach has shown periods of drying to meet irrigation water rights. The 200 cfs minimum discharge from the Milner Pool into the Middle Snake River is a cooperative agreement when water flow is available above the demand for irrigation water rights. If it is not available due to drought conditions, then the potential for drying up the upper stretch of the Middle Snake River will occur. Compare this to the Lake Walcott reach which historically has never been dried to meet irrigation water rights. In fact, during times of drought conditions when the Middle Snake River may be dry, the Milner Pool still receives 5,000 - 10,000 cfs to answer irrigation water rights. From this we may conclude that irrigation management of both systems are different and unique.

IDFG-16 I-(3)	*RESPONSE C*: IDEQ-TFRO respectfully submits that IDFG has incorrectly assessed IDEQ-TFRO's use of the 25 mg/L and 52 mg/L instream TSS targets. And third, the Lake Walcott reach has historical TSS values that average 18.5 mg/L (overall reach average): American Falls Dam discharges a TSS average of 19.0 mg/L (with a range of 1 - 156.0 mg/L); Upper Milner Pool (above Burley) averages 10.3 mg/L (with a range of 1 - 147.0 mg/L); and, Lower Milner Pool (below Burley) averages 14.7 mg/L (with a range of 1 - 49.0 mg/L). The instream TSS decreases on an average basis from 19.0 mg/L (at American Falls Dam) to 14.7 mg/L (at Lower Milner Pool). On the other hand, the Middle Snake River has a historical TSS value that averages 21.1 mg/L (overall reach average): Milner Dam discharges an average of 16.3 mg/L (with a range of 1.0 - 49.0 mg/L) and King Hill averages 26.1 mg/L (with a range of 1.0 - 175.0 mg/L). The instream TSS increases on an average from 16.3 mg/L (at Milner Dam) to 26.1 mg/L (at King Hill). From this we may conclude that suspended sediment functions uniquely and differently in both reaches: one decreases while the other increases. To say that these overall reach averages are justification for using an instream criteria that is < 25 mg/L is scientifically unsound and legal indefensible. Thus, the use of the 25 mg/L TSS average monthly limit in the Lake Walcott reach is an "appropriate target concentration" based on actual that provides a moderate-to-high level of fisheries protection (none-to-slight effect on production) from excessive suspended sediment. Within the same subbasin the use of the 52 mg/L average monthly limit for Rock Creek in Power County is an "appropriate target concentration" because it is a different and unique system when compared to the larger Snake River system. Within the Upper Snake Rock subbasin, the use of the 52 mg/L TSS average monthly limit in the Middle Snake River reach is an "appropriate target concentration" that provides a moderate-to-high level of fisheries protection (none-to-slight effect on production) from excessive suspended sediment. The 25 mg/L target is inappropriate because it does not fully describe the subbasin and the current existing management conditions of the river system and its tributaries. Therefore, the 52 mg/L instream target is for the Middle Snake River, all natural tribuaries, and to manmade waterways that discharge to natural tributaries at their point of discharge. Thus, the concern of accumulative impacts is also answered in the instream water quality target which the TMDL makes applicable to all waterbodies within the subbasin.
IDFG-16J	*QUESTION*: The table on page 158 is somewhat confusing. Why are the tons/year so much higher for the 52 mg/l TSS target than "Estimated Existing TSS Conditions?" This table needs additional explanation.
	RESPONSE: IDEQ-TFRO respectfully submits that its has answered this in Response 2A.
IDFG-16K	*QUESTION*: P.161-3.1.02 TOTAL PHOSPHORUS (TP): The target of 0.10 mg/l TP for tributaries doesn't appear consistent with the Snake River goal of 0.075 mg/l TP. If tributary inputs are greater than the Snake River water quality target, how will the 0.075mg/l TP goal at Gridley Bridge ever be achieved? This issue needs additional justification or the tributary target needs to be adjusted downward.

	RESPONSE: IDEQ-TFRO respectfully submits that it has explained on a number of occasions the logic and approach for using the 0.100 mg/L TP instream target for tributaries versus the 0.075 mg/L TP instream target for the Middle Snake River to the Mid-Snake TAC, of which both IDFG and USEPA have been a party. We also provide this logic within the Mid-Snake TMDL (by reference) and within the Upper Snake Rock TMDL. We shall reiterate it again and shall include the following specific language in §3.5 under the subsection called Total Phosphorus. (1) The Mid-Snake TMDL's water quality target of 0.075 mg/L was established from RBM10 Model simulations using the flow data from 1930-1939 which represented the lowest flow years on the hydrologic record. Model simulation results gave a value of 0.0728 mg/L at Gridley Bridge, thus the Mid-Snake WAG agreed to a target of 0.075 mg/L for the Middle Snake River for meeting beneficial uses to control excess nuisance aquatic plant growth (which does not mean that 100% of the macrophytes will be reduced). This was the initial startup target over a 10-year period with the provision that if beneficial uses were not met, then TP reductions would be more stringently refined. (2) The Middle Snake River has an estimated 26% reservoir-like water; the remaining 74% being riverine-like. However, because of flow management the Middle Snake River has altered streamflow dynamics. The Middle Snake River has 5 reservoirs which are often confused as true reservoirs and lakes. In fact, they are not. According to the State of Idaho's (IDEQ's) 1998 BURP Lake and Reservoir Workplan [p 8] waterbodies that have a residence time > 14 days are candidates for using lake and reservoir BURP. The reservoirs of Bliss, Lower Salmon Falls, Upper Salmon Falls, Shoshone Falls, and Twin Falls all have residence times < 14 days and are operated as "run-of-the-river" by Idaho Power Company (IPC). Milner Dam is operated as an irrigation diversion and its reservoir is in the Lake Walcott reach and being addressed by the Lake Walcott TMDL. As defined by IPC, "run-of-the-river means that the volume of inflow to the reservoir is equal to the volume of outflow within a 24 hour period." Therefore applying water quality criteria that is applicable to lakes or reservoirs is not applicable to the Middle Snake River reservoirs. (3) The Gold Book "standard" (USEPA Quality Criteria for Water 1986) has the following criteria for TP (as "phosphate phosphorus") to prevent the development of biological nuisances and to control accelerated or cultural eutrophication: TP should not exceed 0.050 mg/L "in any stream at the point where it enters any lake or reservoir;" nor 0.025 mg/L "within the lake or reservoir;" and, "a desired goal for the prevention of plant nuisances in streams or other flowing waters not discharging directly to lakes or impoundments" of 0.100 mg/L. <u>CONCLUSION</u>: The water quality target of 0.075 mg/L TP is specific to the Middle Snake River, and under the Mid-Snake TMDL has a compliance point at Gridley Bridge. This compliance point is now superceded by the Upper Snake Rock TMDL such that the entire stretch from Milner Dam to King Hill is the compliance point. Since 74% of the Middle Snake River is riverine-like, and since its reservoirs are currently and historically operated as "run-of-the-river," the entire system may be considered "like a managed river." Application of the 0.100 mg/L is not applicable to the Middle Snake River since it was decided that 0.075 mg/L TP was applicable. However, the 0.075 mg/L TP instream target was never meant as a carryover to its tributaries. Therefore, the application of the 0.100 mg/L TP as an instream target for other tributaries is appropriate and reasonable at this time, and will meet beneficial uses to control excess nuisance aquatic plant growth. This is the initial startup target that will be used for all natural tributaries over a 10-year period with the provision that if beneficial uses are not met, then TP reductions will be more stringently refined. Manmade waterways that discharge to natural waterways shall meet the same instream target of 0.100 mg/L at the point where they discharge to the natural tributary.
IDFG-16L	*QUESTION*: The logic used for the 0.10 mg/l target appears to ignore cumulative effects of the tributaries. When you look at cumulative effects and review the dialogue from lines 24 and 25 which states, "total phosphorus should not exceed 0.05 mg/l TP in streams where it enters a lake or reservoir to prevent the development of biological nuisances and to control accelerated or cultural eutrophication," it appears there is justification for a lower target. Considering the number of reservoirs and manipulation of flow in the Snake River through the USRSA area, a strong case could be made for the 0.05 mg/l TP standard to apply on tributaries.

	RESPONSE: IDEQ-TFRO respectfully submits that accumulative effects by the triburaries is accounted for in the loading analysis that has been included in §3.5 under the subsection called Total Phosphorus. TP loads account for accumulative effects but TP concentrations do not. For this reason the worst case scenario (low flow conditions) was considered so as to minimize the accumulative impacts from tributaries on the Middle Snake River.
IDFG-16M	*QUESTION*: Page 164 - Line 20: This should read "Idaho Dept. of Lands" - not Idaho Bureau of Lands.
	RESPONSE: IDEQ-TFRO respectfully submits that it has responded to this in Response 14A through our technical editor.
IDFG-16N	*QUESTION*: Page 164 - 3.1.04 UNIONIZED AMMONIA: There are extensive literature citations presented on page 94 which indicate coldwater salmonids are impacted by unionized NH3 levels well below your target standards. Why isn't the NH3 target based on page 94 biological literature? Unionized ammonia has impacted native fish within the Subbasin, particularly in the winter when flow is low and cold water temperatures reduce the river's ability to assimilate NH3. This section also needs discussion on acute toxicity as it relates to prolonged exposure to low levels of NH3. We would like to see winter data for streams such as Deep Creek that have a number of nonpoint sources for NH3 and low flow.
	RESPONSE: IDEQ-TFRO respectfully disagrees with IDFG's misuse of Table 44. The intent was to provide the reader with an understanding that various fisheries scientists not only disagree, but have various means of interpreting the impact on coldwater salmonids by un-ionized ammonia within a range of 0.012 - 3.764 mg/L. This gave IDEQ-TFRO the opportunity to make the argument that USEPA's suggested Blue Book criteria (0.020 mg/L) for un-ionized ammonia should be used. Since the 0.020 mg/L un-ionized ammonia criteria is similar to IDAPA 16.01.02.250.02.c.iii for cold water biota as well as IDAPA 16.01.02.250.02.d.iii for salmonid spawning, use of the target is appropriate for the Upper Snake Rock subbasin. The suggestion of incorporating a discussion on acute toxicity as it relates to prolonged exposure to low levels of NH3 during the winter months (November - February) is irrelevant to tributaries since Table 55 (p.119) demonstrates that with the exception of one stream, all exceedences did not occur during the winter months. Clover Creek showed an exceedence on February 12, 1997. However, if your suggestion goes to levels that are < 0.020 mg/L un-ionized ammonia, then we respectfully submit that IDEQ-TFRO cannot overstep its statutory authority beyond what is written in the State water quality standards (IDAPA 16.01.02). Additionally, if IDFG has any scientific information that specifically demonstrates that prolonged exposure to levels of un-ionized ammonia < 0.020 mg/L within the Upper Snake Rock subbasin are toxic to any fisheries of the subbasin, then we request the submission of such information so IDEQ-TFRO can make the case that the current criteria in the regulations is not sufficiently protective year round.
IDFG-16O	*QUESTION*: Page 184 - 3.4 MARGIN OF SAFETY (MOS) AND THE LOAD CAPACITY: Allowing a daily maximum value of 80 mg/l TSS is not an acceptable margin of safety. The 80 mg/l value, as presented in the table on page 185 falls within the "poor" category for supporting beneficial use designations. When setting targets and the margin of safety, you need to take into account that biological communities do not live under average conditions. In the case of fish communities across Southern Idaho, populations respond to the worst case scenarios. Once lethal limits are exceeded, averaging data values are meaningless. Logic would dictate that for beneficial uses to show a positive trend, water quality limits within the USRWA area, including the MOS and maximum instantaneous loads, need to error on the conservative side.
	RESPONSE: IDEQ-TFRO respectfully submits that 80 mg/L TSS is not in the "poor" category. Rather, it may be interpreted as the upper range boundary of a "good" category. IDEQ-TFRO also respectfully submmits that the MOS for TSS as defined in §3.4 is correctly interpreted since the lower limit of Significantly Reduced falls in the >80 but <= 400 mg/L TSS range. Values <= 80 mg/L. This appears to describe what is in the source documents (see Response 16 I-(1)). IDEQ-TFRO will modify the list on page 185 to reflect this change. Additionally, IDEQ-TFRO submits that the 52-80 mg/L TSS range accounts for average conditions. This condition is an accounting methodology IDEQ-TFRO uses to account for loads and discharge limits. A worst case scenario was used with low flow conditions.

IDFG-16P	*QUESTION*: Page 207 - 3.6.03 TREND MONITORING PLAN: If salmonid spawning and support of coldwater biota is the beneficial use designated, then shouldn't sampling of fish populations be part of the trend monitoring program?
	RESPONSE: IDEQ-TFRO respectfully agrees and will add your suggestion to §2.2.5. During the implementation phase, a discussion by the Mid-Snake TAC will provide an opportunity for technical specialists to finalize any additional data gap concerns that have resulted from the public comment period.
IDFG-16Q	*QUESTION*: Page 209 - 3.6.04 LEGAL AUTHORITIES THAT DEFEND CONTROL AND MANAGEMENT ACTIONS: We recommend you expand this table to recognize other agencies with management authority over resources involved in this process. IDFG has sole management authority in the State of Idaho over all fish and wildlife. This is mandated in Idaho Code §36-103.
	RESPONSE: IDEQ-TFRO respectfully disagrees with IDFG's interpretation of Table 109. The table was meant to describe only those agencies that have jurisdiction in land management concerns. The use of the term management actions is in reference to BMPs. As described in the paragraph before Table 109: "BMPs are supported and encouraged by IDEQ according to the recognized land management agencies that provide guidance and technical assistance as summarized in Table 109." IDFG's has management authority over fish and wildlife, but none over habitat needed to support sustainable populations or the development of BMPs that are directed at land management issues.
IDFG-16R	*QUESTION*: It does, however, appear that target values for TSS, TP, and NH3 are set too high to allow recovery of water quality and beneficial uses within a reasonable amount of time. We recommend you again review pertinent literature for the above pollutants and re-evaluate targets for each.
	RESPONSE: IDEQ-TFRO respectfully submits that it has responded to TSS in Responses 16 I-(1), 16 I-(2), and 16 I-(3); to TP in Response 16K; and, NH3 in Response 16N.
USEPA-17A	*QUESTION*: Instream Water Quality Targets – 3.1; 3.1.01 Suspended Sediments, Load Capacity, and Substrate Sediments. TMDLs are required to be established at levels which meet water quality standards, including full support of beneficial uses, and achieving all applicable water quality criteria for those uses. The Snake River segments and tributaries evaluated in your document are not fully supporting their designated cold water biota and salmonid spawning uses. Our concerns with the proposed target for sediment are as follows: while the TSS target may be sufficient to provide protection for cold water biota (see below), it may not necessarily protect salmonid spawning, which is affected both by substrate conditions and water column conditions; the TMDL must provide assurance that <u>all</u> affected uses will be protected by the established target; the TMDL does not clearly link the cause of impairment of salmonid spawning to the instream target nor beneficial use support—The TMDL is incomplete without such a linkage; and, how will the TSS target ensure that substrate conditions will improve such that they are conducive to salmonid spawning, for example interstitial spaces in gravels are not clogged, intergravel dissolved oxygen meets standards, etc.?
	RESPONSE: IDEQ-TFRO respectfully submits that only IDEQ can statutorily interpret the State's water quality standards for meeting beneficial uses for cold water biota and salmonid spawning, not USEPA. We respectfully refer you to Responses 2F, 3G, 16 I-(1), 16 I-(2), and 16 I-(3) and stand by these responses. IDEQ-TFROi has included substrate targets as part of §2.2.5, Data Gaps, and will discuss the issue with the Mid-Snake TAC after TMDL acceptance.

USEPA-17B	***QUESTION***: EPA recommends IDEQ establish a substrate sediments target for both the Middle Snake segments and listed tributaries, all of which are designated for salmonid spawning. For example, IDEQ's draft *Sediment Targets Used or Proposed for TMDLS* (Rowe, Essig, and Fitzgerald, 1999) describes a target for embeddedness: subsurface sediment of <0.85mm should not exceed 10%. Such a target could be an interim target to be used until more data can be collected to link TSS loads to substrate conditions and until we all have a better understanding of how salmonid spawning is affected by substrate and TSS in this system. In the interim, load allocations could be based on the TSS target, since we are not aware of any means to establish a quantitative link between TSS and substrate conditions. The substrate would need to be monitored periodically at selected locations to ensure that the TSS reductions were resulting in the substrate sediment target being met. Such monitoring sites could be potential salmonid spawning habitat and sturgeon, whitefish and other coldwater biota rearing habitat.
	RESPONSE: IDEQ-TFRO respectfully submits that only IDEQ can statutorily interpret the State's water quality standards for meeting beneficial uses for cold water biota and salmonid spawning, not USEPA. We have fully documented all sources that provide substrate sediment data as well as provided the public and USEPA with overwhelming reasons for not providing targets at this time. We respectfully refer you to Responses 3J, 3M, 9M, and 16G and stand by these responses. Additionally, to use a 10% interim target for embeddedness without substantiating scientific and corroborative data specific for the Middle Snake River would open a legal avenue that IDEQ-TFRO (and we asssume USEPA) is ill prepared to defend. We respectfully refer you to the cited draft document (Rowe *et al.* 1999) which states: "These targets or surrogate measures are site-specific and are not enforceable." We respectfully refer you again to §3.1.1, subsection Substrate Sediments, and reiterate: "Therefore, IDEQ-TFRO is not prepared at this time to propose substrate targets for the Middle Snake River or its tributaries because of the managed condition of the river system; the nature of the input sediments; the lack of appropriate substrate sediment research information; and, because IDEQ-TFRO strongly believes that suspended sediment (as TSS) is an appropriate surrogate for substrate sediment reduction. However, IDEQ-TFRO will continue to actively assess and evaluate current and any additional data that defines substrate sediments and will consider a joint-study with USEPA and USFWS so that this issue can be resolved over the next 5 years." We submit that the cited draft document (Rowe *et al.* 1999) supports and enhances IDEQ-TFRO's premise: "Nothing precludes the establishment of site-specific targets ***if enough information is available***." IDEQ-TFRO has assessed that insufficient information exists at this time, and provides substantial information and evidence that TSS is an appropriate surrogate measure on the Middle Snake River for substrate sediment. Within the same cited draft document a recommendation (which is exactly the same as proposed in the Upper Snake Rock TMDL) proposes TSS since "we cannot recommend a specific target for embeddedness of streambed cobble by surface fines." This goes against USEPA's suggestion of subsurface sediment of <0.85mm should not exceed 10% (as a target for embeddedness). Targets <10% are not scientifically descriptive of flow managed systems (such as the Middle Snake River) and provide the basis for legal redress by any water user industry. See Response 17A.
USEPA-17C	***QUESTION***: The rationale for including a substrate target includes evidence in the Subbasin Assessment for the Upper Snake Rock (pages 32 and 36) that salmonid spawning uses are not being met, and that one of reason for this is substrate sediment (see the draft *Ecological Risk Assessment for the Middle Snake River, Idaho*, (EPA, 1999), including Hill (1991), pages 45, 85). This document also discusses negative impacts of sediment accumulation on the cold water biota macroinvertebrate community (pages 88, and 89). Another reference that supports use of a substrate target is *Characteristics of Fish Assemblages and Related Environmental Variables for Streams of the Upper Snake River Basin, Idaho and Western Wyoming, 1993-95* (USGS report 97-4087 by Terry R. Maret).

	RESPONSE: IDEQ-TFRO respectfully refers you to Responses 9M, 17A, and 17B as sufficient response to this question. However, USEPA's use of Maret's reference requires clarification. USEPA misuses the reference as "another reference that supports use of a substrate target." This is scientifically incorrect. Maret provides the purpose of the study: to "provide a framework for developing indices of biotic integrity by using fish assemblages to evaluate water quality of streams in the upper Snake River Basin" [p 1]. IDEQ-TFRO agrees with Maret and supports a multivariate analytical process as an effective mechanism "for identifying similarities among sites with respect to various physical, chemical, and biological characteristics and for depicting relations between assemblage patterns and environmental gradients" [p 2]. Substrate size, % embeddedness, and % substrate fines were 3 of 24 environmental variables evaluated for 30 stream sites on the Snake River. From this, only 8 environmental variables were selected for canonical correspondence analysis: watershed size, % forest land, elevation, % agricultural land, % substrate fines, specific conductance, discharge coefficient of variation, and velocity [p 14]. Table 5 [p 22] of the study shows PCA 3 as relating % substrate fines to % agricultural lands, % embeddedness, sinuosity, specific conductance, and inversely to substrate size. To make the assertion that from these multimetric relations Maret supports use of a specific substrate target in the Middle Snake River is a misrepresentation of Maret's work. A phone call to Maret verified that no where in his study is there any indication or insinuation of a single substrate target for the Middle Snake River without consideration of the multimetric approach. Our review (as found in §3.1.1, subsection Substrate Sediments) of Maret's study (referenced as 1993-1995 USGS Study) correctly states that "the substrate character of sediment inputs [*from tributaries*] is similar to the substrate character of the river." To infer anything else beyond this without consideration of the multimetric relationships does injustice to his study.
USEPA-17D	*QUESTION*: Additional concerns about TSS as an instream target to improve water quality conditions: (1) IDEQ data that show TSS concentrations in the Snake River are generally well below the proposed target indicate that a different target is needed to ensure conditions do not get worse; (2) We are familiar with the basis for suggesting that 50 and 80 mg/L TSS are protective, however, Miller's (1998) survey of the literature indicated that some studies found adverse effects on both salmonids and non-salmonid at TSS concentrations below 50 and 80 mg/l TSS: and (3) We believe IDEQ should commit to evaluating new data on TSS effects on biota, particularly sensitive life stages and species in the Mid-Snake watershed, as it becomes available, and commit to modify the targets and allocations if new information suggests they are not protective.
	RESPONSE: IDEQ-TFRO respectfully refers you to Responses 9M, 17A, 17B, and 17D as sufficient response to this question. IDEQ-TFRO respectfully reiterates its position on the evaluation of new data as described in Response 17B: "IDEQ-TFRO will continue to actively assess and evaluate current and any additional data that defines substrate sediments and will consider a joint-study with USEPA and USFWS so that this issue can be resolved over the next 5 years."
USEPA-17E	*QUESTION*: The differences shown between the existing conditions (see also pages 26-28 of the TSD) where TSS concentrations are 14.6 mg/L to 15.2 mg/L in low flow in the Mid-Snake and target conditions where TSS would be 52 mg/L during low flow is a remarkable 256% increase in TSS (when converted to loads), not a 71.9% reduction in TSS as stated on line 34, page 158. During mean flow, it would be an increase of 216%, and during high flow, TSS would be allowed to increase by 168% using a target concentration of 52 mg/L for the Snake River segments. In light of the existing sediment impairment, the increased loading of TSS this TMDL would allow does not appear to lead to attainment of water quality standards.
	RESPONSE: IDEQ-TFRO respectfully refers you to Response 2A as sufficient response to this question.
USEPA-17F	*QUESTION*: TSS of 52mg/L may support a "good fishery (EIFAC 1964; NAS/NAE 1973)," and a "regional comparison for a high level of protection for cold water biota (IDHW 1991a [p 13])," but EPA questions whether it is a "valid interpretation of Idaho's narrative sediment criteria for the Middle Snake River (Section 3.1.01)." IDEQ points out that TSS concentrations in the river have been consistently around 20 mg/L (page 67 of the TSD) over the years, and only exceed 52 mg/L under high flow conditions from the Box Canyon segment downstream. Yet the river is listed as impaired because of sediment and does not meet the salmonid spawning and coldwater biota uses. Both EPA's draft *Ecological Risk Assessment for the Middle Snake River, Idaho* and Maret's paper describe depressed aquatic communities. A more conservative target appears to be necessary in order to meet water quality standards.

	RESPONSE: IDEQ-TFRO respectfully submits that USEPA has no statutory authority for interpretation of Idaho's narrative standard for sediment criteria on the Middle Snake River or its tributaries. IDEQ-TFRO stands by its interpretation of Idaho's narrative sediment criteria for the Middle Snake River (Section 3.1.01). The issue of a "more conservative target" (which IDEQ-TFRO has translated as meaning a value < 25) is appropriately described in Responses 16 I-(1), 16 I-(2), and 16 I-(3).
USEPA-17G	*QUESTION*: TSS Load Capacity. A fundamental requirement of the CWA is that a TMDL "be established to implement the applicable water quality standards with seasonal variations", and TMDLS "shall take into account critical conditions for stream flow, loading and water quality parameters". Our concerns about your load capacity are as follows: (1) in the case of TSS, the low flow periods may be a critical condition for loading (ie. the lowest load capacity), but data indicate that they are not the most critical condition with regards to TSS concentrations; (2) evidence presented suggests that TSS concentrations are highest in the spring months (3, 4 and 5), during highest flows for the Middle Snake and prior to the irrigation season; and, (3) we suggest load capacity should be established to address critical conditions of both loading (low flow) and TSS concentrations. Critical spring time conditions will likely require higher percent reductions in sediment loading in order to meet the 52/80 targets.
	RESPONSE: IDEQ-TFRO respectfully submits that the instream TSS water quality target presupposes atttainment of beneficial uses under low, average, and high flow conditions for an average monthly limit of 52 mg/L with maximum daily limit of 80 mg/L. Thus, the load capacity is based on an instream target which translates into various load limits as a consequence of flow variability. This means that the instream target is applicable to all flow conditions that might arise in the Middle Snake River or its tributaries. However, there are certain conditons (addressed in Responses 4A for high flows and 7Z for shoreline erosion) which we have addressed that afford protection of the water quality (in §3.5.1) under the antidegradation policy. IDEQ-TFRO respectfully submits that it stands by its TSS load capacity based on the instream TSS water quality target.
USEPA-17H	*QUESTION*: While load capacity was established for baseline years of 1990-1991 for the 1997 TMDL for phosphorus, IDEQ presents compelling reasons in this document to establish load capacity for TSS on spring time conditions of high flow and high TSS. Line 38-39 page 158 describe the TSS worse case scenario for the Snake River, and page 9 of the TSD show average monthly TSS concentrations for spring months as the highest for the year. Using 1990-1991 as an estimate of "baseline" river conditions on which we want to improve underestimates the extent of TSS problems in the river.
	RESPONSE: IDEQ-TFRO respectfully submits that it has responded to this in Response 17G. We also call your attention to Response 2A.
USEPA-17I	*QUESTION*: 3.5 TSS Load Allocation and Assessment. An explanation of the table headings is needed, and EPA could not find an explanation in either Section 3 or the TSD of how the percent land use used for the stream corridor approach were translated into loads used in the "Baseline" and WY2004 LA and WY2009 LA columns. Please explain.
	RESPONSE: IDEQ-TFRO respectfully submits that the table headings are self explanatory. However, since this is still difficult for USEPA to understand, we have added the suggested language in §3.5, preliminary paragraph. All tables in §3.5 are complex and already difficult for the public to grasp. Suggested language within each table will not be added. Relative to the stream corridor approach model, the process of load allocation for nonpoint sources is self-explanatory and found with the main document and in the technical support document. However, since this is still difficult for USEPA for understand, we have added additional language in §3.0.2 that describes exhaustively the process step-by-step.
USEPA-17J	*QUESTION*: Tables for each segment should clearly show the target, the load capacity for the segment, the percent reduction in load (or TSS concentration), and the estimated TSS achieved from the load allocations, if not for each point source and nonpoint source point of confluence with the Snake River, then below the Total (A+B+C+D) row. This will show that targets are designed to be met by the allocations assigned.
	RESPONSE: IDEQ-TFRO respectfully agrees and will provide each pertinent table in §3.5 with the following added language that describes the overall total for: Startup Load for the WY1990-1991 baseline, Load Capacity for the WY2004 and WY2009, and an Overall %Reduction.

USEPA-17K	*QUESTION*: It should be clarified that the tables under each Snake River segment discussion also include the TMDLs for TSS for the listed tributaries that require TMDLs. Again, the target, load capacity, estimated TSS in the tributary or canal achieved from load allocations should be provided in the tables for these tributaries.
	RESPONSE: IDEQ-TFRO respectfully submits that each table already describes these additional TMDLs per tributary (both listed and not listed on the 303(d) list). However, we will provide language in §3.5, preliminary paragraph, that describes this suggestion.
USEPA-17L	*QUESTION*: 3.5.01 Explanation is needed in Table 99 that the background baseline load and allocations include the food processors above Milner dam, as a reminder of statements to this effect in 3.2.02.
	RESPONSE: IDEQ-TFRO respectfully agrees and will provide the suggested language in §3.5.1 that reflects statements in §3.2.2.
USEPA-17M	*QUESTION*: Pages 54-62 of the Technical Support Document. Unique accounting of input sources includes considering some fish hatcheries to be point sources while others are counted under spring sources. Some of those counted under point sources are fed from springs. Please clarify the distinction.
	RESPONSE: IDEQ-TFRO respectfully submits that it is accommodating USEPA's request (verbally discussed with USEPA officials during the drafting of the General Aquaculture Permit) for inventoring aquaculture facilities in the TMDL, as well as satisfying the definition of a TMDL by stream segment. In the Upper Snake Rock subbasin, waterbodies have been defined as spring fed and surface waterbodies (natural and manmade) and IDEQ-TFRO feels that it is answering the intent of the regulations as well as accommodating USEPA's informal request.
USEPA-17N	*QUESTION*: Pages 55-59 of the Technical Support Document. The negative "unaccounted" flows shown and described (i.e., when the gain in the Snake River segment minus known springs, known surface flows, and point source flows is negative) are most likely the errors in measuring and time of measuring the flows on the various inputs rather than reflective of the need to measure the unknown springs. This negative flow is best used as part of the margin of safety, rather than used to subtract TSS load from those segments with negative flows.
	RESPONSE: IDEQ-TFRO respectfully submits that it has answered this question in Responses 7X and 7Z. IDEQ-TFRO respectfully supports its MOS as described in §3.4. To use the MOS to account for negative flows by subtracting TSS load from those segments with negative flows incurs an additional assumption to a load estimate that has 4 broad assumptions defined already in Appendix D, §VII.
USEPA-17O	*QUESTION*: 3.5.02 The Crystal Springs and Lake baseline load is different than the load estimate on page 153 of the SBA (122.5 tons/year plus 10% of load from Crystal Springs FH) for this complex.
	RESPONSE: IDEQ-TFRO respectfully submits that USEPA has misinterpreted the baseline load versus the load estimate, but recognizes that this spring is complex in interpretation. The Crystal Springs FH natural background for TSS is only for the fish hatchery influent water from the Crystal Springs source: 207.6 cfs (1991-1997 average) x 0.6 mg/L TSS x 5.39 x 0.1825 = 122.5 tons/year. Crystal Springs Lake has an additional spring source that bubbles from the lake bottom: 50.0 cfs (estimate from Crystal Springs FH) x 1.3 mg/L (estimate used in TMDL for spring sources) x 5.39 x 0.1825 = 63.9 tons/year. The sum of both the TSS load from the Crystal Springs FH influent water (122.5 tons/year) plus the Crystal Springs Lake TSS load (63.9 tons/year) gives a total natural background load (122.5 tons/year + 63.9 tons/year = 186.4 tons/year) for Crystal Springs + Crystal Springs Lake. The Crystal Springs FH on the other hand has a TSS load is based on what is discharged from the hatchery to the river system: 199.61 cfs (1990-1991 effluent discharge average) x 4.8 mg/L TSS (average TSS concentration) x 5.39 x 0.1825 = 942.5 tons/year. These values are well represented in §3.0.2.5 (Crystal Springs FH natural background [*not total natural background*] and in Appendix D, Segment 2 (Crystal Springs Lake [*which is mislabeled but has been modified*] and Crystal Springs FH [*effluent discharge to the Middle Snake River*]).

USEPA-17P	*QUESTION*: 3.4 Margin of Safety and the Load Capacity. The explanation of the margin of safety that was provided for the TSS TMDL is unclear. The first implicit conservative assumption does not explain how the flow used in determining loads or allocations (1990-1991 average flow) provides for a margin of safety. The second assumption about the conservative nature of the target may be adding a margin of safety to the load allocations for tributaries since they are well above the target, bust see also our comments on TSS targets. Since the Snake River segments have TSS levels well below the target, the use of the 52/80 mg/L TSS target does not provide for a MOS. The third assumption is confusing since the loads and load allocations for aquaculture facilities were based on current discharges of 2 mg/L TSS (from conversations with industry, page 104 of the TSD). The assumption mentions that the "targets" used were based on permit requirements = 5 mg/L, the average monthly limit. We do not understand how this is a MOS, since 2 mg/L reflects reality.
	RESPONSE: IDEQ-TFRO respectfully reiterates again that the MOS is based on implicit conservative assumptions that are incorporated in the TMDL target or load capacity. Therefore: (1) One of those assumptions is flow. The design flow was based on low flow conditions and is applicable to all flow conditions in a similar scenario as a 7Q10 flow. An actual low flow hydrograph was used (as discussed in item 1 of §3.4) to provide seasonal and daily variability which incorporates an implicit MOS. We have added this language to the section to amplify the explanation. (2) IDEQ-TFRO has responded in Responses 16 I-(1), 16 I-(2), and 16 I-(3) and therefore submits that the 52/80 mg/L TSS target does have a MOS as described in the document. (3) The use of the 2/5 mg/L TSS relationship was discussed with USEPA personnel long before the public comment period and was supported as "the way to go with aquaculture facilities." We reiterate again: 5 mg/L is the legal permit limit. This is the target. The 2 mg/L is what is supposedly accomplishable by the industry. We are not certain this is true. We do know that a great majority of the reportable values in the DMRs are < 4 mg/L (due to the MDL). Therefore, 3 mg/L is the MOS. As discussed with USEPA officials, we anticipate that the 2 mg/L TSS limit will eventually be converted into a permit limit (versus the 5 mg/L) to answer USFWS concerns with organic sediments. We selected the average monthly limit (5 mg/L) because it was lower than the maximum daily limit.
USEPA-17Q	*QUESTION*: Total Phosphorus –3.1.02. (1) rationale for a target of 0.10 mg/L TP for the tributaries is deficient, and (2) tributary TMDLs lack WLAs and LA for sources, as well as load capacities. The rationale for a target of 0.10 mg/L TP for the tributaries is deficient in that it does not describe how this target will lead to achieving beneficial uses in the listed tributaries. In addition, the point is made that streams should not exceed 0.05 mg/L TP where they enter lakes or reservoirs. Since the Middle Snake is replete with run-of-the-river reservoirs, 0.075 was chosen as the appropriate, protective target for it. It seems the information about the watershed and the Middle Snake supports a target of 0.075 for the tributaries, rather than 0.10 mg/L.
	RESPONSE: IDEQ-TFRO respectfully submits that it has responded to this question in Responses 16K and 16L.
USEPA-17R	*QUESTION*: Waste load allocations for point sources and load allocations for nonpoint sources were not found for listed tributaries and the drains to these tributaries and the river. These are needed for the TMDLs for nutrients to be complete and to meet the schedule.
	RESPONSE: IDEQ-TFRO submits that it will provide with the following stipulations: (1) The pathogen TMDL will be located in §3.5 (subsection Pathogens) and will be shown only for those natural tributaries that have known information. IDEQ-TFRO will not estimate a pathogen level on any waterbody that has no information. However, for those listed waterbodies that have pathogen as a pollutant, IDEQ-TFRO will monitor for pathogens and will provide an assessment within 2 years of plan implementation. CFOs and/or CAFOs are described in the subsection as being zero discharge. A target of 400 cfu/100 mL will be used to provide a MOS of 100 cfu/100 mL below the 500 cfu/100 mL for primary contact recreation for fecal coliform bacteria on all waterways. (2) The phosphorus TMDL will be located in §3.5 (subsection Total Phosphorus) and will have an instream target of 0.100 mg/L TP with an implicit margin of safety (much like the Mid-Snake TMDL). This TMDL will be fully developed (like the TSS TMDL) but it will not have provisions for certain fish hatcheries because it is unknown at this time what their loadings or targets are. They will be developed after 3 years of monitoring.

USEPA-17S	*QUESTION*: Pathogens – 3.1.03. (1) the target for tributaries is not clear; (2) data were not compared to all applicable water quality criteria; (3) where data is lacking for a listed tributary, options are to develop a TMDL from modeling or change the schedule; and, (4) TMDLs for tributaries were not found in the document. The delisting of bacteria for the Middle Snake may be appropriate, however, percent exceedances of the water quality standards for primary and secondary contact should be shown as part of the rationale. The target for tributaries is not clear. No mention is made of each of the IDEQ water quality criteria for bacteria for protection of primary and secondary contact (e.g., the geometric mean of 50 colonies per 100 ml), and how each is applied to the conditions in the tributaries, or compares to the available data. Percent exceedances of these criteria for the listed tributaries should be provided, as well as an explanation for how you reached your recommendations provided in the column starting on line 42, page 162. When IDEQ does not have data on which to base a decision to delist or to create a TMDL for a stream listed for bacteria, it would appear that the state has two options. You could either model the estimated loading and use these estimates to establish a TMDL and fill in the data gaps over time, or you could change the TMDL schedule such that you have time to collect monitoring data from which to develop a TMDL or establish a basis to de-list the stream. Also, we believe that ag return drains and canals are waters of the U.S., and the data provided is evidence that water quality standards are exceeded in these waters and that they should be added to the next 303(d) list for bacteria and be scheduled for TMDL development.
	RESPONSE: IDEQ-TFRO respectfully submits that it has responded to the question in 17R and 9F. The water quality target, water quality criteria protection for beneficial uses, % exceedences, and % reduction rationale, load capacity, and MOS are shown and explained in §3.5, subsection Pathogens, and §3.1.3. We also have responded to the manmade waterways partially in Response 9C. IDEQ-TFRO respectfully submits that it will not add any manmade conveyence to the 303(d) list for bacteria or for any parameter unless it fits the response in Response 9C. Manmade waters do not function like natural tribuatries and its is ludicrous to expect a load capacity (or assimilative capacity) to be of a similar nature to that of natural tributaries. Section 2.2.2 of the TMDL specifically says that manmade waterways will not be considered for TMDL development at this time due to several reasons. (1) Idaho Code §39-3602.28 (that specifically exempts waters that are storage structures or private reservoirs). (2) The canal companies define storage structures at Murtaugh Lake (south side of the Middle Snake River) and Wilson Lake (north side of the Middle Snake River) <u>and</u> their canal system (High Line and Low Line Canals, and the North Side Main Canal, respectively) that takes storage water to various landowers. This canal system is privately owned by the canal companies and not considered waters of the United States. They are on private ground, conveying storage water to meet the demands of water rights to their stockholders. IDAPA 16.01.02.050.01 specifically states that "the enforcement of water quality standards is not intended to conflict with the apportionment of water to the state...or to interfere with the rights of Idaho appropriators, either now or in the future." A TMDL on any of these canal systems would violate our interpretation of State regulations (as previously cited) and would force legal redress on the part of the canal companies against IDEQ and USEPA. IDEQ will not break State law. We will accommodate and follow federal law within the limits of State law, but no further. (3) IDEQ-TFRO is following the USGS HUC system for waterbody typing. We have evidence that is contrary to some of the map descriptions that are described as tributaries when in fact they are manmade convenyences and the property of the canal company who delivers the waters to the property owners. These too are exempt from the TMDL process at this time. And, (4) if the waterbody was not specifically listed in IDAPA 16.01.02.150 with designated beneficial uses, or if the BURP process had not assessed the waterbody, it was not subject to the TMDL process. Not one canalway listed in the Mid-Snake TMDL has been BURP'd nor are they listed in the IDAPA citation. Therefore, we respectfully submit that we have no intent to do assessments on any manmade conveyence for TMDL development at this time.
USEPA-17T	*QUESTION*: While your recommendations are "TMDL Required" for many listed tributaries, EPA does not find TMDLs in the documents provided. Is the target provided on lines 34-36, page 162 (less than 5% of samples exceed primary and secondary contact recreation criteria–which one?)? The document lacks a load capacity, waste load allocations for point sources, and load allocations for nonpoint sources. A relationship between TSS and bacteria may be real, or statistically significant, but one with such a low r-squared value does not provide an accurate estimate of either loadings (using TSS data) or achievement of bacteria targets.
	RESPONSE: IDEQ-TFRO respectfully submits that it has responded to this question in 17S.

USEPA-17U	*QUESTION*: Unionized Ammonia – 3.1.04. (1) data were not compared to water quality standards criteria; (2) rationale for using 0.020 mg/L as a target is not provided; and, (3) TMDLs were not found in the document for waterbodies with major exceedances. It appears that to evaluate percent exceedances, the data for the Snake River and tributaries were not compared to either the one-hour or four-hour concentration criteria in the state's water quality standards. Pages 110-131 of the TSD show ammonia data, pH, temp and unionized ammonia. Was the unionized ammonia calculated from the stoichiometric relationship between total and unionized, as described in the footnote to Table 51, page 114? Explain why the unionized ammonia data were compared to 0.020 mg/L, and not the state's criteria? I assume when you speak of exceedances in the first paragraph you are talking of exceedances of 0.020 mg/L, the number you use on line 6, page 165. The rationale for using 0.020 mg/L as a target is not provided. The rationale provided for delisting ammonia as a pollutant for the Snake River may be valid, given an acceptable rationale for the target of 0.020 mg/L, however, we believe additional language is needed to support the decision for the record. Line 40, page 166 says that TMDLs will be done for waterbodies where ammonia has been found as a major exceedance. These TMDLs were not found in the document. If IDEQ intends to meet the schedule for the Upper Snake River Rock TMDL, TMDLs should be provided for listed tributaries. For the drains which exceed the criteria, the data provides evidence that these waters should be added to the next 303(d) list for unionized ammonia, and that they be scheduled for TMDL development.
	RESPONSE: IDEQ-TFRO respectfully submits that it has responded to this question in Response 16N, followed by Responses 3N, 3O, and 3P, followed by Response 1B, followed by 7P, 9C, and 9H.
USEPA-17V	*QUESTION*: NOX – 3.1.05. (1) Conflicting information is provided in the subbasin assessment, TSD and Section 3.01.05; and, (2) Additional rationale for NOX not being a pollutant of concern is needed. Sources should be provided for the data that 0.06 mg/L are protective for salmonids and 0.3 for eutrophication (page 114 of the Subbasin Assessment). Also, on this page you indicate that 99% of samples are above the protective level. This contradicts the statement made on line 9, page 167. The TSD provides N:P ratios, some of which suggest that a TMDL should be written to reduce loads of nitrate. Additional explanation and rationale is needed about nutrients and their relative importance in section 3.1.05 to justify not developing TMDLs for NOX for those segments.
	RESPONSE: IDEQ-TFRO respectfully submits that it has responded to this question in Response 9I.
USEPA-17W	*QUESTION*: Pesticides – 3.1.06. It appears IDEQ has the basis for delisting Cottonwood Creek for pesticides. IDEQ may wish to add a discussion about the original listing possibly being in error.
	RESPONSE: IDEQ-TFRO respectfully submits that it has added a sentence that stipulates that the original listing may have been in error, but it is not possible to confirm it.
USEPA-17X	*QUESTION*: Oil and Grease – 3.1.07. Delisting rationale should include an explanation of when and how the monitoring was conducted in Rock Creek. Preferably this would include discussion of why the timing and location of the sampling is likely to identify an oil and grease problem if one existed. Section 3.02.03, item 3, which was cited on page 167 as a reference, could not be found.
	RESPONSE: IDEQ-TFRO respectfully agrees and has provided the necessary documentation you have requestion in §3.1.7 and in §3.2.3, subsection Oil and Grease.
USEPA-17Y	*QUESTION*: Temperature – 3.1.08. While exceedances of the temperature criteria for coldwater biota and salmonid spawning are frequent, a TMDL is not being written at this time. As suggested in the document, we believe it may be reasonable to explore approaches to develop temperature criteria and/or uses which better fit the Middle Snake River and/or its listed tributaries. If no temperature TMDLs will be developed at this time, we request a letter from IDEQ changing the scheduled deadline for the TMDL.

	RESPONSE: IDEQ-TFRO respectfully submits that it has responded to this question in Response 9J. However, IDEQ-TFRO will reference your request for a letter to our IDEQ-State Office requesting a change in the scheduled deadline for the TMDL.
USEPA-17Z	*QUESTION*: Dissolved Oxygen – 3.1.09. It appears IDEQ is applying IDAPA 16.012.02.276 to the Snake River segments which have hydropower facilities or dams. It is not clear to which segments this standard applies, and at what point downstream from each of these facilities IDAPA 16.012.02.250.02.c.i. and d.i. apply. No further discussion is provided to indicate the IDEQ analyzed the DO data for the Snake River segments against these IDAPA 16.012.02.276 criteria. Data for DO on tributaries appears to be lacking. EPA questions whether DO problems on listed tributaries can be attributed to macrophyte beds, as they can on the Snake River. Additional analysis of conditions on all the listed tributaries is needed to justify delisting them for dissolved oxygen.
	RESPONSE: IDEQ-TFRO respectfully submits that it has responded to this question in Response 9K and in the document in §3.1.9. We further stipulate that all data analysis for DO on the Middle Snake River was done to include IDAPA 16.01.02.276. Since the analysis showed that no violations occured of the instantaneous standard, reference to it is irrelevant since the document indicates that no violations occured.
USEPA-17AA	*QUESTION*: One point source missing from your allocation tables for TSS was CAFOs. We would expect to see CAFOs listed for bacteria and nutrient allocations for these TMDLs as well.
	RESPONSE: IDEQ-TFRO respectfully agrees and has provided this in all of the allocation tables. However, we have modified all the tables to into a fifth category, Other Water User Industries, and have included in this category CFOs and/or CAFOs, Hydroelectric Power, and All Land Application Facilities.
USBLM-11	*QUESTION*: [*Paraphrasing*] "We do not understand how loads are derived from the stream corridor approach model. We couldn't link the allocation of loads to how the model appropriated them by land use."
	RESPONSE: IDEQ-TFRO respecfully submits that has responded to this question in 17I.
Prepared by IDEQ-TFRO.	